0002

CARBON RESOURCES, LLC
PO Box 11789
ALBUQUERQUE, NM 87192
Telephone: (505) 286-1253
Fax: (505) 286-1278

Incoming
C/007/0047
#2936

February 19, 2008

Mr. John Baza, Director
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84116

Dear Mr. Baza,

RE: PERMIT APPLICATION SUBMITTAL FOR KINNEY NO. 2 MINE

In compliance with Utah Code 40-10-9, 40-10-10 and Utah Coal Mining Rules R645-300, Carbon Resources LLC is hereby submitting application for a new permit to conduct underground coal mining operations at the proposed Kinney No. 2 Mine in Carbon County, Utah.

The new coal mine permit area will encompass an area of approximately 452 acres, of which, 15.3 acres are owned, 22.9 acres are leased by Carbon Resources, and the balance (413.8 acres) are privately owned. The surface facilities are planned to be located on the land owned and leased by Carbon Resources. The coal is held by lease with Carbon County for the permit area. There are additional Carbon County leased coal reserves contiguous to the 452 acre permit block held by Carbon Resources, and there are additional privately held coal reserves contiguous to the Carbon County lease on the north. In addition, there are unleased Federal coal reserves to the north and south of the Carbon County lease that may be mineable from the Kinney No. 2 Mine.

The surface facilities planned for the Kinney No. 2 Mine will largely be located on land previously disturbed by historic coal mining. Approximately 74% of the area to be disturbed by the Kinney No. 2 Mine has been previously disturbed.

Three hard copies of the application are submitted with this letter. In addition, the application has been formatted in electronic format in conformity with the Division's General Guidelines for Electronic Permitting and Document Conversion, and is included with this application on DVD disc. When the application is determined to be complete by the Division a hard copy will be filed at the Carbon County Courthouse.

File in:
C/007/0047, 2008, Incoming
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Date 02/19/08 for additional information

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Please feel free to contact me, or Ben Grimes of Hansen, Allen & Luce Engineers with any questions regarding this application.

Application Certification

I the undersigned, hereby certify that the material and information contained in this application for a permit to mine coal by underground methods are complete and correct to the best of my knowledge and belief.

Carbon Resources, LLC

By: _____
Clay Wisdom
C.F.O.

State of New Mexico
County of Bernalillo

Subscribed and sworn to and before me this 18th day of February, 2008.

OFFICIAL SEAL
Barbara A. Mast
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 3/15/10

Barbara A. Mast
Notary Public for the State of New Mexico

Residing at: Bernalillo County New Mexico

My Commission Expires: 3/15/10

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☐ New Permit ☒ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Carbon Resources, LLC
Mine: Kinney No. 2 **Permit Number:**
Title: New Mine Permit Application

Description, Include reason for application and timing required to implement:
Start a new coal mining operation. Timing: As soon as possible.

Instructions: If you answer yes to any of the first eight questions, this application may require Public Notice publication.

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 452.50 Disturbed Area: 27.30 ☒ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO#
☒ Yes ☐ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☒ Yes ☐ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☒ Yes ☐ No 6. Does the application require or include public notice publication?
☒ Yes ☐ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☒ Yes ☐ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV #
☒ Yes ☐ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain:
☒ Yes ☐ No 11. Does the application affect the surface landowner or change the post mining land use?
☒ Yes ☐ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☒ Yes ☐ No 13. Does the application require or include collection and reporting of any baseline information?
☒ Yes ☐ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?
☒ Yes ☐ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☒ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?
☒ Yes ☐ No 24. Does the application include confidential information and is it clearly marked and separated in the plan?

Please attach three (3) review copies of the application. If the mine is on or adjacent to Forest Service land please submit four (4) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Clay Wisdom	C.F.O.	2-20-08	
Print Name	Position	Date	Signature (Right-click above choose certify then have notary sign below)

Subscribed and sworn to before me this 20th day of February, 2008

Notary Public: Barbara A. Mast, state of Utah.

My commission Expires: 3/15/10
Commission Number:
Address: 13 Ranch Road
City: Edgewood State: NM Zip: 87015

ss:

OFFICIAL SEAL
Barbara A. Mast
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 3/15/10

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APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Carbon Resources, LLC
Mine: Kinney No. 2 **Permit Number:**
Title: New Mine Permit Application

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☒ Add	☐ Replace	☐ Remove	Entire Mining and Reclamation Application consisting of:
☒ Add	☐ Replace	☐ Remove	Table of Contents, List of Tables, List of Figures, List of Maps & List of Exhibits
☒ Add	☐ Replace	☐ Remove	Sections: 1.0, 2.0, 2.1, 2.2, 2.3, 2.4, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5,
☒ Add	☐ Replace	☐ Remove	Sections: 4.6, 4.7, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 6.0, 6.1, & 7.0
☒ Add	☐ Replace	☐ Remove	Tables: 3.3.2.2, 3.6-1, 3.6-2, 3.6-3, 3.7-1, 3.7-2, 3.7.2.1-1, 3.7.2.2-1, 3.7.2.4-1, 3.7.2.5-1,
☒ Add	☐ Replace	☐ Remove	Tables: 3.7.3.5-1, 3.7.4.1-1, 3.7.4.2-1, 3.7.7-3, 3.7.8.2-1, 4.5-1, 4.72.2-1, 4.7.2.2-1, 4.7.2.3-1
☒ Add	☐ Replace	☐ Remove	Tables: 5.3.2.3-1, & 5.3.2.3-2,
☒ Add	☐ Replace	☐ Remove	Figures: 1.0-1, 3.6-1, 3.6-2, 3.6-3, 3.6-4, 3.6-5, 3.6-6, 3.6-7, 3.6-8, 3.6-9, 3.6-10, 3.6-11, 3.6-12
☒ Add	☐ Replace	☐ Remove	Figures: 3.7.1.3-1, 3.7.2.5-1, 3.7.3.3-1, 3.7.3.3-2, 3.7.3.4-1, 3.7.3.4-2, 3.7.3.5-1, 4.1-1, 4.3-1,
☒ Add	☐ Replace	☐ Remove	Figures: 4.5-1, 4.5-2, 4.5-3, 4.5-4A, 4.5-4B, 4.5-5A, 4.5-5B, 4.5-5C, 4.5-5C, 4.5-5D, 4.5-6A,
☒ Add	☐ Replace	☐ Remove	Figures: 4.5-6B, 4.5-6C, 4.7.2.2-1, 5.4-1, & 5.4-2
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☒ Add	☐ Replace	☐ Remove	Maps: 4.5.1.2-1, 4.5.1.2-2, 4.5.1.2-3, 5.4.1.2-4, 4.5.1.2-5, 4.5.2.3-1A, 4.5.2.3-1B, 4.5.2.3-1C,
☒ Add	☐ Replace	☐ Remove	Maps: 4.5.2.3-1D, 4.5.2.3-2A, 4.5.2.3-2B, 4.5.2.3.-2C, 4.7.2.1-1, 4.7.2.1-2, 4.7.2.1-3, 4.7.2.1-4,
☒ Add	☐ Replace	☐ Remove	Maps: 4.7.2.2-2, 4.7.2.3-1, & 4.7.2.9-1
☒ Add	☐ Replace	☐ Remove	Exhibits: 1.5-1, 2.1.2.2-1, 2.1.3-1, 2.3, 3.1.1.3-1, 3.2, 3.3, 3.7.2.2-1, 3.7.2.2-2, 3.7.2.2-3,
☒ Add	☐ Replace	☐ Remove	Exhibits: 3.7.2.4-1, 3.7.2.5-1, 4.5.2.1-1, 4.5.2.1-2, 4.7.2.2-1, 4.7.5-1, & 5.4.3-1
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

Exhibit 2.1.2.2-1 is a separate CONFIDENTIAL volume. It is requested that the information in this volume be held confidential.

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DIV. OF OIL, GAS & MINING

Mining and Reclamation Permit Application
Kinney No. 2 Mine

Volume 1

Prepared By:

HANSEN ALLEN & LUCE inc
ENGINEERS

Carbon Resources LLC

P.O. Box 11789
Albuquerque, NM 87192
505-286-1253

File in:
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In C/0070047.2008.
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SECTION 1.0

SUMMARY OF PERMIT APPLICATION

1.0 INTRODUCTION

Carbon Resources LLC (CR) is a wholly owned subsidiary of Western Reserve Coal Corporation, and has prepared this Mining and Reclamation Permit application for the Kinney No. 2 Mine, a proposed new underground mine complex. This permit application has been developed to effect full compliance with applicable permitting requirements under the State of Utah Coal Mining Rules and is being submitted for review and approval of the mining and reclamation plans contained herein by the Utah Division of Oil, Gas and Mining (UDOGM), and other jurisdictional agencies.

1.1 LOCATION AND GENERAL SETTING

The proposed Kinney No. 2 Mine is located one half mile north of Scofield, Utah and east of Utah State Highway 96. Surface facilities will be located at the coal outcrop, and adjacent to the highway. The Kinney Mine permit area covers an area of approximately 448 acres as shown on Figure 1.0-1, General Location Map. Mining is planned in the Hiawatha coal seam from the outcrop at the edge of Pleasant Valley.

Entry will be achieved via an approximately 600 foot wide corridor between old abandoned mine workings and extract coal from multiple fault bounded reserve blocks. Maximum currently anticipated production is 800,000 tons annually utilizing continuous mining methods. Surface facilities are proposed to be located at the site of past mining in Sections 32 and 33 of Township 12 South, Range 7 East northeast of Scofield, Carbon County, Utah.

The Kinney Mine is located just north and east of the Town of Scofield, Utah, on the east side of Utah State Highway 96. The area is part of the Wasatch Plateau in Pleasant Valley, and is characterized by high plateaus to the east and Pleasant Valley to the west. Scofield Reservoir is located to the north and west of the permit area. The mine surface facilities are located on semi-arid mountainous land that is dry and sparsely populated by quaking aspen, a few fir trees, and brush. Within the permit area, topographic relief ranges from 7,650 feet, near the highway to over 8,800 feet on the ridge top east of the portal area.

The area is drained by small unnamed ephemeral channels near the portal area, Eagles Canyon over the ridge to the east of the mine site, and Long Canyon east of Eagles Canyon. All drainages eventually lead to Scofield Reservoir. Eagles Canyon is ephemeral, and Long Canyon contains a perennial stream. Several other very small unnamed ephemeral channels drain the permit area. The climate of the area is semi-arid and, with the exception of the noted perennial drainage, most area drainages flow only in response to spring snowmelt or major thunderstorm events. Ground water occurrence and use in the area is limited by low infiltration and recharge, and the relatively low permeability of most units of the geologic sequence. Soils are generally thin and poorly developed except in drainage valleys, where soil depths can reach 5 feet or more. Area vegetation is typical of semi-arid areas in the west and reflects the wide range of topographic conditions within the proposed

permit and adjacent areas. Dominant vegetation types include sagebrush-grass, mountain brush, and aspen in the surface facilities area.

1.2 LAND USE AND HISTORICAL ACTIVITIES

1.2.1 Regional Land Use

Presently much of the Scofield area is used for recreation, domestic livestock production, and water shed. Adjacent streams and reservoirs provide seasonal boating, sport fishing and water fowl hunting. Undeveloped land is used extensively for seasonal wildlife hunting. The westernmost portion of the mine facilities area is located within the Scofield Town boundaries.

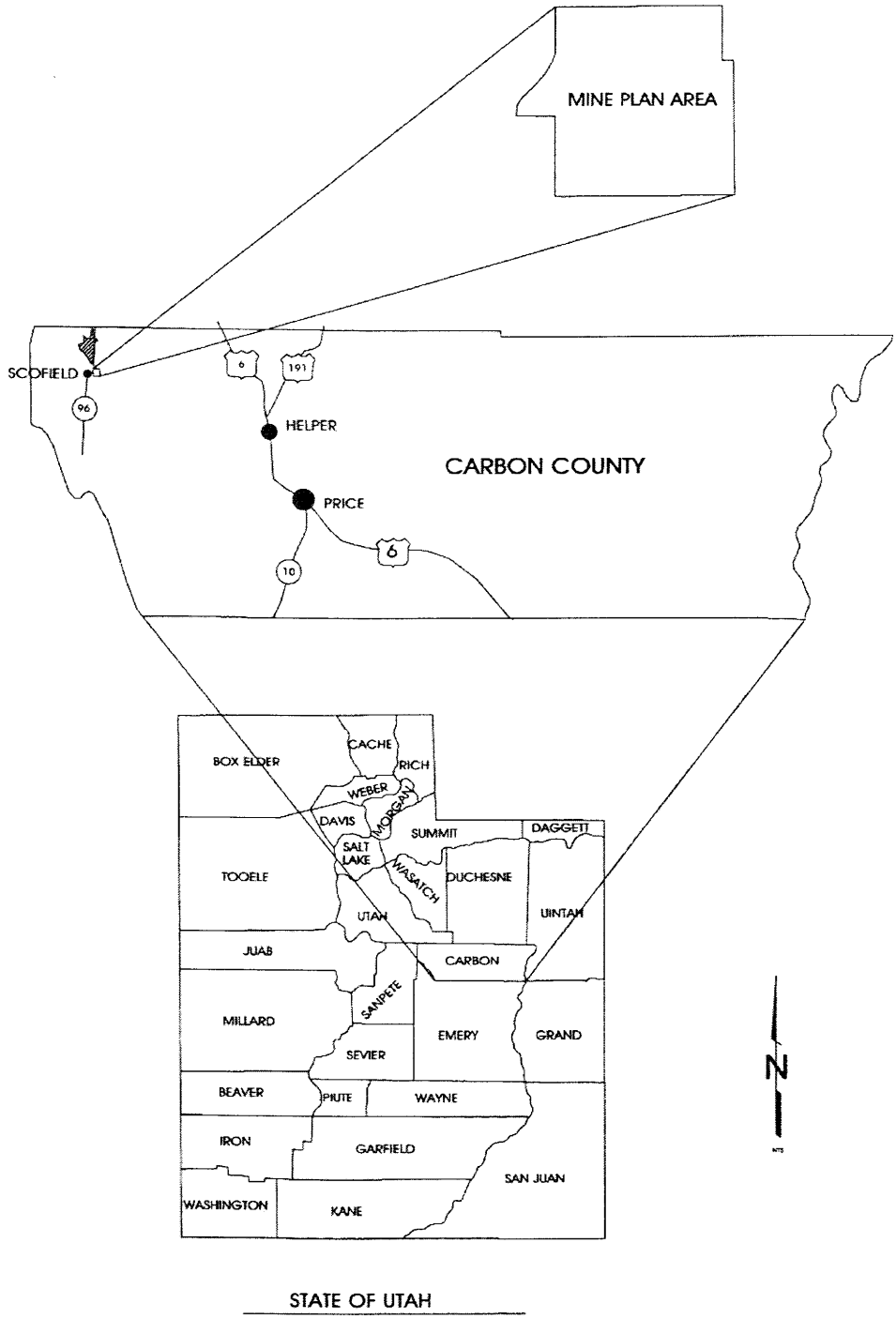
1.2.2 Land Use in Mine Plan Area

Scofield Town rezoned this land as "Commercial" allowing the town to Tax the mine facilities within the Town Limits. The balance of the surface facilities area is located within Carbon County. This portion was re-zoned by Carbon County from WS (Watershed), where surface facilities supporting an underground coal mine are not allowed, to MR (Mountain Range), where surface facilities are allowed, per a request from Carbon Resources. The land use zones can be seen on Map 3.4.1.4-1, Regional Land Use Map.

A "Conditional Use Permit" from Carbon County for the newly re-zoned area will be required prior to ground breaking. This permit will be applied for and approved prior to beginning of construction, and a copy will be submitted to the UDOGM, and a copy inserted into Exhibit 2.1.3-1, Other Permits.

Previous coal mining operations have utilized much of the western portion of the mine plan area. Several old mines existed in the area of the proposed surface facilities as can be seen on Map 3.4.1.4-2, Previous Mining Activity, and on Map 3.4.1.4-1, Regional Land Use Map. These mines included the Kinney Mine, Columbine Mine and the Jones Mine, each of which had portals and operations areas at the outcrop. The surface disturbed areas for these mines can be seen on Map 3.4.1.4-2, Previous Mining Activity, and on Map 3.4.1.4-1, Regional Land Use Map. The outline of the historic mines can be seen on Map 3.4.1.4-2, Previous Mining Activity. These old mines have been mapped on these permit maps from information received from the following sources:

- Utah Division of Oil, Gas & Mining Abandoned Mine Reclamation Division reclamation maps prepared by Dames & Moore in 1985 for the Scofield Mine Reclamation Project,
- 1982 color aerial photography completed by Intersearch
- NAIP 2006 color aerial photography completed by the Utah GIS Division
- site specific vegetation and soils mapping, that included excavation of soils pits, completed for this permit application.



HANSEN ALLEN & LUCE inc

CARBON RESOURCES - KINNEY NO. 2 MINE

GENERAL LOCATION MAP

FIGURE 1.0-1

Of the area planned for disturbance for this permit application, the vast majority has been previously disturbed. In 1985, the Utah Division of Oil, Gas and Mining Abandoned Mine Reclamation program (AML) reclaimed this area to its present configuration. Plans for this AML program were used in preparation of this permit application. Documentation of the condition of the mine plan area can be seen in Exhibit 1.2-1, Documentation of Existing Site Conditions. Photographs are included showing the site as it existed in 2007 prior to proposed mining activities. The locations where the photographs were taken can be found on Map 4.5.1.2.-4, Mine Surface Facilities Area, Pre-Mining Topography Map.

1.3 OWNERSHIP AND INTERESTS

The proposed Kinney No. 2 Mine will be operated by Carbon Resources, LLC (CR). CR's offices are currently located at P.O. Box 11789, Albuquerque, New Mexico 87192. Upon start of operations, temporary office space will be located in Scofield, with permanent offices to be located at the mine site.

The Kinney No. 2 Mine permit area encompasses a block of approximately 452.5 acres. Of this surface acreage, 15.3 acres are owned in fee by Carbon Resources, the remaining 437.2 acres are owned by Evangelos George Telonis, ETAL., of this, 22.8 acres are held by Carbon Resources as an Easement from George Telonis, ETAL.

The area of surface disturbance is confined within the 38.2 acres (combined Fee and Easement) owned or controlled by Carbon Resources. Only 27.3 acres of the 38.2 acres will be disturbed for surface facilities. The coal to be mined lies beneath the George Telonis, ETAL. fee surface land and is owned by Carbon County which in turn has been leased it to Western Reserve Coal, Inc, parent company of Carbon Resources.

1.4 PROPOSED OPERATIONS

The underground mining operations are planned to recover coal reserves contained in the Hiawatha Coal Seam. Mining methods will include room development using continuous mining techniques, with no pillar recovery planed at this time.. Mining will be restricted to blocks of coal lying between faults. Numerous faults will need to be crossed during development of the mine and recovery of the reserves. The mine is being designed for a nominal annual production rate of 800,000 tons of coal, based on an operating schedule of 250 days per year, 2 shifts per day, 8 hour shifts, with a base production of 500 tons per hour. The projected life of the Kinney No. 2 Mine within the Portal Block Permit Boundary is approximately three years, with the potential to extend the mine life significantly with a combination of permitting other coal controlled by CR and acquisition of additional coal reserves which exist to the south and east of the currently planned operation.

Following completion of the initial planning, design, and permitting work and on receipt of required permit approvals, CR will initiate site development. Required development activities will include:

- Installation of required drainage and sediment control structures
- Removal of topsoil during the following activities
- Construction of required access roads and culverts

- General site grading and compaction for the mine facilities area
- Ecavation of portals area and construction of portal facilities
- Construction of required foundation structures
- Installation of conveyor systems
- Installation of required ventilation equipment
- Development of mine portal and underground support facilities
- Required underground development work
- Erection of buildings and other structures

In order to support underground coal mining operations, CR plans to develop, construct, and install surface facilities in the vicinity of the underground mine portals on the east face of Pleasant Valley. The mine facilities area has been extensively disturbed by previous historical mine development activities, highway construction, and Abandoned Mine Reclamation (AMR) projects completed in the 1980's. The surface facilities area is located on relatively flat areas near the portal and adjacent to Utah Highway 96. Constraints imposed by the topographic configuration of the facilities area have generally dictated the location and configuration of the proposed surface facilities. To the extent possible, facilities siteing reflects CR's efforts to minimize additional disturbance, avoid disturbance or potential future impacts to Scofield Reservoir.

Facility construction will generally proceed in parallel with site development activities. The proposed facilities will include the following:

- Mine portal structures (5-entry system)
- Mine ventilation fan structure.
- Conveyor coal haulage system consisting of the following components (all conveyors to be installed with half covers for weather protection and to minimize dust emissions, transfer points to either be enclosed or have BACT dust controls);
  - Conveyor SB-1(640' long, from portals to run-of-mine stockpile)
  - Spec Coal pile)
  - Conveyor SB-2 (185' long, from the Non-Spec Coal pile to the Spec Coal Pile, the conveyor gallery belt)
  - Conveyor SB-3 (485' long, from the Reclaim Tunnel to the Screening & Crushing Building).
  - Conveyor SB-4 (90' long, from the Screening & Crushing Building to the Truck Loadout)
  - Transfer Tower 1 (at mine portal area)
  - Non-Spec Coal pile stacking tube
  - Spec-Coal pile stacking tube
  - Coal piles reclaim tunnel
  - Screening and Crushing Building
- 17,000 ton Non-Spec Coal Stockpile including a stacking tube and sub-grade feeders.
- 6,000 ton Spec-Coal Stockpile including stacking tube and sub-grade feeders.
- Mine Office/Bathhouse Building
- Shop/Warehouse Building
- Parking area
- Water storage tank
- Electrical substation & distribution equipment

- Drainage and sediment control structures
- Access road
- Other service roads and minor ancillary support facilities

1.5 POTENTIAL BENEFITS AND IMPACTS

Development and operation of the proposed Kinney No. 2 Mine offers a number of important benefits specifically including the following:

- Assures continued availability of a valuable energy resource used to generate electricity and as an industrial heating fuel
- Provides for efficient development and consequent conservation of known coal reserves
- Facilitates effective reclamation, through a comprehensive reclamation program, of both new disturbance and previously disturbed areas
- Provides stable, high-paying jobs for approximately 100 to 140 employees with an annual payroll and benefits of $6,000,000 or more.
- Supports Federal, State, and local governments through payments of property, sales, excise, fuel, and other taxes estimated at $1,000,000 or more annually.
- Supports the National, State, and local economies through direct purchases of equipment, materials, supplies, and services (estimated at $4 Million or more annually); royalty payment of fee lands (estimated at $2 Annually); and indirect turn-over of these expenditures in the economy (multiplier of approximately 3.00 in total economic benefits for every dollar spent in wages, benefits, and purchases of goods and services)
- Supports local communities through charitable contributions

Since the proposed mine is located near the Town of Scofield, which has a limited availability of jobs, the mine will be a substantial benefit to the town.

As well as the noted benefits, the proposed mining and reclamation operations and related activities have the potential to result in possible environmental and socio-economic impacts. Based on available information on existing environmental resources and the proposed mining and reclamation plans, potential impacts could occur in the following areas:

- Disturbance of existing soils, vegetation, and wildlife resources
- Impacts on existing land uses
- Air quality impacts
- Surface and ground water impacts
- Subsidence impacts
- Socio-economic impacts

The following sections briefly describe potential impacts for each of the general impact categories. More detailed information on existing environmental resources, proposed mining and reclamation plans, potential mining related impacts, and planned control and mitigation measures is presented in the various sections of the permit application.

Disturbance of Existing Soils, Vegetation, and Wildlife

The only direct surface disturbance which will result from the Kinney No. 2 Mine will be that associated with development and construction of the required mine surface facilities. As a result of previous historic mining, reclamation, and other development activities, approximately 73% of the mine surface facilities disturbance area has already been extensively disturbed. Existing site soils, vegetation, and wildlife resource values reflect and are limited by the previous disturbance. Due to the relatively small affected area and the limitations resulting from the previous disturbance, re-disturbance of the mine facilities area will not result in significant adverse impacts on soils, vegetation, or wildlife resources.

Evaluation of the soils in the proposed mine area was conducted in 1981 prior to the Abandoned Mine Reclamation project conducted at the mine site in the mid-1980's. This evaluation program found the soils to be adequate for reclamation. The AMR project was very successful as evidenced by the vegetation in the area, and further verifies the soils to be adequate for final reclamation. The alternative reclamation materials used by the AMR program for reclamation will be available for final reclamation for the Kinney No. 2 Mine project. These materials will be treated as topsoil for the purposes of this application. The only mining related vegetation impacts anticipated in conjunction with the proposed operations would be temporary elimination of existing vegetation from surface disturbance areas. Of this area, only a very small portion will occur in pre-mining areas where no historic mining was conducted.

Wildlife habitat and use in the surface disturbance area is limited by both the previous disturbance and the level of existing development in the immediate area. Since the area is in very close proximity to the Town of Scofield, large wildlife species use is somewhat limited because of the presence of human activity in the town and also due to the presence of Highway 96 which is adjacent to and parallels the mine site area. Contemporary reclamation including seeding the slopes of facilities pads and roads will to some degree offset the vegetation lost from disturbance during the life of the mine.

Impacts on Existing Land Uses

The mining operations will result in a temporary change in land use for the affected surface disturbance area. Minor impacts on areas which may fall under the definition of renewable resource lands, dependent on interpretation may occur. Potential mining related land use and related impacts are not expected to be significant due to the limited area of proposed surface disturbance, the fact that this area has already been extensively disturbed by previous historical mining, and grazing activities, and specific proposed protection and mitigation measures. Development, operation, and reclamation of the Kinney No. 2 Mine will not result in any long-term or permanent changes in land use, will not affect any areas designated unsuitable for mining, and will not impact any recreational facilities. The closest recreational facilities are at Scofield Reservoir, located north of the mine site, with the Scofield State Recreation Area being more than 4 miles north of the mine site. The Huntington and Eccles Canyons Scenic Byways are accessed from the north by Utah State Highway 96, which passes by the mine site, however, the Scenic Byways starts at the mouth of Eccles Canyon where it meets Highway 96 approximately 3.5 miles south of the mine site. One of the attractions promoted on the Scenic Byway is the Skyline Mine in Eccles Canyon. The Kinney Mine will be another possible attraction in the area of the Scenic Byway, along

with the historic Scofield Cemetery, which lies less than a half mile south of the proposed mine site.

Lands within the mine facilities surface disturbance area are currently lands used for grazing, wildlife habitat, and for water shed. With construction of the surface facilities the new land use will be surface support for the Kinney No. 2 Mine with construction of the facilites listed in other sections.

As mentioned, the area has been extensively disturbed historically by mining activities ; the old mining operations were reclaimed in the mid-1980's. The Kinney No. 2 Mine development and operations activities will result in a temporary change for this area to a mining use in compliance with both Scofield Town, and Carbon County zoning ordinances. Following completion of mining, associated surface disturbance areas will be reclaimed and restored to the premining land uses of wildlife habitat, grazing, and water shed.

A baseline cultural resource survey has been conducted covering the mine permit area. Since the surface facilities area was extensively disturbed by mining, and because the portal area is steep, the cultural inventory conclusion is that no cultural resources were found that would require further investigation or documentation. Based on the findings of the cultural survey, archeological clearance was recommended.

Under the Utah Coal Mining Rules, renewable resource lands are defined as:

> "...geographic areas which contribute significantly to the long-range productivity of water supply or of food or fiber products, such as lands to include aquifers and aquifer recharge areas."

The definition is so broad as to potentially include any areas where an aquifer exists, recharge occurs, or any type of grazing or other agricultural activity is conducted. The clause "which contribute significantly" is the only limiting factor which would prevent this definition from applying to virtually any potentially affected lands. Given this limitation, the following are the only areas which would reasonably be considered renewable resource lands:

Areas which support agricultural activities (cultivation, grazing, or timber) as the sole or primary land us

- Areas where a productive regional aquifer exists which is utilized as a ground water supply source
- Areas which provide a significant portion of the total recharge for any productive regional aquifer

A negative determination for prime farmlands has been received from the USDA Natural Resources Conservation Service as evidenced by letter, refer to Exhibit 1.5-1, Prime Farmland Determination.

There have been no regional aquifers identified in the vicinity of the mine. Some small localized perched aquifers may exist, but limited recharge area, and narrow, steep ridges

preclude the formation of extensive aquifers above, or in the strata associated with the coal seams. Since the area has been extensively mined in the past, any aquifers in the area have likely been impacted previously. Some of the old mine works may be sinks for water as discussed in Section 3.7. Given these considerations, lands within the proposed permit area which could reasonably be characterized as renewable resource lands will be limited, and regardless of designation, potential mining related impacts are expected to be negligible.

Air Quality Impacts

Development of the Kinney No. 2 Mine will result in a minimal localized increase in air emissions, however BACT controls will help mitigate those impacts, and emissions will be held within Utah Division of Air Quality limits. The mine area is currently designated by the Utah Division of Air Quality (UDAQ) as an "attainment" area indicating no significant existing pollution problems. In cooperation with the UDAQ and in order to comply with all applicable regulatory requirements, CR has incorporated air emission control considerations in the mine design and planning phases and will implement specific operational control measures under a Notice of Intent with UDAQ. Given existing air quality conditions, consideration of natural air movements in the area, and CR's planned control measures under the provisions of the required UDAQ permit, no significant adverse mine related air quality impacts are anticipated. Due to the nature of the proposed operations, vehicular emissions will be negligible. During site development, active operations, and site reclamation CR will control fugitive dust emissions by implementing the following control measures:

- Minimizing surface disturbance
- Surface watering in active operating areas as needed
- Use of suitable surfacing materials and surfactants, if necessary, on unpaved roads
- Paving of high traffic areas as needed
- Posted speed limits on all roads
- Regular road maintenance
- Use of natural windbreaks to minimize wind exposure where possible
- Use of covered conveyors
- Use of a sub-grade reclaim system for the coal stockpiles
- Full enclosures for crushing and screening equipment and transfer points with BACT controls

Surface and Ground Water Impacts

Construction of mine related surface facilities and development and production of coal from underground mine working will result in localized changes in surface runoff characteristics and potential increases in runoff, erosion, and sediment loss; minor reduction in surface flows corresponding to operational water supply requirements; possible increases in infiltration and ground water recharge. Some drainage of very small, localized perched aquifers due to mining as mine inflows and resultant increases in the volume and areal occurrence of stored mine water; and minor changes in surface and ground water chemistry and quality. Generally, potential surface water impacts will be confined to the mine facilities surface disturbance area. Potential indirect mining related ground water impacts due to mining are addressed in the following section as a separate topic. Direct mining related ground water impacts will be limited by the lack of significant ground water aquifers, low overall

permeability of the effected geologic sequence, relatively slow rate of ground water movement, and the absence of any significant quantities of acid or toxic forming materials. While some temporary, localized surface and ground water impacts may be unavoidable, the combination of natural limiting factors and specific control and mitigation measures, as proposed in the operation and reclamation plans, will effectively prevent any significant long-term adverse hydrologic impacts.

Re-disturbance of the mine surface facilities area is required for site grading and facility construction, and will result in removal of existing vegetative cover and exposure and disturbance of surficial and near-surface overburden materials. Soils and other surficial materials which may be suitable as revegetation media will be removed and stockpiled for future use in reclaiming mining disturbance areas. Removal of vegetation and exposure of surficial materials may result in increased runoff, erosion, and sediment loss. These potential impacts will be addressed by minimizing the total disturbance area, diverting runoff from upgradient undisturbed areas around the area of disturbance, grading and surfacing disturbed areas to minimize erosion and sediment loss, intercepting and routing disturbed area drainage to a sedimentation pond to allow settlement of suspended sediments prior to discharge to natural drainages, and reclaiming the disturbed areas as soon as operationally feasible following completion of mining and related activities.

Mine water supply requirements for sanitary use will be provided by Scofield Town through a long term agreement with CR. Scofield Town has excess capacity in their culinary water system, having a 100 thousand gallon water tank perched on the mountain side west of town. The water tank elevation is sufficient to provide at least 40 psi to the bath-house and warehouse. Mine water supply for surface dust control, fire fighting reserve, and operational mine water will also be provided by Scofield Town through a long term agreement with CR. Scofield Town has significant water rights on Mud Creek with a point of diversion suitable for pumping non-potable water to CR.

In the permit area, no significant aquifers have been identified. Perched water may occur in the formations above the coal beds, but a limited to small, perched, localized areas. The regional ground water table is clearly below the proposed mine as evidenced by the absence of a static water level in any of the four monitor wells located near the portal and first two years of production area (CR-06-01, CR-06-01BLW, CR-06-02, CR-06-02-ABV). Ground water occurrence is limited to the few units which have sufficient permeability to contain and transmit ground water flows. Where mine workings intercept any of these more permeable units, discharge to the mine workings will occur. Discharge rates and mine inflow quantities will be limited by generally low permeabilities and limited head as resulting form the extensive historic mining in the area. During active mining operations, mine inflows will be collected and routed to centralized underground sumps which will serve as collection points for mine water. Mine water will be used for dust control in active underground working areas and, to the extent operationally feasible, the water will be recycled and reused.

Based on existing available information, mine water inflows will not exceed operational mine water requirements and underground storage capacity, consequently it is not anticipated that there will be any need to discharge mine water to the surface. Following completion of active mining in any given area, any mine inflows to the area will result in very slow, gradual flooding of the excavated mine workings and any downgradient areas. Given the proposed mining depth and development sequence, flooding of the underground workings will not

result in any anticipated surface discharge since mine openings will be above the water table and outcrop areas will de upgradient from the mine workings. Gradual flooding may result in accumulation and storage of mine water in the abandoned mine workings, with inflows continuing until the water level in the mine workings reaches equilibrium with the natural ground water system. However, due to there not being any significant aquifers in the mine area and overlying formations, very little mine water accumulation. Mine water storage and restoration of hydraulic equilibrium following the completion of mining will minimize any long-term hydrologic impacts with the overall result being no significant mining related impact on the ground water system.

Increased surface runoff and sedimentation resulting from surface disturbance may result in minor changes in surface water chemistry and may increase the levels of certain chemical constituents due to exposure of partially weathered or unweathered overburden materials. These changes are not expected to be significant based on chemical characterization of the overburden materials and any potential changes will be monitored and evaluated under the proposed comprehensive hydrologic monitoring program. Similar changes are anticipated for ground water resources due to exposure of geologic strata in the underground mine workings to oxidizing conditions. However, the changes are not expected to be significant due to relatively low rates of ground water movement and the absence in the overburden sequence of any significant quantities of potentially acid or toxic forming materials.

Subsidence Effects CR has no plans to conduct full extraction mining within the permit boundary at this time.

Socio-Economic and Transportation Impacts

Construction and operation of the proposed Kinney No. 2 Mine may result in various potential direct and indirect socio-economic and transportation impacts to the general Carbon County area, and especially to the Town of Scofield including:

- A temporary increase in the local workforce of approximately 20 to 50 contractor employees during the 1 year mine construction and development phase
- Increased short-term demands on temporary housing, schools, utilities, and health and social services
- A potential long-term increase in overall employment of approximately 50 to 100 employees
- Increased long-term demand for housing, schools, utilities, health and social services, and retail goods and services
- Increases in traffic levels on Utah Highway 96, and on US Highway 6 and 50 in the Price Canyon area between Price and Scofield junction.

The potential socio-economic impacts will be mitigated to a degree by the fact that the mine will be phased in over a 1 to 3 year period. Temporary construction is projected to be completed by local companies in the Price and Scofield areas, and thus will not likely have a significant impact. Since the mine production is planned to be in the range of 300,000 to 800,000 tons per year, and the workforce requirements are relative low, no significant socio-economic impacts are expected. As has been experienced in Carbon and Emery Counties, mining employment tends to fluctuate with the price of coal, and due to mine reserves

depletion and other factors. At any given time, up to hundreds of coal miners can lose their jobs instantaneously, creating a glut of employees. Availability of employees to fill the needs of CR is not expected to be a problem, and likely will not have a significant impact on Carbon County or Scofield Town. The Town of Scofield is likely to experience a boon with the mine, which will provide valuable income for a town that has experienced severe ups and downs in its' economy. Given these considerations, no significant long-term mining related socio-economic impacts are anticipated. Anticipated increases in traffic levels are well within the design capacities for the effected roadways and traffic impacts will be mitigated to some extent by an organized program to encourage employee carpooling and by multiple shift operations.

1.6 PERMITTING

The UDOGM Mining and Reclamation Plan approval under applicable provisions of the Utah Coal Mining Rules for Coal Mining will be the primary operating permit required to initiate construction, development, and mining operations for the Kinney No. 2 Mine. In addition, the following permit approvals may be required under other applicable regulatory provisions and requirements:

- Surface Water Discharge Permit (UDWQ)
- Air Emissions Notice of Intent (UDAQ)
- Pond Construction Permit (Utah State Engineer)
- Pond Approvals (MSHA – for any ponds meeting criteria of 30CFR 77.216)
- Highway Access Permits (UDOT)
- Mine ID Number (MSHA)
- Archeological Clearance (SHPO)
- Carbon County Building Permits
- Carbon County Conditional Use Permit
- Building Permit (Scofield Town)

1.7 PERMIT CONTENT AND ORGANIZATION

This permit application has been prepared to provide all required information consistent with applicable regulatory provisions of the Utah Coal Mining Rules. In order to facilitate both initial agency review and future use and revision of this permit application document, CR met with UDOGM representatives early in the permit preparation process. The permit format is designed to provide a clearly organized comprehensive permit document for initial review and approval which can, subsequent to initial review, be broken into; 1) An active working document containing all ownership and compliance information, and operation, reclamation, and monitoring plans and designs; and 2) An archival document containing baseline information, supporting exhibits, and other materials which will not be utilized or referenced on a regular ongoing basis. This permit application has been organized consistent with the accepted format and presents required permitting information under the following section and sub-section headings which each address a specific category of permitting information;

Section		Section Title
1.0		Introduction
2.0		Administrative Information
	2.1	Legal, Financial, Compliance, and Related Information
	2.2	Permit Chronology
	2.3	Permit Revisions
3.0		Environmental Information
	3.1	Soils Information
	3.2	Vegetation Information
	3.3	Fish and Wildlife Information
	3.4	Land Use Information
	3.5	Air Quality Information
	3.6	Geologic Information
	3.7	Hydrologic Information
4.0		Operating Plans and Design Criteria
	4.1	Exploration Plans and Activities
	4.2	Soil Handling Plans
	4.3	Protection of Biological Resources
	4.4	Air Emission Controls
	4.5	Engineering Design and Operation Plans
	4.6	Geologic Protection Plans
	4.7	Hydrologic Resource Protection
5.0		Reclamation Plans
	5.1	Reclamation of Exploration Disturbance
	5.2	Soil Replacement Plans
	5.3	Habitat Restoration Plans
	5.4	Reclamation of Mining Disturbance
	5.5	Hydrologic Restoration
6.0		Bonding and Insurance
	6.1	Bonding Information
	6.2	Liability Insurance
7.0		Special Categories of Mining
		Experimental Practices
		Mountaintop Removal
		Steep Slope Mining
		Auger Mining
		In-Situ Processing
		Coal Processing Plants Not Within Mine Permit Area
		Variances from Approximate Original Contour Restoration
		Variances fro Delay in Contemporaneous Reclamtion

Small Operator Assistance

8.0 Special Areas of Mining
Prime Farmlands
Alluvial Valley Floors

The permit is formatted to comply with the UDOGM electronic format submission. Relevant tables, exhibits, maps, and figures are presented at the end of each section, and in some cases directly within the text. Maps are generally presented in AutoCAD format. The permit is presented in PDF format to prevent repagination, and other reformatting problems. All relevant permit materials are listed and identified by the comprehensive permit Table of Contents, which also includes lists of all permit tables , figures, maps and exhibits.

Each permit section contains a summary of applicable regulations in the introductory section which cross references applicable regulatory provisions to the specific sub-sections where they are addressed.

2.0 ADMINISTRATIVE INFORMATION

This section of the Kinney No. 2 Mine Permit Application provides relevant information on the mine operator, ownership interests, other required permits and notices, and permit organizational and compliance references and aids. Information sources utilized for this section include legal ownership records, company information, regulatory references, and various other sources. The legal, financial, compliance and related information presented in this section has been developed and is presented in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to provide a basis for verification of the ability of the operator o develop and operate the Kinney No. 2 Mine in a reasonable, responsible manner in full compliance with applicable property rights and State and Federal laws and regulations.

The various information categories addressed in the subsections which make up the Administrative Information Section are consistent with the information categories outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

2.1 Legal, Financial, Compliance, and Related Information]

2.2 Regulatory Cross-Reference (cross-references applicable regulatory provisions to the permit section(s) which address those provisions

2.3 Permit Chronology (an organizational aid which will be used to track present and future permit related meetings, submittals, and responses)

2.4 Permit Revisions (an organizational aid which will contain transmittal letters and application forms identifying the contents of future permit revision submittals)

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps and exhibits, is referenced in the text and provided in the separate map and exhibits volumes as necessary.

2.1 LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

2.1.1 General Legal, Financial, Compliance and Related Information

This section of the Kinney No. 2 Mine permit application provides relevant information on the ownership and control of the permit applicant and operator, ownership and right of entry for the properties which will be affected by the mining and reclamation operations, compliance history for the applicant/operator and associated officers and directors, and other important information. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-100) for coal mine permitting in the State of Utah.

2.1.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R654-301-110 through 150. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
2.1.1	
2.1.1.1	Introductory Information
2.1.1.2	Introductory Information
2.1.2	
2.1.2.1	R645-301-112.100 through 230
2.1.2.2	R645-301-112.300 through 350
2.1.2.3	R645-301-112.400 through 420
2.1.2.4	R645-301-112.500 through 800
2.1.2.5	R654-301-112 900
2.1.3	R645-301-112.700 and Reference Information
2.1.4	
2.1.4.1	R645-301-113.100 through 250
2.1.4.2	R645-301-113.300 through 400
2.1.4.3	R645-301-113.100 through 300
2.1.5	
2.1.5.1	R645-301-114.100 through 230
2.1.5.2	R645-301-114.300
2.1.6	
2.1.6.1	R654-301-115.100 through 200
2.1.6.2	R645-301-115.300
2.1.7	R645-301-116.100 through 220
2.1.8	
2.1.8.1	R645-301-117.100
2.1.8.2	R645-301-117.200
2.1.8.3	R645-301-117.300

2.1.9	R645-301-118
2.1.10	R645-301-121 through 123
2.1.11	R645-301-131 through 132
2.1.12	R645-301-141 through 142.400
2.1.13	R645-301-150
Maps	R645-301-112.500 and 600
Exhibits	R645-301-112.300 through 420, 114.100 through 230, and 117.100 through 300

2.1.1.2 Sources for legal, Financial, Compliance and Related Information

Legal, financial, compliance, and related information presented in this section has been obtained from records and other information maintained by CR.

2.1.2 Identification of Interests

Coal ownership for the permit area is held by Carbon County and is leased to Western Reserve Coal, Inc. effective March 6, 1997, (lease document recorded in the Carbon County Recorders Office in Book 385, Page 396), as amended December 31, 2002, (recorded in the Carbon County Recorders Office in Book 523, Page 522). The coal is subleased from Western Reserve Coal to WRCC, LLC, (which sublease is recorded in the Carbon County Recorder's Office in Book 607, Page 768) the owner of Carbon Resources, LLC, and subleased from WRCC, LLC to Carbon Resources, LLC (which sublease is recorded in the Carbon County Recorder's Office in Book 607, Page 771).

The Kinney No. 2 Mine permit surface area encompasses a block of approximately 452.5 acres. Of this surface acreage, 15.3 acres are owned in fee by Carbon Resources, the remaining 437.2 acres are owned by Evangelos George Telonis, ETAL., of this, 22.8 acres are held by Carbon Resources as an Easement from George Telonis, ETAL.

The area of surface disturbance is confined within the 38.1 acres (combined Fee and Easement) owned or controlled by Carbon Resources, of which only 27.3 acres are planned to be disturbed by mining operations. The coal to be mined lies beneath the George Telonis, ETAL. Fee surface land and is owned by Carbon County which in turn has leased it to Western Reserve Coal, Inc,

Lands adjoining the permit boundary are owned by private owners, and the Utah Department of Transportation.

2.1.2.1 Applicant Information

This application for a Mining and Reclamation Permit for the Kinney No. 2 Mine is submitted by Carbon Resources, LLC (CR) as the permit applicant,. CR is a Nevada limited liability company, authorized to do business in the State of Utah.

The following is the business address, phone number, and employer identification numbers for CR, and Western Reserve Coal, Inc.

Carbon Resources, LLC
P.O. Box 11789
Albuquerque, New Mexico 87192
Phone: (505) 286-1253
Tax ID No. Confidential (See Exhibit 2.1.2.2-1)

Correspondence regarding the Kinney No. 2 Mine Permit and related operations should be directed to:
Carbon Resources, LLC
P.O. Box 11789
Albuquerque, New Mexico 87192
Attention: Clay Wisdom

Carbon Resources, LLC currently maintains administrative and operations at:

P.O. Box 11789
Albuquerque, New Mexico 87192

CR, as the mine operator, will be responsible for payment of the Abandoned Mine Land Reclamation Fee. CR's Resident Agent is:

Ronald C. Barker
2870 S. State Street
Salt Lake City, UT 84225-3624

2.1.2.2 Ownership and Control

The following summarizes Corporate Information, provides the name, business address, telephone number, and employer identification number and list of officers and directors, with their titles, (social security numbers are confidential and can be found in Exhibit 2.1.2.2-1, Confidential Information, and the date that they assumed position of responsibility.

Chief Executive Officer
William J.H. Reeves
Box 954 Sandia Park
New Mexico 87047
Social Security Number Confidential (See Exhibit 2.1.2.2-1)
505-286-7985

Chief Financial Officer
Clay Wisdom
P.O. Box 950 Sandia Park
New Mexico 87047
Social Security Number Confidential (See Exhibit 2.1.2.2-1)
505-286-1253

Manager
Gregory L. Hunt
16577 Columbine Lane
Cedaredge, CO 81413
Social Security Number Confidential (See Exhibit 2.1.2.2-1)
970-856-9477

2.1.2.3 Other Coal Mining Operations Under Common Ownership or Control

The individuals and entities listed in Section 2.1.2.1, Applicant Information have no current or past ownership or control of any coal mining and reclamation operations in the United States. There are no coal mining operations associated with either of these individuals or entities that are included in the Applicant Violator System.

2.1.2.4 Surface and Mineral Ownership

The legal and equitable owners of record of surface lands associated with those areas to be mined by underground coal mining activities or of surface lands to be affected by surface operations and facilities incidental thereto (lands within the permit area) are shown on the Regional Surface Ownership Map, Map 4.5.1.2-1, and are listed below:

Carbon Resources, LLC
P.O. Box 11789
Albuquerque, New Mexico 87192

Evangelos George Telonis Trust
c/o Nick Sampinos
190 North Carbon Ave.
Price, Utah 84501

In addition to the designated owners of lands within the permit area identified above, the owners of record of all surface areas contiguous to the permit area are shown on the Regional Surface Ownership Map 4.5.1.2-1, and are listed below:

Hilda M. Hammond
2912 Redwood Ave.
Costa Mesa California 92626-3719

Utahna Pace Jones, Trust
HC 35 Box 510
Helper, Utah 84526-0000

LH2 Enterprises, Inc.
6338 South Happiness Circle
West Jordan, Utah 84084-0000

Utah Department of Transportation
4501 South 2700 West
Salt Lake City, Utah 84114-1200

The legal and equitable owners of record of the coal to be mined within the permit area are shown on the Regional Coal Ownership Map, (Map 4.5.1.2-2), and are listed below:

Carbon County
120 East Main Street
Price, Utah 84501

(Lease from Carbon County dated March 7, 1997, as amended December 31, 2002)
Carbon Resources, LLC
P.O. Box 11789
Albuquerque, New Mexico 87192

Peabody Natural Resources
701 Market Street
St. Louis MO 63101

In addition to the designated owners of minerals within the permit area identified above, the owners of record of minerals contiguous to the permit area are shown on the Regional Coal Ownership Map (MAP 4.5.1.2-2), and are listed below:

Pit-Min, Inc.,
an Ohio Corporation, of Cincinnati, Hamilton County, State of Ohio
Address Unknown

Hilda M. Hammond
2912 Redwood Ave.
Costa Mesa California 92626-3719

Utahna Pace Jones, Trust
HC 35 Box 510
Helper, Utah 84526-0000

2.1.2.5 Provision for Updating Information

Upon notification of permit approval and prior to permit issuance CR will, as applicable, update, revise, or indicate that the identification of interests and ownership information presented in the preceding sections has not changed.

2.1.3 Other Permits and Approvals

The following permits and approvals will be required to initiate and conduct mining and related operations for the Kinney No. 2 Mine:

Federal Permits and Approvals

USDI – Office of Surface Mining Reclamation and Enforcement (OSMRE), Review, approval, and oversight of the UDOGM Mining and Reclamation Permit

USDL – Mine Safety and Health Administration (MSHA), Issuance of an MSHA I.D. number, approval of mine ventilation and roof control plans, and oversight and enforcement of applicable health and safety provisions under the Coal Mine Health and Safety Act of 1966.

U.S. Commerce Department – Bureau of Alcohol, Tobacco, and Firearms, Approval of Federal permits for transportation, storage, and handling of explosives. Powder and cap magazines are depicted on Map 4.5.1.2-3, Mine Surface Facilities Map.

State Permits and Approvals

Utah Division of Oil, Gas and Mining (UDOGM) – Approval of Mining and Reclamation Permit and enforcement of applicable provisions under the Surface Mining Control and Reclamation Act of 1977

Utah Division of Water Quality (UDWQ) – Approval of Surface Water Discharge Permits and enforcement of applicable provisions under the Utah Pollution discharge Elimination Program (UPDES) in compliance with the Federal Water Pollution Control Act of 1977

Utah Division of Air Quality (UDAQ) – Approval of Air Emission Permits and enforcement of applicable provisions under the Utah Air Pollution Control Program in compliance with the Federal Clean Air Act of 1970

Utah State Engineer – Approval of Pond Construction and Water Well Construction Permits and surface and ground water appropriations

County and Local Permits and Approvals

Carbon County – Conditional Use Permit for mining operations

Scofield Town – Building Permit

CR either has applied or is in the process of applying for all required permits and approvals. Copies of permit applications are included or will be provided for insertion in Exhibit 2.1.3-1, Other Permits. Documentation of approval for all required permits will be submitted to UDOGM on receipt for replacement of applications in Exhibit 2.1.3-1.

The Mine will operate under the name "Carbon Resources LLC - Kinney No. 2 Mine". The MSHA identification number for the mine will be obtained prior to November 2008.

2.1.4 Compliance Information

2.1.4.1 Permit Suspension or Revocation or Bond Forfeiture

Neither the applicant, affiliate nor persons controlled by or under common control with the applicant has had a Federal or State mining permit suspended or revoked in the five (5) years previous to the date of this application. Likewise, no mining bond or similar security deposited in lieu of bond has been forfeited by any affiliated entities or persons.

2.1.4.2 Summary of Notices of Violation, Unabated Cessation Orders, and Unabated Air and Water Quality Violation Notices

The Kinney No. 2 Mine will be a new operation, therefore, no notices of violation (NOV), cessation orders (CO), or air or water quality violation notices have been issued in conjunction with this operation.

2.1.4.3 Provision for Updating Compliance Information

Upon notification of permit approval and prior to permit issuance CR will, as applicable, update or revise the compliance information presented in this section.

2.1.5 Right of Entry

CR's right of entry for surface lands and coal extraction is based on it's ownership of part of the surface and on an agreement with the major property owner, Evangelos George Telonis, ETAL, and on ownership of the Carbon County Coal Lease covering the permit area.

2.1.5.1 Right of Entry Documentation

The following describes fee surface, leased surface, and lease coal, held by CR and coal leases held by CR:

Fee Surface

Title to 15.3 acres of surface lands adjacent to the highway.
Title recorded in the Carbon County Court House Book 657 Page 128.

Located in Section 32, T 12 S, R 7 E, SLB&M as follows:

Beginning at a point which lies North, a distance of 1320.00 feet from the southeast corner of Section 32, Township 12 South, Range 7 East, Salt Lake Base & Meridian, thence S 89°59' W a distance of 920.00 feet, more or less to the intersection of the east right-of-way boundary of the State Road 96; thence in a Northerly direction along said east right-of-way boundary a distance of 270.00 feet; thence in a Northeasterly direction along said highway boundary a distance of 317.10 feet; thence N 45°32' E along said highway boundary a distance of 465.40 feet; thence in a Northeasterly direction along said highway boundary a distance of 733.00 feet, more or less to the intersection of said highway boundary, and the East boundary of Section 32; thence South a distance of 1475.00 feet, more or less to the point of beginning. Containing 16.33 acres, more or less.

Excepting a parcel more particularly described as follows:

Commencing at the Southeast quarter of said Northeast quarter of the Southeast quarter of said Section 32, running thence North along the section line 330 feet, more or less to a point 50 feet North of the railway track of the Union Pacific Railway running across said land; thence in a Southwesterly direction parallel with and 50 feet distance from center line of said track, 412.5 feet, more or less to the South line of said Northeast quarter of the Southeast quarter; thence East 132 feet, more or less to the point of beginning. Containing 1 acre, more or less.

Total acreage of the parcel is 15.33 acres.

Leased Surface

Lease and Easement Agreement with Evangelos George Telonis, ETAL for 22.88 acres of surface land.
Recorded in the Carbon County Court House Book 666, Page 106, dated 2/15/08.

Located in Section 33, T 12 S, R 7 E, SLB&M as follows:

Beginning at a point on the east Right-Of-Way line of the Utah Sate Highway 96, said point being further described as being S00°14'01"E, 1652.62 feet along the west section line of Section 33, Township 12 South, Range 7 East, Salt Lake Base & Meridian in Carbon County, Utah and N90°00'00"E, 235.93 feet from said west line of Section 33; thence along said east right-of-way line the following three courses, N11°02'21"E, 75.98 feet; thence N18°41'18"E, 180.40 feet; thence N10°47'24"E, 82.52 feet; thence along the Telonis north property line N90°00'00"E, 285.41 feet; thence S01°17'17"W, 175.81 feet; thence S26°57'44"W, 450.28

feet; thence S0°14'01"E, 1947.79 feet; thence S90°00'00"W, 400 feet to the west line of the Telonis property, which is the west line of said Section 33; thence N0°14'01"W, 2200.00 feet along said section line being also the west line of the Telonis property; thence N90°00'00"E, 235.93 feet to the point of beginning. Containing 22.88 acres.

Leased Coal

Coal ownership for the permit area is held by Carbon County and is leased to Western Reserve Coal, Inc. effective March 6, 1997, (lease document recorded in the Carbon County Recorders Office in Book 385, Page 396), as amended December 31, 2002, (recorded in the Carbon County Recorders Office in Book 523, Page 522). The coal is subleased from Western Reserve Coal to WRCC, LLC, (which sublease is recorded in the Carbon County Recorder's Office in Book 607, Page 768) the owner of Carbon Resources, LLC, and subleased from WRCC, LLC to Carbon Resources, LLC (which sublease is recorded in the Carbon County Recorder's Office in Book 607, Page 771).

Township 12 South, Range 6 East, SLB&M

Section 24: E1/2SE1/4
Section 25: E1/2E1/2
Section36: N1/2N1/2; S1/2S1/2

Township 12 South, Range 7 East, SLB&M

Section 5: NW1/4NW1/4; SE1/4SW1/4
Section 8: NW1/4NW1/4; SW1/4NW1/4
Section 30: SW1/4
Section 31: NW1/4NW1/4; SE1/4SW1/4; S1/2NE1/4; N1/2SE1/4
Section 32: SW1/4NW1/4; W1/2SW1/4
Section 33: S1/2NW1/4; SW1/4NE1/4; N1/2S1/2; S1/2SE1/4; S1/2SW1/4
Section 34: All
Section 35: All
Section 36: All

Township 13 South, Range 6 East, SLB&M

Section 1: W1/2
Section 12: NW1/4NW1/4; SW1/4SW1/4

Township 13 South, Range 7 East, SLB&M

Section 3: NW1/4
Section 4: All
Section 5: E1/2E1/2
Section 9: N1/2NW1/4
Section 16: SE1/4NW1/4; E1/2SW1/4; SW1/4NE1/4; W1/2SE1/4
Section 21: SE1/4; E1/2SW1/4
Section 28: E1/2; E1/2W1/2
Section 33: E1/2NE1/4; SW1/4NE1/4; NE1/4SE1/4

2.1.5.2 UDOGM Authority to Adjudicate Property Right Disputes

The information presented in this section and submittal of this information as a part of this permit application does not grant, convey, or obligate UDOGM to become involved in or to adjudicate any related property right disputes.

2.1.6 Status of Unsuitability Claims

2.1.6.1 Areas Designated Unsuitable for Mining

Based on available information and to the best of the applicant's knowledge, the permit area is not within and does not include any area designated or under current study for designation as unsuitable for mining.

2.1.6.2 Operations Within 300 Feet of an Occupied Dwelling or Within 100 Feet of a Public Road

Mining operations will be conducted within 100 feet of Utah State Highway 96, which is a public road. In compliance with the applicable regulatory provisions of Rules R645-103-234.100 through 400, CR has contacted and obtained approval from the Utah Department of Transportation (UDOT) for access to Highway 96, and will initiate a formal request for public hearing with UDOGM. A notice of public hearing will be published at least two weeks in advance of the hearing in a local paper of general circulation and opportunity was provided in the hearing for the public and any affected owners to present information relating to protection of their interests. Copies of the public notice and hearing documentation and written findings relative to mining within 100 feet of a public road, will be submitted to UDOGM on receipt for insertion in Exhibit 2.3, Public Notice and Proof of Publication, Hearing Notices and Documentation.

This permit application provides general information relative to the location, sequence, timing, and affected areas for all anticipated mining and reclamation operations over the life of the mine. The proposed timetable for each phase of mining and reclamation is discussed in Sections 4.5, Engineering Design and Operation Plans, and 5.4, Reclamation of Mining Disturbance, and illustrated by the Mine Plan Layout & Production Schedule Map, (Map 4.5.1.2-5).

This application is for an initial permit term of five years beginning from the date of permit approval and issuance. Since the proposed mining and reclamation operations will extend beyond this initial permit term.

2.1.7 Permit Term

This permit application provides general information relative to the location, sequence, timing, and affected areas for all anticipated mining and reclamation operations over the life of the mine. The proposed timetable for each phase of mining and reclamation is discussed in Sections 4.5, Engineering Design and Operation Plans, and 5.4, Reclamation of Mining Disturbance.

2.1.8 Insurance, Proof of Publication

2.1.8.1 Certificate of Insurance

CR will obtain and provide UDOGM with the certificate of insurance prior to initiation of development and mining activities. On receipt, a copy of the certificate of insurance will be submitted to UDOGM for insertion in Exhibit 5.4.3-1, Bonding and Insurance Information, as evidence that CR has a public liability insurance policy in force for the Kinney No. 2 Mine and related operations. The insurance policy will meet all applicable regulatory requirements for minimum coverage, will be maintained in full force during the permit term and all subsequent renewals, and will include a rider providing for notification to UDOGM of any termination or substantive changes in the policy.

2.1.8.2 Proof of Publication

Upon receipt of notification that UDOGM has determined the permit application to be administratively complete, CR will place the advertisement in the Sun Advocate for publication at least once per week for a period of four weeks. A copy of the proof of publication for the public notice will be provided to UDOGM no later than four weeks after the last date of publication for insertion in Exhibit 2.3, Public Notice and Proof of Publication, Hearing Notices and Documentation. Any public notices and proof of publication documentation for future permit revisions will also be inserted in Exhibit 2.3.

2.1.9 Filing Fee

This permit application was accompanied by the required filing fee.

2.1.10 Permit Application Format and Contents

The information presented in this permit document represents a compilation of relevant historic information and recent site environmental and planning information developed specifically for the Kinney No. 2 Mine. Within the constraints of applicable regulatory information requirements, CR has endeavored to present permit information in a clear and concise manner.

Permit information has been formatted to address applicable regulatory information requirement in a logical organized manner. Permit format and organization is also designed to facilitate both initial agency review and future use and revision of the permit documents a reference for permit commitments and requirements and as the plan basis for ongoing mining and reclamation operations. Permit format and organization is similar to previous permits submitted to the UDOGM, and is formatted to comply with the electronic permit guidelines.

Any references or assumptions which serve to clarify or qualify the information provided are presented and discussed and any technical data utilized as the basis for permit discussions has been reviewed and validated to verify that any conclusions presented have a sound technical basis. The descriptions of legal, financial, compliance, and related Information

and environmental resources and the discussions of operation and reclamation plans are supported by relevant tables, figures, maps and exhibits which are included as part of the permit application document. Other information which is either readily available or is too voluminous for inclusion in the permit document has been referenced, as appropriate.

The required notarized verification by a responsible CR official that the information presented in this permit application is true and correct to the best of that individual's information and belief is included on the transmittal which accompanied the permit application submittal.

2.1.11 Reporting of Technical Data

CR has reviewed sampling, testing, and analysis information developed in conjunction with this permit application and has confirmed that the information was collected, developed, and analyzed by or under the supervision of a competent qualified professional in the discipline under consideration. All laboratory analyses were performed by experienced laboratory personnel using accepted standardized analysis methods.

In order to assure appropriate documentation, technical data presented in this application includes the name(s) of the persons or organizations directly responsible for its collection and analysis, dates of collection and analysis, and a description of collection and analysis methodologies where appropriate.

This application reflects the efforts of numerous individuals and organizations. Considerable time, expense, and many man-hours have been devoted to the collection, analysis, and presentation of technical data and other information contained in this permit application. Those individuals are identified and listed by organization as follows:

Carbon Resources LLC

J.H. Reeves	CEO
M. Clay Wisdom	CFO

Geo-Hunt Consulting LLC

Gregory L. Hunt, M.S.	Geologist
Eric Robeck, M.S.	Geologist

Rock Logic LLC

Brad Lindsey, B.S.	Geologist

Hansen, Allen & Luce, Inc. Engineers

David Hansen, PhD, P.E.	Hydrology, Engineering
Tyler Shelley, E.I.T	Hydrology
David Bruse	Land Technologist
Ben Grimes, P.L.S.	Surveying, Permitting Specialist

Mt Nebo Scientific

Patrick D. Collins, PhD	Botanist

Bruce Chesler BA Soil Science — Soils Scientist

Rollins, Brown & Gunnell Engineers

Brad Price, P.E.	Geotechnical Engineering
Randall Peterson, P.E.	Mining Engineering

Risun Technologies

William Simmons, P.E.	Facilities Engineer
Bill Whitney. P.E.	Facilities Engineer

Gault Group, Inc.

Major N. Kindsfater, B.S.	Environmental Engineer, Air Quality

2.1.12 Maps and Plans

All maps included in the permit application document are based on either U.S. Geological Survey Mapping or site specific mapping developed using surveyed aerial control and accepted aerial photogrammetry methods. Maps showing overall permit area and regional information are presented at an AutoCAD scale of 1:1, with produced maps at a general scale of 1" = 1,000', or 1"=2,000' for larger areas, and smaller areas down to 1"=100'. Maps presented electronically as an integral part of the permit document have been produced in electronic PDF format. Original AutoCAD files of the appropriate maps are included for use by UDOGM in permit review. Electronic AutoCAD files of the maps will not be provided in hard copies of the permit document for public review, however, hard copies of the maps are provided in these copies of the permit application. The maps also clearly designate the limits of anticipated surface disturbance under this permit application. Rule R645-301-512 and a number of other regulatory provisions specify that certain designated maps and cross-sections be completed under the direction of and certified by a qualified, registered professional engineer, or land surveyor. Those permit maps which have been certified in compliance with applicable regulatory provisions are identified in Section 4.5.1.8, Certification, Inspection, Reporting, and Emergency Procedures.

2.1.13 Permit Completeness

The information provided in this permit is designed to adequately address and effect compliance with all applicable regulatory provisions. The summaries of applicable regulatory sections addressed included at the beginning of each permit section provide documentation that all regulatory provisions have been addressed and also serve as a ready reference to verify the completeness of the permit application.

2.2 REGULATORY CROSS REFERENCE

This section is intended to provide a cross reference for the MPR document where the sections of the MRP are listed, with the R645 regulations pertinent to each section. This Section can be searched using the PDF MRP, as well as using the hard copy as a reference. Each section of the MRP document is listed with the various sub-sections within each section, and the regulation numbers applicable to that section or sub-section.

1.0 INTRODUCTION

Permit Section	Regulatory Provisions Addressed
1.0	R645-300-112.400

2.0 ADMINISTRATIVE INFORMATION

Introduction - No Regulations Cited

2.1 LEGAL AND FINANCIAL COMPLIANCE

Specifically, this section addresses Rules R654-301-110 through 150. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
2.1.1	
2.1.1.1	Introductory Information
2.1.1.2	Introductory Information
2.1.2	
2.1.2.1	R645-301-112.100 through 230
2.1.2.2	R645-301-112.300 through 350
2.1.2.3	R645-301-112.400 through 420
2.1.2.4	R645-301-112.500 through 800
2.1.2.5	R654-301-112 900
2.1.3	R645-301-112.700 and Reference Information
2.1.4	
2.1.4.1	R645-301-113.100 through 250
2.1.4.2	R645-301-113.300 through 400
2.1.4.3	R645-301-113.100 through 300

2.1.5	
2.1.5.1	R645-301-114.100 through 230
2.1.5.2	R645-301-114.300
2.1.6	
2.1.6.1	R654-301-115.100 through 200
2.1.6.2	R645-301-115.300
2.1.7	R645-301-116.100 through 220
2.1.8	
2.1.8.1	R645-301-117.100
2.1.8.2	R645-301-117.200
2.1.8.3	R645-301-117.300
2.1.9	R645-301-118
2.1.10	R645-301-121 through 123
2.1.11	R645-301-131 through 132
2.1.12	R645-301-141 through 142.400
2.1.13	R645-301-150
Maps	R645-301-112.500 and 600
Exhibits	R645-301-112.300 through 420, 114.100 through 230, and 117.100 through 300

2.3 PERMIT CHRONOLOGY

No Regulations Cited

3.0 ENVIRONMENTAL DISCRIPTON

Introduction - No Regulations Cited

3.1 SOILS INFORMATION

Specifically, this section addresses Rules R645-301-210 and 220. Operation plans (Rules R645-301-231 through 234) are addressed in Section 4.2 of this permit application and reclamation plans and performance standards (Rules R645-301-241 through 244, and 250) are addressed in Section 5.2. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
3.1.1	
3.1.1.1	General Introductory Information
3.1.1.2	R645-301-211, 222, and 223
3.1.1.3	R645-301-211, 222, and 223
3.1.1.4	R645-301-222.100
3.1.1.5	R645-301-222.300 and 400, 223, and 224
3.1.1.6	R645-301-221
3.1.2	
3.1.2.1	R645-301-211 and 222
3.1.2.2	R645-301-211 and 222.300
3.1.2.3	R645-301-222.400, 223, and 224
3.1.2.4	R645-301-211, 212, 222.400, and 224
Maps	R645-301-222.100
Exhibits	R645-301-211, 222, and 223

3.2 VEGETATION INFORFMATION

Specifically, this section addresses Rules R645-301-310 and 311, 321.100 through 200, 322.210, and 323.100 and 400. Operation plans (Rules R645-301-330 and 331) are addressed in Section 4.3 of this permit application and reclamation plans and performance standards (Rules R645-301-341, 342.200 through 400, and 352 through 357) are addressed in Section 5.3. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
3.2.1	
3.2.1.1	
3.2.1.2	R645-301-321.100, and 200
3.2.1.3	R645-301-321.100
3.2.1.4	R645-301-140, 311 and 323
3.2.2	
3.2.2.1	R645-301-321.100 and 200
3.2.2.2	R645-301-321.100 and 200
3.2.2.3	R645-301-321.100
3.1.2.4	R645-301-321-200
3.2.2.5	R654-301-321-200
3.2.2.6	R645-301-321.100 and 200, and 323.100 and 400
3.2.3	
3.2.3.1	R645-301-322.210 and 300
3.2.3.2	R645-301-322.210 and 230
3.2.3.3	R645-301-322.210

3.2.3.4	R645-301-322.210 and 323.300
Maps	R645-301-323.100 and 400
Exhibits	R645-301-311, 321.100 and 200, 322.210, and 323.100 and 400

3.3 WILDLIFE INFORMATION

Specifically, this section addresses Rules R645-301-310 and 311, 322.100 through 300, and 323.200 and 300. Operation plans (Rules R645-301-330 through 333) are addressed in Section 4.3 of this permit application and reclamation plans and performance standards (Rules R645-301-342 and 358) are addressed in Section 5.3.

The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section		Applicable Regulatory Provisions
3.3.1		
	3.3.1.1	
	3.3.1.2	R645-301-322.100, 200 and 300
	3.3.1.3	R645-301-322.220, 330 and 323.400
	3.3.1.4	R645-301-323.200, 300 and 400
3.3.2		
	3.3.2.1	R645-301-311 and 322
	3.3.2.2	R645-301-322.200, 210, 220 and 230
	3.3.2.3	R645-301-311 and 322
3.3.3		
	3.3.3.1	R645-301-311 and 322
	3.3.3.2	R645-301-322.200, 210, 220 and 230
	3.3.3.3	R645-301-311 and 322
3.3.4		
	3.3.4.1	R645-301-322.100, and 300
	3.3.4.2	R645-301-322.210, and 230
	Maps	R645-301-323
	Exhibits	R645-301-322.100 and 300

3.4 LAND USE INFORMATION

Specifically, this section addresses rule R645-301-411. Reclamation plans and performance standards (Rules R645-301-412 through R645-301-414) are addressed in Section 5.4 of this permit application. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
3.4.1	
3.4.1.1	
3.4.1.2	R645-301-130
3.4.1.3	R645-301-411.110 and 200
3.4.1.4	R645-301-411.110, 140, and 141, and 512
3.4.2	
3.4.2.1	R645-301-411.100 and 120
3.4.2.2	R645-301-411.110 and 130; 411.200
3.4.2.3	R645-301-411.120
3.4.2.4	R645-301-411.130 and 141
3.4.2.5	R645-301-411.130
3.4.3	
3.4.3.1	R645-301-411.140
3.4.3.2	R645-301-411.140
3.4.3.3	R645-301-411.140
3.4.3.4	R645-301-411.140, 141, 143, and 144
3.4.3.5	R645-301-411.142
3.4.4	
3.4.4.1	R645-301-411.200, 240
3.4.4.2	R645-301-411.200 through 250
Maps	R645-301-411.110, 140, 141, and 230
Exhibits	R645-301-411.140 through 143

3.5 AIR QUALITY INFORMATION

Specifically, this section addresses existing baseline conditions under Rules R645-301-420 through 422. Air quality considerations relative to proposed mining and related activities operation and reclamation plans are addressed in Sections 4.4, and 5.2 and 5.3, respectively, of this permit application.

The following cross references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
3.5.1	
3.5.1.1	R645-301-421
3.5.1.2	R645-301-130 and 140
3.5.1.3	General background - not required by regulation
3.5.1.4	R645-301-421

Exhibits	R645-301-422

3.6 GEOLOGICAL INFORMATION

Permit Section	Regulatory Provisions Addressed
3.6.1	
3.6.1.1	R645-301-610 through 611
3.6.1.2	R645-301-624, 100, 130 and 210 through 340
3.6.1.3	R645-301-624.100
3.6.1.4	R645-301-612, and 622
3.6.1.5	R645-301-623 and 624.200 and 300
3.6.2	
3.6.2.1	R645-301-624.100
3.6.2.2	R645-301-624.100
3.6.2.3	R645-301-624.210 and 310
3.6.3	
3.6.3.1	R645-301-623 and 624.200, 210, 310, and 340
3.6.3.2	R645-301-623 and 624.200, 220, 230, 320, and 330
3.6.4	R645-301-620 through 627
Maps	R645-301-622
Exhibits	R645-301-624.210 through 340

3.7 HYDROLOGIC INFORMATION

Permit Section	Regulatory Provisions Addressed
3.7.1	
3.7.1.1	R645-301-711 and 720
3.7.1.2	R645-301-711 and 721
3.7.1.3	R645-301-720, 721, 722, 724
3.7.1.4	R645-301-724.400 through 724.413
3.7.1.5	R645-301-512 and 722.100 through 722.500
3.7.2	
3.7.2.1	R645-301-724.100 and 724.300
3.7.2.2	R645-301-724.100 and 722.400
3.7.2.3	R645-301-724.100 and 722.400
3.7.2.4	R645-301-724.100 and 723
3.7.2.5	R645-301-722.400
3.7.2.6	R645-301-724.100
3.7.2.7	R645-301-724.300

3.7.3.1	R645-301-724.200
3.7.3.2	R645-301-724.200
3.7.3.3	R645-301-724.200
3.7.3.4	R645-301-724.200 and 723
3.7.3.5	R645-301-724.200
3.7.3.6	R645-301-724.200
3.7.3.7	R645-301-724.200
3.7.4	
3.7.4.1	R645-301-724.410
3.7.4.2	R645-301-724.410, 724.413, and 724.420
3.7.4.3	R645-301-724.410, 724.411, and 724.420
3.7.4.4	R645-301-724.410, 724.412 and 724.420
3.7.5	
3.7.5.1	R645-301-724.600
3.7.5.2	R645-301-724.600
3.7.5.3	R645-301-724.600
3.7.6	R645-302-320
3.7.7	R645-301-724.310, 725.100, 725.200 and 725.300
3.7.8	R645-301-726
3.7.9	R645-301-727

4.0 OPERATION PLANS

Introduction - No Regulations Cited

4.1 EXPLORATION PLANS

Specifically, this section addresses Rules R645-201-200 and 300, and R645-202-100 and 200 through 236. Reclamation plans and related performance standards (Rules R645-202-240 through 244.300) are addressed in Section 5.1. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
4.1.1	
4.1.1.1	General Introductory Information
4.1.1.2	R645-201-210, 220 through 225, and 310 through 332, and 202-100 and 210
4.1.1.3	R645-201-210 through 225, 300 through 352, and 400 through 434
4.1.2	

4.1.2.1	R645-201-225, 323-100 and 200, 325, and 202-232
4.1.2.2	R645-201-225, 323.100 through 400, and 202-230 through 236
4.1.2.3	R645-201-225, 323.100 through 400, and 202-230 through 236
4.1.2.4	R645-201-225, 323.200, and 202-235
4.1.2.5	R645-201-225, 323.200, 325, and 202-235 and 236
4.1.2.6	R645-201-225, 323.200, and 202-240 through 244.300
4.1.3	
4.1.3.1	R645-201-225, 323.100 and 400, and 202-231
4.1.3.2	R645-201-225, 323.200, and 202-232
4.1.3.3	R645-201-225, 323.400, and 202-233
4.1.3.4	R645-201-225, 323.400, and 202-234
4.1.3.5	R645-201-225, 323.400, and 202-235
4.1.3.6	R645-201-225, 323.200 and 400, and 202-236
4.1.4	R645-203-100 through 220
Maps	None
Exhibits	None

4.2 SOIL HANDELINING PLANS

Permit Section	Applicable Regulatory Provisions
4.2.1	
4.2.1.1	General Introductory Information
4.2.1.2	R645-301-231.100, 200, 251, 252, 232.200, and 233.100 through 400
4.2.2	
4.2.2.1	R645-301-231.100, 232.100 through 720, and 233.100 through 400
4.2.2.2	R645-301-231.200, 300, and 233.200 through 400
4.2.2.3	R645-301-231.100, 400, and 234.100 through 320
Maps	None
Exhibits	None

4.5 Engineering Design

Specifically, this section addresses Rules R645-301-510, 520, 530 and 560. Reclamation plans and related performance standards (Rules R645-301-540 and 550) are addressed in Section 5.5. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
4.5.1	
4.5.1.1	General Introductory Information
4.5.1.2	R645-301-521.130 through 133, and 150 through 152
4.5.1.3	R645-301-521.110 through 125
4.5.1.4	R645-301-521.111 through 124
4.5.1.5	R645-301-521.140 through 143 and 160 through 190
4.5.1.6	R645-301-513.100 through 800
4.5.1.7	R645-301-553.500 and 731.600
4.5.1.8	R645-301-512.100 through 260, 514.100 through 330, and 515.100 through 322
4.5.1.9	R645-301-521.100 through 132, 521.140 through 170
4.5.2	
4.5.2.1	R645-301-521
4.5.2.2	R645-301-522, 523.100 through 220, 524.100 through 800, and 525.100 through 300
4.5.2.3	R645-301-526.100 through 300, 527.100 through 250, 528.100 through 322, and 529.100 through 400
4.5.2.4	R645-301-531 through 537.250
Maps	R645-301-512.100 through 260, 514.100 through 330, and 515.100 through 322
Exhibits	R645-301-512.100 through 200, 513.100 through 800, 524.100 through 800, 528.320 through 322, 530 through 534.340, 536.100 through 900.

4.6 GEOLOGIC PROTECTION PLAN

Specifically, this section addresses Rules R645-301-630 through 642. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
4.6.1	
4.6.1.1	General Introductory Information
4.6.1.2	R645-301-631 and 632
4.6.2	
4.6.2.1	R645-301-631 through 631.200, and 641
4.6.2.2	R645-301-632 through 632.200, and 642
4.6.2.3	R645-301-515.100
Maps	R645-301-632.200

4.7 HYDROLOIC RESOURCES

Specifically, this section addresses Operational Plans (Rules R645-301-730 through R645-301-750) and Probable Hydrologic Consequences (Rule R645-301-728). The following table cross-references the headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
4.7.1	
4.7.1.1	General Introductory Information
4.7.1.2	R645-301-731
4.7.1.3	R645-301-731
4.7.1.4	R645-301-731.610 through 620
4.7.1.5	R645-301-731.700 through 760
4.7.2	
4.7.2.1	R645-301-731.110 through 112
4.7.2.2	R645-301-731.120 through 122
4.7.2.3	R645-301-731.200 through 225
4.7.2.4	R645-301-731.300 through 320
4.7.2.5	R645-301-731.500 through 522
4.7.2.6	R645-301-731.600 through 620 and 731.700 through 760
4.7.2.7	R645-301-731.800 and 731.900
4.7.2.8	R645-301-732 and 732.100
4.7.2.9	R645-301-742.300 through 333
4.7.2.10	R645-301-742.300 through 333
4.7.2.11	R645-301-732.200 through 420, 733.100 through 420, and 742.220 through 225.2
4.7.2.12	R645-301-733.100 through 240
4.7.2.1	R645-301-735, 736, and 737
4.7.2.4	R645-301-738
4.7.3	
4.7.3.1	R645-301-742.100 through 126
4.7.3.2	R645-301-742.200 through 240, and 750.752 and 752.100
4.7.3.3	R645-301-742.300 through 333
4.7.3.4	R645-301-742.400 through 423, and 752.200 through 250
4.7.3.5	R645-301-743.100 through 300
4.7.3.6	R645-301-744.100 through 200, and 753
4.7.3.7	R645-301-745.100 through 400, and 754
4.7.3.8	R645-301-746.100 through 430, and 754
4.7.3.9	R645-301-747.100 through 300, and 754
4.7.3.10	R645-301-750 and 751
4.7.3.11	R645-301-748 and 755
4.7.4	
4.7.4.1	R645-301-728.200
4.7.4.2	R645-301-728.310
4.7.4.3	R645-301-728.320
4.7.4.4	R645-301-728.330 through 335
4.7.4.5	R645-301-728.340
4.7.5	R645-301-729.100 and 729.200

5.0 RECLAIMATION PLANS

Introduction - No Regulations Cited

5.1 RECLAIMATIN OF EXPLORATION DISTURBNCE

Specifically, this section addresses Rules R645-201-225, 323, and 327, and 202-240 through 244.425. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
5.1.1	
5.1.1.1	General Introductory Information
5.1.1.2	R645-201-225, 323.200 through 400, 327.100 through 900, and 202-240 through 244.300
5.1.2	
5.1.2.1	R645-202-244
5.1.2.2	R645-201-225, 323.200 through 400, 327.100 through 900, and 202-240 through 244.300

5.2 SOIL REPLACEMENT PLANS

Specifically, this section addresses Rules R645-301-240, 241 through 244.320, and 250. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Requirements
5.2.1	
5.2.1.1	General Introductory Information
5.2.1.2	R645-301-240, 241, and 250
5.2.2	
5.2.2.1	R645-301-242.130
5.2.2.2	R645-301-242.100 through 310
5.2.2.3	R645-301-243
5.2.2.4	R645-301-244.100 through 320

5.3 HABITAT RESTORATION PLAN

Specifically, this section addresses Rules R645-301-341, 342, 351 through 357.300, and 358. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Requirements
5.3.1	
5.2.1.1	General Introductory Information
5.2.1.2	R645-301-341, 342, 352, 353 and 358
5.3.2	
5.3.2.1	R645-301-341.100 and 354
5.3.2.2	R645-301-341.220
5.3.2.3	R645-301-341.210 and 342.200 through 230
5.3.2.4	R645-301-341.230 and 355
5.3.2.5	R645-301-341.240 and 357.300
5.3.2.6	R645-301-341.250, 300, 353.100 through 300, 356.100 through 400, and 357.100 through 300
5.3.3	
5.3.3.1	R645-301-342.100 and 358.400 through 530
5.3.3.2	R645-301-342.200 through 400
5.3.3.3	R645-301-358.100 and 400
5.3.3.4	R645-301-358.200, 300, and 510

6.0 BONDING AND INSURANCE

This section of the Kinney No. 2 Mine Permit Application provides information relative to reclamation bonding requirements and provisions and the public liability insurance required under Rule R645-301-800.

6.1 DETERMINATION OF BOND AMOUNT

Specifically, this section addresses Rules R645-301-820 through 880.932. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
6.1.1	General Introductory Information
6.1.2	General Introductory Information
6.1.3	R645-301-820.100 through 352
6.1.4	R645-301-830.100 through 500
6.1.5	R645-301-840.100 through 520
6.1.6	R645-301-850.100 through 320
6.1.7	R645-301-860.100 through 380
6.1.8	R645-301-870.100 through 200

6.1.9	R645-301-880.100 through 932
Maps	None
Exhibits	R645-301-830.100 through 300

7.0 SPECIAL CATEGORIES AND MINING AREAS

This section of the Kinney No. 2 Mine Permit Application provides both general and specific information on design, construction, operation, maintenance, and reclamation for mining and related operations which fall under the categories of either "Special Categories of Mining", as defined by Rule R645-302-200, or "Special Areas of Mining", as defined by Rule R645-302-300.

Specifically, this section addresses Rules R645-302-210, 220, 230, 240, 250, 260, 270, 280, 290, 310 and 320. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
7.1	R645-302-211 through 218
7.2	R645-302-221 through 227.900
7.3	R645-302-231 through 234.400
7.4	R645-302-241 through 245.500
7.5	R645-302-251 through 254.620
7.6	R645-302-261 through 264.900
7.7	R645-302-271 through 275
7.8	R645-302-281 through 284
7.9	R645-301-291 through 299.400
7.10	R645-302-311 through 317.628.2
7.11	R645-302-321 through 324.330

2.3 PERMIT CHRONOLOGY

Note: This document is intended to keep an ongoing log of permit activities to assist both DOGM and Kinney No. 2 Mine in tracking activities, and submittals to DOGM.

Date Description

Initiate permitting work

Baseline data collection and field work

25 February 2005
Meeting at DOGM Office, Initial discussions regarding size of permit application, Portal Block size VS larger permit application and the implications relative to permit timing and approval. Need for groundwater monitor wells and surface water monitoring.
DOGM Personnel:
Pam Grubaugh Littage,
Wayne Hedberg
Dave Darby
Danna Dean
Greg Glowackie (sp?)
Carbon Resources Representatives:
Mark Wayment (Whisky Creek Consulting)
Gregory Hunt

15 August 2005
First Draft Exploration Plan submitted to DOGM

22 December 2005
Carbon Resources Exploration License application APPROVED to explore for coal and to complete ground water monitoring wells to gather data in support of a mine permit application.

3 April 2006
Meeting at DOGM Office to discuss permit preparation, format and other issues.
DOGM Personnel:
Pamela Grubaugh Littage
Wayne Hedberg
Jerry-Ann Ernstsen
Steve Fluke
Steve Christensen
Carbon Resources Representatives:
Ben Grimes
Gregory Hunt

26 May 2006
Field Meeting at Scofield to review recent completion of ground water monitoring wells and discuss additional monitor wells and baseline data collation in general.
DOGM Personnel:
Wayne Hedberg
Priscilla Burton
Steve Christensen
Steve Fluke
Carbon Resources Representatives:
Ben Grimes
Brad Lindsay
Gregory Hunt

22 June 2007
Meeting at DOGM Offices to discuss forthcoming Permit Application Package and recently issued Division Order.
DOGM Personnel:
Pam Grubaugh-Littig
Wayne Hedberg
Steve Christensen
Carbon Resources Representatives:
Ben Grimes
Gregory Hunt

10 August 07
Meeting in DOGM Offices regarding "Order" DOGM had issued, Carbon Resources Response to the "Order" including Carbons' preparation to plug CR-06-03, and request a permit for soils pit excavations.
DOGM Personnel:
Mary Ann Wright,
Pamela Grubaugh Littig
Steve Christensen
Carbon Resources Representatives:
Ben Grimes
Gregory Hunt

October 2007
Carbon County Zoning Hearing
Approved Zoning Change from WS to MR

November - December 2007
Scofield Town Zoning Hearing, Town Council Hearing and Decision
Approved Zone Change to Commercial

Baseline data collection and field work

11 May 2005
Surface water monitoring commenced.

6 January 2006
Raptor Survey
Nathan Sill
UDWR/Oil and Gas Biologist
Helicopter provided by Carbon Resources

10 January 2006
Drilling started to collect geologic data and complete groundwater monitor wells.

3 March 2006
Groundwater monitoring commenced.

June 2006
Spring and seep survey completed

October 2005 - October 2007
Multiple Surveys, land, drill hole, soil pit, roads, fence lines, etc.
Ben Grimes HAL

June 2007
Cultural Resource Survey
May - September 2007
Vegetation Survey

October 2006 & September 2007
Soil Chemistry Survey

October 2007
Soil Stability Survey

3.0 ENVIRONMENTAL DESCRIPTION

This section of the Kinney No. 2 Mine Permit Application provides general descriptions and the qualitative and quantitative information necessary to adequately characterize existing environmental resources and conditions in the permit and adjacent areas. Information used in developing the resource characterizations has been obtained through site-specific resource investigations, monitoring activities, research of available documents and reports, and contacts with Federal, State, and local agencies, and individuals familiar with site history and conditions. The resource characterizations presented in this section have been prepared in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to provide a basis for identification and evaluation of potential environmental impacts from mining and related activities. This information has also been used in developing site-specific mining and reclamation plans and related control and mitigation measures in order to avoid or minimize potential adverse mining related impacts.

The various resource categories described in the subsections which comprise the Environmental Information Section are consistent with resource category breakdowns as outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

3.1	Soils Information
3.2	Vegetation Information
3.3	Fish and Wildlife Information
3.4	Land Use Information
3.5	Air Quality Information
3.6	Geologic Information
3.7	Hydrologic Information

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps, tables, figures, and exhibits, is referenced in the text and provided in the separate map and exhibits volumes as necessary.

3.1 SOILS INFORMATION

3.1.1 General Soils Information

This section describes the existing soil types and characteristics of the soils found within the permit area that could be affected or impacted by mining and reclamation activities. Detailed chemical and physical testing of those soils which have been disturbed by previous mining operations to determine their potential for reclamation is also addressed. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-200) for coal mine permitting in the State of Utah and applicable provisions of the current UDOGM Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining.

3.1.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-210 and 220. Operation plans (Rules R645-301-231 through 234) are addressed in Section 4.2 of this permit application and reclamation plans and performance standards (Rules R645-301-241 through 244, and 250) are addressed in Section 5.2. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section		Applicable Regulatory Provisions
3.1.1		
	3.1.1.1	General Introductory Information
	3.1.1.2	R645-301-211, 222, and 223
	3.1.1.3	R645-301-211, 222, and 223
	3.1.1.4	R645-301-222.100
	3.1.1.5	R645-301-222.300 and 400, 223, and 224
	3.1.1.6	R645-301-221
3.1.2		
	3.1.2.1	R645-301-211 and 222
	3.1.2.2	R645-301-211 and 222.300
	3.1.2.3	R645-301-222.400, 223, and 224
	3.1.2.4	R645-301-211, 212, 222.400, and 224
Maps		R645-301-222.100
Exhibits		R645-301-211, 222, and 223

3.1.1.2 Sources for Soils Information

The information presented in this section was obtained from various published studies and mine permit related evaluations which have previously been conducted in the area corresponding to the permit and adjacent areas. A soils report was prepared in 1981 by Patrick D. Collins, Botanist/Reclamation Specialist for Western Reserve Coal Company, Inc. for a Mining and Reclamation Permit application for the Kinney No. 2 Mine. In that report, the

soils description was taken from the then current United States Department of Agriculture, Soil Conservation Service Soil Survey (USDA-SCS). The soils investigation for the Kinney No. 2 Mine did not use the 1981 report by Dr. Collins because the mine site was extensively modified in 1985-1986 by the Utah Abandoned Mine Reclamation program (AML). That work by AML extensively disturbed the soils in the area, and made the earlier work by Dr. Collins unusable.

3.1.1.3 Kinney No. 2 Mine Soil Survey Report

During October 2006, and September 2007, field work was conducted by Bruce Chelser, Soils Scientist for the proposed Kinney No. 2 Mine area. A report of the investigation and findings is included in Exhibit 3.1.1.3-1, Soils Information. For the complete report refer to Exhibit for the following:

- Presentation of methods
- Lab analysis and data interpretation
- Potential soil management alternatives discussion
- Soil Survey results
- Soil salvage discussion
- Primary grown medium discussion

3.1.1.4 Prime Farmland Investigation

The report above addresses prime farmland in the Soil Survey Results section. In addition, a formal request to the U.S.D.A., Natural Resources Conservation Service (NRCS) for a determination on prime farmland for the permit area. Documentation of the response from the NRCS can be found in Exhibit 1.5-1, Prime Farmland Determination.

The NRCS determined that the soils in the area do not meet the criteria for prime, state important, or unique farmlands.

3.1.1.5 Soil Availability and Suitability

In order to evaluate the availability of existing surficial soil materials to support future revegetation efforts for the proposed disturbance areas, soil mapping information has been correlated with the limits of proposed surface disturbance to quantify available soil removal and replacement volumes. Since soil removal/replacement are operations and reclamation functions, the soil volumetric analysis is presented in Sections 4.2 and 5.2 of this permit application document. Evaluation of reclamation suitability for potential growth media materials focuses on comparison of available soil analysis data as outlined in the preceding section with applicable soil suitability criteria as outlined in the UDOGM Topsoil/Overburden Guidelines.

CR is not proposing to use coal or coal waste materials as substitute topsoil materials. This material has been mostly covered by soil materials by the AML reclamation project. There are areas where historic mining left coal fines on the surface in the area to be disturbed for the Kinney No. 2 Mine. The AML project did not remove 100% of the coal fines, as this would

have unnecessarily disturbed a much larger area. These coal fines can be found in most of the proposed disturbance area. The growth medium in place has been demonstrated to be suitable for reclamation use by the success of vegetation on the reclaimed areas, even with the large amounts of coal fines remaining at and near the surface. Final topsoil replacement depths for reclamation will depend on the amount of growth medium CR is actually able to salvage. An effort to quantify the amount of coal fines lying below the ground surface in the proposed disturbance area has been conducted. During the soils study, and geotechnical investigation process, below ground surface historic coal fines were documented in an effort to determine the possible volume of historic coal fines that will need to be removed during surface facilities construction. It is impossible to determine with 100% accuracy the amount of coal fines that will be encountered by CR during the construction of the surface facilities, however, it is estimated that there are approximately 12,000 cubic yards of historic coal fines and coal waste in the 27.3 acres of planned disturbance that will be encountered during construction of the surface facilities. Coal fines do not compact well, and therefore must be removed to prevent ground stability problems with operations buildings, conveyors, roads, and other mine facilities. The historic coal fines and coal waste materials will be recovered and sold as coal product.

3.1.2 Soil Amendments

The UDOGM regulations require that soil amendments be applied at the recommended rates to assure that proper revegetation is achieved. The present UDOGM Topsoil/Overburden Guidelines contain no recommended soil amendment application levels. Following final seedbed preparations of the reclaimed areas of the Kinney No. 2 Mine, a soil sampling program will be implemented prior to fertilization and seeding. Results of the analyses should identify fertility problems and will provide a basis for determining necessary soil amendments and fertilization rates. The parameters to be analyzed will include:

- Electrical conductivity (EC)
- Sodium adsorption ratio (SAR)
- pH
- Texture
- Organic matter
- Available phosphorus (P)
- Potassium (K)
- Nitrate

This program is necessary because topsoil and substitute topsoil materials stockpiled for years may change slightly in quality and chemical makeup. In addition, significant volumes of coal fines left in place are estimated at the time of this permit application. As much of this coal material will be removed during site construction and sold as possible. There will undoubtedly be some coal fines that cannot realistically be removed during initial site construction that will be mixed into the topsoil/substitute topsoil material during removal and handling. These small amounts of coal fines will not degrade the quality and usefulness of the topsoil/substitute materials according to the soils report. In addition, the substantial amounts of coal fines in the pre-disturbance area, both on the surface and mixed into the soil profile have not significantly affected the ability of the soils to support vegetation. This is demonstrated by visual observation of the site, where the observer can readily see that

vegetation has proliferated in the area, including the areas reclaimed by the AML in the 1980's. The vegetation investigation included in Section 3.2 also verifies that vegetation is apparently doing well, even considering the long term draught experienced over the past decade.

3.1.3 Summary

From the soils investigation summary, the following is included:

> There are some limitations to soil salvage in the proposed disturbed area within the Kinney #2 Mine Order 2 soil survey area. The primary limitations are the available water holding capacity of soils containing greater than 50% rock content, slope gradients of over 50 percent affecting use of soil salvage machinery, soil materials with sandy textures, and an accurate determination of the quantity of coal found within the mixture of alternative reclamation materials located in Disturbed Lands Map Units DA and DB. Soil salinity, pH, calcium carbonate percentage, and plant nutrition do not pose any limitations to plant growth medium at the Kinney #2 soil survey area. To ensure maximum utilization of the soils resource, soil salvage should be coordinated with the planning and construction phases of mining operations. A soil reclamation plan, at a later date, will have to address the issue of separation of the previous coal mining affected surfaces from natural topsoil, in the stripping and salvage operations.

Topsoil removal, salvage, storage and replacement during reclamation are addressed Section 4.2, Soil Handling Plan, Section 5.0, Reclamation Plans.

3.2 VEGETATION INFORMATION

3.2.1 General Vegetation Information

This section describes the existing vegetation communities, types, species, and conditions within the permit and adjacent areas that could be affected or impacted by the mining and reclamation activities. Information presented in this section was developed in accordance with applicable regulatory requirements (R54-301-140 and R645-301-300) for coal mine permitting in the State of Utah.

3.2.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-310 and 311, 321.100 through 200, 322.210, and 323.100 and 400. Operation plans (Rules R645-301-330 and 331) are addressed in Section 4.3 of this permit application and reclamation plans and performance standards (Rules R645-301-341, 342.200 through 400, and 352 through 357) are addressed in Section 5.3. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section		Applicable Regulatory Provisions
3.2.1		
	3.2.1.1	
	3.2.1.2	R645-301-321.100, and 200
	3.2.1.3	R645-301-321.100
	3.2.1.4	R645-301-140, 311 and 323
3.2.2		
	3.2.2.1	R645-301-321.100 and 200
	3.2.2.2	R645-301-321.100 and 200
	3.2.2.3	R645-301-321.100
	3.1.2.4	R645-301-321-200
	3.2.2.5	R654-301-321-200
	3.2.2.6	R645-301-321.100 and 200, and 323.100 and 400
3.2.3		
	3.2.3.1	R645-301-322.210 and 300
	3.2.3.2	R645-301-322.210 and 230
	3.2.3.3	R645-301-322.210
	3.2.3.4	R645-301-322.210 and 323.300
Maps		R645-301-323.100 and 400
Exhibits		R645-301-311, 321.100 and 200, 322.210, and 323.100 and 400

The following discussion describes the vegetation resources within the boundaries of the Kinney No. 2 Mine Permit Area in sufficient detail to identify the characteristics of the plant communities and their associated habitats. This evaluation specifically addresses the

requirements of the UDOGM's regulations for Biology at R645-301-300.321, Vegetation Information, as well as the requirements contained in the UDOGM's Vegetation Information Guidelines. This evaluation addresses the types of plants found in the permit area in order to assure that all mining and related activities minimize the impacts on the vegetation resources of the area and contains sufficient information to assure that all unavoidable impacts caused by mining are mitigated through properly planned reclamation operations. Mining will be a temporary land use and following the cessation of mining the disturbed areas will be reclaimed to a suitable configuration to affectively sustain the postmining landuse of wildlife habitat, watershed and grazing land.

3.2.1.2 Sources of Vegetation Information

The following characterization of vegetation resources in the permit and adjacent areas was completed by Patrick D. Collins, Ph.D. of Mt. Nebo Scientific, Inc.

Scope

Exhibit 3.2, Vegetation Information includes a report of the vegetation at and adjacent to the proposed Kinney No. 2 Mine completed by Nt. Nebo Scientific. The Methods section describes the scientific methodology used in obtaining the data herein. The Introduction presents a general site description giving the reviewer an idea of the physical appearance of the area and some general information. The Results section describes the plant communities and gives the data from field sampling. A short description of each plant community of the proposed mine area is then given. Proposed new disturbance communities (undisturbed by previous mining) have been scientifically sampled to be accurately defined quantitatively and qualitatively. A reference area similar to the proposed disturbance area has also been appropriately sampled to aid in future reclamation of the mine area.

Areas disturbed by previous mining activity have been described. Tables showing living cover and frequency by plant species, total cover and composition, statistical comparison of total living cover, woody species density, and other useful material are included for each plant community. Adjacent community types are shown on Figure 1, Regional & Site Vegetation Map in the Vegetation Report, Exhibit 3.2, Vegetation Information. Figure 1 shows the permit area, community types, sample locations and other pertinent information. Map 3.2.1.2-1, Facilities Area Vegetation shows the same information as Figure 1above, except at a larger scale for the immediate mine area.

3.3 FISH & WILDLIFE INFORMATION

3.3.1 General Fish and Wildlife Information

This section generally describes existing habitat conditions and potential fish and wildlife resources within the permit area and adjacent areas that could be affected or impacted by the mining and reclamation activities. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-300) for coal mine permitting in the State of Utah.

3.3.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-310 and 311, 322.100 through 300, and 323.200 and 300. Operation plans (Rules R645-301-330 through 333) are addressed in Section 4.3 of this permit application and reclamation plans and performance standards (Rules R645-301-342 and 358) are addressed in Section 5.3.

The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section		Applicable Regulatory Provisions
3.3.1		
	3.3.1.1	
	3.3.1.2	R645-301-322.100, 200 and 300
	3.3.1.3	R645-301-322.220, 330 and 323.400
	3.3.1.4	R645-301-323.200, 300 and 400
3.3.2		
	3.3.2.1	R645-301-311 and 322
	3.3.2.2	R645-301-322.200, 210, 220 and 230
	3.3.2.3	R645-301-311 and 322
3.3.3		
	3.3.3.1	R645-301-311 and 322
	3.3.3.2	R645-301-322.200, 210, 220 and 230
	3.3.3.3	R645-301-311 and 322
3.3.4		
	3.3.4.1	R645-301-322.100, and 300
	3.3.4.2	R645-301-322.210, and 230
	Maps	R645-301-323
	Exhibits	R645-301-322.100 and 300

3.3.1.2 Sources for Fish and Wildlife Information

Fish and wildlife resources and habitat values in the permit area and adjacent areas have been characterized in this section using information from previous and ongoing baseline characterization and monitoring activities, principally by the UDWR. Existing available information was utilized to the extent possible. Information resources utilized, nature of information, and relevance to this site are summarized below:

- Multiple historic site-specific investigations, principally by the UDWR. The latest available data and information available from the UDWR has been included in this application.

- Occasional site-specific investigations, observations, and/or notes which have occurred intermittently over the previous two decades.

- USDI-BLM. 1983. Uintah - Southwestern Utah Coal Region. Round Two, Draft EIS.

- Dalton, L.B., J.S. Price, and L.A. Romin. 1990. Fauna of Southeastern Utah and Life Requisites Regarding Their Ecosystems. Publication No. 90-11. Utah Dept. of Nat. Res. Div. of Wildlife Resources. 326 pp.

- Musclow, H.J. and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Publication No. 90-3. Utah Dept. of Nat. Res. Div. of Wildlife Resources. 141 pp.

- Personal Communications with UDWR Biologists, Wood, C. (Regional Habitat Manager), Beagley, K. (Regional Oil & Gas Biologist), Mead, L. (Regional Biologist) from June, 2007 - Sept., 2007.

- UDWR Website: http://dwrcdc.nr.utah.gov/ucdc/
  Including:
  Utah's Federally (US F&EWS) Listed Threatened (T), Endangered (E), and Candidate (C) Plant Species – 08/27/2007.
  Utah Sensitive Species List,October 17, 2006.
  Utah's State Listed Species by County, October 20, 2006.
  County Lists of Utah's Federally Listed Threatened (T), Endangered (E), and Candidate (C) Plant Species – 08/27/2007.
  Vertebtate Animals, Southeastern Utah's Fish, Southeastern Utah's Reptiles, Southeastern Utah's Amphibians, & Southeastern Utah's Birds.
  Invertebrate Animals, Mollusks, & Insects.
  Plants.

- Falk, J.A. 1990, Landscape Level Raptor Habitat Association in Northwest Connecticut. M.S. Thesis, Virginia Polytechnic Inst. 127 pp.

- Speiser, R. and T. Bosakowski. 1987. Nest site seclection by northern goswahks in northern New Jersey and southeastern new York. Condor 89:387-394

- Squires, J.R and R.T. Reynolds. 1997. Northern Goshawk, No. 298 in Birds of North America series. c/o Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philidelphia, Pa. 31 pp.

- Basakowski, T. and R. Speiser. 1994. Macrohabitat selection by nesting northern goshawks: implications for managing eastern forests. Studies in Avian Biology (16): 46-49.

- Bosakowski. T. and D.G. Smith. 1997. distribution and species richness of a forest raptor community in relation to urbanization. J. Raptor Res. 31(1):26-33.

- www.fws.gov/r5gomp/gom/habitatstudy/metadata/northern_goshawk_model.htm

- Worthington, D. J. 1991. Abundance, distribution, and sexual segregation of bats in the Pryor Mountains of south central Montana. M.A. Thesis, University of Montana, Missoula, Montana. 41 pp.

- Hendricks, P. 2000. Preliminary bat inventory of caves and abandoned mines on BLM lands, Judith Mountains, Montana. Montana Natural Heritage Program, Helena, Montana. 21 pp.

- Hendricks, P., D. L. Genter, and S. Martinez. 2000. Bats of Azure Cave and the Little Rocky Mountains, Montana. Canadian Field-Naturalist 114 :89-97.

- Hendricks, P., and D. Kampwerth. 2001. Roost environments for bats using abandoned mines in southwestern Montana : a preliminary assessment. Report to the U.S. Bureau of Land Management. Montana Natural Heritage Program, Helena, Montana. 19 pp.

- Foresman, K. R. 2001. The wild mammals of Montana. American Society of Mammalogists, Special Publication No. 12. 278 pp. Parks Home Page

The Utah Division of Wildlife Resources, Utah Conservation Data Center (UCDC) is the central repository for Utah biodiversity information, and has been used extensively to prepare this permit application section. In addition, Utah's Sensitive Species List, as well as Utah's federally (US F&WS) Listed Threatened (T), Endangered (E), and Candidate (C) Plant Species list have been used extensively.

Utah Administrative Rule R657-48, Implementation of the Wildlife Species of Concern and Habitat Designation Advisory Committee specifies designation of certain species categories including, Conservation species, State sensitive species, Wildlife species of concern, and creation of the Utah Sensitive Species List. These categories and the Utah Sensitive Species List will be addressed in the following section.

3.3.1.3 Background Ecology of Proposed Permit Area and Adjacent Areas

The mining and related activities surface facilities and permit area are located immediately northeast of the town of Scofield in Pleasant Valley in Central Utah. Primary surface facilities

will be sited on the west facing slope of Pleasant Valley within sight of Scofield town and adjacent to, and within sight of Utah Highway 96. The surface disturbances related to mine development will be in areas which have already been largely disturbed (80%+) by previous mining related activities, some of which were reclaimed by the UDOGM Abandoned Mine Reclamation program in the 1980's. This percentage may be higher since mining has been conducted in the area since the early 1900's. There were four mines in the area of the proposed surface facilities for the Kinney No. 2 Mine, (Kinney Mine, Columbine Mine, Jones Mine, and the UP Mines). These four mines disturbed approximately 74% of the area estimated to be disturbed by the proposed Kinney No. 2 Mine.

The west facing slopes of Pleasant Valley contain small, very shallow intermittent drainage channels and moderate pediments which slope gradually toward the bottom of Pleasant Valley from the ridges to the east of the valley. Elevations in the proposed permit area range between 7,750 feet near the lower end of the facilities area up to about 8,800 feet at the ridge top a the south-central portion of the permit area. The proposed permit area encompasses a portion of the west-facing slope of Pleasant Valley and drains to Mud Creek which is tributary to the Scofield Reservoir which in turn flows to the Price River and then to the Colorado River. Soils are generally shallow and skeletal in the steeper portions of the proposed permit area. Sandstone is the predominant parent material. Soils in approximately 74% of the surface facilities area has been disturbed by previous mining activities prior to the SMCRA laws, and no topsoil salvage was conducted. There are very limited areas of deeper and more well developed soils. The vegetation communities of the region consist predominantly of Sagebrush, Rabbitbrush with some small stands of Quaking Aspen. In descending order, these communities are encompassed by the montane (Canadian life zone) (6,500 – 12,721 feet elevation), and submontane (Transition life zone) (5,500 – 8,500 feet elevation) ecological associations. Other than coal exploration and mining, the predominant land uses of the area include wildlife habitat, livestock rangeland, and water shed. A wide variety of wildlife species may potentially utilize habitats within and adjacent to the mine plan area. Common species of interest or species which are economically important include mule deer, elk, mountain lion, bobcat, black bear, coyote, blue grouse, ruffed grouse, sage grouse, snowshoe hare, mountain cottontail, and several raptor species.

As a reflection of the arid climate and rugged topography of the region runoff channels in the surface facilities area are characterized by narrow, high-gradient channels, with very little evidence of erosion from runoff events. Because these drainages receive runoff flows from limited surface areas, ephemeral flows fluctuate significantly, especially in response to spring runoff and major summer thunderstorms. Only one major drainage exists on the proposed permit area at the extreme east side of the permit block. This drainage (Eagles Canyon) is tributary to Scofield Reservoir, and is shown by the USGS to be ephemeral in nature generally, with no significant flow, except in response to snowmelt runoff, and where small springs and seeps surface near the bottom of the canyon. These seeps and springs generally flow in the spring and early summer in response to snow melt and then the flow drops significantly as dry weather predominates. The flows in the bottom of Eagles Canyon resulting from the seeps and springs disappear into the canyon alluvium after flowing a short distance. The mine site surface facilities area will be located on the west facing slope of Pleasant Valley, which contains Mud Creek to the west approximately on quarter mile from the closest point of the permit boundary, and Scofield Reservoir to the northwest of the permit boundary approximately one half mile at its closest point (high water mark). Mud Creek is tributary to Scofield Reservoir.

3.3.1.4 Mapping of Fish and Wildlife Information

Information relative to fish and wildlife resources and habitat values is presented on Map 3.3.1.4, Regional Wildlife. Information presented on the Regional Wildlife Map includes the following UDWR designations:

- Mule Deer Summer Range
- Elk Year Round Range
- Sage Grouse Winter and Brooding Range
- Critical Bald Eagle Winter Range
- Wetlands and Riparian Zones

3.3.2 Terrestrial Wildlife Information

As indicated in Section 3.3.1.2, characterization of fish and wildlife resources is based on existing available documentation from previous wildlife research and studies and recent site specific wildlife research, principally by UDWR, and field investigations.

3.3.2.1 Habitat Evaluation for Proposed Permit Area and Adjacent Areas

There are a number of accepted approaches for habitat definition and evaluation, however, with respect to the proposed permit area and evaluation of potential mining related impacts, two basic approaches are of particular relevance. First, the floral associations and physical attributes of a given area can be described relative to habitat value as most species have particular affinities for certain features and conditions of their environment. Second, habitat value for certain geographical areas which correspond to a unique combination of floral associations and/or physical attributes can be described with respect to the necessary life requisites they provide for particular species of wildlife, especially during critical periods of their life cycles.

With respect to the first approach to habitat classification, two characteristic floral associations are described in Section 3.2, Vegetation Information for the permit boundary area. The location and areal extent of these associations within the proposed permit area are illustrated by the Regional Vegetation Map, (Figure 1 in the Vegetation Report included in Exhibit 3.2, Vegetation Information). As indicated in Section 3.2, the two floral associations in the permit boundary are generally described as follows: Sagebrush/Grasslands, and Aspen. In addition, there is one characteristic floral association within one mile of the permit boundary, as can be seen on the Regional & Site Vegetation Map, (Figure 1 in the Vegetation Report included in Exhibit 3.2, Vegetation Information). This association is the Mud Creek Riparian zone. Between the permit area and the Mud Creek riparian association lies an expanse of pastureland. In addition, Scofield Reservoir is located approximately one half mile from the closest point of the permit boundary. Scofield Reservoir with it's associated riparian zone is an important habitat for numerous species of fishes, birds, mammals and amphibians. Relative utility of these habitats is dependent on each species of wildlife, but in general, the riparian bottom areas offer the highest level and greatest diversity of habitat values due to their use by most species at some point in their diurnal activities or life-cycles. The following discussion of wildlife occurrence and use identifies known affinities for each potential species relative to any specific floral association(s) and physical habitat attributes. The second approach to habitat classifications relating to geographical areas and/or areas occupied by certain species during particular periods of their life-cycle, focuses on four main designations by the UDWR with respect to the need for various levels of isolation or protection

from human activity and development. These categories, as defined by the UDWR for management purposes, include Critical, High-Priority, Substantial Value, and Limited Value areas. Designation of these categories for specific species in the vicinity of the proposed permit area is shown on Map 3.3.1.4, Regional Wildlife Map. It should be noted that these designations are intended to identify management objectives and may not relate directly to the potential impacts of disturbance in the designated areas.

Critical wildlife use areas are "sensitive use areas" necessary to sustain the existence and perpetuation of one or more species of wildlife during critical periods of their life-cycles. These areas are restricted in areal extent and lie within high-priority wildlife use areas. All stream 8segments, reservoirs, lakes and ponds identified by UDWR as Class 1 or 2 are classified as critical use areas. Biological intricacies dictate that significant disturbances cannot normally be tolerated by the members of an ecological assemblage within critical sites. Generally, disturbance of critical use areas or habitats may result in changes in species composition and/or biological productivity of an area. However, what constitutes a significant "disturbance" must be left to the interpretation of professional ecologists.

High-priority wildlife use areas are "intensive use areas" for one or more species of wildlife. "Intensive use areas" are not restricted in areal extent and in conjunction with limited value use areas form the substantial value distribution for a wildlife species. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 3 are classified as high-priority use areas. In a6ddition, wildlife use areas where either significant surface disturbance or underground activities which result in subsidence, interruption of any significant ground water aquifers, and consequent decreased flows in seeps and springs should be considered as being of high-priority to wildlife.

Substantial value wildlife use areas are "existence areas" for one or more species of wildlife. "Existence areas" represent a herd or population distribution and are formed by the merging of high-priority and limited value wildlife use areas for a species. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 4 are classified as substantial value use areas.

Limited value wildlife use areas are "occasional use areas" for one or more species of wildlife. "Occasional use areas" are part of the substantial value wildlife use area for a species. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 5 or 6 are classified as being of limited value.

3.3.2.2 General Wildlife Occurrence and Use

While the majority of the permit area occupies only a very small portion of the Wasatch Plateau, it has essentially the same characteristic associated habitats and faunal resource potentials and is a typical representation of the upper portion of the Transitional and lower portion of the Canadian life zones in this part of Utah. However, the proposed mine facilities area is located in the Transitional life zone and is not totally characteristic of this life zone owing to both past and current impacts from previous mining activities, residential development, commercial development, transportation corridor, and electrical power transmission facilities and operations. It should be noted that only two floral associations exist in the permit boundary, the aspen and sagebrush/grass associations. In the general area of the mine within a one mile zone around the permit boundary there are additional associations, such as the riparian association along Mud Creek. Given these associations and characteristics, the permit area could provide potential habitat for approximately 329 species of vertebrate wildlife, including; 7 fish species, 8 amphibians, 17 reptile species, 231

birds, and 66 mammals. Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, identifies those species known to occur in this general area as well as the likelihood of occurrence in the permit area. Of the 329 species identified as occurring in the general area, 92 are known, potential, or likely inhabitants of the permit area, and 237 are considered unlikely, or not inhabitants based on known range or habitat preference. Included on this list are several species of wildlife considered to be of high interest to the State of Utah. High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific, or educational significance, and those species listed on the Utah Sensitive Species List. Included in this category are those species of wildlife Federally listed as Endangered or Threatened.

Given the significant extent of previous and existing disturbance in the proposed surface facilities area and the very limited aerial extent of the new surface disturbance, initial site-specific wildlife baseline studies have been limited to review of available documentation on wildlife occurrence and habitat in the area, ground and aerial raptor surveys. Any supplemental wildlife information requirements will be determined by UDOGM in consultation with State and Federal wildlife agencies. In order to address potential mining related wildlife impacts, the following discussion addresses important and/or typical species which may occur as inhabitants or transients in the permit area. Furthermore, though the permit area may provide "critical", "high priority", or "substantial value" habitat for these species (according to UDWR definitions), the potential for significant adverse impacts to the vast majority of species, and individual animals, is quite low. An evaluation of the potential for impact is detailed in Section 4.3.2 of this application. Only those species of high interest as listed in the Utah Sensitive Species List will be specifically addressed below in this application.

Amphibians

Eight species of amphibians, as listed on Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit and adjacent areas are located. However, only one amphibious species is categorized as possible, or a likely inhabitant of the permit area. The Western toad is the only species listed on the Utah Sensitive Species List that has the potential to inhabit the mine permit area. The UDWR considers the Western toad as uncommon in the Wasatch Plateau and it is unlikely to inhabit the mine permit area because of it's affinity for riparian habitats. Since the mine site disturbance area is dry, with no permanent, or intermittent water areas, and no perennial or intermittent streams, the likelihood of significant numbers of amphibians inhabiting the area is low. The other amphibians included in Table 3.3.2.2 are potential residents of the mine site, however, these species are not considered to be of high interest and the limited size of the disturbed area reduces the potential for substantial impact from mining disturbance.

TABLE 3.3.2.2 POTENTIAL WILDLIFE SPECIES OF THE WASATCH PLATEAU (11 pages)

TABLE 3.3.2.2
POTENTIAL WILDLIFE SPECIES OF THE WASATCH PLATEAU

(From Dalton et. Al., 1990, Fauna of Southeastern Utah and Life Requisites Regarding Their Ecosystems. UDWR Publication No.90-11).

* Status in Wasatch Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; L = Limited; P = Ptotected; N = Unprotected
** Likelihood in Mine Plan Area; K = Known; L = Likely; P = Potential; U = Unlikely; N = None

Federal Status; E = Endangered; EXP = Experimental; T = Threatened; C = Candidate;
Utah Status; C2 = Conservation Agreement; C3 = Species of Concern; EXT = Extirpated

Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
Fishes - *42 species total in Price River, Scofield Reservoir and their tributaries (7 species). *Only those species in the Scofield Reservoir and it's tributaries included in table (montane ecological associations).					
1	Cutthroat trout	Oncorhynchus	C	N	
2	Rainbow trout	Oncorhynchus my kiss	C	N	
3	Carp	Cyprinus carpio	C	N	
4	Utah chub	Gila atraria	L	N	
5	Red side shiner	Richardsonius balteatus	C	N	
6	Mountain sucker	Catostomus platyrhynchus	C	N	
7	Waleye	Stizostedion vitreum	O	N	
Reptiles - *17 species total in mine biogeographic area					
1	Leopard lizard	Crotaphytus wislizenii	C	U	
2	Eastern fence lizard	Sceloporus undulates	C	L	
3	Sagebrush lizard	Sceloporus graciosus	C	L	
4	Tree lizard	Urosaurus ornatus	C	U	
5	Side-blotched lizard	Uta stansburiana	C	P	
6	Short-horned lizard	Phrynosoma douglassi	C	P	
7	Rubber boa	Charina bottae	U	U	
8	Ring-necked snake	Diadophis punctatus	U	U	
9	Striped whipsnake	Masticophis taeniatus	C	U	
10	Sanoran mountain king	Lampropeltis pyromelana	R	U	
11	Racer	Coluber constrictor	U	U	
12	Smooth Green	Opheodrys vernalis	U	U	C3
13	Pine snake	Pituophis melanoleucus	C	P	
14	Milk snake	Lampropeltis triangulum	R	U	
15	Western terrestrial garter snake	Thamnophis elegans	C	U	
16	Common garter snake	Thamnophis sirtalis	C	U	
17	Night snake	Hypsiglena torquata	C	U	

TABLE 3.3.2.2
POTENTIAL WILDLIFE SPECIES OF THE WASATCH PLATEAU

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Federal Status; E = Endangered; EXP = Experimental; T = Threatened; C = Candidate;
Utah Status; C2 = Conservation Agreement; C3 = Species of Concern; EXT = Extirpated

Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
Amphibians - * 8 species total in mine biogeographic area					
1	Tiger salamander	Ambystoma tigrinum	C	U	
2	Great Basin spadefoot toad	Scaphiopus intermontanus	C	P	
3	Western toad	Bufo boreas	U	U	C3
4	Woodhouse's toad	Bufo woodhousei	C	U	
5	Great Plains toad	Bufo cognatus	C	U	
6	Chorus frog	Pseudacris triseriata	C	U	
7	Spotted frog	Rana pretiosa	R	U	
8	Leopard frog	Rana pipiens	C	U	
Birds – * 231 species total in mine biogeographic area					
1	Common loon	Gavia immer	U	U	
2	Horned grebe	Podiceps auritus	C	U	
3	Eared grebe	Podiceps nigricollis	C	U	
4	Western grebe	Aechmophorus occidentalis	C	U	
5	Pied-billed grebe	Pdoilymbus podiceps	C	U	
6	White pelican	Pelecanus erythrorhynchos	C	U	C3
7	Double-crested cormorant	Phalacrocorax auritus	C	U	
8	Great blue heron	Ardea herodias	K	U	
9	Black-crowned night heron	Nycticorax nycticorax	U	U	
10	Snowy egret	Egretta thula	O	U	
11	White-faced ibis	Plegadis chihi	T	U	
12	Canada goose	Branta Canadensis	C	P	
13	Snow goose	Chen caerulescens	O	P	
14	Mallard	Anas platyrhynchos	C	P	
15	Wood duck	Aix sponsa	O	U	
16	Gadwall	Anas strepera	C	U	
17	Northern pintail	Anas acuta	C	P	
18	Green-winged teal	Anas crecca	C	P	
19	Blue-winged teal	Anas discors	U	P	

TABLE 3.3.2.2
POTENTIAL WILDLIFE SPECIES OF THE WASATCH PLATEAU

(From Dalton et. Al., 1990, Fauna of Southeastern Utah and Life Requisites Regarding Their Ecosystems. UDWR Publication No.90-11).

* Status in Wasatch Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; L = Limited; P = Ptotected; N = Unprotected
** Likelihood in Mine Plan Area; K = Known; L = Likely; P = Potential; U = Unlikely; N = None

Federal Status; E = Endangered; EXP = Experimental; T = Threatened; C = Candidate;
Utah Status; C2 = Conservation Agreement; C3 = Species of Concern; EXT = Extirpated

Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
20	Cinimon teal	Anas cyanoptera	C	P	
21	American wigeon	Anas Americana	C	P	
22	Northern shoveler	Anas clypeata	C	P	
23	Redhead	Aythya mericana	C	U	
24	Ring-necked duck	Aythya collaris	O	U	
25	Canvasback	Aythya yallisineria	O	U	
26	Greater scaup	Aythya marila	O	U	
27	Lesser scaup	Aythya affinis	O	U	
28	Common goldeneye	Bucciphala clangula	O	U	
29	Bufflehead	Bucephala albeola	U	U	
30	Hooded merganser	Mergus cucullatus	O	U	
31	Common merganser	Mergus merganser	O	U	
32	Red-breasted merganser	Mergus serrator	O	U	
33	Turkey vulture	Cathartes aura	C	K	
34	Northern goshawk	Accipiter gentiles	U	U	C2
35	Sharp-shinned hawk	Accipiter striatus	U	U	
36	Cooper's hawk	Accipiter cooperii	C	P	
37	Red-tailed hawk	Buteo jamaicensis	C	K	
38	Swainson's hawk	Buteo swainsoni	R	U	
39	Rough-legged hawk	Buteau lagopus	C	U	
40	Ferruginous hawk	Buteo regalis	R	U	C3
41	Golden eagle	Aquila chrysaetos	C	K	
42	Bald eagle	Haliaeetus leucocephalus	U	P	T
43	Northern harrier	Circus cvaneus	C	U	
44	Osprey	Pandion haliaetus	U	U	
45	Prairie falcon	Falco mexicanus	C	U	
46	Peregrine falcon	Falco peregrinus	U	U	
47	American kestrel	Falco sparverius	C	U	
48	Blue grouse	Dendragapus obscurus	C	U	

TABLE 3.3.2.2
POTENTIAL WILDLIFE SPECIES OF THE WASATCH PLATEAU

(From Dalton et. Al., 1990, Fauna of Southeastern Utah and Life Requisites Regarding Their Ecosystems. UDWR Publication No.90-11).

* Status in Wasatch Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; L = Limited; P = Protected; N = Unprotected
** Likelihood in Mine Plan Area; K = Known; L = Likely; P = Potential; U = Unlikely; N = None

Federal Status; E = Endangered; EXP = Experimental; T = Threatened; C = Candidate;
Utah Status; C2 = Conservation Agreement; C3 = Species of Concern; EXT = Extirpated

Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
49	Ruffed grouse	Bonasa umbellus	C	U	
50	Sage grouse	Centrocercus urophasianus	C	L	C3
51	California quail	Lophortyx californicus	L	U	
52	Chukar	Alectoris chukar	C	U	
53	Common moorhen	Gallinula chloropus	A	U	
54	Sora	Porzana Carolina	U	U	
55	Virginia rail	Rallus limicola	C	U	
56	Whooping crane	Grus Americana	E	U	EXT
57	Sandhill crane	Crus Canadensis	U	U	
58	American coot	Fulica Americana	L	U	
59	Semipalmated plover	Charadrius semipalmatus	U	U	
60	Snowy plover	Charadrius alexandrinus	R	U	
61	Killdeer	Charadrius vociferous	C	U	
62	Mountain plover	Charadrius montanus	R	U	
63	Lesser golden plover	Pluvialis dominica	U	U	
64	Black-billed plover	Pluvialis squatarola	C	U	
65	Common snipe	Capella gallinago	C	U	
66	Long-billed curlew	Numenius americanus	R	U	C3
67	Willet	Catoptrophorus semipalmatus	U	U	
68	Spotted sandpiper	Actitis macularia	C	U	
69	Solitary sandpiper	Tringa solitaria	U	U	
70	Greater yellowlegs	Tringa melanoleuca	U	U	
71	Lesser yellowlegs	Tringa flavipes	C	U	
72	Pectoral sandpiper	Calidris melanotos	U	U	
73	Baird's sandpiper	Calidris bairdii	U	U	
74	Least sandpiper	Calidris minutilloa	C	U	
75	Western sandpiper	Calidris mauri	C	U	
76	Sanderling	Calidris alba	U	U	
77	Short-billed dowitcher	Limnodromus griseus	U	U	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
78	Long-billed dowitcher	Limnodromus scolopaceus	C	U	
79	Marbled godwit	Limosa fedoa	C	U	
80	American avocet	Recurvirostra Americana	C	U	
81	Black-necked stilt	Himantopus mexicanus	U	U	
82	Red-necked phalarope	Phalaropus labatus	C	U	
83	Wilson's phalarope	Phalaropus tricolor	C	U	
84	Herring gull	Larus argentuatus	U	U	
85	California gull	Larus californicus	C	U	
86	Ring-billed gull	Larus delawarensis	C	U	
87	Franklin's gull	Larus pipixcan	C	U	
88	Bonaparte's gull	Larus philidelphia	U	U	
89	Foster's tern	Sterna foresteri	C	U	
90	Common tern	Sterna hirundo	U	U	
91	Black tern	Childonias niger	C	U	
92	Caspian tern	Hydropprogne caspia	R	U	
93	Bandtailed pigeon	Columba fasciata	O	P	
94	Rock dove	Columba livia	C	U	
95	Mourning dove	Zeniada macroura	C	L	
96	Yelow-billed cuckoo	Coccyzus americanus	R	U	C
97	Common barn-owl	Tyto alba	U	U	
98	Great-horned owl	Bubo virginianus	C	L	
99	Northern Pygmy owl	Glaucidium gnoma	C	P	
100	Burrowing owl	Athene cunicularia	L	U	C3
101	Long-eared owl	Asio otus	C	P	
102	Northern saw-whet owl	Aegolius acadicus	U	U	
103	Common nighthawk	Chordeiles minor	C	P	
104	Common poorwill	Phalaehoptilus nuttallii	C	U	
105	Black swift	Cypseloides niger	U	U	C3
106	Black-chinned hummingbird	Archilochus alexandri	C	P	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood In Mine Plan Area **	T & E Status
107	Broad-tailed hummingbird	Selasphorus platycercus	C	P	
108	Rufous hummingbird	Selasphorus rufus	C	P	
109	Calliope hummingbird	Seellula calliope	U	U	
110	Belted kingfisher	Ceryle alcyon	U	U	
111	Northern flicker	Colaptes auratus	C	P	
112	Red-headed woodpecker	Melanerpes erythrocephalus	U	U	
113	Williamson's sapsucker	Sphryapicus thyroids	R	N	
114	Yellow-bellied sapsucker	Sphryapicus varius	C	P	
115	Hairy woodpecker	Picoides villosus	C	P	
116	Downy woodpecker	Picoides pubescens	C	P	
117	Three-toed woodpecker	Picoides tridactylus	U	U	C3
118	Western kingbird	Tyrannus verticalis	C	U	
119	Cassin's kingbird	Tyrannus vociferans	U	U	
120	Eastern kingbird	Tyrannus tyrannus	C	U	
121	Ash-throated flycatcher	Mylarchus cinerascens	C	U	
122	Say's phoebe	Savornis sava	C	P	
123	Willow flycatcher	Empidonax traillii	C	U	
124	Hammond's flycatcher	Empidonax hammondii	U	U	
125	Dusky flycatcher	Empidonax oberholderi	C	P	
126	Gray flycatcher	Empidonax wrightii	U	U	
127	Olive-sided flycatcher	Contopus borealis	U	P	
128	Horned lark	Eremophila alpestris	C	U	
129	Cliff swallow	Hirundo pyrrhonota	C	U	
130	Barn swallow	Hirundo rustica	C	U	
131	Violet-green swallow	Tachycineta thalassina	C	P	
132	Tree swallow	Tachycineta biocolor	C	U	
133	Bank swallow	Riparia riparia	C	U	
134	Purple martin	Progne subis	R	U	
135	Northern rough-winged swallow	Stelgidopteryx serripennis	C	U	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
136	Steller's jay	Cyanocitta stelleri	C	L	
137	Scrub jay	Aphelocoma coerulescens	C	U	
138	Gray jay	Perisoreus Canadensis	U	U	
139	Black-billed magpie	Pica pica	C	K	
140	Common raven	Corvus corax	C	K	
141	American crow	Corvus brachyrhyncos	O	U	
142	Pinyon jay	Gymnorhinus cyanocephala	C	U	
143	Clark's nutcracker	Nucifraga Columbiana	C	U	
144	Black-capped chickadee	Parus atricapillus	C	L	
145	Mountain chickadee	Parus gambelli	C	L	
146	Plain titmouse	Parus Inorntus	U	U	
147	Bushtit	Psaltriparus minimus	C	P	
148	White-brested nuthatch	Sitta carolinensis	C	P	
149	Red-brested nuthatch	Sitta Canadensis	C	U	
150	Pygmy nuthatch	Sitta pygmaea	C	P	
151	Brown creeper	Certhia Americana	C	U	
152	American dipper	Cinclus mexicana	C	N	
153	House wren	Troglodytes aedon	C	P	
154	Rock wren	Salpinctes obsoletus	C	U	
155	Canyon wren	Catherpes mexicanus	C	U	
156	Marsh wren	Cistothorus palustris	L	U	
157	Bewick's wren	Thryomanes bewickii	C	U	
158	Blue-gray gnatcatcher	Polioptila caerulea	C	U	
159	Sage thrasher	Oreoscoptes montanus	C	U	
160	American robin	Turdus migratorius	C	L	
161	Hermit thrush	Catharus gattatus	C	P	
162	Swainson's thrush	Catharus ustulatus	C	P	
163	Western bluebird	Sialia mexicana	R	U	
164	Mountain bluebird	Sialia currucoides	C	K	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
165	Townsend's solitaire	Myadestes townsendi	C	P	
166	Golden-crowned kinglet	Regulus satrapa	U	P	
167	Ruby-crowned kinglet	Regulus calendula	C	P	
168	Veery	Catharus fuscoscens	U	U	
169	American robin	Turdus migratorius	C	L	
170	Gray catbird	Dumetella carolinensis	U	U	
171	Northern mockingbird	Mimus polyglottos	U	U	
172	Water pipet	Anthus spinoletta	C	U	
173	Cedar waxwing	Bombycilla cedrorum	C	U	
174	Bohemian waxwing	Bombycilla garrulous	U	U	
175	Northern shrike	Lanius excubitor	U	U	
176	Loggerhead shrike	Lanius ludovicianus	C	U	
177	European starling	Sturnus vulgaris	C	U	
178	Solitary vireo	Vireo solitarius	C	P	
179	Warbling vireo	Vireo gilvus	C	L	
180	Orange-crowned warbler	Vermivora celata	C	P	
181	Nashville warbler	Vermivora ruficapilla	U	U	
182	Yellow warbler	Dendrioca petechia	C	L	
183	Magnolia warbler	Dendrocia magnolia	R	N	
184	Yellow-rumped warbler	Dendrocia coronata	C	U	
185	Townsend's warbler	Dendrocia townsendi	U	U	
186	Black-throated gray warbler	Dendroica nigrenscens	C	U	
187	MacGilivray's warbler	Oporomis tolmiei	C	P	
188	Virginia's warbler	Vermivora virginiae	C	U	
189	Common yellowthroat	Geothlypis trichas	L	U	
190	American redstart	Setophaga ruticilla	C	U	
191	Yellow-breasted chat	Lcteria virens	R	U	
192	Wilson's warbler	Wilsonia pusilla	C	U	
193	House sparrow	Passer domestious	C	U	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
194	Brown-headed cowbird	Molothrus ater	C	U	
195	Western tanager	Piranga ludoviciana	C	P	
196	Black-headed grosbeak	Pheucticus melanocephalus	C	P	
197	Rose-breastered grosbeak	Pheucticus ludovicianus	O	U	
198	Red-winged blackbird	Agelaius hoeniceus	C	U	
199	Rusty blackbird	Euphagus carolinus	O	U	
200	Brewer's blackbird	Euphaqus cyanocephalus	C	U	
201	Yellow-headed blackbird	Xanthocephalus xanthocephalus	C	U	
202	Northern oriole	Icterus galbula	C	U	
203	Lazuli bunting	Passerian amoena	C	U	
204	Indigo bunting	Passerina cyanea	U	U	
205	Lark bunting	Calamospiza melanocorys	O	U	
206	Green-tailed towhee	Pipilo chlorurus	C	L	
207	Rufous-sided townee	Pipilo erythrophthalamus	C	U	
208	Vesper sparrow	Pooecetes gramineus	C	P	
209	Dark-eyed junco	Junco hyemalis	C	L	
210	Tree sparrow	Spizella arborea	U	U	
211	Chipping sparrow	Spizella passerine	C	L	
212	White-crowned sparrow	Zonotrichia leucophrys	C	L	
213	Fox sparrow	Passerella iliaca	U	U	
214	Song sparrow	Melospiza melodia	C	U	
215	Sage sparrow	Amphispiza belli	U	U	
216	Black-throated sparrow	Amphispiza bilineata	U	U	
217	American tree sparrow	Spizella arborea	U	U	
218	Harris' sparrow	Zonotrichia querula	U	U	
219	Common grackle	Ouiscalus quiscula	A	U	
220	Evening grosbeak	Coccothraustes vespertinus	C	P	
221	Lincoln's sparrow	Melosoiza lincolnii	U	U	
222	Lesser goldfinch	Cardvelis Psaltria	C	U	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
223	American goldfinch	Cardvelis tristis	C	U	
224	Cassin's finch	Carpodacus cassinii	C	U	
225	House finch	Carpodacus mexicanus	C	U	
226	Pine grosbeak	Pinicola enucleator	U	U	
227	Evening grosbeak	Coccothraustes vespertinus	C	U	
228	Rosy finch	Leucosticte arctoa	U	U	
229	Common redpoll	Carduelis fl' ammea	C	U	
230	Pine siskin	Carduelis pinus	C	U	
231	Red crossbill	Loxia curvirostra	U	N	
Mammals – * 66 species total in mine biogeographic area					
1	Dwarf shrew	Sorex nanus	L	P	
2	Water shrew	Sorex palustris	C	U	
3	Merriam's shrew	Sorex merriami	U	U	
4	Vagrant shrew	Sorex vagrans	U	U	
5	Masked shrew	Sorex cinereus	C	U	
6	Little brown myotis	Myotis lucifugus	C	P	
7	Fringed myotis	Myotis thysanodes	U	U	C3
8	Long-eared myotis	Myotis evotis	C	U	
9	Long-eared myotis	Myotis volans	C	U	
10	Yuma myotis	Myotis yumanensis	R	U	
11	Silver-haired bat	Lasioncteris noctivagans	C	P	
12	Big brown bat	Eptesicus fuscus	C	P	
13	Hoary bat	Lasiurus cinereus	C	P	
14	Townsend's big-eared bat	Plecotus townsendii	C	U	C3
15	Spotted bat	Euderma maculatum	U	U	C3
16	Pallid bat	Antorozous pallidus	U	U	
17	Pika	Ochotona princes	R	N	
18	White-tailed jackrabbit	Lepus townsendii	C	L	
19	Snowshoe hare	Lepus americanus	C	P	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
20	Black-tailed jackrabbit	Lepus californicus	U	U	
21	Nuttall's cottontail	Sylvilagus nuttallii	C	P	
22	White-tailed prairie dog	Cynomys leucurus	C	N	C3
23	Red squirrel	Tamiasciurus hudsonicus	C	U	
24	Rock squirrel	Spermophilus variegates	C	U	
25	Uintah ground squirrel	Spermophilus armatus	C	U	
26	Golden-mantled ground squirrel	Spermophilus lateralis	C	L	
27	Whitetail antelope squirrel	Ammospermophilus leucurus	U	N	
28	Yellow-bellied marmot	Marmota flaviventris	C	L	
29	Northern flying squirrel	Glaucomys sabrinus	R	N	
30	Least chipmunk	Tamias minimus	C	K	
31	Uinta chipmunk	Tamias umbrinus	C	U	
32	Cliff chipmunk	Eutamius dorsalis	C	U	
33	Northern pocket gopher	Thomomys talpoides	C	L	
34	Botta pocket gopher	Thomomys bottae	U	U	
35	Ord kangaroo rat	Dipodomys ordii	U	U	
36	Beaver	Castor Canadensis	C	P	
37	Western harvest mouse	Reithrodontomys megolotis	C	P	
38	Canyon mouse	Peromyscus crinitus	U	U	
39	Deer mouse	Peromyscus maniculatus	C	L	
40	Brush mouse	Peromyscus boylei	C	L	
41	Piñon mouse	Promyscus truei	C	U	
42	Brushy-tailed woodrat	Meotoma cinerei	C	L	
43	Muskrat	Ondatra zibethicus	C	U	
44	Montane vole	Microtus montanus	C	L	
45	Long-tailed vole	Microtus longicaudus	C	L	
46	Porcupine	Erethizon dorsatum	C	P	
47	Coyote	Canis latrans	C	L	
48	Red fox	Vulpes vulpes	C	L	

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Life Form	Common Name	Scientific Name	Status in Wasatch Plateau *	Likelihood in Mine Plan Area **	T & E Status
49	Kit fox	Vulpes macrotis	R	U	C3
50	Black bear	Ursus americanus	C	L	
51	Ring-tailed cat	Bassariscus astutus	U	U	
52	Racoon	Procyon lotor	K	U	
53	Short-tailed weasel	Mustela erminea	K	U	
54	Long-tailed weasel	Mustela frenata	C	L	
55	Mink	Mustela vison	L	U	
56	Black-footed ferret	Mustela nigripes	U	U	E – EXP
57	Marten	Martes Americana	R	U	
58	Badger	Taxidea taxus	C	L	
59	Striped skunk	Mephitus mephitus	C	L	
60	Bobcat	Felis rufus	U	P	
61	Canada lynx	Felis lynx Canadensis	R	U	T
62	Mountain lion	Felis concolor	C	L	
63	Mule deer	Odocoileus hemionus	C	K	
64	Rocky mountain elk	Cervus elaphus	C	K	
65	Moose	Alces alces	U	U	
66	Northern river otter	Lutra Canadensis	R	U	

Fishes

Seven (7) species of fishes, as listed on Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. There are 42 species of freshwater fish inhabiting southeastern Utah' streams and lakes, however, only the seven potential species listed in the UDWR database are included in this permit application as shown on Table 3.3.2.2. Since Pleasant Valley and it's tributaries in the mine geographic area all drain to Scofield Reservoir, only those species in the UDWR database included for the Scofield Reservoir and it's tributaries are included in Table 3.3.2.2. There are no species on the Utah Sensitive Species List that inhabit the mine permit area, or the Scofield drainage area. Because there are no streams or lakes within the permit boundary there is no potential for fish species to exist in the permit boundary.

Reptiles

Seventeen (17) species of reptiles, as listed on Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. Only 5 reptile species are catagorized as likely or possible inhabitants of the permit area. The other 12 species are considered unlikely to inhabit the permit area due to their affinity for riparian areas. The only species listed on the Utah Sensitive Species List that may inhabit the area is the smooth greensnake (Opheodrys vernalis), but it is considered uncommon to the area. This species prefers meadows and riparian areas and thus is unlikely to inhabit the mine operations area east of Highway 96.

Birds

Two hundred thirty one (231) species of birds, as listed by Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. However, only 92 bird species are catagorized as potential, likely, or known inhabitants of the permit area. Of thise 92 speices, 10 are on the Utah Sensitive Species List, and will be discussed below.

Waterfowl (ducks and geese), all of which are considered to be of high interest to the State of Utah due to their status as "gamebirds", are represented by 21 species that may, on occasion or seasonally, occur as minor inhabitants or transients in the general permit area. Of these, only nine (9) species could reasonably be expected to occur in the permit area, other than on an occasional basis. In general, the limited riparian and wetland vegetation types encompassed by the proposed permit area and adjacent areas provide marginally suitable habitat values for these nine (9) and possibly other waterfowl species. Each species has different life requisites and nature and frequency of use of the riparian and wetland habitats found in the area may vary significantly. The importance, however, of these habitats for breeding purposes results in their being ranked as high-priority if utilized during the breeding period though such use is not expected.

The mine plan area provides substantial potential habitat for a variety of raptor species including the: turkey vulture, golden eagle, bald eagle, osprey, prairie falcon, peregrine falcon, American kestrel, northern goshawk, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, northern harrier, barn owl, great-horned owl, northern pygmy owl, long-eared owl, burrowing owl and northern saw-whet owl. Many of these species are of high Federal interest pursuant to 43 CFR, 3461.1 (n-1), and all are considered of high interest to the State of Utah. There is some potential, though minimal, for incidental use of the permit area by bald eagles, a Federally listed Threatened species as further discussed in Section 3.3.4.2. High-priority and/or critical habitat for certain raptor species exists within the permit area during the nesting/breeding period (February - July). For these species, construction activities within one-half mile of a nest site during the species specific nesting/breeding period should be avoided.

Because certain raptor species may be sensitive to disturbance during their active nesting period, surveys of those portions of the permit area where surface disturbance has or is anticipated to occur have been implemented intermittently during the period from 2005 through 2007. As a result of these efforts several nest sites have been located in and near the permit area. Locations for these sites are provided on Map 3.3.1.4, Regional Wildlife Map. As indicted on Map 3.3.1.4, one nest (No 1541) was observed south of the proposed disturbed area in the southwest quarter of Section 33, T12S, R7E. This nest was categorized during the

2005 helicopter survey as being either goshawk or red-tailed hawk. As discussed further under Section 3.3.4.2, goshawks prefer conifer stands for nesting and therefore nest No. 1541 is more likely a red-tailed hawk nest. No nesting activity was observed at this nest site during the 2007 nesting period.

The Ferruginous hawk is listed by the UDWR as rare in the Wasatch Plateau. This species may use the area in the summer, and inhabit submontane and desert elevations and therefore the mine are may be on the extreme upper end of their affinity area. They rarely nest in Utah and prefer open country, primarily praries, plains and badlands. Because of the above factors, the Ferruginous hawk is unlikely to be found in the mine plan area.
The Bald eagle is listed as Threatened and is listed by the UDWR as uncommon in the Wasatch Plateau, however Scofield Reservoir is a favorite gathering place for this bird primarily during their southern migration during the winter. Many Bald eagles can be seen near the reservoir during the winter, and may spend the entire winter in the area. It is unlikely that this species would spend a lot of time in the mine permit area, however, road killed deer and other large mammals may lure them to this food source along Highway 96 in the vicinity of the mine site. There are no known Bald eagle nest sites in the area of the mine site, although there are a few nesting pairs in Utah.

The UDWR lists the northern goshawk as an uncommon species in the Wasatch Plateau according to the UDWR, and is listed on the Utah Sensitive Species List as a Conservation Agreement species. Because this bird prefers the interiors of extensive, remote, mature and old-growth forests dominated by large trees, high canopy closure, on moderate slope, with an open understory (Falk 1990, Speiser and Bosakowski 1987, Squires and Reynolds 1997) it is unlikely that nesting occurs in the mine disturbed area, or near it. According to Speiser and Bosakowski 1987, Basakowski and Speiser 1994, Bosakowski and Smith 1997 and Falk 1990, goshawks nest further from areas of human habitation than would be expected by chance. They found that the average distance to human habitation in New Jersey sites was about 1050 m, OR 3,445 feet, with a distance to the nearest paved road of about 1170 m, or 3,839 feet.

The following Northern Goshawk Habitat Model is presented in the USFWS web site at http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/northern_goshawk_model.htm:

> Several models were developed and the resulting habitat maps were compared to known goshawk occurrences in the study area. The best fit was achieved by regarding goshawk habitat as patches of forest, of adequate size, and which include areas likely to be suitable for nesting.
>
> Goshawk nesting areas were identified as: 1) having suitable forest cover; 2) situated at least 460 m (1,509 ft) from developed ((based on Bosakowski and Speiser, 1994 average distance of nests from roads and dwellings of 1,100 m (3,609 ft), 1 s.d. of 640 m (2,099 ft)); 3) situated within 500 m (1,640 ft) of a pond or shrub swamp, and; 4) having north, northeast, northwest, or flat aspect. These areas were scored 1.0. Other contiguous forest within 500 m, or (1,640 ft) of the nesting habitat was scored 0.5. The sizes of the habitat patches then was computed, and only clusters having at least some nesting habitat and an area of 8 ha (19.77 acres) or larger were retained.

This model and the other factors presented above would seem to preclude goshawks from choosing to nest in the location of Nest No. 1451.

Blue grouse, as yearlong residents of the Wasatch Plateau, prefer open stands of conifers which serve as the principal source of forage. In the warmer months, blue grouse are found in

the lower elevation sagebrush, piñon-juniper, and mixed brush habitats where they can obtain newly developing buds and other tender vegetation. At various times during the breeding and brooding seasons, insects and berries become an important dietary component and habitats which supply these requisites are classified as high-priority. During the colder months, young needles and buds from Douglas-fir and spruce trees at higher elevations provide the necessary forage for survival. Therefore, high elevation coniferous stands rank as critical habitat during the months of December through February for blue grouse. Since there are no conifer stands in the mine surface disturbance area, there will be no impact to Blue grouse.

Sage grouse are listed on the Utah Sensitive Species List as a species of concern, and are year-round residents of the high plateau and adjacent portions of the permit area which lie east of the mine site. However, within their substantial use area are locations of critical value winter range, leks (strutting grounds), brooding areas, and high-priority summer range. Sage grouse only occur in sagebrush dominated vegetation types or communities in close proximity to sagebrush types within the submontane life zone. Open areas (e.g., wet meadows) surrounded by sagebrush are often utilized as strutting grounds during the critical breeding period from March 15 through June 15. Sagebrush stands within a two-mile radius of such sites are also classified as critical value areas due to their use as brooding habitat following nesting. Following the brooding period, the sage grouse disperse over the entire substantial use area until about mid-November. During this period, use areas are considered as high-priority summer range. As indicated by the Map 3.3.1.4, Regional Wildlife Map, the mine surface disturbance area east of Highway 96 is classified as winter and brooding habitat. Due to the close proximity of Scofield Town and Highway 96, it is unlikely that Sage Grouse significantly use the area. No leks have been identified in the mine area.

Riparian areas and adjoining brushlands associated with the Mud Creek may provide yearlong, substantial value habitat for California quail. Because the quail is completely dependent on riparian systems during its life cycle, especially for wild grains and insects, this habitat type is ranked as critical for this species. The UDWR indicates that there are limited populations of this bird in the Wasatch Plateau. Due to the mine surface disturbed area being distant from a water source, and since the site lies near Highway 96 it is unlikely that significant numbers of California Quail inhabit the area.

The Long-billed curlew is listed by the DWR as a species of concern, and as rare to the Wasatch Plateau. This species has a strong affinity for riparian and shoreline areas, but may forage in pastureland, and may nest in pastureland habitats. Because of these factors, this species is unlikely to inhabit the mine plan area.

The Whooping crane is listed by the UDWR as exterminated in the Wasatch Plateau and is therefore not expected to be found in the mine area.

The Yellow-billed cuckoo is listed by the UDWR as Federal Candidate species, is listed as rare in the Wasatch Plateau. This species prefers woodland areas, and is thought to nest primarily in the eastern United States. Due to the above factors, it is unlikely that this species can be found in the mine plan area.
The Burrowing owl is listed by the UWR as limited in the Wasatch Plateau, and as a Species of Concern. This species prefers open, dry grasslands, agricultural and range lands associated with burrowing animals, particularly prarie dogs, ground squirrels and badgers. Because of these factors, this species is considered as unlikely to inhabit the mine plan area.

The Black swift is listed by the UDWR as a Species of Concern, and as uncommon in the Wasatch Plateau. The Audubon Society says about the Black Swift, "Black Swift is considered primarily a mountainous species, occurring over a range of highland habitats, particularly over rugged terrain and coastal cliffs. Nests on canyon walls near water and sheltered by overhanging rock or moss, preferably near waterfalls or on sea cliffs. It occasionally occurs in lowlands during migration or in bad weather conditions. It breeds in California from May to September. Autumn migration from northern portions of the breeding range begins as early as late August. The species' wintering grounds are not definitively known. The nests are shallow cups made of moss bound with mud. Lays one to two eggs. Feeds on flying insects."

Due to the above information, and the fact that no cliffs exist in the mine plan area, it is thought that this species in unlikely to inhabit the mine plan area.

The Three-toed woodpecker is listed by the UDWR as a Species of Concern, and as uncommon on the Wasatch Plateau. This species exhibits a strong preference for the bark insects of spruce trees, and inhabits coniferous forests at submontane and montane elevations, and therefore is considered to be uncommon to the mine plan area. There is very limited conifier habitat in the mine plan area, with only a few isolated conifer trees intersperced within the aspen communities. For these reasons, it is very unlikely that this species can be found in the mine plan area.

White pelicans can be found in and near Scofield Reservoir to the north of the mine site, however, due to this birds requirement to be very near water bodies, it is unlikely that they would be found in the mine area. This bird only visits the area during the open-water seasons, and is not found in the area during the winter.

Mammals

Sixty six (66) species of mammals, as listed by Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. However, only 32 mammal species are classified as known, likely, or potential residents of the permit area. Of the 32 potential State high-interest species possible in the region, the occurrence of 17 are either known, likely, or possible in the permit area. Seven (7) species are listed by the UDWR on the Utah Sensitive Species List and will be addressed below.

The Fringed myotis is listed by the UDWR as a Species of Concern on the Utah Sensitive species List, and as uncommon on the Wasatch Plateau. This species preferres Oak, pinyon, and juniper forests; desert scrub. Roosts in caves, mines, buildings, and other protected locations, and therefore is thought not to inhabit the mine plan area.

The Townsend's big-eared bat is listed by the UDWR as a Species of Concern on the Utah Sensitive Species List, and as common to the Wasatch Plateau. Habitat use in has not been evaluated in detail, but seems to be similar to other localities in the western United States. Caves and abandoned mines are used for maternity roosts and hibernacula (Worthington 1991, Hendricks et al. 1996, Hendricks 2000, Hendricks et al. 2000, Foresman 2001, Hendricks and Kampwerth 2001); use of buildings in late summer has also been reported (Swenson and Shanks 1979). Habitats in the vicinity of roosts include Douglas-fir and lodgepole pine forests, ponderosa pine woodlands, Utah juniper-sagebrush scrub, and cottonwood bottomland.

Due to the preceeding factors, this species is considered as unlikely to inbhabit the mine plan area.

The Spotted bat is listed by the UDWR as a Species of Concern on the Utah Sensitive Species List, and as uncommon on the Wasatch Plateau. Spotted bats may be found in a variety of habitats, ranging from deserts to forested mountains; they roost and hibernate in caves and rock crevices. Spotted bats occur state-wide in Utah, but have probably never been abundant in any particular location. Current data suggest that the species may be becoming even more rare in Utah than it was in the past. Due to these factors, it is thought that this species is unlikely to inhabit the mine plan area.

The White-tailed prairie dog is listed by the UDWR as a Species of Concern on the Utah Sensitive Species List, and as common to the Wasatch Plateau. According to the UDWR publication, Species on the Edge, the white-tailed prairie dog inhabits mountain valleys, semi-desert grasslands, agricultural areas, and open shrublands, but the map included in the publication does not show any populations in Pleasant Valley. There are no observed prairie dog populations in the mine plan area, and therefore it is thought that they do not inhabit the mine plan area.

The kit fox is listed by the UDWR as a Sensitive Species on the Utah Sensitive Species List, and as rare on the Wasatch Plateau. The species most often occurs in open prairie, plains, and desert habitats, and therefore is thought to be uncommon in the mine plan area.

The Black-footed ferret, a Federally listed Endangered species, is listed by the UDWR as endangered and extirpated, and is primarily dependent upon prairie dogs as a prey source, therefore, the substantial value use area for this species is restricted to prairie dog colonies which do not occur within the permit area. The re-introduced populations have been classified as "nonessential-experimental" by the U.S. Fish and Wildlife Service. In addition to Utah's re-introduced black-footed ferret population, unconfirmed sightings of naturally occurring ferrets persist throughout eastern Utah. Because there are no known prairie dog populations in the mine plan area, it is highly unlikely that the Black-footed ferret is found in the area.

The Canada lynx, is listed as a threatened species by the UDWR and the U.S. Fish and Wildlife Service. The range of *Lynx canadensis* extends from Canada and Alaska south to Maine, the Rocky Mountains, and the Great Lakes region. Although sightings of the Canada lynx in Utah over the past twenty years are exceedingly rare, the U.S.D.A. Forest Service recently announced that Canada lynx hair was found in the Mani-La Sal National Forest during 2002.

The preferred habitat of the Canada lynx is montane coniferous forest. The Canada lynx is listed by the UDWR as rare in the Wasatch Plateau, and therefore it is thought to be highly unlikely that it can be found in the mine plan area.

Although not listed by the UDWR as sensitive species, mule deer, elk, and moose are very important species in the State of Utah and will therefore be discussed below.

Mule deer (herd unit 17) is a common yearlong inhabitant of the Wasatch Plateau with substantial value use areas spanning all wildlife habitats from the cold desert to the montane ecological associations. Some vertical migration occurs in response to seasonal changes, resulting in concentration of deer populations in lowland areas during winter months. These concentration areas, known as winter range, are variably utilized depending on the severity of

the winter. In all cases, this winter range is defined as high-priority for mule deer. During more severe winters and certain times of any given winter, the most concentrated use defines the most critical winter range for the general maintenance of the mule deer population. There is no critical winter range in the mine permit area, as shown on the Regional Wildlife Map (Map 3.3.1.4). The entire mine geographic area is listed by the UDWR as summer range. Although no specific areas are known, fawning grounds for this herd unit likely occur within the permit area. Use of fawning grounds during critical periods (June), would be considered to be of critical value to the mule deer population. The mining operations area is in close proximity to Scofield Town and Highway 96, and therefore may have less impact on mule deer than would otherwise.

Evidence of mule deer use of the mine plan area has been observed, however, shrub species do not exhibit significant winter browse impact, and therefore it is not anticipated that mining

activity will significantly impact critical winter habitat. Add to this the fact that the UDWR does not show any winter range in the area as discussed previously.

Rocky mountain elk are inhabitants of the Wasatch Plateau with substantial use areas spanning all wildlife habitats from the submontane through the montane ecological association. The local elk population does not exhibit as strong a vertical migration as mule deer, however, such a migration does exist resulting in some concentration during the winter months. These concentration areas, known as winter range, are variably utilized depending on the severity of the winter. In all cases, winter range is defined as high-priority for elk. During more severe winters and certain times of any given winter, the most concentrated use defines the most critical winter range for the maintenance of the elk population. These critical winter range areas, with regard to the proposed permit area, are not shown on the Regional Wildlife Map (Map 3.3.1.4) since they occur far to the east, not on the map area. Based on the mapping information, the entire permit area lies within the designated elk summer range. Although no specific areas are known, calving grounds for this herd unit possible occur within the permit area. Use of calving ground during critical periods (June), would be considered to be of critical value to the elk population. Since the mine operations area lies within close proximity to both Scofield Town and Highway 96, it is unlikely that elk would use the area for calving due to human activity.

Moose are listed by the UDWR as an uncommon inhabitant of the Wasatch Plateau. Moose have a strong affinity for riparian habitats, especially during the late spring through fall periods, and prefer aquatic vegetation. During the winter, moose will browse on twigs and conifers and bark in all areas of their habitat. Because they are strongly associated with riparian habitats during most of the year, they would be primarily found in the Mud Creek riparian area, and in the other riparian areas as shown on Map 3.3.1.4, Regional Wildlife Map. Since the mine site is located very near Scofield Town and Highway 96, moose presence is unlikely in the area. However, there is the possibility of the occasional moose passing through the area.

3.3.3 Wildlife Summary

While the permit area occupies only a small portion of the Wasatch Plateau, it has essentially the same characteristic associated habitats and faunal resource potentials and is a typical representation of the Transitional and Canadian life zones in this part of Utah. Given these associations and characteristics, the permit area provides potential habitat for approximately

329 species of vertebrate wildlife, including; 7 fish species, 8 amphibians, 17 reptile species, 231 birds, and 66 mammals. Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, identifies those species known to occur in this general area as well as the likelihood of occurrence in the permit area. Included on this list are several species of wildlife considered to be of high interest to the State of Utah, and/or are listed on the Utah Sensitive Species List. High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific, or educational significance. Included in this category are those species of wildlife listed as Federally Endangered or Threatened.

Although wildlife occurrence and habitat values in the general permit area may be typical for this part of Utah, the surface disturbance areas (main facilities area) have generally been extensively disturbed by previous mining and other related activities. Therefore, the value and utility of these areas to indigenous wildlife has already been somewhat reduced. Because the mine operations area is in very close proximity to both Scofield Town and Highway 96, use of the area is likely affected and probably reduces to some degree. In effect, the potential for any adverse impacts to wildlife habitats in the previously disturbed areas has already been

largely realized and redisturbance of these areas is not expected to result in any significant incremental impacts.

3.3.4 Threatened, Endangered, and Sensitive Species

3.3.4.1 Consultation Process

The Endangered Species Act of 1973 (the Act) requires Federal agencies to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species." Section 4 of the Act (Determination of Endangered Species or Threatened Species) grants the Secretary of the Interior power to determine whether any species is considered threatened or endangered. While Section 7 of the Act (Interagency Cooperation) specifies that all other Federal departments and agencies shall, take such action necessary to insure that actions authorized, funded, or carried out by them (Federal departments and agencies) do not jeopardize the continued existence of any listed species (pursuant to Section 4) or result in the destruction or modification of critical habitat of such species." It should be noted that all of the permit area is on private property and the coal reserves are either private or are controlled by Carbon County and therefore the only federal action in the Kinney Mine operation is concurrence by the Office of Surface Mining and Reclamation, with primacy held by the Utah Division of Oil, Gas and Mining.

The consultation process is designed to assist Federal agencies when complying with the Act, and authority of consultation has been delegated by the Secretary of the Interior to the Director of the U.S. Fish and Wildlife Service (USFWS). The consultation process involves several phases. First, a general description of the proposed action and a formal request for a listing of proposed and listed endangered and threatened species potentially affected by the proposed action is submitted to the USFWS by the affected agency (or entity). The USFWS responds with a list of proposed, candidate, and listed species within the proposed permit area. When the project is a construction project, the agency (or entity) then prepares a Biological Assessment which identifies the project, details the biology of the species on the list submitted by the USFWS, analyzes the cumulative effects of the project, and determines if there is likely to be an effect (either beneficial or adverse) on any listed or proposed species.

If a "may affect" determination is made, the responsible federal agency must request formal consultation with the USFWS.

Formal consultation involves USFWS consideration of the proposed project and how it may affect the biology of any listed threatened or endangered species, including the magnitude of such effects and potential cumulative effects. Based on this information, a Biological Opinion is issued by the USFWS which states one of three possible conclusions: the proposed action (1) may promote the continued existence of the species, (2) is not likely to jeopardize the continued existence of the species, or (3) is likely to jeopardize the continued existence of the species. Reasonable and prudent alternatives must be addressed by the USFWS as part of the Biological Opinion when a determination is made that the proposed project is likely to jeopardize the continued existence of the species.

3.3.4.2 Threatened, Endangered, and Sensitive Species Occurrence and Use of Area

The following list is from the latest UDWR sensitive species list, (Utah Sensitive Species List, October 17, 2006).

Listed Species

Threatened Species

Bald Eagle _____ *Haliaeetus leucocephalus*
Canada lynx _____ *Lynx Canadensis*

Endangered Species

Whooping crane (extirpated) _____ *Grus Americana*
Black-footed ferret _____ *Mustela nigripes*
(experimental, non-essential
in Duchesne & Uintah counties)

Conservation Agreement Species

Northern goshawk _____ *Accipiter gentilis*

Candidate Species

Yellow-billed cuckoo _____ *Coccyzus americanus*

Species of Concern

Western toad _____ *Bufo boreas*
Smooth greensnake _____ *Opheodrys vernalis*
Burrowing owl _____ *Athene cunicularia*
Ferruginous hawk _____ *Buteo regalis*
Sage Grouse _____ *Centrocercus urophasianus*
Black swift _____ *Cypseloides niger*

Long-billed curlew	*Numenius americanus*
American white pelican	*Pelecanus erythrorhynchos*
Three-toed woodpecker	*Picoides tridactylus*
Townsend's big-eared bat	*Corynorhinus townsendii*
Spotted bat	*Euderma maculatum*
Fringed myotis	*Myotis thysanodes*
White-tailed prairie-dog	*Cynomys leucurus*
Kit fox	*Vulpes macrotis*

Subsequently, Carbon Resources, will request from the USFWS an updated listing of threatened, endangered, or candidate species potentially occurring within the proposed permit area. Those species formally listed as threatened or endangered and potentially subject to impacts from the project at that time, will be sufficiently evaluated through the process of a biological assessment, if necessary, as opposed to detailed effects analyses in this document. Development of such a biological assessment (if necessary) would occur following submittal of this application to UDOGM and will ensure compliance with any applicable provisions of the Endangered Species Act of 1973, P.L. 93-205 (87 Stat. 884), as amended.

Terrestrial

With regard to the permit area, potential habitat for 16 Federal candidate (Category 2) species and 4 listed threatened or endangered species exists according to UDWR records and based on current listings. The 16 candidate species are indicated on Table 3.3.2.2, Potential Wildlife Species of the Wasatch Plateau, and have previously been discussed in Section 3.3.2.1 as appropriate. The five listed species include: 1) Bald eagle; 2) Canada lynx; 3) Whooping crane; 4) Black-footed ferret.

With regard to the Bald eagle, critical wintering areas exist at Scofield Reservoir just north of the permit area as shown on the Regional Wildlife Map, (Map 3.3.1.4). At present, there are no known high-priority concentration areas or critical roost trees within proposed permit area boundaries, however, the proposed permit area has been classified as substantial value use area to wintering eagles due to foraging opportunities presented. No historical nesting by bald eagles is known to have occurred in this part of Utah, and foraging requisites for nesting activity are not available in the immediate area.

As indicated previously, although sightings of the Canada lynx in Utah over the past twenty years are exceedingly rare, the U.S.D.A. Forest Service recently announced that Canada lynx hair was found in the Mani-La Sal National Forest during 2002. The preferred habitat of the Canada lynx is montane coniferous forest. The Canada lynx is listed by the UDWR as rare in the Wasatch Plateau, and therefore it is highly unlikely that it can be found in the mine plan area.

The Whooping crane is listed by the USF & WS as exterpitated, but formerly passed through Eastern Utah. It is highly unlikely that this species would be found in the mine plan area.

The Black-footed ferret, a Federally listed Endangered species, is listed by the UDWR as endangered and extirpated, and is primarily dependent upon prairie dogs as a prey source, therefore, the substantial value use area for this species is restricted to prairie dog colonies which do not occur within the permit area. The re-introduced populations have been classified as "nonessential-experimental" by the U.S. Fish and Wildlife Service. In addition to

Utah's re-introduced black-footed ferret population, unconfirmed sightings of naturally occurring ferrets persist throughout eastern Utah. Because there are no known prairie dog populations in the mine plan area, it is highly unlikely that the Black-footed ferret is found in the area.

Aquatic

There are no aquatic species in the vicinity of the mine operations area, however Mud Creek, located approximately a quarter of a mile west of the operations area contains some species of fish, and the associated riparian zone around Mud Creek likely contains several of the amphibian species. In addition, this riparian zone likely contains several of the reptile species that prefer riparian hatibats.

UDWR Consultation

On August 9, 2007 a request was made to the UDWR for a list of T&E species for the mine plan area (See Exhibit 3.3, Fish, and Wildlife Information for this request and UDWR's response).

The UDWR responded by letter dated August 13, 2007 with the following:

> The Utah Division of Wildlife Resources (UDWR) has records for sandhill crane and bald eagle within the project area noted above. In addition, in the vicinity there are records of occurrence for northern flying squirrel and northern river otter.

The only species noted by the UDWR in this letter that is on the Utah Sensitive Species List is the bald eagle, which has been addressed previously. Since the UDWR indicated that records show occurrence of sandhill cranes, northern flying squirrel and northern river otter, they will be discussed below as species of high interest.

The sandhill crane is listed by the UDWR as uncommon on the Wasatch Plateau. According to UDWR information:

> The sandhill crane, Grus canadensis, breeds primarily in Alaska, northern Canada, and in the Great Lakes, but small, scattered breeding populations are also found in the northwestern United States (including northeastern Utah), the southeastern United States, and Cuba. With the exception of populations in the southeastern United States and Cuba, breeding populations migrate south to wintering grounds in the southern United States and northern Mexico.
>
> The sandhill crane is usually found foraging in open grasslands, meadows, and marshy portions of lakes, ponds, and rivers. Its diet is diverse, consisting of roots, tubers, seeds, grain, berries, small vertebrates, and invertebrates. At night, flocks roost in open expanses of shallow water.

The sandhill crane is migratory bird and occurs primarily seasonally in Utah and as noted by the UDWR is usually found foraging in open grasslands, meadows and marshy areas. Occurance of sandhill cranes in the mine operations area would be very rare, and therefore no impact from mining is anticipated.

The northern flying squirrel is a yearlong resident of the Wasatch Plateau, however, its relative abundance is unknown, and listed as rare by the UDWR. Its substantial use area is restricted to spruce-fir or mixed conifer habitats of the montane ecological association. Critical use periods occur during the bi-modal breeding season, from April through May and from August to September. Since this species prefers mature conifer habitats it is not expected to occur in the mine operations area, or the mine general geographic area since there are no conifer stands in the area.

The northern river otter is listed by the UDWR as being rare on the Wasatch Plateau. Since this species habitat is associated very closely with rivers, streams and water bodies, it is very unlikely that it would be found in the mine disturbed area, or the general mine area. It may be found along Mud Creek west of the mine area, and in or near Scofield Reservoir north and west of the mine permit area.

3.4 LAND USE INFORMATION

3.4.1 General Land Use Information

This section describes existing land uses, land use classifications, and land use condition and capabilities within the permit area and adjacent areas which could be affected or impacted by the mining and reclamation activities. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-400) for coal mine permitting in the State of Utah.

3.4.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses rule R645-301-411. Reclamation plans and performance standards (Rules R645-301-412 through R645-301-414) are addressed in Section 5.4 of this permit application. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
3.4.1	
3.4.1.1	
3.4.1.2	R645-301-130
3.4.1.3	R645-301-411.110 and 200
3.4.1.4	R645-301-411.110, 140, and 141, and 512
3.4.2	
3.4.2.1	R645-301-411.100 and 120
3.4.2.2	R645-301-411.110 and 130; 411.200
3.4.2.3	R645-301-411.120
3.4.2.4	R645-301-411.130 and 141
3.4.2.5	R645-301-411.130
3.4.3	
3.4.3.1	R645-301-411.140
3.4.3.2	R645-301-411.140
3.4.3.3	R645-301-411.140
3.4.3.4	R645-301-411.140, 141, 143, and 144
3.4.3.5	R645-301-411.142
3.4.4	
3.4.4.1	R645-301-411.200, 240
3.4.4.2	R645-301-411.200 through 250
Maps	R645-301-411.110, 140, 141, and 230
Exhibits	R645-301-411.140 through 143

3.4.1.2 Sources for Land Use Information

Land use history, designations, capabilities, and values in the permit and adjacent areas have been characterized in this section using information from local land use records, studies and reports, existing environmental documents, and previous and ongoing baseline characterization efforts. Available land use information and relevance to this site are summarized below.

Carbon County Assessor's Office, Zoning and Land Ownership Records and Information – The County records provided zoning designations for the proposed permit area and surrounding areas as well as documentation of both present and historical ownership.

Scofield Town Zoning information – Town records providing zoning designations for the proposed permit area and surrounding area within Scofield Town.

The wildlife documentation describes wildlife use and habitat values in the Project and adjacent areas. Rather than create both a baseline report and the related permit section, all wildlife baseline information was prepared and formatted for inclusion in the permit.

3.4.1.3 General Land Use Patterns of Permit Area and Adjacent Areas

Land uses in the permit area and adjacent areas are presently and have historically been constrained by location, topography, climate, and availability of important resource values. Rugged terrain, limited soil resources, low precipitation, high elevation, and seasonally harsh weather conditions, limited water resources, and existence of significant high quality coal reserves are the primary factors which determine land use capabilities in this area. Generally, these factors limit land use options to mining, scattered oil and gas production, low-intensity grazing, wildlife habitat, limited timber production at the higher elevations, and dispersed recreational uses including hunting, fishing, hiking and similar activities. The Scofield Reservoir, located north and west of the permit area, represents a unique land use which is indirectly tied to the surface water and the coal resources available in the area. With the exceptions of the Scofield Reservoir, historic and current mining activities, and limited grazing, there are no significant residential, commercial, or agricultural land uses in the permit area. A portion of the permit area has been annexed into the boundaries of Scofield Town.

3.4.1.4 Mapping of Land Use Information

Information presented on the Regional Land Use Map (Map 3.4.1.4-1), and the Previous Mining Activities Map, (Map 3.4.1.4-2), includes:

- Current land use designations and areas
- Locations of identified cultural, historic, and paleontological resource values
- Boundaries of any public parks, or units of the National System of Trails or Wild and scenic Rivers System

- Any cemetery located within 100' of the permit area
- Locations of existing mining related surface disturbance and mine structures and facilities, and location and extent of known underground mine workings

Consistent with applicable provisions of R645-301-512, information on previous mining activities has been prepared under the direction of, and certified by a qualified, registered professional engineer or land surveyor with assistance form experts in the related field.

3.4.2 Land Use Information

Land uses and capabilities in the permit and adjacent areas have been determined through historical records and evaluation of baseline soils, vegetation, wildlife, and hydrology information.

3.4.2.1 Land Use Capability and Condition

The primary constraints relative to the condition and capability of lands within the permit and adjacent areas to support various land uses are the rugged terrain of the area, high elevation, short spring and summer seasons, and long winters as shown on the Regional Land Use Map, (Map 3.4.1.4-1). The rugged natural topography of the area may generally be characterized as a small, high elevation valley, with high plateaus to the east and west, narrow ridgelines cut by deep drainages with steep, narrow drainage valleys over most of the proposed permit and adjacent area. The area is semi-arid with mean annual precipitation of only 14.56 (Scofield Dam) inches. Most of the precipitation occurs as either snowfall during the winter months or as brief high-intensity thunderstorms during late summer and early fall. Generally, mining and other development in the area has been limited to valley bottoms and the adjacent lower valley slopes with little or no significant development of high plateau and steep ridge and valley areas. In recent years, summer home construction has become a major development on the ridges west and north of Scofield Reservoir.

Upper plateaus on the east and west of the permit area receive slightly greater amounts of precipitation and because they are typically higher in elevation. Access problems due to the rugged surrounding terrain and harsh climatic conditions during portions of the year have limited both disturbance and use of these areas. The land east of the mine site is private property and has historically been heavily used for sheep and cattle grazing. Generally, potential land uses for the high plateaus in this area are limited by topography and resource constraints to wildlife habitat, low intensity grazing, recreational uses, and scattered timber production. The mining and related activities will not directly affect upper plateau areas since no surface disturbance is proposed or anticipated in these areas.

Land use capability and condition for the permit area is a direct reflection of the rugged terrain. Because the rugged natural terrain makes access and development so difficult and most of the area remains in a natural, undisturbed condition, except for cattle and sheep grazing as mentioned previously. The potential for alternative land uses in these areas is also affected by shallow, poorly developed soils with low water holding capacity and high erosion potential, and by a general lack of adequate surface or ground water resources.

The mining and related activities will not directly affect steep ridge and valley areas since no surface disturbance is proposed or anticipated in these areas.

Most existing and historical development in the general area has occurred in the valley bottoms and adjacent lower valley slopes. These areas offer the benefits of practical access, proximity to surface water sources, and more extensive and fertile soil resources. Extensive historical mining and related activities have occurred in the Pleasant Valley within the permit area. Generally these activities have resulted in extensive surface disturbance and alteration of natural conditions in the effected areas. Existing and potential uses in the valley bottom areas include mining, transportation, wildlife habitat, low intensity grazing, and undeveloped and developed recreational uses, as well as development of private property in and around the Town of Scofield. While areas do exist outside of the permit boundary where valley bottom soil resources are adequate to support limited agricultural activities, these areas are limited to the Mud Creek (Pleasant Valley), in the flatter valley bottom. Due to the high elevation of Pleasant Valley, this agricultural use is limited to grass-type pasture use. The short warm season limits crops to grass and grass-hay production, and therefore row crops are not possible.

3.4.2.2 Description of Existing Land Uses

Existing land uses in the proposed permit area and adjacent areas, as illustrated by the Regional Land Use Map, (Map 3.4.1.4-1), include the following, classified under specific land use categories as defined by Rule 645-100-200.

Industrial/Commercial Uses

- Underground Coal Mining
- Scattered Oil and Gas Production
- Transportation and Utilities

Undeveloped Lands

- Low-Intensity Grazing
- Fish and Wildlife Habitat
- Dispersed Recreation
- Limited Timber Production
- Watershed

Developed Lands

- Residential – (Within Scofield Town)

Of these multiple uses, watershed, and wildlife habitat are the dominant use for undeveloped lands and mining constitutes the primary developed land use in the immediate area. Residential and a few commercial uses are located within Scofield Town. The following descriptions characterize the nature of and areas associated with each of these land use categories.

Underground Coal Mining - Extraction of reserves of high quality coal using underground mining methods has resulted in extensive historical mining related development and use within the permit boundary and adjacent areas. Generally, mining related surface disturbance has been limited to that disturbance associated with mine openings, surface facilities, coal processing facilities, transportation systems, and housing for miners and their families. While locally extensive, the underground mine workings have not resulted in significant surface disturbance or other impacts on overlying surface areas or associated land uses. There are some relatively minor subsided areas in the permit boundary resulting from historic mining near the outcrop. Several sink-holes and areas of mine portal areas that collapsed due to very thin overburden, and apparently inadequate roof support. Previous mining activities are discussed in greater detail in Section 3.4.4. Given the configuration of the coal seams and access constraints imposed by the relatively rugged terrain of the area, most mining related development has been limited to valley bottoms and adjacent lower valley slopes.

The period of active mine development and operation in this area extended from the late 1880's through the early 1970's. At the present time there are no active mining operations in or near the proposed permit boundary. Within the proposed permit planned disturbance area, approximately 74% has been previously disturbed by historic mining activities. The State of Utah AMR Program completed extensive work involving the removal of multiple piles of coal fines and coal material in disturbed areas paralleling Highway 96 in the area planned to be used for the Kinney Mine facilities. This coaly material was placed in areas of the previously disturbed areas, covered with soil, graded, and revegetated. Extensive remaining coal reserves offer the potential for future mining related development and use.

Scattered Oil and Gas Production - Oil and gas production activity in the general permit area and adjacent areas is very limited with no active wells in the permit area. Based on available information, there are no known plans for development of oil and gas wells in the proposed permit area vicinity and the potential for future oil and gas development is limited.

Transportation and Utilities - The rugged terrain of the area limits routing options for major roads and utility transmission lines, consequently roads and utility lines typically follow the existing natural drainage valleys. Within the general permit area, State Highway 96 follows the Pleasant Valley from it's northern head, starting at Highway 6 junction, and running west and south to the old mining community of Clear Creek. A north-south rail line follows generally the eastern toe of Pleasant Valley from the Scofield dam southward to the Skyline Mine load out. Due to access considerations and practical construction constraints, transportation and utility related development is also concentrated in the valley bottom and adjacent lower valley slope areas. The narrow configuration of area drainage valleys and existing developed transportation and utility infrastructures generally preclude any significant additional development or use for this land use category.

Low-Intensity Grazing - Effective grazing use of portions of the permit area and adjacent areas is limited by the rugged terrain and lack of adequate surface water sources. Small cattle ranching and sheep grazing operations do, however, utilize some of the high plateau areas on a seasonal basis. Since the property in the permit boundary and adjacent areas is privately owned, no formal animal number limits are imposed, and the area is heavily grazed. Grazing use should not be significantly impacted by proposed mining operations since very little surface disturbance will occur in potential grazing areas and underground development should not significantly impact overlying areas or uses. The potential for future

expansion of grazing use is generally constrained by topography, and vegetation and water availability.

Fish and Wildlife Habitat - As described in Section 3.3 of this permit application, the permit area and adjacent areas provide habitat for a wide variety of fish and wildlife species. Generally, any areas not utilized for other designated uses are considered to be undeveloped lands, which are utilized to varying degrees, dependent on the availability of other resource, values as wildlife habitat. Given this consideration, wildlife habitat is one of the two primary land uses for the permit and adjacent areas and these areas are subject to low-intensity management for wildlife use by the responsible wildlife management agency.

Various species are associated with one or more of the habitat zones which occur throughout the area. Portions of the permit area have been designated by the UDWR as critical and high-priority habitat for mule deer and elk, and sage grouse as shown on the Regional Wildlife, (Map 3.3.1.4). Species occurrence and habitat values have been impacted to some degree in those areas affected by previous mining related surface disturbance. Historic mining disturbances typically remain in a partial state with varying levels of plant reestablishment and resultant restoration of habitat values. In those limited areas where more recent mining activity has occurred, full-scale reclamation efforts have resulted in effective vegetative reestablishment and general restoration of many of the premining habitat values.

Historic mining operations resulted in disturbance of relatively limited surface areas generally, although much of the disturbance was near the valley bottom areas associated with high-value habitat. Generally, surface disturbance for the Kinney Mine mining and related activities will be in previously disturbed areas so incremental disturbance and associated wildlife habitat impacts will be negligible. Although, the reclaimed areas of historic mining by the Utah AML project in the 1980's have provided some habitat for local wildlife species. On completion of the Kinney Mine proposed mining and related activities, affected surface disturbance areas will be reclaimed, resulting in full restoration of the premining habitat values.

Dispersed Recreation - Generally, these activities occur on a seasonal basis primarily on public lands in the area, such as the Scofield Reservoir area. Since all of the permit boundary area, and adjacent areas are privately owned, recreation activities are limited to those private land owners and their guests. The recreational activities associated with Scofield Reservoir are limited to the lake itself and a narrow band along the shore of the lake where the general public has access. These activities will not be affected by mining at the Kinney Mine. Availability of and proximity to much more desirable recreational areas along the Wasatch Front and in the canyonlands to the south are also limiting factors. Given existing low use levels and the various limiting factors, the potential for expanded recreational use of this area is small, and limited to developments on private property.

Limited Timber Production - The scattered coniferous forest growth in the general area supports limited logging on private property in the general area. Limited public lands available for logging and access constraints generally make large-scale logging activities economically infeasible. The permit area, and adjacent areas north, south and east of the mine area do not contain significant stands of conifers that would support timber production. Given the limited importance of logging use in this area and the practical operational and economic constraints, there is little potential for expanded future logging use.

Watershed – A majority of the general area is zoned by Carbon County Watershed Zone. The entire permit area is tributary to Scofield Reservoir, a Bureau of Reclamation project that serves water users in the Price and Carbon County areas. The main source of irrigation and culinary water for Carbon County, and Price City is Scofield Reservoir. Impacts from livestock grazing adjacent to Scofield Reservoir has been a problem to water quality in the reservoir, as well as human uses in the area.

3.4.2.3 Land Use Constraints Due to Other Environmental Values

As previously noted, topography and climate are the primary environmental constraints on potential land uses in the permit and adjacent areas. In addition, the following specific environmental constraints may limit potential land uses either generally or in specific areas:

Soils - Potential soil constraints correspond to three general soil groupings; 1) Upland soils; 2) lowland and riparian soils; and 3) Disturbed soils. Upland soils are commonly shallow, poorly developed, and have moderate to high erosion potential and low to moderate water holding capability. Given these considerations combined with the rugged terrain, upland soils are generally not suitable for intensive agricultural uses or commercial/industrial/residential development and may be a limiting factor for grazing, logging, and wildlife habitat. The areal extent of lowland and riparian soils is typically limited by high drainage gradients and narrow stream valleys. Limited occurrence and a high proportion of coarse fragments are limiting factors for lowland soils relative to any intensive agricultural uses. Given poor soil development in many areas, soil disturbance may not significantly impact overall soil productivity. Disturbed soils in the permit area, do, however, frequently contain coal materials and coarse fragments which may affect soil handling activities and soil productivity relative to any intensive agricultural uses.

Vegetation - Site vegetation is generally a reflection of soils, water availability, elevation, and topographic configuration and aspect. Vegetation type and occurrence are natural constraints relative to potential grazing and wildlife habitat uses. No threatened, endangered, or sensitive plant occurrence have been identified in mining and related activities surface disturbance areas.

Wildlife - Wildlife is a constraining land use factor only to the extent that certain development activities may be precluded or otherwise limited in areas identified as critical habitat for certain species of high interest. These areas would include breeding and rearing areas, animal migration routes, and areas in close proximity to active raptor nests. Significant habitat areas for most wildlife species do not exist in the planned permit disturbed area. There have been no identified eagle nests in the area. Since prime nesting habitat dies not exist in the mine plan area, no specific habitat mitigation measures are proposed for eagle nests in close proximity to active surface disturbance or operating areas. There are no riparian habitat areas within the proposed disturbance area or the immediate adjacent area.

Hydrology - As a critical component of both intensive agricultural practices and grazing activities, and an important element relative to fish and wildlife uses, water availability may limit these uses in most portions of the permit area. The only identified riparian habitat in the general area of the mine is a narrow band of riparian vegetation along Mud Creek, which is approximately one quarter mile west of the permit area. There are no identified riparian habitat areas within the permit boundary.

3.4.2.4 Restricted Use Areas

With the exception of the existing public right-of-way for Highway 96 that borders the permit area, and the watershed area tributary to Scofield Reservoir there are no public parks, components of either National river or trail systems, renewable resource lands, areas designated unsuitable for mining, or other restricted use areas within the proposed permit area or immediately adjacent areas. The mining and related activities have been planned and designed to maintain a minimum distance 300 feet from any occupied dwelling. There are no Identified cultural/historic resource sites within or adjacent to the mine permit area. The mining activities will occur within 100 feet of the outside right-of-way line of Highway 96 and CR has complied with applicable public notification and comment requirements as described in Section 4.5.

3.4.2.5 Land Use Classifications and Zoning Restrictions

The majority of the eastern portion of the permit area in Section 33, T12S, R7E, and Section 4 T13S, R7E, Salt Lake Base & Meridian as shown on the Regional Land Use Map, (Map 3.4.1.4-1) is zoned by Carbon County as Watershed, which does not allow coal mining surface facilities. A small area encompassing the proposed disturbed area as shown on Map 3.4.1.4-1 has been rezoned by Carbon County to Mountain Land, effective October 17, 2007, which does allow surface facilities associated to coal mining. The area shown on Map 3.4.1.4-1 in Section 32, T12S, R7E lying within Scofield Town boundaries has been rezoned to Commercial, effective January 2008, which allows coal mining facilities. The designated land use classifications and any related zoning restrictions are consistent with both existing land use activities and those activities proposed in conjunction with the Kinney Mine mining and related activities operation and reclamation plans.

3.4.3 Cultural and Historic Resources

This section describes existing cultural, historic, and paleontological resource values identified within the permit and adjacent areas which could potentially be impacted by mining and related operations. Cultural/historic/paleontological resource values in the permit and adjacent areas have been identified and characterized through review of previous studies and reports, conversations with individuals familiar with the history of the area, and site specific field investigations of surface disturbance areas. The Regional Surface Ownership Map (Map 4.5.1.2-1) shows the area included within the detailed study area boundary.

Site specific field inventories of the proposed surface disturbance areas were conducted during the month of May 2007. Field inventory work followed extensive research and review of previous studies of the area, and historical accounts. Field surveys involved coverage of an area of approximately 395 acres by a qualified archaeologist and a paleontologist using parallel pedestrian transects spaced at intervals of up to 10 meters to search for any evidence of cultural, or historic values. In addition, accessible rock outcrop exposures around the perimeter of the survey area were examined for any evidence of paleontological values. Detailed discussion of site specific field inventories and descriptions of any resources identified as a result of the field investigations are presented in Exhibit 2.1.2.2-1, Cultural Resource Information (included in the confidential information section).

3.4.3.1 Cultural Context

Although human habitation of the area may have occurred as early as the Clovis Period (12000 to 9000 B.C.), the majority of prehistoric cultural resource sites identified in this part of Utah date from the Black Rock (4000 B.C. to A.D. 500) or more recent periods. The dominant prehistoric cultures known to have inhabited the general area are the Fremont and Numic/Shoshonean Cultures. The Fremont Culture (A.D. 400 to 1300) was characterized by a settled horticultural lifestyle with well developed construction practices (laid masonry), distinctive ceramics, and advanced farming methods. The Fremont Culture appears to have been supplanted by semi-nomadic Numic/Shoshonean speaking Indians which migrated into Utah from the northern Great Basin of Nevada and Idaho. These Numic/Shoshonean peoples are probably the ancestors of the Northern and Western Utes which now inhabit the Uintah-Ouray Indian Reservation located to the northeast of the proposed permit area. The Numic/Shoshonean habitation extended from approximately A.D. 1200 to 1400 with individual family groups or larger multi-family bands migrating seasonally within semi-fixed territories in response to the availability of various food sources.

The Ute descendants of the Numic/Shoshonean peoples continued to reside in the general proposed permit area vicinity until shortly after the arrival and initial settlement of the area by Mormon settlers in 1847. At that time the Timpanogots, a subgroup of the Western Ute, were displaced from the Utah Valley and Spanish Fork Canyon and resettled on a reservation at the south end of Utah Lake. They subsequently abandoned this reservation in favor of a larger reservation established in the Uintah Basin, although they continued to return to their original lands through the early 1900's to fish during the spawning season. While the proposed permit area and adjacent areas are not known to have been primary settlement areas for either prehistoric or historic native peoples they were probably utilized on an occasional or intermittent basis for migrational food gathering activities.

3.4.3.2 Historic Context

The first non-native exploration of this general area occurred in approximately 1776 when members of the Dominguez-Escalante expedition passed through Spanish Fork Canyon to the north on their way to California. While exploration and fur trapping in the 1820's and 1830's covered large areas to both the north and south, John C. Fremont's exploration of this general area in 1844 is the only other known occurrence of non-native exploration or use of the area prior to the arrival of Mormon pioneers in 1847.

Following initial settlement of Salt Lake City by the Mormons, Mormon settlement began expanding southward to the Utah Valley and adjacent areas. The settlements of Palmyra and Spanish Fork were founded at the mouth of the canyon adjacent to the Spanish Fork River in 1852. Settlement of the very desirable rich open farmlands of the Utah Valley delayed settlement of other nearby areas until much later. The early settlers did, however, utilize the natural resources of the nearby mountains, establishing a rough road up Spanish Fork Canyon prior to 1869 which was apparently used to access logging areas and by settlers to move their herds to summer range areas near Colton and Soldier Summit.

The more modern history of the Scofield/upper Pleasant Valley area is diverse and dramatic, despite the fact that Europeans did not firmly establish themselves until the early 1870's (Madsen 1947). The earliest settlers in Pleasant Valley came not for coal, but the abundant

grasses that covered the valley floor, with which they grazed herds of cattle. Timber was another early resource found in the area, and b the early 1880's numerous mills were in operation. However, neither of these industries brought as many people to the valley, however, as coal mining. Coal deposits in the region were recognized by the Beckwith-Gunnison Expedition a early as the mid-1870's. Near Scofield, at least one mine was in operation as early as 1877 and several others began operations during the first few years of the 1880's (Madsesn 1947)

A narrow-guage railroad between Pleasant Valley and Springville, started in 1877, was completed in 1879; the Utah and Pleasant Valley Railway made the transportation of coal much more cost-effective than hauling the material by wagon (Carr and Edwards 1989). In 1881 the Denver and Rio Grande Western purchased the Utah and Pleasant Valley Railway, which helped to break Union Pacific's monopoly on railroad transportation to and within Utah (Watt 1997). In 1877, Peter Morgan located the Winter Quarters Mine near Scofield. Until 1900, coal mining was extremely prosperous in the Scofield area and the small town prospered. The coal mining industry's demand for labor required the recruitment of men from outside the state and resulted in the emigration of varied nationalities including Italians, Greeks, Chinese, Finns, Japanese, Mexicans, and Yugoslavians (Watt 1997). Labor conflicts and strikes were recurrent after the turn of the century, with the largest occurring in 1901, 1902-1903, 1922, and1933. Unionization attempts and strikes during this period attracted the attention and support of Charles DeMolli and Mother Mary Jones, prominent American labor and community organizers (Watt 1997). A recurrent labor demand was for safer working conditions.

The most deadly mining accident in Carbon County occurred at the Winter Quarters Mine. On May 1, 1900 a coal mine explosion commonly referred to as the Scofield Mine Disaster occurred. In Number 4 Mine of the Winter Quarters Mine, a spark ignited coal dust, ultimately resulting in the death of 200 miners (Madsen 1947, O'Neil 1981, Watt 1997). After the May 1 mine accident, coal mining began a series of boom and bust cycles resulting from political and economic factors in an ever-shrinking world market. Boom cycles occurred in conjunction with World War 1, World War II, and to a smaller degree the Korean War. Coal production has fallen dramatically since the 1950's as natural gas and oil began to fulfill the nation's energy needs.

3.4.3.3 Paleontological Context

Within the permit area, the Upper Cretaceous Blackhawk Formation of the Mesa Verde Group is the only geologic formation which is exposed at the surface within the existing or proposed surface disturbance areas. The Blackhawk Formation has been characterized as a representing a wave dominated delta system (Chan et. al., 1991) with a broad, flat marshy belt along a shoreline coastal plain. Vegetation included marginal coniferous forests, scattered deciduous trees such as gum, walnut, fig, and cottonwood, and numerous grass and sedge species. Dinosaurs roamed the marshy areas as evidenced by numerous dinosaur tracks. Generally, known fossils occurring in the Blackhawk Formation include plants, palynomorphs (pollen), occasional mollusks, dinosaur tracks, animal tracks, and other trace fossils. Actual bone or skeletal fossils are rare and most of the known fossils are found in association with the coal seams. A listing of paleontological Sensitive Formations in Utah (Madsen, 1985) ranks the Blackhawk Formation as second for trace fossils, third for fossil plants, twenty-seventh for vertebrate fossils, and does not present a ranking for this formation

for invertebrate fossils. Generally, trace fossils, and specifically dinosaur tracks, are the most common fossils associated with the Blackhawk Formation in this area.

3.4.3.4 Cultural, Historic, and Paleontological Resources

As previous described in Section 3.4.3, cultural, historic, and paleontological investigations for the permit area included research and review of previous studies and records, conversations with individuals familiar with the area, and site specific field investigations for surface disturbance areas which generally corresponds to the mine facilities and permit boundary area. Generally, the research and review phase established the context of the area as discussed in the preceding sections and provided some insight relative to the locations and types of resources which might be present. Site specific field investigations were then utilized to locate, identify, and characterize any resources actually encountered. Cultural, and historical, investigations for the proposed permit area resulted in identification of one previously documented site, the documentation of three previously recorded sites, and the documentation of five new sites.

The complete Cultural Resource Inventory report is located in Exhibit 2.1.2.2-1, Cultural Resource Information and considered to be confidential. The locations of all inventoried sites can be found in Figure 1 of the report, and will not be found on any other map in the permit application due to the sensitive nature of cultural, historical information.

The Conclusion and Recommendations from the Cultural Resource Inventory Report states:

> "The inventory of Carbon Resources LLC's proposed Kinney No. 2 Mine resulted in the location of one previously documented site, the documentation of three previously recorded sites, and the documentation of five new sites. Three of these sites are recommended as eligible to the NRHP and the remaining six sites are recommended as not eligible to the NRHP. Sites 42Cb477 (Jones Mine), 42Cb479 (Kinney Mine) and 42Cb1032 (Utah & Pleasant Valley Railway) are evaluated as eligible to the NRHP under Criterion A (associated with significant events in regional history). Therefore, the proposed undertaking will not diminish the integrity of these properties which deems them eligible under Criterion A. Based on the findings archeological clearance is recommended for this project."

3.4.3.5 Coordination Efforts with SHPO

As a component of the initial site investigations the State Historical Preservation Office (SHPO) was contacted to obtain information on existing identified cultural resource sites in the permit area. Following the site specific field investigations, official site listing forms for any new cultural resource sites identified have been prepared and submitted to the SHPO for review and determination of eligibility.

3.4.4 Previous Mining Activity

Previous mining activities within the permit area and adjacent areas are important because they directly impact the coal resource available to support further mining operations and

are associated with existing site disturbance and environmental impacts as reflected by baseline environmental characterizations. The nature and extent of previous mining and related activities in the permit area and adjacent areas have been identified and characterized through review of historical mine maps, records, publications, and reports and conversations with individuals familiar with the history of the area.

3.4.4.1 History of Previous Mining Activity

As previously described in Section 3.4.3.2, Historical Context, the earliest recorded mining activity in the area was the development of the Winter Quarters Mine in 1877. Extensive mine development and operations continued throughout the area through World War II. After the war, mining in the area experienced a gradual decline due primarily to the shift from coal fired to diesel locomotives. In the proposed permit area and adjacent areas numerous mines operated through the 1970's. The UP (Union Pacific) Mine, with portals located south of the proposed mine permit area mined from 1877 through about 1936. Underground workings from this mine extended well into the area where the Kinney No. 2 Mine is planned. Four other mines operated in the area of the proposed Kinney No. 2 Mine, from north to south in the following order; 1) the Blue Seal Mine, located approximately 1 mile north of Scofield Town, and approximately 500 feet north of the proposed permit boundary operated from 1921 to the 1940's, 2) the Kinney Coal Company operated the Kinney Mine from 1918 to 1956, and was known from 1946 through 1956 as the Monay Mine; 3) the Columbine Mine was operated from 1960 through early 1971; and 4) the Jones Mine was operated by the Spring Creek Coal Company from 1960 to about 1970 (Cunningham 1990).

3.4.4.2 Description of Known Historic Mining Operations

All of the previous historical mining operations in the area have been conventional underground room and pillar coal mines extracting coal reserves from one or more of the known coal seams in the Blackhawk Formation. These mines operated in the Hiawatha, UP Upper Split, and UP Lower Split coal seams. Map 3.4.1.4-2, Previous Mining Activity shows the aerial extent of historic mining in the various coal seams in the area of the proposed Kinney No. 2 mine. This same map shows the locations of the portals for these mines. There is some confusion as to which of these portals actually belong to each mine in some cases because the mines were partially interconnected.

3.5 AIR QUALITY INFORMATION

3.5.1 General Air Quality Information

This section describes existing air quality conditions and emission sources within the permit area and adjacent areas. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-400) for coal mine permitting in the State of Utah.

3.5.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses existing baseline conditions under Rules R645-301-420 through 422. Air quality considerations relative to proposed mining and related activities operation and reclamation plans are addressed in Sections 4.4, and 5.2 and 5.3, respectively, of this permit application.

The following cross references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
3.5.1	
3.5.1.1	R645-301-421
3.5.1.2	R645-301-130 and 140
3.5.1.3	General background - not required by regulation
3.5.1.4	R645-301-421
3.5.1.5	R645-301-422
Exhibits	R645-301-422

3.5.1.2 Sources of Air Quality Information

Air quality conditions in the proposed permit area and adjacent areas have been characterized in this section using information from studies and reports, previous and ongoing monitoring activities, and existing air emission permit application. Available air quality information and relevance to this site are summarized below.

Gault Group, Inc. Draft Notice of Intent for Kinney No. 2 Mine Project, February, 2008. Draft notice outlines proposed development plans, describes potential emissions and controls, and provides documentation for calculated emissions projections.

No site specific emission studies or monitoring were conducted given the classification of this area as an "attainment" area and the lack of site-specific monitoring requirements under applicable regulatory provisions.

3.5.1.3 Regional Air Quality Conditions

The permit and adjacent areas lie within the central area of the Upper Colorado River Air Basin. The central area has been divided into smaller sub-basins, each of which is characterized by meteorological conditions and related dispersion characteristics which are relatively homogeneous. The sub-basin concept, which assumes contained airflow within the basin, is generally applicable for normal air flow conditions but breaks down under storm conditions or other situations where strong regional air movements result in greater air turbulence and mixing between sub-basins and even major air basins.

Air movements in this area are strongly affected by natural drainage patterns and daily temperature variations. As local air masses cool at night, the denser, cool air flows down valleys and other natural drainage channels. Generally, the winds associated with downslope movements are low to moderate, however, if the drainage alignment parallels the prevailing wind direction or if topographic features concentrate natural air flows, moderate to strong downslope winds and high intensity gusts may result. As natural warming occurs during the morning and early afternoon, warm air masses begin to move up-valley. Differential heating and upper level winds tend to have a greater impact on the upward air movements resulting in greater mixing and instability with resultant variable winds and greater potential for gusty conditions. Normally, prevailing winds in the area are from the west and northwest, however, during the winter persistent high pressure cells which settle above the Wasatch Mountains to the north can shift the prevailing winds to the northeast for extended periods.

The Federal Clean Air Act establishes acceptable levels of air quality based primarily on human health related exposure levels. Quantitatively, air quality exposure levels are defined by the National Ambient Air Quality Standards (NAAQS) as maximum allowable primary and secondary concentration levels for the following specific pollutants:

- Nitrogen Dioxide (NO_2)
- Sulfur Dioxide (SO_2)
- Carbon Monoxide (CO)
- Particulate matter smaller than 10 microns in size (PM_{10})
- Ozone (O_3)
- Lead (Pb)

Based on the standards and available regional air quality monitoring data, specific areas are then evaluated and classified relative to compliance with the NAAQS. Areas where monitoring data indicate exceedances of the standards for one or more of the designated pollutants are designated as "non-attainment areas" for those specific pollutants. Carbon County, which encompasses most of the proposed permit area and adjacent areas, has been designated as an attainment area for all NAAQS primary pollutant levels indicating no significant existing air pollution problems in this area. Available monitoring data does indicate spot exceedances of secondary standards for total suspended particulates (TSP) for the areas of Price, Huntington, and Cedar Mountain, however, these exceedances are generally due to natural conditions of blowing dust and are not related to any specific development or operating activities.

There are specific areas designated by Federal regulation where potential air emission sources are not allowed to result in any significant deterioration of existing air quality. These

areas, which include National Parks and designated Wilderness areas, are classified as "Prevention of Significant Deterioration - Class I Areas" (PSD). The only Class I PSD area in the general vicinity of the proposed permit area is Capital Reef National Park, which is located approximately 90 miles southwest of the proposed permit area. Given the combined factors of very limited potential from air emissions, mining and related activities, distance, and prevailing wind direction, the mining and related activities have negligible potential to adversely affect air quality in this area. Other areas under consideration for Class I designation in the general vicinity include Desolation Canyon, the San Rafael Reef, Lower Green River, Mexican Mountain, and Sids Mountain. The closest proposed Class I area is over 45 miles from the permit area and the same limiting factors would apply relative to potential mining related air quality impacts. With the exception of these specific areas, all other areas within and in the immediate vicinity of the permit area are classified as PSD Class II areas.

3.5.1.4 Coordination With Applicable Federal and State Air Emission Requirements

Given that the permit and adjacent areas fall within a designated attainment area, the only applicable Federal air emission requirements are those provisions providing for State responsibility for protection of air quality within the State and applicable provisions providing for application of the best available control technology (BACT) for potential emission sources. Applicable State air emission requirements include provisions for air emissions permitting, application of BACT, submission of an annual air emissions inventory, stack height limitations, a 20 percent opacity limitation at all emission points, evaluation of visible emissions, reporting unavoidable control equipment breakdowns, and emergency episode requirements.

3.5.1.5 Coordination and Compliance With UDAQ

All applicable State air emission requirements will be addressed through maintenance of an air permit with the UDAQ. CR will submit a Notice of Intent application for mining and related activities to UDAQ in early 2008. A copy of the NOI is included in Exhibit 2.1.3-1, Other Permits, and documentation of permit approval will be provided for insertion in this exhibit on receipt.

3.6 GEOLOGICAL INFORMATION

3.6.1 General Description of Geologic Information

This section describes existing geologic conditions, resources, and features within the permit and adjacent areas that could potentially be affected or impacted by the mining and reclamation activities. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-600) for coal mine permitting in the State of Utah.

3.6.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses rules R645-301-620 through R645-301-627. Operation plans and performance standards (Rules R645-301-630 through R645-301-642) are addressed in Section 4.7 of this permit application. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section		Regulatory Provisions Addressed
3.6.1		
	3.6.1.1	R645-301-610 through 611
	3.6.1.2	R645-301-624, 100, 130 and 210 through 340
	3.6.1.3	R645-301-624.100
	3.6.1.4	R645-301-612, and 622
	3.6.1.5	R645-301-623 and 624.200 and 300
3.6.2		
	3.6.2.1	R645-301-624.100
	3.6.2.2	R645-301-624.100
	3.6.2.3	R645-301-624.210 and 310
3.6.3		
	3.6.3.1	R645-301-623 and 624.200, 210, 310, and 340
	3.6.3.2	R645-301-623 and 624.200, 220, 230, 320, and 330
3.6.4		R645-301-620 through 627
Maps		R645-301-622
Exhibits		R645-301-624.210 through 340

3.6.1.2 Sources of Geological Information

Geologic conditions in the permit and adjacent areas have been characterized in this section using information from studies and reports and previous and ongoing baseline characterization and monitoring activities. Available geologic information and relevance to this site are summarized below.

Interpretive data available include the following reports:

- Mounir Tawfik Moussa (1965)
- Vard H. Johnson Ph.D. (1977)
- Joel E. Palmer, Sanders Associates, Inc. (1979)
- Steven P. Knowles (1985)
- Wade Hutchings for Geo-Hunt Consulting (1997)
- David E. Pedersen Ph.D. for Geo-Hunt Consulting (1998)

Additional information was obtained from personal communications with Eric Robeck, who refined geologic interpretations together with Gregory Hunt. Additional data was obtained from work performed by W.R. Grace (1974) and Itel Resources (~1977).

The Geologic data set includes data from 70 drill holes from several vintages (26 are located within the Permit Boundary) Figure: 3.6-1, Drill Hole Locations.

The data set also includes maps from four old mines that show the location of numerous faults and recorded coal thickness and conditions, limited surface outcrop exposures, and high quality aerial photography.
Drill hole data include:

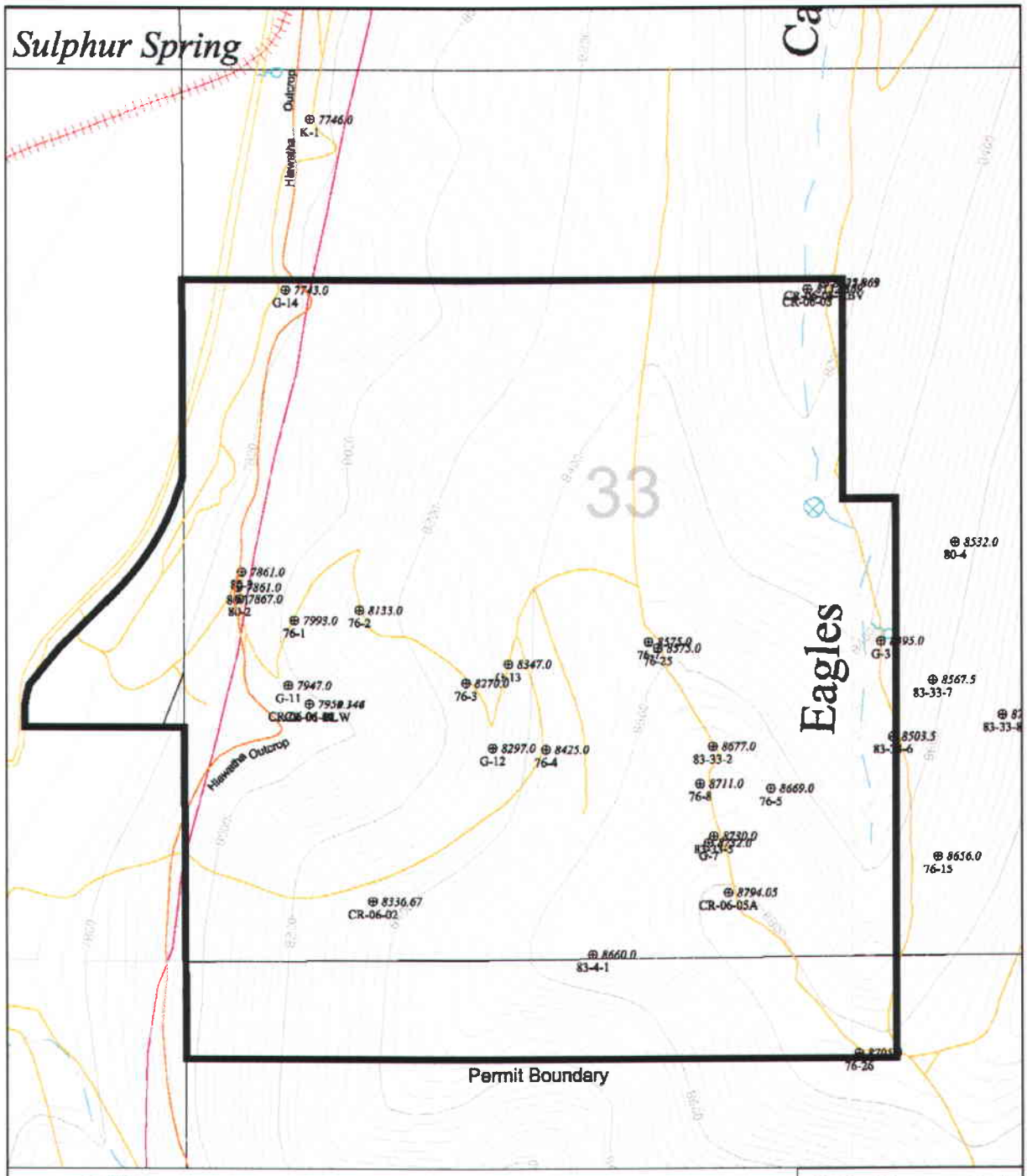
1. gamma, density, caliper logs and down hole surveys

2. continuous core of the coal horizons and enclosing strata

3. chemical analysis of the coal seams and enclosing strata

4. rock mechanics data from the coal seams and enclosing strata

Nine of the drill holes, located on four of the drill sites, were completed as groundwater monitor wells with completions in the Hiawatha Seam and enclosing strata. Three of these locations are within the permit boundary. A digital color down-hole camera was lowered into and recorded continuous data from four of the completions to document the presence or non-presence of groundwater soon after the wells were completed. Subsequently, monthly baseline groundwater data have been collected from these monitor wells throughout most of the past two years.



Drill Hole Locations w/ Hiawatha Outcrop

7789.5 Collar Elevation

G-9 Hole Name

N

0 600 ft

SCALE 1 in.600 or 1" = 600'

Topo Contour Interval = 20 ft

REGISTERED LAND SURVEYOR 167246 STATE OF UTAH

Carbon Resources LLC

KINNEY NO 2 MINE

Figure 3.6-1

DRAWN BY: GLH DATE: 1-8-08

APPROVED BY: GLH DATE: 1-8-08

23 S. Carbon Ave., Suite 21
Price, UT 84501

FILE: Drill Hole Locations.dwg

These data have been integrated to form a conceptual geologic model which is here presented as a digital representation of that conceptual model in the form of maps and descriptions.

3.6.1.3 Regional Geology

Topography

The permit area is characterized as incised "Basin and Range style Topography". This topography consists predominately of parallel N-S valleys separated by flat-topped ridges, typical of "graben and horst" physiogragpy. Strata in the area are composed of moderately weak fine-grained units interfingered with thick, resistant sandstone units. Erosionally, these units create moderate to steep weathered slopes.

Major canyons include Pleasant Valley, Eagles Canyon, and Longs Canyon all draining northward tributary to Scofield Reservoir. Elevations in the general permit area range from over 9,000 feet above sea level on the tops of the flat-topped ridges to about 7,600 feet above sea-level in Pleasant Valley.

Stratigraphy and General Lithology

The general lithology of the area consists of thick accumulation of Upper Cretaceous and Tertiary strata, exposed in the Book Cliffs and Wasatch Coal Fields.

The Upper Cretaceous sediments of the section were deposited along the western margins of a north-south oriented Cretaceous Interior Seaway. This seaway is defined by the pattern of marine, marginal marine, and coastal plain sediments deposited at that time. A rapidly rising mountain belt to the west supplied clastic material for shoreline construction by wave-dominated delta systems. Throughout Cretaceous time, this seaway underwent a series of transgressive and regressive (advancing and retreating) phases depositing a number of broad subaerial to submerged delta and prodelta sheet sandstones. These sandstones display landward shoreline pinchouts and seaward thinning and fining of sediment sizes. Major coal deposits found in Utah are usually formed immediately landward of shoreline delta sandstone pinchouts and on top of these regressive delta (foreshore) deposits.

Landward of the thick shoreline coal accumulations, lower coastal plain depositional influences come into play, generally creating a series of splits in the coal section by splays, small channels, and levee deposits. Above the delta sandstones, the coal seams are often thinner and/or split due to the decreased time available for peat deposition and common presence of additional "stacked" transgressive-regressive events which invaded the swamp system with interdeltaic features such as storm washover fans, tidal inlet deltas, and lagoonal muds.

Coals formed on delta sandstone sheets are usually very planar and continuous while coal seams found in the lower coastal plain are much more likely to exhibit rolls or undulations, scouring by fluvial channels, and discontinuous or lenticular geometry. A classic model of the Book Cliffs Delta Systems was developed by Balsley, 1980.

The formations are composed of, in ascending order, the Blue Gate Member of the Mancos Shale, the interfingering deltaic members of the Blackhawk Formation, the coal-bearing Blackhawk Formation, the unconformably overlying Castlegate Sandstone, the Price River Formation, and the North Horn Formation.

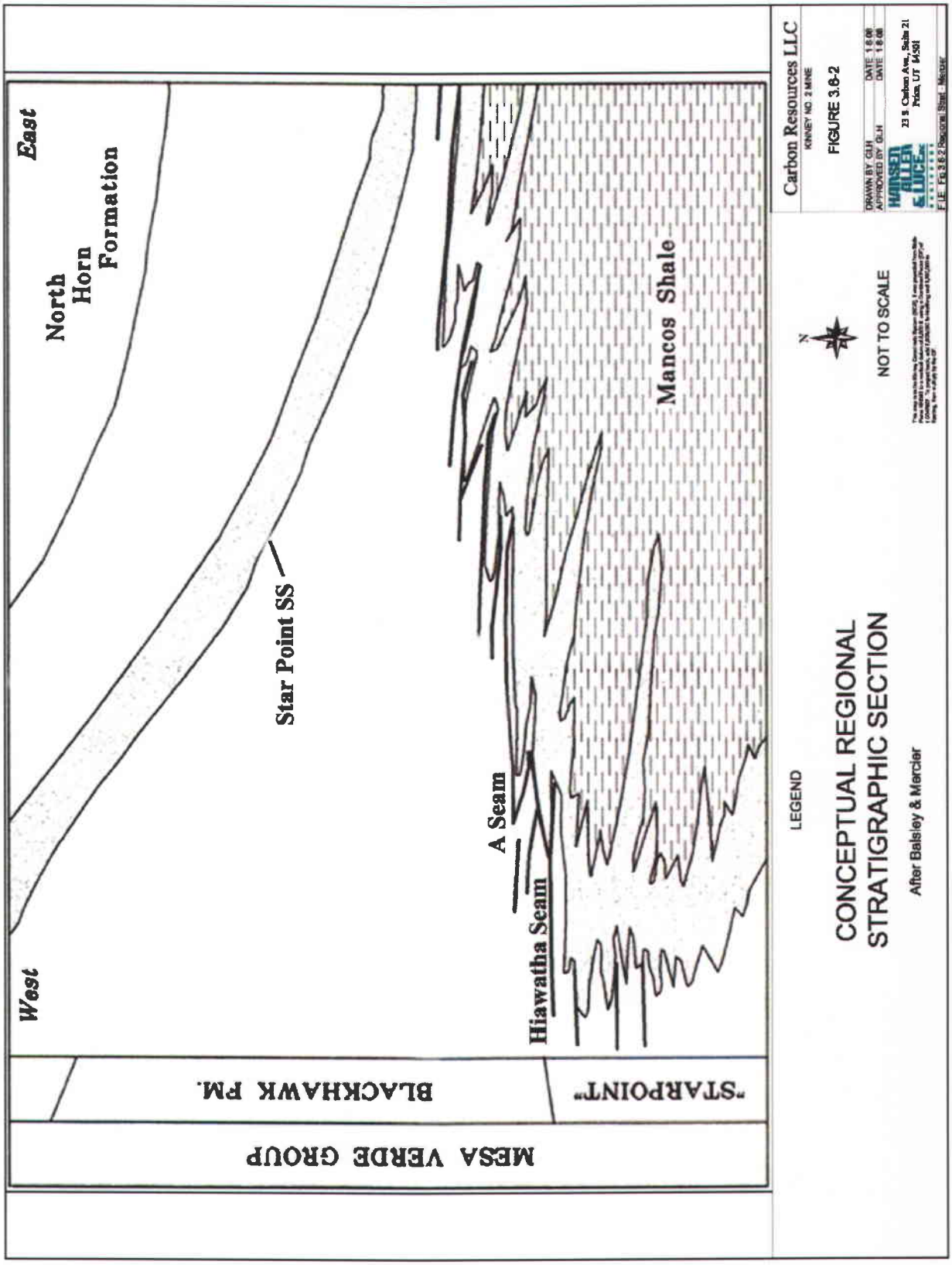
The Blue Gate Member of the Mancos Shale, which forms the valley floor and lower slopes of the prominent cliffs, is over 4,000 feet thick in the area and consists primarily of interbedded marine shales. The Mancos is a clay-rich unit and is relatively impervious to water.

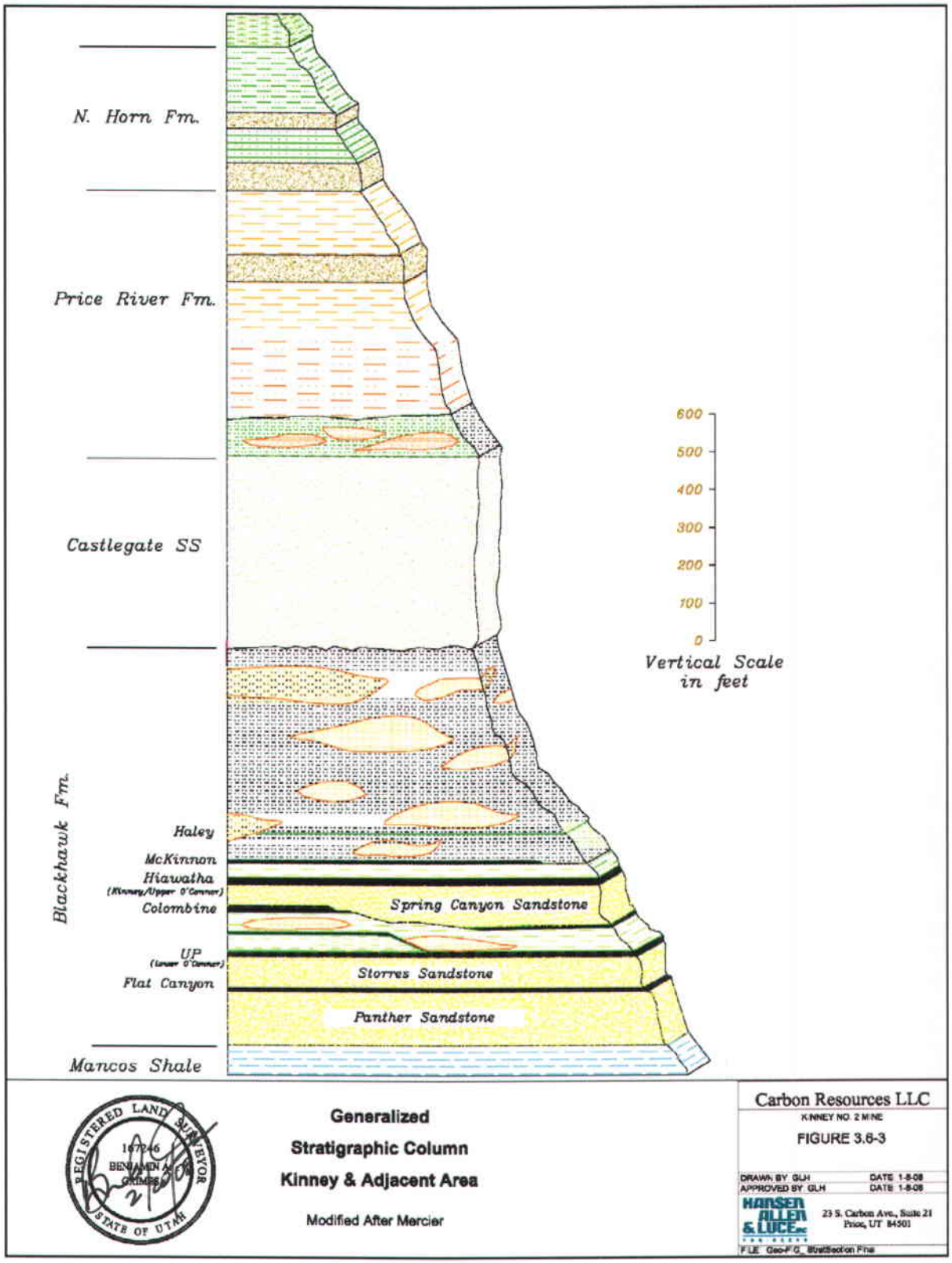
The base of the Blackhawk Formation is locally comprised of five deltaic cliff-forming sandstone members, the Panther, Storrs, Spring Canyon, Aberdeen, and Kenilworth Sandstones, in ascending order. These sandstone units interfinger to the west with the Mancos Shale. Locally the Panther, Storrs, and Spring Canyon Units have been combined under a formational status as the Star Point Sandstone. It is suggested here that these deltaic units be recognized as basal members of the Blackhawk. Lithologies are usually comprised of gradationally sorted sandstones; medium-grained and cross-bedded at the top and fine-grained to silty at their base. Figure 3.6-2, Regional Stratigraphic Section and Figure 3.6-3, General Stratigraphic Column.

The lower half of the Blackhawk, which contains the major coal seams, consists of sandstone, shale and coal. The upper part of the Blackhawk contains sandstone and a lesser amount of shale. The Blackhawk is about 900 to 1,300 feet thick in the Pleasant Valley District and is the exposed bedrock of the permit area.

Structure

The Kinney No. 2 Mine Permit area lies near the north end of the Wasatch Plateau structural province, immediately south of the north-west trending Fish Creek Graben which delineates the local northern border of the Castle Valley thrust. The position of the permit area, essentially at the intersection of the compression formed then extended Fish Creek Graben and the extensional Wasatch Plateau province, accounts for the very complex system of faults that chop up the property into relatively small mining blocks. Detailed description of faults is discussed in Section 3.6.2.1, Structural Features and Controls.


East
North Horn Formation
Star Point SS
Mancos Shale
A Seam
Hiawatha Seam
West
BLACKHAWK FM.
"STARPOINT"
MESA VERDE GROUP
LEGEND
CONCEPTUAL REGIONAL STRATIGRAPHIC SECTION
After Balsley & Mercier
NOT TO SCALE
N
Carbon Resources LLC
KINNEY NO. 2 MINE
FIGURE 3.6-2
DRAWN BY: GLH
APPROVED BY: GLH
DATE: 1.6.08
DATE: 1.6.08
HANSEN ALLEN & LUCE
23 S. Carbon Ave., Suite 21
Price, UT 84501
F.I.E. Fig 3.6-2 Regional Strat - Mercier


N. Horn Fm.
Price River Fm.
Castlegate SS
Blackhawk Fm.
Haley
McKinnon
Hiawatha
(Kinney/Upper O'Connor)
Colombine
UP
(Lower O'Connor)
Flat Canyon
Spring Canyon Sandstone
Storres Sandstone
Panther Sandstone
Mancos Shale
600
500
400
300
200
100
0
Vertical Scale
in feet
REGISTERED LAND SURVEYOR
STATE OF UTAH
Generalized
Stratigraphic Column
Kinney & Adjacent Area
Modified After Mercier
Carbon Resources LLC
KINNEY NO. 2 MINE
FIGURE 3.6-3
DRAWN BY: GLH
DATE: 1-8-08
APPROVED BY: GLH
DATE: 1-8-08
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Price, UT 84501

3.6.1.4 Mapping of Geologic Information

Information presented on the geology maps, cross-sections, and isopachs include:

- Locations and elevations of drill sites and coreholes
- Major structural features
- Depth, thickness designations, and outcrop locations of the Hiawatha Coal Seam (the seam to be mined)
- Dip and strike of major formations and Hiawatha Coal Seam
- Areas of coal previously mined out
- Location and depth of groundwater where encountered during exploration drilling

There are NO oil and gas wells, and NO planned exploration drill holes within the Portal Block Permit Boundary.

Consistent with applicable provisions of R645-301-512, geologic maps and cross-sections have been prepared under the direction of, and certified by a qualified, registered engineer or land surveyor with assistance from experts in the related field.

3.6.1.5 Lithologic Logs and Material Analyses

Information gathered from previous drilling and exploratory programs varied considerably in completeness, format, and uniformity of the resulting data. Significant data gaps included the lack of geophysical logs, incomplete cutting logs, generalized core descriptions, rare and/or partial coal core analyses, and non-existent geotechnical descriptions for several of the prior exploration programs.

The primary focus of the 2006 exploration program was the development of ground water monitor wells to gather groundwater data for the permitting process. In conjunction with well drilling activities, geologic data was also collected to address existing gaps in the baseline geologic data.

Holes were both rotary drilled and spot cored. Cuttings were collected on ten foot increments and described for lithologic type, color, and significant grain size, mineral and carbon content. Drilling conditions are noted and are summarized by drill logs. Core sample descriptions include sample increments, recovery rates, strength designations, discontinuity descriptions and graphs, lithologic columns, detailed lithologic descriptions, and photographs. Any water, gas, fractures, etc. encountered during drilling were noted. Holes were deepened approximately 20 feet beyond the lowest strata of interest to create a "rat hole" for cuttings prior to geophysical logging or installation of well screen and casing.

Holes were geophysically logged producing curves including but not limited to Natural Gamma, Compensated Density, and Caliper. Geophysical logging information is provided as both hard-copy and in digital format. Four of the groundwater monitor wells were logged with a digital down-hole camera, providing color video of the hole, casing conditions, water inflow zones and water level.

Coal core samples were analyzed for a variety of parameters including: Moisture, Ash, BTU, Sulfur, Volatile Matter, Fixed Carbon, Acid Potential (TCaCO3/1000T), Ash Fusion Temperatures. Ash Mineral Analysis includes, Ash Type, Specific Gravity, multiple Trace and major elements. Immediate roof and floor rock samples were separated and analyzed for acid forming or toxic-forming materials. Roof and floor analysis results are included in Exhibit 9, Geologic Information.

Any significant ground water encountered during drilling was reported to UDOGM. Each hole collar was surveyed after installation of the well monitoring equipment, and the drill sites reclaimed. All significant drilling parameters, hydrologic, and physical data about the hole is recorded on a Hole Completion Report with detailed backup residing in the accompanying drill hole file folder. Core not taken for laboratory analysis is being held for possible future geotechnical or geochemical testing.

3.6.2 Geologic Structure, Stratigraphy, Lithology, and Ground Water Occurrence

3.6.2.1 Structural Features and Controls

Two and possibly three periods of structural deformation influenced deposition and are responsible for the present position of the strata of the Pleasant Valley District. The Sevier Orogeny, dating from post-Triassic to pre-Oligocene time, is characterized by compressional faulting and folding with the formation of the large Cretaceous clastic wedges west of the district and supplied the sediments that forced the Cretaceous sea eastward. The Laramide Orogeny, which overlaps the Sevier Orogeny in late Cretaceous through the Eocene Epoch, is characterized by vertical uplifts of the Rocky Mountains. The extent of influence of this tectonic event is uncertain in the Pleasant Valley District. Miocene to Recent relative uplift and block faulting is responsible for the present topography and position of the strata.
These structural events have imparted a regional dip of approximately 3 degrees North North-East and generally striking North-West South-East as can be observed on Figure 3.6-4, Hiawatha Regional Structure.
Local exceptions to the regional dip are numerous with some fault blocks even dipping south due to the complex faulting described below.

<u>Faults</u>
There are two distinct styles of faulting within the district. The oldest system is a conjugate set of strike-slip and or oblique-slip vertical faults. The dominant half of this set is oriented north ~57deg. west. The minor half of the set is oriented north ~60 east. The most prominent faults in this system form the Fish Creek Graben, the UP-South-Saddle-Fault, the UP-North-Saddle-Fault, and the G-7 Fault. These structures were first formed in the early compressive episode and then were re-activated by regional uplift Figure 3.6-4.

FIGURE 3.6-4 Regional Hiawatha Top Structure & X-Sections,
is considered Confidential Information under R645-300-124
and has been relocated to
Exhibit 2.2.2-1 Confidential Information.

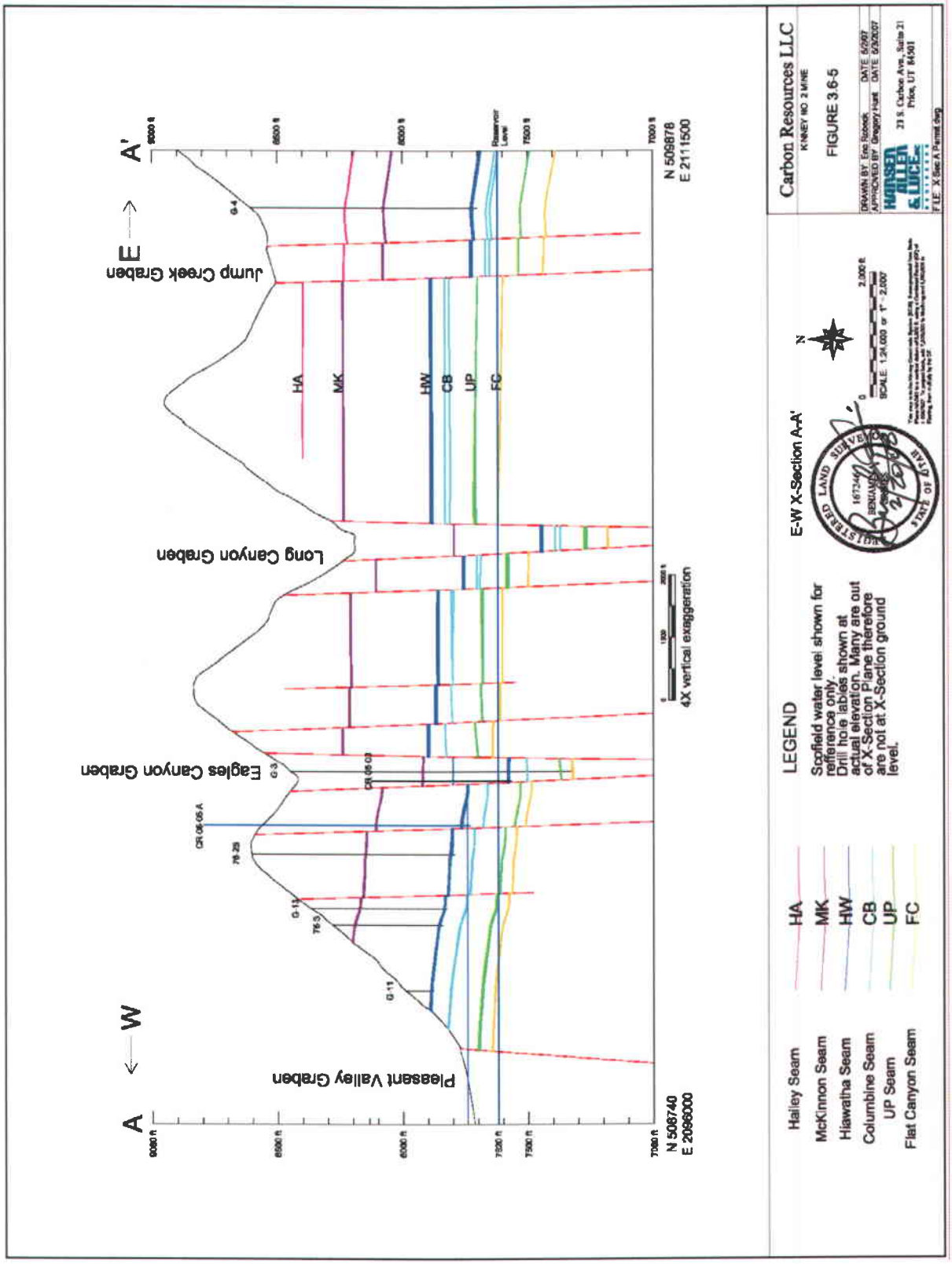
Elsewhere on the Eastern Wasatch Plateau, other faults in this system have been preferentially invaded with maffic dikes. This conjugate set of faults and dikes are cut by a later forming north-northeast set of normal faults. This later N-S fault system is by far the most dominant in terms of number, throw, and influence on the geomorphology. The largest local faults in this system have throws in excess of 600 feet. These faults form a series of "Basin and Range-style" horsts and grabens that are predominantly half grabens with the largest side dipping westerly. The N-S grabens are responsible for the N-S valleys that dominate the physiography.

Many of these N-S faults display characteristics of "curvy crossovers," some wandering in strike and most displaying "scissor action" or highly variable throw along strike. This is due, in part, to the perturbations to local stress fields caused by interaction between the early E-W compress ional structures and the N-S extensional system.
The numerous grabens and interaction between the two types of fault systems has resulted in a complex geometry of N-S elongated fault controlled structural blocks, some large enough to mine and others too small and isolated by elevation differences to be economically mineable.

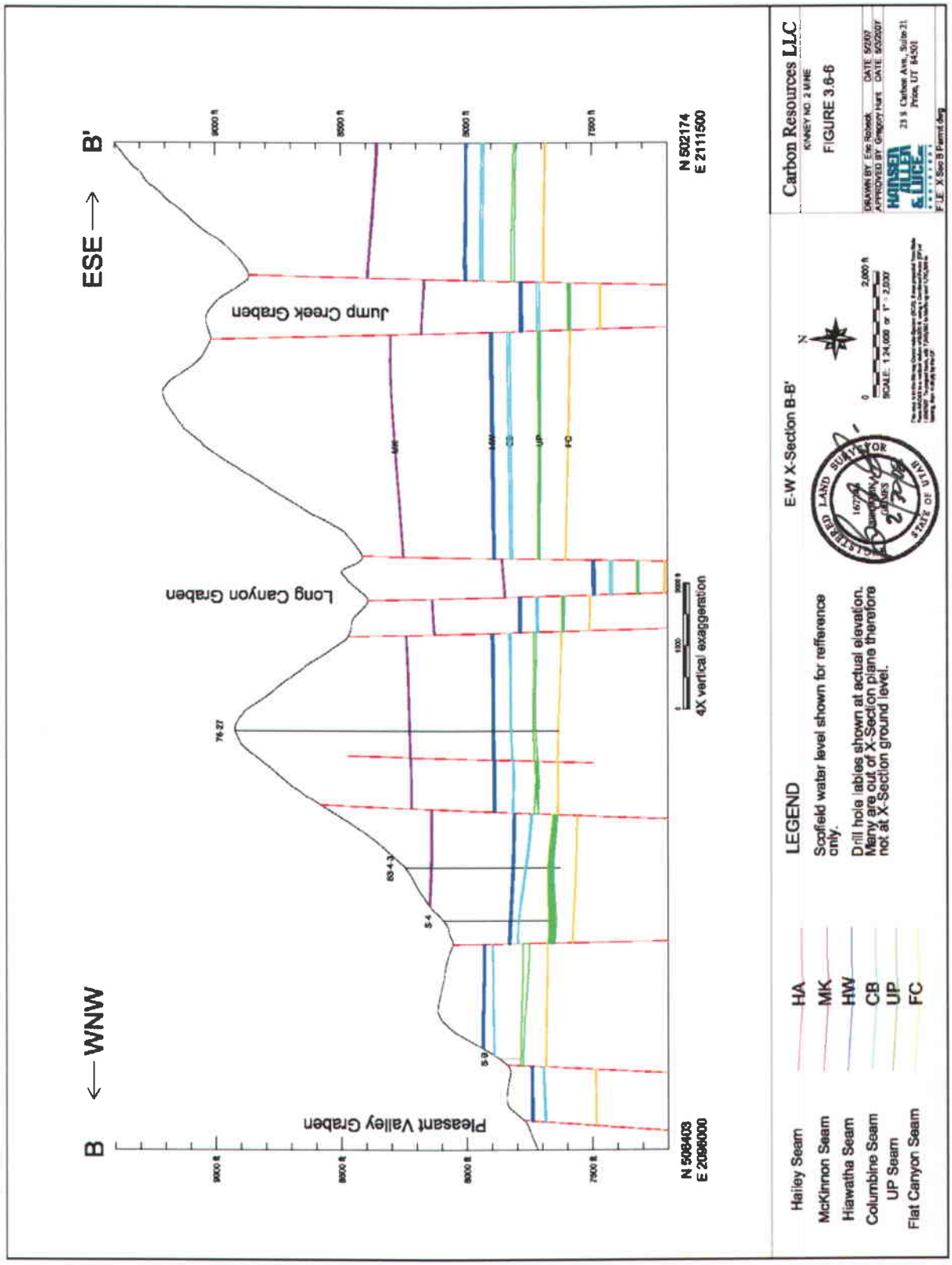
Four major north-south grabens dominate the structural elements within and in near vicinity of the property. From west to east these are; the Pleasant Valley Graben, the Eagles Canyon Graben the Long Canyon Graben, and the Jump Creek Graben. This Basin and Range style structure is clearly viewed in X-Sections Figures 3.6-5 through 3.6-8. Lines of section are shown on Figure 3.6-4 Hiawatha Regional Structure. Figure 3.6-5, Structure Section A-A', Figure 3.6-6, Structure Section B-B', Figure 3.6-7, Structure Section C-C', Figure 3.6-8, Structure Section D-D'.

The Scofield area is unique in the Eastern Wasatch Plateau having the northwest-southeast Fish Creek Graben south of Scofield Town. The Fish Creek Graben forms the northern limit of mining in this area. Two other faults, UP-North Saddle Fault, and UP-South Saddle Fault, were formed in the same structural event that formed the Fish Creek Graben. These faults limit the north south length of individual mining blocks in the area.

The horsts, strata remaining standing high between the down-dropped grabens, have not been named, but the mining blocks within the horsts constrained by both the bounding faults and by legal boundaries have been given names Figure 3.6-9, Hiawatha Overburden & Mine Blocks. Of these mining blocks only the Portal block and part of the Scofield North blocks are located within the "Portal Block Permit Boundary" and are described below.



A
W
E
A'
Pleasant Valley Graben
Eagles Canyon Graben
Long Canyon Graben
Jump Creek Graben
HA
MK
HW
CB
UP
FC
4X vertical exaggeration
N 508740
E 2096000
N 509878
E 2111500
Reservoir Level
LEGEND
Scofield water level shown for refference only.
Drill hole lables shown at actual elevation. Many are out of X-Section Plane therefore are not at X-Section ground level.
Hailey Seam
McKinnon Seam
Hiawatha Seam
Columbine Seam
UP Seam
Flat Canyon Seam
E-W X-Section A-A'
Carbon Resources LLC
KINNEY NO 2 MINE
FIGURE 3.6-5
HANSEN ALLEN & LUCE


B ← WNW
ESE → B'
Pleasant Valley Graben
Long Canyon Graben
Jump Creek Graben
N 508403
E 2098000
N 502174
E 2111500
4X vertical exaggeration
LEGEND
Scofield water level shown for refference only.
Drill hole lables shown at actual elevation. Many are out of X-Section plane therefore not at X-Section ground level.
Hailey Seam HA
McKinnon Seam MK
Hiawatha Seam HW
Columbine Seam CB
UP Seam UP
Flat Canyon Seam FC
E-W X-Section B-B'
Carbon Resources LLC
KINNEY NO. 2 MINE
FIGURE 3.6-6
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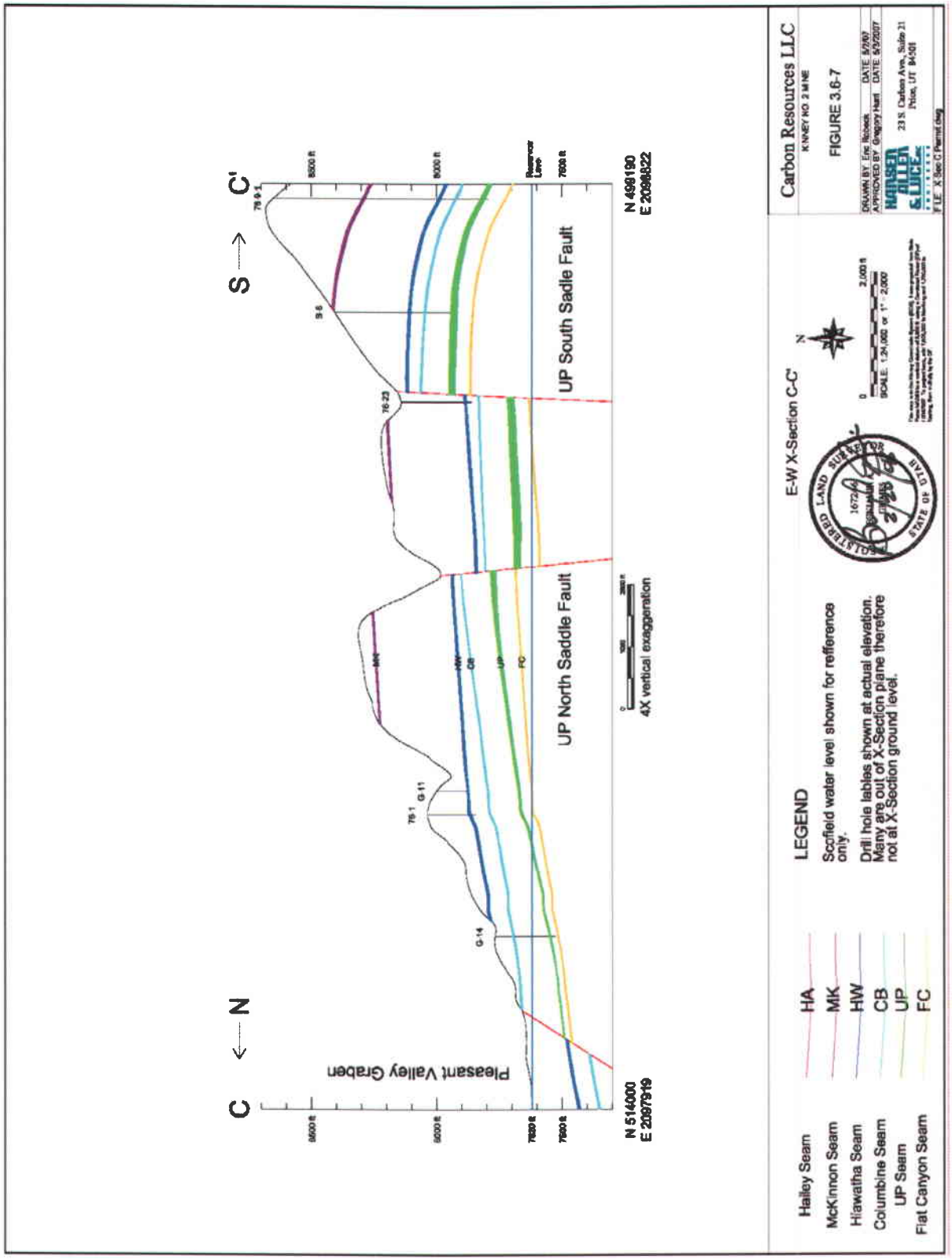
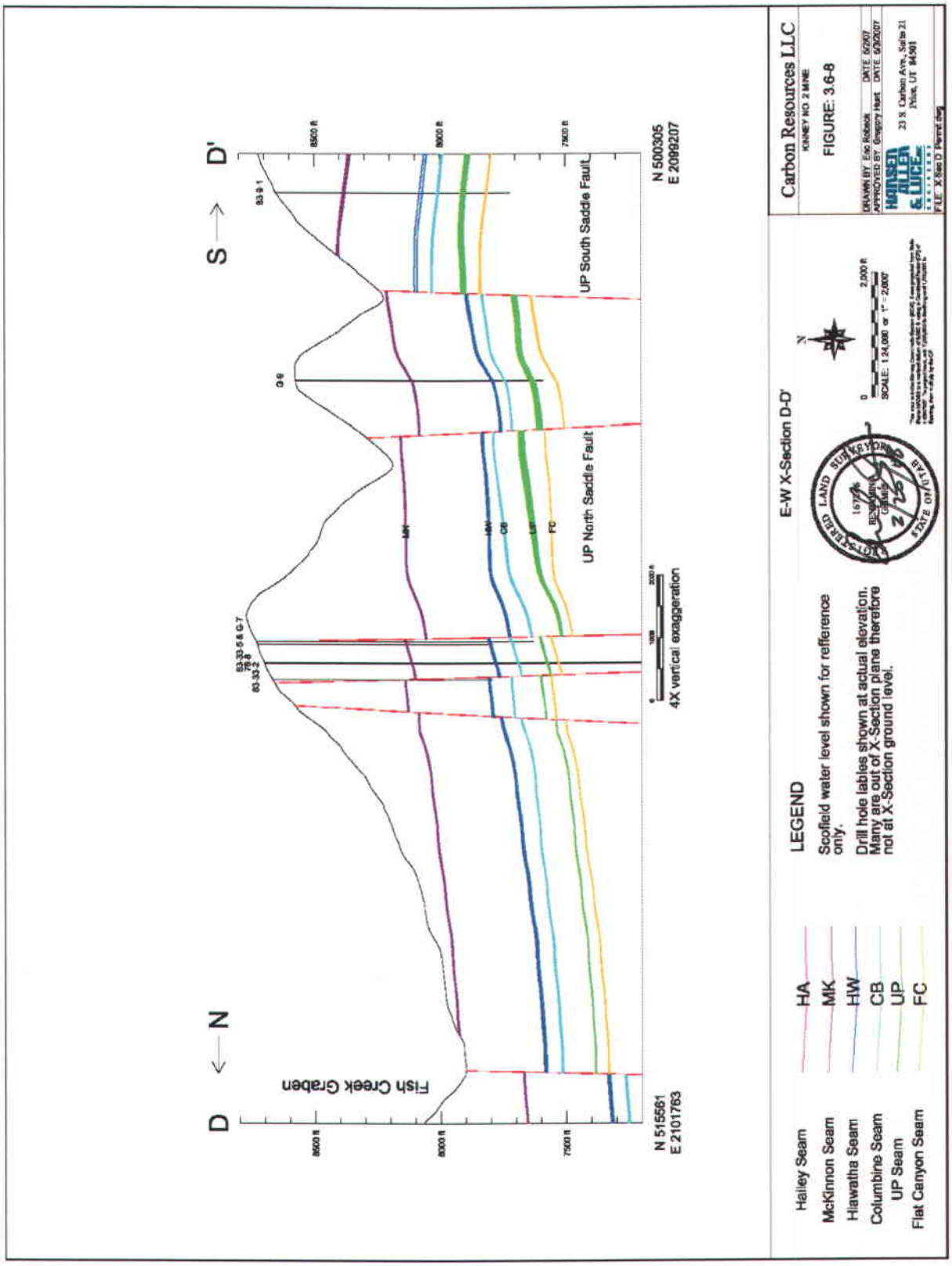
Price, UT 84501


C
N
S
C'
Pleasant Valley Graben
UP North Saddle Fault
UP South Saddle Fault
N 514000
E 2097919
N 499190
E 2098322
4X vertical exaggeration
Carbon Resources LLC
KINNEY NO. 2 MINE
FIGURE 3.6-7
E-W X-Section C-C'
LEGEND
Scofield water level shown for refference only.
Drill hole lables shown at actual elevation. Many are out of X-Section plane therefore not at X-Section ground level.
Hailey Seam HA
McKinnon Seam MK
Hiawatha Seam HW
Columbine Seam CB
UP Seam UP
Flat Canyon Seam FC



D
N
S
D'
Fish Creek Graben
UP North Saddle Fault
UP South Saddle Fault
N 515561
E 2101763
N 500305
E 2099207
4X vertical exaggeration
LEGEND
Scofield water level shown for refference only.
Drill hole lables shown at actual elevation. Many are out of X-Section plane therefore not at X-Section ground level.
Hailey Seam HA
McKinnon Seam MK
Hiawatha Seam HW
Columbine Seam CB
UP Seam UP
Flat Canyon Seam FC
E-W X-Section D-D'
Carbon Resources LLC
KINNEY NO. 2 MINE
FIGURE: 3.6-8

Cover or "overburden" covering the Mine Blocks ranges from zero at the outcrop along the west side of the Portal Block Permit Boundary to maximum of 1,000 feet along the east side of the Portal Block Permit Boundary, and of course mimics topography but modified by faulting, Figure 3.6-9, Hiawatha Overburden & Mine Blocks.

Mining Blocks

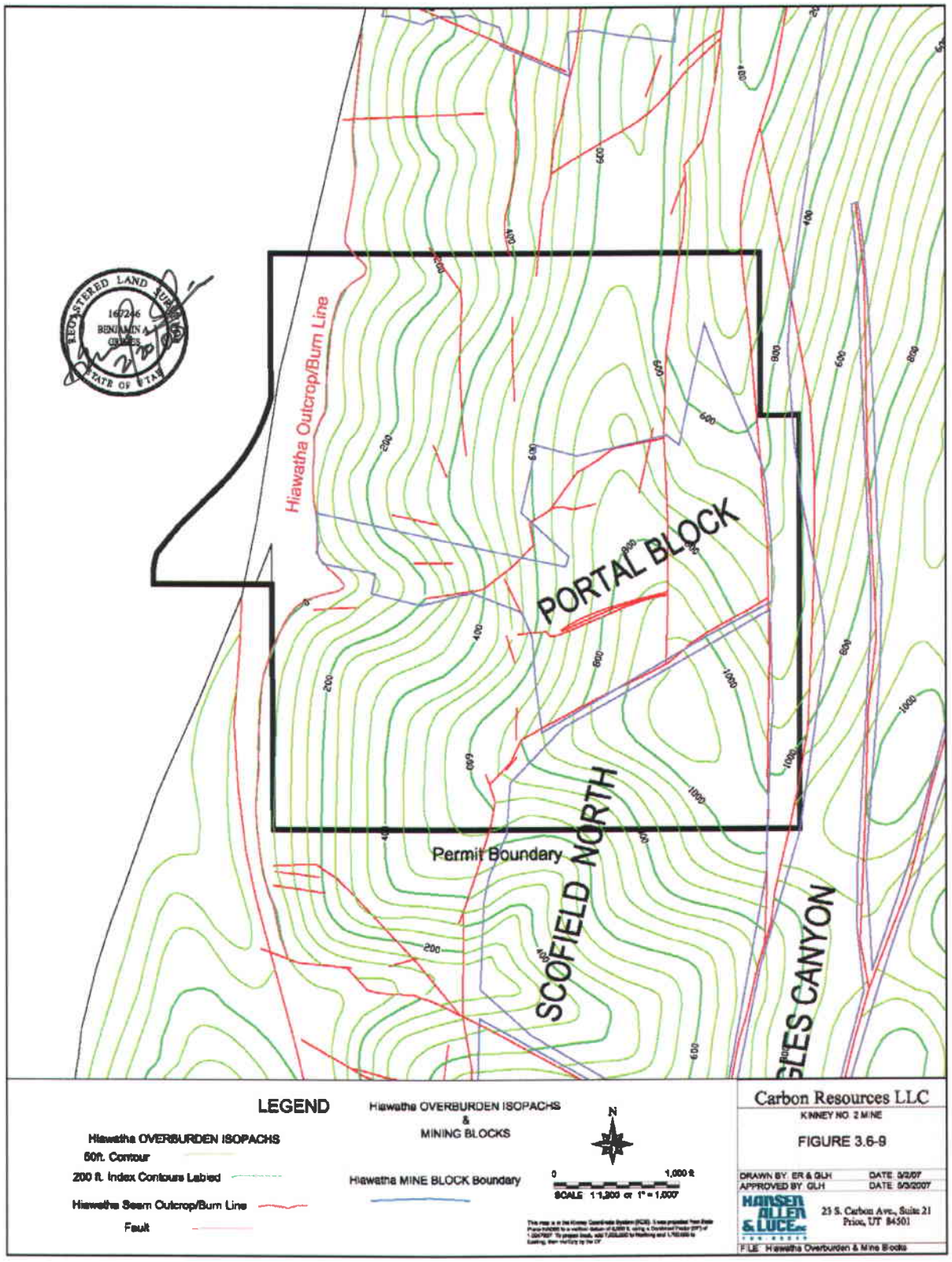
Experience mining throughout the Eastern Wasatch Plateau has shown that mining within most grabens is very problematic for several reasons. The lower relative elevations cause the coal there to be saturated with water, this together with the near order of magnitude number of small faults and fractures within the grabens, in contrast to the horsts, make mining conditions in the grabens very unfavorable. Therefore planned mining blocks are predominately in the larger horsts within the property.

Portal Mining Block: The Portal Block will be accessed from outcrop via a narrow corridor of coal left un-mined by previous operators. From the Portal block we will ramp down across the G-6 fault, approximately 50 vertical feet, to access the Scofield North Block. The Portal block is bounded mostly by previous workings, but on the East by the Eagles Canyon Graben and on the South-East by the G-6 fault.

Scofield North Mining Block: The Scofield North Block is created by bounding faults; on the North and West by the G-6 Fault; on the East by the Eagles Canyon Graben, on the south by the UP North Saddle Fault. All of the bounding faults display throws of approximately 100 feet except the Eagles Canyon Graben (or the southern extension of it) which has an apparent throw of approximately 20 feet.

Joints

A joint study on the permit property has not been completed, however, Wade Hutchings (1997) completed field mapping on property immediately adjacent to the north of the this property and found joint orientations consistent with those predicted by a model of regional geology (GL Hunt Unpublished data) by understanding of the regional geology and the position occupied by the property within it. This allows a rather high degree of comfort in predicting the joint patters within the permit boundary to be predominately N-S with fewer numbers of NW and NE joints.


Hiawatha Outcrop/Burn Line
PORTAL BLOCK
SCOFIELD NORTH
Permit Boundary
LEGEND
Hiawatha OVERBURDEN ISOPACHS
50ft. Contour
200 ft. Index Contours Labled
Hiawatha Seam Outcrop/Burn Line
Fault
Hiawatha OVERBURDEN ISOPACHS
&
MINING BLOCKS
Hiawatha MINE BLOCK Boundary
N
0
1,000 ft
SCALE 1"=1,000' or 1" = 1,000'
Carbon Resources LLC
KINNEY NO. 2 MINE
FIGURE 3.6-9
DRAWN BY: ER & GLH
DATE: 5/2/07
APPROVED BY: GLH
DATE: 5/3/2007
HANSEN ALLEN & LUCE
23 S. Carbon Ave., Suite 21
Price, UT 84501
FILE: Hiawatha Overburden & Mine Blocks

3.6.2.2 Stratigraphy and Lithology

The predominate lithotype in the Blackhawk Formation is sandstone. Above the thick marginal marine sandstones forming the base of the formation, are thick (10 - 50 foot) sequences of lenticular channel deposits interspersed with more moderate (5 - 15 foot) sequences of sheet sandstone deposits. These sandstones are medium to fine-grained with a high percentage of silica and/or calcite cement filling the sand matrix which generally produces a low permeability. An estimated 35 percent of the formation is composed of correlatable sandstones.

About 30 percent of the Blackhawk is formed of thin, dirty, or discontinuous sandstones. Another 35 percent of the unit is composed of siltstones, often interbedded with the thin sandstones, and the remainder of the formation is composed of mudstones, carbonaceous mudstones, or claystones. The finer grained materials, especially the siltstones, have a higher percentage of silica cement and are often very well indurated. The interbedded units range in thickness from a few tenths of a foot to over a hundred feet. Thick sequences of mudstones in the Blackhawk are less common in this area.

The coal seams in the permit area are contained in the bottom half of the Blackhawk Formation and are interbedded with sandstone and shale. They are, in ascending order, the Flat Canyon, U.P. (Union Pacific), Columbine, Hiawatha and Haley seams Figure 3.6-3, General Stratigraphic Column.

The base of the coal-bearing section is a transition between the lower seams deposited on and above the "Panther Sandstone" and the Seams deposited on and above the " Spring Canyon Member of the Starpoint Sandstone". The westward pinchout of the "Spring Canyon Member of the Star Point Sandstone" occurs within the permit boundary, thus the immediate floor of the Hiawatha Seam changes westward from marine sandstone to shale.

<u>Flat Canyon Seam</u>

The Flat Canyon Seam occurs near the bottom of the Blackhawk Formation a few feet above the Panther Sandstone. It reaches thicknesses of up to four feet locally but is split or absent over the permit area.

<u>U.P. Seam</u>

The U.P. Seam is the thickest seam found in the Pleasant Valley District. In the U.P. Pleasant Valley Mine it attained a thickness of thirty feet and is greater than twenty feet for at least half a mile south and southwest of that mine. To the north and east of the U.P. Pleasant Valley Mine the seam splits into two or more seams ranging from six feet to one foot. It lies 70 to 90 feet above the Flat Canyon zone. It is correlated to the Lower O'Connor Seam south and west of the Western Reserve properties and has been mined in the Clear Creek, U.P., and Winter Quarters mines. It is of mineable thickness in the permit area, as can be seen in cross sections of drill holes and on drill logs.

Colombine Seam

The Colombine Seam occurs in a limited area northeast of Scofield. The Colombine Mine was the only development of this seam where it is five feet thick. The seam thins and splits east of the mine. It lies 30 to 55 feet above the U.P. Seam. Insufficient reserves and lack of access eliminate this seam from mining considerations.

Spring Canyon Member, Starr Point Sandstone

This unit can generally be described as a series of seaward imbricated sheet sandstones locally containing fluvial channels and tidal inlet deposits on its upper surface. The upper portion of the Spring Canyon (upper shoreface) is typically composed of silica and dolomite-cemented, medium-grained, well-sorted, coarsening upward, sandstone.

Hiawatha Seam

The Hiawatha Seam is the most laterally persistent seam in the Pleasant Valley District and is the only economically mineable seam within the permit boundary. The Hiawatha Seam directly overlies the Spring Canyon Sandstone throughout all but the western-most 500 feet of the permit area where the sandstone pinches out westward. The Hiawatha Seam overlies the U.P. zone by 80 to 130 feet. It is correlated to the Upper O'Connor Seam to the south and west. It has been mined in the Clear Creek, O'Connor, Belina, Utah No. 1, Utah No. 2, Kinney, Blue Seal and Monay, Blazon mines and is being developed in the Skyline mines. Historically it has been referred to as the Kinney Seam, but only at the Kinney Mine.
The Hiawatha Seam Ranges from 6 to 12 feet in thickness locally, and is the only seam to be mined within the Portal Block Permit Boundary, Figure 3.6-10, Hiawatha Thickness and Mine Blocks .

McKinnon Seam

The McKinnon Seam lies 250-400 feet above the Hiawatha Seam. It reaches a maximum thickness of four feet but is usually much thinner or parted and is not easily identified in drill holes over the permit area.

Haley Seam

The Haley Seam is very inconsistent in stratigraphic position and thickness. The seam is found only in the northeast corner of the study area. It overlies the Hiawatha by about 500 feet. The Haley Seam locally achieves a thickness of five feet but is usually absent or very thin. It was worked to a limited extent at the Haley Mine east of the Scofield Dam but is not considered economic in the permit area.

FIGURE 3.6-10 Hiawatha Thickness & Mining Blocks
is considered Confidential Information under R645-300-124
and has been relocated to
Exhibit 2.2.2-1 Confidential Information.

Immediate Roof and floor of the Hiawatha Seam

Strata enclosing the Hiawatha Seam with the potential of being mined together with the coal varies from marine sandstone, where the Spring Canyon Member of the Star Point Formation underlies the Seam, to fluvial dominated sandstones and overbank mudstones and siltstones.

The immediate roof rock of the Hiawatha Seam is typically composed of a locally thin veneer of clay-rich mudstones grading upwards into muddy to sandy siltstones. Meandering sandstone channels have been picked up by drill holes which intersect the top of the seam.

Strata from Hiawatha Seam to Top of Blackhawk Formation

Rocks overlying the seam are dominated by fluvial rocks containing an abundance of mudstone often rooted and carbon-rich with some ribbon shaped channel sands. This portion of the Blackhawk Formation above the Hiawatha Seam is extremely variable, being formed in a fluvial dominated system. This system produced numerous fluvial channel deposits and their related overbank deposits of siltstone, mudstone, claystone, and discontinuous inter-channel coals.

3.6.2.3 Ground Water Occurrence

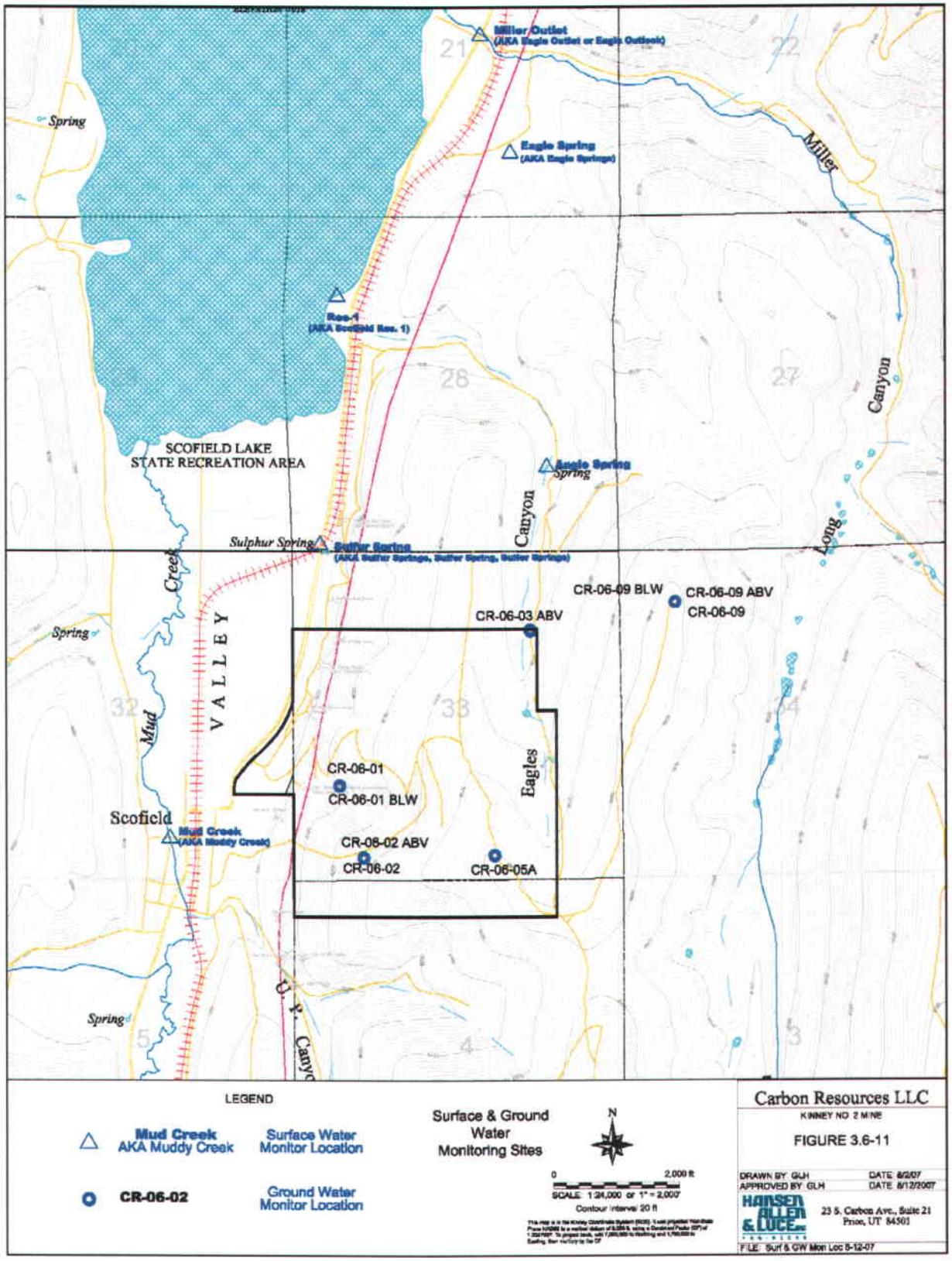
Six groundwater monitor wells were completed in the 2006 drilling program. Holes CR-06-01, CR-06-01-BLW, comprise a double completion on a single pad. CR-06-02, and CR-06-02-ABV are another double completion on a single pad. These four monitor wells are located near the planned portal within the "portal block mining block" and CR-06-03-ABV and CR-06-05A are single completions located along the NE and SE corners of the permit boundary respectively.

Three additional groundwater monitoring wells CR-06-09, CR-06-09 Above, CR-06-09-Below, were completed northeast of the permit boundary and are included here as background data, Figure 3.6-11, Surface and Ground Water Monitoring Sites.

Nomenclature for the groundwater monitoring wells is keyed around the Hiawatha Seam (seam to be mined). That is, holes named ending in "ABV" are completed above the Hiawatha Seam, holes named ending in "BLW" are completed below the Hiawatha Seam and holes with a number only are complete in the Hiawatha Seam.

All of the holes except CR-06-03-ABV are dry as is suggested by the elevation of the lake and the base of the drill hole demonstrated on Figure 3.6-5, X-Section A. It is understood that the piezometric surface is likely not be flat, as suggested on X-Section A, however, it apparently has a relatively low gradient.

Hole CR-06-01-BLW was intentionally drilled to almost 200 feet below the Hiawatha Seam in an effort to find the water table. A small inflow of water was encountered at the UP Seam level and the hole was then deepened more than 50 feet below this level with intent to complete a well in the a water table. A well screen was placed (completed) approximately 50 feet below the UP Lower Split, however, no water has accumulated in it. The hole is dry as can be observed in the monitoring data set displayed in Exhibit 3.7.2.2-2, Surface and Ground Water Field Measurements.


Miller Outlet
(AKA Eagle Outlet or Eagle Outlook)
Eagle Spring
(AKA Eagle Springs)
Res-1
(AKA Scofield Res. 1)
SCOFIELD LAKE
STATE RECREATION AREA
Eagle Spring
Sulphur Spring
Sulfur Spring
(AKA Sulfur Springs, Sulfur Spring, Sulfur Springs)
CR-06-09 BLW
CR-06-09 ABV
CR-06-09
CR-06-03 ABV
CR-06-01
CR-06-01 BLW
CR-06-02 ABV
CR-06-02
CR-06-05A
Scofield
Mud Creek
(AKA Muddy Creek)
VALLEY
Mud
Creek
Eagles
Canyon
Long
Miller
Spring
LEGEND
Mud Creek
AKA Muddy Creek
Surface Water
Monitor Location
CR-06-02
Ground Water
Monitor Location
Surface & Ground
Water
Monitoring Sites
N
0
2,000 ft
SCALE 1:24,000 or 1" = 2,000'
Contour Interval 20 ft
Carbon Resources LLC
KINNEY NO 2 MINE
FIGURE 3.6-11
DRAWN BY GLH
DATE 8/2/07
APPROVED BY GLH
DATE 8/12/2007
HANSEN ALLEN & LUCE
23 S. Carbon Ave., Suite 21
Price, UT 84501
FILE Surf & GW Mon Loc 8-12-07

Apparently there was a little "perched" water in the UP Seam that drilling released but not enough to sustain a water table. The water table is apparently some distance below this well screen, Figure 3.6-12, CR06-01 and BLW As Built.

Hole CR-06-03-ABV encountered significant groundwater above the level of the Hiawatha Seam. A rough estimate of flow from evacuation with compressed air indicates the flow exceeded 30 gpm. It is important to note that this hole is located within the Eagles Canyon Graben and the elevation of the Hiawatha Seam is 388 feet lower in CR-06-03-ABV than in CR-06-01. All groundwater monitoring well completion diagrams are located in Exhibit 9, Geologic Information.

3.6.3 Coal and Overburden/Interburden Characteristics

Geologic information from various sources obtained between 1977 and the present were used to evaluate the physical and chemical characteristics of coal and non-coal strata within the proposed lease and adjacent areas. Generally, the historical information is very limited. The 2006 Drilling Program generated the lion's share of the available data that include geophysical logging, and laboratory analyses of coal, roof, and floor samples from the Hiawatha Seam.

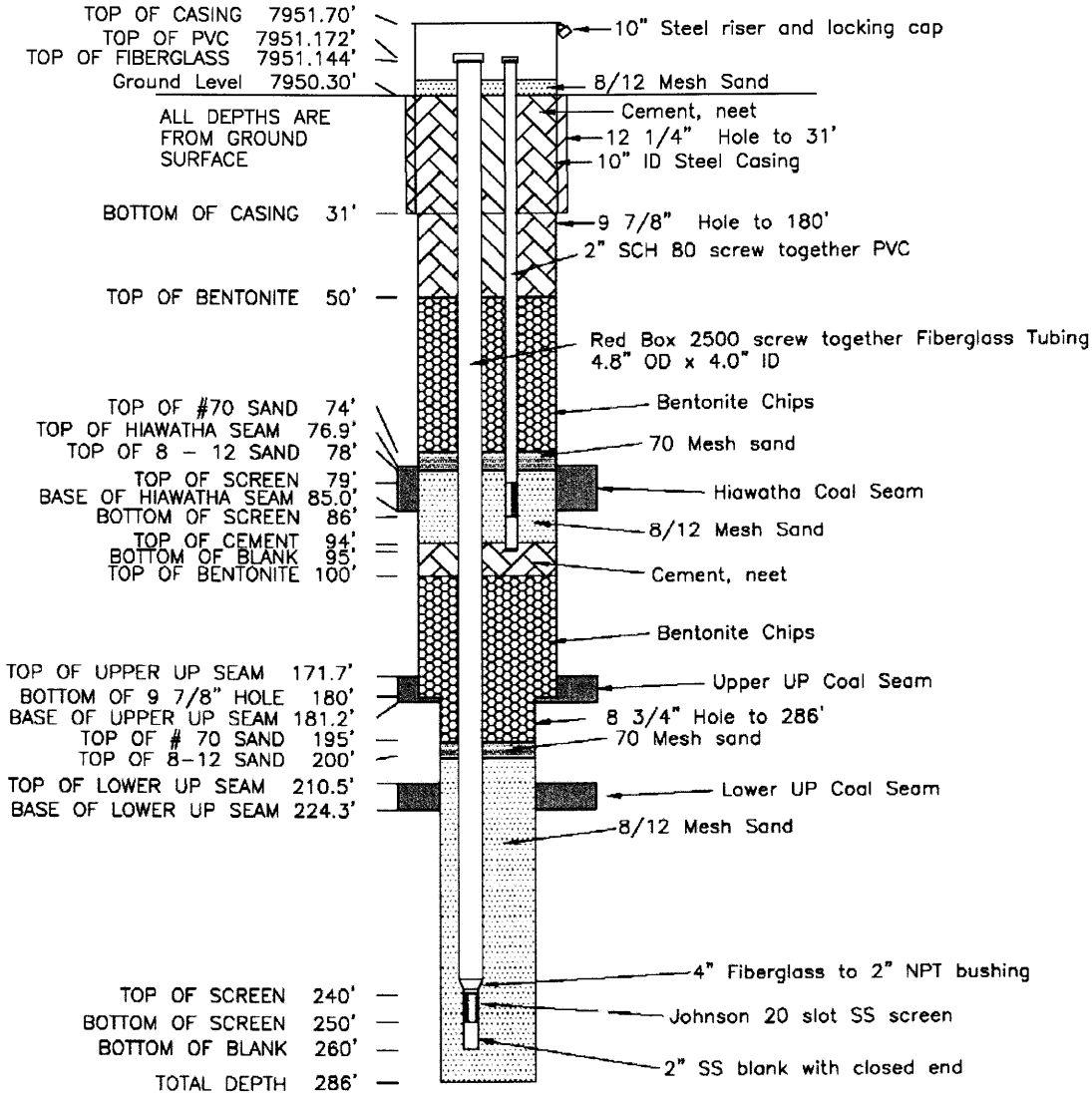
During exploration drilling, drilling conditions were recorded and core samples were described. Descriptions included sampling increments, recovery rates, strength designations, discontinuities, and detailed lithology. Occurrences of water, gas, and fractures were also noted. At a minimum, boreholes were logged for natural gamma, compensated density, and caliper.

Geologic logs and core data for the permit area are considered confidential information and are not included in this submittal. These logs provide valuable information which has been used to characterize the lithologic characteristics of coal reserve areas and define site-specific information on the thickness of coal and other strata within the proposed permit area. The locations of the drillholes in the proposed permit area are shown on the Figure 3.6-1. Geologic information is also graphically illustrated by the Geologic Cross-Sections, Figures 3.6-5 through 8.

Coal core samples were analyzed for a variety of parameters including: Moisture, Ash, BTU, Sulfur, Volatile Matter, Fixed Carbon, Acid Potential (TCaCO3/1000T), Ash Fusion Temperatures. Ash Mineral Analysis includes, Ash Type, Specific Gravity, multiple Trace and major elements and others. Immediate roof and floor rock samples were separated and analyzed for acid or toxic-forming materials. Roof/floor rock analysis results are included in Exhibit 9, Geologic Information.

Monitor Well Completion Diagram
CR-06-01 AND CR-06-01-BLW

NOT TO SCALE



8000 ft Elevation Datum
E. 1739299.757
N. 7073837.862
Gounnd Surface, ELEV. 7950'

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-01 AND CR-06-01-BLW

Figure 3.6-12

DWG BWJ
CKD
APD

DATE: 3/25/06

Drawing Loc: Drilling Phase 1\Completion Diagrams\CR-06-01 AS BUILT.dwg

3.6.3.1 Physical Properties of Coal/Overburden/Interburden

Regionally and in the permit area, the Spring Canyon Member of the Starr Point Sandstone has historically been considered a regional aquifer. The well sorted, fine to medium-grained nature of the Spring Canyon Member even with moderate cementation, appeared to allow for ground water migration. However, more recent observations throughout the Eastern Wasatch Plateau has shown that the Spring Canyon is quite well cemented restricting the permeability and transmissivity to a degree as to render the Spring Canyon Member only a marginal regional aquifer. The one thing it has going is lateral persistence. The major coal seams having large secondary permeability due to cleating are better aquifers than is the Spring Canyon Member.

Ribbon shaped (plan view) and lenticular (x-section view) fluvial sandstones, occurring in the Blackhawk Formation act as perched aquifers and in some cases as small reservoirs for methane or natural gas. Experience in coal mines throughout the Eastern Wasatch Plateau Coal Field shows that these units drain quickly when encountered by mining due to their limited thickness and lateral continuity. Interconnection of permeable units by cross-cutting joints appears to be rare due to limited jointing and "healing" of most fractures by calcite cement.

Virtually no rock mechanics data were available prior to the 2006 drilling program. Testing of collected coal core and core of representative rock units above and below the Hiawatha seam provide the available data set.

Uniaxial Compressive Strength for the Hiawatha seam and associated immediate roof and floor found in the proposed permit area are summarized by Table 3.6-1, Strength Characteristics of Coal, Roof, and Floor Materials.

TABLE 3.6-1

STRENGTH CHARACTERISTICS OF COAL, ROOF, AND FLOOR MATERIALS

Specimen No.		Lithologic Description	Failure Load (lb)	UCS* (psi)	Failure Mode Notes
06-CR-06-01_5B/4-U-01	Hiawatha Upper Roof	Sandstone	27,700	3180	
06-CR-06-01 5B/5-U-02	Hiawatha Upper Roof	Sandstone	49,220	5951	
06-CR06-05A-5/1-U-13*	Hiawatha Roof	Mudstone	40,850	5,561	45° fracture
06-CR06-05A-6/1-U-14*	Hiawatha Roof	Sandstone	79,850	11,033	Axial fractures
06-CR-06-02_1A/17-U-06	Hiawatha Imm Roof	Silty Sandstone	142,800	17299	
06-CR06-05A-8/2-U-03	Hiawatha Seam	Sandstone	8,200	1,162	Axial fractures
06-CR06-05-5/1-U-08	Hiawatha Floor	Sandstone	16,530	2,363	45° fracture
06-02-CR-02_5A/18-U-07	Hiawatha Floor	Sandstone	57,930	6,998	

* UCS values for samples with L/D<2.0 are corrected as per ASTM D2938-86.

3.6.3.2 Chemical Characteristics of Coal and Associated Strata

As part of the 2006 Drilling Program coal core samples were analyzed for a variety of parameters including: Moisture, Ash, BTU, Sulfur, Volatile Matter, Fixed Carbon, Acid Potential (TCaCO3/1000T), Ash Fusion Temperatures. Ash Mineral Analysis includes, Ash Type, Specific Gravity, multiple Trace and major elements and others. Immediate roof and floor rock samples were separated and analyzed for acid or toxic-forming materials.

TABLE 3.6-2
LIST OF SAMPLES and DATA from ACID FORMING POTENTIAL ANALYSES

Seam Site	SGS Lab Number	Core Hole ID	Sample #	Ftg. Begin	Ftg. End	Acid Potential TCaCO3/1000 T
HIA Roof	072-21001-001	CR-06-01	5B/5	75.60	76.40	4.91
HIA Roof	072-19142-002	CR-06-01	5C/5	76.40	76.90	7.50
HIA Roof	072-19142-005	CR-06-01	1/6	78.20	78.80	9.38
HIA Roof	072-19143-001	CR-06-02	1B-17	426.60	427.50	2.19
HIA Roof	072-19143-002	CR-06-02	2/17	427.50	428.00	5.36
HIA Seam	072-19143-005	CR-06-02	5/17	430.00	431.20	19.38
HIA Floor	22212-002	CR-06-05	2/1	1043.05	1043.50	13.44

The chemical analysis parameters used to evaluate coal, roof, and floor materials are listed on Table 3.6-3, Analysis Parameters - Coal, Roof, and Floor Materials. Chemical analyses for coal is considered confidential and not included in this submittal. Analyses of roof, and floor materials are included in Exhibit 9, Geologic Information. This information is included for reference only. Carbon Resources has no plans to place roof and floor materials in long term stockpiles on the surface. Roof and floor materials cut during fault crossing, overcasts and or undercasts will be stored in designated in-mine rock storage areas.

TABLE 3.6-3
ANALYSIS PARAMETERS – COAL, ROOF AND FLOOR MATERIALS

COAL ROOF AND FLOOR

PROXIMATE ANALYSIS
% Moisture
% Ash
% Volatile
% Fixed Carbon
Btu/lb
% Sulfur
MAF Btu/lb
% MAF Volatile
% MAF Fixed Carbon
lb SO2/mm Btu
% Air Dry Loss
lb Sulfur/mm Btu
As Received Net Sample Wt.

MINERAL ASH ANALYSIS
(Rock Forming Elements)
Silicon Dioxide
Aluminum Oxide
Titanium Dioxide
Iron Oxide
Calcium Oxide
Magnesium Oxide
Potassium Oxide
Sodium Oxide
Sulfur Trioxide
Phosphorus Pent oxide
Strontium Oxide
Barium Oxide
Manganese Oxide
Silica
Base: Acid Ratio
T 250 Temp
Ash TYPE
Fouling Index
Slagging Index

TCLP EXTRACT ELEMENTS
Arsenic, As
Barium, Ba
Cadmium, Cd
Chromium, Cr
Lead, Pb
Mercury, Hg
Selenium, Se
Silver, Ag

COAL ONLY with ROOF and FLOOR as part of COMPOSITE

TRACE ELEMENTS
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Cobalt
Copper
Lead
Mercury
Molybdenum
Nickel
Selenium
Thallium
Vanadium
Zinc

3.6.4 Geologic Summary

The geology of the permit area is dominated by relatively flat-lying, interbedded sedimentary units chopped into Basin and Range style North-South Horst and Grabens which control the N-S elongate valleys and long skinny flat topped ridges (plateaus).

The rather large number of faults have formed a series of mining blocks separated by vertical distances created the throws on the mostly normal faults. These faults dictated the lateral limits of historic mining. The previous mine operators chose not to cross the larger faults (in excess of 90 feet) instead stopped mining against the faults. In order for Carbon Resources to reach the remaining reserves, a number of large fault crossings will have to be completed.

The Cretaceous Blackhawk Formation is the principal coal-bearing formation. Coal seams include, in ascending order, the Flat Canyon, UP, Columbine, Hiawatha, McKinnon, and Haley. The Hiawatha Seam is the only mineable coal seam within the permit boundary. The other two seams of mineable thickness (UP and Columbine) have already been mined. The Hiawatha Seam has also been mined over a large portion of the permit area. However, a fortuitous East-West elongate corridor of Hiawatha Seam Coal remains unmined. This corridor of unmined coal apparently was not mined because of a rock parting that may have rendered this local area less appealing to historic mine operators because of the high ash content of the coal where this parting is present. The parting appears to be a very small, mid to late swamp, channel that meandered through the swamp and deposited some mud and clay (possibly sand and silt also) in a sinuous East-West trending pattern.

The corridor of unmined coal is clearly high and dry, relative to ground water. Data from the nine monitor well completions makes a compelling case and when coupled with the structural data helps explain the basis for low water table.
Based on chemical analysis of coal, roof, and floor samples, overall sulfur content is low, however, sulfur in the coal demonstrates a bi-modal distribution. With organic sulfur being responsible for the background sulfur values of approximately 0.5% and presence of pyritic being obviously responsible for driving the sulfur content to over 1% in some local areas. Acid producing potential is considered low and the buffering capacity is relatively high due to the presence of significant quantities of calcium carbonate as the nearly exclusive matrix in the sandstones and mudstones and a common cleat filling, which results in very low acid-forming potential. Similarly, chemical analysis generally indicate low concentrations of most potentially toxic components and low alkalinity producing potential. The chemical analysis results and subsequent conclusions are generally consistent with chemical analysis of coal refuse materials from previous mining operations involving production from the same coal seams in the area.

3.7 HYDROLOGIC INFORMATION

3.7.1 General Description of Hydrologic Information

This section describes the hydrologic conditions and resources within the permit and adjacent areas that could potentially be affected or impacted by the mining and reclamation activities. Information in this section was developed following applicable regulatory guidelines (R645-301-700) for coal mine permitting in the State of Utah.

3.7.1.1 Applicable Regulatory Sections Addressed

Specifically, this section of the permit application addresses Rules R645-301-710 through R645-301-727. Operational Plans (Rules R645-301-730 through R645-301-765) and Probable Hydrologic Consequences (Rule R645-301-728) are addressed in Section 4.7 of this permit application and reclamation plans (Rules R645-301-760 through R645-301-765) are addressed in Section 5.6.

The following list cross-references the headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
3.7.1	
3.7.1.1	R645-301-711 and 720
3.7.1.2	R645-301-711 and 721
3.7.1.3	R645-301-720, 721, 722, 724
3.7.1.4	R645-301-724.400 through 724.413
3.7.1.5	R645-301-512 and 722.100 through 722.500
3.7.2	
3.7.2.1	R645-301-724.100 and 724.300
3.7.2.2	R645-301-724.100 and 722.400
3.7.2.3	R645-301-724.100 and 722.400
3.7.2.4	R645-301-724.100 and 723
3.7.2.5	R645-301-722.400
3.7.2.6	R645-301-724.100
3.7.2.7	R645-301-724
3.7.3.1	R645-301-724.200
3.7.3.2	R645-301-724.200
3.7.3.3	R645-301-724.200
3.7.3.4	R645-301-724.200 and 723
3.7.3.5	R645-301-724.200
3.7.3.6	R645-301-724.200
3.7.3.7	R645-301-724.200

3.7.4	
3.7.4.1	R645-301-724.410
3.7.4.2	R645-301-724.410, 724.413, and 724.420
3.7.4.3	R645-301-724.410, 724.411, and 724.420
3.7.4.4	R645-301-724.410, 724.412 and 724.420
3.7.5	
3.7.5.1	R645-301-724.600
3.7.5.2	R645-301-724.600
3.7.5.3	R645-301-724.600
3.7.6	R645-302-320
3.7.7	R645-301-724.310, 725.100, 725.200 and 725.300
3.7.8	R645-301-726
3.7.9	R645-301-727

3.7.1.2 Sources of Hydrologic Information

Hydrologic conditions in the permit and adjacent areas have been characterized in this section using information from ongoing baseline characterization and monitoring activities. This hydrology description represents a consolidation of regional information, identified historical information, and recent monitoring data specific to the Kinney No. 2 Mine permit area. Ongoing baseline monitoring activities are as specified herein, and within Section 3.7.1.3 and 3.7.2.6.

This hydrology description represents a consolidation of regional information and recent monitoring data specific to the Kinney No. 2 Mine permit area. Ongoing baseline monitoring activities to be a part of the Baseline Hydrology Monitoring Plan for the Kinney No. 2 Mine are discussed briefly below. The purpose of the plan is to collect and evaluate baseline hydrologic data specific to the Kinney No. 2 Mine. Data collected under the plan will be used to characterize existing surface water and ground water in the area and evaluate potential impacts to these resources from mining and reclamation activities. The monitoring plan consists of a comprehensive seep and spring survey completed by Rock Logic Consulting, LLC of Cedaredge, Colorado in 2006 (see Exhibit 3.7.2.2-1, Seep and Spring Survey). The survey resulted in the identification of 25 spring/seep locations. In addition to the seep and spring survey, well drilling, testing, and monitoring has been completed on 6 wells to evaluate geohydrologic conditions including the occurrence of ground water and hydraulic characteristics of the aquifers. Perennial surface water sources found within or adjacent to the mine permit area, include Mud Creek, Miller Canyon, and Scofield Reservoir.

All surface and well monitoring stations utilized for baseline monitoring for the Kinney No. 2 Mine permit area are listed in Table 3.7-1 Kinney No. 2 Mine Baseline Monitoring Stations. Operational monitoring stations are shown in Table 3.7-2, Kinney No. 2 Mine Operational Monitoring Stations. Surface and ground water monitoring locations are shown on Map 3.7.1.3-1, Regional Hydrology, and Map 4.7.2.3-1, Surface and Ground Water Monitoring Sites. During the preparation of the mine permit application it was discovered that some monitoring stations had inadvertently been given different names during data collection. Attempts have been made to rectify this situation including the identification of a preferred monitoring station name. However, the following clarification is provided in the event that old references are located within the permit or its appendices.

Preferred Station Name	Alternate Documented Names
CR-06-03	CR-06-03-ABV
Eagle Spring	Miller Spring, Eagle Springs
Miller Outlet	Eagle Outlet, Eagle Outlook
Mud Creek	Muddy Creek
Res-1	Scofield Res. 1
Sulfur Spring	Sulfur Springs, Sulfer Spring, Sulfer Springs

Baseline hydrologic monitoring will be performed for the Kinney No. 2 Mine permit area at the following frequency:

Springs – R645-301-724.100 requires minimum baseline monitoring of TDS or Specific Conductance, pH, total iron and manganese, and the rate of discharge or usage. Springs and seeps identified in Table 3.7-1 have or will be monitored for a two year period to establish baseline conditions for aqueous parameters according to the schedule provided in Table 4.7.2.3-1, Monitoring Schedule.

Stream Stations - R645-301-724.200 requires minimum baseline monitoring of Total Suspended Solids, TDS or Specific Conductance, pH, total iron and manganese, and the rate of discharge or usage. Flow and field water quality parameters have or will be measured on a monthly basis for the Miller Outlet and Mud Creek surface stations, and for the Scofield "Res-1" site during periods wherein access is not limited due to ice. All stream stations have or will be monitored for a two year period to establish baseline conditions for aqueous parameters according to the schedule provided in Table 4.7.2.3-1, Monitoring Schedule.

Monitoring Wells - R645-301-724.100 requires minimum baseline monitoring of TDS or Specific Conductance, pH, total iron and manganese, the rate of discharge or usage (if applicable) and depth to water. Wells shown on Map 4.7.2.3-1, Surface and Ground Water Monitoring Sites, have or will be sampled on a monthly basis for a one year period, through each of the four seasons (when the well is accessible, and when sufficient water exists to extract a sample) to establish baseline conditions for aqueous parameters according to the schedule provided in Table 4.7.2.3-1, Monitoring Schedule.

Data obtained from the baseline monitoring plan will characterize current surface and ground water flows, water quality conditions, and any seasonal variations in these characteristics. Approximately two years of baseline data are available from the surface monitoring locations and Approximately one year of groundwater baseline hydrologic data is now available for most stations for UDOGM's technical adequacy review of this permit application. Adequate baseline data have been collected, per discussions with UDOGM personnel, and CR has now moved into quarterly sampling.

3.7.1.3 General Hydrogeology

Within the permit and adjacent areas both surface and ground water hydrologic features and regimes are reflective of and strongly influenced by localized topography (as shown on

Map 3.7.1.3-1, Regional Hydrology), Surface Water Resources and Monitoring, by geologic structure, stratigraphy, lithology, and described in Sections 3.6, Geologic, and by Climatological Information as discussed in Section 3.7.4.

The topography and general hydrogeology of the mine permit area is typical of central Utah mountain areas, containing both valley and mountain segments. The direct permit area lies within a north south trending mountain range traversed by small east to west drainages as shown in Figure 3.7.1.3-1, Arial View of Permit Area. The figure, looking to the north-east shows the general topographic nature of the area, Scofield Reservoir to the north, the town of Scofield in the bottom central portions, the railroad which goes through the town of Scofield then bends to the east, then crosses and parallels the highway as it continues northward, a private mountain access road that zig-zags up the mountain side within the southern portions of the permit area, and an un-named ephemeral drainage lying just south of the mountain access road. In general, the permit area includes the area north of the un-named ephemeral drainage, south of the point where the railroad crosses the highway, and within 1,500 feet east of Utah highway 96.

The relatively dry climate and limited up-gradient drainage area limit local ground water recharge and surface water runoff. The majority of seeps and springs identified within the general area were found within the north-south trending drainages lying to the east and south of the permit area including Long Canyon, Merrill Canyon, Eagle Canyon, and UP Canyon. Eagle and Sulphur Springs are located along highway 96 north of the mine permit area, and two small springs were identified within the un-named ephemeral drainage located immediately south of the mine site. No seeps and springs were found within the permit area itself.

Semi-arid climatic conditions and precipitation patterns result in a high loss of moisture to runoff, evaporation, and sublimation reducing the amount of water available for recharge or stream flow. Recharge to underlying units is also limited by flat lying units. Downward movement of recharge through the stratigraphic sequence to underlying units is limited by low vertical permeabilities of the units (which are often fine-grained, well cemented, or massive), the presence of relatively impermeability shale units acting as confining layers.

As a result of these controls, ground water has only been noted to occur in limited quantities during well drilling activities. Shallow ground water is present however in the alluvial/colluvial deposits associated with Pleasant Valley located west of the mine site. Very limited ground water is expected to be encountered during mining operations.

The coal mining operations planned for the site will include mine portals, office and maintenance facilities, coal processing, storage, and loadout facilities, roads, and runoff control facilities. The facilities will be constructed on a series of pads interconnected by roads. Runoff control facilities will consist of a series of ditches, culverts, and a single flow/sediment pond located at the extreme north end of the disturbed area. One small alternate sediment control area is planned for the fill out-slope area located east of and adjacent to highway 96, and immediately south of the main entrance and access road. This alternate sediment control area will utilize silt fence and/or straw bales to fully contain any sediment runoff. Details regarding the runoff control plan are provided within Section 4.7.2.

3.7.1.4 General Climatology

The climate of the permit area is semi-arid with natural variations in climatic conditions due to the size of the area, rugged terrain, and significant elevation differences. Temperatures in the area reflect a typical seasonal pattern with gradual warming beginning in late March, high seasonal temperatures in July and August, a gradual cooling beginning in late August to early September, and seasonal lows in late December through mid-February. Due to fast moving storm fronts, wide temperature variances can occur over relatively short periods of time. More specific data relating to precipitation, temperature and wind speed and direction is provided in Section 3.7.4

3.7.1.5 Mapping of Hydrologic Information

Hydrologic iinformation is presented in various locations within the permit including:

Springs and seeps	Exhibit 3.7.2.2-1 /Map 3.72.4-1
• Surface water bodies	Map 3.7.1.3-1
• Boreholes and test wells	Map 3.7.1.3-1
• Surface and ground water monitoring locations	Map 4.7.2.3-1
• Drainages and drainage basins	Map 4.7.2.1-1 / 4.7.2.1-2
• Ground Water Level Data	Map 3.7.2.1-1
• Faults and other geologic structures affecting hydrology	Map 3.7.2-1

3.7.2 Ground Water Information

Ground water occurrence in the permit and adjacent areas has been quantified by the completion of a seep and spring survey, exploratory well drilling, a geologic analysis of potential water-bearing strata, the identification of potential ground water storage in underground mines, and the analysis of water quality and quantity characteristics. The evaluation of ground water occurrence involved the collection of data from well drilling activities and for saturated strata in the permit and adjacent areas, and general knowledge regarding regional hydrogeologic conditions. Raw data have been reviewed to develop interpretations and reach the conclusions presented in this section.

Consistent with applicable provisions of R645-301-512, hydrologic information has been prepared under the direction of, and certified by a qualified registered professional engineer or land surveyor with assistance from experts in the related fields. To aid in the following discussion, Map 3.7.2-1, Works-Wells-Springs-Faults has been created to assist in showing the inter-relationships between important geologic and man made features.

3.7.2.1 Ground Water Environment

The geology of the permit and adjacent areas is described in detail in preceding Section 3.6, however, the regional hydrostratigraphy of the area is reflective of the following primary

formations, listed and described in order beginning with the lowermost stratigraphic unit of interest:

Mancos Shale - A massive grey marine shale. Commonly fine grained, the Mancos Shale is generally interbedded with fine to medium-grained sandstones. While the shale members are characterized by relatively low permeability, any ground water percolating through the more permeable interbedded sandstones may come in contact with associated evaporites such as gypsum resulting in rapid degradation of water quality. The Mancos Shale is laterally continuous in the proposed permit area.

Blackhawk Formation - The principal coal-bearing formation of the Mesa Verde Group, the Blackhawk Formation, is a sequence of alternating sandstone, shale, and coal. The coal seams of greatest economic importance occur within the lower portions of the formation. The sandstones are fine to medium-grained and are typically well cemented resulting in relatively low permeabilities. The shale units are similar in character to the Mancos Shale and are relatively tight, acting as aquitards to limit vertical ground water movement.

In ascending order, major units of the Blackhawk Formation include the Panther sandstone, Flat Canyon coal seam, Storres sandstone, Lower UP coal seam, Columbine coal seam, Spring Canyon sandstone, Hiawatha coal seam, McKinnon coal seam, and Haley Coal Seam

Castle Gate Sandstone - A fine to medium-grained, argillaceous to slightly calcareous massive sandstone. The Castle Gate Sandstone grades to shale both along its basal contact with the Blackhawk Formation and, in many locations, near the top of the unit. Due to its massive occurrence and strong cementation, it is highly resistant to weathering forming prominent cliffs throughout the region, and exhibits relatively low permeability. The thickness of this unit typically ranges from 100 to 500 feet.

Price River Formation - Medium-grained sandstone and shaley sandstone grading to a grey to green shale. The Price River Formation is generally characterized by low primary permeability with some localized increases in permeability due to extensive fracturing.

North Horn Formation - A series of shales, sandstones, conglomerates, and freshwater limestone deposits, which throughout the region can be 2,400 feet thick, and laterally discontinuous in rugged topography. The shales are relatively tight, functioning as aquitards to minimize downward ground water movement.

Although ground water can occur in all of the major stratigraphic units identified, all are considered poor to moderate aquifers. Ground water yields are limited within the proposed permit area by small recharge basins, the semi-arid climate of the region which limits recharge to the units, low permeabilities, and the lack of regional lateral continuity resulting from dissection by deep drainage valleys. While many of the minor stratigraphic units (such as sandstones and coal seams) are capable of storing and transmitting ground water, regional ground water transmission capabilities are limited by the relatively thin and laterally discontinuous nature of these semi-permeable units.

Generally speaking, hydrologic impacts on the local and regional environment including surface and ground water quality/quantity impacts, due to mining are anticipated to be very minor. These concepts are briefly explained below.

Surface Water Impacts

The proposed Kinney No. 2 Mine and related surface facilities are confined to a very small area or footprint. The surface facilities plan has been developed to consolidate the disturbed surface area into as small a space as possible, utilizing a series of pads to contain needed infrastructure. Impacts are limited to:

- Control of runoff and erosion within the disturbed permit area. When it occurs, historical runoff is generally noted as either sheet flow or small concentrated flow within ephemeral channels. Because of decreased vegetation which results in higher runoffs, it is anticipated that total runoff volume will increase slightly from historic conditions. Operational runoff will be contained and controlled via a series of ditches, culverts, a sedimentation pond, and alternate sediment control methods. In general, it is anticipated that better runoff controls, resulting in less sediment leaving the site, will exist during mining than pre mining.

- Surface water from undisturbed areas historically ran downhill to the highway, then flowed parallel to the highway until culvert(s) were encountered wherein the water could cross the highway and continue it's path toward Scofield Reservoir. Runoff during operational mining will work in very much the same way with only minor exceptions. First, runoff from areas immediately above the permit area will be diverted by a non-mine access road and two undisturbed area drainage ditches (UDD-1 and UDD-2) which will parallel the eastern permit boundary. Water collected by UDD-1 will flow to the north until it joins UDD-2 which directs water from the north. Water from both undisturbed drainage ditches are then combined and conveyed via culvert UDC-2 through the mine area and discharged to an inlet of an existing highway culvert. From there, undisturbed drainage water is combined with pond discharge water, and conveyed via an existing 36" culvert (CP2) beneath the highway before continuing toward Scofield Reservoir.

- The last minor change involves the construction of an undisturbed area bypass culvert UDC-1 which will convey potential runoff from upland areas, beneath surface mine facilities and the highway, into the Scofield Reservoir drainage system west of the highway.

- Water quality impacts are projected to be similar to other local mine working operations. Historical runoff, and hence quality impacts has been sporadic as evidenced by limited and weathered upland channels. In similar nature, it is anticipated that impacts to water quality will be minor, and limited to major runoff events wherein runoff is sufficient to result in a water discharge from the sedimentation pond. Discharges during these potential extreme events are expected to be in compliance with regulations thus resulting in minimal, if any, negative water quality impact due to mining.

Ground Water Impacts

Unlike many local mines, ground exploration in and around the proposed Kinney No. 2 Mine has encountered only limited amounts of water, indicating the presence of very limited ground water resources. Although some limited water was reported during drilling, it appears that all but one of the wells drilled within the proposed Portal Block permit boundary are now dry. This conclusion was reached based on the observation that water within many of the wells remained below the top of the lowermost blank section following bailing. The lack of water level change since that time has shown that there have been no inflows into most of the wells, thus indicating that wells CR-06-01 CR06-01-BLW, CR-06-02, CR-06-02-ABV, and CR-06-05A are dry. Table 3.7.2.1-1, Well Conditions as of 5/29/2007, has been inserted to show the location of the water level in each well in reference to the bottom of the lowermost screen. The locations of these wells are shown on Map 3.7.1.3-1.

Data within Table 3.7.2.1-1 also show that only minor water level variations have been noted for wells CR-06-01-BLW and CR-06-009-BLW for water that was encountered within zones below the coal seam. Mining is not anticipated to impact any water or aquifer zone below the coal seam.

Only three wells (CR-06-03-ABV, CR-06-09, and CR-06-09ABV) show the presence of water above the coal seam. The first of these wells is located within the Eagle Canyon drainage, and has been ordered to be abandoned by DOGM. The CR-06-09 wells are located along the ridgeline between Eagle and Long Canyons. Although these wells show water levels above the coal seam, it is believed that the zones into which they penetrate are limited in regional extent, and therefore will have little regional impact, if any. Water encountered within the mine is expected to be limited to the draining of localized sandstone channels and perched zones.

It is fully anticipated that mining operations will have little if any impacts on the ground water hydrologic balance. This conclusion is reached based on the fact that limited ground water was encountered during drilling and that a significant number of the wells are dry, indicating the general lack of a regional ground water system within explored zones. The area therefore appears to be strongly influenced by localized confining layers that have the ability to create perched aquifers, but generally lacking the formation of a regional ground water aquifer. This is evidenced through a review of Map 3.7.2.1-1, Ground Water Level Data, wherein the inconsistency of water levels is observed.

Note for example the distinctly different and downward trending water levels of 7977, 7861 and 7851 noted in the zones above, within, and below the Hiawatha coal seam in well CR-06-09. A similar perched/downward trend is noted within well CR-06-01 where levels of 7854 and 7709 are noted above and within the coal seam. Finally, note the inconsistency in east-west trends. Water levels for example above the coal seam in CR-06-01 (7854) and CR-06-09 (7977) are significantly higher than well CR-06-03 (7798) which lies between both wells, indicating either a significant sink, or perched systems.

It is unlikely that the limited water encountered within well drilling operations is sufficient to provide any significant source for the local seeps and springs identified in the recent survey completed by Rock Logic, Consulting, LLC in 2006.

Further evaluation also shows that with the exception of Sulphur Spring, seeps and springs located along the western facing slope of the mine permit area are all located south of the mine permit area and are at elevations of 8,000 feet msl or higher. Water measured on May 29, 2007 within wells CR-06-01, CR-06-01 BLW, and CR-06-02 during and after drilling has noted at a maximum water elevation of 7898 feet msl, over 100 feet below the lowermost spring elevation. The fact that well levels are lower than the springs, that the wells are dry, and that the springs are located approximately ¾ mile south of the permit area supports the "no impact" by mining theory.

The majority of water resources including seeps, springs and ponds noted within the seep and spring survey are located east of the permit area within Long Canyon and it's tributaries. Three small seeps, one small spring, and two ponds are located within the eastern portion of the permit area are located within Eagle Canyon. A review of the mine portal elevation and the location of these springs indicates that there will be in excess of 500' of cover over mine workings, and hence there will be little potential for spring disturbance. As indicated earlier, mine workings dip to the east, increasing cover as the mine advances. As such, mine workings will have even less potential to impact surface water resources further east in Long or Miller Canyons.

It is further anticipated that no impact to the local surface or ground water systems west of the mine will occur due to 1) the general lack of water encountered during drilling and 2) the fact that the local geologic dip is to the east, away from Mud Creek and Scofield Reservoir.

3.7.2.2 Ground Water Aquifers

Ground water aquifers within the proposed lease and adjacent areas have been characterized on the basis of information obtained from field investigations, well drilling, and ongoing monitoring activities. These activities include borehole drilling and well installation, geologic and geophysical logging, observations of the occurrence of water during borehole drilling, aquifer testing, routine water level monitoring, and routine ground water quality analyses. Ground water occurrence and movement in the proposed permit boundary and adjacent areas can best be characterized by describing the four primary aquifer systems identified through field investigations and monitoring activities to date.

The four aquifer systems include the:

- Alluvial/Colluvial Aquifer System
- Perched / Isolated Ground Water Systems
- Stored Mine Water System
- Regional Ground Water System

These aquifer systems are individually described below.

Alluvial/Colluvial Aquifer System - The alluvial/colluvial aquifer system consists of shallow ground water contained in limited alluvial/colluvial deposits associated with area surface drainages. In the smaller drainages, these alluvial/colluvial deposits are very narrow and may store and transmit relatively minor amounts of ground water. The only alluvial/colluvial

aquifers of any significance occur along the channels of the perennial drainages of Mud Creek downstream of the permit area and are generally confined to the active stream channel, immediately adjacent areas, and any hydrologically connected inactive or abandoned channel segments.

The alluvial/colluvial aquifer system in the area appears to be closely tied to the surface water system with ground water recharge occurring during periods of high flow and ground water discharge occurring near Scofield Reservoir on a relatively continuous basis but becoming more pronounced during periods of low flow when stream levels may drop below the existing potentiometric surface of the alluvial/colluvial aquifer. Some lateral discharge from the shallow ground water aquifer to Mud Creek may also occur from side channel tributaries during late season low flow periods. The regional aquifer system may also be a source of recharge to the alluvial/colluvial system as base ground waters move into the area.

Perched Ground Water System Perched ground water in the permit area can occur within limited semi-permeable units associated with the Blackhawk Formation. Typically, perched ground water systems consist of isolated lithologic members which have sufficient permeability to store and transmit ground water and are connected to a natural source of recharge. Either alternating sequences or interbedded deposits of sandstone, siltstone, and shale dominate the geologic formations which are exposed at or near the surface in the proposed permit area.

Perched ground water occurrence are typically associated with ribbon shaped sand-rich fluvial paleo-channels that are enclosed in an envelope of rather impervious mudstone and siltstone. These channels become water bearing in two ways. one; data from other mines throughout the Eastern Wasatch have shown that much of the water in perched systems is conate, as determined by age dating. Two; because these channels have extremely long lateral extent along he their axis they either daylight in a recharge zone or "sub-light" against a fault and receive recharge from water that is moving downward within the breccia zone of the fault when structural dip of the fault block in which they reside is favorable.
A second group of perched aquifers consist of coal seams. Coal seams have inherently low permeability and transmissivity but possess rather large secondary permeability and transmissivity due to cleating. The coal seams are also enclosed, generally, with rather impervious mudstone and siltstone but unlike the narrow sinuous shapes of paleo-channels, coal seams have large areal extent. The same two basic recharge mechanisms apply to coal seams as apply to channels.

The thickness of perched (unconfined) aquifers may vary significantly corresponding to the thickness of the sandstone or other water-bearing units. Generally perched aquifers are limited in areal extent by the numerous large and small surface drainages which dissect the area and truncate the relatively flat-lying sedimentary units.

The perched ground water system is recharged almost exclusively by direct precipitation and near-surface ground water infiltration. Principal recharge areas for the perched ground water system include formation outcrops and in basins where runoff or snowfall accumulations provide supplemental recharge. The combination of steep terrain and relatively low permeabilities typical of the region, limit infiltration to less than 5 percent of annual precipitation (Price and Arrow, 1974; USGS, 1979), and the limited areal extent of the water-bearing strata result in low discharge rates from the perched ground water system.

Discharge from the perched ground water system occurs primarily in the form of seeps and springs at sandstone-shale interfaces where the water-bearing strata outcrop. Limited discharge from the perched ground water system to the regional ground water system may also occur due to fracture or fault related secondary permeability. It is possible that vertical losses may be occurring locally within faulted and fractured units.

A comprehensive spring and seep inventory of the permit and adjacent areas, conducted in June 2006, identified 6 active seeps and 27 active springs. The locations of known springs and seeps are shown within the report included as Exhibit 3.7.2.2-1, Seep and Spring Survey. As can be seen in Table 3.7.2.2-1, Seep and Spring Flow Summary, discharges were reported to typically vary from small or negligible seeps to approximately 10 gpm. Isolated flows in two springs have flows recorded up to 15 to 20 gpm, and one spring (Sulfur spring) has flows up to 80 gpm. As is typical of the intermountain region, discharges from the perched ground water system, which feed local seeps and springs, will exhibit significant seasonal variation with maximum discharge following spring snowmelt followed by a decline in discharge with many springs and seeps drying up during late summer and early fall. Springs and seeps are discussed further in Section 3.7.3, Surface Water Information.

Of the springs identified in the survey, Eagle, Sulfur, and Angle are included within the ground water monitoring program, data for which is included within Exhibit 3.7.2.2-2, Surface and Ground Water Field Measurements. As can be seen from the data, Eagle spring only flows during the April-May time period in response to spring snowmelt events. Sulfur Spring flows year round with the highest flows occurring in the fall and winter periods. During the period of measurement, Angle Spring was found to flow between 0.25 and 1.25 gpm, the highest flows occurring during the print and early summer of 2006. Angle Spring has not been measured since September of 2006.

Stored Mine Water System - Historic coal mining in the area has resulted in well documented underground mine workings. In those areas where the mine workings are below the local ground water table or where subsidence has resulted in fractures connecting to the perched ground water system, mine inflows may have resulted in the gradual accumulation of stored ground water in the underground workings. Mining planned for this permit will include the extraction of coal from seams overlying abandoned workings, and thus are not anticipated to have any potential impact upon lower ground water systems resulting from mining activities including subsidence.

The total volume of ground water storage in the old mine workings is unknown since abandoned mine workings in the area have been sealed. Any water accumulations however (if they exist) would occur within down-dip workings. To the applicants knowledge, there are no known mine water discharges reported from old workings.

Regional Aquifer System - Any so-called regional aquifer would consist of a water table (unconfined) aquifer in which all units below the normal water table have sufficient permeability to contain and transmit ground water to some degree. In the permit area the regional aquifer system includes the deeper portions of the Blackhawk Formation and extends into the underlying Star Point and Mancos Formations. Because the lower portion of the Blackhawk Formation is the primary coal-bearing sequence in the area, the regional aquifer system is the only ground water system which could be directly affected by the mining operations.

Given a gradual overall dip to the north-east and significant localized variation in the water table in the area of both the many drainage valleys which dissect the area and abandoned underground mine workings, occurrence of the regional aquifer is not tied to any specific stratigraphic unit. Generally, those stratigraphic units which are associated with the regional aquifer system are relatively "tight" with fine to medium grain size, cementation, and cross-bedding contributing to low overall permeabilities.

The local and regional aquifer systems are highly influenced by the presence of multiple north-south trending fault systems which have in fact created a series of local horsts and grabens. These geologic mountain / valley sections create blocks and impediments to the horizontal movement of ground water, and limit the ability of water to move within a consistent and homogeneous aquifer system. Locally, the horizontal movement of ground water within the geologic system is impeded by the presence of faults and fractures, which will either impede flow, or re-direct it from an easterly flow pattern to a north-south pattern based on fault characteristics. More information related to the locations of horsts and grabens is provided within the geologic section of this permit.

Information characterizing the ground water flow regime and hydraulic parameters of the regional aquifer comes from nine wells located in six different locations in and around the permit area. The locations of all wells shown on Map 3.7.1.3-1, Regional Hydrology. Wells CR-06,01, CR-06-02, CR-06-05A and CR-06-09 all penetrate and are screened within the Hiawatha coal seam. Wells CR-06-02-ABV, CR-06-03-ABV, and CR-06-09-ABV all penetrate and are screened into potential water bearing zones above the Hiawatha coal seam, while wells CR-06-01-BLW and CR-06-09-BLW penetrate zones below the Hiawatha seam. Well completion details for all monitoring wells are included within Exhibit 3.7.2.2-3, Monitor Well Completion Details. Field data collected for the monitoring wells is included within Exhibit 3.7.2.2-2, Surface and Ground Water Field Measurements.

Recharge to the local and regional aquifer systems appears to occur primarily in upgradient areas where limited outcrop zones are exposed to direct precipitation and near-surface infiltration. This recharge mechanism is, however, limited by steep slopes and relatively small outcrop exposure areas. Similarly, recharge from vertical ground water movement through the overlying sediments is believed to be relatively minor due to the presence of mixed overlying low permeability units. Some recharge of the regional aquifer system may occur where the associated formations are exposed in deep drainage canyons and as a result come into direct contact with either surface drainages or the associated alluvial/colluvial aquifer system.

Within and downdip of the permit area, potential impacts to the regional aquifer system are believed to be small to non-existent. Although there is some potential to drain overlying small perched and isolated water bearing zones, there are no plans to discharge the water to the surface environment. The limited amount of water anticipated to be encountered within the mine will be diverted to abandoned mine areas where it will create a storage pool, which over time will contribute to the regional system via horizontal and downward leakage to adjacent units.

3.7.2.3 Ground Water Occurrence

The evaluation of the occurrence and movement of ground water is based on ground water characteristics and site-specific information obtained during drilling, testing, and monitoring of wells and springs within the permit area.

It has been observed through data collected that there is a mix of local water resources. Areas to be mined have been shown to have limited water resources through exploratory drilling, while surrounding areas east of planned mining show the presence of more significant seeps and springs, all of which are influenced by local confining geologic strata. The most significant, yet least preferable water source within the general area is Sulfur Spring, located adjacent to Highway 96 along the western slope of the permit area. Although this spring flows year round at an approximate 80 gpm, it's water quality is relatively poor, having a strong sulfur smell. Flows from this spring are not used directly, but cross the highway and enter the Scofield Reservoir flood plain.

As documented within the 2006 Seep and Spring Survey discussed earlier, no other springs of significance are found along the western slopes, either north or south of the permit area. Flows within Eagle Canyon, the next north-south trending drainage east of the mine portals has limited flows, all less than ½ gpm each. Not until Long Canyon, located 1 ½ miles east of the mine portals, does one encounter flows of any significance. The 2006 Seep and Spring discussed three seeps with only minor flows, and springs with flows ranging between 0.5 and 20 gpm. Combined, flows from these 9 springs at the time of the field investigation averaged 6.8 gpm and totaled 61 gpm.

Seeps and springs located within Jump Creek and Merrill Canyon, located 2 ½ miles east of the mine portals were also relatively significant. Of the 11 springs identified, three had minor flows of less than 1 gpm, four had flows of 5gpm, three of 10 gpm, and one of between 10 and 15 gpm.

On a regional basis, ground water occurrence and movement are believed to be stratigraphic and structurally controlled. Faulting is believed to have impact on ground water movement as is the layered geologic strata. At times, shales in or adjacent to fractured or faulted zones will swell, acting as an aquitard thus limiting vertical ground water movement via the fault, and horizontal movement through the fault. Folding is also limited to low-gradient regional features which may influence the overall direction and rate of regional ground water movement but have limited localized influence.

Although there have been nine monitoring wells constructed, there use is limited to determine local and regional ground water flow directions due to the presence of many interrupting faults that form localized horst, and graben systems. Generally speaking, it is believed that the general ground water flow direction is to the, north-east, consistent with the strike and dip of local geologic structure as shown on Map 3.7.2.1-1, Ground Water Level Data. Information that is available to characterize the occurrence and movement of ground water within the permit area comes from the installation, testing, and routine monitoring of the wells installed and used within the Baseline Hydrologic Monitoring Plan.

Due to the extensive underground disturbance from historic mining within the permit area, the relatively low permeability of the rock units overlying the regional aquifer, and the

corresponding slow recharge/discharge capabilities of those units, a uniform, stable potentiometric surface does not appear to exist in this area. Therefore, an exemption is requested from any requirement to create a potentiometric surface map and cross section depicting regional aquifer water levels across the permit area. Data showing available water level elevations for all monitoring wells are provided in Exhibit 3.7.2.2-2, Surface and Ground Water Field Measurements. Data plots and graphs are provided in Section 3.7.3.

3.7.2.4 Ground Water Quality

Although water quality data has been collected from surface water and spring sources, ground water quality from wells is limited to a single well, CR-06-03A as shown in Exhibit 3.7.2.2-2. Well water quality data is limited by the general lack of water encountered within the wells subsequent to drilling. As discussed previously, water levels within the majority of the wells remains within the lowermost blank casing section indicative of dry holes. Field water quality data collected from well CR-06-03ABV show that the well has moderately variable pH, Dissolved Oxygen, Specific Conductivity and Temperature ranges of 6.87-7.28, 1.1-5.7, 245-689, and 20.7-28.3 respectively. A complete set of field and laboratory water quality data is provided in Exhibit 3.7.2.2-2, Surface and Ground Water Field Measurements and Exhibit 3.7.2.4-1, Surface and Ground Water Quality Data, respectively. A summary of water quality data is provided in Table 3.7.2.4-1, Surface and Ground Water Quality Summary.

A plot of major anions and cations for base water quality data collected during the summer of 2006 (shown on Map 3.7.2.4-1, Regional Water Quality), shows that although the waters are generally of calcium bicarbonate type, there are some distinct variations between sources as shown on Map 3.7.2.4-1, Regional Water Quality. Waters from Angle and Sulfur Springs, and from well CR-06-03ABV show a strongly calcium bicarbonate type water. Miller Outlet, Mud Creek, and Res-1 also show calcium bicarbonate type waters, but with slightly lesser contents than Angle and Sulfur springs and Well CR-06-03 ABV. Mud Creek also appears to show stronger content of sodium potassium, magnesium, and sulfate than other samples, most likely the result of upstream mine discharges. The real water quality anomaly lies with Eagle spring which shows a sodium - calcium bicarbonate type water, but at much higher quality than other sources. From the data shown it can be concluded that a clear distinction lies between the water type of Eagle Spring and all other local waters tested. The data also shows a clear distinction between ground waters and surface waters, ground waters having higher calcium and bicarbonate contents than surface waters.

Basic anion-cation data and total dissolved solids for Eagle Spring shows a significantly higher water quality than other local sources. Average TDS of Eagle Spring is 137 for the documented period of record whereas Angle and Sulfur Springs have TDS values of 304 and 353 mg/l respectively. A relatively short flow path between the recharge area and discharge point for most perched ground water is expected to result in limited formation water quality degradation.

The average TDS of well CR-06-03 ABV is calculated to be 399 mg/l and surface sources including Miller Outlet, Mud Creek and RES-1 are 302, 486 and 226 mg/l respectively. It is interesting to note that local general surface water quality is quite good, Mud Creek having the poorest water quality of the samples taken. Again, the degradation of water quality in Mud Creek is believed to be the result of upstream mine discharges.

3.7.2.5 Ground Water Rights and Use

Ground water rights within a 4 mile radius of the central mine area are shown on Figure 3.7.2.5-1, Ground Water Right Locations, and listed in Table 3.7.2.5-1, Ground Water Rights. None of the ground water rights identified are believed to be potentially impacted by the mining operation for the reasons discussed below.

The closest ground water rights to the mining operation are located approximately ½ mile to the southwest, and are associated with small domestic single family dwellings. Water rights 91-3401 and 91-3402 (included within Exhibit 3.7.2.5-1, Water Rights) are supplemental rights to each other with a total domestic and stock watering withdrawal limit of 0.73 acre-feet. Exchange applications E164 and E1912 exchange surface water flows for ground water flows tributary to Scofield Reservoir and are both limited to a 1.0 acre-foot withdrawal for domestic purposes. These water rights are all located within valley alluvium, and lie within an unconfined ground water aquifer zone fed by local surface sources, and geologically below the elevation of the coal seams to be mined. With dry conditions encountered during exploration and the fact that geologic strata dip to the north-east, there is little to no potential for mining activities to affect these water rights.

Water rights west of Mud Creek follow a similar impact potential since they are 1) hydrologically disconnected from surface sources, and 2) geologically disconnected from the coal seam and overlying strata.

Water rights a28898 and E1934 (see Exhibit 3.7.2.5-1, Water Rights), both located approximately 2 miles to the north near the mouth of Miller Canyon, are domestic and irrigation ground water rights that have either been changed or exchanged from surface water sources. The volume of water allowed to be diverted under the rights are 2.0 and 20.0 acre-feet respectively. No impact to these water rights is anticipated since 1) the ground water would be withdrawn adjacent to Scofield Reservoir at relatively shallow depths, 2) the rights are located north of planned mined areas, 3) the coal seams to be mined are relatively dry and are located hydrologically above the water right areas.

3.7.2.6 Ground Water/Surface Water Interactions

Ground water/surface water interactions in the permit area are controlled by stratigraphy, lithology, localized topography, and climatic conditions, which affect recharge, subsurface flow paths and direction, and discharge areas.

In many cases, shallow perched ground water discharges as springs or seeps to the small tributary surface drainages both from outcrop exposures on exposed slopes above the drainages and from stratigraphic exposures within the drainage channels. Discharge of perched ground water to the surface drainage system occurs most frequently where flat lying, relatively low permeable, and consequent low infiltration stratigraphic units are found.

Significant alluvial/colluvial deposits, particularly in the flatter reaches of area drainages, form localized ground water storage systems which may or may not be laterally continuous

along the length of the drainage depending on localized conditions. During periods of high runoff, the alluvial/colluvial deposits are recharged. As surface flows recede, limited stored ground water may discharge to the surface system extending the period of active surface flow. Residual ground water storage in the alluvial/colluvial system may be retained, may serve as a source of recharge to more permeable exposed bedrock units, or may be depleted through normal evapo-transpiration during extended dry periods.

3.7.2.7 Ground Water Summary

Ground water resources in the permit and adjacent areas are limited in both extent and quantity. Ground water occurrences are limited to: shallow alluvial/colluvial valley-fill deposits in local drainages; perched ground water in thin, laterally discontinuous geologic units; ground water accumulated over time in lower underground mine workings; and, the regional aquifer consisting of deeper units in the Blackhawk Formation extending into the underlying Star Point and Mancos Formations.

Ground water movement is limited by low transmissivities, the lack of significant secondary permeabilities, and limited recharge in outcrop zones. It is likely that ground water has gradually accumulated over time in the down-dip workings of abandoned and sealed mines underlying the Hiawatha Coal seam, resulting in potentially significant volumes of water. Mine inflows are minimal.

3.7.3 Surface Water Information

Surface water in the permit and adjacent areas is limited to Scofield Reservoir, perennial flows within Mud Creek, Miller and Long Canyon, and ephemeral flows from various side tributaries. Flows have been quantified by analysis of water quality and quantity characteristics, historic flow and quality data for Mud Creek, Miller Canyon (Miller Outlet), Scofield Reservoir, Angle Spring, Eagle Spring, and Sulfur Spring. Some flow data is able provided for seeps and springs identified in the Seep and Spring survey completed in 2006. The evaluation of surface water involved the collection of surface water data in the permit and adjacent areas and an assessment of regional hydrologic information from adjacent areas. Raw data have been reduced by standard scientific methods to develop interpretations and reach conclusions presented in this section.

3.7.3.1 Surface Water Environment

As discussed in the ground water section (Section 3.7.2), both surface and ground water hydrologic features and regimes within the permit and adjacent areas are reflective of and strongly influenced by geologic structure, stratigraphy, lithology, and localized topography and climatic conditions. Map 3.7.1.3-1, Regional Hydrology and Map 3.7.2.4-1, Regional Water Quality display surface topography and watersheds in the permit area.

The climate in the proposed lease area and adjacent areas is arid to semi-arid. Table 3.7.4.1-1, Summary of Temperature Data, Table 3.7.4.2-1, Summary of Precipitation Data – Scofield Dam, and Table 3.7.7-3, Summary of Wind Data – Price, Utah provide data believed

to be representative to the mine site. Wind data provided was the closest found to the project site.

According to the data, the area has an average annual precipitation of 14.56 inches. Average monthly precipitation ranges from 0.90 inches in June to 1.65 inches in January. Most of the precipitation falling as snowfall occurs during November, December, January, February, March and April, although it often falls in October and May, and sometimes in June. Like many areas within the State, precipitation falling as rainfall, commonly occurs in response to high-intensity short-duration storms of limited aerial extent (Butler and Marsell, 1972).

Temperatures in the proposed permit area are seasonal, with the high mean monthly temperature occurring in July and the low mean monthly temperature occurring in February. Evaporation and infiltration rates in the proposed lease and adjacent areas vary with vegetation, soil type, and time of year. The average annual potential evaporation in central Utah is 40 inches per year (Geraghty, et al., 1973).

The permit area is located near the north end of the Wasatch Plateau, which is an uplifted N-S elongated geomorphic feature extending over more than 60 miles in Central Utah. The Wasatch Plateau forms the transition zone between the Basin and Range and Colorado Plateau Structural Provinces. The Uintah Basin structural element also affects this northern end of the Wasatch Plateau, causing the northward "regional dip" of the beds in the area.
Generally, the topography in the area is fairly mountainous with shallow narrow valleys and side channel tributaries. The mountainous terrain combined with climate influence the surface drainage configuration and flow characteristics. Most drainage channels contain no flowing water except during snowmelt and/or precipitation events. Rapid runoff from snowmelt and thunderstorm precipitation often cause relatively brief, high velocity flows in the smaller drainages, and significant flow variation in the larger drainages.

Velocities in Mud Creed measured since May of 2005 have varied between 11.0 and 131.1 cfs. Measured stream flows in Miller Canyon to the north range from 0.0 during winter months when the stream is frozen to 1.21 cfs which occurred on April 26, 2005.

3.7.3.2 Drainages and Surface Water Bodies

Drainages - The permit and adjacent areas fall within the upper Price River drainage basin. Miller Canyon and Mud Creek are the major perennial streams in the area adjacent to the mine site. These water sources are tributary to Scofield Reservoir, which is the source of headwaters for Price River. Minor perennial streams drain watersheds adjacent to the proposed permit area including several small intermittent and ephemeral tributaries are located within and adjacent to the permit area, including UP Canyon to the south and Eagle Canyon to the north. The majority of the smaller drainages exhibit an ephemeral flow pattern with sustained flows only in response to spring snowmelt and major thunderstorms. All or portions of the following named drainages fall within a two-mile radius of the permit area. Drainage west of Pleasant Valley as well as Mud Creek are hydraulically disconnected to potential impacts from potential mining activities.

Perennial	Ephemeral
Drainages East of Pleasant Valley	

Mud Creek	Eagle Canyon
Miller / Long Canyon	UP Canyon
Drainage West of Pleasant Valley	
Bear Canyon Creek	Number Four Gulch
Fish Creek	Tucker Canyon
Green Canyon	Woods Canyon
Winter Quarters Canyon	Winter Quarters

General basin characteristics are rolling uplands and open parks above the Price River Canyon, with vegetation communities of sagebrush/grasslands and mixed coniferous/aspen forests.

Mud Creek where it enters Scofield Reservoir drains an area of approximately 42 square miles. The headwaters lie approximately 9 miles south of the proposed lease area. Elevations range from approximately 10,394 feet to 7,612 feet at its confluence with Scofield Reservoir. Mud Creek, having a length of 11.2 miles is the only major tributary to Scofield Reservoir within the vicinity of the proposed permit area.

The general local basin topography can be characterized as moderately steep mountain lands with narrow valleys having a mixed vegetation consisting of pinion, quaking aspen, and sagebrush vegetative mixes. Stream flow from local intermittent/ephemeral drainages is commonly very low.

Surface Water Bodies – Scofield Reservoir, a man-made reservoirs is not located within the permit area, but is located a short distance to the north west. Several very small stock-watering ponds and beaver dams were however, identified in the Seep and Spring Survey, basically located within the small canyon drainages to the east, including Eagle and Long Canyons. As is typical of the region, stock ponds are commonly associated with local springs.

The sedimentation structure planned for the Kinney No. 2 Mine surface facility will exist solely for the containment and retention of disturbed area runoff to allow for settling of suspended solids prior to release and discharge to natural drainages. The active sedimentation pond will be monitored on a regular basis to verify compliance with all applicable regulatory provisions and effluent discharge limitations. Because the sediment pond will be utilized solely for temporary retention of stormwater runoff, no water rights or beneficial uses are associated with it. Water rights associated with springs and/or stock ponds are provided in Exhibit 3.7.2.5-1, Water Rights.

Perennial Streams - As previously described under the sub-heading "Drainages", the perennial streams in the permit and adjacent areas include Mud Creek, and Long/Miller Canyons. All other area drainages are characterized by intermittent or ephemeral flow patterns. In the vicinity of the permit area, the floodplain areas of the perennial streams have experienced only limited disturbance. Disturbance along Mud Creek is mostly confined to areas through the Town of Scofield, and very minor disturbance in grazing areas along the creek. Flood plain disturbance within Long and Miller Canyons appears to be basically limited to small road and ranch property zones within the lower reaches of Miller Canyon, and stock watering ponds within the reaches of Long Canyon.

Based on available information, some floodplain areas in the immediate vicinity and downstream of Scofield, Utah have a limited history of irrigation or farming. These small areas bordering Mud Creek are shown on aerial photography easily visible on aerial photography to be west of the proposed permit area and Highway 96. Small irrigated areas are also visible on photography in the vicinity of the ranch house located within Miller Canyon downstream of the confluence of Miller and Long Canyons.

According to the Utah Division of Water Quality, surface water sources including Mud Creek and Scofield Reservoir have stream classifications of 1C, 2B, 3A and 4 in the areas adjacent to the proposed lease area. Definitions of each classification are:

- 1C – Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
- 2B – Protected for secondary contact recreation such as boating, wading, or similar uses.
- 3A – Protected for cold water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
- 4 – Protected for agricultural uses including irrigation of crops and stock watering.

These drainage classifications indicate that the Scofield Reservoir and associated tributaries are designated for culinary use when treated, recreation, as cold water non-game fish habitat, and irrigation and stock watering with no associated natural resource waters restrictions other than applicable effluent standards for discharges.

3.7.3.3 Surface Water Occurrence

Significant runoff characteristics relative to both definition of baseline condition and evaluation of any potential mining related impacts include, peak flow rate, low flow rate, mean annual discharge rate, and any seasonal variations in flow. These runoff parameters will be defined through baseline monitoring for individual drainages at approved monitoring stations.

Mean annual discharge for Mud Creek, as measured from 1978-2007 at USGS station 09310700, Mid CRK BL WINTER QUARTERSCYN @ SCOFIELD, UT, is 16.9 cfs (12,260 ac-ft/yr). This station is located on Mud Creek just south of the town of Scofield, Utah and approximately 0.75 miles southwest of the proposed mine portals. A plot of USGS data is shown in Figure 3.7.3.3-1 Mud Creek Flows.

No historic monitoring information is available for the named and unnamed minor area drainages, most of which are dry over much of the year. In May 2005, in conjunction with development of the Kinney No. 2 Mine Project, Carbon Resources (CR) began monitoring Scofield Reservoir, Mud Creek, and Miller Canyon, the three major surface water sources in the mine vicinity. Ongoing monitoring will supplement existing data and provide a basis for definition of existing hydrologic baseline conditions. Surface water monitoring locations are shown on Map 3.7.2.4-1, Regional Water Quality.

The available data indicate the surface hydrology is typical of high-mountain headwater watersheds with a pronounced seasonal variation in the flow regime. Stream flow in Mud Creek, Miller Canyon, and Long Canyon typically peaks with snowmelt in late spring/early

summer. Unnamed drainages also have a potential for snowmelt runoff, especially during the spring period when rapid increases in air temperatures are experienced. Low flows in perennial streams occur during late fall and winter months. Field data collected from Miller Canyon are shown along with other surface and spring data in Figure 3.7.3.3-2 Flow Data. During the "non frozen" period of record, high and low flows of 545 gpm (1.21 cfs) and 18 gpm (0.04 cfs) were recorded at the Miller Outlet station.

The Mud Creek data shows, and the Miller Outlet data suggest that flows within local drainages also respond to local precipitation events. Rapid runoff resulting from short-duration high-intensity precipitation events will cause relatively brief, high velocity flows. Most of the local intermittent/ephemeral drainage channels contain flowing water only during rapid snowmelt or precipitation events. The steep slopes and numerous deep, narrow, drainages contribute to a storm-event driven flow regime.

3.7.3.4 Surface Water Quality

The water monitoring program initiated in 2005 under the Utah coal program and Carbon Resource's ongoing monitoring activities provide relevant water quality information for the permit area. Generally, the objectives of surface water quality monitoring have included; 1) Definition of baseline water quality conditions; 2) Identification of any seasonal variations in water quality and correlation to flow levels; and 3) Identification of any mining related changes in surface water quality. Water monitoring activities for surface drainages have typically included measurement of flow and field parameters (temperature, pH, electrical conductivity, and dissolved oxygen) and collection of water samples for laboratory analyses.

Both field activities and laboratory analyses have been conducted according to standard protocol as defined by applicable regulations, guidelines, and technical standards, and water samples have been analyzed for specific parameters as defined by the regulatory authority. Water quality analysis and testing requirements are reflected in Table 4.7.2.3-1, Monitoring Schedule.

General Water Quality Characteristics

The chemical characteristics of surface water, based on major ion chemistry, are displayed on Map 3.7.2.4-1, Regional Water Quality. Surface waters are generally of a calcium-bicarbonate chemical type, although Mud creek shows higher portions of sodium, potassium, and sulfate than does Scofield Reservoir or Miller Outlet. Angle Spring, Sulfur spring, and well CR-06-03-ABV are also found to typically be of a calcium-bicarbonate type, and to have higher concentrations than surface water sources. However, Eagle Spring, is very different than other local sources having very low concentrations of basic anions-cations and being of a higher quality.

Surface water quality is summarized in Table 3.7.2.4-1, Surface and Ground Water Quality Summary, and in Exhibit 3.7.2.2-2, Surface and Ground Water Field Measurements. The following discussions summarize important information relative to existing surface water conditions in the proposed permit area.

pH - Measured pH values range from 4.36 to 8.28 for local springs, from 6.67 to 10.16 for surface sources, and from 6.87 to 7.28 from well CR-06-03-ABV. The low pH values noted

were collected from Sulfur and Angle Springs. With the exception of these two springs, pH levels generally indicate a neutral to moderately alkaline condition. High pH values are relatively common in the arid western United States and are reflective of the geochemistry of the dominant stratigraphic units. It is believed that mining will show no impact on local pH data due to hydrologic considerations discussed within this permit.

Sulfate – A natural sulfur spring is located near the north end of the permit area adjacent to Highway 96. However, average sulfate levels of 43 in this spring are not significantly higher than those found within well CR-06-03-ABV, Miller Outlet, or Scofield Reservoir that average 36, 26, and 47 respectively. Mud Creek with an average value of 169 is clearly distinct from other samples taken and is likely impacted by upstream sources.

Total Dissolved Solids – With one exception, observed high TDS values are relatively consistent within the samples taken, ranging between 226 mg/l in Scofield Reservoir to 489 mg/l in Mud Creek. The exception is in Eagle spring, which has a distinctly different water source with an average recorded TDS of 137 mg/l.

Total Suspended Solids - Given the topography and climate of the area, moderately high TSS values may normally be expected during spring runoff and following major thunderstorms. Steep natural slopes and channel gradients combined with short duration, high-intensity flows resulting from snowmelt and major thunderstorms can result in significant surface erosion and sediment transport. TSS variations at the sample points indicates site specific conditions which contribute to erosion and soil movement. Angle Spring and Scofield Reservoir have very low TSS values as would be anticipated. Although Mud Creek has an average value of 44, the recorded peak value of 128 for Miller Outlet shows the potential for high TSS values which likely resulted from a short duration, high-intensity rainfall event.

Temporal and Spatial Water Quality Characteristics

Figure 3.7.3.4-1; Basic Water Quality, plots pH, Conductivity, TDS and Sulfate data over time for each monitored station. The plots help identify the presence, or lack of, annual cycles or trends. Observations made from the data plots follows:

Miller Outlet	-No annual or seasonal cycle identified.
Eagle Spring	-Insufficient data available for analysis
Sulfur Spring	-No annual or seasonal cycle identified.
Angle Spring	-No annual or seasonal cycle identified.
Mud Creek	-A slight decrease in Conductivity and TDS appears to exist in the June period of each year with highest values occurring during the winter months of November through January. Sulfate values may be lowest in the spring – early summer time period, and highest in the November through January winter months.
Res-1	-Although a complete record of data is not available for this site during winter months, Conductivity, TDS, and Sulfate appear to reach annual lows during the summer period.

Surface water quality variation plots versus flow for pH, Conductivity, TDS and Sulfate are shown for sampled locations on Figure 3.7.3.4-2, Water Quality vs Flow. A unilateral clear

and distinct pattern showing variation in quality versus flow in all stations is not apparent. A review of the figures does show what we believe to be improved water quality with increasing flow or storage volume for both Mud Creek and Scofield Reservoir for Conductivity, TDS and Sulfate. Decreased values for Conductivity and TDS may also be indicating some possible water quality improvement with increasing flow for Miller Outlet and Angle Spring although the trends are not as apparent. These water quality improvements with increased flow or volume are believed to result from high flow dilution of existing water quality bases.

As discussed earlier, water quality parameters are relatively consistent for the sites monitored with two basic exceptions, Eagle Spring which has very good water quality, and Mud Creek which has significantly higher values of TDS and Sulfate than other surface or spring sources. Surface waters associated with Miller Outlet for example have TDS and Sulfate values that are on the order of 200 - 400 mg/l and 20 - 35 mg/l respectively. Mud Creek TDS and Sulfate values generally range between 350 – 700 mg/l and 100 – 250 mg/l respectively, a 175% increase over Miller Outlet for TDS, and a 500 to 700% increase for Sulfate.

3.7.3.5 Surface Water Rights and Use

Surface water rights within a 4 mile radius of the central mine area are shown on Figure 3.7.3.5-1, Surface Water Right Locations, and listed in Table 3.7.3.5-1, Surface Water Rights. Since the mine is projected to be dry, and is not anticipated to have a mine discharge, there are no anticipated additive effects upon the local surface waters. In a similar manner, no impacts are believed possible to surface waters located within or west of Pleasant Valley and Mud Creek since surface drainages are discontinuous east and west of the valley.

3.7.3.6 Surface Water/Ground Water Interactions

With the exception of the lowermost portions of Mud Creek, which is a gaining system due to sub-flow from the associated alluvial/colluvial deposits and contributions from tributary drainages, most of the drainages in the permit areas are believed to be losing systems.

Due to the geologic complexity of the area and significant local variations in topography, geology, and associated recharge conditions, any given drainage may exhibit gaining or losing characteristics over various portions of its drainage length. Recent monitoring indicates that most, if not all, of the surface water discharge from springs and seeps in the upper portions of the smaller drainages is lost to localized ground water storage, ground water recharge, and/or evapo-transpiration resulting in a net surface flow loss over the drainage length.

Discharge to the area stream systems occurs from the alluvial/colluvial aquifer system and from springs and seeps in the upper reaches of the drainages. Alluvial/colluvial deposits are recharged during periods of high stream runoff and later discharge stored water to the stream systems, extending the period of active stream flow. Springs and seeps contribute

flow to local tributaries on a seasonal basis or intermittently in delayed response to local recharge.

3.7.3.7 Surface Water Summary

Other than Mud Creek and Scofield Reservoir, surface water resources in the area adjacent to the proposed permit are limited. The principle perennial streams located within or adjacent to the permit area boundary include: 1) Mud Creek, the dominant drainage, and 2) Miller Canyon, both of which drain directly into Scofield Reservoir. Mud Creek drains areas not tributary to lands included within the permit area. Miller Canyon drains tributaries overlying future mining zones within Long Canyon. Limited intermittent and ephemeral channels also drain the area, many of which normally exhibit short term continuous flow in response to spring snowmelt and/or high intensity thunderstorms.

Presently, beneficial surface water use in the area includes domestic water supply, secondary recreations uses, cold water fame fish and aquatic life, and agriculture. As discussed in Section 3.7.3.2, Drainages and Surface Water Bodies, streams are classified as either 1C, "protected for domestic purposes with prior treatment by complete treatment processes", 3A, "protected for cold water species of fish and other cold water aquatic life", or 3C, "protected for non-game fish, and other aquatic life". 1C, Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water, 2B, Protected for secondary contact recreation such as boating, wading, or similar uses, 3A, Protected for cold water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain, and 4, Protected for agricultural uses including irrigation of crops and stock watering.

Although water quality is relatively consistent for monitored sources, some variation is noted to exist as a result of the composition of contributing water, and the flow regime, especially within Mud Creek where the source includes disturbed upstream areas. Overall, surface water conditions are typical of arid regions of the western United States and seasonal or storm-event peak flows tend to dilute geochemical constituent concentrations. However, during low-flow periods, constituent concentrations of surface waters tend to increase. For those constituents that appear to show elevated levels, it is reasonable to assume the elevated levels are a result of natural sources and the processes of weathering, oxidation, erosion, evaporative concentration and sediment transport.

3.7.4 Climatological Information

The general mine permit and surrounding area is characteristic of rugged terrain with significant elevation differences result in some natural variation in climatic conditions. Generally, temperatures are lower on the exposed high plateaus and upper slopes when compared with lower slope and valley areas. Temperature differences are usually pronounced between upper slopes with southern exposures, and deep valleys which can trap and hold cold air masses due to inversions during the winter. Local variations in precipitation amounts may be pronounced dependent on topography, exposure, and the direction of prevailing winds. Exposure may result in higher wind velocities on plateau and ridgeline areas when compared with more sheltered slope, basin, and valley areas,

although natural down-valley airflow patterns can result in localized high winds in certain valley areas.

The closest SNOTEL meteorological reporting stations were identified as Clear Creek #1, Clear Creek #2, Scofield Dam, and Price, Utah. The Clear Creek and Scofield Dam sites provided temperature, precipitation and snowfall data, and the Price, Utah site provided wind direction data. Climatic characterization of the permit area is based on historical climate data from these stations and general regional climatic information. Generally, the climate of the Project area is temperate with summer high temperatures in the range from 75° to 80°F (24° to 27°C) and winter lows from 0° to -5°F (-17° to -21°C). Annual average precipitation in the area is on the order of 14.6 inches.

The summer high temperature recorded at the Clear Creek #1 SNOTEL site between 1989 and 2006 was 90°F (32°C). The winter low during the same time period was -22°F (-30°C). Monthly mean, maximum and minimum data are shown in Table 3.7.4.1-1, Summary of Temperature Data.

3.7.4.1 Temperature

Temperatures in the area normally reflect a typical seasonal pattern with gradual warming beginning in mid to late-March, high seasonal temperatures in July and early August, a gradual cooling beginning in late August to early September, and seasonal lows in late-December through mid-February. Although recorded high and low temperatures of 90°F (32°C) and -22°F (-30°C) were recorded at the Clear Creek #1 station, the average high and low temperatures for the area are believed to be on the order of 77.7°F (25.4°C) and -1.4°F (-18.6°C) respectively as shown for the Scofield Dam station. The average frost-free period in this area ranges from approximately 60 to 120 days dependent primarily on elevation and exposure. Due to fast-moving storm fronts, wide temperature variances can occur over a relative short period of time. A summary of SNOTEL climatic data is provided in Table 3.7.4.1-1, Summary of Temperature Data.

3.7.4.2 Precipitation

Given a low average annual precipitation of only 14.56 inches, the permit area is classified as semi-arid. The majority of the precipitation received in the area occurs a snowfall during the months of December, January, February, and March. Rainfall typically occurs in the form of brief, high-intensity thunderstorms with most thunderstorm activity occurring during late summer and early fall, peaking in August. Monthly average precipitation ranges from 0.90 inches (June) to 1.65 inches (January) and the high average monthly snowfall is 26.2 inches (December). Average monthly precipitation and snowfall for the SNOTEL site located at Scofield Dam are summarized by Table 3.7.4.2-1, Summary of Precipitation Data. While a significant portion of the annual precipitation is captured in Scofield Reservoir (located immediately downstream and to the north of the permit area), some water is lost to evapotranspiration, sublimation, and local ground water recharge.

3.7.4.3 Wind

Data is provided in Table 3.7.7-3, Summary of Wind Data - Price, Utah, for the closest wind SNOTEL monitoring site located near Price, Utah. As can be seen in the data, wind speeds average 6.8 mph with average highs and lows of 8.5 and 5.1 mph occurring in April and January respectively. For this station winds are generally out of the north.

General regional information taken from the Willow Creek permit indicates that prevailing winds are from the west and northwest with average wind velocities generally not exceeding 20 miles per hour. During the winter the prevailing wind direction can shift for extended periods, blowing predominantly from the northeast.

Locally, surface air movements are strongly affected by natural drainage patterns and daily temperature variations. As local air masses cool at night, the denser, cool air flows down valleys and other natural drainage channels. Generally, the winds associated with this downslope movement are low to moderate, however, if the drainage alignment is the same as the prevailing wind direction or if the natural topography tends to concentrate natural air movement, moderate to strong downslope winds and high-intensity gusts may result. As natural warming occurs during the morning and early afternoon, warm air masses begin to move up-valley. Differential heating and upper level winds tend to have a greater impact on the upward air movements resulting in greater mixing and instability with resultant variable winds and greater potential for gusty conditions.

3.7.5 Renewable Resource Lands

The regulatory definition for "Renewable Resource Lands" includes geographic areas which are important in supporting and maintaining water supplies and areas which contribute significantly to agricultural production. The water supply component of this definition specifically includes those areas containing ground water aquifers and associated recharge areas.

While there are known, but limited, ground water occurrences within the permit and adjacent areas, none of the identified aquifers are important water supply sources. In general, the sparse vegetation, geologic stratification, and semi-arid climate combine to limit ground water infiltration, with either runoff or evaporation/transpiration accounting for most of the precipitation received. Based on this and test drilling data, we conclude that the area does not provide significant recharge to any regional ground water aquifer. The most important local feature is the areas importance as a watershed for local surface drainages. The are no known significant historical nor recent agricultural activity within the permit or adjacent areas and the USDA-SCS has issued a negative determination for prime farmlands for the area as discussed and documented in Section 3.1.3, Prime Farmlands.

3.7.5.1 Occurrence of Aquifers and Recharge Areas within the Permit and Adjacent Area

As previously noted in Section 3.7.2.2, only limited ground water exists within the permit and adjacent areas, and is mostly limited to the alluvial/colluvial deposits associated with area

drainages. Some water may also be found within localized perched ground water system within the stratigraphic sequence, and as stored water in adjacent abandoned underground mine workings, and within shallow unconfined water table aquifers associated with small drainages. These ground water occurrences, especially within the proposed permit area are not significant as water supplies due to the limited regional continuity of the associated units, low overall permeabilities, limited recharge and, in the case of the water table aquifer, relative depth and lack of confinement. Surface water sources, dominated by Mud Creek, provide a much more consistent and reliable water supply source.

While some ground water recharge undoubtedly occurs within the permit and adjacent areas, recharge is limited both by the factors noted above and by the low overall permeability of the stratigraphic sequence which effectively limits significant vertical ground water movement. On a regional basis, recharge is believed to occur through isolated outcrop areas where permeable units are exposed to direct precipitation, near-surface infiltration, or direct contact with the alluvial/colluvial aquifer system.

3.7.5.2 Potential for Disruption of Aquifers or Changes in Recharge Relationships Due to Subsidence

Given the general absence of both aquifers within the permit or adjacent areas which can be characterized as significant water supplies and significant recharge areas, the potential for adverse water supply impacts due to mining related subsidence is negligible. Mining may result in drainage of small perched ground water occurrences and localized increases in mine water storage, however, the depth of mining, limited coal seam thickness and specific mine design which calls for first mining only provides effective protection for area drainages and associated alluvial/colluvial aquifer systems.

3.7.6 Evaluation of Potential Impacts on Alluvial Valley Floors

While limited areas downstream from the study area contain resource values consistent with the AVF criteria, present and future mining activities will not change the status or condition of the geology, soils, or water resources associated with these areas. It is further believed that mining will not interrupt or cause significant diminution of surface or ground water flows.

3.7.7 Cumulative Impact Area Information

Generally, the surface disturbance associated with the mining operations will involve such a small area that the overall impact on surface water resources will be negligible. Any potential surface water impacts which may result from mining and related activities will also be effectively mitigated by a comprehensive drainage and sediment control plan and controlled discharge under specific effluent limitations and permit requirements of the mine UPDES Permit. Similarly, potential mining related ground water impacts will inherently be minimized by limited ground water occurrence and low overall permeabilities. While both mining related surface and ground water impacts are expected to be minimal, a complete evaluation of potential hydrologic impacts must consider the larger area over which any

mine related impacts could combine with other unrelated environmental impacts to produce a cumulative adverse impact.

3.7.7.1 Definition of Cumulative Impact Area

In order to evaluate the potential cumulative hydrologic impacts which could result from the proposed mining activities in combination with other unrelated activities, it is necessary to define a cumulative impact area and identify other activities which may contribute to any cumulative impacts within that area.

3.7.7.2 Relationship of Proposed Permit Area Ground Water to Cumulative Impact Area Ground Water System

For potential ground water impacts, the cumulative impact area includes the permit area along with any upgradient areas which could be impacted by mining related drawdown and downgradient areas which could be impacted by any mining related changes in ground water flow volumes or ground water quality. Given the characteristic low permeability of the geologic sequence, the limited volume and flow of ground water, and the consistently flat dip of the geologic units to the northeast, the ground water cumulative impact area can reasonably be defined by Mud Creek on the west, Miller Canyon to the north, Long Canyon to the east, and the headwaters of UP Canyon on the south. Other activities which could result in possible contributing ground water impacts within this area are believed to be limited to contributions from existing abandoned underground mine workings.

Any drawdown of perched aquifers would occur either immediately above the underground mine workings or within the limits of subsidence, both of which are believed to be encompassed within the permit area boundary. Given the unconfined nature, overall low permeability, and limited storage and flow volume of the regional aquifer within mined zones, potential mining related drawdown is expected to be negligible. Interruption of groundwater flows should be minimal to non-existent based on the general lack of water encountered during exploratory activities associated with this mine permit. No known potential upgradient effects are projected for the direct permit area since 1) bedrock dips to the east-northeast with no upgradient source beyond the surface mine facilities themselves, and 2) potential mine impacted surface waters associated with Mud Creek flow west of the permit area and will bypass the mine without direct contact or impact.

Any potential downgradient mining related ground water impacts would be most pronounced within and immediately adjacent to the actual area of underground mining disturbance with these impacts becoming less pronounced with increasing distance from the impact source due to the effects of ground water contributions from adjacent areas and consequent mixing, dispersion, and dilution. The area which would be affected by the mining activities is relatively small when compared with the overall regional ground water basin and low permeability combined with relatively flat gradients will effectively limit downgradient ground water movement. Water quality should not be affected as a result of mine development because the existing stored mine water as well as water which will accumulate in new mine workings is regional groundwater. Potential downgradient mining related ground water impacts would, therefore, be confined to a relatively limited

downgradient area which is expected to fall within the cumulative impact area as defined above.

3.7.8 Hydrologic Modeling Methodology

This section presents the climatological information and methodology used in performing a hydrologic analysis to determine runoff volumes and peak runoff discharges which were used in designing the sediment pond, drainage ditches, conveyance/by-pass culverts, and reclamation channel.

3.7.8.1 Runoff Calculations

Discharge Rate Calculations

There are no streams that traverse the permit area. Three perennial streams however are located within ¾ to 2 1/5 miles which are tributary to Scofield Reservoir. Mud Creek is the largest and is located within the central valley area west of the proposed permit area and Long and Miller Canyons are located ¾ and 2 1/3 miles to the east. Smaller local drainages exhibit intermittent flow in response to spring snowmelt and high intensity thunderstorms. These drainages do not contribute significant quantities, or yields of stream flow to Mud Creek or Scofield Reservoir.

The USGS monitors stream flow in the area at the Mud Creek below Winter Quarters Canyon @ Scofield (USGS Station 09310700). This monitoring station is immediately downstream of the confluence of Winter Quarters Canyon and Mud Creek.

Mud Creek is the only perennial stream potentially directly tributary to the mine permit area. It is however more likely that permit area discharges will enter Scofield Reservoir directly and will not enter Mud Creek itself. Long and Miller Canyons enter Scofield Reservoir approximately 1.6 miles north of the mine site.

Flows within Miller Canyon, to which Long Canyon is tributary, and from Sulphur Spring are measured in the field utilizing flow area and velocity calculations.

All other surface water discharge rates used for ditches, culverts and the pond are calculated using standard runoff prediction modeling which utilizes the SCS Curve Number method.

Volume Calculations

Surface water volume determinations used within in the permit area for the design of the sediment pond utilizes the SCS Curve Number procedure mentioned above for flow calculations, and is reported in ac-ft/year.

3.7.8.2 Climatological Information

Precipitation depths were obtained from the Point Precipitation Frequency Estimates from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 found on the NOAA website (http://hdsc.nws.noaa.gov/hdsc/pfds). This site calculates rainfall depths at various durations and return frequencies for a given location and elevation. Estimates are based on annual precipitation data from over 300 stations in Utah and over 2,000 stations in the semiarid southwest. The design rainstorm depths were taken from the NOAA website at a location approximately near the center of the proposed mine site. The design rainfall depths used in the hydrologic analysis are shown in Table 3.7.8.2-1, Design Rainfall Depths.

3.7.8.3 Modeling Methodology

There are two ephemeral drainages located at the north and south ends of the mine permit area with no perennial drainages. These two drainages currently are conveyed under Highway 96. The south drainage will be conveyed by way of culvert UDC-1 through the mining area and under Highway 96. The north drainage will also be culverted to bypass the proposed roads and ditches without effecting the mine permit area via culvert UDC-2. Storm drainage runoff from the remaining permit area, with exception of a small area south of the main mine access road and east of Highway 96, will be captured and conveyed to a sediment pond by way a drainage collection system consisting of a series of ditches and culverts. Runoff from the small area south of the entrance will be managed using alternate sediment control methods with revegetation and silt fencing and/or straw bales. The runoff conveyance plan is shown in Map 4.7.2.1-2, Drainage and Sediment Control Plan – Disturbed Drainage Areas.

In order to design the collection system ditches and culverts, hydrographs and peak runoff flows were determined. The hydrology for the mine permit area was modeled with Hydrologic Modeling Software (HEC-HMS) 3.1.0 developed by the Army Corps of Engineers using the Soil Conservation Service (SCS) curve number loss method and the SCS unit hydrograph transform method. The SCS Type II rainfall distribution was used in analyzing the storm drainage runoff which was developed by the Natural Resources Conservation Service (NRCS) for 24 hour rainfall events. A modified SCS Type II 6-hour distribution was also developed by the Soil Conservation Service and is provided in the SCS National Engineering Handbook-4 (NEH-4).

Drainage basins (also referred to as watersheds or catchments) were delineated in AutoCAD using existing and proposed elevation contour data and the location of proposed pads and storm drainage facilities. A drainage basin is an area where all rainfall or snowmelt runoff within it will collect to a common point. Each drainage basin includes one or a combination of the following three land types: hard surface pad area revegetated graded area, and natural undisturbed area.

Each basin was assigned an SCS (Soil Conservation Service) curve number. The curve number is a function of vegetative cover, hydrologic soil groups, and Antecedent Moisture Conditions (AMC). Curve numbers range from 0 to 100. Areas with high runoff rates have high curve numbers. Areas that are more pervious have lower curve numbers. Area-

weighted curve numbers for each drainage basin were estimated by delineating the area of the three land types within each drainage basin and using curve numbers for the three land types obtained from the SCS NEH-4 which are 90 for the hard surface pads (C soil, hard surface, AMCII), 82 for the revegetated graded area (C soil, 10% ground cover density, AMCII condition), and 75 for the natural undisturbed area (C soil, 20% ground cover density, AMCII condition).

Drainage basins were modeled in HEC-HMS using the SCS unit hydrograph transform method which requires a lag time t_L for each basin. Lag time is described as the time from the center of mass of rainfall excess to the peak of the runoff hydrograph. According to the SCS, the watershed lag time is equal to 0.6* t_c (Time of concentration). The time of concentration t_c, (not is defined as the time required for flow from the hydraulically most remote point in a basin to reach the basin outlet. Times of concentration and lag times were calculated for each basin within the mine permit area using the method described in SCS Technical Report-55 (TR-55) which takes into account sheet flow travel time, shallow concentrated flow travel time, and channel flow travel time. A lag time for the mountain watershed tributary to UDC-1 was estimated using the method described in the publication by M.J. Simas and R.H. Hawkins called "Lag time characteristics for small watersheds in the U.S." which takes into account width, slope, and curve number of the mountain drainage basin.

3.7.9 The Major Perennial Streams

Major perennial streams within 5 miles radius of the permit area include the Price River and Fish Creek, Mud Creek, Miller Canyon. Smaller drainages in the area exhibit an intermittent or ephemeral flow regime with sustained flows occurring only in response to spring snowmelt and high intensity thunderstorms. These drainages do not contribute significant quantities, or yields of stream flow to the Price River, except during high-intensity short-duration storm-generated events, and possibly during snowmelt runoff.

3.7.9.1 Potential Impacts on Surface and Ground Water Sources

The hydrogeologic characteristics of the coal-bearing Blackhawk and overlying formations will effectively limit the extent of impacts to the hydrologic system as a result of new mining. Therefore, impacts from the mines will be of local, as opposed to regional, significance. Potential impacts to the hydrologic resources are discussed further below.

Mining activities may result in the following potential localized, temporary effects on the surface and ground water environments:

Stream Flows and Surface Water Quality - Mine related surface development will result in removal of vegetation and soils, grading, paving and other surface alterations which may increase surface runoff and sediment transport from the disturbed areas. During construction, development, and active operations, runoff and sediment will be controlled through the use of temporary diversion and collection ditches, berms, sedimentation ponds, and appropriate alternative sediment control measures. Increased runoff amounts will be buffered to some extent by temporary containment in sedimentation ponds but some minor

temporary increases in discharge to stream reaches downgradient of surface disturbance areas is anticipated. Following completion of active operations, surface disturbance areas will be reclaimed with the objective of reestablishing baseline drainage conditions. Runoff and sediment control structures will remain in place until this objective is achieved.

The only site available for construction of the required mine facilities is a very limited area adjacent to and east of Highway 96. As a component of the overall mine development plan, CR proposes to convey one short segment of an un-named ephemeral drainage near the south end of the mine site beneath the mine surface facilities via the construction of a bypass culvert. The diversion will protect natural drainage flows upstream of the disturbed area, thus preventing or minimizing potential runoff degradation. Upon mine abandonment, the culvert will be removed, the area regraded, and the stream channel restored as closely as possible to current conditions within the constraints of site conditions and practical construction capabilities.

With the exception of the temporary conveyance of the un-named channel discussed above, underground mining activities are not expected to result in any impact on the alluvial/colluvial aquifer system. Recharge areas for the alluvial/colluvial system will not be affected, and CR plans to avoid full extraction under any of the local drainages. Underground mine development and mining operations may intercept perched aquifers, but are not expected to intersect the regional ground water system. Resulting impacts on stream flow are not anticipated since flow contributions from the perched ground water systems represent only very small flow potentials.

Surface runoff from mining related disturbance areas has the potential to impact surface water quality. As noted in the preceding section, surface runoff and associated sediment loading will be effectively addressed through operation of engineered drainage and sedimentation control structures and site reclamation. During active mining operations, the limited underground mine drainage encountered will be controlled using a network of sumps, transfer pumps and pipelines wherein the water will be pumped to abandoned mine areas. The surface discharge of mine water is not anticipated.

Given that the proposed mine workings will be down-dip from the mine portals, any upgradient workings will drain to the lower workings. History has also shown that there has been no direct surface discharge from inactive mine workings locally. Given the anticipated mining depth and configuration of the proposed mine workings, it is anticipated that the ultimate equilibrium water level in the mine workings (if any) will be below any potential mine discharge point.

There have been some indications in other local and regional mines that the interception and accumulation of ground water in underground mine workings limits percolation of the water through the underlying sediments, preventing further contact with underlying shales and resultant increases in TDS. Given this consideration, mine water accumulations and any associated lateral ground water movements through the geologic sequence to a surface discharge point may actually result in an overall enhancement of downgradient water quality. Since the coal seams dip to the northeast and become increasingly deep with no outcrops on the east side of the mining area, there is little or no potential for mine water to impact water users.

Ground Water Occurrence, Movement, Discharge, and Quality

Underground mine development and operations, and related surface disturbances are not expected to significantly impact ground water recharge areas given the limited extent of anticipated surface disturbance. There is also little to no potential for minor, localized, mining-related impacts on the alluvial/colluvial ground water system (as discussed previously), localized impacts on the perched ground water system, increases in the amount and areal extent of stored ground water, and limited short-term impacts on the regional ground water system.

Mine development entries may intercept limited water-bearing members of the perched ground water system. These activities could increase vertical permeability and result in localized drainage of perched ground water resources. However, given the limited thickness and areal extent, storage capacity, and transmissivity of most of the perched ground water occurrences, direct mining-related impacts resulting from interception by development or mine workings are anticipated to be very localized with relatively low flow rates and total flow volumes. Similarly, loss of ground water from the perched ground water system due to rock fracturing would be a localized phenomenon.

Development of mine workings and subsequent coal removal is not expected to directly impact the regional ground water system since a consistent water system has not been identified. If a regional system is however encountered during mining, the void spaces and resultant mine inflows created would provide for the accumulation of storage of ground water. Impacts on the regional ground water system in this case would be expected to include a localized, temporary, depression of the potentiometric surface and localized reduction of ground water volumes and flow rates in effected portions of the regional aquifer zone. As noted in the previous section, ground water accumulations are not expected to result in direct mine water discharges. Instead, under such conditions, gradual accumulations of ground water would reach an equilibrium point with the regional ground water system with no significant long-term effects.

The primary potential mining-related impact relative to ground water quality would be an increased oxidation potential in the void spaces resulting from mine development and coal extraction.

3.7.9.2 Alternative Water Sources

The surface mining activities are not expected to cause proximate contamination, diminution or interruption of any underground or surface source of water. As discussed previously, mining operations are not expected to have any significant adverse impacts on the prevailing hydrologic balance, existing water resource or water rights. Furthermore, the potential impacts of mining on ground water systems (dewatering of accumulated water, solute leaching, and solute transport) will not result in any measurable effect on surface water or ground water rights nor will the potential impacts of mining on surface water systems (increased runoff, erosion and sediment load, salt loading and changes in ion balance) cause measurable injury to surface water rights. In the unlikely event that proximate contamination, diminution, or interruption does occur, CR will acquire or purchase surface and or ground water rights or supplies from local sources including Scofield Reservoir to replace impacted water rights.

Table 3.7-1 Kinney Mine Baseline Monitoring Stations

Location	Type	5/2005	9/2005	10/2005	11/2005	12/2005	1/2006	2/2006	2/2006	3/2006	4/2006	5/2006	6/2006	7/2006	8/2006	9/2006	10/2006	11/2006	12/2006	1/2007	2/2007	3/2007	4/2007	5/2007	6/2007	7/2007
Angle Spring	Spr																									
CR-06-01	Well																									
CR-06-01-BLW	Well																									
CR-06-02	Well																									
CR-06-02-ABV	Well																									
CR-06-03	Well																									
CR-06-05-A	Well																									
CR-06-09	Well																									
CR-06-09-ABV	Well																									
CR-06-09-BLW	Well																									
Eagle Spring [1]	Spr																									
Miller Outlet [2]	Surf																									
Mud Creek [3]	Surf																									
Res–1 [4]	Surf																									
Sulfur Spring [5]	Spr																									

Water Quality Data Available
Water Level Data Available
Water Level and Quality Data Available

Table 3.7-2 - Kinney Mine Operational Monitoring Stations

Location	Type	5/2005	9/2005	10/2005	11/2005	12/2005	1/2006	2/2006	2/2006	3/2006	4/2006	5/2006	6/2006	7/2006	8/2006	9/2006	10/2006	11/2006	12/2006	1/2007	2/2007	3/2007	4/2007	5/2007	6/2007	7/2007
CR-06-01	Well																									
CR-06-01-BLW	Well																									
CR-06-02	Well																									
CR-06-02-ABV	Well																									
CR-06-05-A	Well																									
CR-06-09	Well																									
CR-06-09-ABV	Well																									
CR-06-09-BLW	Well																									
Eagle Spring [1]	Spr																									
Miller Outlet [2]	Surf																									
Mud Creek [3]	Surf																									
Res-1 [4]	Surf																									
Sulfur Spring [5]	Spr																									

1 – Some data herein may also refer to this sources as Miller Spring
2 – Some data herein may also refer to this source as Eagle Outlet or Eagle Outlook
3 – Some data herein may also refer to this source as Muddy Creek
4 – Some data herein may also refer to this source as Scofield Res-1
5 – Some data herein may also refer to this source as Sulfur Springs, Sulfer Spring, or Sulfer Springs

Water Quality / Well Level Data Available.
Water Level Data Available

Table 3.7.2.1-1 – Well Conditions as of 5/29/2007

Well	Bottom of Screen	Water Level	Depth above Blank Casing	Status
CR-06-01	7865.2	7853.8	-11.4	Dry
CR-06-01-BLW	7701.1	7708.8	7.7	With the exception of 1 month, water level has varied by only 0.4 feet
CR-06-02	7901.6	7898.5	-3.1	Dry
CR-06-02-ABV	8039.8	8036.0	-3.8	Dry
CR-06-03-ABV*	7646.0	7798.2	152.2	Ordered to be reclaimed by UDOGM
CR-06-05A	7747.9	7741.1	-6.8	Dry
CR-06-09-BLW	7802.9	7851.9	49.0	Water level has varied by only 1.7 feet over period of record
CR-06-09	7841.8	7860.7	18.9	Water level has varied by only 2.1 feet over period of record
CR-06-09-ABV	7945.3	7977.2	31.9	Water level has varied by only 2.2 feet over period of record

* - Last reading taken on 9/7/2006 due to a property owner access dispute.

Table 3.7.2.2-1. Seep and Spring Flow Summary

Spring	Location	Est. Flow (gpm)
Sulfur Spring	Adjacent to Highway 96	80 – Yr Round
Miller Spring	1 ¼ mile north of Sulfur Spring, east of Highway 96	1
UP Spring	South Fork, UP Canyon	Seep
Angle Spring	Eagle Canyon	0.5 – Yr Round
Eagle Seep 1		< 0.5
Eagle Seep 1A		< 0.5
Eagle Spring 2		Seep under pond
Eagle Seep 3		< 0.5
Long Canyon Seep 1 & 2	Long Canyon	Seep
Long Canyon Seep 3		
Long Canyon Spring 1		10
Long Canyon Spring 2		0.5
Long Canyon Spring 3		3
Long Canyon Spring 4		< 0.5
Long Canyon Spring 5 & 5A		5
Long Canyon Spring 6		10
Long Canyon Spring 7		7
Long Canyon Spring 8		20
Merrill Spring 1	Merrill Canyon	10
Luis Spring		10 - 15
Guzman Spring		0.5
Merrill Spring 2		10
Merrill Spring 4		5
Merrill Springs 5 & 5A		10
Merrill Spring 6		< 1
JC Spring 1	Jump Creek	10
JC Spring 2		5
JC Spring 3		< 1
JC Spring 4		< 1
JC Spring 5		< 1

Table 3.7.2.4-1. Surface and Ground Water Quality Summary

WATER QUALITY SUMMARY				
Angle Spring thru 9/27/2006				
Analyte	Count	Max	Min	Avg
Acidity	13	0.00	0.00	0.00
Alkalinity,(As CaCO3)	13	320.00	290.00	300.77
Aluminum	13	0.00	0.00	0.00
Ammonia (as N)	13	0.17	0.00	0.01
Arsenic	13	0.01	0.00	0.00
Bicarbonate (As CaCO3)	14	320.00	290.00	300.71
Boron	14	0.00	0.00	0.00
Cadmium	14	0.09	0.00	0.01
Calcium	14	100.00	90.00	97.07
Carbonate (As CaCO3)	14	0.00	0.00	0.00
Chloride	14	67.00	20.00	25.79
Copper	14	0.02	0.00	0.00
Conductivity	1	670.00	670.00	670.00
Hardness (as CaCO3)	14	340.00	220.00	317.86
Iron - Total	14	0.00	0.00	0.00
Iron - Diss	14	0.00	0.00	0.00
Lead	14	0.00	0.00	0.00
Magnesium	14	20.00	17.00	18.50
Manganese - Total	14	0.00	0.00	0.00
Manganese - Diss	14	0.01	0.00	0.00
Molybdenum	14	0.00	0.00	0.00
Nitrate (as N)	13	1.10	0.92	0.99
Nitrite (as N)	13	0.10	0.00	0.01
Oil & Grease	14	5.50	0.00	3.01
pH @ 25° C	2	7.71	7.04	7.38
Phosphate, ortho (as P)	14	0.04	0.00	0.00
Potassium	14	1.90	0.00	1.33
Selenium	14	0.05	0.00	0.00
Settleable Solids	14	0.00	0.00	0.00
Sodium	14	21.00	8.70	10.49
Sulfate	14	19.00	0.00	13.86
TDS	13	400.00	190.00	303.85
TSS	14	0.00	0.00	0.00
Zinc	14	0.11	0.00	0.04

WATER QUALITY SUMMARY				
Eagle Spring thru 5/25/2006				
Analyte	Count	Max	Min	Avg
Acidity	3	24.00	0.00	14.00
Alkalinity,(As CaCO3)	3	64.00	34.00	48.00
Aluminum	3	1.50	0.94	1.21
Ammonia (as N)	3	0.09	0.08	0.08
Arsenic	3	0.01	0.00	0.00
Bicarbonate (As CaCO3)	3	64.00	34.00	48.00
Boron	3	0.08	0.00	0.03
Cadmium	3	0.00	0.00	0.00
Calcium	3	15.00	11.00	13.67
Carbonate (As CaCO3)	3	0.00	0.00	0.00
Chloride	3	5.00	3.80	4.60
Copper	3	0.01	0.01	0.01
Conductivity	0	na	na	na
Hardness (as CaCO3)	3	55.00	28.00	44.67
Iron - Total	3	2.70	1.10	2.00
Iron - Diss	3	1.10	0.75	0.93
Lead	3	0.00	0.00	0.00
Magnesium	3	3.50	2.70	3.17
Manganese - Total	3	0.02	0.01	0.01
Manganese - Diss	3	0.02	0.00	0.01
Molybdenum	3	0.00	0.00	0.00
Nitrate (as N)	2	0.10	0.00	0.05
Nitrite (as N)	2	0.03	0.01	0.02
Oil & Grease	3	3.40	3.30	3.33
pH @ 25° C	0	na	na	na
Phosphate, ortho (as P)	3	0.13	0.06	0.10
Potassium	3	4.50	1.10	2.30
Selenium	3	0.00	0.00	0.00
Settleable Solids	3	0.00	0.00	0.00
Sodium	3	25.00	4.40	13.47
Sulfate	3	6.20	4.80	5.67
TDS	3	150.00	120.00	136.67
TSS	3	36.00	8.00	25.67
Zinc	3	0.03	0.02	0.02

WATER QUALITY SUMMARY				
Miller Outlet thru	7/30/2007			
Analyte	Count	Max	Min	Avg
Acidity	24	86.00	0.00	3.58
Alkalinity,(As CaCO3)	24	300.00	210.00	255.83
Aluminum	24	0.24	0.00	0.01
Ammonia (as N)	24	0.16	0.00	0.05
Arsenic	24	0.00	0.00	0.00
Bicarbonate (As CaCO3)	25	300.00	200.00	251.60
Boron	25	0.03	0.00	0.00
Cadmium	25	0.05	0.00	0.00
Calcium	25	100.00	63.00	83.52
Carbonate (As CaCO3)	25	21.00	0.00	3.16
Chloride	25	39.00	8.50	11.45
Copper	25	0.01	0.00	0.00
Conductivity	1	550.00	550.00	550.00
Hardness (as CaCO3)	25	330.00	180.00	277.20
Iron - Total	25	6.50	1.20	2.80
Iron - Diss	25	1.30	0.00	0.05
Lead	25	0.00	0.00	0.00
Magnesium	25	20.00	14.00	16.92
Manganese - Total	25	0.34	0.06	0.16
Manganese - Diss	25	0.15	0.00	0.04
Molybdenum	25	0.00	0.00	0.00
Nitrate (as N)	24	0.92	0.00	0.33
Nitrite (as N)	24	0.04	0.00	0.01
Oil & Grease	25	6.20	3.00	4.00
pH @ 25° C	2	8.44	8.10	8.27
Phosphate, ortho (as P)	25	0.13	0.00	0.03
Potassium	25	2.80	1.10	2.08
Selenium	25	0.03	0.00	0.00
Settleable Solids	22	0.30	0.00	0.15
Sodium	25	19.00	5.40	9.74
Sulfate	25	48.00	19.00	26.00
TDS	24	620.00	200.00	298.33
TSS	25	340.00	39.00	124.28
Zinc	25	0.09	0.00	0.02

WATER QUALITY SUMMARY				
Mud Creek thru 7/30/2007				
Analyte	Count	Max	Min	Avg
Acidity	24	68.00	0.00	2.83
Alkalinity,(As CaCO3)	24	300.00	160.00	244.17
Aluminum	24	0.00	0.00	0.00
Ammonia (as N)	24	0.57	0.00	0.04
Arsenic	24	0.00	0.00	0.00
Bicarbonate (As CaCO3)	24	280.00	150.00	231.67
Boron	25	0.10	0.00	0.00
Cadmium	25	0.05	0.00	0.00
Calcium	25	100.00	48.00	78.16
Carbonate (As CaCO3)	25	55.00	0.00	11.48
Chloride	25	63.00	10.00	20.00
Copper	25	0.01	0.00	0.00
Conductivity	1	1000.00	1000.00	1000.00
Hardness (as CaCO3)	25	490.00	120.00	369.60
Iron - Total	25	2.70	0.11	0.53
Iron - Diss	25	0.07	0.00	0.00
Lead	25	0.00	0.00	0.00
Magnesium	25	59.00	14.00	42.52
Manganese - Total	25	0.15	0.02	0.04
Manganese - Diss	25	0.09	0.00	0.02
Molybdenum	25	0.00	0.00	0.00
Nitrate (as N)	24	0.74	0.10	0.32
Nitrite (as N)	24	0.02	0.00	0.00
Oil & Grease	25	5.10	0.00	3.32
pH @ 25° C	2	8.50	8.18	8.34
Phosphate, ortho (as P)	25	0.07	0.00	0.00
Potassium	25	9.70	1.90	6.95
Selenium	25	0.03	0.00	0.00
Settleable Solids	21	0.60	0.00	0.09
Sodium	25	57.00	18.00	39.88
Sulfate	25	290.00	42.00	168.28
TDS	24	720.00	230.00	484.58
TSS	25	320.00	4.00	42.24
Zinc	25	0.16	0.00	0.02

WATER QUALITY SUMMARY				
Res-1 thru 7/30/2007				
Analyte	Count	Max	Min	Avg
Acidity	11	0.00	0.00	0.00
Alkalinity,(As CaCO3)	11	330.00	120.00	194.55
Aluminum	11	0.00	0.00	0.00
Ammonia (as N)	11	0.11	0.00	0.04
Arsenic	11	0.00	0.00	0.00
Bicarbonate (As CaCO3)	11	330.00	0.00	156.36
Boron	11	0.00	0.00	0.00
Cadmium	11	0.00	0.00	0.00
Calcium	11	71.00	21.00	48.00
Carbonate (As CaCO3)	11	140.00	0.00	36.45
Chloride	11	86.00	3.60	24.49
Copper	11	0.01	0.00	0.00
Conductivity	0	na	na	na
Hardness (as CaCO3)	11	420.00	130.00	225.45
Iron - Total	11	10.00	0.10	2.43
Iron - Diss	11	0.15	0.00	0.03
Lead	11	0.00	0.00	0.00
Magnesium	11	58.00	16.00	25.18
Manganese - Total	11	1.50	0.06	0.39
Manganese - Diss	11	0.85	0.00	0.16
Molybdenum	11	0.00	0.00	0.00
Nitrate (as N)	11	0.37	0.00	0.06
Nitrite (as N)	11	0.04	0.00	0.01
Oil & Grease	11	5.10	0.00	2.95
pH @ 25° C	1	8.12	8.12	8.12
Phosphate, ortho (as P)	11	0.12	0.00	0.04
Potassium	11	15.00	1.30	4.38
Selenium	11	0.01	0.00	0.00
Settleable Solids	9	5.50	0.10	1.11
Sodium	11	42.00	8.40	20.32
Sulfate	11	97.00	24.00	48.55
TDS	11	590.00	96.00	267.82
TSS	11	1600.00	14.00	227.27
Zinc	11	0.04	0.00	0.01

WATER QUALITY SUMMARY				
Sulfur Spring thru 7/30/2007				
Analyte	Count	Max	Min	Avg
Acidity	24	80.00	0.00	3.33
Alkalinity,(As CaCO3)	24	380.00	290.00	344.17
Aluminum	24	0.00	0.00	0.00
Ammonia (as N)	24	0.44	0.00	0.09
Arsenic	24	0.00	0.00	0.00
Bicarbonate (As CaCO3)	24	380.00	290.00	344.17
Boron	25	0.07	0.00	0.00
Cadmium	25	0.00	0.00	0.00
Calcium	25	95.00	82.00	89.56
Carbonate (As CaCO3)	25	10.00	0.00	0.40
Chloride	25	7.20	5.10	6.35
Copper	25	0.01	0.00	0.00
Conductivity	1	710.00	710.00	710.00
Hardness (as CaCO3)	25	390.00	210.00	366.80
Iron - Total	25	0.52	0.00	0.03
Iron - Diss	25	0.15	0.00	0.01
Lead	25	0.01	0.00	0.00
Magnesium	25	38.00	31.00	35.88
Manganese - Total	25	0.17	0.03	0.04
Manganese - Diss	25	0.16	0.00	0.04
Molybdenum	25	0.00	0.00	0.00
Nitrate (as N)	24	0.02	0.00	0.00
Nitrite (as N)	24	0.10	0.00	0.01
Oil & Grease	25	5.30	0.00	3.78
pH @ 25° C	2	7.47	7.38	7.43
Phosphate, ortho (as P)	25	0.02	0.00	0.00
Potassium	25	5.90	4.20	4.86
Selenium	25	0.01	0.00	0.00
Settleable Solids	21	0.00	0.00	0.00
Sodium	25	19.00	7.40	9.47
Sulfate	25	47.00	29.00	43.92
TDS	24	420.00	230.00	354.17
TSS	25	17.00	0.00	2.08
Zinc	25	0.12	0.00	0.02

WATER QUALITY SUMMARY				
CR-06-03 thru 9/27/2006				
Analyte	Count	Max	Min	Avg
Acidity	7	0.00	0.00	0.00
Alkalinity,(As CaCO3)	7	410.00	370.00	382.86
Aluminum	7	0.12	0.00	0.02
Ammonia (as N)	7	0.00	0.00	0.00
Arsenic	7	0.05	0.03	0.03
Bicarbonate (As CaCO3)	7	410.00	370.00	382.86
Boron	8	0.00	0.00	0.00
Cadmium	8	0.00	0.00	0.00
Calcium	8	130.00	110.00	120.00
Carbonate (As CaCO3)	8	0.00	0.00	0.00
Chloride	8	63.00	17.00	25.75
Copper	8	0.07	0.00	0.01
Conductivity	1	800.00	800.00	800.00
Hardness (as CaCO3)	8	460.00	280.00	416.25
Iron - Total	8	4.30	0.31	1.52
Iron - Diss	8	0.07	0.00	0.02
Lead	8	0.00	0.00	0.00
Magnesium	8	31.00	28.00	29.88
Manganese - Total	8	0.15	0.02	0.06
Manganese - Diss	8	0.10	0.02	0.05
Molybdenum	8	0.01	0.00	0.00
Nitrate (as N)	7	0.09	0.00	0.04
Nitrite (as N)	7	0.03	0.00	0.01
Oil & Grease	0	na	na	na
pH @ 25° C	2	7.24	7.14	7.19
Phosphate, ortho (as P)	8	0.07	0.00	0.01
Potassium	8	2.50	1.40	2.01
Selenium	8	0.00	0.00	0.00
Settleable Solids	0	na	na	na
Sodium	8	25.00	8.70	14.36
Sulfate	8	50.00	31.00	38.25
TDS	8	460.00	350.00	401.25
TSS	0	na	na	na
Zinc	8	2.80	0.10	0.62

Table 3.7.2.5-1. Ground Water Rights

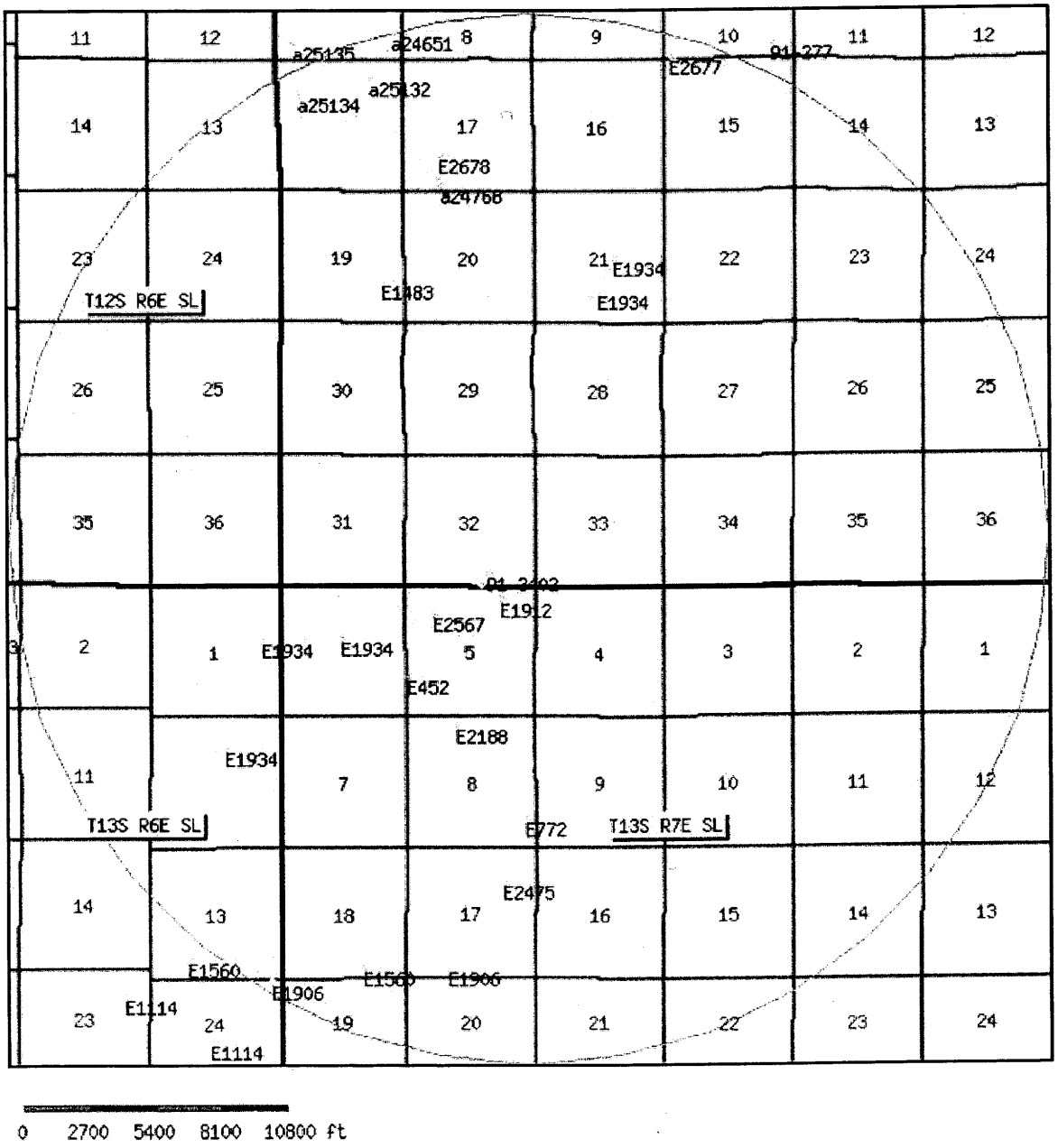
utah gov | Online Services | Agency List | Business | Search

Utah Division of Water Rights

WRPLAT Program Output Listing

Version: 2007.04.13.01 Rundate: 08/30/2007 12:53 PM

Radius search of 21120 feet from a point N2000 W250 from the SE corner, section 32, Township 12S, Range 7E, SL b&m Criteria:wrtypes=W,C,E podtypes=U,Sp status=U,A,P usetypes=all



Water Rights

WR Number	Diversion Type/Location	Well Log	Status	Priority	Uses	CFS	ACFT	Owner Name
91-200	Underground N450 E500 S4 08 13S 7E SL		P	19540322	DIO	0.134	0.000	ALPINE SCHOOL DISTRIC 50 NORTH CENTER STREE
91-206	Underground N840 E430 SW 10 12S 7E SL	well info	P	19550212	D	0.015	0.000	PAUL MANCINA GENEREL DELIVERY
91-223	Underground S20 W2206 N4 15 12S 7E SL		P	19560713	D	0.025	0.000	RICHARD L. & EVANN RIL SUTTON 3203 PEARCE STREET
91-277	Underground N610 W930 SE 10 12S 7E SL		P	19600720	D	0.015	0.000	CARBON WATER CONSER DISTRICT PRICE UT 84501
91-3401	Underground N625 E710 S4 32 12S 7E SL		P	18950000	DS	0.011	0.000	WAINO E. BURTON SCOFIELD UT
91-3402	Underground N570 E690 S4 32 12S 7E SL		P	18950000	DS	0.011	0.000	WAINO E. BURTON SCOFIELD UT
91-3460	Underground N450 E500 S4 08 13S 7E SL		P	19530715	DIO	0.134	0.000	ALPINE SCHOOL DISTRIC OF EDUCATION 50 NORTH CENTER
91-4140	Underground S1020 W310 NE 17 13S 7E SL		P	18820000	DO	0.150	0.000	KANAWHA AND HOCKIN AND COKE COMPANY 700 WEST GATE TOWER
91-4159	Underground N1220 W780 SE 08 13S 7E SL		P	18820000	O	1.000	0.000	KANAWHA AND HOCKIN AND COKE COMPANY 700 WEST GATE TOWER
91-5060	Underground N775 E0 S4 13 13S 6E SL		U	20020429	M	16.000	0.000	CARBON WATER CONSER DISTRICT P.O. BOX 509
91-5061	Underground S136 E444 NW 24 13S 6E SL		U	20020524	M	15.600	0.000	PRICE MUNICIPAL CORPO P.O. BOX 893
91-5061	Underground N727 W1356 SE 13 13S 6E SL		U	20020524	M	15.600	0.000	PRICE MUNICIPAL CORPO P.O. BOX 893
91-5061	Underground N795 W278 SE 13		U	20020524	M	15.600	0.000	PRICE MUNICIPAL CORPO P.O. BOX 893

	13S 6E SL						
a21912	Underground		A	19980209 O	0.000	427.000	CANYON FUEL COMPANY
	N615 W200 S4 13 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
a21912	Underground		A	19980209 O	0.000	427.000	CANYON FUEL COMPANY
	N330 W1020 SE 13 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
a21912	Underground		A	19980209 O	0.000	427.000	CANYON FUEL COMPANY
	S70 W370 NE 24 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
a21912	Underground		A	19980209 O	0.000	427.000	CANYON FUEL COMPANY
	N390 E1730 SW 17 13S 7E SL						ATTN: PROPERTY ADMINISTRATION
a24651	Underground	well info	A	20000620 DI	0.000	2.000	PRICE RIVER WATER USEI ASSOCIATION
	N1120 W400 SE 07 12S 7E SL						375 SOUTH CARBON AVEI
a24768	Underground	well info	A	20060404 DIO	0.000	31.440	PARADISE ACRES L.C.
	N825 E1200 SW 17 12S 7E SL						1111 BRICKYARD ROAD S
a24768	Underground	well info	A	20060404 DIO	0.000	31.440	PARADISE ACRES L.C.
	N270 E1525 SW 17 12S 7E SL						1111 BRICKYARD ROAD S
a25132	Underground		A	20001207 DI	0.000	1.000	PRICE RIVER WATER USEI ASSOCIATION
	S727 W1323 NE 18 12S 7E SL						375 SOUTH CARBON AVEI
a25133	Underground		A	20001207 DI	0.000	1.000	SCOFIELD ESTATES L.C.
	S36 E1956 NW 18 12S 7E SL						3625 SOUTH HARRISON BI
a25134	Underground		A	20001207 DI	0.000	1.000	SCOFIELD ESTATES L.C.
	S1375 E969 NW 18 12S 7E SL						3625 SOUTH HARRISON BI
a25135	Underground		A	20001207 DI	0.000	1.000	SCOFIELD ESTATES L.C.
	N672 E770 SW 07 12S 7E SL						3625 SOUTH HARRISON BI
a28898	Underground	well info	A	20040409 DI	0.000	2.000	TOM F. & KIM KREEK
	N1050 W360 S4 21 12S 7E SL						233 EAST 3000 SOUTH
a30907	Spring		A	20051227 DI	0.000	1.000	PRICE RIVER WATER USEI ASSOCIATION
	N1340 E664 SW 17 12S 7E SL						375 SOUTH CARBON AVEI
a30907	Underground		A	20051227 DI	0.000	1.000	PRICE RIVER WATER USEI

							ASSOCIATION
	N867 E1226 SW 17 12S 7E SL						375 SOUTH CARBON AVEN
a30907	Underground		A	20051227 DI	0.000	1.000	PRICE RIVER WATER USEI ASSOCIATION
	N565 E1327 SW 17 12S 7E SL						375 SOUTH CARBON AVEN
a30908	Underground		A	20051227 DI	0.000	1.000	LAZY CP LIMITED PARTNI
	N150 E300 SW 10 12S 7E SL						C/O CLYDE PANNIER & M. PANNIER
t32943	Underground		A	20070503 OX	0.000	3.000	PRICE RIVER WATER USEI ASSOCIATION
	N330 W1020 SE 13 13S 6E SL						375 SOUTH CARBON AVEN
E1114	Underground		A	19770613 O	0.000	30.000	CANYON FUEL COMPANY
	S1000 W1000 NE 23 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
E1114	Underground		A	19770613 O	0.000	30.000	CANYON FUEL COMPANY
	N700 E1300 SW 13 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
E1114	Underground		A	19770613 O	0.000	30.000	CANYON FUEL COMPANY
	S2500 E2500 NW 24 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
E1483	Underground		A	19790503 D	0.000	1.000	SCOFIELD MOUNTAIN HO RECREATION ASSOC.
	S990 W900 E4 19 12S 7E SL						4420 BRIARWOOD CIRCLE
E1560	Underground		A	19790719 X	0.000	118.000	CANYON FUEL COMPANY
	N850 E1600 SW 13 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
E1560	Underground		A	19790719 X	0.000	118.000	CANYON FUEL COMPANY
	N175 W375 SE 13 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
E1560	Underground		A	19790719 X	0.000	118.000	CANYON FUEL COMPANY
	N460 W1725 SW 17 13S 7E SL						ATTN: PROPERTY ADMINISTRATION
E164	Underground		A	19650218 D	0.000	1.000	LOUIS GORISHEK
	N30 E465 S4 32 12S 7E SL						SCOFIELD UT
E1906	Underground	well info	A	19810528 O	0.000	118.000	CANYON FUEL COMPANY
	N350 E4300 SW 13 13S 6E SL						ATTN: PROPERTY ADMINISTRATION
E1906	Underground	well info	A	19810528 O	0.000	118.000	CANYON FUEL COMPANY
	S100 W300 NE 24 13S 6E SL						ATTN: PROPERTY ADMINISTRATION

E1906	Underground	well info	A	19810528 O	0.000	118.000	CANYON FUEL COMPANY
	N460 E1725 SW 17 13S 7E SL						ATTN: PROPERTY ADMINISTRATION
E1912	Underground		A	19810611 D	0.000	1.000	JIM NICOLODEMOS
	N2145 W1350 E4 05 13S 7E SL						1221 SOUTH 2820 WEST
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	S2000 W2300 NE 01 13S 6E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	S1300 W2200 NE 12 13S 6E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	S2200 W700 NE 01 13S 6E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	S2100 E1000 NW 06 13S 7E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	S2100 E2500 NW 06 13S 7E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	N1320 0 S4 21 12S 7E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	N1771 E210 S4 21 12S 7E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	N2220 E420 S4 21 12S 7E SL						1580 LINCOLN SUITE 530
E1934	Underground		A	19810629 O	0.000	20.000	UCO INCORPORATED
	N2640 E630 S4 21 12S 7E SL						1580 LINCOLN SUITE 530
E2188	Underground	well info	A	19830516 OS	0.000	1.000	CORPORATION OF THE PR BISHOP LDS CHURCH
	S310 W580 N4 08 13S 7E SL						ATTN: NATURAL RESOUR SERVICES
E2475	Underground	well info	A	19861008 D	0.000	1.000	CORPORATION OF THE PR BISHOP LDS CHURCH
	S1400 W1305 NE 17 13S 7E SL						ATTN: NATURAL RESOUR SERVICES
E2567	Underground	well info	A	19871013 M	0.000	30.000	SCOFIELD TOWN
	S1056 W1451 N4 05 13S 7E SL						ATTN: JAY N. NELSON, MA
E2620	Underground		A	19880705 D	0.000	1.000	LEE J. AND HELEN G. DUN

	N150 E300 SW 10 12S 7E SL						STAR ROUTE BOX 80 SCOI UTAH 84526
E2677	Underground N150 E300 SW 10 12S 7E SL		A	19890516 D	0.000	1.000	LAZY CP `P` LTD. PARTNE C/O BUD PANNIER
E2678	Underground N1445 E1470 SW 17 12S 7E SL		A	19890516 D	0.000	1.000	LAZY CP `P` LTD. PARTNE C/O BUD PANNIER
E452	Underground S970 E60 W4 05 13S 7E SL		A	19710809 S	0.000	1.000	ROBERT AND ELLEN RAD MARITAL & FAMILY TRUS ROBERT RADAKOVICH, TI
E772	Underground N1150 W400 SE 08 13S 7E SL	well info	A	19740515 O	0.446	0.000	VALLEY CAMP COAL COM CASTLE GATE UT 84514

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Table 3.7.3.5-1. Surface Water Rights

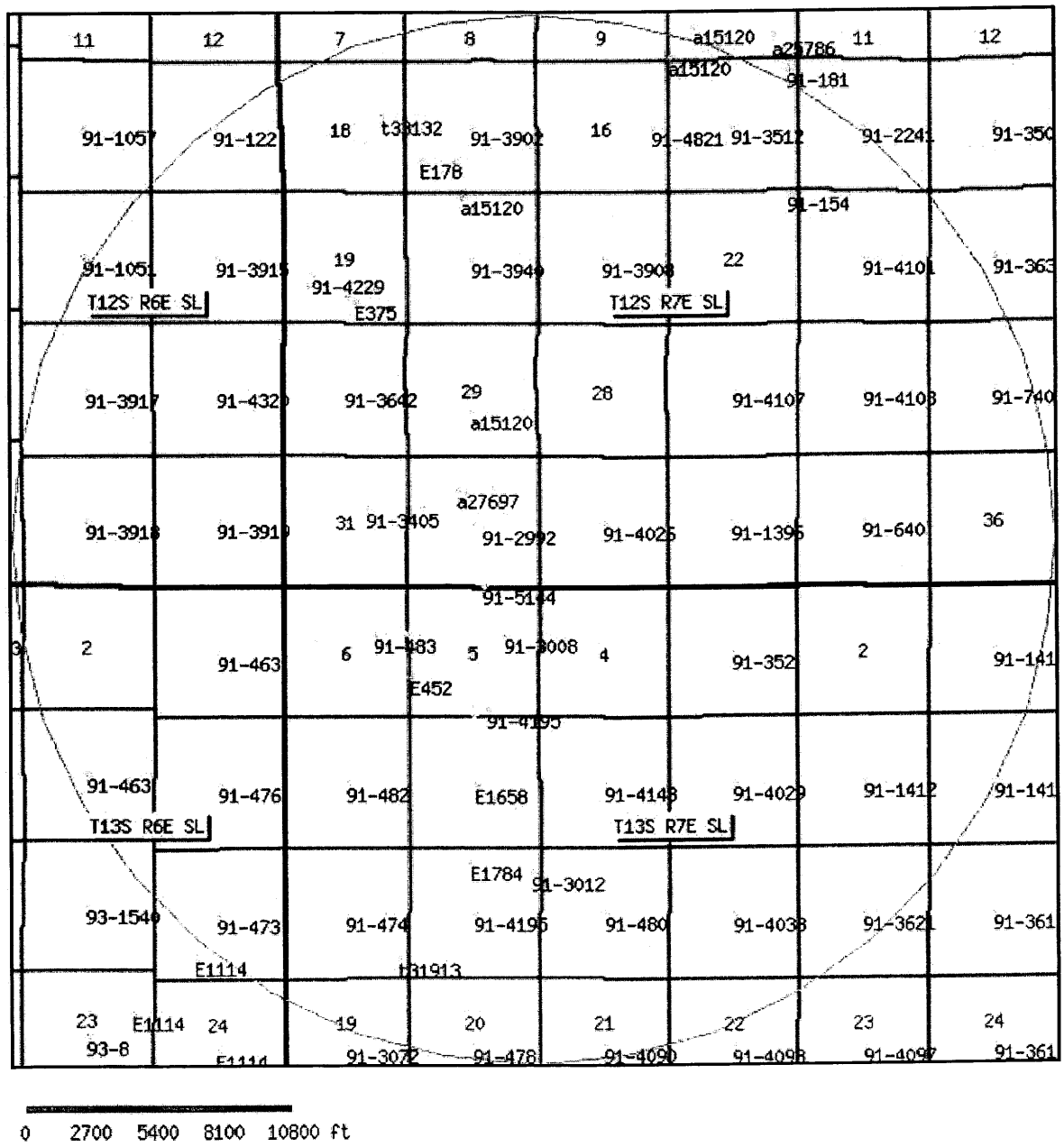
utah gov | Online Services | Agency List | Business | Search

Utah Division of Water Rights

WRPLAT Program Output Listing

Version: 2007.04.13.01 Rundate: 08/30/2007 01:09 PM

Radius search of 21120 feet from a point N2000 W250 from the SE corner, section 32, Township 12S, Range 7E, SL b&m Criteria:wrtypes=W,C,E podtypes=S,D,P,R status=U,A,P usetypes=all



Water Rights

WR Number	Diversion Type/Location	Well Log	Status	Priority	Uses	CFS	ACFT	Owner Name
51-7684	Point to Point S660 E660 NW 18 12S 7E SL		P	18500000 S		0.000	2.360	SCOFIELD ESTATES L 3625 HARRISON BLVI
91-1023	Point to Point N660 W660 SE 23 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1024	Point to Point N660 W660 SE 23 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1025	Point to Point N660 E1980 W4 23 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1026	Point to Point S660 W660 N4 23 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1027	Point to Point N660 W660 S4 14 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1028	Point to Point N660 W660 S4 14 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1029	Point to Point N660 E1980 W4 14 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1030	Point to Point S660 E660 NW 14 13S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324-25TH STREET
91-1039	Point to Point N660 E660 W4 25 12S 6E SL		P	18600000 S		0.015	0.000	USA FOREST SERVICI 324 25TH STREET
91-1040	Point to Point S660 E1980 W4 25 12S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1041	Point to Point N660 E660 W4 25 12S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1042	Point to Point N660 W660 E4 24 12S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1043	Point to Point S1980 E660 N4 26 12S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1044	Point to Point S1980 E660 N4 26 12S 6E SL		P	18600000 S		0.000	0.000	USA FOREST SERVICI 324 25TH STREET

91-1051	Point to Point S660 W1980 E4 23 12S 6E SL	P	18600000 S	0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1057	Point to Point S660 W660 E4 14 12S 6E SL	P	18600000 S	0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1058	Point to Point S660 W660 E4 13 12S 6E SL	P	18600000 S	0.000	0.000	USA FOREST SERVICI 324 25TH STREET
91-1148	Point to Point N660 E660 S4 07 13S 7E SL	P	18600000 S	0.000	0.000	TOM & LEON NICOLA 1026 EAST 1ST SOUTH
91-122	Point to Point N660 E660 SW 13 12S 6E SL	P	19460830 D	0.005	0.000	USA FOREST SERVICI 324 25TH STREET
91-1221	Point to Point N660 W660 SE 26 12S 7E SL	P	18600000 DS	0.100	0.000	CLARENCE ANDERSC PRICE UT 84501
91-1396	Point to Point N660 W660 S4 34 12S 7E SL	P	19020000 S	0.000	0.000	CLARENCE ANDERSC PRICE UT 84501
91-1397	Point to Point N660 W660 E4 35 12S 7E SL	P	19020000 S	0.015	0.000	CLARENCE ANDERSC PRICE UT 84501
91-1398	Point to Point N660 E660 S4 35 12S 7E SL	P	19020000 S	0.000	0.000	CLARENCE ANDERSC PRICE UT 84501
91-1399	Point to Point S660 W660 NE 35 12S 7E SL	P	18600000 DS	0.100	0.000	CLARENCE ANDERSC PRICE UT 84501
91-1400	Point to Point N660 E660 S4 35 12S 7E SL	P	18600000 DS	0.000	0.000	CLARENCE ANDERSC PRICE UT 84501
91-1403	Point to Point S1980 E660 N4 03 13S 7E SL	P	18600000 DS	0.150	0.000	CLARENCE ANDERSC GENERAL DELIVERY
91-1404	Point to Point S1980 E660 N4 24 13S 7E SL	P	18690000 DS	0.000	0.000	HELPER STATE BANK GENERAL DELIVERY
91-1405	Point to Point S660 E660 N4 13 13S 7E SL	P	18600000 DS	0.000	0.000	HELPER STATE BANK GENERAL DELIVERY
91-1406	Point to Point S660 W660 E4 14 13S 7E SL	P	18600000 DS	0.000	0.000	HELPER STATE BANK GENERAL DELIVERY
91-1407	Point to Point	P	18600000 S	0.000	0.000	HELPER STATE BANK

	S660 E660 NW 14 13S 7E SL					GENERAL DELIVERY
91-1412	Point to Point	P	18600000 DS	0.000	0.000	HELPER STATE BANK
	N660 E660 SW 11 13S 7E SL					GENERAL DELIVERY
91-1413	Point to Point	P	18600000 DS	0.000	0.000	HELPER STATE BANK
	S660 W1980 E4 01 13S 7E SL					GENERAL DELIVERY
91-1414	Point to Point	P	18600000 S	0.000	0.000	HELPER STATE BANK
	N660 E660 W4 12 13S 7E SL					GENERAL DELIVERY
91-1475	Point to Point	P	19020000 S	0.000	0.000	CLARENCE ANDERSC
	N660 W660 E4 27 12S 7E SL					GENERAL DELIVERY
91-1644	Point to Point	P	18600000 S	0.000	0.000	LEE THOMAS
	S660 W1980 E4 08 13S 7E SL					UT
91-1679	Point to Point	P	18600000 DS	0.011	0.000	J. MARK JACOB
	N660 E660 S4 21 13S 7E SL					914 EAST 300 NORTH
91-1680	Point to Point	P	18600000 S	0.011	0.000	J. MARK JACOB
	N660 W660 SE 21 13S 7E SL					914 EAST 300 NORTH
91-1681	Point to Point	P	18600000 S	0.011	0.000	J. MARK JACOB
	S1980 E660 N4 21 13S 7E SL					914 EAST 300 NORTH
91-201	Point to Point	P	19530930 S	0.068	0.000	ALBERT B. AND APRI CORNABY
	S660 E660 NW 09 13S 7E SL					5167 SOUTH 3200 WES
91-2018	Point to Point	P	19020000 S	0.000	0.000	L. CLAN & BETH STIL
	S660 E660 NW 17 13S 7E SL					82 SOUTH 100 WEST
91-2019	Point to Point	P	19020000 S	0.000	0.000	L. CLAN & BETH STIL
	S660 E660 W4 08 13S 7E SL					82 SOUTH 100 WEST
91-2020	Point to Point	P	18690000 S	0.000	0.000	L. CLAN & BETH STIL
	S660 E660 NW 17 13S 7E SL					82 SOUTH 100 WEST
91-2042	Point to Point	P	18690000 S	0.011	0.000	DELLA SIMONSEN
	S660 E1980 W4 23 13S 7E SL					647 NORTH 1ST EAST
91-2048	Point to Point	P	18690000 S	0.000	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS
	S1980 E660 N4 08 13S 7E SL					A SPECIAL SERVICE I CREATED BY CO. OF

91-2049	Point to Point	P	18690000	S	0.011	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS
	S660 W1980 E4 08 13S 7E SL						A SPECIAL SERVICE I CREATED BY CO. OF (
91-2146	Point to Point	P	1869	S	0.000	0.000	WILLIAM ARGYLE CC FAMILY TRUST
	N660 E660 W4 05 13S 7E SL						WILLIAM ARGYLE AI MATTIE B. CORNABY TRUSTEES
91-2233	Point to Point	P	18690000	S	0.000	0.000	MILTON E. JACOB
	S660 E660 N4 13 12S 7E SL						PAUL JACOB, TRUSTI
91-2235	Point to Point	P	18690000	S	0.000	0.000	GLADYS P. BUTLER
	N660 W660 E4 13 12S 7E SL						1138 MICHIGAN AVEI
91-2236	Point to Point	P	18690000	S	0.000	0.000	GLADYS P. BUTLER
	N660 W660 E4 13 12S 7E SL						C/O ALICE M. PANNIE
91-2237	Point to Point	P	18690000	S	0.000	0.000	CLYDE R. PANNIER
	S660 E660 NW 13 12S 7E SL						1781 MOUNTAIN VIEV
91-2240	Point to Point	P	18690000	S	0.000	0.000	DELLA L. & HILDA M.
	S660 E660 N4 14 12S 7E SL						UT
91-2241	Point to Point	P	18690000	S	0.000	0.000	LOUISE M. WATTS
	S660 E660 N4 14 12S 7E SL						287 EAST 1ST NORTH
91-2246	Point to Point	P	18690000	S	0.000	0.000	ASEMO METOS ESTA'
	S660 E1980 W4 18 12S 7E SL						C/O TOM METOS
91-2249	Point to Point	P	18690000	S	0.000	0.000	PETE & BETTY FRANI
	S660 E660 W4 18 12S 7E SL						RFD BOX 213
91-2250	Point to Point	P	18690000	S	0.011	0.000	PETE FRANDSEN
	N660 E660 S4 18 12S 7E SL						RFD BOX 213
91-2251	Point to Point	P	18690000	S	0.011	0.000	PETE & BETTY FRANI
	N660 W660 SE 18 12S 7E SL						RFD BOX 213
91-2288	Point to Point	P	1869	IS	0.011	0.000	WILLIAM ARGYLE CC FAMILY TRUST
	S660 W1980 E4 31 12S 7E SL						WILLIAM ARGYLE AI MATTIE B. CORNABY TRUSTEES
91-2341	Point to Point	P	19020000	S	0.000	0.000	J. MARK JACOB
	N660 W660 SE 22						914 EAST 300 NORTH

	13S 7E SL						
91-2495	Point to Point	P	1869	IS	0.000	0.000	WILLIAM ARGYLE CC FAMILY TRUST
	S1980 E660 N4 31 12S 7E SL						WILLIAM ARGYLE AN MATTIE B. CORNABY TRUSTEES
91-2496	Point to Point	P	1902	S	0.000	0.000	WILLIAM ARGYLE CC FAMILY TRUST
	N1160 E460 SW 32 12S 7E SL						WILLIAM ARGYLE AN MATTIE B. CORNABY TRUSTEES
91-2548	Point to Point	P	18690000	S	0.000	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS
	S660 W1980 E4 08 13S 7E SL						A SPECIAL SERVICE I CREATED BY CO. OF
91-2549	Point to Point	P	18690000	S	0.000	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS
	S660 W1980 E4 08 13S 7E SL						A SPECIAL SERVICE I CREATED BY CO. OF
91-2647	Point to Point	P	18690000	S	0.011	0.000	MILTON E. JACOB
	S660 E1980 W4 15 12S 7E SL						PAUL JACOB, TRUSTI
91-2663	Point to Point	P	18690000	S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN
	S660 E1980 W4 23 13S 7E SL						PRICE UT 84501
91-2664	Point to Point	P	18690000	S	0.000	0.000	G. PETE & BETTY RAI FRANDSEN
	S660 W660 N4 23 13S 7E SL						PRICE UT 84501
91-2669	Point to Point	P	18690000	S	0.011	0.000	H.B. & DELLA SIMON
	S660 W660 NE 07 13S 7E SL						PRICE UT 84501
91-2970	Point to Point	P	18600000	S	0.015	0.000	ANGELO GEORGEDE
	S660 W660 N4 17 13S 7E SL						761 NORTH 3RD EAST
91-3011	Point to Point	P	18690000	S	0.000	0.000	FRED AND SHELIA JE
	N660 W660 E4 05 13S 7E SL						P.O. BOX 113
91-3040	Point to Point	P	18690000	S	0.000	0.000	TOM NICOLAIDES
	N660 W660 SE 17 13S 7E SL						1026 EAST 1ST SOUTH
91-3041	Point to Point	P	18690000	S	0.011	0.000	MILTON E. JACOB
	N660 W660 E4 24 12S 7E SL						PAUL JACOB, TRUSTI
91-3043	Point to Point	P	18690000	S	0.011	0.000	PETE FRANDSEN

	S660 E1980 W4 19 12S 7E SL					321 NORTH 7TH EAST
91-3044	Point to Point	P	18690000 S	0.011	0.000	PETE FRANDSEN
	S1980 E660 N4 19 12S 7E SL					321 NORTH 7TH EAST
91-3045	Point to Point	P	18690000 S	0.000	0.000	MILTON A OMAN
	N660 W660 SE 20 13S 7E SL					717 CONTINENTAL B/ BUILDING
91-3051	Point to Point	P	18690000 S	0.000	0.000	JOHN MARAKIS
	N660 E660 SW 21 13S 7E SL					160 EAST 1ST SOUTH
91-3052	Point to Point	P	18690000 S	0.000	0.000	NICK MARAKIS
	N660 E660 SW 21 13S 7E SL					789 EAST 8TH NORTH
91-3056	Point to Point	P	18690000 S	0.000	0.000	TOM NICOLAIDES
	S660 E660 N4 17 13S 7E SL					1026 EAST 1ST SOUTH
91-3057	Point to Point	P	18690000 S	0.000	0.000	MILTON A. OMAN
	S1980 E660 N4 24 13S 6E SL					717 CONTINENTAL B/ BUILDING
91-3059	Point to Point	P	18690000 S	0.000	0.000	JOHN MARAKIS
	S660 W660 NE 24 13S 6E SL					160 EAST 1ST SOUTH
91-3060	Point to Point	P	18690000 S	0.000	0.000	NICK MARAKIS
	S660 W660 NE 24 13S 6E SL					789 EAST 8TH NORTH
91-3070	Point to Point	P	18690000 S	0.000	0.000	JOHN MARAKIS
	N660 E660 S4 13 13S 6E SL					160 EAST 1ST SOUTH
91-3071	Point to Point	P	18690000 S	0.000	0.000	NICK MARAKIS
	N660 E660 S4 13 13S 6E SL					789 EAST 8TH NORTH
91-3072	Point to Point	P	18690000 S	0.000	0.000	MILTON A. OMAN
	S660 E660 NW 19 13S 7E SL					717 CONTINTENTAL E BUILDING
91-3074	Point to Point	P	18690000 S	0.000	0.000	MILTON A. OMAN
	N660 E660 SW 17 13S 7E SL					717 CONTINENTAL B/ BUILDING
91-3075	Point to Point	P	18690000 S	0.000	0.000	TOM NICOLAIDES
	N660 E660 S4 17 13S 7E SL					1026 EAST 1ST SOUTH
91-3076	Point to Point	P	18690000 S	0.011	0.000	MILTON A. OMAN
	N660 W660 S4 20 13S 7E SL					717 CONTINENTAL B/ BUILDING
91-3094	Point to Point	P	18690000 M	0.033	0.000	SCOFIELD TOWN
	S660 W660 N4 17 13S 7E SL					SCOFIELD UT

91-3131	Point to Point N660 W660 SE 24 12S 7E SL	P	19020000 DS	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3163	Point to Point S660 W660 NE 30 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN FRD BOX 213
91-3419	Point to Point N660 E660 SW 14 13S 7E SL	P	18690000 S	0.011	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3421	Point to Point N660 E660 SW 14 13S 7E SL	P	18690000 S	0.000	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3423	Point to Point N660 W660 E4 22 13S 7E SL	P	18690000 S	0.011	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3425	Point to Point S660 W660 N4 22 13S 7E SL	P	19020000 S	0.000	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3440	Point to Point N660 W660 E4 20 13S 7E SL	P	18690000 S	0.000	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3441	Point to Point N660 E660 SW 20 12S 7E SL	P	18690000 S	0.011	0.000	DELLA L. MADSEN MEADOW UT 84644
91-3442	Point to Point S660 E660 NW 29 12S 7E SL	P	18690000 S	0.011	0.000	DELLA L. MADSEN MEADOW UT 84644
91-3443	Point to Point S660 E660 NW 29 12S 7E SL	P	18690000 S	0.011	0.000	DELLA L. MADSEN MEADOW UT 84644
91-3444	Point to Point S660 E660 NW 29 12S 7E SL	P	18690000 S	0.011	0.000	DELLA L. MADSEN MEADOW UT 84644
91-3505	Point to Point S660 W660 E4 22 13S 7E SL	P	18690000 DS	0.000	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3506	Point to Point N660 W660 SE 24 13S 7E SL	P	18690000 S	0.000	0.000	J. MARK JACOB 914 EAST 300 NORTH
91-3508	Point to Point N660 W660 E4 23 12S 7E SL	P	18690000 S	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3509	Point to Point N660 W660 SE 13 12S 7E SL	P	18690000 S	0.011	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3510	Point to Point	P	18690000 S	0.011	0.000	MILTON E. JACOB

	S1980 E660 N4 23 12S 7E SL					PAUL JACOB, TRUSTI
91-3511	Point to Point S660 W660 NE 15 12S 7E SL	P	18690000 DS	0.011	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3512	Point to Point S660 W660 NE 15 12S 7E SL	P	18690000 DS	0.011	0.000	CALVIN K. JACOB PLEASANT GROVE UT
91-3513	Point to Point S660 E660 N4 26 12S 7E SL	P	18690000 S	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3514	Point to Point S660 W660 E4 21 12S 7E SL	P	18690000 S	0.011	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3515	Point to Point S1980 E660 N4 21 12S 7E SL	P	18690000 S	0.011	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3516	Point to Point S660 W660 NE 27 12S 7E SL	P	18690000 S	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3517	Point to Point S660 E660 N4 25 12S 7E SL	P	19020000 DS	0.011	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-352	Point to Point N660 E1980 W4 03 13S 7E SL	P	18600000 DS	0.000	0.000	CLARENCE ANDERSC PRICE UT
91-3525	Point to Point N660 W660 E4 24 12S 7E SL	P	18690000 S	0.011	0.000	MILTON E. JACOB PAUL JACOB, TRUSTI
91-3569	Point to Point S660 E660 NW 18 12S 7E SL	P	18690000 IS	0.000	16.490	SCOFIELD ESTATES L 3625 HARRISON BLVI
91-3570	Point to Point S660 W660 E4 19 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3571	Point to Point N660 W660 E4 19 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3572	Point to Point N660 W660 E4 19 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3574	Point to Point N660 E660 S4 19 12S 7E SL	P	18690000 S	0.011	0.000	G. PETE FRANDSEN P.O. BOX 717
91-3575	Point to Point N660 E1980 W4 19 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213

91-3576	Point to Point N660 E660 W4 19 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD 213
91-3577	Point to Point S660 E660 NW 19 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3578	Point to Point S660 W660 E4 18 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3579	Point to Point N660 E660 S4 18 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3580	Point to Point N660 W660 S4 18 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3581	Point to Point N660 W660 S4 18 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN RFD BOX 213
91-3582	Point to Point N660 E660 SW 18 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN UT
91-3583	Point to Point N660 E660 SW 18 12S 7E SL	P	18690000 S	0.011	0.000	PETE FRANDSEN UT
91-3587	Point to Point S660 E660 N4 22 13S 7E SL	P	18690000 S	0.000	0.000	CLEAR CREEK HOME ASSOCIATION P.O. BOX 263
91-3599	Point to Point S660 E660 W4 20 12S 7E SL	P	18690000 S	0.011	0.000	DELLA L. MADSEN MEADOW UT 84644
91-3600	Point to Point N660 E660 W4 20 12S 7E SL	P	19020000 S	0.011	0.000	LEW M. AND ANNE M ANDERSEN 1211 SIERRA WAY
91-3601	Point to Point N660 E660 W4 29 12S 7E SL	P	18690000 S	0.011	0.000	DELLA L. MADSEN MEADOW UT 84644
91-3607	Point to Point N660 W660 S4 23 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3608	Point to Point N660 W660 SE 23 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
						G. PETE & BETTY RAI

91-3609	Point to Point S660 E1980 W4 23 13S 7E SL	P	18690000 S	0.011	0.000	FRANDSEN PRICE UT 84501
91-3610	Point to Point S660 W660 E4 23 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3611	Point to Point S660 W1980 E4 23 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3612	Point to Point S660 E660 W4 24 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3613	Point to Point S660 E1980 W4 24 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3614	Point to Point S660 E660 NW 24 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3616	Point to Point N660 E660 SW 13 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3617	Point to Point S660 E660 W4 13 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3618	Point to Point S660 E660 W4 13 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3619	Point to Point S660 W660 NE 23 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3620	Point to Point N660 W660 SE 14 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3621	Point to Point S660 W1980 E4 14 13S 7E SL	P	18690000 S	0.011	0.000	G. PETE & BETTY RAI FRANDSEN PRICE UT 84501
91-3631	Point to Point	P	18690000 S	0.000	0.000	D. EURAY ALLRED

	S1980 E660 N4 35 12S 6E SL					FOUNTAIN GREEN UT
91-3632	Point to Point	P	19020000 S	0.011	0.000	D. EURAY ALLRED
	N660 E660 SW 19 12S 7E SL					FOUNTAIN GREEN UT
91-3633	Point to Point	P	18690000 S	0.000	0.000	D. EURAY ALLRED
	N660 E660 W4 01 13S 6E SL					FOUNTAIN GREEN UT
91-3634	Point to Point	P	18690000 S	0.011	0.000	D. EURAY ALLRED
	S660 W660 N4 36 12S 6E SL					FOUNTAIN GREEN UT
91-3635	Point to Point	P	18690000 S	0.000	0.000	D. EURAY ALLRED
	N660 E1980 W4 01 13S 6E SL					FOUNTAIN GREEN UT
91-3636	Point to Point	P	18690000 S	0.000	0.000	D. EURAY ALLRED
	N660 W660 SE 24 12S 7E SL					FOUNTAIN GREEN UT
91-3637	Point to Point	P	18690000 S	0.000	0.000	PETE FRANDSEN
	S660 E660 NW 19 12S 7E SL					TOOELE UT 84074
91-3638	Point to Point	P	18690000 S	0.011	0.000	D. EURAY ALLRED
	S660 E660 N4 35 12S 6E SL					FOUNTAIN GREEN UT
91-3640	Point to Point	P	1869 S	0.000	0.000	ANGELO GEORGEDES
	N660 W660 S4 10 13S 7E SL					PRICE UT 84501
91-3641	Point to Point	P	19020000 S	0.000	0.000	PETE FRANDSEN
	N660 W660 E4 30 12S 7E SL					BOX 213
91-3642	Point to Point	P	1902 S	0.011	0.000	BILL & UTAHNA JONI FAMILY TRUST
	S660 W660 E4 30 12S 7E SL					GAYLAND B.JONES & SMITH AS SUCCESSO TRUSTEES
91-3644	Point to Point	P	18690000 S	0.000	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS
	N660 E660 S4 05 13S 7E SL					A SPECIAL SERVICE I CREATED BY CO. OF
91-3645	Point to Point	P	18690000 S	0.000	0.000	FRED AND SHELIA JE
	S660 W1980 E4 05 13S 7E SL					UT
91-3648	Point to Point	P	1869 S	0.000	0.000	BILL B. AND UTAHNA JONES
	S660 W1980 E4 32 12S 7E SL					555 W. FRONT STREET
91-3655	Point to Point	P	1869 S	0.000	4.200	BILL & UTAHNA JONI

							FAMILY TRUST
	N660 E1980 W4 32 12S 7E SL						BILL & UTAHNA JONI TRUSTEES, GAYLORI
91-3658	Point to Point	P	1902	S	0.000	0.000	BILL & UTAHNA JONI FAMILY TRUST
	S660 W660 NE 31 12S 7E SL						GAYLAND B.JONES & SMITH AS SUCCESSO TRUSTEES
91-3665	Point to Point	P	18690000	S	0.000	0.000	JOHN MARAKIS
	S660 W660 E4 17 13S 7E SL						UT
91-3666	Point to Point	P	18690000	S	0.000	0.000	NICK MARAKIS
	S660 W660 E4 17 13S 7E SL						UT
91-3667	Point to Point	P	18690000	DS	0.000	0.000	CORPORATION OF TH PRESIDING BISHOP LI CHURCH
	N1250 W630 E4 17 13S 7E SL						ATTN: NATURAL RES SERVICES
91-3668	Point to Point	P	18690000	S	0.015	0.000	L. CLAN & BETH STIL
	S660 W660 N4 17 13S 7E SL						82 SOUTH 100 WEST
91-3875	Point to Point	P	18690000	S	0.000	0.000	G. PETE FRANDSEN
	N660 E660 W4 19 12S 7E SL						24 WEST 1STSOUTH
91-3895	Point to Point	P	18690000	S	0.022	0.000	KATHERINE RUDMAN
	S660 E660 W4 17 12S 7E SL						UT
91-3901	Point to Point	P	18690000	S	0.000	0.000	HELEN L. WATTS
	S660 E660 NW 17 12S 7E SL						UT
91-3902	Point to Point	P	18690000	S	0.000	0.000	DELLA L. & HILDA M.
	S660 E660 NW 17 12S 7E SL						UT
91-3902	Point to Point	P	18690000	S	0.000	0.000	DELLA L. & HILDA M.
	S660 W660 N4 17 12S 7E SL						UT
91-3908	Point to Point	P	18690000	S	0.000	0.000	MILTON E. JACOB
	N660 W660 E4 20 12S 7E SL						PAUL JACOB, TRUSTI
91-3908	Point to Point	P	18690000	S	0.000	0.000	MILTON E. JACOB
	S660 W660 NE 20 12S 7E SL						PAUL JACOB, TRUSTI
91-3908	Point to Point	P	18690000	S	0.000	0.000	MILTON E. JACOB
	S660 W660 E4 20 12S 7E SL						PAUL JACOB, TRUSTI
91-3908	Point to Point	P	18690000	S	0.000	0.000	MILTON E. JACOB

	S660 E660 NW 21 12S 7E SL						PAUL JACOB, TRUSTI
91-3909	Point to Point N660 E660 S4 20 12S 7E SL	P	1869	S	0.000	0.000	LOUISE M. WATTS UT
91-3910	Point to Point S660 E660 N4 29 12S 7E SL	P	1869	S	0.000	0.000	REED & LEON GUNDI UT
91-3910	Point to Point S660 W660 N4 29 12S 7E SL	P	1869	S	0.000	0.000	REED & LEON GUNDI UT
91-3911	Point to Point S1980 E660 N4 29 12S 7E SL	P	1869	S	0.000	0.000	DELLA L. & HILDA M. UT
91-3911	Point to Point N660 E1980 W4 29 12S 7E SL	P	1869	S	0.000	0.000	DELLA L. & HILDA M. UT
91-3915	Point to Point S660 W660 E4 24 12S 6E SL	P	1869	S	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3916	Point to Point S660 W660 E4 26 12S 6E SL	P	1869	DS	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3917	Point to Point S660 W1980 E4 26 12S 6E SL	P	1869	DS	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3918	Point to Point N660 W660 E4 35 12S 6E SL	P	1869	S	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3919	Point to Point N660 E660 W4 36 12S 6E SL	P	1869	S	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3920	Point to Point S660 W660 N4 31 12S 7E SL	P	1869	DS	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3922	Point to Point N660 E660 W4 31 12S 7E SL	P	1869	S	0.011	0.000	D. EURAY ALLRED FOUNTAIN GREEN UT
91-3940	Point to Point S1080 E1370 W4 20 12S 7E SL	P	18690000	S	0.011	0.000	CHARLES J. AND EVE AND STEPHEN C. JAC UT
91-3969	Point to Point S660 W660 NE 19 12S 7E SL	P	18690000	DS	0.022	0.000	CAROLINE FASSELIN UT
91-3970	Point to Point S660 W660 NE 19	P	18690000	DS	0.022	0.000	CAROLINE FASSELIN

	12S 7E SL						UT
91-4026	Point to Point	P	1869	S	0.000	0.000	GEORGE TELONIS
	S660 W1980 E4 33 12S 7E SL						PRICE UT 84501
91-4027	Point to Point	P	1869	S	0.011	0.000	GEORGE TELONIS
	N660 E660 W4 10 13S 7E SL						PRICE UT 84501
91-4028	Point to Point	P	1902	S	0.011	0.000	GEORGE TELONIS
	S660 W660 NE 15 13S 7E SL						PRICE UT 84501
91-4029	Point to Point	P	1869	S	0.011	0.000	GEORGE TELONIS
	N660 W660 SE 10 13S 7E SL						PRICE UT 84501
91-4031	Point to Point	P	1902	S	0.011	0.000	GEORGE TELONIS
	N660 W660 S4 09 13S 7E SL						PRICE UT 84501
91-4032	Point to Point	P	1902	S	0.011	0.000	GEORGE TELONIS
	S660 E660 W4 15 13S 7E SL						PRICE UT 84501
91-4033	Point to Point	P	1902	S	0.011	0.000	GEORGE TELONIS
	S660 E1980 W4 15 13S 7E SL						PRICE UT 84501
91-4090	Point to Point	P	1902	S	0.000	0.000	J. MARK JACOB
	N660 W660 S4 21 13S 7E SL						914 EAST 300 NORTH
91-4097	Point to Point	P	1869	S	0.022	0.000	J. MARK JACOB
	S660 E660 NW 23 13S 7E SL						914 EAST 300 NORTH
91-4098	Point to Point	P	1902	S	0.022	0.000	J. MARK JACOB
	S660 W660 NE 22 13S 7E SL						914 EAST 300 NORTH
91-4100	Point to Point	P	1869	S	0.011	0.000	MILTON E. JACOB
	S660 W1980 E4 23 12S 7E SL						PAUL JACOB, TRUSTI
91-4101	Point to Point	P	1869	S	0.011	0.000	MILTON E. JACOB
	N660 W660 SE 23 12S 7E SL						PAUL JACOB, TRUSTI
91-4102	Point to Point	P	1869	S	0.000	0.000	MILTON E. JACOB
	S660 E660 W4 16 12S 7E SL						PAUL JACOB, TRUSTI
91-4107	Point to Point	P	1869	DS	0.011	0.000	MILTON E. JACOB
	S660 E660 N4 27 12S 7E SL						PAUL JACOB, TRUSTI
91-4108	Point to Point	P	1869	S	0.011	0.000	MILTON E. JACOB
	S660 W660 N4 26 12S 7E SL						PAUL JACOB, TRUSTI

91-4143	Point to Point	P	18690000 S	0.011	0.000	GEORGE TELONIS
	S660 W1980 E4 09 13S 7E SL					C/O LUKE PAPPAS
91-4195	Point to Point	P	18740000 M	0.100	0.000	SCOFIELD TOWN
	S660 W660 N4 17 13S 7E SL					SCOFIELD UT 84538
91-423	Point to Point	P	18600000 S	0.000	0.000	NICK MARAKIS
	N660 E660 W4 06 13S 7E SL					165 E. 100 S.
91-424	Point to Point	P	19020000 S	0.011	0.000	NICK MARAKIS
	S660 W660 E4 01 13S 6E SL					165 E. 100 S.
91-425	Point to Point	P	18600000 S	0.022	0.000	NICK MARAKIS
	S660 E660 W4 06 13S 7E SL					165 E. 100 S.
91-431	Point to Point	P	18600000 S	0.000	0.000	NICK MARAKIS
	N660 E660 W4 12 13S 6E SL					166 EAST 1ST SOUTH
91-432	Point to Point	P	18600000 S	0.011	0.000	NICK MARAKIS
	N660 W660 S4 12 13S 6E SL					165 EAST 1ST SOUTH
91-4320	Point to Point	P	18690000 S	0.000	0.100	USA FOREST SERVICI
	0 0 25 12S 6E SL					324 25TH STREET
91-433	Point to Point	P	19020000 S	0.011	0.000	NICK MARAKIS
	S660 E660 N4 13 13S 6E SL					675 EAST 1ST SOUTH
91-434	Point to Point	P	19020000 S	0.011	0.000	NICK MARAKIS
	S660 E1980 W4 18 13S 7E SL					165 EAST 1ST SOUTH
91-4344	Point to Point	P	18690000 S	0.000	0.000	USA FOREST SERVICI
	N660 W660 SE 23 13S 6E SL					324 25TH STREET
91-4345	Point to Point	P	18690000 S	0.015	0.000	USA FOREST SERVICI
	N660 E660 W4 13 13S 6E SL					324 25TH STREET
91-435	Point to Point	P	18600000 S	0.011	0.000	NICK MARAKIS
	N660 E1980 W4 07 13S 7E SL					165 EAST 1ST SOUTH
91-436	Point to Point	P	18600000 S	0.000	0.000	NICK MARAKIS
	N660 E660 SW 12 13S 6E SL					165 EAST 1ST SOUTH
91-437	Point to Point	P	18600000 S	0.000	0.000	NICK MARAKIS
	N660 W660 SE 08 13S 7E SL					UT
91-438	Point to Point	P	18600000 S	0.000	0.000	NICK MARAKIS
	S660 W660 NE 20					165 EAST 1ST SOUTH

	13S 7E SL					
91-440	Point to Point	P	19020000 S	0.000	0.000	NICK MARKIS
	N660 E660 S4 16 13S 7E SL					165 EAST 1ST SOUTH
91-441	Point to Point	P	19020000 S	0.000	0.000	NICK MARAKIS
	N660 W660 S4 16 13S 7E SL					165 EAST 1ST SOUTH
91-455	Point to Point	P	18600000 S	0.011	0.000	ELLEN R. RADAKOVI(MARITAL AND FAMIL
	S660 W1980 E4 06 13S 7E SL					ROBERT RADAKOVIC TRUSTEE
91-462	Point to Point	P	18600000 S	0.000	0.000	EUREKA ENERGY CO.
	N660 E660 W4 06 13S 7E SL					215 MARKET STREET
91-463	Point to Point	P	19020000 S	0.011	0.000	EUREKA ENERGY
	S660 W660 E4 11 13S 6E SL					215 MARKET STREET
91-463	Point to Point	P	19020000 S	0.011	0.000	EUREKA ENERGY
	S660 W660 E4 01 13S 6E SL					215 MARKET STREET
91-464	Point to Point	P	18600000 S	0.022	0.000	EUREKA ENERGY CO.
	S660 E660 W4 06 13S 7E SL					215 MARKET STREET
91-471	Point to Point	P	18600000 S	0.000	0.000	JOHN MARAKIS
	N660 E660 W4 12 13S 6E SL					165 EAST 1ST SOUTH
91-472	Point to Point	P	18600000 S	0.011	0.000	JOHN MARAKIS
	N660 W660 S4 12 13S 6E SL					165 EAST 1ST SOUTH
91-473	Point to Point	P	19020000 S	0.011	0.000	JOHN MARAKIS
	S660 E660 N4 13 13S 6E SL					165 EAST 1ST SOUTH
91-474	Point to Point	P	19020000 S	0.011	0.000	JOHN MARAKIS
	S660 E1980 W4 18 13S 7E SL					165 EAST 1ST SOUTH
91-475	Point to Point	P	18600000 S	0.011	0.000	JOHN MARAKIS
	N660 E1980 W4 07 13S 7E SL					165 EAST 1ST SOUTH
91-476	Point to Point	P	18600000 S	0.000	0.000	JOHN MARAKIS
	N660 E660 SW 12 13S 6E SL					165 EAST 1ST SOUTH
91-477	Point to Point	P	18600000 S	0.000	0.000	JOHN MARAKIS
	N660 W660 SE 08 13S 7E SL					165 EAST 1ST SOUTH
91-478	Point to Point	P	18600000 S	0.000	0.000	JOHN MARAKIS
	S660 W660 NE 20 13S 7E SL					165 EAST 1ST SOUTH

91-479	Point to Point N660 E660 S4 16 13S 7E SL	P	19020000 S	0.000	0.000	JOHN MARAKIS UT
91-480	Point to Point N660 W660 S4 16 13S 7E SL	P	19020000 S	0.000	0.000	JOHN MARAKIS 165 EAST 1ST SOUTH
91-481	Point to Point S660 E1980 W4 06 13S 7E SL	P	18600000 S	0.011	0.000	ELLEN R. RADAKOVI(MARITAL AND FAMII ROBERT RADAKOVIC TRUSTEE
91-482	Point to Point S660 W660 NE 07 13S 7E SL	P	18600000 S	0.000	0.000	ELLEN R. RADAKOVI(MARITAL AND FAMII ROBERT RADAKOVU(TRUSTEE
91-5069	Point to Point N660 E1980 W4 32 12S 7E SL	P	18690000 S	0.000	1.400	RUDMAN LAND & LI\ L.L.C. 1111 EAST BRICKYAR SUITE 106
91-640	Point to Point S660 W660 E4 35 12S 7E SL	P	18600000 DS	0.000	0.000	CLARENCE ANDERSC PRICE UT 84501
91-660	Point to Point S660 E660 N4 25 12S 7E SL	P	19020000 S	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTE
91-665	Point to Point S660 E660 N4 25 12S 7E SL	P	19020000 S	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTE
91-667	Point to Point S660 E660 N4 25 12S 7E SL	P	19020000 S	0.000	0.000	MILTON E. JACOB PAUL JACOB, TRUSTE
91-740	Point to Point N660 W660 SE 25 12S 7E SL	P	18600000 DS	0.150	0.000	CLARENCE ANDERSC PRICE UT 84501
93-13	Point to Point N660 E660 S4 23 13S 6E SL	P	18750000 DS	0.000	0.000	USA FOREST SERVICI 324 25TH STREET
93-1539	Point to Point N660 E660 SW 14 13S 6E SL	P	18750000 S	0.011	0.000	USA FOREST SERVICI 324 25TH STREET
93-1540	Point to Point S660 E660 W4 14 13S 6E SL	P	18750000 S	0.011	0.000	USA FOREST SERVICI 324 25TH STREET
93-3676	Point to Point N660 E660 W4 23 13S 6E SL	P	S	0.000	0.000	USA FOREST SERVICI UT
93-8	Point to Point N660 W660 S4 23	P	18750000 S	0.000	0.000	USA FOREST SERVICI

	13S 6E SL						324 25TH STREET
91-135	Surface	A	19420310	DIMOSP	0.000	43000.000	USA BUREAU OF RECLAMATION
	N988 E1674 S4 10 12S 7E SL						PROVO AREA OFFICE
91-154	Surface	P	19461004	D	0.002	0.000	PRICE FIELD OFFICE I BUREAU OF LAND MANAGEMENT
	S135 W425 NE 22 12S 7E SL						125 SOUTH 600 WEST
91-181	Surface	P	19490209	D	0.002	0.000	PRICE FIELD OFFICE I BUREAU OF LAND MANAGEMENT
	S445 W405 NE 15 12S 7E SL						125 SOUTH 600 WEST
91-1986	Surface	P	18720000	O	0.050	0.000	CORPORATION OF TH PRESIDING BISHOP LI CHURCH
	S1020 W310 NE 17 13S 7E SL						ATTN: NATURAL RES SERVICES
91-2	Rediversion	P	19060830	DIMOSP	0.000	10363.940	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL						375 SOUTH CARBON A A-10
91-2	Rediversion	P	19060830	DIMOSP	0.000	10363.940	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL						375 SOUTH CARBON A A-10
91-2	Rediversion	P	19060830	DIMOSP	0.000	10363.940	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL						375 SOUTH CARBON A A-10
91-2	Rediversion	P	19060830	DIMOSP	0.000	10363.940	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL						375 SOUTH CARBON A A-10
91-2	Surface	P	19060830	DIMOSP	0.000	10363.940	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL						375 SOUTH CARBON A A-10
91-2144	Surface	P	1869	D	0.022	0.000	MATTIE B. CORNABY TRUST
	N470 E1280 W4 06 13S 7E SL						MATTIE B. AND WILL ARGYLE CORNABY T
91-2145	Surface	P	18690000	D	0.022	0.000	ROBERT RADAKOVIC MARITAL AND FAMIL
	N470 E1280 W4 06 13S 7E SL						ROBERT R. RADAKOV TRUSTEE

91-2248	Surface S650 W1670 E4 18 12S 7E SL	P	18740000	DIS	0.000	0.539	G. PETE FRANDSEN 9267 TORTELLINI DRI
91-2494	Surface N490 W1580 E4 31 12S 7E SL	P	1874	IS	0.000	0.000	MATTIE B. CORNABY TRUST MATTIE B. AND WILL ARGYLE CORNABY T
91-2971	Surface S700 W1840 E4 08 13S 7E SL	P	18740000	I	0.106	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2972	Surface S700 W1840 E4 08 13S 7E SL	P	18740000	I	0.106	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2973	Surface S700 W1840 E4 08 13S 7E SL	P	18740000	I	0.381	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2974	Surface S700 W1840 E4 08 13S 7E SL	P	18740000	IS	0.170	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2975	Surface N420 W80 S4 05 13S 7E SL	P	18740000	IS	0.011	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2976	Surface N100 W10 S4 05 13S 7E SL	P	18740000	IS	0.011	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2977	Surface S700 W1840 E4 08 13S 7E SL	P	18740000	I	0.075	0.000	FRED AND SHELIA JE P.O. BOX 113
91-2978	Surface N310 E510 S4 05 13S 7E SL	P	18740000	IS	0.683	0.000	CARBON CO. REC. TRANSPORTATION SI SERVICE DIS A SPECIAL SERVICE I CREATED BY CO. OF
91-2979	Surface N310 E510 S4 05 13S 7E SL	P	18740000	I	0.453	0.000	FRED AND SHELIA JE P.O. BOX 113

91-2980	Surface	P	18740000	I	0.100	0.000	FRANK T. JR. & PAME HELSTEN
	N310 E510 S4 05 13S 7E SL						1339 EAST 3955 SOUTI
91-2981	Surface	P	18740000	I	0.100	0.000	ORSON MARSING
	N310 E510 S4 05 13S 7E SL						MILLER CREEK UT
91-2982	Surface	P	18740000	I	0.100	0.000	LILLIE PEARSON
	N310 E510 S4 05 13S 7E SL						315 SOUTH 7TH EAST
91-2983	Surface	P	1874	I	0.100	0.000	THOMAS BIGGS
	N310 E510 S4 05 13S 7E SL						COLUMBIA UT
91-2984	Surface	P	18740000	I	0.100	0.000	WAINO E. BURTON
	N310 E510 S4 05 13S 7E SL						SCOFIELD UT
91-2985	Surface	P	18740000	I	0.100	0.000	PHYLLIS M. CONOVEI
	N310 E510 S4 05 13S 7E SL						358 SOUTH 1ST WEST
91-2986	Surface	P	18740000	I	0.015	0.000	JAMES F. LEVANGER
	N310 E510 S4 05 13S 7E SL						HC-35 BOX 250
91-2987	Surface	P	18740000	I	0.100	0.000	LEAH B. JOHNSON
	N310 E510 S4 05 13S 7E SL						273 WEST MAIN
91-2988	Surface	P	18740000	I	0.000	0.000	NOLAN G. AND LARU DAVIS
	N310 E510 S4 05 13S 7E SL						HELPER UT 84526
91-2989	Surface	P	18740000	IM	0.100	0.000	TOWN OF SCOFIELD
	N310 E510 S4 05 13S 7E SL						SCOFIELD UT
91-2990	Surface	P	18740000	I	1.166	0.000	DELLA L. MADSEN
	N310 E510 S4 05 13S 7E SL						MEADOW UT 84644
91-2991	Surface	P	1874	I	0.000	0.000	JOHN B. JONES
	N310 E510 S4 05 13S 7E SL						RT. 2 BOX 96
91-2992	Surface	P	1874	I	4.580	0.000	BILL B. AND UTAHNA JONES
	S120 W2230 E4 32 12S 7E SL						PALMYRA UT
91-2993	Surface	P	1874	I	4.580	0.000	BILL B. AND UTAHNA JONES
	S1200 E800 N4 32 12S 7E SL						PALMYRA UT
91-2994	Surface	P	1874	I	0.012	0.000	BILL B. AND UTAHNA

							JONES
	S1410 W350 N4 32 12S 7E SL						PALMYRA UT
91-2995	Surface	P	1874	I	0.000	0.000	BILL B. AND UTAHNA JONES
	S1160 W580 N4 32 12S 7E SL						PALMYRA UT
91-2997	Surface	P	1874	DI	0.000	38.800	LAZY CP LIMITED PARTNERSHIP
	S1160 W580 N4 32 12S 7E SL						C/O CLYDE PANNIER MARILYN PANNIER
91-2997	Surface	P	1874	DI	0.000	38.800	LAZY CP LIMITED PARTNERSHIP
	S190 E2225 NW 20 12S 7E SL						C/O CLYDE PANNIER MARILYN PANNIER
91-2997	Surface	P	1874	DI	0.000	38.800	LAZY CP LIMITED PARTNERSHIP
	N1810 E2535 SW 29 12S 7E SL						C/O CLYDE PANNIER MARILYN PANNIER
91-2997	Surface	P	1874	DI	0.000	38.800	LAZY CP LIMITED PARTNERSHIP
	N135 E80 SW 10 12S 7E SL						C/O CLYDE PANNIER MARILYN PANNIER
91-2997	Surface	P	1874	DI	0.000	38.800	LAZY CP LIMITED PARTNERSHIP
	N1400 E1090 SW 10 12S 7E SL						C/O CLYDE PANNIER MARILYN PANNIER
91-2998	Surface	P	18740000	I	0.500	0.000	LAZY CP LIMITED PARTNERSHIP
	S1160 W580 N4 32 12S 7E SL						(CLYDE PANNIER AN MARILYN PANNIER)
91-2999	Surface	P	18740000	I	0.136	0.000	REED & LEOAN M. GUNDERSON
	N660 E660 W4 32 12S 7E SL						3990 RAYMOND
91-3002	Surface	P	1874	I	0.035	0.000	DELLA L. MADSEN
	N660 E660 W4 32 12S 7E SL						MEADOW UT 84644
91-3003	Surface	P	1874	I	0.433	0.000	CHARLES J. JACOBSE
	N660 E660 W4 32 12S 7E SL						284 `M` STREET
91-3004	Surface	P	1874	I	0.433	0.000	LOUISE M. AND HELE WATTS
	N660 E660 W4 32 12S 7E SL						287 EAST 1ST NORTH
91-3007	Surface	P	1874	IS	0.630	0.000	MATTIE B. CORNABY TRUST
	N700 W1400 E4 06						MATTIE B. AND WILL

	13S 7E SL						ARGYLE CORNABY T
91-3008	Surface	P	18740000	I	0.693	0.000	FRED AND SHELIA JE
	N700 W1400 E4 05 13S 7E SL						P.O. BOX 113
91-3009	Surface	P	1874	I	0.068	0.000	MATTIE B. CORNABY TRUST
	N780 W60 E4 06 13S 7E SL						MATTIE B. AND WILL ARGYLE CORNABY T
91-3010	Surface	P	18740000	I	0.213	0.000	FRED AND SHELIA JE
	N780 W60 E4 06 13S 7E SL						P.O. BOX 113
91-3012	Surface	P	18690000	IS	0.015	0.000	CORPORATION OF TH PRESIDING BISHOP LI CHURCH
	S1030 W300 NE 17 13S 7E SL						ATTN: NATURAL RES SERVICES
91-3042	Surface	P	18690000	DS	0.011	0.000	SCOFIELD MOUNTAIN RECREATION ASSOCI
	N1105 E90 S4 19 12S 7E SL						4420 BRIAWOOD CIRC
91-3042	Surface	P	18690000	DS	0.011	0.000	SCOFIELD MOUNTAIN RECREATION ASSOCI
	N865 E425 S4 19 12S 7E SL						4420 BRIAWOOD CIRC
91-3042	Surface	P	18690000	DS	0.011	0.000	SCOFIELD MOUNTAIN RECREATION ASSOCI
	N1445 E990 S4 19 12S 7E SL						4420 BRIAWOOD CIRC
91-3383	Surface	P	18690000	DIS	0.100	0.000	PETE FRANDSEN
	S290 E1860 W4 18 12S 7E SL						TOOELE, UT 84074
91-3405	Surface	P	1874	IS	0.500	0.000	MATTIE B. CORNABY TRUST
	N540 W1610 E4 31 12S 7E SL						MATTIE B. AND WILL ARGYLE CORNABY T
91-345	Surface	P	18740000	I	0.750	0.000	TOM NICOLAIDES
	S650 W100 N4 17 13S 7E SL						1026 EAST 1ST SOUTH
91-354	Surface	P	19030000	O	0.019	0.000	PIONEER DITCH COM
	N388 E437 W4 05 13S 7E SL						PRICE UT 84501
91-3573	Surface	P	18800000	IS	0.088	0.000	G. PETE FRANDSEN
	N1500 W1520 SE 19 12S 7E SL						P.O. BOX 717
91-3622	Surface	P	1874	I	0.016	0.000	MAE NICOLODEMAS
	N310 E510 S4 05 13S 7E SL						SCOFIELD UT 84538

91-4120	Surface	P	19020000 S	24.870	0.000	CARBON WATER CONSERVANCY DIST.
	N810 W990 SE 10 12S 7E SL					PRICE UT 84501
91-4195	Surface	P	18740000 M	0.100	0.000	SCOFIELD TOWN
	S546 W285 N4 17 13S 7E SL					SCOFIELD UT 84538
91-4195	Surface	P	18740000 M	0.100	0.000	SCOFIELD TOWN
	N310 E510 S4 05 13S 7E SL					SCOFIELD UT 84538
91-4229	Surface	P	19800814 D	0.000	25.600	SCOFIELD MOUNTAI RECREATION ASSOC.
	S1080 E980 W4 19 12S 7E SL					4420 BRIARWOOD CIF
91-4229	Surface	P	19800814 D	0.000	25.600	SCOFIELD MOUNTAI RECREATION ASSOC.
	S630 E1040 W4 19 12S 7E SL					4420 BRIARWOOD CIF
91-4229	Surface	P	19800814 D	0.000	25.600	SCOFIELD MOUNTAI RECREATION ASSOC.
	S755 E1190 W4 19 12S 7E SL					4420 BRIARWOOD CIF
91-4265	Surface	U	19810601 P	550.000	0.000	A MUNICIPAL CORPO PRICE CITY
	N1050 W1000 SE 10 12S 7E SL					MUNICIPAL BUILDIN
91-4821	Surface	P	19320401 D	0.010	0.000	DOUG & SUE HELSTE
	S55 W640 E4 16 12S 7E SL					POA DOUG HELSTEN SUE HELSTEN
91-483	Surface	P	18740000 IS	0.443	0.000	ROBERT RADAKOVIC MARITAL AND FAMIL
	N700 W1400 E4 06 13S 7E SL					ROBERT R. RADAKO TRUSTEE
91-4833	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4833	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4833	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4833	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32					375 SOUTH CARBON

	12S 7E SL					A-10
91-4833	Surface	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4950	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4950	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4950	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4950	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4950	Surface	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4961	Rediversion	P	19060830 I	0.000	18.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4961	Rediversion	P	19060830 I	0.000	18.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4961	Rediversion	P	19060830 I	0.000	18.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4961	Rediversion	P	19060830 I	0.000	18.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4961	Surface	P	19060830 I	0.000	18.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4962	Rediversion	P	19060830 I	0.000	0.450	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON A

	12S 7E SL					A-10
91-4962	Rediversion	P	19060830 I	0.000	0.450	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4962	Rediversion	P	19060830 I	0.000	0.450	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4962	Rediversion	P	19060830 I	0.000	0.450	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4962	Surface	P	19060830 I	0.000	0.450	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4973	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4973	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4973	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4973	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4973	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4986	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4986	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4986	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17					375 SOUTH CARBON A

	12S 7E SL					A-10
91-4986	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4986	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4992	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4992	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4992	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4992	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4992	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-4999	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-4999	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-4999	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-4999	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-4999	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5000	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5000	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5000	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5000	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5000	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5005	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5005	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5005	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5005	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5005	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5006	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5006	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05					375 SOUTH CARBON /

	13S 7E SL					A-10
91-5006	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5006	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-5006	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5010	Rediversion	P	19060830 O	0.000	427.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-5010	Rediversion	P	19060830 O	0.000	427.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5010	Rediversion	P	19060830 O	0.000	427.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5010	Rediversion	P	19060830 O	0.000	427.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-5010	Surface	P	19060830 O	0.000	427.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5011	Rediversion	P	19060830 I	0.000	75.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-5011	Rediversion	P	19060830 I	0.000	75.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5011	Rediversion	P	19060830 I	0.000	75.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5011	Rediversion	P	19060830 I	0.000	75.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5011	Surface	P	19060830 I	0.000	75.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5013	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5013	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5013	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5013	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5013	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5017	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5017	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5017	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5017	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5017	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5021	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON /

	12S 7E SL					A-10
91-5021	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5021	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5021	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-5021	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5025	Rediversion	P	19060830 I	0.000	20.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-5025	Rediversion	P	19060830 I	0.000	20.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5025	Rediversion	P	19060830 I	0.000	20.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5025	Rediversion	P	19060830 I	0.000	20.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-5025	Surface	P	19060830 I	0.000	20.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5027	Rediversion	P	19060830 I	0.000	25.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-5027	Rediversion	P	19060830 I	0.000	25.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5027	Rediversion	P	19060830 I	0.000	25.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5027	Rediversion	P	19060830 I	0.000	25.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5027	Surface	P	19060830 I	0.000	25.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5030	Rediversion	P	19060830 I	0.000	377.200	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5030	Rediversion	P	19060830 I	0.000	377.200	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5030	Rediversion	P	19060830 I	0.000	377.200	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5030	Rediversion	P	19060830 I	0.000	377.200	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5030	Surface	P	19060830 I	0.000	377.200	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5033	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5033	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5033	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5033	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5033	Surface	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10					375 SOUTH CARBON /

	13S 7E SL					A-10
91-5038	Rediversion	P	19060830 I	0.000	31.440	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5038	Rediversion	P	19060830 I	0.000	31.440	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5038	Surface	P	19060830 I	0.000	31.440	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5040	Rediversion	P	19060830 I	0.000	9.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5040	Rediversion	P	19060830 I	0.000	9.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5040	Rediversion	P	19060830 I	0.000	9.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5040	Rediversion	P	19060830 I	0.000	9.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5040	Surface	P	19060830 I	0.000	9.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5042	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5042	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5042	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5042	Rediversion	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32					375 SOUTH CARBON /

	12S 7E SL					A-10
91-5042	Surface	P	19060830 I	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5044	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-5044	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5044	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5044	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-5044	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5045	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A-10
91-5045	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A-10
91-5045	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A-10
91-5045	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A-10
91-5045	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A-10
91-5046	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON

	12S 7E SL					A-10
91-5046	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5046	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5046	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5046	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5047	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5047	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5047	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5047	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5047	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5048	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5048	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5048	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5048	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5048	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5049	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5049	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5049	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5049	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5049	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5050	Rediversion	P	19060830 I	0.000	1.000	JUMPCREEK PROPER
	N860 E430 S4 19 12S 7E SL					P.O. BOX 224
91-5050	Rediversion	P	19060830 I	0.000	1.000	JUMPCREEK PROPER
	S970 E60 W4 05 13S 7E SL					P.O. BOX 224
91-5050	Rediversion	P	19060830 I	0.000	1.000	JUMPCREEK PROPER
	N1338 E655 SW 17 12S 7E SL					P.O. BOX 224
91-5050	Rediversion	P	19060830 I	0.000	1.000	JUMPCREEK PROPER
	N30 E465 S4 32 12S 7E SL					P.O. BOX 224
91-5050	Surface	P	19060830 I	0.000	1.000	JUMPCREEK PROPER
	N810 W990 SE 10 12S 7E SL					P.O. BOX 224
91-5051	Rediversion	P	19060830 I	0.000	5.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5051	Rediversion	P	19060830 I	0.000	5.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5051	Rediversion	P	19060830 I	0.000	5.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5051	Rediversion	P	19060830 I	0.000	5.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5051	Surface	P	19060830 I	0.000	5.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5052	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5052	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5052	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5052	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5052	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5054	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5054	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5054	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17					375 SOUTH CARBON /

	12S 7E SL					A-10
91-5054	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5054	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5057	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5057	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5057	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5057	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5057	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5058	Rediversion	P	19060830 I	0.000	1.000	JOHN & JERI HOUSTO
	N860 E430 S4 19 12S 7E SL					809 NORTH 200 EAST
91-5058	Rediversion	P	19060830 I	0.000	1.000	JOHN & JERI HOUSTO
	S970 E60 W4 05 13S 7E SL					809 NORTH 200 EAST
91-5058	Rediversion	P	19060830 I	0.000	1.000	JOHN & JERI HOUSTO
	N1338 E655 SW 17 12S 7E SL					809 NORTH 200 EAST
91-5058	Rediversion	P	19060830 I	0.000	1.000	JOHN & JERI HOUSTO
	N30 E465 S4 32 12S 7E SL					809 NORTH 200 EAST
91-5058	Surface	P	19060830 I	0.000	1.000	JOHN & JERI HOUSTO
	N810 W990 SE 10 12S 7E SL					809 NORTH 200 EAST
91-5064	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5064	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5064	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5064	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5064	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5065	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5065	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5065	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5065	Rediversion	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5065	Surface	P	19060830 D	0.000	0.250	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5068	Rediversion	P	19060830 I	0.000	1.000	DOUGLAS D. & ROBY FAUSETT
	N860 E430 S4 19 12S 7E SL					563 SOUTH 1750 EAST
91-5068	Rediversion	P	19060830 I	0.000	1.000	DOUGLAS D. & ROBY FAUSETT
	S970 E60 W4 05 13S 7E SL					563 SOUTH 1750 EAST
91-5068	Rediversion	P	19060830 I	0.000	1.000	DOUGLAS D. & ROBY FAUSETT
	N1338 E655 SW 17					

	12S 7E SL					563 SOUTH 1750 EAST
91-5068	Rediversion	P	19060830 I	0.000	1.000	DOUGLAS D. & ROBY FAUSETT
	N30 E465 S4 32 12S 7E SL					563 SOUTH 1750 EAST
91-5068	Surface	P	19060830 I	0.000	1.000	DOUGLAS D. & ROBY FAUSETT
	N810 W990 SE 10 12S 7E SL					563 SOUTH 1750 EAST
91-5076	Rediversion	P	19060830 DIOS	0.000	10.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5076	Rediversion	P	19060830 DIOS	0.000	10.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5076	Rediversion	P	19060830 DIOS	0.000	10.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5076	Rediversion	P	19060830 DIOS	0.000	10.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5076	Surface	P	19060830 DIOS	0.000	10.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5080	Rediversion	P	19060830 IO	0.000	2.000	MILLSTREAM PROPEI
	N860 E430 S4 19 12S 7E SL					380 EAST MAIN STREI B 2ND FLOOR
91-5080	Rediversion	P	19060830 IO	0.000	2.000	MILLSTREAM PROPEI
	S970 E60 W4 05 13S 7E SL					380 EAST MAIN STREI B 2ND FLOOR
91-5080	Rediversion	P	19060830 IO	0.000	2.000	MILLSTREAM PROPEI
	N1338 E655 SW 17 12S 7E SL					380 EAST MAIN STREI B 2ND FLOOR
91-5080	Rediversion	P	19060830 IO	0.000	2.000	MILLSTREAM PROPEI
	N30 E465 S4 32 12S 7E SL					380 EAST MAIN STREI B 2ND FLOOR
91-5080	Surface	P	19060830 IO	0.000	2.000	MILLSTREAM PROPEI
	N810 W990 SE 10 12S 7E SL					380 EAST MAIN STREI B 2ND FLOOR
91-5083	Rediversion	P	19060830 IO	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5083	Rediversion	P	19060830 IO	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5083	Rediversion	P	19060830 IO	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5083	Rediversion	P	19060830 IO	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5083	Surface	P	19060830 IO	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5085	Rediversion	P	19060830 IO	0.000	65.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5085	Rediversion	P	19060830 IO	0.000	65.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5085	Rediversion	P	19060830 IO	0.000	65.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5085	Rediversion	P	19060830 IO	0.000	65.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5085	Surface	P	19060830 IO	0.000	65.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5087	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5087	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5087	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5087	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5087	Surface	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5094	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5094	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5094	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5094	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5094	Surface	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5095	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5095	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5095	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5095	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5095	Surface	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5096	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5096	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5096	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5096	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5096	Surface	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5097	Rediversion	P	19060830 IO	0.000	1.000	TAYKIN-A-BREAK LL
	N860 E430 S4 19 12S 7E SL					C/O BRUCE TAYLOR
91-5097	Rediversion	P	19060830 IO	0.000	1.000	TAYKIN-A-BREAK LL
	S970 E60 W4 05 13S 7E SL					C/O BRUCE TAYLOR
91-5097	Rediversion	P	19060830 IO	0.000	1.000	TAYKIN-A-BREAK LL
	N1338 E655 SW 17 12S 7E SL					C/O BRUCE TAYLOR
91-5097	Rediversion	P	19060830 IO	0.000	1.000	TAYKIN-A-BREAK LL
	N30 E465 S4 32 12S 7E SL					C/O BRUCE TAYLOR
91-5097	Surface	P	19060830 IO	0.000	1.000	TAYKIN-A-BREAK LL
	N810 W990 SE 10 12S 7E SL					C/O BRUCE TAYLOR
91-5100	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5100	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5100	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5100	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5100	Surface	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5101	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5101	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5101	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5101	Rediversion	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5101	Surface	P	19060830 IO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5102	Rediversion	P	19060830 DIO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5102	Rediversion	P	19060830 DIO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5102	Rediversion	P	19060830 DIO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5102	Rediversion	P	19060830 DIO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5102	Surface	P	19060830 DIO	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5105	Rediversion	P	19060830 I	0.000	26.500	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5105	Rediversion	P	19060830 I	0.000	26.500	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5105	Rediversion	P	19060830 I	0.000	26.500	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5105	Rediversion	P	19060830 I	0.000	26.500	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5105	Surface	P	19060830 I	0.000	26.500	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5108	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5108	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5108	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5108	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5108	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5109	Rediversion	P	19060830 I	0.000	21.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5109	Rediversion	P	19060830 I	0.000	21.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05					375 SOUTH CARBON A

	13S 7E SL					A-10
91-5109	Rediversion	P	19060830 I	0.000	21.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5109	Rediversion	P	19060830 I	0.000	21.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5109	Surface	P	19060830 I	0.000	21.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5110	Rediversion	P	19060830 I	0.000	0.980	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5110	Rediversion	P	19060830 I	0.000	0.980	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5110	Rediversion	P	19060830 I	0.000	0.980	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5110	Rediversion	P	19060830 I	0.000	0.980	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5110	Surface	P	19060830 I	0.000	0.980	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5138	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5138	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5138	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5138	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32					375 SOUTH CARBON A

	12S 7E SL					A-10
91-5138	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5139	Rediversion	P	19060830 I	0.000	14.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5139	Rediversion	P	19060830 I	0.000	14.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5139	Rediversion	P	19060830 I	0.000	14.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5139	Rediversion	P	19060830 I	0.000	14.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5139	Surface	P	19060830 I	0.000	14.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5142	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON / A-10
91-5142	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON / A-10
91-5142	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON / A-10
91-5142	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON / A-10
91-5142	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON / A-10
91-5143	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19					375 SOUTH CARBON /

	12S 7E SL					A-10
91-5143	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5143	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5143	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5143	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-5144	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N860 E430 S4 19 12S 7E SL					375 SOUTH CARBON A A-10
91-5144	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	S970 E60 W4 05 13S 7E SL					375 SOUTH CARBON A A-10
91-5144	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N1338 E655 SW 17 12S 7E SL					375 SOUTH CARBON A A-10
91-5144	Rediversion	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N30 E465 S4 32 12S 7E SL					375 SOUTH CARBON A A-10
91-5144	Surface	P	19060830 I	0.000	1.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
91-78	Surface	P	19371011 DIMOS	0.000	17960.000	PRICE RIVER WATER ASSOCIATION
	N810 W990 SE 10 12S 7E SL					375 SOUTH CARBON A A-10
a15120	Surface	A	19890608 DI	0.500	0.000	GLADYS P. BUTLER
	S1160 W580 N4 32 12S 7E SL					1584 EAST 1500 NORTI
a15120	Surface	A	19890608 DI	0.500	0.000	GLADYS P. BUTLER
	S190 E2225 NW 20 12S 7E SL					1584 EAST 1500 NORTI
a15120	Surface	A	19890608 DI	0.500	0.000	GLADYS P. BUTLER

	N1810 E2535 SW 29 12S 7E SL					1584 EAST 1500 NORT
a15120	Surface	A	19890608 DI	0.500	0.000	GLADYS P. BUTLER
	N135 E80 SW 10 12S 7E SL					1584 EAST 1500 NORT
a15120	Surface	A	19890608 DI	0.500	0.000	GLADYS P. BUTLER
	N1400 E1090 SW 10 12S 7E SL					1584 EAST 1500 NORT
a24768	Surface	A	20060404 DIO	0.000	31.440	PARADISE ACRES L.C
	N1338 E655 SW 17 12S 7E SL					1111 BRICKYARD RO 106
a24768	Surface	A	20060404 DIO	0.000	31.440	PARADISE ACRES L.C
	N1200 E2000 SW 17 12S 7E SL					1111 BRICKYARD RO 106
a25786	Surface	A	20010709 O	0.000	5.000	ROSS GIGLIOTTI
	N810 W990 SE 10 12S 7E SL					1110 NORTH MARTIN
a27697	Surface	A	20030331 OS	0.000	1.400	RUDMAN LAND & LI LLC
	S1346 W630 N4 32 12S 7E SL					1111 EAST BRICKYAR SUITE 106
t29665	Surface	A	20041220 O	0.000	3.000	CARBON COUNTY
	S2100 W920 NE 18 12S 7E SL					120 EAST MAIN STRE
t31913	Surface	A	20060831 O	0.000	3.000	PRICE RIVER WATER ASSOCIATION
	N792 W463 SW 17 13S 7E SL					375 SOUTH CARBON A-10
t32977	Surface	A	20070515 O	0.000	2.000	PRICE RIVER WATER ASSOCIATION
	N448 W941 E4 18 12S 7E SL					375 SOUTH CARBON A-10
t33132	Surface	A	20070619 O	0.000	3.000	PRICE RIVER WATER ASSOCIATION
	N448 W941 E4 18 12S 7E SL					375 SOUTH CARBON A-10
E1114	Surface	A	19770613 O	0.000	30.000	CANYON FUEL COMP
	S1700 W800 NE 23 13S 6E SL					ATTN: PROPERTY ADMINISTRATION
E1114	Surface	A	19770613 O	0.000	30.000	CANYON FUEL COMP
	N900 E1700 SW 13 13S 6E SL					ATTN: PROPERTY ADMINISTRATION
E1114	Surface	A	19770613 O	0.000	30.000	CANYON FUEL COMP
	N2400 E2600 SW 24 13S 6E SL					ATTN: PROPERTY ADMINISTRATION
E1658	Surface	A	19800303 O	0.000	1.000	ROBERT AND ELLEN RADAKOVICH MARIT

						FAMILY TRUST
	S120 W2540 E4 08 13S 7E SL					ROBERT RADAKOVIC TRUSTEE
E178	Surface	A	19650809 DO	0.000	1.000	CATHERINE RUDMAN
	N1338 E655 SW 17 12S 7E SL					378 EAST BURTON AV
E1784	Surface	A	19810206 M	0.000	15.000	KANAWHA AND HOC COAL AND COKE CO
	S530 E2490 NW 17 13S 7E SL					SCOFIELD ROUTE
E375	Surface	A	19700716 D	0.000	6.000	SCOFIELD MOUNTAI RECREATION ASSOCI
	N860 E430 S4 19 12S 7E SL					4420 BRIARWOOD CI
E452	Surface	A	19710809 S	0.000	1.000	ROBERT AND ELLEN RADAKOVICH MARIT FAMILY TRUST
	S970 E60 W4 05 13S 7E SL					ROBERT RADAKOVIC TRUSTEE

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Table 3.7.4.1-1. Summary of Temperature Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station - Clear Creek #1													
Record Mean:	23.5	22.5	28.5	34.5	44.1	52.0	60.0	56.4	49.3	35.8	28.6	20.8	n/a
Record Max:	55.4	59.0	62.6	68.0	77.0	82.4	89.6	86.0	78.8	73.4	64.4	53.6	n/a
Record Min:	-11.2	-5.8	-18.4	-2.2	-11.2	19.4	24.8	19.4	17.6	5.0	-4.0	-22.0	n/a
Station - Scofield Dam													
Avg Max (F):	27.4	31.9	38.1	48.2	59.4	70.2	77.7	75.4	67.3	56.1	39.9	30.4	51.8
Avg Min. (F):	-1.4	0.6	11.9	21.9	31.0	38.0	44.4	42.9	34.9	26.1	15.8	3.4	22.5

Table 3.7.4.2-1. Summary of Precipitation Data – Scofield Dam

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Avg Precipitation (in)	1.65	1.47	1.29	0.95	1.04	0.90	1.09	1.41	1.18	1.18	1.12	1.27	14.56
Avg Snowfall (in)	26.2	21.8	20.1	8.4	2.0	0.1	0.0	0.0	0.3	3.5	13.5	19.8	115.8
Avg Snow Depth (in)	18	20	14	3	0	0	0	0	0	0	3	9	6

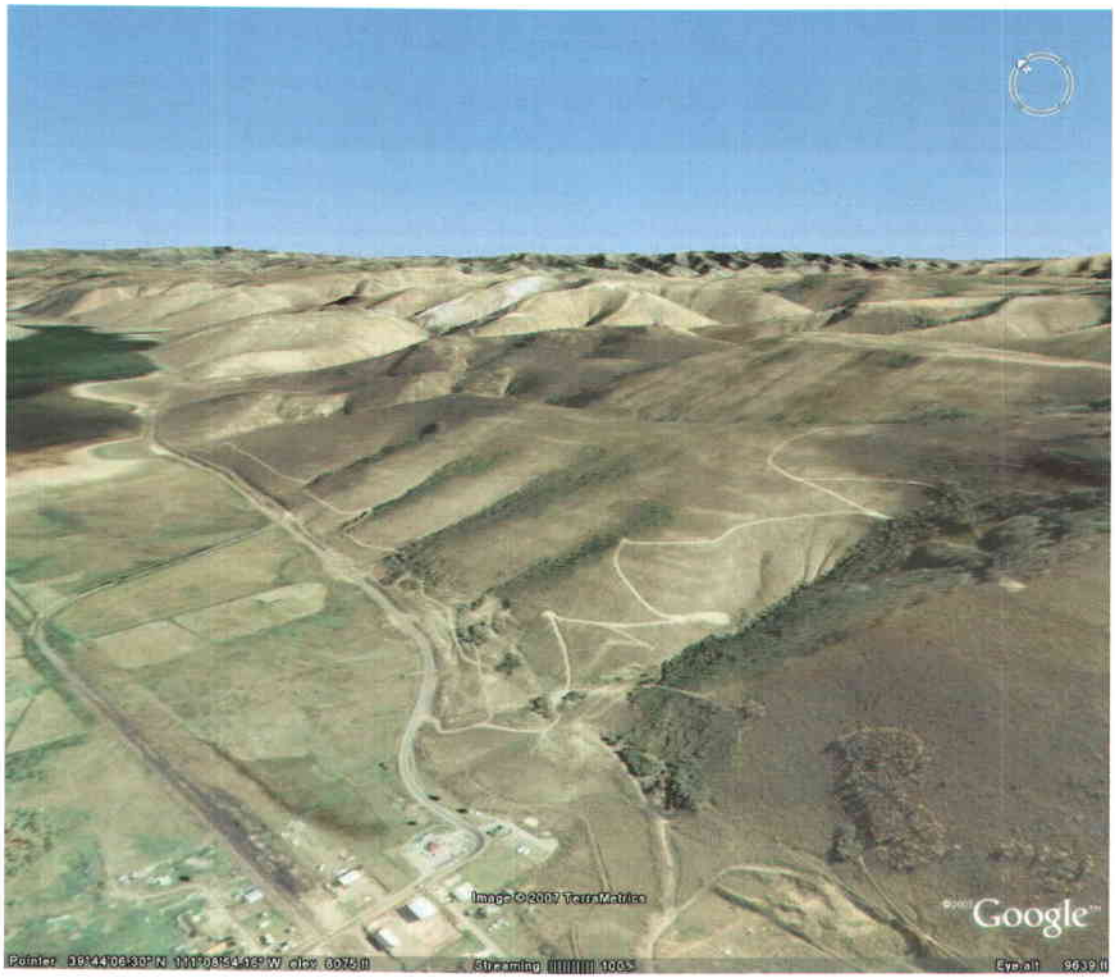
Table 3.7.7-3. Summary of Wind Data - Price, Utah

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Avg Wind Speed (mph)	5.1	5.8	7.9	8.5	8.4	8.2	7.0	6.6	6.9	6.7	5.8	5.2	6.8
Avg Wind Direction	N	N	N	N	N	N	N	N	N	N	N	N	N

TABLE 3.7.8.2-1 - DESIGN RAINFALL DEPTHS

LOCATION	RETURN PERIOD	RAINFALL DEPTH (INCHES) BY DURATION	
		6-HOUR	24-HOUR
Kinney Mine	10-Year	1.28	1.92
	100-Year	2.08	2.73

Figure 3.7.1.3-1. Arial View of Permit Area



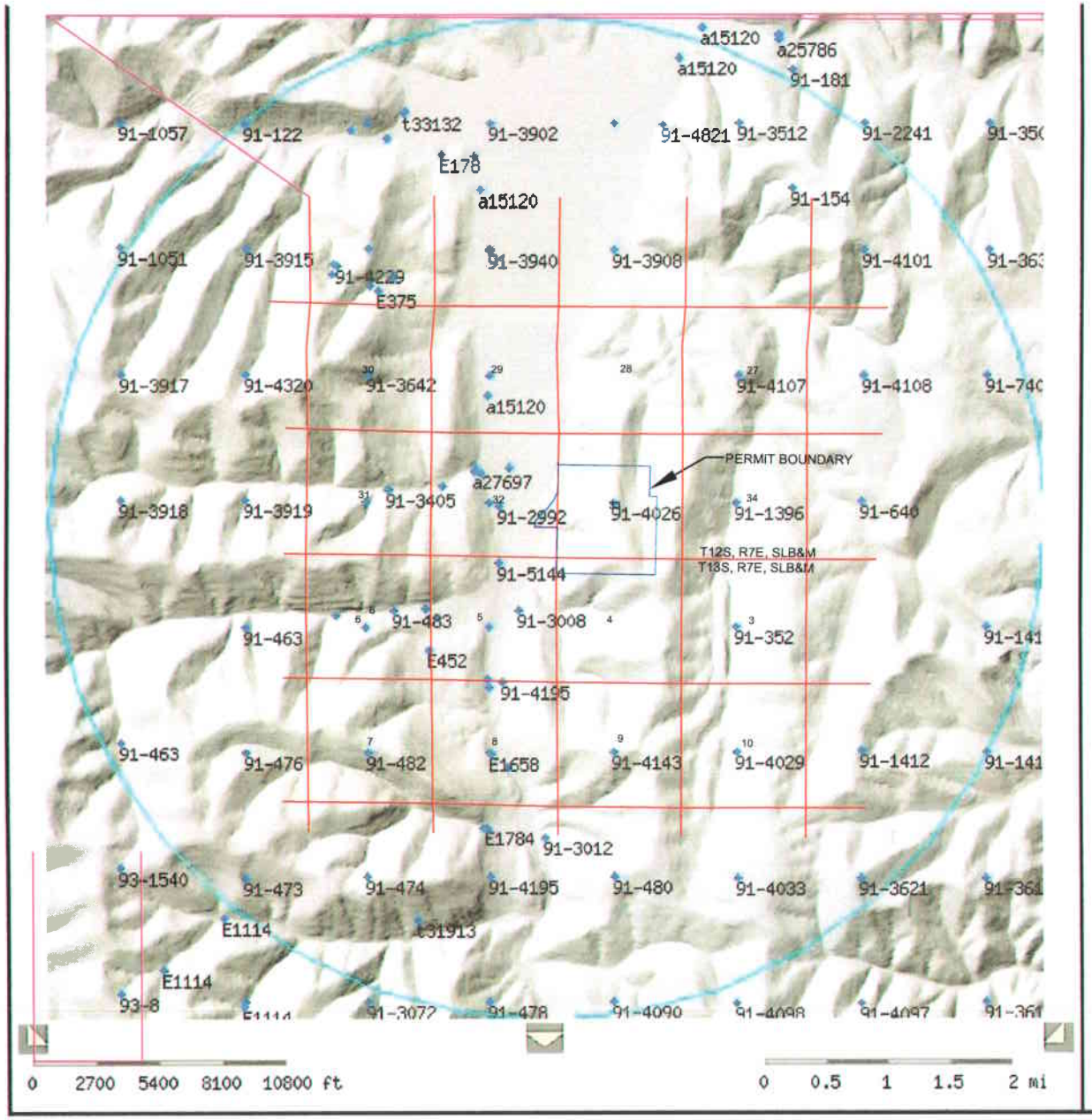


Figure 3.7.3.5-1
Surface Water Right Locations

USGS

Figure 3.7.3.3-1 Mud Creek Flows

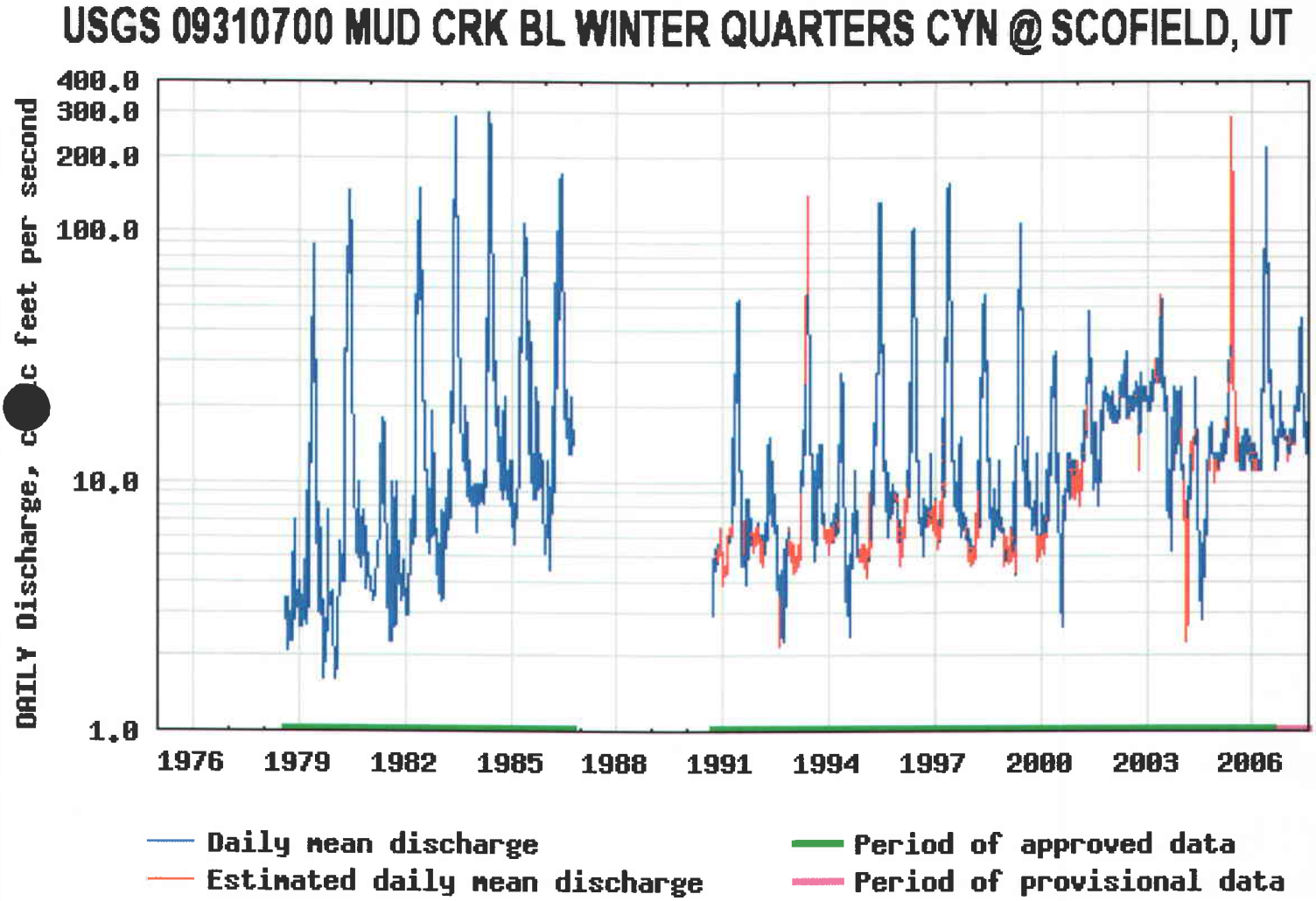
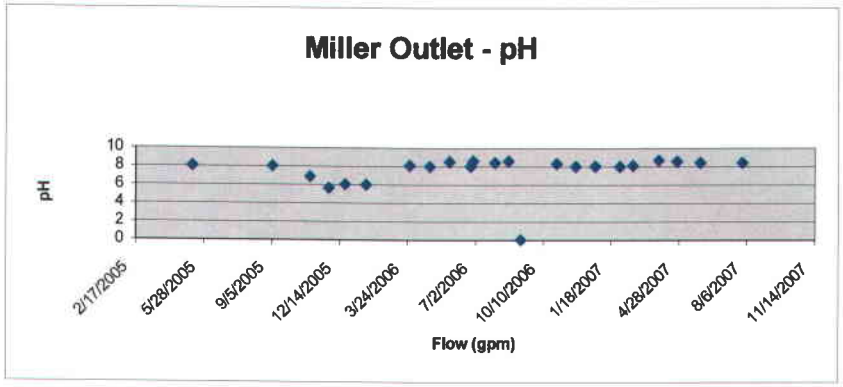
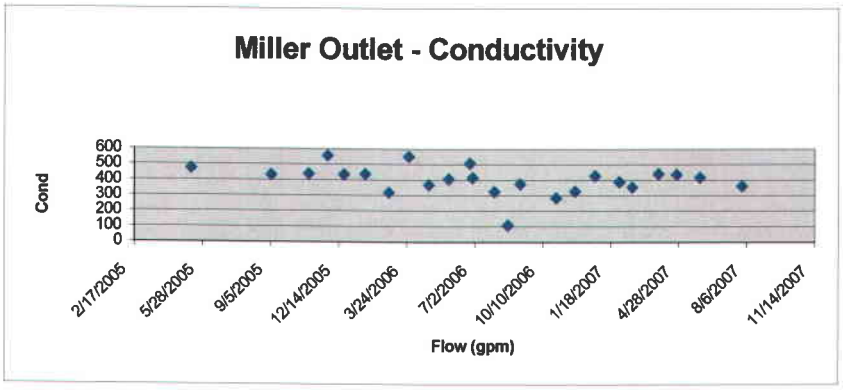
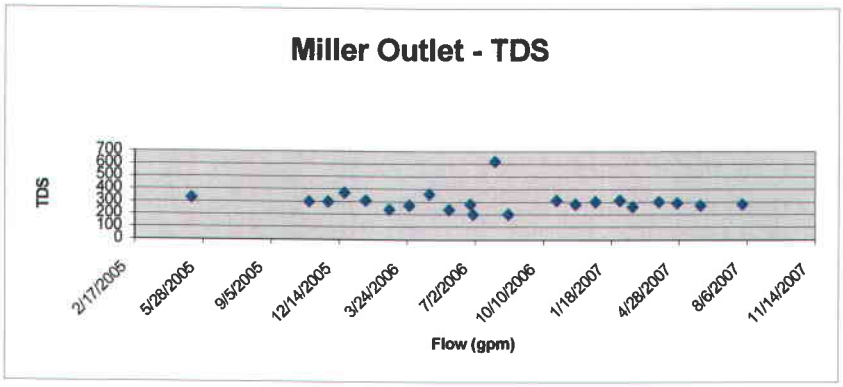


Figure 3.7.3.4-1 Basic Water Quality







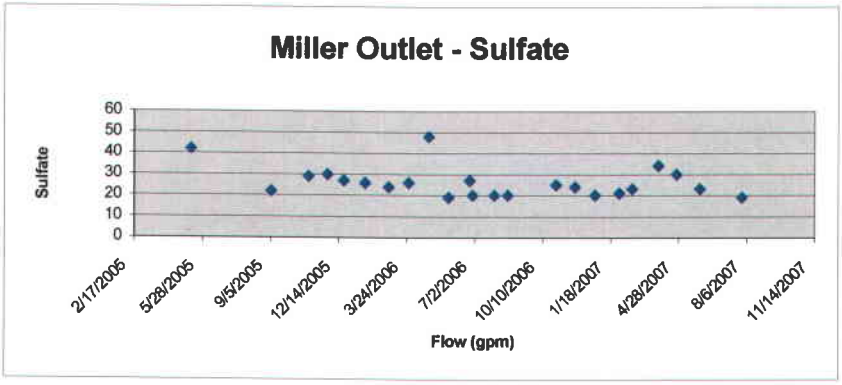
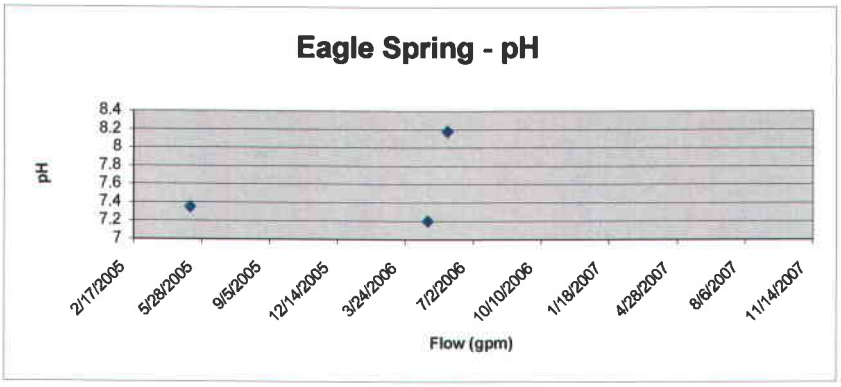
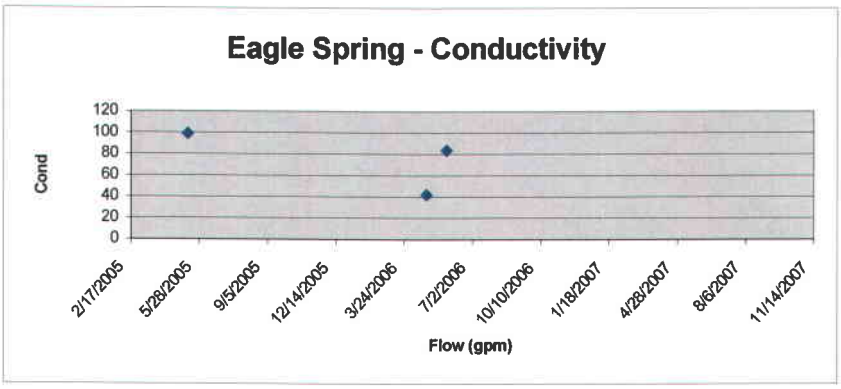
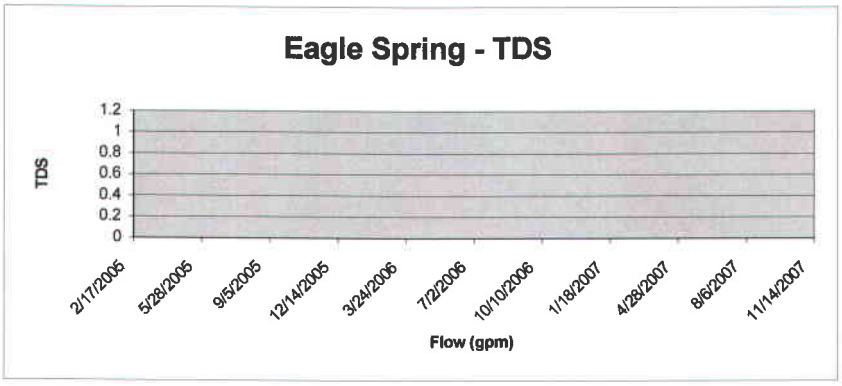


Figure 3.7.3.4-1 (Continued)







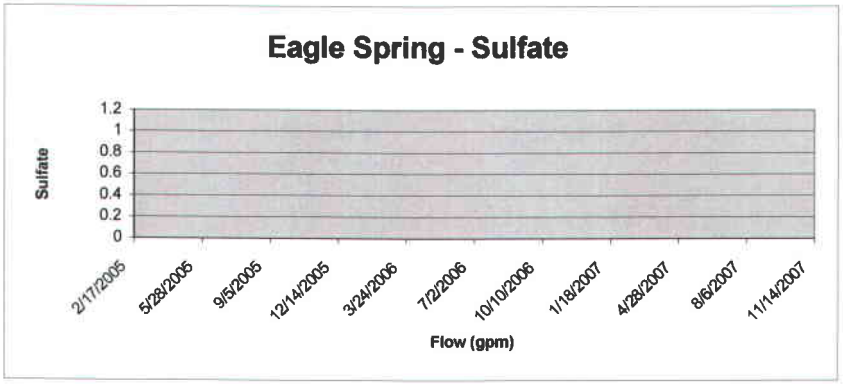
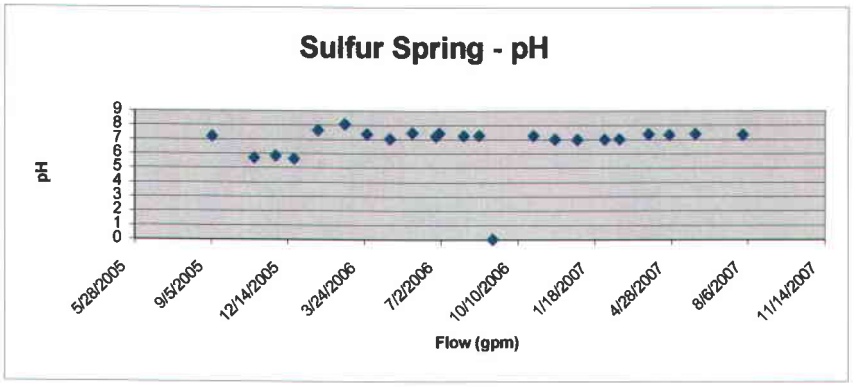
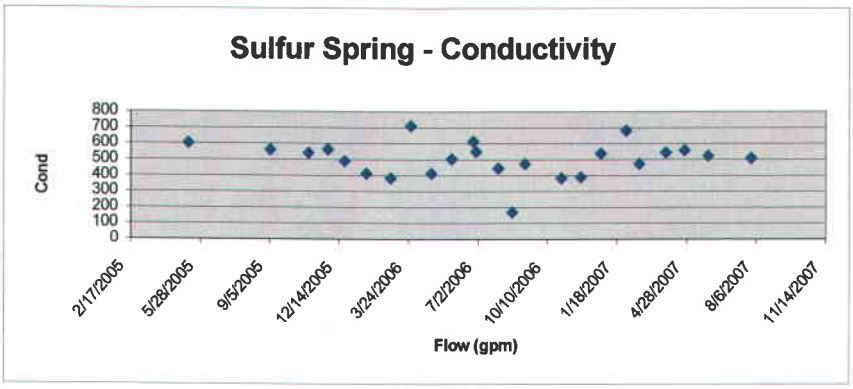
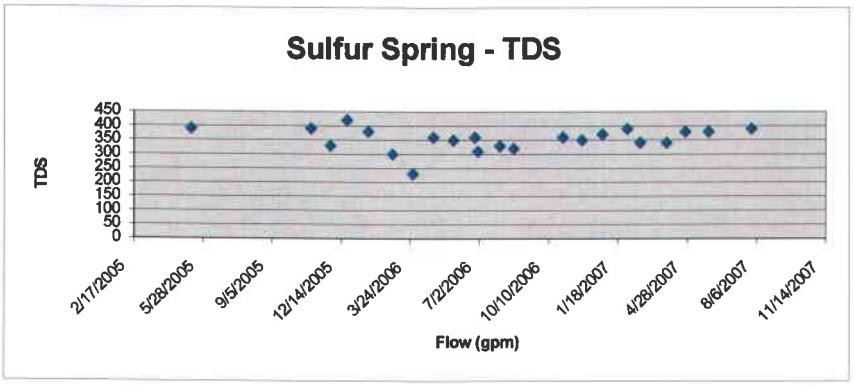


Figure 3.7.3.4-1 (Continued)







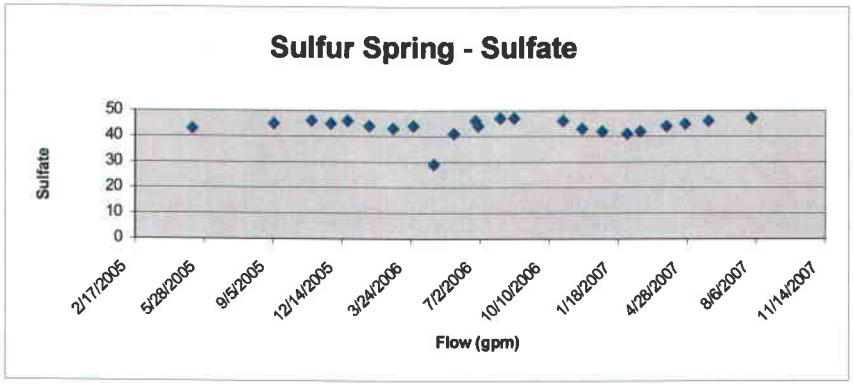
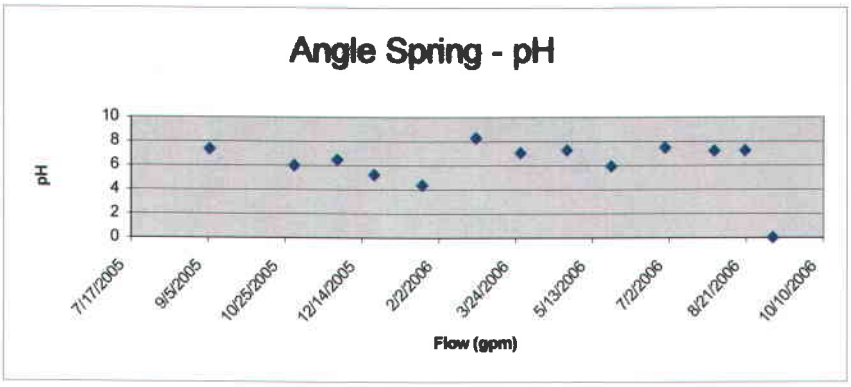
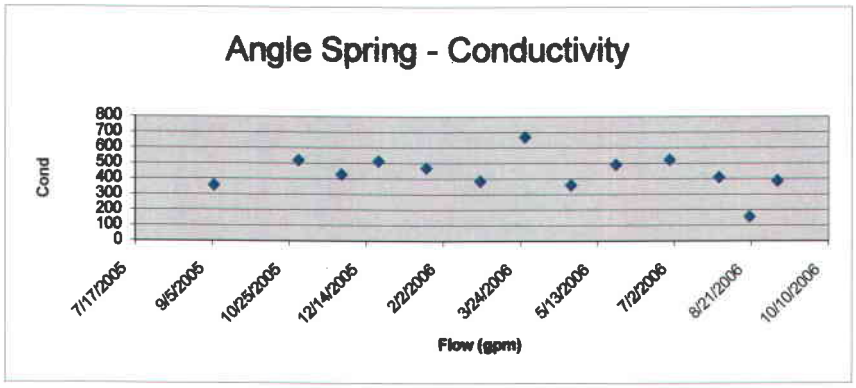
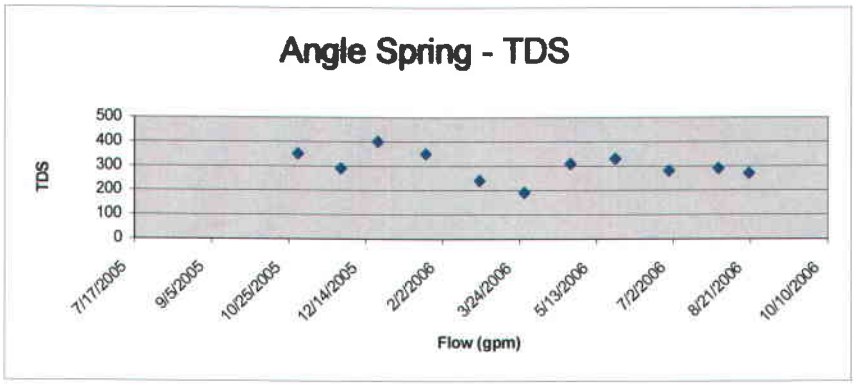
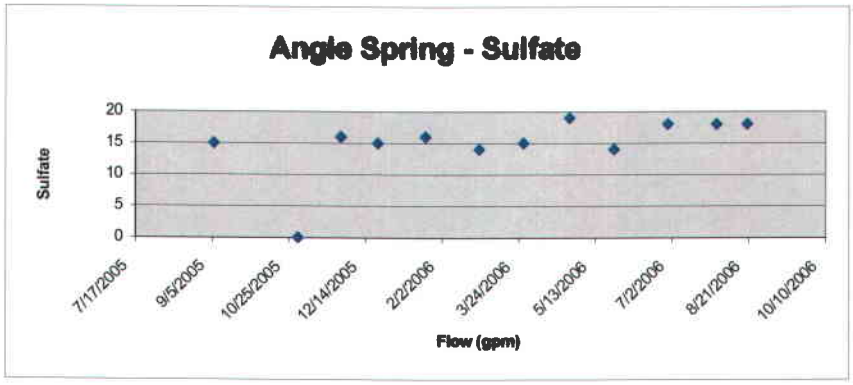


Figure 3.7.3.4-1 (Continued)









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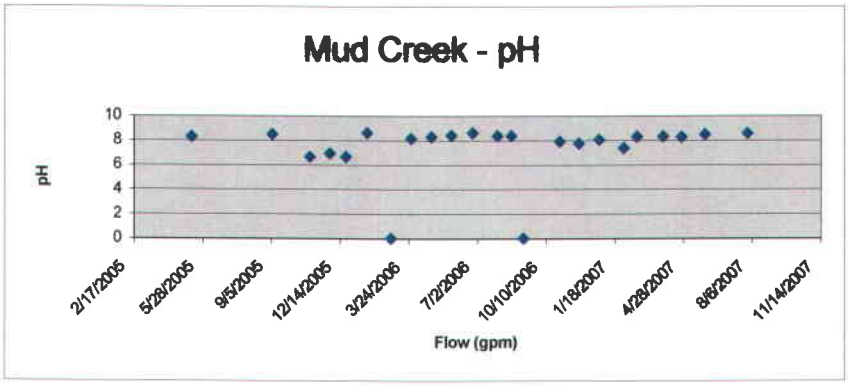
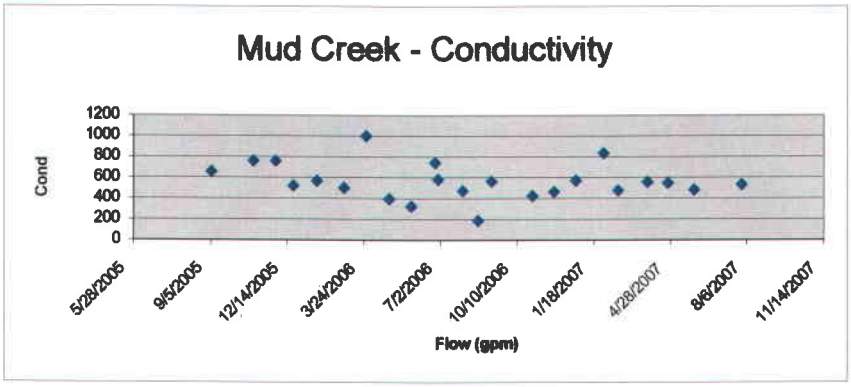
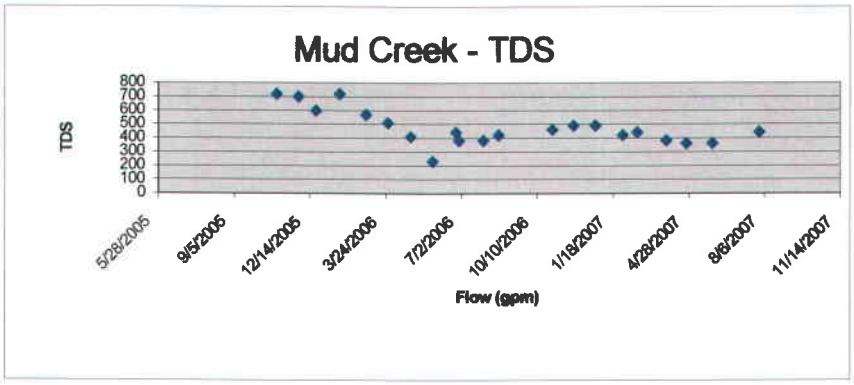






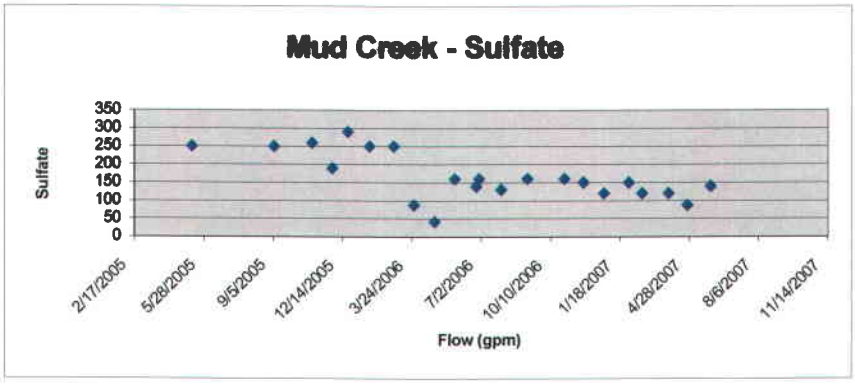
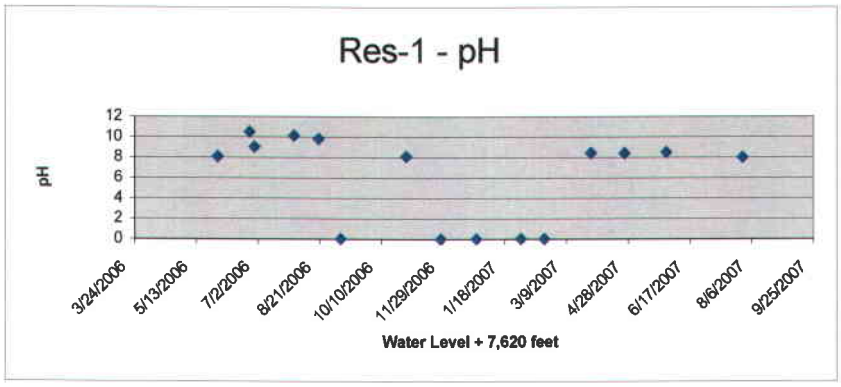
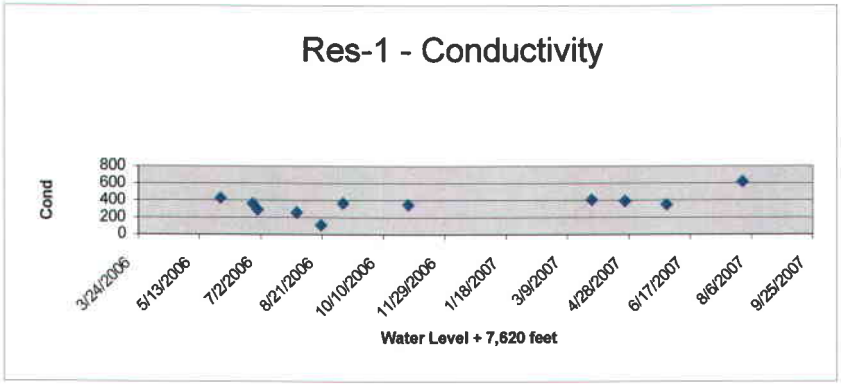
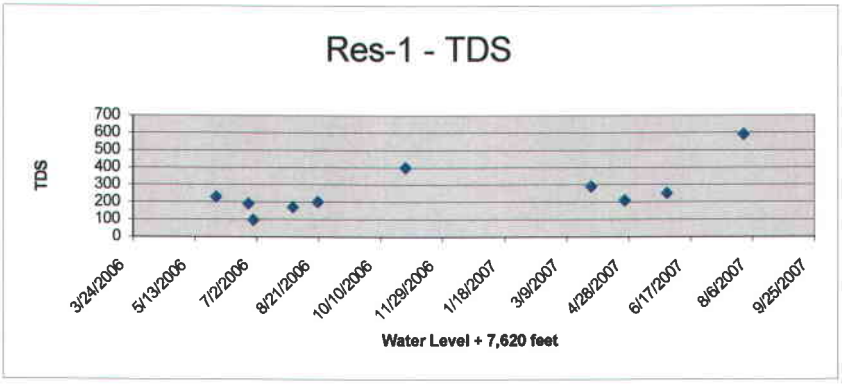


Figure 3.7.3.4-1 (Continued)







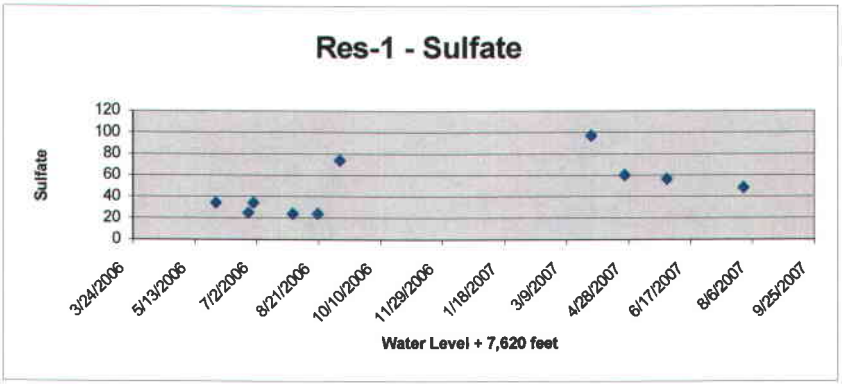
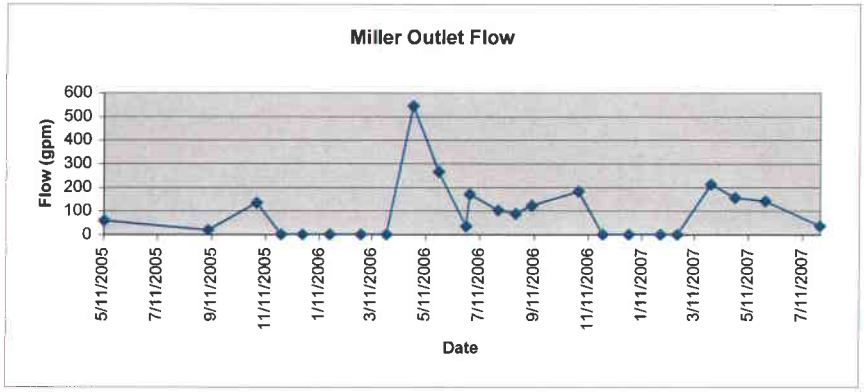
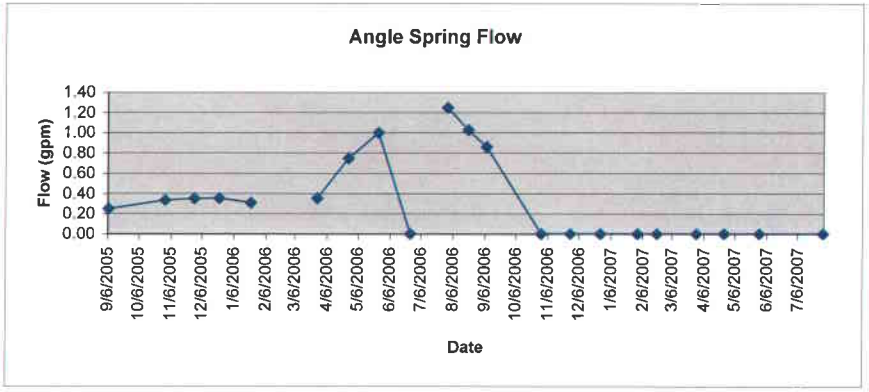
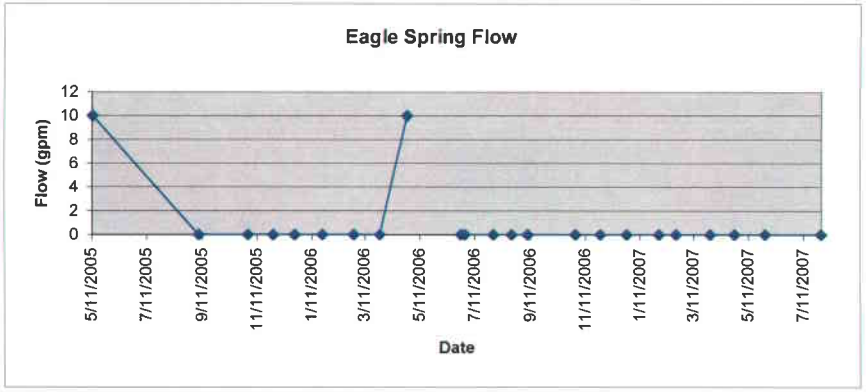
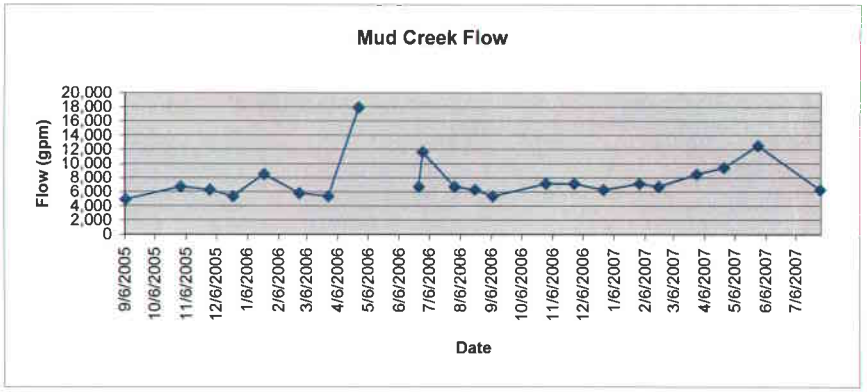


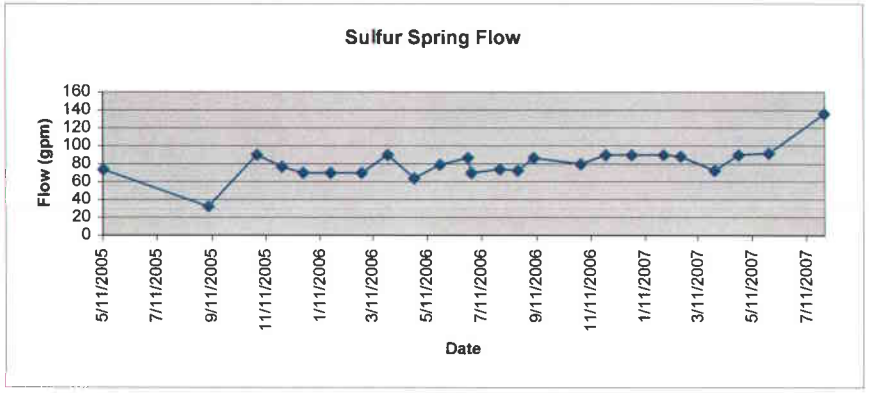
Figure 3.7.3.3-2 Flow Data

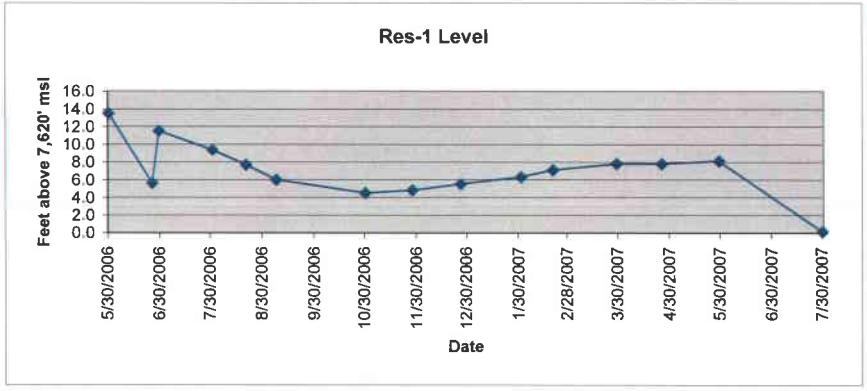












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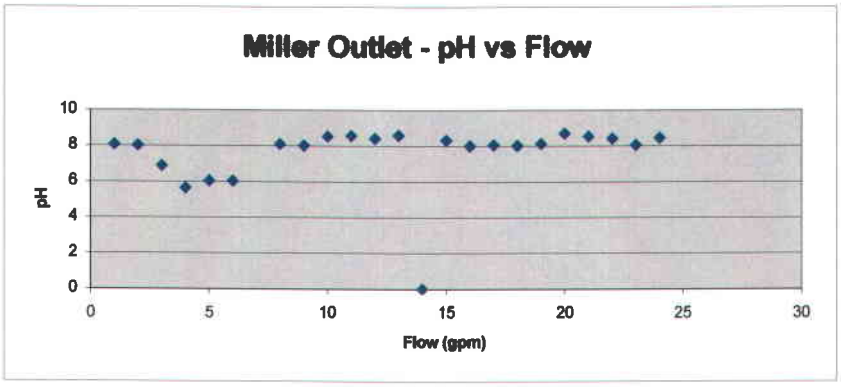

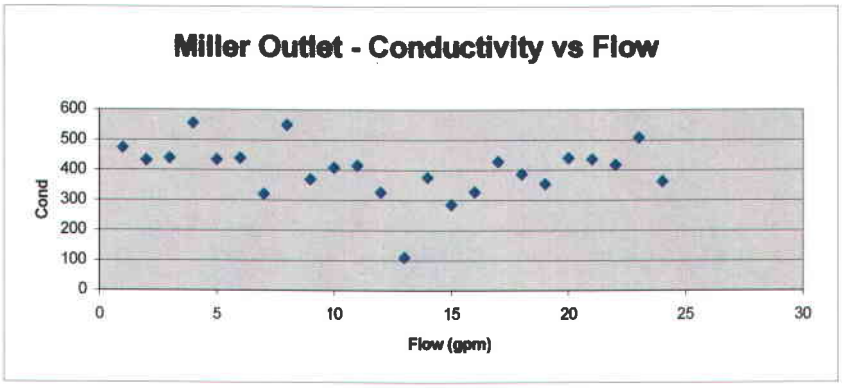

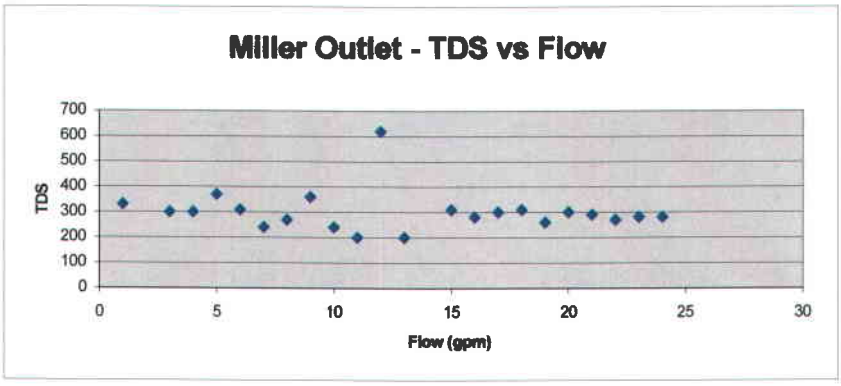

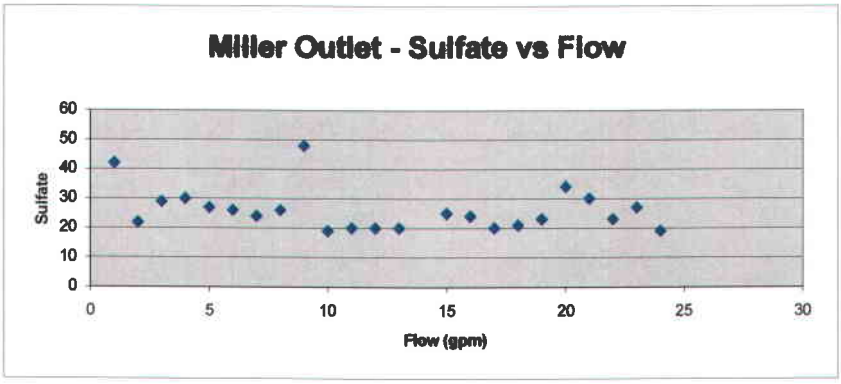

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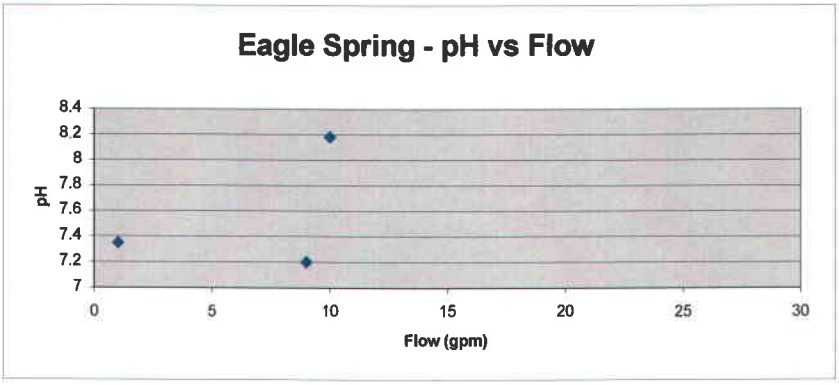

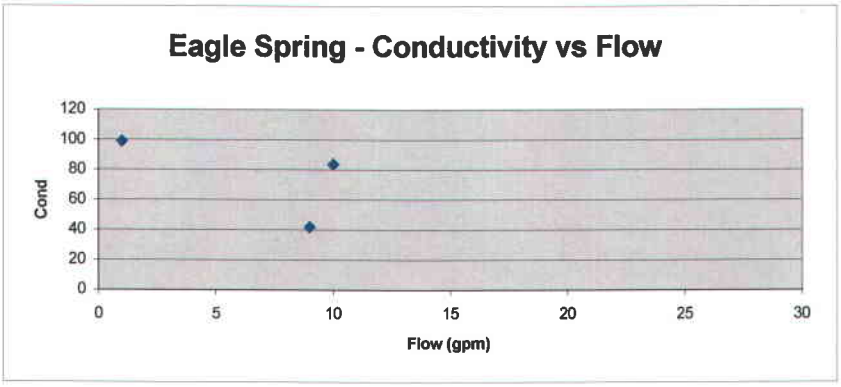

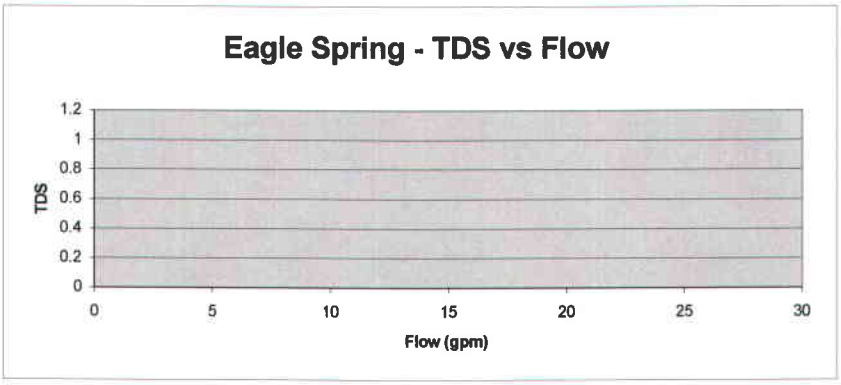

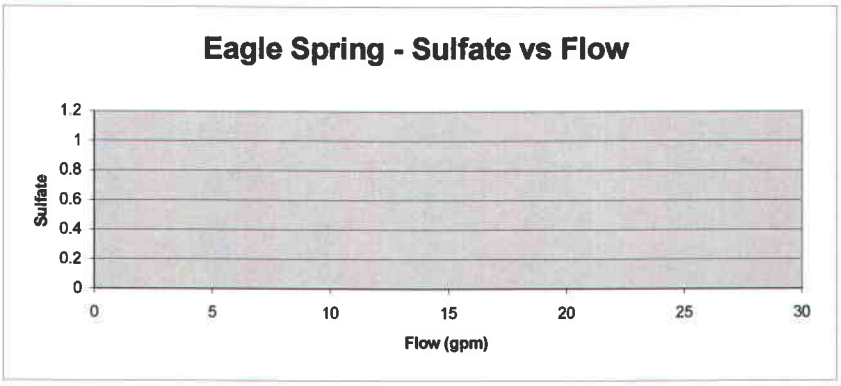

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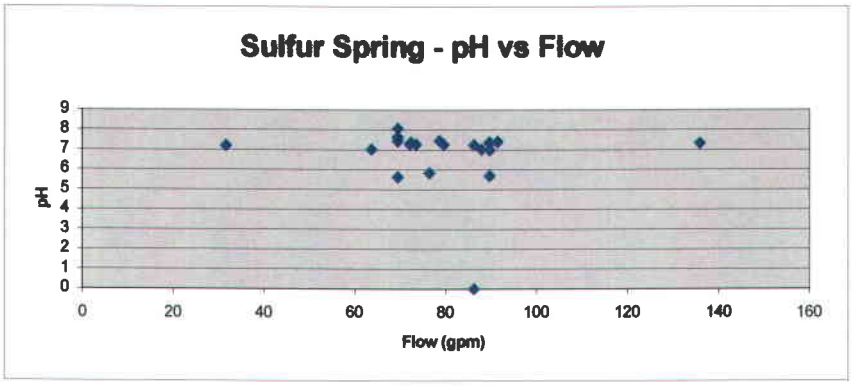

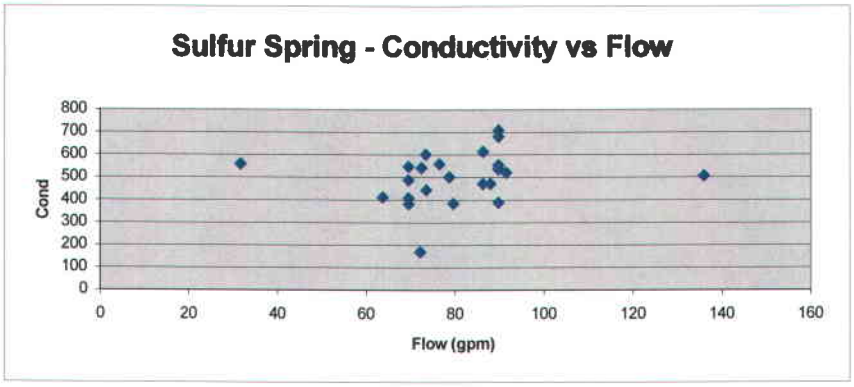

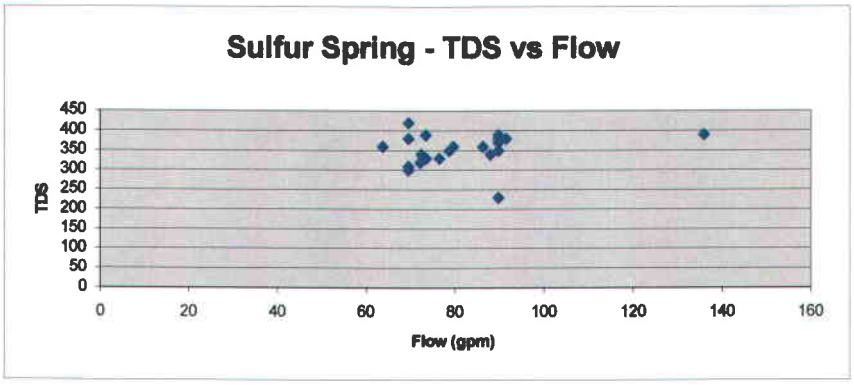

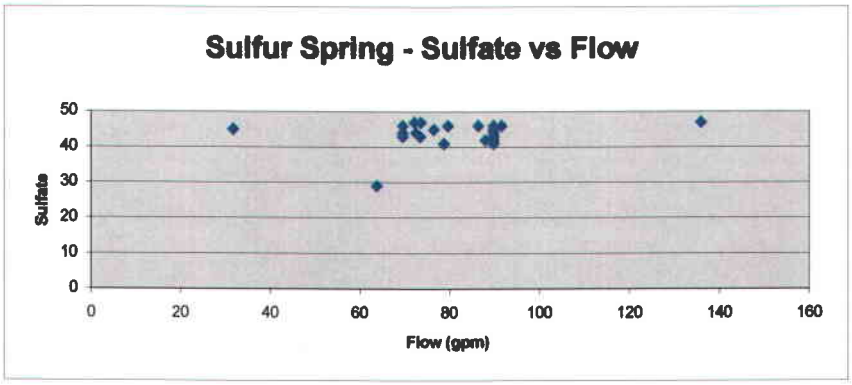

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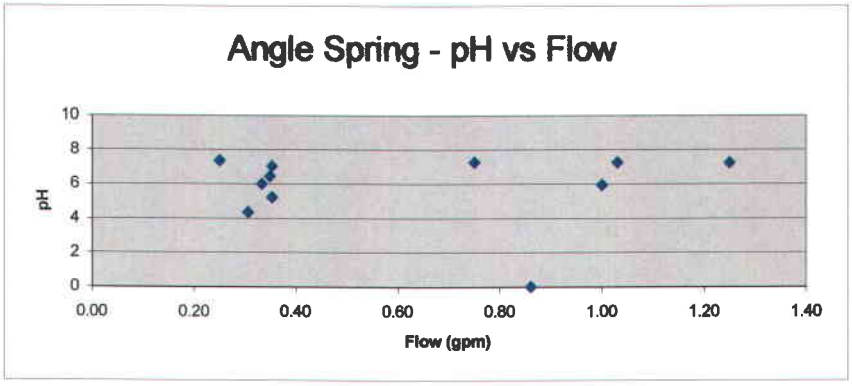

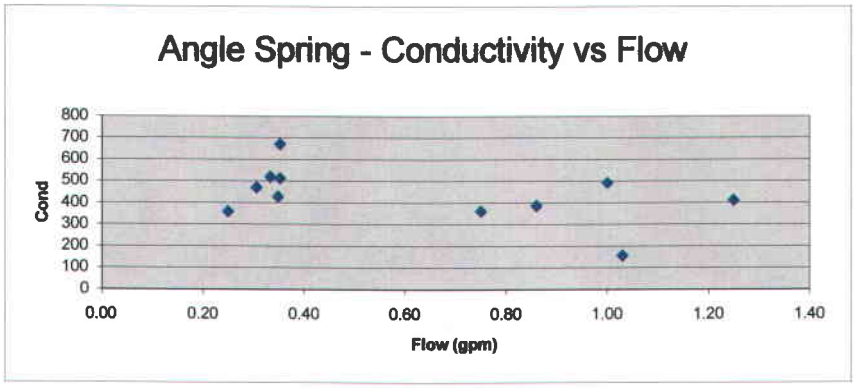

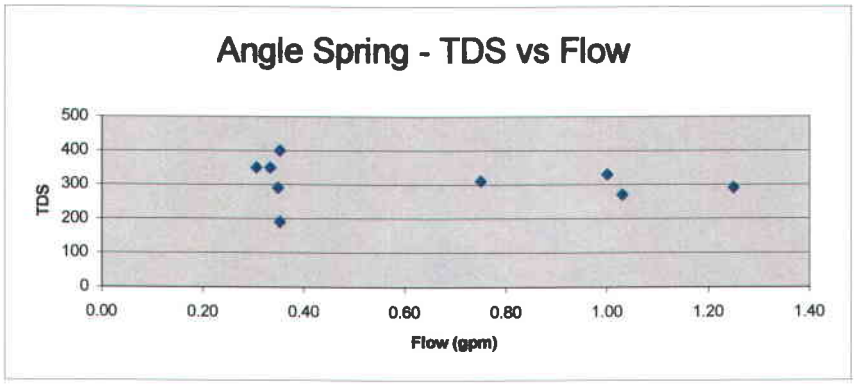

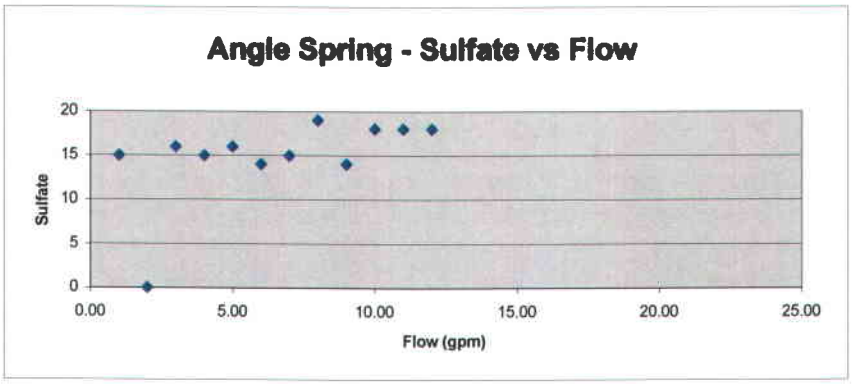

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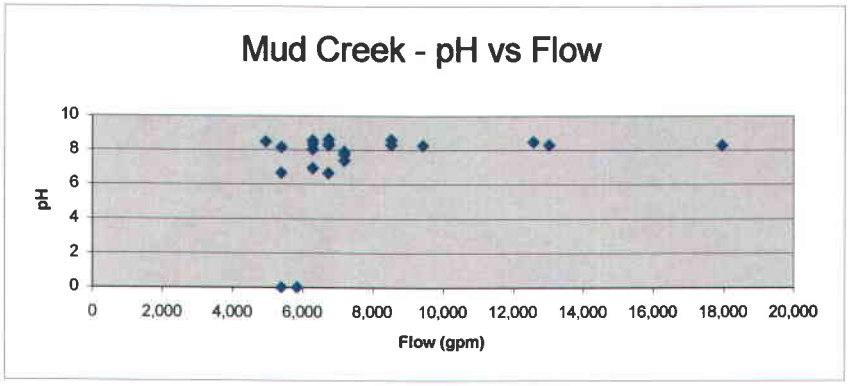

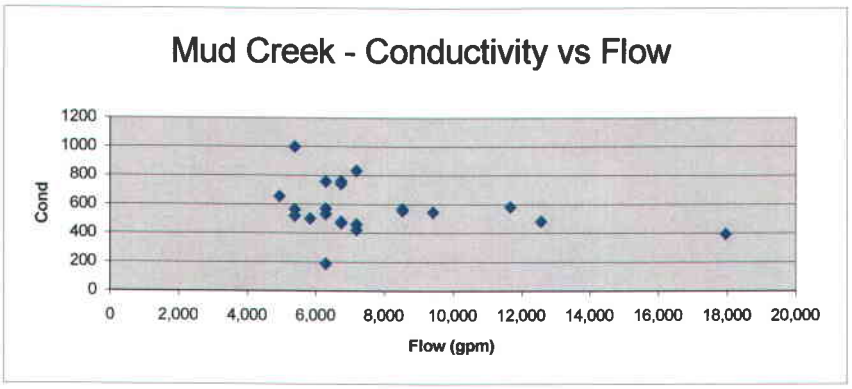

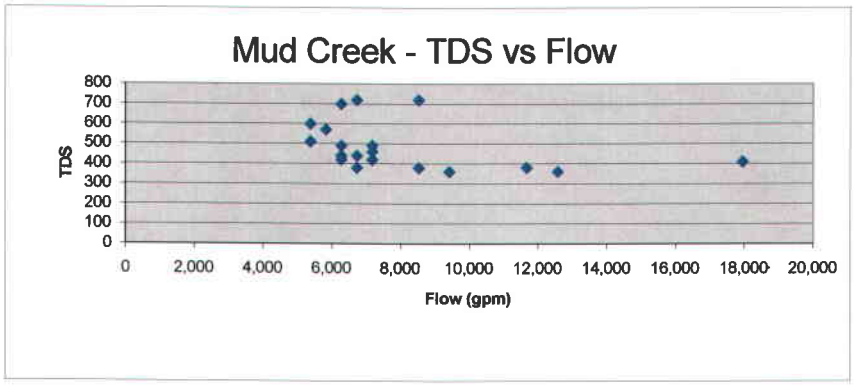

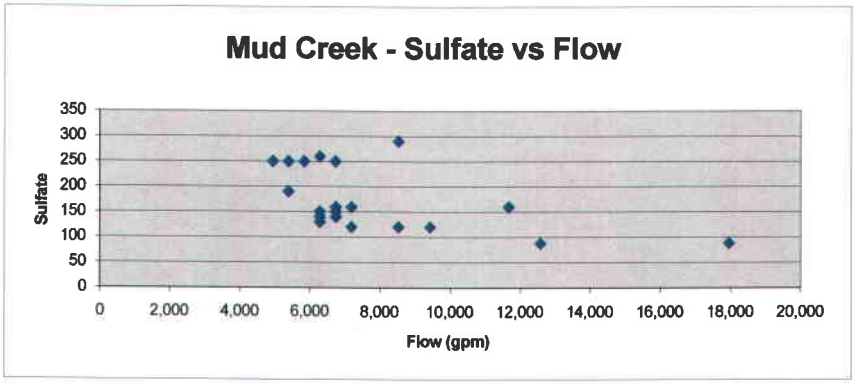

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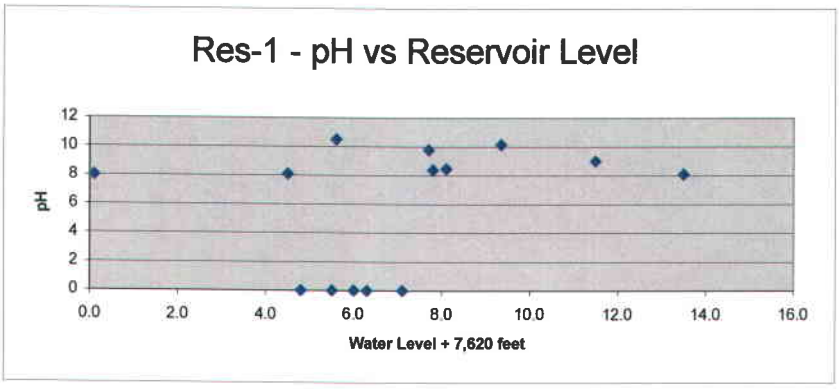
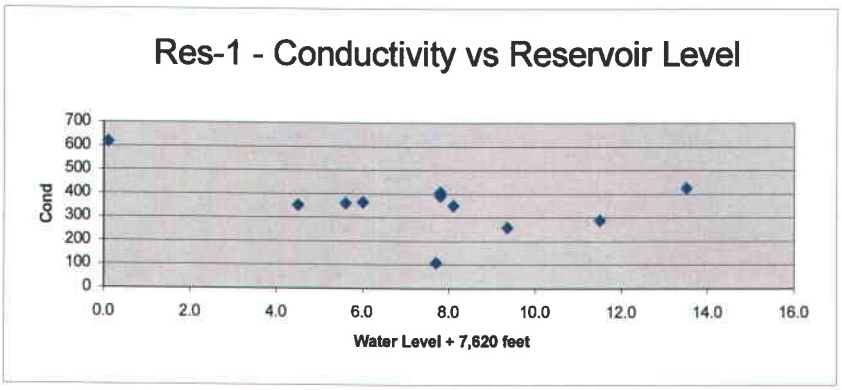
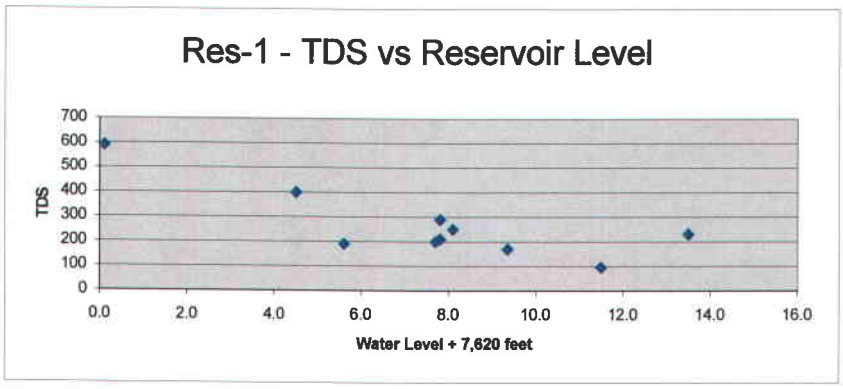
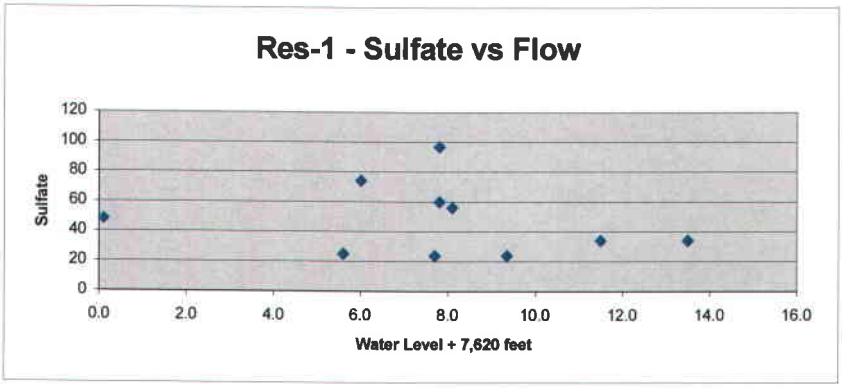








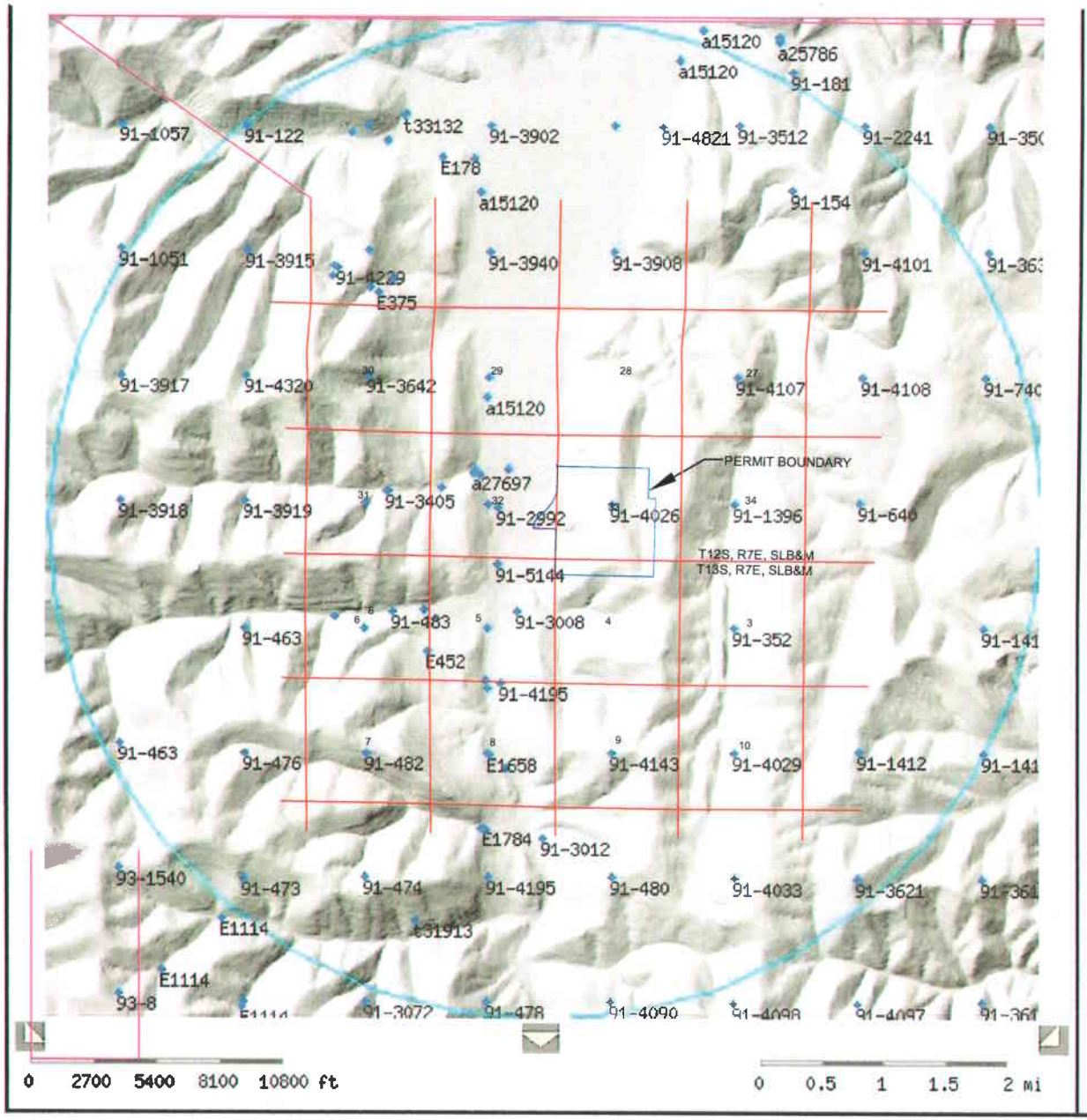


Figure 3.7.3.5-1
Surface Water Right Locations

4.0 OPERATING PLANS AND DESIGN CRITERIA

This section of the Kinney No. 2 Mine Permit Application provides both general and specific information on the design, construction, operation, and maintenance of planned mining and related structures and activities. Information sources utilized in developing the operations descriptions presented in this section include geologic evaluations of the minable coal reserves, detailed mining plans developed by the CR Team, conceptual and detailed facility layouts and designs, geotechnical evaluations of both the geologic sequence and mining plans, detailed drainage and sediment control plans, and specific plans for control, monitoring, and mitigation of mining related impacts. The design and operating information presented in this section has been prepared in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to provide a reasonable description of the location and nature of all mining and related activities and disturbances as a basis for identification and evaluation of potential mining related environmental and other impacts. The mining plans presented in this section reflect consideration of the environmental resource information presented in Section 3.0, Environmental Information, and are designed to prevent, control, and mitigate to the extent operationally practicable the potential effects of mining.

The various information categories addressed in the subsections which make up the Operating Plans and Design Criteria Section are consistent with the information categories outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

4.1 Exploration Plans and Activities

4.2 Soil Handling Plans

4.3 Protection of Biological Resources

4.4 Air Emissions Controls

4.5 Engineering Design and Operating Plans

4.6 Geologic Protection Plans

4.7 Hydrologic Resource Protection

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps and exhibits, is referenced in the text and may be provided in the separate map and exhibit volumes.

4.1 EXPLORATION PLANS AND ACTIVITIES

4.1.1 General Description of Exploration Plans

This section describes general exploration practices, and associated environmental control and mitigation measures which would be applicable for any future exploration activities. Information presented in this section was developed in accordance with applicable regulatory requirements (R-645-201 and 202) for coal mine permitting in the State of Utah.

4.1.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-201-200 and 300, and R645-202-100 and 200 through 236. Reclamation plans and related performance standards (Rules R645-202-240 through 244.300) are addressed in Section 5.1. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
4.1.1	
4.1.1.1	General Introductory Information
4.1.1.2	R645-201-210, 220 through 225, and 310 through 332, and 202-100 and 210
4.1.1.3	R645-201-210 through 225, 300 through 352, and 400 through 434
4.1.2	
4.1.2.1	R645-201-225, 323-100 and 200, 325, and 202-232
4.1.2.2	R645-201-225, 323.100 through 400, and 202-230 through 236
4.1.2.3	R645-201-225, 323.100 through 400, and 202-230 through 236
4.1.2.4	R645-201-225, 323.200, and 202-235
4.1.2.5	R645-201-225, 323.200, 325, and 202-235 and 236
4.1.2.6	R645-201-225, 323.200, and 202-240 through 244.300
4.1.3	
4.1.3.1	R645-201-225, 323.100 and 400, and 202-231
4.1.3.2	R645-201-225, 323.200, and 202-232
4.1.3.3	R645-201-225, 323.400, and 202-233
4.1.3.4	R645-201-225, 323.400, and 202-234
4.1.3.5	R645-201-225, 323.400, and 202-235
4.1.3.6	R645-201-225, 323.200 and 400, and 202-236
4.1.4	R645-203-100 through 220
Maps	None
Exhibits	None

4.1.1.2 Previous, Current, and Planned Exploration Activities

As described in Section 3.6, Geologic Information, an extensive exploration drilling has been conducted within the permit area over a period of many years. The Geologic data set includes data from 70 drill holes from several vintages (26 are located within the Permit Boundary). Nine of the drill holes, located on four of the drill sites, were completed as groundwater monitor wells with completions in the Hiawatha Seam and enclosing strata. Four of these locations are within the permit boundary.

A digital color down-hole camera was lowered into and recorded continuous data from four of the completions to document the presence or non-presence of groundwater soon after the wells were completed. Subsequently, monthly baseline groundwater data have been collected from these monitor wells throughout most of the past two years.

Data from the historical drilling and exploratory programs varied considerably in completeness and uniformity. Significant limitations for the historical information included the lack of geophysical logs, incomplete cutting logs, generalized core descriptions, very few coal analyses, and little or no information on material physical characteristics. The primary purpose of the 2006 drilling efforts was completion of ground water monitoring wells, however, a full data collection and analysis program provided valuable information to address existing data deficiencies. The 2006 drilling program included the following data collection activities:

- Collection and description of cuttings during rotary drilling
- Spot coring and development of complete core descriptions
- Photography of cores
- Notation of any water or gas encountered in the drillholes and measurement of discharge flow rates
- Geophysical logging of drillholes
- Laboratory analysis of coal core samples
- Suitability analysis of roof and floor samples for each coal seam

Significant drilling information exists for most of the permit area, however, it is anticipated that additional exploration drilling will be required for certain areas in the future to more accurately delineate coal seam limits, define the extent of near surface weathering and burn, possibly refine location of old mine workings, and provide additional information on coal quality characteristics.

4.1.1.3 Permitting of Exploration Activities

Any future exploration drilling, either within or outside of the Kinney No. 2 permit boundary will be conducted under appropriate UDOGM exploration permits or other regulatory authorities as appropriate. Generally, it is anticipated that most if not all future exploration will fall under the category of "Minor Coal Exploration" or "Geotechnical Drilling"

For minor coal exploration resulting in removal of no more than 250 tons of coal exploration permitting requirements will be limited to preparation, submittal, and approval of a Notice of Intent to Conduct Minor Coal Exploration. The required notice of intent will include information on the applicant, identify the applicant's representative, provide a map and

narrative description of the exploration area and proposed exploration activities, define the period during which exploration will occur, and describe proposed environmental protection and reclamation measures in accordance with Rules R645-201-210 through 225.

Any "Major Coal Exploration", defined as exploration activities resulting in removal of more than 250 tons of coal, will be conducted under a Major Exploration Permit in accordance with Rules R645-201-300 through 352. In addition to the information required under a notice of intent for minor coal exploration, a major coal exploration permit application will include the following:

- Information on environmental resources within the proposed exploration area
- A more detailed description of proposed exploration activities including identification of the equipment to be used, description of construction practices, and plans for material placement and disposal
- A schedule for each phase of the exploration project
- Justification for removal of more than 250 tons of coal
- A detailed map showing all existing site features and environmental values as well as specific proposed exploration disturbance activities
- Documentation for right-of-entry
- A detailed reclamation cost estimate
- A public notice providing for written comments

Approval of a major exploration permit will involve many of the same procedural and administrative steps as a mine permit application including a completeness determination, public notice, public comment period, written findings, publication of a proposed decision, and provisions for administrative and judicial review.

Given that CR is proceeding with permitting of the Kinney No. 2 Mine as a full-scale mining and reclamation operation there are no current or anticipated future plans for commercial use or sale of coal under an exploration permit. The only conditions under which exploration would result in commercial coal sales would be for testing and market evaluation of coal from an area or coal seam distinct from those included in the mineable coal reserves for the proposed Kinney No. 2 Mine. In the unlikely event that this situation occurs in the future, CR will proceed with preparation and submittal of an application and supporting justification in accordance with applicable provisions of Rules R645-201-400 through 434.

4.1.2 Exploration Methods and Practices

Future exploration activities may vary with respect to location and number and depth of drillholes, however, other significant aspects of future exploration programs will generally be similar and will incorporate many of the basic elements included in the recent 2006 exploration program. Those elements of CRs' exploration program which will generally be consistent for all future exploration programs include the following:

- Site Access
- Drill Pad Construction
- Drilling Operations
- Data Collection and Reporting
- Completion as Ground Water Monitoring Wells

The following describes each of the standard elements for future exploration programs.

4.1.2.1 Site Access

Typically, drill sites will be selected which can be accessed by existing unimproved dirt roads. In some cases, it may be necessary to travel for short distances off existing roads to access proposed drill sites, however, overland travel will generally be limited to dry periods and traffic will be minimized. Drilling rigs will normally have 4-wheel drive capability and will be able to travel over relatively rough terrain but effective access may require limited road construction and minor road maintenance. Maintenance of existing roads and construction of any new road segments in order to provide exploration access will be conducted in compliance with all applicable regulatory provisions relating to road construction and drainage requirements. Required maintenance may include removal of large rocks and boulders using a tracked dozer, minor grading to eliminate significant ruts and provide a passable travel surface, and localized drainage control including repair of significant erosion, construction of water bars and short diversion ditches and sloping of any road cuts into the hill slope. Typical road construction practices will include soil removal and placement in windrows, limited cut/fill and grading operations to establish the road alignment, and installation of required drainage structures.

Exploration roads will typically be 10 to 15 feet wide and, to the extent reasonably practicable, will be located to avoid steep slopes, drainage bottoms, and heavily vegetated areas. Where drainage crossings are required, road construction or maintenance activities will focus on preventing or minimizing erosion and siltation by utilizing areas with natural rock beds, where possible, and limiting disturbance within the drainage channel. Travel to and from drill sites will be limited where possible by transporting all required drilling supplies at the time of initial set-up. Required drilling water will be provided from the closest practical source using either a water truck or a portable pump and piping system. During active exploration, required access roads will be maintained as necessary to minimize erosion, siltation, and air pollution and provide proper drainage. Maintenance will include periodic grading, minor repairs, and watering as required.

4.1.2.2 Drill Pad Construction

Drill pads will be constructed to provide a relatively flat area for drill set-up and operations and to provide sufficient room for temporary mud pits (if required) and storage of required drilling supplies. A typical drill pad will be approximately 50 x 150 feet in size and will be sized and oriented to minimize overall surface disturbance. In most cases, drill pads will

incorporate all or parts of the existing dirt roadway and may also be located to take advantage of previously disturbed areas.

Pad construction activities will include removal and stockpiling of available topsoil materials, minor grading to establish a flat set-up area as well as effective pad drainage, and excavation of temporary mud pits (if required). Topsoil materials will normally be bladed into windrows on the upslope perimeter of the pad area and berms, ditches, and/or silt fences will be used to protect the soil material from erosion and loss. Generally, pad areas will be graded to contain drainage internally and prevent drainage off the pad. In some cases

berms or small diversion ditches may be required to achieve internal containment. If large rocks or resistant rock layers are encountered during pad construction, the pad may be relocated, reoriented, or ripping or blasting may be utilized to establish a suitable drill site. Material excavated from mud pits will either be windrowed separately from soil materials or utilized as fill during pad construction. Where mud pits are required, they will be sized to meet the maximum anticipated fluid circulation requirement with sufficient excess capacity to also contain any surface drainage from the pad area with zero discharge. Most pad construction activities will require either a tracked dozer or wheeled loader and a backhoe may be utilized to excavate mud pits if required.

4.1.2.3 Drilling Operations

Drilling equipment may vary dependent on location, depth, and information required from each drill hole but will generally include truck-mounted conventional rotary drill rigs, truck or track or skid-mounted continuous coring rigs, and truck-mounted top drive drill rigs for angle drilling in areas where environmental constraints may limit direct access and drilling. Required ancillary drilling equipment may include pipe trucks, water trucks, portable mud pits, trailers for drilling supplies and core storage, compressors, generators, light towers, and pickup trucks for transport of miscellaneous supplies and drilling crews.

Drillholes will typically range from 4.75 inches (continuous core holes) to 10 inches in diameter. For shallow holes where coring is not required, conventional rotary drilling will be used with air or air/foam as the circulation medium. Deeper holes and coring operations will require water and drilling mud as circulation media to maintain drill hole integrity, cool and lubricate the drill head, and carry drill cuttings to the surface. For any operations other than air circulation, temporary mixing and storage facilities will be required for the circulation medium. For shallow holes a portable steel "pit" may provide adequate storage and circulation capacity, however, for deeper holes and in most cases where drilling mud is required, one or more temporary excavated mud pits will be necessary. Where required, mud pits will be excavated to provide adequate capacity for maximum fluid circulation requirements with some excess capacity to accommodate pad drainage and assure full drainage containment.

During drilling operations, all drill cuttings not collected for sampling purposes will be retained on the drill pad and mixing of cuttings and windrowed soil materials will be avoided. Any other debris resulting from drilling operations including mud bags, scrap drill pipe and bits, etc. will be retained on the drill pad or in a storage trailer for proper disposal.

4.1.2.4 Data Collection and Reporting

For all drilling operations, the driller will record drilling conditions, penetration rates, and the level(s) at which any water or gas is encountered. Any significant ground water and gas occurrences will be documented and flow rates measured. For conventional rotary drilling, drill cuttings will be collected, logged, and described relative to lithotype, color, grain size, and other significant features for each 10 foot drilling increment. For coring operations, either continuous or spot coring, core samples will be collected, logged, and described relative to sample increment, recovery, strength designation, discontinuities, lithology, and other relevant characteristics. Core samples will also be photographed. All drillholes will

also be logged using geophysical logging methods to record natural gamma, compensated density, verticality, bed resolution density, and any other parameters of interest. Geophysical logging documentation will include both hard-copy graphic plots and magnetic media. Following completion of drilling, drill hole locations and collar elevations will be surveyed and mapped.

Dependent on the type of information required core samples and, in some cases drill cuttings, will be analyzed to determine physical and chemical characteristics. Coal cores will typically be analyzed for Proximate Analysis, Ultimate Analysis, Ash Fusion, Ash Mineral Analysis, Trace Elements, Sulfur Forms, Soluble Alkalies, and other parameters of interest. Roof and floor samples will normally be analyzed to evaluate acid/toxic/alkalinity producing potential and for specific suitability parameters defined by the UDOGM Guidelines.

All relevant drilling information, including geologic, hydrologic, physical, and chemical data, will be reviewed, correlated, and entered into a geologic database from which Drill hole Completion Reports will be generated. Splits from all core samples will be properly bagged and stored for future reference and any required supplemental analysis or testing. As required under applicable regulatory provisions, relevant drilling data will be provided to UDOGM and the USDI-BLM for their files and in support of existing permit documents.

4.1.2.5 Completion as Ground Water Monitoring Wells

In order to obtain maximum benefit from exploration drilling efforts and expenditures and more accurately define ground water conditions in the area, CR may complete some future exploration drillholes as ground water monitoring wells. The decision to proceed with well completion will depend on specific information needs, drill hole location and depth, ground water occurrence as documented during drilling, and drill hole conditions at the time drilling is completed. Generally, well completion as illustrated by Figure 4.1-1, Typical Well Completion Dagram will involve installation of approximately 3.0" O.D. flush-joint steel well tubing, or similar fiberglass, with slotted well screen set at a pre-determined depth. In order to provide for effective well completion within a targeted interval and isolation of that interval, the following typical sequence of well completion materials will be utilized:

- The annulus around the well tubing will be filled with cement and bentonite mix
- A 5 foot bentonite grout seal will be placed to the bottom of the screened interval.
- Clean sand or gravel packing material will be placed within the screened interval.
- A 5 foot bentonite grout seal will be placed above the top of the screened interval.
- The remaining annular space will be filled with cement or bentonite or a mixture of both to within 20 feet of the ground surface, or a particular targeted hydrologic unit will be isolated by sealing above the target zone with bentonite, cement/bentonite mixture.
- A surface seal will be placed in the top 20 feet of the hole to act as a surface water intrusion barrier.
- A steel pipe of larger diameter than the well casing and extending 2 to 3 feet above the round surface will be placed.
- A locking well cap will be installed on the surface casing to prevent tampering and allow authorized access for well monitoring activities.

Following completion, wells will be developed by flushing continuously with either air or water until the discharge is relatively clear. The wells will then be allowed to recharge and will be flushed a second time until clear discharge is obtained.

4.1.2.6 Reclamation of Exploration Disturbance

On completion of drilling activities, any drill hole not completed as a ground water monitoring well will be abandoned by pumping a cement bentonite mixture from bottom of the hole up, a concrete surface plug will be established from a depth of approximately 20 feet to within 3 feet of the original ground surface. All drillholes will be marked with either a metal or a substantial wooden post to facilitate a location survey and possible future location efforts.

Any trash or debris resulting from drilling operations will be collected and removed from the drill site for disposal in the local municipal landfill. If mud pits were utilized during drilling, they will be allowed to dry out and will be backfilled with drill cuttings and/or the material originally excavated from the pits. Any remaining excess drill cuttings will be spread over the drill pad surface and the pad areas will be regraded to their approximate original configuration with restoration of drainage to complement existing natural drainage patterns. Reclamation of pad areas will be completed by scarifying the regraded surface, if necessary, respreading the windrowed topsoil material and reseeding and mulching the disturbed area. Where existing roads are utilized for exploration access, water bars will be constructed where appropriate to minimize erosion and natural drainage patterns will be reestablished. Any new road segments constructed specifically for exploration access will be reclaimed by ripping the road surface, grading to reestablish the approximate original configuration and drainage, replacing soil material removed during construction, and reseeding the disturbance area. Additional information on exploration reclamation measures is presented in Section 5.1, Reclamation of Exploration Disturbance.

4.1.3 Specific Environmental Protection Requirements for Coal Exploration Activities

All exploration drilling and related operations will be conducted by experienced, qualified drillers under the direct supervision of CR company representatives. The company representative, who will be an experienced engineer or geologist, will be responsible for assuring that exploration operations are conducted in accordance with the approved exploration permit and in such a way as to prevent or minimize potential adverse environmental impacts.

Specific environmental protection measures, representing accepted engineering practices and the best available current technology, will include but may not be limited to the following:

- Location and orientation of exploration roads and facilities to minimize new surface disturbance and any adverse environmental impacts
- Implementation of appropriate measures during the initial phase of construction to provide for effective drainage and sediment control
- Use of alternative sediment control measures where appropriate to minimize surface disturbance and provide for effective control
- Sound engineering design and proper construction/installation of all exploration

facilities including roads, drill pads, mud pits, ditches, berms, silt fences, and straw bales
- Initiation of site reclamation as soon as operationally practicable following completion of exploration activities

Some or all of these practices may be utilized for any given exploration site dependent on specific site characteristics and operation/reclamation requirements as defined by each individual exploration permit.

4.1.3.1 Avoidance of Habitats of Unique or Unusually High Value

Future coal exploration activities will avoid any identified fish or wildlife habitats of unique or unusually high value and any identified critical habitat areas for threatened, endangered, or sensitive plant or animal species. As a component of the exploration permitting process, proposed exploration sites and access routes will be evaluated and appropriate clearances obtained under applicable provisions of the Endangered Species Act of 1973.

For the permit and adjacent areas, areas of concern which may require special consideration relative to avoidance may include any golden eagle nesting sites, critical winter range for both mule deer and elk, deer fawning areas and elk calving areas, and sage grouse strutting or nesting areas. While these species are not designated as threatened or endangered, the associated critical use areas and corresponding use periods will be considered in the exploration planning process. The Price River and portions of Kinney No. 2 also provide important habitat values for various fish and, to a very limited extent, aquatic species and will generally be avoided when planning exploration programs.

4.1.3.2 Design, Construction, and Maintenance Requirements for Exploration Roads

Existing roads and any new road segments required for exploration access will be constructed and maintained to effect full compliance with all applicable regulatory provisions including:

- Minimizing disturbance and adverse effects on fish, wildlife, and related environmental values (R645-301-358)
- Certification of primary roads (R645-301-512.250)
- Minimizing damage, destruction, or disruption of service for utility and transmission lines (R645-301-526.200)
- Road classification (R645-301-527.100)
- Road maintenance plans (R645-301-527.230)
- Road design and construction requirements (R645-301-534.100 through 300)
- Road reclamation (R645-301-542.600 and 762)
- Design for traffic loading and include provisions for appropriate drainage control including avoidance (unless specifically approved) of intermittent and perennial stream channels and measures to minimize downstream sedimentation and flooding (R645-301-742.410 through 420)
- Control erosion, siltation, and air pollution by revegetating or stabilizing exposed surfaces (R645-301-752.200)

Access road design, construction, maintenance, drainage control, and reclamation practices will reflect sound engineering practices and the best available current technology as previously described under Section 4.1.2, Exploration Methods and Practices.

4.1.3.3 Requirements for Topsoil Removal and Storage

As part of all exploration related construction activities, including access road and drill pad construction, existing available topsoil materials will be removed from disturbance areas and placed in temporary storage in the immediate vicinity of the disturbance. Topsoil removal depths will be site-specific and will reflect the actual depth of the established soil profile (typically A and B soil horizons). If adequate topsoil is not available to support subsequent reclamation efforts, other surficial materials may be recovered for use as a revegetation medium. Stored soil materials will be located and placed to minimize the potential for loss, contamination, or wind or water erosion. Appropriate control measures including the use of berms, ditches, silt fences, or straw bales may be utilized to minimize erosion potential. Following completion of exploration activities and site regrading, available topsoil or growth media will be redistributed over the disturbance areas at a relatively uniform depth.

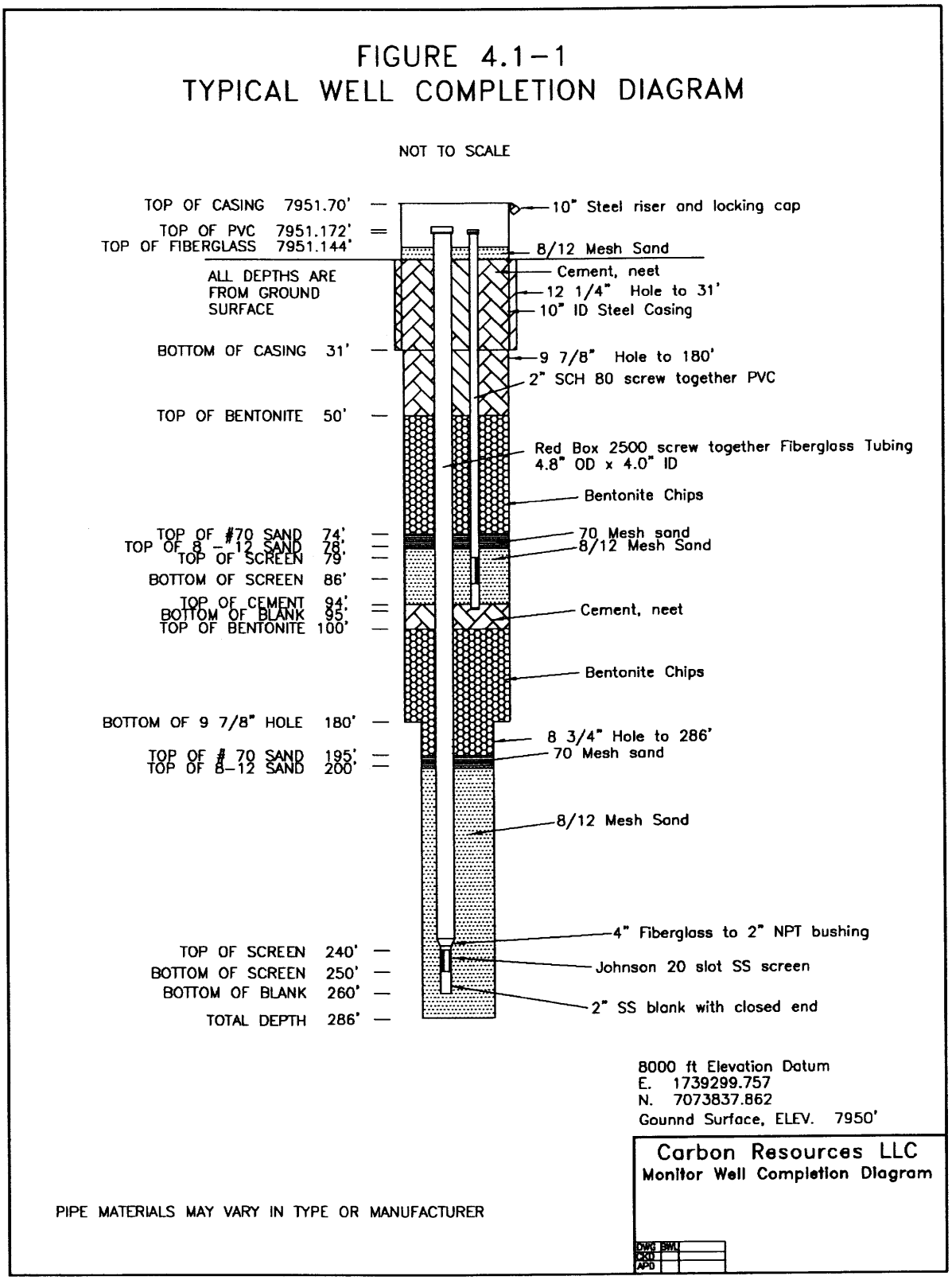
4.1.3.4 Design, Construction, and Maintenance of Diversions and Other Drainage Structures

Where required to control erosion, drainage, and siltation from exploration disturbance activities, diversions and other drainage structures will be constructed, maintained, and reclaimed in compliance with all applicable regulatory provisions (R645-301-742.300). All diversions and related structures will be designed to minimize adverse impacts to the hydrologic balance in the permit and adjacent areas, prevent material damage outside the permit area, and assure public safety. Diversions and appurtenant structures will be designed, located, constructed, and maintained to:

- Be stable
- Protect against flooding and resultant damage to life and property
- Prevent to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow outside the permit area
- Comply with applicable local, Utah, and Federal laws and regulations

When no longer required to provide drainage and sediment control, diversions and related structures will be removed and the related disturbance areas will be reclaimed using essentially the same reclamation practices as previously described for other exploration related disturbance.

Figure 4.1-1 TYPICAL WELL COMPLETION DIAGRAM



4.1.3.5 Measures to Minimize Disturbance of the Hydrologic Balance

Coal exploration and related activities will be conducted in accordance with all applicable regulatory provisions which may include:

- Retention of siltation structures until disturbed areas have been stabilized and revegetated (R645-301-356.300 through R645-301-356.400)
- Design and certification of impoundments (R645-301-512.240)
- Compliance with applicable MSHA requirements (R645-301-513.200)
- Impoundment inspections (R645-301-514.300)
- Notification provisions for identified impoundment hazards (R645-301-515.200)
- Impoundment design and construction requirements (R645-301-533.100 through R645-301-533.600)
- Protection of hydrologic balance including provisions for minimizing acid or toxic drainage, restoring recharge capacity, minimizing sediment contributions, maintaining flows, limiting certain types of discharge, and monitoring and reporting (R645-301-731.100 through R645-301-731.522)
- Protecting or replacing effected water rights (R645-301-731.800)
- Permanent impoundment design and construction requirements (R645-301-733.220 through R645-301-733.240)
- Design, construction, operation, and maintenance of sedimentation structures (R645-301-742.200 through R645-301-742.300)
- Impoundment requirements (R645-301-743)
- Siltation structure requirements (R645-301-763)

Under the potentially applicable regulations, the following summarize the primary control measures to be utilized consistent with continued compliance with applicable water quality standards and effluent limitations.

Any surface or ground water discharges from areas disturbed by exploration and related activities will comply with all applicable Utah and Federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency (EPA) as set forth in 40 CFR Part 434. Sediment control measures, including minimizing disturbance, selective grading, surfacing, temporary revegetation, and any alternative control methods utilized will be located, constructed, maintained, and reclaimed according to the plans and designs approved in the exploration permit.

Any modification or maintenance of existing roads and construction of any new exploration road segments will involve location, design, construction, reconstruction, use, maintenance, and reclamation in compliance with approved exploration plans and applicable provisions of Rules R645-301-732.400, R645-301-742.400 and R645-301-762. Compliance with approved plans and applicable regulatory provisions will:

Effectively control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area

- Neither cause nor contribute to, directly or indirectly, the violation of effluent standards under R645-301-751
- Minimize diminution or degradation of the quality or quantity of surface and ground water systems

- Prevent significant alteration of normal flows in streambeds or drainage channels

Any required siltation structures or diversions will be located, constructed, maintained, and reclaimed in accordance with applicable provisions of Rules R645-301-732, R645-301-742 and R645-301-763, and approved exploration plans. Siltation structures will be maintained until exploration activities are completed, at which time they will be removed and the associated disturbance areas reclaimed. Reclamation will involve any required backfilling, regrading to reestablish the approximate original configuration, soil material replacement, and revegetation in accordance with the approved exploration plans. It is not anticipated that construction of any impoundments will be necessary in conjunction with future exploration activities, however in the unlikely event that impoundments are required, any impoundments and associated discharge structures will be located, constructed, maintained and reclaimed to effect compliance with Rules R645-301-733, R645-301-734, R645-301-743, R645-301-745 and R645-301-760, and in accordance with approved exploration plans.
Waste materials resulting from coal exploration activities will be limited to drill cuttings, minor quantities of trash and debris, and any drilling mud retained in the temporary mud pits. Disposal areas for any exploration related waste materials will be located, constructed, maintained, and reclaimed to comply with applicable provisions of Rules R645-301-735, R645-301-736, R645-301-745, R645-301-746, R645-301-747 and R645-301-760. Any non-coal waste other than geologic materials such as drill cuttings and drilling mud will be collected and hauled to the local permitted municipal landfill.

Any exploration drillholes converted to ground water monitoring wells will be completed, developed, and managed in compliance with Rules R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis in accordance with Rule R645-301-738.

4.1.3.6 Handling of Acid or Toxic-Forming Materials

Any potentially acid or toxic forming materials encountered or exposed by exploration and related activities will be handled and disposed of in compliance with the applicable regulatory provisions of R645-301-731.110 and 300, and R645-301-553.260 and any additional measures specified by the UDOGM. Generally, the quantity of any potentially acid or toxic forming material which may be exposed by the proposed future exploration activities (exploration drilling) will be so small as to have no significant potential for adverse surface water, ground water, or vegetation impacts.

4.1.4 Public Availability of Information

Generally, any exploration information provided to the UDOGM under applicable regulatory information requirements will be available for public inspection and copying. CR may, at the time of information submittal, elect to limit public access to any information which is considered privileged commercial or financial information relating to competitive rights. This election will be exercised through submittal of a written confidentiality request.

4.2 SOIL HANDLING PLANS

4.2.1 General Description of Soil Handling Plans

This section describes the soil handling practices and related environmental control and mitigation measures which will be utilized for any surface disturbance activities associated with the proposed mining and related operations. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-230) for coal mine permitting in the State of Utah.

4.2.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses R645-301-230 through 234.320 and 250 through 252. Reclamation plans and related performance standards (Rules R645-301-240 through 252) are addressed in Section 5.2.

The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
4.2.1	
4.2.1.1	General Introductory Information
4.2.1.2	R645-301-231.100, 200, 251, 252, 232.200, and 233.100 through 400
4.2.2	
4.2.2.1	R645-301-231.100, 232.100 through 720, and 233.100 through 400
4.2.2.2	R645-301-231.200, 300, and 233.200 through 400
4.2.2.3	R645-301-231.100, 400, and 234.100 through 320
Maps	None
Exhibits	Exhibits

4.2.1.2 General Soil Availability and Handling Requirements

The mine facility area will be the only area where direct surface disturbance will occur as a result of the mining and related activities. As described in Section 3.1, Soils Information, the majority of the mine facilities area has been extensively disturbed by previous mining and related activities. No soil salvage occurred at the historic disturbance activities. In addition, the existing surficial materials over much of the area represent disturbed soils which are intermixed with overburden and coal fines materials. Potential disturbance areas where natural undisturbed soils remain will generally be small, occurring in the southwest corner, in the southeast area at the proposed mine portal area, and a small area in the northeast corner of the proposed mine disturbance area.

For those limited areas where natural soils remain, if the area is sufficiently large to allow recovery with conventional mobile equipment, available soils will be recovered and stockpiled for future reclamation use. Given the combined factors of the limited amounts of

soil available from new disturbance areas, and the relatively favorable suitability characteristics of existing disturbed soils, disturbed soils will also be recovered from proposed facilities areas prior to redisturbance.

Soil materials will be recovered and placed in stockpiles for temporary storage in such a manner as to minimize loss, erosion, or further contamination of these materials. To the extent practicable, stockpiles will be located and oriented to minimize exposure to wind and water erosion and avoid active operating areas, and any stockpile which will remain in-place for over 6 months will be seeded to provide a temporary protective vegetative cover.

4.2.2 Soil Salvage, Handling, and Storage

With the exception of recovery depth, soil salvage, handling, and storage practices will generally be the same regardless of location or material type and will include the following specific activities:

- Clearing and grubbing
- Soil/substitute removal
- Material haulage
- Material placement in temporary stockpile
- Stockpile construction/protection measures

The following sections describe these specific soil and substitute salvage, handling, and storage practices.

4.2.2.1 Soil Salvage Practices

Soil materials will be recovered from any disturbance area where natural soils exist and the area is large enough to permit soil recovery using conventional mobile equipment and from previously disturbed areas where suitable disturbed soils exist. Soil material will not be recovered from very limited disturbance areas such as power pole locations, steep hillslope areas, or areas where soil recovery is limited by the practical considerations of limited depth or high rock content.

The initial step in recovering available soil materials will be removal of any trees, large bushes or large rocks and boulders which could interfere with recovery operations. These materials will be removed prior to soil recovery using the same equipment used for soil recovery operations, typically a tracked dozed or wheel loader, and placed in one or more debris piles on the margins of the disturbance area. Smaller brush and other vegetative materials will not be removed and will be incorporated into the soil materials during soil recovery operations. Incorporation of vegetative material with the soil provides an effective mulch to stabilize the soil material and increases natural re-establishment of indigenous species through roots, seeds, plant fragments and other plant propagules in the soil material.

Soil recovery operations may take place at any time during the period from early spring through late fall when ground conditions are favorable but will occur prior to any other site disturbance activities. CR will generally utilize tractor scrapers or a combination of tracked dozers, wheel loaders, and rear dump trucks to recover, transport, and place available soil and substitute materials. Soil materials will be removed in horizontal layers by either a tractor

scraper or tracked dozer. Where tractor scrapers are utilized, they will load, haul, and place the salvaged soil material in the temporary storage stockpiles directly. Where tracked dozers are utilized for material removal, the soil material will be pushed into temporary piles. A wheel loader will then either load from the temporary pile, transport, and place the material in stockpile if the stockpile is located in close proximity to the recovery area, or will load the material into rear dump trucks which will then transport and place the material in stockpiles.

Given existing limitations on the availability of suitable soil materials, where recoverable undisturbed soils exist, soil recovery operations will focus on removal and salvage of all reasonably recoverable soils. In these areas, available soil material will be recovered to a reasonable depth, or until highly consolidated, coarse fragment content or clayey materials are encountered, if these limiting conditions occur at a shallower depth. In any area where suitable materials exist at depths greater than 3 feet, those materials will be salvaged to a reasonable depth in an effort to provide as much usable material for final reclamation as possible. The soils investigation presented in Section 3.1 found very limited areas where topsoil, or substitute topsoil depths were greater than 3 feet. Considering the high percentage of the proposed disturbance area that has been previously disturbed by pre-SMCRA mining (approximately 74%), it is unlikely that large areas of topsoil exist. Given relatively poor soil development, high rock content, and limited salvage areas, no effort will be made to segregate individual soil horizons since segregation may not be operationally feasible and doing so would not result in any appreciable revegetation benefit.

Generally, maximum recovery depths will be achieved on relatively flat or gently sloping areas where rock content, presence of coally materials, or natural obstacles are not limiting factors relative to full recovery. To the extent operationally feasible, zones or areas with any significant coal or coal refuse content will be avoided during soil material recovery operations and any coally significant deposits or accumulation will be excavated and removed to avoid intermixing with topsoil, or topsoil substitute materials. As indicated previously, it is not practicable or possible to totally separate coal fines materials from topsoil or substitute topsoil where the coal is less that about 6 inches thick. A large portion of the proposed disturbance area has been previously disturbed causing the coal fines to be extensively mixed with the soils materials. Where the coally materials are thicker that about 6 inches, they will be removed separately from the soils and sold as a fuel source.

Soil material recovery areas and volumes for proposed mining and related surface disturbance are summarized on Figure 1, Soil Map Unit ID Legend with Sampled Soil Profile Locations, found in the Soil Survey Report, Kinney No. 2 Mine, Carbon County, Utah located in Exhibit 3.1.1.3-1, Soils Information. The soil removal thicknesses and volumes are estimates based on extensive field sampling of both disturbed and undisturbed soils in the proposed surface disturbance area. Actual recovery depths, and therefore volumes, may vary dependent on site-specific conditions and practical operating limitations. In order to assure that all operationally recoverable soil material is removed and stockpiled for later reclamation use, soil recovery operations will be supervised and monitored by a qualified and experienced reclamation specialist/soil scientist. Actual soil recovery depths and volumes will be documented and any site-specific limitations on soil recovery will be noted and described. Following completion of soil removal operations, a narrative description of soil recovery operations along with appropriate supporting documentation will be prepared and incorporated into the next Annual Reclamation Monitoring Report for submittal to UDOGM. Any variations between actual and projected soil recovery depths and volumes (as outlined on Figure 1 of the soils report referenced above) will be identified and explained.

CR will remove all available soil material to a maximum depth of 3 feet in areas where good topsoil exists, or until highly consolidated, excessive coarse fragment content, or clayey materials are encountered. Recognizing that the soil volumes calculated are based on limited soil pits and other investigation means, and that volumes could vary, CR will make every effort to salvage good soil materials where they are encountered up to the total volume available in the topsoil stockpile. Soil removal operations will be dependent on the topographic configuration of the recovery area and site specific conditions encountered. In order, therefore, to assure compliance with this permit commitment, CR will commit to supervision of all topsoil salvage operations by an experienced reclamation specialist/soil scientist who will assure that all available soil materials are removed prior to any mining-related disturbance. The results of the soil removal operations will then be reported in the Annual Reclamation Monitoring Report which will contain a written narrative documenting actual soil recovery thicknesses and volumes and comparing actual recovery versus projected recovery (as outlined on Figure 1 of the soils report in Exhibit 3.1.1.3-1). For any areas where either less or more soil material is recovered than originally projected, the narrative will address the reasons for any soil recovery limitations and associated soil losses or increases in recoverable soil depths.

Areas where site conditions would preclude soil salvage include rock outcrop areas, areas where large boulders occurred, or where coally materials preclude soil salvage.

Based on the field measurements, soil volumes for each soil map unit can be found on Table 8 of the soils report found in Exhibit 3.1.1.3-1, Soils Information, for a total volume of 182,216 cubic yards. This volume includes the entire 36.7 acres included in the soils investigation. Actual proposed disturbance is proposed on 27.3 acres as shown on Map 4.5.1.2-3, Surface Facilities Map, labeled Disturbance Boundary. The topsoil volume estimate of 68,092 cubic yards included in Section 3.1 has been estimated from the 36 soils backhoe pits, hand dug pits, and road cut excavations (see Figure 1 in the soils report in Exhibit 3.1.1.3-1). The topsoil stockpile maximum volume is 54,760, therefore this amount is the total that can be salvaged for final reclamation. This will provide 1.24 feet, or 14.9 inches of topsoil available for reclamation as follows:

$$\frac{\dfrac{54{,}760 \text{ CY X } 27 \text{ CF/CY}}{27.3 \text{ ACRES}}}{43{,}560 \text{ SF/ACRE}} = 1.24 \text{ FT or } 14.92 \text{ INCHES}$$

4.2.2.2 Soil Suitability and Testing

Given the lack of available natural soils and CR's resultant plans to recover disturbed soils for use as soil material, CR is relying primarily on the baseline soil sampling information presented in Exhibit 3.1.1.3-1, Soils Survey Information, to establish the relative suitability of disturbed soils as the best material available in the proposed disturbance area to support revegetation efforts. Based on the available soils sampling and testing information, which included undisturbed and disturbed soil, the following summarizes the overall suitability of disturbed soils and topsoil as soil material based on the UDOGM Topsoil/Overburden Guidelines:

As documented in the soils report in Exhibit 3.1.1.3-1 the results of the soil sample analyses and the field survey of the soils resources, the salvageable soils within the 36.7 acres for the

proposed mine facilities are adequate for use as plant growth material. The pre-SMCRA disturbed soil materials are an equivalent vegetative growth media in this area based on the UDOGM suitability criteria. The only parameters of concern relative to suitability of the soils are water holding capacity of soils containing greater than 50% rock content, slope gradients of over 50% affecting use of soil salvage machinery, soil materials with sandy textures, and an accurate determination of the quantity of coal found within the mixture of alternative reclamation materials in disturbed land Map Units DA and DB. While these may be considered limiting factors under the UDOGM Guidelines and may in fact limit maximum vegetation potentials, they do not appear to have had a significant adverse impact on vegetation establishment in the area nor on the natural reinvasion of previously disturbed areas which have not been intentionally revegetated by the Utah AML Program. The available soil materials have been mixed by historic mining activities and by reclamation work completed by the Utah AML Program. This mixing has not greatly affected the ability of the materials to support vegetation, and there is little reason to doubt the same effect for final reclamation of the Kinney No. 2 Mine. The available soil materials will be salvaged, stockpiled, and used for final reclamation.

While it is documented in Exhibit 3.1.1.3-1, Soil Survey Report, based on available sampling and testing data, that the disturbed soils are suitable as soil material and that they represent the best available material to support revegetation efforts, CR plans to sample these materials prior revegetation as described in Section 5.2, Soil Replacement Plans.

4.2.2.3 Soil Handling and Storage

The topsoil stockpile will be located in a stable, protected area well away from active operations, natural water-courses, and coal handling activities to avoid disturbance, loss or contamination of the stored soil resources. To the extent operationally practicable, the stockpile will be located and oriented to minimize exposure to wind and water erosion, utilizing the natural topography or grading to divert drainage away from stockpile area. The stockpile location has been selected to avoid potential future operations so that once the stockpile is established the soil material will not have to be moved until it is utilized for reclamation. The proposed stockpile location is shown on Map 4.5.1.2-3 Surface Facilities Map. The location is adjacent to Highway 96 at the southwest corner of the permit area, and is as far away and upwind of the coal handling facilities. Since the location is adjacent to Highway 96, where winter road salting occurs, a six (6) foot thick base (see Map 4.5.2.3-1A, Mine Surface Facilities Area, Pre-Mining, Mining & Post Mining Cross Sections) of clean excavated material will be placed to provide a buffer for the topsoil material. Salt migration from the Highway will be isolated from the toe of the topsoil by the highway-side ditch, the berm as shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan, and the six foot clean excavated material base.

The topsoil stockpile will be constructed by placing soil materials in successive horizontal layers with stockpile sideslopes at 2H:1V or less. Stockpile construction activities will be designed to minimize compaction of the soil resource to the extent operationally feasible. Where necessary to prevent erosion of stockpiled material by upgradient drainage, temporary berms or diversion ditches will be used to intercept and route drainage around the stockpiles. The topsoil stockpile lies on the outside fill slope if the Office Pad, and will be isolated from pad by a berm as shown on Map 4.5.2.3-1A, Mine Surface Facilities Area, Pre-Mining, Mining & Post Mining Cross Sections. Drainage from the stockpile area will be

controlled by the proposed surface drainage and sediment control system as described in section 4.7, Hydrologic Resource Protection. In order to stabilize and minimize erosion of the stockpiled material the surface of the soil stockpile will be left in a roughened condition to minimize erosion and runoff. Any long-term stockpile which will remain in-place for over 6 months will be seeded with a rapid-germinating temporary seed mixture as described in Section 5.3, Habitat Restoration Plan, to provide a protective vegetative cover. Seeding will normally occur as soon as reasonably feasible once active soil stockpiling operations cease for a given stockpile area. In addition, each soil and substitute stockpile will be identified by a durable sign placed so as to be readily visible from the closest point of access. Stockpile areas will be inspected on a periodic basis and any significant erosion or other problems will be noted and repaired.

4.3 PROTECTION OF BIOLOGICAL RESOURCES

4.3.1 General Description of Biological Resource Protection Plans

This section describes specific control and mitigation practices which will be implemented to prevent or minimize the impact of mining and related activities on biological resources including fish, aquatic species, wildlife, associated habitat values, and vegetation. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-330) for coal mine permitting in the State of Utah.

4.3.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-312, 330 through 333.300, and 358 through 358.530. Reclamation plans and related performance standards (Rules R645-301-340 through 342.400, and 350 through 357.300) are addressed in Section 5.3.

Permit Section	Applicable Regulatory Provisions
4.3.1	
4.3.1.1	General Introductory Information
4.3.1.2	R645-301-312 and 330 through 333.300
4.3.1.3	R645-301-330 through 333.300 and 358 through 358.530
4.3.2	
4.3.2.1	R645-301-312 and 313
4.3.2.2	R645-301-312 and 313
4.3.3	
4.3.3.1	R645-301-330 through 333.300 and 301-358
4.3.3.2	R645-301-330 through 333.300 and 301-358
4.3.3.3	R645-301-330 through 333.300 and 301-358
4.3.3.4	R645-301-330 through 333.300 and 301-358
4.3.3.5	R645-301-330 through 333.300 and 301-358
4.3.3.6	R645-301-330 through 333.300 and 301-358
4.3.3.7	R645-301-330 through 358.530
4.3.4	
4.3.4.1	R645-301-333
4.3.4.2	R645-301-333
4.3.4.3	R645-301-333
4.3.5	
4.3.5.1	R645-301-333
4.3.5.2	R645-301-333

Maps None

Exhibits None

4.3.1.2 General Biological Resource Protection Requirements

The mine facilities area will be the only area where direct surface disturbance will occur as a result of the mining and related activities. In addition, the potential exists for indirect impacts on vegetation, fish, and wildlife due to equipment operations, noise and human activity associated with mining operations, mine related traffic, electrical equipment, and water discharges.

As previously noted, the majority of the mine facilities area has been extensively disturbed by previous historical mining and related activities. This previous disturbance has resulted in the elimination or significant modification of natural vegetation communities and fish and wildlife habitat values within the disturbed area.

General control and mitigation measures, addressing both potential direct and indirect mining related biological impacts will include the following:

- Minimizing the total area of disturbance
- Limiting disturbance, and operations any important resource areas
- Design, construction, and operation of mine facilities to minimize biological impacts including barriers to wildlife movements
- Control and monitoring of surface and related effects
- Design and installation of electrical equipment to minimize electrocution hazards
- Control and monitoring of surface discharges and water quality
- Exclusion of wildlife from potentially hazardous areas
- Reclamation of disturbed areas when they are no longer needed to support ongoing mining and related activities
- Site specific wildlife enhancement measures

Detailed discussions of specific potential impacts and proposed control and mitigation measures are presented in the following sections.

4.3.1.3 Specific Resources Requiring Special Protection Measures

Within the general permit area, several areas have been designated by the UDWR as high priority, seasonal habitat for elk, mule deer, golden eagle, moose, bald eagles, and critical seasonal habitat for sage grouse. Under certain conditions, including severe winters and during breeding, fawning, calving, or brooding periods, concentrated use of selected areas may result in temporary designation as critical range. Golden eagles and certain other raptors are known to inhabit or utilize portions of the permit area at various times of the year. High priority habitat areas and golden eagle or certain other raptor nesting sites may require special protection in compliance with applicable State and Federal laws and regulations. Generally, the basic biological resource protection measures which will be implemented in conjunction with the mining and related activities will provide the necessary level of protection to achieve full compliance.

4.3.2 Potential Mining Related Impacts - Fish and Wildlife Resources, Related Habitat Values, and Vegetation Communities

Comparison of the mining related surface disturbance with previous surface disturbance due to historic mining and related activities and more recent disturbances associated with

construction of transportation and electric transmission facilities indicates that there is little potential for any significant new fish, wildlife, habitat, or vegetation impacts. This conclusion is based on the fact that most potentially significant terrestrial biological impacts have already occurred given the extent and nature of previous development in the surface disturbance areas. In addition, while Utah AML reclamation has been successful in re-establishing vegetative cover and some habitat values, the limited age of reclaimed vegetation and proximity to human activity continue to limit wildlife use. Most of the anticipated surface disturbance for mining and related activities will involve previously disturbed areas. Mining related disturbance of previously undisturbed areas will be negligible. The potential for aquatic impacts is very limited since there are no water sources in the immediate area of the proposed mining surface facilities area. The following sections provide additional details relative to potential mining related impacts on individual biological resource values.

4.3.2.1 Potential Effects on Terrestrial Vegetation, Wildlife, and Wildlife Habitat (Includes Sensitive Species and Associated Habitat Values)

Potential impacts on terrestrial vegetation, wildlife, and habitat values resulting from the mining and related operations may include:

- Redisturbance of approximately 20.4 acres of disturbed vegetation and habitat occurring on previously disturbed areas
- Temporary loss of approximately 6.9 acres of previously undisturbed vegetation and habitat
- Displacement of mobile resident wildlife to nearby areas providing similar habitat and adequate carrying capacity
- Direct mortality of non-mobile wildlife
- Increases in indirect wildlife disturbance due to increased human activity in the area
- Increased potential for accidental wildlife losses through electrocution or traffic related mortality
- Localized reduction or elimination of certain vegetation types

With regard to sensitive species of vegetation or terrestrial wildlife, no known threatened, endangered, or sensitive vegetation or wildlife species existing within or occupy or utilize surface disturbance areas for their basic life requisites. The potential, therefore, for any significant adverse mining related impacts would be limited to the unlikely situation of an accident involving a transitory animal.

The potential for significant adverse impacts due to redisturbance of previously disturbed areas is low due to existing vegetation and habitat conditions in the proposed disturbance areas. The Utah AML reclamation efforts have resulted in effective reestablishment of vegetation on portions of the previously disturbed areas. While these areas currently provide some cover and forage values, the area is close to Highway 96, and Scofield Town, with their noise, highway traffic, and human presence. These proximity factors and resulting level of human activity in the area are also important factors which tend to preclude significant long-term use by large mammals, raptors, and many other terrestrial wildlife species with current use being limited to opportunistic or seasonal migratory use. The temporary mining related impacts will be effectively mitigated by the comprehensive reclamation program including all surface disturbance areas which will be implemented when the mine facilities are no longer needed to support ongoing operations.

The potential impact of losses of existing vegetation and habitat in previously undisturbed areas will be minimized by the limited areal extent (approximately 6.9 acres) of any new

disturbance. Areas of potential new disturbance are immediately adjacent to previously disturbed areas, and as such exhibit some inherent limitations relative to their value as wildlife habitat. Field surveys of potential new disturbance areas did not result in identification of any unique habitat characteristics (e.g., nests, wetland pockets, bat roosts, etc.) within these areas, although one raptor nest (No. 1541) was identified approximately 650 feet southeast of the proposed disturbed area. This nest is likely a red-tailed hawk nest as discussed in Section 3.3.2.2, and should not be adversely impacted by mining operations as red-tailed hawks are very adaptable to human activity. Minor vegetation and habitat impacts for any new disturbance areas will be a temporary result of the mining and related operations, however, proposed site reclamation measures will result in effective mitigation of any temporary impacts and in most cases offer the potential for overall enhancement of vegetation and habitat conditions.

Displacement of mobile wildlife due to mining related surface disturbance will largely affect only those species and individuals animals which utilize the limited area encompassed by the mine surface facilities area. At this time, terrestrial wildlife use of this area appears to be limited to rodent species and a number of bird and bat species with occasion opportunistic and migration use by mule deer and occasionally elk, although very few elk droppings were observed in the area. Most other terrestrial wildlife have already been displaced by prior disturbance and do not appear to have reestablished in the area due to reduced habitat values and existing levels of human activity. Given that the numbers of potentially displaced wildlife will be small due to limited populations and the small total surface disturbance area, the ability of the surrounding habitats to absorb these immigrants should be more than adequate. The greatest potential for significant impacts of this type would be associated with the displacement of any small mammals and birds utilizing the area. Disruption of raptor species is not considered significant due to the close proximity of Highway 96 and Scofield Town, with their associated noise, and other human activity.

During initial site earthwork and subsequent facility construction, non-mobile wildlife which occupy previously disturbed and adjacent undisturbed habitats affected by the surface disturbance activities may be lost. Affected wildlife could include species groups such as amphibians, lizards, snakes, small rodents, and younger or older individuals of other small mammal groups whose mobility may be limited by age. The loss, however, of a few individual animals within much larger animal populations and distribution does not represent a significant impact since none of the affected species are known sensitive species and any resultant impacts will be compensated over the short and long term by normal animal reproduction.

Increased levels of human activity may result in indirect wildlife impacts including some alteration of diurnal and seasonal animal movements. Another impact frequently associated with mine development activities is the increased potential for illegal harvest of game animals due to localized population increases. This impact is not anticipated for the proposed operations since the required workforce will be composed primarily of local employees which already live in the Scofield/Price/Helper area. There may be some increase in wildlife disturbance due to the noise, lights, and human activity levels required

for surface support activities. Use of existing ancillary roads to access environmental monitoring sites may also result in minor localized wildlife disturbance.

Another potential mining related impact would be the direct mortality of individual wildlife due to contact with live electrical lines or other electrical equipment and traffic related mortality in either mine areas or due to mine related traffic on public roads. Both types of

accidental occurrence are a potential impact of any large-scale development activity but the effectiveness of specific protective measures and a low overall incidence rate render any related impacts inconsequential.
Generally, the basic biological resource protection measures which will be implemented in conjunction with all mining and related activities outlined in Section 4.3 will provide the necessary level of protection to achieve full compliance of state and federal regulations for the Barn Canyon air ventilation shaft.

4.3.2.2 Potential Effects on Aquatic and Riparian Resources (Includes Sensitive Species)

The primary potential impacts on fish and aquatic species, aquatic habitat, and riparian vegetation which may result from the mining and related activities would be from drainage from the proposed sedimentation pond, or from alternative sediment controls used where drainage from small areas does not report to the sedimentation pond.

Prior to reclamation, stormwater runoff from disturbed areas would be a potential source of additional sediment contributions to Mud Creek. Sediment contributions will, however, be effectively controlled by construction, operation, and maintenance of a integrated drainage and sediment control system including diversion and collection ditches, sedimentation ponds, and alternative sediment control measures. Implementation of drainage and sediment control measures as described in Section 4.7, Hydrologic Resource Protection, will limit any increase in suspended sediments to levels corresponding to general background concentrations. Mining related sediment contributions would, therefore, result in little or no significant incremental impacts on fish and macroinvertebrate communities or aquatic habitat values in and near Mud Creek, and Scofield Reservoir.

Coal stockpiling and conveyor transport of coal will result in minor contributions of coal dust to both the atmosphere and area surface drainage which could potentially be transported to Mud Creek and Scofield Reservoir. Wind-blown dust from coal stockpiles could result in deposition of small amounts of coal dust near the mine site. Operating practices for stockpile areas including material placement in coal stockpiles and, and coal recovery have been designed to minimize dust generation. These practices, as described in Section 4.4, Air Emission Controls, include controlled discharge to or placement in stockpiles (coal stacker tubes), the use of surfactants where necessary to control fugitive dust, and enclosed draw points and BACT dust controls on coal reclaim systems.

The conveyor system will be covered to minimize exposure and dispersion of coal fines during transport and all transfer points will be partially or fully enclosed and will incorporate BACT emission controls. Small amounts of coal dust or fines may escape from the conveyor system and minor spillage may occur in the area immediately adjacent to the conveyor.

Mine water supply requirements for sanitary use, surface dust control, fire fighting reserve, and operational mine water will be obtained from Scofield Town, and collection and recycling of both mine water and mine inflows where they may exist. Recycled water encountered within the mine would remove a negligible amount of water from the system. For this reason, it is anticipated that the incremental mining related withdrawals will have no measurable effect relative to potential downstream surface water depletion in the Price or Green River drainages.

A Section 7 consultation process under applicable U.S. Fish and Wildlife Service regulations will be conducted as part of the inter-agency review of the UDOGM permit application. In the unlikely event that consultation results in a determination that the proposed water use represents a new depletion, a biological assessment of potential effects on endangered fish species and associated critical habitat designations in the Green and Colorado Rivers would be completed. Three Federal candidate Category 2 species (roundtail chub, leatherside chub, and flannelmouth sucker) for which the Price River may provide potential habitat would also be included in any biological assessment. However, since the mine area is tributary to Mud Creek and then Scofield Reservoir, no incremental impact can be experienced in the Price, Green, and Colorado Rivers, because of the water retention in Scofield Reservoir. There are no T&E species in Mud Creek or Scofield Reservoir.

4.3.3 Provisions for Protection of Fish and Wildlife, Associated Habitat Values, and Vegetation Resources

To the extent reasonably feasible, CR plans to prevent or minimize potential mining related impacts on biological resources by minimizing any new surface disturbance. Implementation of the following specific control and mitigation measures for those limited areas which represent redisturbance or new disturbance will effectively minimize potential impacts for these areas.

4.3.3.1 Provisions to Minimize Total Disturbance

Development and production of the minable coal reserves by underground methods will effectively limit the area of required surface disturbance. Recognizing the environmental benefits of keeping surface disturbance to an absolute minimum, CR has designed the required surface facilities to maximize utilization of the available space and has sited the surface facilities where possible in areas which have been previously disturbed. Specific design and operational measures which will limit surface disturbance include the use of a conveyor system; and consolidation of all required new surface facilities in one area near existing transportation routes which avoids the need for both multiple surface disturbance areas and the disturbance which would be associated with required connecting roads, powerlines, and other necessary infrastructure.

4.3.3.2 Avoidance and/or Enhancement of Wetlands, Riparian Areas, and Aquatic Habitat

No areas were identified as potential jurisdictional wetland areas (regulated by the U.S. Army Corps of Engineers) during the baseline field surveys of surface disturbance areas, therefore, the mining and related operations are not expected to impact any jurisdictional wetlands. Disturbance of riparian areas and aquatic habitat will not occur since none exist in the proposed mine disturbance area.

4.3.3.3 Measures to Stabilize and Minimize Erosion From Mine Disturbance Areas

All construction and operations activities will require the application of drainage and sediment control measures to minimize erosion, control surface runoff, and limit additional contributions of suspended solids to Mud Creek and Scofield Reservoir. Specific proposed drainage and sediment control methods and practices are discussed in detail in Section 4.7, Hydrologic Resource Protection. Temporary controls for construction activities will include the use of protective berms, silt fences, sediment traps, straw bales, and other suitable control measures. It should be noted that the designed operational drainage and sediment control systems and structures will be established prior to most surface disturbance and construction activities. These systems and structures will include diversions to route drainage from undisturbed areas around disturbance areas, collection ditches to intercept and route disturbed area drainage to the sedimentation pond, culverts, sediment traps, and sedimentation pond, which will retain disturbed area runoff allowing settlement of suspended solids prior to discharge to area drainages. Drainage and sediment control structures will be operated and maintained until effective revegetation has occurred and surface drainage quality is restored to a condition comparable to baseline conditions. To assure the continuing effectiveness of the drainage and sediment control measures, water quality monitoring will be conducted during active operations, site reclamation, and the reclamation liability period.

Other erosion control and stabilization measures to be utilized for selected disturbance areas will include asphalt surfacing of the main access road and parking areas, surfacing of other roads and operations areas with gravel or similar material, and temporary revegetation or the use of synthetic erosion control materials on exposed cut/fill slopes. All active operating areas will be inspected on a periodic basis for evidence of erosion or instability and any significant problems will be addressed in a timely manner by modifying or repairing the area to eliminate or control the problem.

4.3.3.4 Subsidence Potential and Related Impacts on Renewable Resource Lands

CR's mining operations will use conventional room development mining, with no pillar extraction and thus no subsidence will occur. Coal outcrop barriers will prevent subsidence of near-surface shallow cover areas. Mine portals and entries have been designed to be stable, and to prevent subsidence. Portal and entries near the surface will be designed with steel, and concrete face-up materials, and tunnel support structures that will support the roof and near-surface overburden.

Baseline hydrologic field investigations during 2005 through 2007 included ground surveys designed to locate and characterize all existing surface and ground water resources. Prior to the field surveys, available topographic mapping and the Utah State Engineer's water rights records for the area were reviewed and water right locations plotted on the topographic maps. The surveys included site specific inspections of all areas shown on the topographic maps where either recorded water rights or surface or ground water occurrences were believed to exist. The surface and ground water resources identified as a result of the baseline field investigations are shown on the Map 3.7.1.3-1 Regional Hydrology Map. No material damage or diminution of value are anticipated due to the proposed mining activities.

4.3.3.5 Provisions to Minimize Raptor Electrocution Hazards

CR will design and construct any mine related power transmission lines as shown on Figure 4.3-1, Typical Raptor Proof Power Pole Configuration (or equivalent) for protection of raptors from potential electrocution hazards in accordance with the guidelines set forth in "Environmental Criteria for Electric Transmission Systems" (USDI, USDA, 1970) and/orREA Bulletin 61-10 "Powerline Contacts by Eagles and Other Large Birds". These guidelines specify pole and transmission line configurations which isolate the ground wire minimizing the potential for simultaneous contact with a live and ground wire by a raptor or other bird approaching or landing on the support poles or cross beams. An existing powerline traverses from south to north immediately east of the proposed mine facilities and belongs to Rocky Mountain Power.

4.3.3.6 Measures to Minimize Barriers to Large Mammal Movements

Site-specific evaluation of the facilities area resulted in the conclusion that the proposed conveyor location parallel to the base of the natural valley slope would not represent a significant barrier to large mammal movements. An additional important consideration relative to potential animal movements is the existence of Highway 96 and Scofield Town which have probably already eliminated most large mammal movements in the mine facilities area. Although the likelihood of large mammal movements through the facilities area is small, CR has made provision for any potential movements by designing conveyor structures to provide a minimum clearance of approximately 40 inches and will establish a maximum speed limit for mine roads of 15 miles per hour. Several sections of the conveyors will have clearances well over 40 inches where the conveyors are elevated for mechanical reasons or for vehicular underpasses as shown on the Map 4.5.1.2-3, Mine Surface Facilities Map. These elevated sections provide crossing areas for larger animals. In addition, the relatively short length of the overland conveyor system would allow animals to go around the site if they feel threatened.

4.3.3.7 Protective Measures for the Facilities Area and Any Open Ponds Containing Potentially Hazardous or Toxic Materials

CR has no plans to store, utilize, or generate any materials or wastes classified as hazardous or toxic in conjunction with the proposed operations. The surface facilities have been designed and will be operated in such a way that any materials such as petroleum products which would represent a potential hazard to wildlife will be contained within closed areas or containers. There will be no open ponds which would contain any potentially hazardous substances.

Potential petroleum related risks will be limited by operation of the drainage and sediment control system. The sedimentation pond has been designed with a decant structure which incorporates an oil skimmer to minimize the potential for discharge of any petroleum products which might accidentally enter the drainage control system. Regular pond and discharge monitoring will include visual inspection for any oil sheen. CR has designed the mine water handling system as a closed-loop system with recycle or underground storage of mine water and no discharge to surface systems or drainages. In the unlikely event that it becomes necessary to discharge excess mine water to the surface, the water will be sampled prior to discharge and will be routed through the sedimentation control system to assure that it will meet all applicable effluent limitations and standards. All construction activities, as well as future operational activities, will be managed and monitored consistent

with an approved Spill Prevention, Control, and Countermeasures (SPCC) Plan to address the potential for accidental petroleum spills and petroleum-related contamination of surface waters.

4.3.4 Provisions for Protection of Threatened, Endangered, or Sensitive Species

4.3.4.1 Compliance with the Endangered Species Act

As discussed in Section 3.3.4, Threatened, Endangered, and Sensitive Species, submittal of this permit application to UDOGM will result in review of appropriate sections by UDWR and the USFWS and issuance of a current listing of proposed and listed threatened and endangered species potentially affected by the proposed mining and related activities. These actions, which are part of the Section 7 consultation process of the Endangered Species Act of 1973, will be followed by a determination by the agencies of whether or not a biological assessment will be required to identify and evaluate the potential effects of the proposed action on threatened and endangered species. Given the nature and scope of the information presented in this permit application, the very limited amount of associated surface disturbance, and the absence of any known threatened, endangered, or sensitive species in the permit area, preparation of a biological assessment may not be necessary. Completion of the required procedural steps, as described above, and preparation of a biological assessment, if required, will assure full compliance under applicable provisions of the Endangered Species Act.

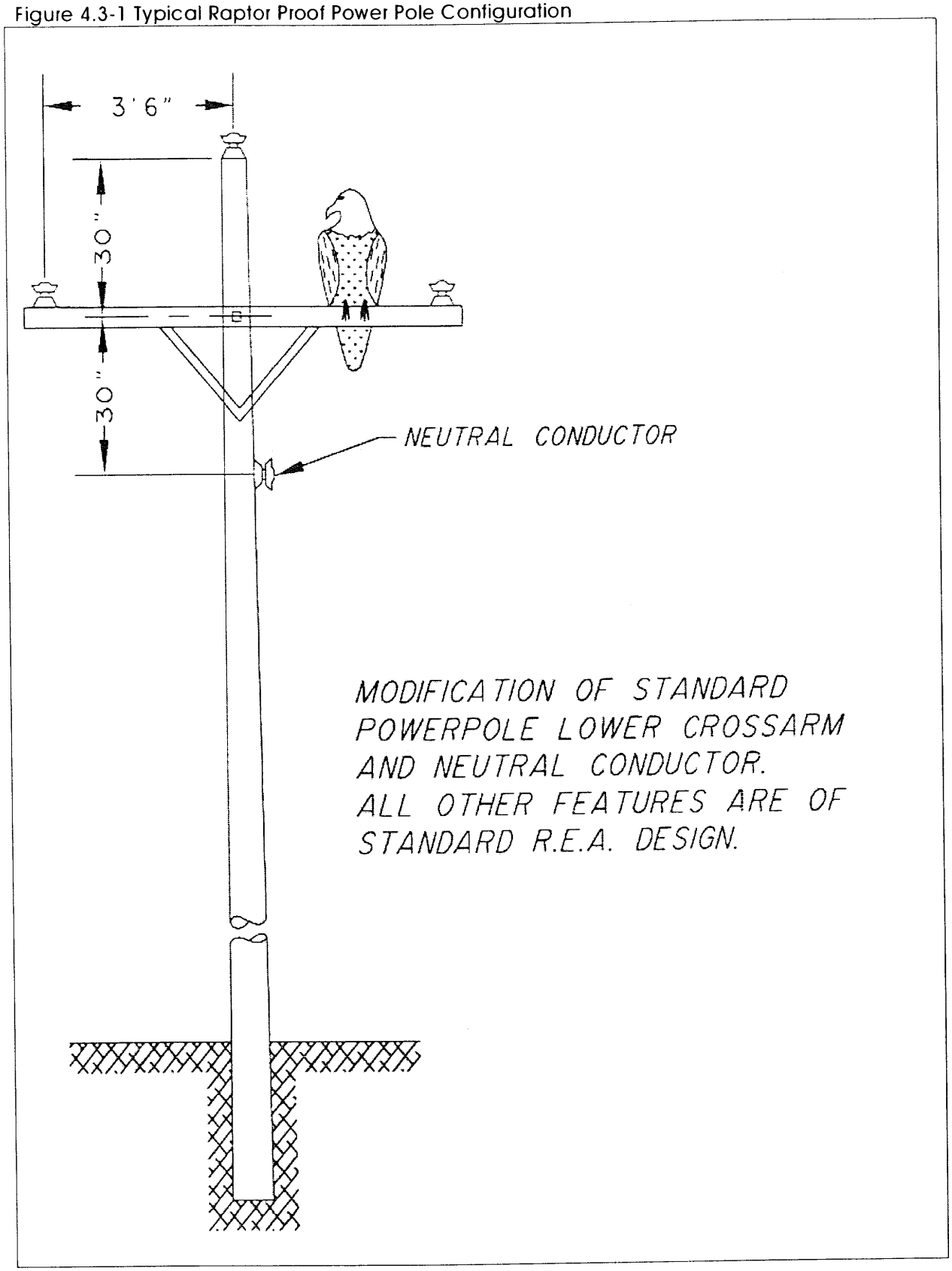
4.3.4.2 Compliance with the Bald Eagle Protection Act

The permit area provides minimal potential for wintering bald eagle roosts since there are no conifer trees, or typical roost trees that would be utilized by eagles in the area of the mine facilities. Summer eagle utilization in the immediate area of the mine facilities is unlikely since Scofield Reservoir, and Mud Creek would be preferred feeding habitat for Bald Eagles. There is little or no potential for nesting by golden eagles within the permit area since there are no cliffs, and very few large conifers in the area. Under applicable provisions of the Bald Eagle Protection Act CR will either not initiate new activities including surface disturbance or exploration drilling within one-half mile of any active golden eagle nest during the spring breeding season or will, in consultation with UDOGM and UDWR, initiate appropriate mitigation measures. In addition, if golden eagle nesting activity is observed anywhere within the permit area but especially in close proximity to any mining related surface disturbance such activity will immediately be reported to the local UDWR office. If it is determined that the proposed mining activities have significant potential to adversely affect raptor breeding, CR as part of a cooperative program with the UDWR, will conduct periodic raptor surveys of any specific areas of concern.

4.3.4.3 Reporting and Consultation Procedures

Reporting procedures in conjunction with the consultation process under applicable State and Federal wildlife protection laws and regulations will involve documentation of all contacts and correspondence regarding TES species. All telephone conversations and meetings regarding TES species will be documented in written form. If it is determined that preparation of a biological assessment is necessary, an outline will be developed and reviewed with the UDWR and the USFWS in order to establish the required organization and content of the report. The outline will incorporate any specific applicable requirements identified in the Endangered Species Act.

Figure 4.3-1 Typical Raptor Proof Power Pole Configuration



4.3.5 Operational Fish and Wildlife Monitoring

4.3.5.1 Terrestrial Wildlife

During the period of active operations, CR will work closely with UDWR biologists from the local Price Office to develop and maintain a program for reporting any significant wildlife observations in the proposed permit area. As part of an ongoing employee training and communication program, CR employees will be instructed to report any incidents of accidental wildlife mortality or eagle sightings to the Kinney Mine Environmental personnel. CR will also coordinate with UDWR and private sector biologists to perform periodic raptor monitoring surveys if it is determined that mining and related activities have significant potential to adversely affect raptor breeding in the area.

4.3.5.2 Aquatic Resources

Since no aquatic species have been found in the permit area, and since there is no riparian habitat, or standing water sources within the permit area, no aquatic resources will be impacted by mining operations.

4.3.6 Site-Specific Wildlife Habitat Enhancement Measures

In order to address mining related impacts on wildlife habitat in proposed surface disturbance and adjacent areas CR will utilize interim seeding and reclamation to both stabilize soils, and provide habitat for wildlife species during mining operations. Final reclamation has been designed to bring the vegetation communities back to pre-mining levels, or better.

4.4 AIR EMISSION CONTROLS

4.4.1 General Description of Air Emission Control Plans

This section describes the air emission control measures and practices which will be utilized to prevent significant degradation of air quality as a result of the mining and related operations. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-420) for coal mining in the State of Utah.

4.4.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-420 through 425. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
4.4.1	
4.4.1.1	General Introductory Information
4.4.1.2	R645-301-421 and 422
4.4.2	
4.4.2.1	R645-301-421 and 422
4.4.2.2	R645-301-421 and 422
4.4.2.3	R645-301-421 and 422
4.4.2.4	R645-303-421 and 422

4.4.1.2 General Air Emission Control Requirements

All mining and related operations will be conducted in compliance with applicable provisions of both the Federal Clean Air Act and Utah air emission laws and regulations. As noted in Section 3.5.1, General Air Quality Information, the proposed permit area falls within an area presently classified as an attainment area under the primary pollutant standards as defined by the National Ambient Air Quality Standards (NAAQS). Given this classification, Federal air emission requirements are not applicable except to the extent that they provide for State responsibility for protection of air quality and application of Best Available Control Technology (BACT) for potential emission sources.

Generally, all design and operating plans for the mining and related operations incorporate BACT to effectively minimize and control potential air emissions. BACT and other general control measures will include:

- Minimizing the total area of surface disturbance
- Paving the main access road and employee parking area
- Controlling fugitive dust from construction areas, unpaved roads and operating areas, and reclamation areas through the use of appropriate surfacing materials, regular watering, maintenance, and the use of surfactants, where appropriate

- Limiting speeds on all mine roads
- Using covered conveyors to minimize wind exposure and material loss
- Partially or fully enclosing all conveyor transfer points and using water sprays or chemical surfactants to control dust in these area
- Locating material stockpiles in protected areas, taking advantage of natural barriers to minimize wind exposure
- Using a stacking tube for both the spec coal and non-spec coal stockpiles to limit drop exposure
- Reclaiming coal from both the spec coal and non-spec coal stockpiles using an enclosed sub-grade coal reclaim system
- Use of a fully enclosed building to house coal crushing and screening operations with full enclosure of the coal stream during these operations and the use of a negative pressure dust collection system
- Enclosing the coal loadout surge bin and providing a drop chute with flexible wind flaps to minimize dust generation and exposure during truck loading
- Reclaiming surface disturbance areas as soon as reasonably practicable after they are no longer required to support ongoing operations

4.4.2 Air Emission Control Measures

Given that the Kinney No. 2 Mine will be an underground mining operation, potential air emissions resulting from the mining and related operations will be limited to fugitive dust and vehicular emissions. Potential fugitive dust sources will include construction activities in the mine surface facilities area; unpaved mine roads and surface operations areas; coal, and topsoil stockpiles; conveyors and associated coal handling systems; coal processing equipment; coal loadout operations; mine ventilation fans; wind erosion on disturbed and exposed surface areas; and site reclamation activities. Potential mine related vehicular emissions will be limited to construction equipment during the initial construction phase, employee and supplier traffic to and from the mine, operation of a small fleet of surface maintenance and support vehicles, and reclamation equipment during the final reclamation and closure phase.

Proposed air emission control measures are designed to minimize the release of potential air pollutants which will consist primarily of fugitive dust but will also include small amounts of combustion and vehicular emissions. Proposed air emission control measures are described in the following sections.

4.4.2.1 Fugitive Dust Control

Generally, all proposed fugitive dust control measures involve one or more of three basic control mechanisms; 1) Limiting exposure of potential dust producing materials; 2) Agglomeration of dust particles to minimize dispersion; and 3) Containment/Collection of dust to avoid dispersion. Based on the emissions calculations provided in the project Notice of Interest (NOI) included in Exhibit 2.1.3-1, Other Permits, total maximum controlled fugitive dust emissions due to the mining and related activities are projected at 19 tons per year (tpy) of total suspended particulate matter smaller than 10 microns (PM10). In addition, uncontrolled emissions are estimated at 105 tons per year. These emissions levels are very low and when total emissions are spread over a full year the incremental effect on overall air quality in the area is negligible. Emissions will be controlled using a combination of

mechanical means, roadway watering and dust surfactants.

Roads and Operating Areas

The potential exists for fugitive dust emissions from mine roads and operating areas including primary and ancillary roads and those areas where active construction, operations, and reclamation activities are occurring. Potential fugitive dust emissions from these areas will be controlled by minimizing the area of surface disturbance; paving the main access road and employee parking area; surfacing other mine roads with gravel or other similar materials, maintaining the roads on a regular basis, and watering the roads and/or using suitable surfactants to control dust during dry periods; limiting speeds on mine roads; maintaining and watering active construction, operating, and reclamation areas as necessary to control dust; and reclamation of disturbance areas as soon as reasonably practical after they are no longer required to support ongoing operations.

Maintenance for unpaved roads and operating areas will include periodic grading to remove any coal, rocks, or other debris and provide a smooth operating surface, and repair or resurfacing as necessary to address any problem areas. Watering of these same areas will involve the use of a water truck to wet the exposed surfaces in order to control dust generation. Watering requirements will vary dependent on soil moisture content, temperature, wind speed, and traffic levels but will typically be greatest during the dry summer months with watering potentially required two to three times daily. Generally, speeds in all active operating areas will be limited to 15 miles per hour by posted speed limits, both to minimize dust emissions and as a safety consideration, with lower speed limits in any areas which are particularly congested or where traffic hazards exist.

A road sweeper machine will be utilized on paved roads where heavy vehicular traffic may track site dust onto paved roads, particularly on the main access road into the mine site and on Highway 96 leading away from the mine site. This sweeper will help minimize dust emissions and help prevent particulates from leaving the mine site and getting into the environment.

Conveyor Systems

Coal from underground mining operations will feed to a conveyor system which will carry the coal to the surface. On the surface, the coal will transfer to a surface conveyor system consisting of four separate conveyor belts to transport coal to the truck loadout varying from approximately 90 to 652 feet in length and connected by intermediate transfer points. Mine conveyot belt MB-1will transfer coal from underground to a transfer building and Conveyor SB-1. Conveyor SB-1 will transfer coal to the Non-Spec Coal Stockpile stacking tube and Conveyor SB-2. Conveyor SB-2 will transfer coal to the Spec Coal Stockpile stacking tube. Reclaim Conveyor SB-3 will take coal from beneath both the Non-Spec and Spec Coal piles to a Screening and Crushing Building, where the coal will be reduced in size for shipment. Conveyor SB-4 will carry coal from the Screening and Crushing Building to the Truck Loadout.

Coal from the underground mining operations will have an elevated moisture content due to the dust control water sprays used on the underground mining equipment. The elevated moisture levels will inherently limit the potential for dust generation during subsequent coal handling operations. Potential fugitive dust emissions from the conveyor system will be

controlled by using covered conveyors, partially or fully enclosed transfer points, and water sprays or surfactant applicators at the transfer points. In addition, bag houses will be utilized at three locations, at the reclaim tunnel beneath the two coal stacking tubes, at the screening and crushing building, and at the truck loadout building. The conveyor covers will be conventional half shell covers which bolt onto the conveyor support framework and are removable for maintenance access. This type of cover provides full coverage for the upper coal-carrying portion of the conveyor belt minimizing both wind exposure and dispersion of any minor amounts of dust generated by the moving coal stream. Transfer points, where the coal drops from one belt to another, have been designed to minimize drop height to the extent possible and will be partially or fully enclosed to contain both the moving coal and any coal dust generated by the falling coal. At the baghouse locations. Conveyor transfer points will be totally enclosed and air emissions controlled be the bag house filtration equipment. Where relatively long drops are necessary, chutework, low friction impact beds, and conveyor skirting may be utilized to limit free fall and the impact of the falling coal, and to contain both the coal stream and any resulting coal dust. Where necessary to effectively control dust generation, water sprays or surfactant applicators will be used at some or all transfer points. A number of non-hazardous surfactants are available on the market which effectively limit the amount of water added to the coal stream, provide effective dust control, and can provide longer lasting control than water alone.

Stockpiles

Stockpile areas required in conjunction with the mining and related operations will include the spec coal, and non-spec coal stockpiles located on the second level down from the portal pad, and several temporary soil or topsoil substitute stockpiles at various locations in the mine facilities area. These temporary stockpiles of soils will be necessary at various times during site construction and during mine operations and reclamation activities. Generally, all coal stockpiles will vary in size up to the maximum design capacity dependent on mining rate, reserve requirements, and market demand. Coal will be placed in stockpile through discharge from a transfer conveyor to a vertical concrete or steel stacking tube, with the coal flowing out of the openings in the stacking tube at progressively higher levels to form a conical pile around the stacking tube. Coal may be pushed away from the conical pile with dozers to increase the stockpile sizes as market and shipping schedules dictate. Soil or substitute material stockpiles will be constructed by controlled placement of the material in continuous horizontal lifts by either tractor scrapers or rear dump trucks and tracked dozers.

Selective location and construction will be the primary means of controlling fugitive dust emissions from stockpile areas. Dust control measures for construction of soil or substitute material stockpiles will be essentially the same as previously discussed for mine operating areas including minimizing the area of surface disturbance and periodic surface maintenance and watering. In addition, these areas will be regraded and temporary or permanent vegetation will be established to protect and control wind and water erosion on the exposed surfaces. Dust emissions from coal stockpile areas will be controlled through the use of stacking tubes to limit fall height and provide for even distribution of coal in the pile, watering and/or the use of surfactants if necessary to effectively control dust emissions, and the use of sub-grade reclaim systems to recover coal from the piles and feed it to the associated reclaim conveyors. Sub-grade coal reclaim systems will utilize vibratory feeders and gated chutes in the base of the pile which will feed coal directly onto a reclaim conveyor located in a concrete or metal tunnel structure beneath the coal stockpile. Enclosed chutes and conveyor skirting at the transfer feed points will effectively control and

contain both the coal flow and any dust generated in the reclaim process. A baghouse dust collection system will be installed on the reclaim tunnel to control dust emissions, and to meet MSHA dust control safety standards.

Coal Loadout Operations

Direct coal feed from the sub-grade stockpile reclaim system enters the upper enclosed portion of steel loadout building and discharges to two 50-ton enclosed surge bins. Loadout chutes on the bottoms of the surge bins equipped with hydraulically activated gates allow controlled coal feed to double trailer coal haul trucks passing under the loadout building. The telescoping loadout chutes are designed so that they can be extended down into the truck trailers as they pass underneath to limit wind exposure and coal drop height.

Fugitive dust control for loadout operations is provided by the partially enclosed loadout building, including a baghouse dust collection system, the fully enclosed conveyor discharge and surge bin and the extensible gated loading chute which serve to minimize wind exposure and dust dispersion.

4.4.2.2 Combustion Emissions

No combustion emissions are planned besides normal building heating systems.

4.4.2.3 Air Emissions Permitting Requirements

CR has prepared a Notice of Intent (NOI) to UDAQ covering the operation, and the proposed operations and will conduct all construction, operation, and reclamation activities to effect full compliance with UDAQ requirements and approvals. A copy of the NOI is provided in Exhibit 2.1.3-1, Other Permits, for general information and reference and copies of any UDAQ approvals will be provided on receipt for insertion in this exhibit.

4.4.2.4 Air Emissions Monitoring Requirements

Given the very limited quantity of anticipated air emissions and the existing designation of the area under the NAQS as an "attainment" area, no air emissions or other air quality monitoring is expected to be required by the air quality permitting permit from the Utah State Division of Air Quality, except for ocular opacity levels from stationary and mobil equipment.

4.5 ENGINEERING DESIGN AND OPERATING PLANS

4.5.1 General Description of Engineering Designs and Operating Plans

This section describes and presents engineering designs and operating plans for the proposed mining and related operations and associated structures and facilities. It also provides detailed information and designs for the environmental control and mitigation measures which will be utilized to prevent or minimize potential mining related environmental impacts. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-500) for coal mine permitting in the State of Utah.

4.5.1.1 Applicable Regulatory Sections

Specifically, this section addresses Rules R645-301-510, 520, 530 and 560. Reclamation plans and related performance standards (Rules R645-301-540 and 550) are addressed in Section 5.5. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
4.5.1	
4.5.1.1	General Introductory Information
4.5.1.2	R645-301-521.130 through 133, and 150 through 152
4.5.1.3	R645-301-521.110 through 125
4.5.1.4	R645-301-521.111 through 124
4.5.1.5	R645-301-521.140 through 143 and 160 through 190
4.5.1.6	R645-301-513.100 through 800
4.5.1.7	R645-301-553.500 and 731.600
4.5.1.8	R645-301-512.100 through 260, 514.100 through 330, and 515.100 through 322
4.5.1.9	R645-301-521.100 through 132, 521.140 through 170
4.5.2	
4.5.2.1	R645-301-521
4.5.2.2	R645-301-522, 523.100 through 220, 524.100 through 800, and 525.100 through 300
4.5.2.3	R645-301-526.100 through 300, 527.100 through 250, 528.100 through 322, and 529.100 through 400
4.5.2.4	R645-301-531 through 537.250
Maps	R645-301-512.100 through 260, 514.100 through 330, and 515.100 through 322
Exhibits	R645-301-512.100 through 200, 513.100 through 800, 524.100 through 800, 528.320 through 322, 530 through 534.340, 536.100 through 900.

4.5.1.2 Surface and Mineral Ownership and Right of Entry

Sections 2.3.2, Identification of Interests, and 2.3.5, Right of Entry, provide detailed information on surface and coal ownership and right of entry and the Surface Ownership Map and Coal Ownership Map. (Maps 4.5.1.2-1 and 4.5.1.2-2, respectively) show ownership blocks and boundaries. The Kinney No. 2 Mine permit area encompasses an area of approximately 456 acres, of which 16.8 is fee surface, 22.95 (less UDOT R-O-W) is leased, and the remaining 416.24 acres are private land.

4.5.1.3 Previous Mining and Related Disturbance

As described in Section 3.4.4, Previous Mining Activity, extensive historic mining activity has occurred throughout the proposed permit area with resulting development of underground mine workings in many areas and disturbance of limited surface areas for mine portals; coal stockpiles; coal handling, processing, and loadout facilities; and mine support facilities. Mining related underground workings are shown and labeled on Map 3.4.1.4-2, Previous Mining Activity Map. The surface disturbance area from the various historic mines is shown on Map 3.4.1.4-2, Previous Mining Activity, and on Map 3.4.1.4-1, Regional Land Use Map.

Some of the previous historical mining related disturbance is of particular significance with respect to its relationship to the proposed mining operations. The most obvious area of significance is the previous underground mine development and production which has resulted in depletion of discrete coal reserve blocks in the targeted mineable coal seam. CR has utilized available maps of the previous underground workings to eliminate the previously mined reserves from consideration under the proposed mining plans and to establish the proposed mining layout and sequence. Extensive previous surface disturbance was also a factor in selecting the proposed mine surface facilities area. By utilizing an area which has been previously substantially disturbed, CR can effectively avoid much of the disturbance and related environmental impacts associated with any new surface disturbance.

4.5.1.4 Existing Configuration, Conditions, Structures, and Facilities

As discussed in Section 3.4.2. Land Use Information, the rugged natural topography of the area may generally be characterized as a small, high elevation valley, with high plateaus to the east and west, narrow ridgelines cut by deep drainages with steep, narrow drainage valleys over most of the proposed permit and adjacent area. Existing site topography, structures, and facilities, are shown on Map 3.4.1.4-1, Regional Land Use Map.

Most of the structures and facilities associated with previous historic mining have been removed and some of the previously disturbed areas have been reclaimed. Those structures which remain include an old fan house, a small, one-room concrete structure, and several foundations. The remaining historic structures are identified and described in Section 3.4.3, Cultural and Historic Resources.

4.5.1.5 Affected Areas and Timing of Disturbance

Areas potentially effected by the proposed mining and related operations will include any areas subject to direct mining related surface disturbance. Anticipated mining and related surface disturbance will involve a very limited total surface area and, to the extent reasonably practicable, has been planned to maximize the utilization of previously disturbed areas.

For the proposed mining and related activities, surface disturbance areas will include the following:

- Mine Office Pad
- Operations Pad
- Parking/Storage Pad
- Storage Area Pad
- Portal Pad
- Coal Pile Pad
- Loadout Pad
- Sedimentation Pond
- Topsoil Pile

New mine surface facilities to support the proposed mining and related operations will be constructed in an area which has been largely previously disturbed by historic mining activities. The proposed new facilities will include mine portals; shop, warehouse, and administration/bathhouse buildings; a coal handling system including a spec coal stockpile, a non-spec coal stockpile and conveyor systems; and associated roads and ancillary facilities. The location of the proposed new facilities is also shown on Map 4.5.1.2-3, Mine Surface Facilities Map. Reclamation bonding calculations based on the applicable regulatory bonding requirements will be based on the total area of direct mining related surface disturbance including the proposed facilities areas as described above. Construction of the proposed new surface facilities is scheduled to begin immediately on receipt of required permit approvals and to be completed in approximately one to two years.

The proposed mining and related operations have been designed and will be operated and maintained to effect full compliance with all applicable Federal, State, and local laws and regulations. Specifically, CR will comply with applicable regulatory requirements relating to the following designated activities/structures under the authority of the noted jurisdictional agencies:

Federal Agencies

Office of Surface Mining Reclamation and Enforcement (OSMRE) – Compliance with the Surface Mining Control and Reclamation Act (SMA) under the Utah State Program as administered by UDOGM

Environmental Protection Agency (EPA) – Compliance with applicable air, water and hazardous materials requirements under programs administered by the Utah Division of Air Quality (UDAQ), Utah Division of Water Quality (UDWQ), and the Utah Department of Health

U.S. Commerce Department, Bureau of Alcohol, Tobacco, and Firearms – Permits for procurement, transportation, storage, and use of explosives

Mine Safety and Health Administration (MSHA) – Compliance with applicable requirements relating to coal processing waste dams; impoundments and sedimentation ponds; plans for underground disposal of development waste, coal processing waste, or excess spoil; refuse piles; reclamation and closure of mine openings; any discharges into underground mines; mining within 500 feet of an active underground mine; and plans for extinguishing coal mine waste fires

U.S. Fish and Wildlife Service (USFWS) – Compliance under the Endangered Species Act, Bald Eagle Protection Act, and Migratory Bird Act

State Agencies

Utah Division of Oil, Gas, and Mining (UDOGM) – Compliance under the State of Utah Coal Mining Rules

Utah Division of Air Quality (UDAQ) – Compliance with applicable air quality permitting and operational requirements

Utah Division of Water Quality (UDWQ) – Compliance with applicable water discharge permitting, operational, monitoring, and reporting requirements

Utah State Engineer – Compliance with well and pond design and construction requirements and water rights requirements

Utah Department of Transportation (UDOT) – Highway modification and driveway permits

Utah Division of Wildlife Resources (UDWR) – Compliance with applicable wildlife protection measures

Utah State Historic Preservation Office (SHPO) – Compliance with applicable provisions of the National Historic Preservation Act

Local Agencies

Carbon County – Compliance with applicable requirements for special use, building, and water and sewer permits

Scofield Town – Compliance with applicable requirements for building, sewer and water permits

Specific compliance requirements and corresponding design, operations, maintenance, monitoring, reporting, and reclamation measures for mining and related activities are described in detail for each activity or structure in the following sections of this operations

plan. Information on required permits and approvals is provided in Section 2.1.3, Other Permits and Approvals.

4.5.1.7 Proposed Variances from Regulatory Standards

Applicable regulatory provisions provide for variances from regulatory requirements and performance standards in order to reflect and accommodate site specific conditions and unique environmental or operating considerations

Due to previous mining and other disturbance of the area there is not sufficient available spoil to completely backfill all highwalls and return the area to AOC. One highwall remains as a result of previous mining at the old Kinney Mine portal face-up. This highwall was partially reclaimed by the Utah AML program in the 1980's. Given that the Kinney No. 2 Mine development activities effectively constitute remining of the previously disturbed areas which included an area adjacent to the preexisting highwall, variances from both the general AOC and the specific highwall elimination provisions of the regulations are not required consistent with applicable regulatory provisions dealing with remining of previously mined areas (R645-301-553.500 through 524) and AOC (R645-301-553.600 through 653). Justification for this conclusion is provided under the detailed discussion of backfilling and grading in Section 5.4.2.3, Reclamation Practices.

4.5.1.8 Certification, Inspection, Reporting, and Emergency Procedures

Rule R645-301-512 specifies that certain designated cross-sections, maps, and plans be prepared by or under the direction of a qualified Registered Professional Engineer (PE) and that certain maps and design plans be certified by a PE or Registered Land Surveyor. Consistent with this requirement, the following components of this permit application meet the regulatory supervision and certification requirements:

- Previous Mining Activities Map, (Map 3.4.1.4-2)
- Mine Surface Facilities Map, (Map 4.5.1.2-3)
- Regional Hydrology Map, (Map 3.7.1.3-1)
- Drainage and Sediment Control Plan (Map 4.7.2.1-2)
- Regional Geology Map, (Map 3.6-1)
- Hiawatha Overburden Isopachs & Mining Blocks (Figure 3.6-9)
- Geologic E-W X-Section A-A' (Figure 3.6-5)
- Geologic E-W X-Section B-B' (Figure 3.6-6)
- Geologic E-W X-Section C-C' (Figure 3.6-7
- Geologic E-W X-Section D-D' (Figure 3.6-8)
- Mine Plan Layout & Production Schedule (Maps 4.5.1.2-5)
- Drainage and Sediment Control Plan, Map 4.7.2.1-2
- Sedimentation Pond No. 1, (Map 4.7.2.1-3)
- Mine Surface Facilities Area, Pre-Mining Topography Map, (Map 4.5.1.2-4)
- Mine Surface Facilities Area – Pre Mining, Mining & Post Mining Cross-Sections, (Maps 4.5.2.3-1A – 4.5.2.3.-1D)
- Exhibit 4.5.2.1-1 Geotechnical Investigations

In order to assure that designed structures are constructed according to the design plans and to verify that designed structures and facilities continue to function as designed, Rule R645-301-514 specifies that the following structures and facilities be inspected by a qualified Registered Professional Engineer or a qualified professional specialist under a professional engineer's direction and outlines specific inspection requirements:

- Excess spoil fills
- Coal refuse piles
- Impoundments

No excess spoil fill, or coal refuse pile is planned for the Kinney No. 2 Mine. Specific inspection and reporting practices for the proposed sediment pond is described in detail in the following sections of this operations plan.

Certain situations involving accidents, emergencies, or unforeseen circumstances may require immediate or timely reporting to provide for appropriate coordination of required control and mitigation measures. Under applicable regulatory requirements, these situations are specifically identified as including the following:

- Slides which may have potential adverse effects on public health and safety, property, or the environment
- Excess spoil fills
- Impoundment hazards
- Accidental releases of potentially hazardous or toxic materials including petroleum products
- Temporary cessation of mining operations

Reporting and emergency measures for potential slides are specifically addressed in Section 4.6 Geologic Protection; for impoundment hazards and accidental releases of potentially hazardous or toxic materials in Section 4.7, Hydrologic Resource Protection; and for temporary cessation of mining operations in Section 4.5.2.5, Temporary Cessation.

4.5.1.9 Mapping of Engineering and Mine Planning Information

Information presented on the regional and mine area engineering and planning maps includes:

- Proposed mine permit and disturbance boundaries
- Existing land configuration
- Existing and proposed surface structures and facilities
- Location, extent, and sequencing of proposed underground mine development
- Drainage and sediment control plans and designs for associated structures
- Existing and proposed roads and utility installations

The pre-mining topography of the mine site and area can be seen on Map 4.5.1.2-4, Pre-Mining Topography.

4.5.2 Engineering Designs and Operating Plans

In developing the engineering designs and operating plans for the mining and related operations, CR has reviewed and evaluated all existing available information on site geology, coal occurrence and characteristics, and environmental resource values. This information along with sound engineering principals has been combined to develop designs and plans which will provide for safe, efficient, and effective mining operations while minimizing potential related environmental impacts and effecting full compliance with all applicable regulatory requirements. The following sections describe the specific design methods, operating measures, and associated control and mitigation practices which will be utilized to accomplish these objectives.

4.5.2.1 General Description of Mine Construction and Development Activities

The new mine facilities access road will generally follow the alignment of the undeveloped dirt road which begins near the south end of the proposed operations on Highway 96, and Mine construction and development will involve those activities necessary to complete the surface facilities and systems and to develop mine portals, main entries, and the entire underground infra-structure which will be required to support the proposed underground mining operations. From an environmental standpoint, the mine construction and development phase will be important due to the fact that essentially all direct mining related surface disturbance will occur during this phase. Mine construction and development activities will be conducted in a manner that prevents or controls erosion and siltation, water pollution, and damage to public or private property; and to the extent possible using the best technology currently available, minimizes damage to fish, wildlife, and related environmental values, and minimizes additional contributions of suspended solids to streamflow or runoff outside the permit area. Any contributions of suspended solids from mine disturbance areas will not exceed applicable effluent limitations under Utah or Federal law.

Construction/Development Schedule - Required highway modifications will occur prior to mine development and entirely within the existing Highway 96 right of way and will be conducted under approved plans developed in consultation with the Utah Department of Transportation (UDOT). All other proposed construction and development activities will proceed as soon as operationally feasible following receipt of required permit approvals. Construction and development activities proceeding immediately and continuing over the next 18 to 24 months.

Construction/Development Activities and Associated Control and Mitigation Measures - Required mine construction and development activities will proceed in a logical sequence to assure effective environmental protection and engineering control of these activities. The following general sequence of activities will be applicable for all proposed mine construction and development activities:

- Establish preliminary access
- Construct required drainage and sediment control structures

- Recover and stockpile available soil or substitute materials
- Construct required roads
- Proceed with required site grading, excavation, and cut/fill operations
- Complete required foundation preparation work
- Construct required structures and facilities
- Complete required utility installations
- Develop mine portals, and main entries
- Complete infra-structure for underground operations (includes electrical systems, water distribution, communications, ventilation, mine drainage systems, and conveyors)
- Systems testing and commissioning

The following sections describe each of these construction/development activities and the associated control and mitigation measures which will be utilized to minimize potential related environmental impacts and assure that each activity is conducted in conformance with approved designs and plans.

Establish Preliminary Access - Preliminary access for the proposed construction and development activities will be made at the location of the pre-mining dirt road to the site, and utilizing the other existing roads on the site. Preliminary access routes will only be utilized for a very brief period to facilitate initial drainage construction and soil removal activities, consequently, associated environmental control and mitigation measures will be limited to alternative sediment control such as silt fences, straw bales, sediment traps, berms and watering on an as needed basis.

Construct Required Drainage and Sediment Control Structures - Due to the importance of effective water quality protection, required drainage and sediment control structures will be constructed prior to any other significant site disturbance. Drainage construction will be a phased process with construction of the sedimentation pond, and principal undisturbed drainage diversion ditches and disturbed area collection ditches occurring as the first activities in the construction phase. Temporary sediment controls to be utilized during initial construction will include the use of silt fence, straw bales, berms, temporary ditches and sediment traps. Temporary controls will be utilized to effectively control runoff and sedimentation until designated structures can be completed. As progressive construction activities are extended to other areas, the associated drainage structures will be developed and connected to the existing drainage system prior to other area disturbance. Detailed descriptions of drainage design and construction procedures are presented in Section 4.5.2.3, Mine Structures and Facilities, and the proposed drainage control system is shown on Map 4.7.2.1-3, Drainage and Sediment Control Plan. These structures have been designed and will be constructed, operated, and maintained to provide effective drainage and sediment control during both construction/development activities and subsequent mining and related operations. Construction of all drainage and sediment control structures will be monitored by qualified individuals under the supervision of a Registered Professional Engineer and specific designed structures including the sedimentation pond will be inspected according to design plans certified as required by applicable regulatory provisions.

Recover and Stockpile Available Soil and Substitute Materials - Once the required drainage structures are in place to effectively control surface runoff and minimize additional sediment

contributions, construction will proceed with recovery of available soil and substitute materials from the proposed surface disturbance areas. Soil and substitute recovery will involve removal of existing materials which will be utilized as vegetative growth media during future site reclamation activities. These materials will be removed using either tractor scrapers or an equipment team composed of a tracked dozer, wheel loader, and rear dump truck, and will be transported and placed in temporary stockpiles for future reclamation use. The coal fines identified during the soils investigation will be removed and sold as discussed previously. The previously constructed drainage and sediment control structures will provide effective water quality control for soil removal operations and periodic watering of soil removal areas and haulage roads will be utilized to control dust emissions. A detailed discussion of soil and substitute recovery and stockpiling practices is presented in Section 4.2, Soil Handling Plans, and proposed soil/substitute stockpile locations are shown on Map 4.5.1.2-3, Mine Surface Facilities Map.

Construct Required Roads - Construction of required roads will be included in a phased manner as the site is developed. Seven primary access roads will be required in conjunction with the proposed mining and related activities as follows:

- Main Access Road – P1 - From Highway 96 to the Operations Pad
- Office Access Road – P2 – From P1 to the Mine Office Pad
- Portal Access Road – P3 – From P1 to the Portal Pad
- Storage Access Road – P4 – From P3 to Storage Area Pad
- Loadout Access Road – P5 – From the Operations Pad to the Loadout Pad
- Sediment Pond Access Road – P6 – From the Loadout Pad to the Sediment Pond
- North Access Road – P7 – From the Loadout Pad to the Private Property to the North

Primary roads which will be utilized in conjunction with the proposed mining and related operations as well as existing roads which are not related and will not be utilized in conjunction with the proposed activities are shown on Map 3.4.1.4-1, Regional Land Use Map, and Map 4.5.1.2-3, Mine Surface Facilities Map. Roads existing prior to mining, and roads to be left for post mining land use are shown on Map 4.5.1.2-4, Pre-Mining Topography Map. All roads have been designed and will be constructed and maintained to prevent or control damage to property; erosion, siltation, and air pollution; and minimize disturbance and impacts to fish, wildlife, and related environmental values. Construction of primary roads will be monitored and construction according to the design plans certified consistent with applicable regulatory provisions. Detailed discussions of road design, construction, and maintenance practices are presented in Sections 4.5.2.3, Mine Structures and Facilities, and 4.5.2.4, Design Standards and Requirements.

Proceed With Required Site Grading, Excavation, and Cut/Fill Activities - Cut/fill operations and grading will be required to establish final design grades for the proposed mine surface facilities. Design grades for the proposed mine facilities area reflect an overall cut/fill balance so that no excess spoil disposal will be required. Cut/fill slopes have been designed at grades of approximately 0.8H:1V to 3.0H:1V dependent on material to minimize erosion potential and provide for effective long-term stability as recommended by Rollins, Brown and Gunnel Geotechnical Engineers in their geotechnical investigations report, Exhibit 4.5.2.1-1, Geotechnical Investigations. Required site construction earthwork will involve the use of tracked dozers, tractor scrapers, wheel loaders, backhoes, and trucks to establish final design grades and all earthwork operations will be supervised and monitored by a qualified

individual familiar with construction earthwork. Consistency with design plans will be monitored and checked using conventional engineering survey methods. Drainage from areas disturbed or otherwise affected by site grading activities will be controlled by either temporary controls or the previously constructed drainage and sediment control system and watering will be utilized to minimize potential fugitive dust emissions.

Complete Required Foundation Preparation Work - Once design grades have been established through completion of site earthwork and grading, work will proceed with preparation and installation of foundations for all proposed major structures and facilities. CR has completed geotechnical investigations to evaluate site foundation conditions as a basis for foundation and facility design. Foundation investigations, as described in Exhibit 4.5.2.1-1, Geotechnical Investigations, included completion of 6 borings, and 14 test pits at the locations of proposed major facilities, penetration tests, and collection, laboratory analysis, and evaluation of the representative material types encountered by the test borings and pits. Findings and recommendations are presented in the final report found in Exhibit 4.5.2.1-1. Proposed mine facilities, structures, roads and the sedimentation pond have been designed according to these findings and recommendations.

Foundation preparation activities will generally involve excavation and removal of any potentially deleterious material including but not limited to organic material, debris, coal or carbonaceous materials, and wet or frozen materials and compaction of the upper three feet in the foundation area. In any areas where the surficial materials have been identified as having any limitations relative to use as foundation materials, appropriate remedial measures including over excavation and recompaction or replacement with more suitable materials will be implemented. Foundations will generally be spread footings with floating slabs, which will be used for most of the major buildings and structures, concrete pier type footings for the conveyor support structures, or slab type foundations for the electrical substation and other minor structures. Foundation construction will be monitored under a construction quality assurance program implemented under the CR facility construction contract to assure compliance with design plans and specifications. Specific foundation designs are discussed for individual facilities in Section 4.5.2.3, Mine Structures and Facilities.

Construct Required Structures and Facilities - Construction of the major required structures and facilities will involve fabrication and erection of the following designed structures:

- Maintenance shop and warehouse building
- Administration/Bathhouse facility
- Coal handling system (includes coal conveyors and transfer points, stacking tubes, coal stockpiles, coal reclaim system, usher building and truck loadout building)
- Miscellaneous structures

All mine support buildings will be constructed with fixed concrete foundations, a structural steel framework, and pre-fabricated sheet steel siding and roofs or will be concrete precast structures. Internal design and construction will vary for each facility dependent on use. Conveyor structures and supports will be pre-fabricated steel frames supported by steel trusses which will be anchored by concrete piers. Conveyor transfer points will consist of a steel framework supporting conveyor head and tail pulleys, drive units, and any required chutework and dust control equipment. The coal stacking tubes will be steel tubes set on heavy reinforced concrete slab foundations. The coal reclaim system will consist of several

steel chutes and vibratory feeders supported by reinforced concrete foundation structures feeding to a heavy steel tunnel structure which will house the coal reclaim conveyor and associated support equipment. Facility construction will be monitored under a construction quality assurance program implemented under the CR facility construction contract to assure compliance with design plans and specifications. All proposed mine structures and facilities are shown on Map 4.5.1.2-3, Mine Surface Facilities Map, and detailed facility descriptions and operating/maintenance plans are presented in Section 4.5.2.3, Mine Structures and Facilities.

Complete Required Utility Installations - Concurrently with construction of the major structures and facilities, CR will complete required utility installations including electrical power distribution, raw and potable water systems, and the sanitary sewer system. The mine electrical power distribution system will consist of a substation located near the mine portal area; transmission lines running from the substation to each of the major facilities, the mine fan installation, the major conveyor drive installations, and connecting to the underground mine electrical system; and related electrical transformers and switchgear.

Water systems will provide both raw and potable water for sanitary use in the mine facilities, fire-fighting reserve, mine water requirements, and dust control sprays in coal handling areas. A 50,000 gallon raw water storage tank along with associated piping, control valves, and control/monitoring systems will be constructed on the north end of the mine portal area and will connect to a distribution network running through the mine facilities area and connecting to the underground mine water system. Water for this tank and the mine water system will be provided by Scofield Town. The potable water system will connect to the existing Scofield Town water system and will supply potable water to the maintenance shop, warehouse, and administration building/bathhouse facility. All facilities served by the potable water system will also be connected to a main sewer line running from the mine facilities area to the Scofield Town sewer system near the southwest corner of the mine site. The location of all existing and proposed utility installations are shown on Map 4.5.1.2-3, Mine Surface Facilities Map, and utilities are described in greater detail in Section 4.5.2.3, Mine Structures and Facilities.

Develop Mine Portals, and Main Entries - Portal development can be initiated following completion of required drainage and sediment control structures, access roads, and the portal pad area. In order to initiate portal development as early as possible in the construction/development process, temporary electrical connections, a temporary water supply, and temporary ventilation measures may be employed. Portal development will be initiated with erection of pre-fabricated steel portal structures to protect workers from any rocks falling off the steep slope above the face-up area. To the extent operationally feasible, portal and mine development will occur in the Hiawatha Seam from the point where it outcrops in the face-up area. In the event the coal seam does not exist at the face-up area, rock slopes will be constructed to access the coal seam. Portal development will involve development using conventional methods of a five entry system. One or more continuous miners will be utilized to drive the development entries and conventional roof bolters will be utilized to provide roof control during development operations. Blasting may be necessary for development of the portals and will be conducted according to the blasting plan addressed in Exhibit 4.5.2.1-2, Kinney No. 2 Mine Blasting Plan. Development rock from these activities will be temporarily stockpiled in the portal area and will be periodically loaded into rear dump tracks and hauled to temporary stockpile areas until it

can be returned to the mine, where it will be placed in areas specifically designated for this purpose.
Entry No. 2 will be a Temporary Portal entry and will be used for the installation of a temporary auxiliary fan. This temporary configuration will initially consist of up to 2 - 100 HP auxiliary exhausting fans and ductwork to provide adequate airflow for initial portal face development operations and to sustain mains development until the main mine fan is installed. Intake air will be heated by MSHA approved propane heaters as needed. All MSHA rules and regulations will be complied with as well as prudent safe operating practice. As lower cost natural gas becomes available to the local area intake air heaters may be converted according to improve the cost economics of the operation.

It is anticipated that these auxiliary fans will be required for an interim period of time while setting up the main mine fan installation and establishing the initial airways of the mine. Once progress has developed airways to the point and construction is complete so that the permanent fan can be placed in service the auxiliary fans will be taken out of service or will be used at the face in series or parallel with the mine fan to assist with face ventilation there.

The main mine fan will be installed on the northern-most portal entry to replace the temporary system (the auxiliary fans) and construction and installation will begin as soon as possible. The mine fan is shown on Map 4.5.1.2-3, Surface Facilities Map. This fan will be adequate for the duration of mining and will provide statutory fresh air volumes to working areas of the mine within the permit application as shown in Map 4.5.1.2-5, Mine Plan Layout and Production Schedule. The fans together with full or temporary stoppings and/or curtains will provide adequate ventilation volume and control for all initial portal and main entry development work and draw fresh air to the working places of the mine to places where coal and/or rock is cut mined and loaded.

Upon the completion of all five portal entries, development of the main entries will proceed with extension of the portal entries to the Southeast on an approximate bearing of South 102 Degrees East i.e., "S102E Portal Mains".

At some point during development of the main entries, the main mine fan installation will be completed, ventilation will switch over to the permanent ventilation system, and the temporary mine fan will be removed. All mine development and mine operations activities will be conducted in full compliance with all applicable state and federal regulatory requirements for health, safety, and environmental protection at all times.

Portal No. 5, the southernmost portal, is positioned such that it is not possible to construct the portal pad to include the portal as can be seen on Map 4.5.1.2-3, Surface Facilities and Map 4.7.2.1-2, Drainage and Sediment Control Plan. The entry (No 5) will be constructed from inside the main by cutting back toward the outcrop. At the appropriate location, a short air shaft will be driven to the surface for intake air. The air shaft will be lined with a steel structure to support the walls of the shaft, and the steel structure will be covered with solid steel from approximately 15 feet below the ground surface to approximately 5 feet above the ground surface, and then grouted between the steel and the ground adjacent to seal the annulus from surface water infiltration. Runoff from the very small runoff area covered by the air shaft will be contained by a total containment berm as shown on Map 4.7.2.1-3.

Once development of all five portal entries is completed, development of the main entries will proceed with extension of the portal entries to the east. At some point during

development of the main entries, the main mine fan installation will be completed, ventilation will switch over to the permanent ventilation system, and the temporary mine fan will be removed. All mine development activities will be conducted in full compliance with applicable regulatory requirements for health, safety, and environmental protection. CR will monitor all mine development activities to assure compliance with both applicable regulatory provisions and mine plans. The location and configuration of the mine portals, and main entries are shown on Map 4.5.1.2-3, Mine Surface Facilities Map, and ,Map 4.5.1.2-5, Mine Plan Layout and Production Schedule Map, and additional discussion of development and mining methods and practices is provided in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements.

Complete Infra-Structure for Underground Operations - Installation of required mine utility systems, as previously described, will occur during development of the mine portals and main entries. Once these utilities are in place, CR will complete and connect the infra-structure required to support underground mining operations. This infra-structure will include the underground electrical power and mine water distribution systems, required communications systems, the mine ventilation system, mine drainage systems, and the underground coal handling system. The systems are identified and discussed in Section 4.5.2.3, Mine Structures and Facilities

Systems Testing and Commissioning - As the specific components of the overall mine operations and support system are completed, they will be inspected and tested to assure consistency with design plans and safe and effective operation consistent with both the design plans and their intended purpose. Testing will include both no-load testing to identify any problems and allow repair or modification to address the problems and load testing to verify system reliability and performance under design operating conditions. Where systems rely on or are integrated with other operating systems, progressive testing will be completed to verify that all systems work together as an integrated whole. Final testing and commissioning of all mining and support systems will occur prior to initiation of full-scale mining operations.

4.5.2.2 General Description of Mine Plans, Mining Methods, and Related Design Requirements

The mine plans and proposed mining methods described in this section reflect CR's detailed review and evaluation of all existing available geologic and coal quality data, consideration of related environmental factors such as hydrologic considerations. This broad base of relevant information was utilized to develop a number of conceptual mine plan alternatives which were then evaluated relative to consistency with CR's overall project objectives. These objectives include the following:

- Maximize recovery and utilization of the available coal resource
- Optimize coal production efficiency and economics
- Facilitate potential future development of nearby coal reserves
- Provide a safe, healthy, secure working environment
- Minimize potential adverse environmental impacts

On completion of mining, provide for restoration of a productive, self-sustaining postmining land use

Based on CR's detailed review and evaluation of possible alternative mining scenarios, the plans presented in this section were selected as the best combination of mine layout, mining method, and mine sequencing in order to achieve the noted objectives and provide for organized sequential mining operations.

Areas and Sequencing of Mine Development

The proposed mining operations will target recovery of remaining minable coal reserves contained in the Hiawatha coal seam. This coal seam and other seams in the area have been previously mined in the area with access to the seams from portals at the coal outcrop. Previous mining areas are delineated for each seam on both Map 3.4.1.4-2, Previous Mining Activities Map, and Map 4.5.1.2-5, Mine Plan Layout & Production Schedule Map. Target minable coal reserves identified in this plan reflect consideration of practical mineral ownership, geologic, environmental, and mining constraints which may limit access to and recovery of coal reserves which otherwise might be considered as recoverable reserves. Generally, the proposed coal extraction limits are shown on Map 4.5.1.2-5, Mine Plan Layout & Production Schedule Map exclude all previously mined areas, any areas where CR does not have existing rights to mine the coal. Proposed mining limits and the alignment of mine entries reflect consideration of those areas where historic mining removed the reserves and geological features that dictate mine layout and design. As indicated, considerable minable coal reserves remain in the area which can be effectively recovered while avoiding the existing abandoned mine workings. A maximum effective cover of approximately 1,000 feet exists in the permit boundary area and therefore there is no limit to coal recovery due to cover depth.

The proposed mine development and production sequence, as illustrated by Map 4.5.1.2-5, Mine Plan Layout & Production Schedule Map reflects orderly sequential development of available minable reserve areas, and the development/production requirements necessary to meet CR's current overall annual coal production targets. It should be noted that coal production requirements as outlined by Table 4.5-1, Projected Annual Coal Production, are based on current marketing projections for the first permit term. Additional coal reserves east and south of the proposed permit boundary are controlled by CR as shown on Map 4.5.1.2-2, Regional Coal Ownership Map. These reserves are planned to be mined at a future date under a major permit revision completed as soon after the first permit approval as possible. The projected mine life is anticipated to be 20 years including the eastern and southern reserves controlled by CR. Unanticipated fluctuations in coal market demand and other factors may result in some variance between projected and actual annual and total production rates. At the time of the permit mid-term review and permit renewal, CR will re-evaluate coal production projections and make appropriate adjustments as necessary.

Proposed coal development and production is expected to occur as shown on Map 4.5.1.2-5, Mine Plan Layout & Production Schedule Map, and Table 4.5-1, and as outlined by the following general sequence:

2008 – Complete permitting and approval.

2009 - Development of the main mine portals in the Hiawatha Seam
Complete MSHA mine and ventilation plans

2009 - 2010 - Development of Hiawatha Seam S102E Portal Mains entries

2010 – Development of N13E Panel A entries
Set-up N13E Panel A
Mine N13E Panel A
Set-up N13E Panel
Mine N13E Panel B
Develop First Fault crossing FC1 Rock Slope Raises and slopes construction
Mine S79W Mains A
N11W Panel A

Ongoing engineering (mine and site design), permitting (permit revision work) for adjacent coal blocks and completion of any remaining backfill work in N13E Panels A and Panel B;

In simplified terms, mining will begin with the Hiawatha Seam (2009 through 2210).

Use and Conservation of Coal Resources

Maximum resource recovery has always been and will continue to be one of CR's primary objectives as a matter of sound resource management and efficient mining and economic practice. Conservation and maximum utilization of the available coal resource will involve mining to the minimum practical seam thickness and maximizing overall coal recovery consistent with sound engineering and mining practices.

Proposed mining methods will result in extraction of minable coal reserves down to a minimum practical mining thickness of 5 feet which is below the lower limit for the continuous mining equipment which will be utilized. The average mining height in the permit area is expected to be 8 ft. in the Hiawatha seam which is the only targeted mineable seam in the permit area. At the current time, the quality, market price, and effective cost of mining the type of coal that occurs in this area at thicknesses less than 5 feet renders such operations economically infeasible. If, however, future changes in mining technology or market conditions make it feasible to mine seams below the present 5 foot cut-off, mining plans may be modified to accommodate the resulting expanded mining operations.

Mining Methods and Equipment

The Kinney No. 2 Mine will be an underground mine utilizing development mining methods for primary coal. No pillar extraction is planned for the first 5 year permit term. Both mine plans and the proposed mining methods are designed to maximize recovery of the minable coal resource while limiting dilution of the coal by unmarketable waste, and to optimize mining operations to achieve maximum operational efficiency while assuring safe operating conditions. CR has and will continue to use sound engineering judgment and proven mining techniques in designing the overall mine layout; selecting appropriate pillar sizing, entry widths, and entry height; and in selecting suitable mining and support equipment and systems.

The following criteria listed in order of importance have been used to design the mine openings, select the mining methods and to layout the mine workings:

Maximum Overall Ultimate Safe Recovery of Coal to determine the extraction rate and the width of the openings;

Provisions for expedient development and for the use of large shuttle cars (25 ton) for hauling coal (60 deg chevrons);
Provisions for handling, stowage and backfill of development rock and provisions for wrap-around bleeder to ventilate fill areas and to allow monitoring them for spontaneous combustion until they can be completely sealed from the mine atmosphere;
Provisions for the drainage and collection of insitu mine water and for reuse for dust suppression;
Provisions for the future expansion of the mine into adjacent reserves blocks;
Provisions for the development of Rock Development at Fault crossings; and
Provisions to accommodate future long-term best extraction methods (i.e., shortwall or longwall mining methods in adjacent coal reserves) that will maximize the ultimate safe life of mine recovery rates

CR currently projects an annual production rate of 0.18 to 0.49 million tons of coal per year for the first permit term from the Kinney No. 2 Mine. The long term goal is to revise the permit to include all coal reserves held by CR, and possibly additional unleased Federal reserves to increase production and sustain the mine over a 20 year mine life. Annual production may fluctuate dependent on changes in coal market conditions and other factors. Coal production for the first 5 year permit term is shown on Table 4.5-1, Projected Annual Coal Production.

TABLE 4.5-1
PROJECTED ANNUAL COAL PRODUCTION

YEAR	COAL (TONS)
2009	180,349
2010	491,514
2011	Additional reserves under revised permit1
2012	Additional reserves under revised perm1
2013	Additional reserves under revised perm1

1. See Map 4.5.1.2-2, Regional Coal Ownership for additional reserves controlled by CR.

Underground mining is a relatively complex process involving a number of inter-related activities which are designed to optimize coal production and handling, minimize environmental damage, and assure safe and healthy working conditions for the miners. The proposed mining operations will involve the following activities:

Mining Activities

- Mine development
- Coal extraction
- Coal haulage
- Development rock handling

Support Activities

- Ground control
- Mine ventilation
- Mine drainage
- Maintenance and miscellaneous support activities

The mining activities are discussed in the following sections. Ground control is an integral part of mining and is addressed in the discussion of mining activities. Other associated support activities are discussed separately under individual sub- headings.

Mine Development - Mine development involves excavation and construction of the underground openings, or entries, required to access the minable coal reserves, provide for efficient production of those reserves, facilitate haulage of both coal and mine development rock, and provide for effective ventilation of the mine workings. Development activities will include development of mine portals, main entries, and sub-mains. All mine development activities including both development methods and actual physical dimensions of development entries have been designed to provide for long-term stability during active mining operations and to effect full compliance with all applicable regulatory provisions. CR will generally complete most development in the minable coal seam to minimize mine development rock generation and provide some economic offset of development costs through production of marketable coal.

Mine development will involve the use of continuous miners to advance the development entries, electric or diesel shuttle cars to remove the excavated coal or waste rock, and electric roof bolters to provide required roof support. Fault crossings may require blasting to develop the crossing entries.

Development of slopes and raises may take advantage of modern raise boring technology which involves drilling a pilot hole using conventional surface or underground long-hole drilling equipment, connecting a rotary cutterhead on the lower level to a drive unit on the upper level, and progressively boring the required mine opening by advancing the rotating cutter-head toward the drive unit.

The main entries will be the primary mine access and supply routes for the minable coal seam, providing access and ventilation for all other underground mine workings and carrying the principal coal haulage conveyor. Typical main entry development may vary from a three to a seven entry configuration, however, most main entry development will consist of five parallel entries with crosscuts at regular intervals. Typical sub-main development may vary from a three to a seven entry configuration, however sub-main development in general will consist of five entries with crosscuts at regular intervals. Development of bleeder entries, which will be used to bleed off naturally occurring methane gas prior to mining and to route any continuing methane drainage to exhaust entries during and following mining, may consist of three to five entries. Figures 4.5-1 and 4.5-2, Typical Mine Entry Development Configuration, illustrate the normal anticipated development configuration along with typical design dimensions and Map 4.5.1.2-5, Mine Plan Layout & Production Schedule Map shows anticipated development requirements for the minable coal seam.

Coal Extraction - CR plans to utilize the room development (first mining) mining method as the primary coal extraction and production technique. In these areas, conventional room development mining methods will be utilized with continuous miners, shuttle cars, and roof bolters as the primary production equipment. The following sections describe the two proposed coal extraction methods.

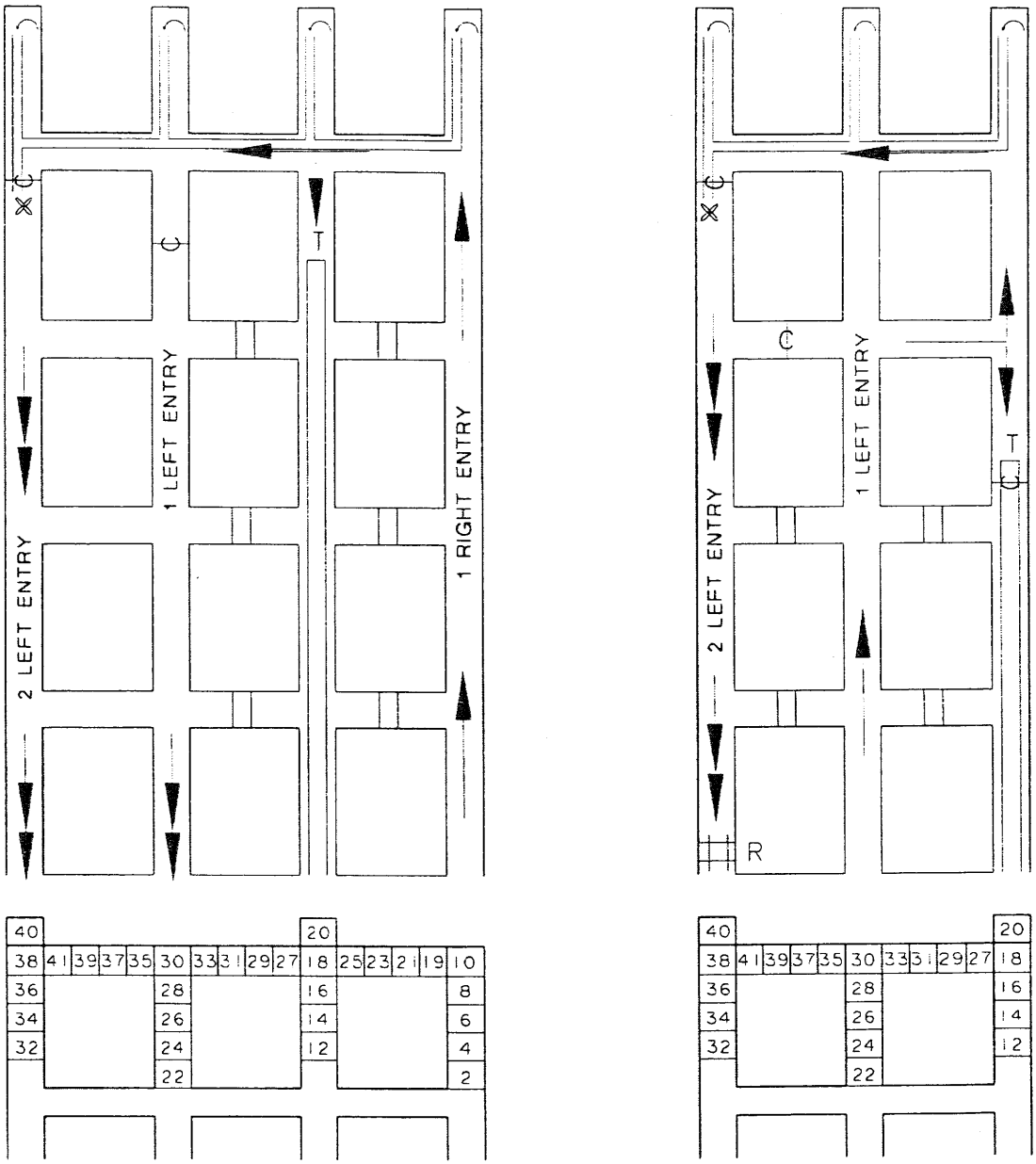
Conventional room development mining, using continuous miners, is one of the primary underground coal mining method utilized in many mines and offers the benefits of low capital cost for the required mining equipment and considerable flexibility. Continuous miners can negotiate technically disturbed areas of the mine and adapt to seam variations and uneven reserve blocks. Continuous mining equipment is also relatively mobile and can easily be moved to different locations within the mine allowing relatively quick adjustments and continued production if ground control, water or other problems prevent further mining in an active mining area. Room development mining involves development of underground mine openings (entries and cross-cuts) with intermediate pillars to support the mine roof during active mine advance. Each mining area developed using this method then becomes a "room" with a grid of supporting pillars.

Conventional room development mining (first mining) methods will be used for essentially all mine development work except slopes and fault crossings. Room development mining involves the use of a continuous miner to cut the coal and progressively advance each entry and cross-cut in a pre-determined development sequence. The cut coal is collected by the gathering pan on the continuous miner and discharged from the miner tailpiece by conveyor to a waiting electric shuttle car. The shuttle car will transport the coal to a feeder-breaker which will be centrally located in each continuous miner section or development area. The feeder-breaker will then feed the coal to a section belt for transport to the mine coal haulage conveyor system. As a safety consideration consistent with applicable MSHA regulations, the continuous miner is not allowed to advance under unsupported roof so following each cut an electrically powered roof bolter will install roof bolts and any other support required under the an MSHA approved roof control plan in preparation for the next cut. During bolting operations, the continuous miner will move to a nearby face and take a full cut and miner and bolting operations will proceed in staggered sequence as development progresses. The following primary equipment required to support room and pillar mining operations:

- Continuous miner
- Shuttle cars
- Roof Bolter
- Feeder Breaker
- Section power center
- Mantrip vehicle
- LHD scoop
- Portable rock duster
- Section conveyor
- Miscellaneous support equipment

Figures 4.5-1, Typical Mine Entry Development Configuration

TYPICAL MINE ENTRY DEVELOPMENT (THREE AND FOUR ENTRY)



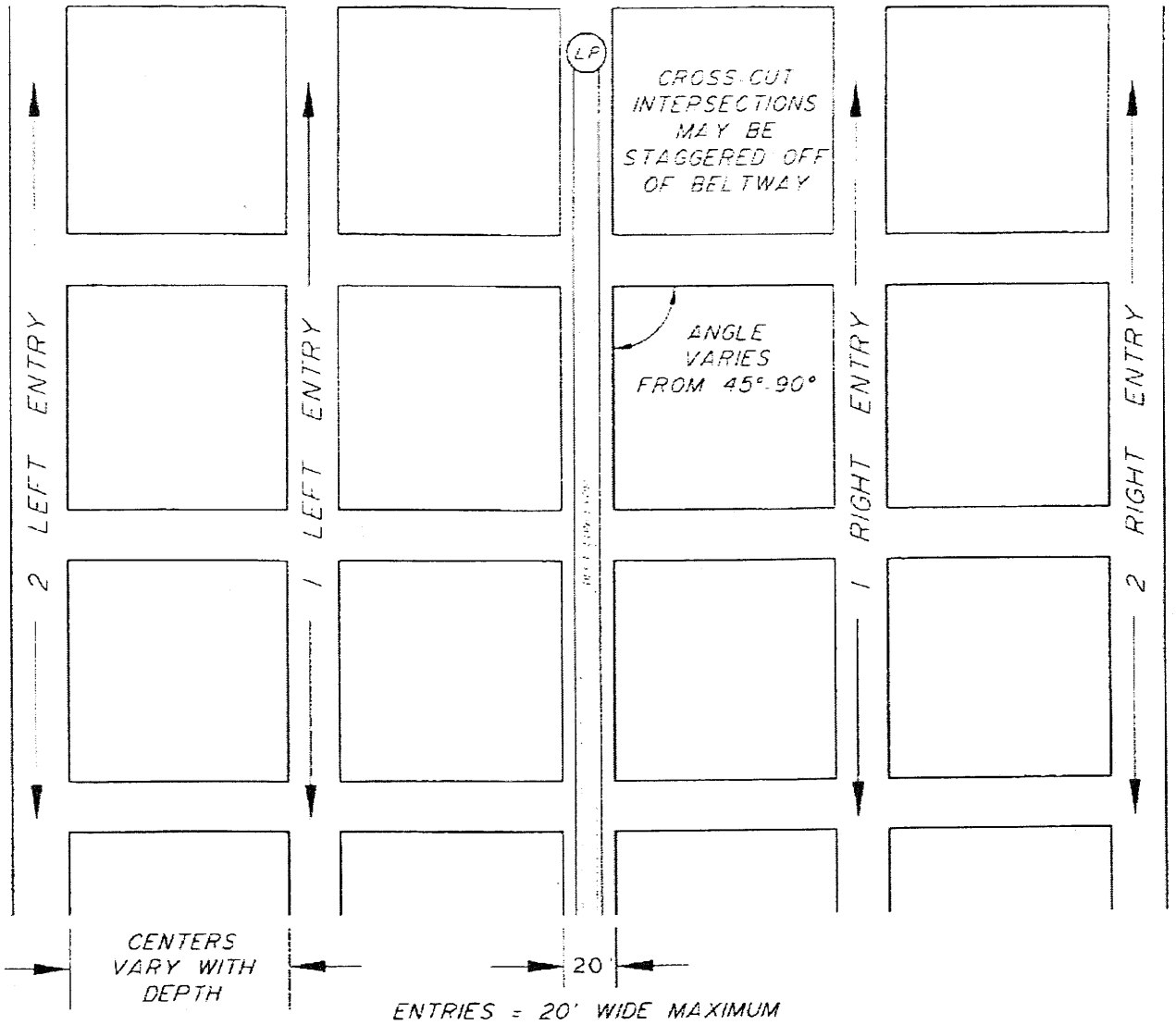
TYPICAL CUT SEQUENCE

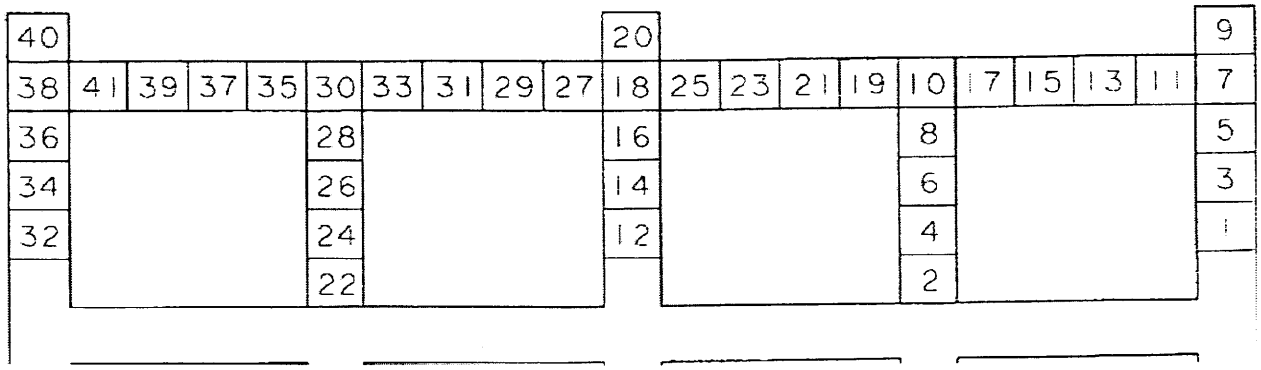
LEGEND

→	INTAKE AIR	T	BELT TAILPIECE
⇒	RETURN AIR	⊗	AUXILIARY FAN
‖	PERMANENT STOPPING	⊞ R	REGULATOR
⊂	CHECK CURTAIN		

Figures 4.5-2, Typical Mine Entry Development Configuration

TYPICAL MINE ENTRY DEVELOPMENT (FIVE ENTRY)





Coal Haulage - Marketable coal resulting from either underground mine production or mine development activities must be transported from the underground mine workings to the surface where it will be transfer to the surface coal handling system and be routed to the coal loadout. The mine coal haulage system will consist of several interconnected components to transport the coal to the surface. In conventional room development areas or production sections coal will be transported by electric or diesel shuttle car to a feeder-breaker which will feed a 42 inch section conveyor belt. From the active mining or development areas the section or panel belts will transfer the coal to either secondary haulage belts in the sub-mains or the primary coal haulage belts in the main entries. Secondary belts from the sub-mains will feed to the primary main haulage belt which will carry the coal to the surface. The section belts will move with progressive mining advance and will be 42 inch conveyors with modular components, take-ups, and drives capable of handling 1200 TPH. The secondary conveyor belts will remain in place for an extended time and will typically be 42 inch roof hung conveyors with modular tail section and intermediate booster drives capable of handling 1200 TPH.

Coal haulage between the various mining levels (between faults) will involve the use of main haulage belts on the intermediate access slopes which will transfer the coal to the main haulage belt on the next level above, or below. These belts will typically be 42 inch roof hung conveyors with modular tail sections and intermediate booster drives as needed capable of handling 1200 TPH. All coal transfer points will be partially or fully enclosed to minimize dust generation and dispersion, drop height will be limited to the extent operationally feasible, and impact beds and conveyor skirting will be utilized as appropriate to minimize coal breakage and dust generation, and contain both the coal stream and any associated coal dust. Consistent with safety considerations and applicable MSHA regulations, all underground coal haulage belts will be located in separate entries where they are isolated from both intake and return airways.

Mine Development Rock Handling - Several mining and related activities may result in production of significant quantities of mine development rock materials potentially including rock, carbonaceous shale, floor clay, and parting material. Operations which may result in generation of mine development rock will include general mine development, slope/raise development, room development mining operations, and development of overcasts for ventilation or coal haulage. Where mine development rock materials are encountered in mining operations or where the rock materials are integral to the coal seam in development areas or room development mining sections they will be recovered and handled with the coal during mining and coal haulage and will later be removed in the coal handling process. Where it is operationally feasible to separate these materials they will be removed and handled separately using the same equipment and haulage systems that will be utilized for conventional room development operations.

Continuous mining equipment is generally capable of excavating and handling most sedimentary units typically associated with coal deposits. On those occasions when considerable quantities of development rock may be generated by mining and related operations, the coal haulage system may be run during a scheduled rock development materials handling shift until it is cleared of coal and then the rock materials will be fed into the system for haulage to the surface. Surface coal handling systems have been design to also effectively handle mine rock development materials as discussed in detail in Section 4.5.2.3, Mine Structures and Facilities, and will route any mine rock development materials to the rotary breaker facility where the rock will be separated out and routed to a temporary

mine rock development materials stockpile for later transfer back into the mine and placed in specific areas developed for this purpose. Any minor quantities of mine rock development materials generated in conjunction with ongoing mining and related operations will be temporarily stockpiled in inactive areas underground until they can be recovered and transported to the surface during a scheduled rock development materials handling shift.

Disposal of Coal Mine Development Rock in Designated Areas Underground - Two special areas have been designated underground as mine development rock disposal sites for the emplacement of mining generated rock (see Map 4.5.1.2-5, Mine Plan Layout & Production Schedule Map,). Both areas are within practical operating proximity of the rock slope development area and also close to the Surface portal area where Mine Development waste may be temporarily stored as "off-spec" product coal.
Disposal Area 1 is the area known as "N13E Panel A" and it is located on the North side of the Portal Mains. It is separated from the adjacent Disposal Area "N13E Panel B" with a 140 ft wide Barrier Pillar which adds to the long-term integrity of the backfill area stability.
Both of these disposal areas are strategically located, life of mine fill emplacement areas designed for the emplacement of all types of mine development rock containing or not containing coal. Both areas will be ventilated before, during and after backfill emplacement operations and at all times according to MSHA standards and according to MSHA approved ventilation and roof control plans for the mine.

Mine Ventilation - The mine ventilation system has been designed to provide sufficient quantities of air and airflow rates in active working areas to sufficiently dilute any coal dust or methane gas present so that potentially explosive dust/gas/air mixtures do not develop and to provide sufficient fresh air flow to assure safe and healthy working conditions for the miners.

During portal development small auxiliary fans will be used to ventilate the working places. These fans will be used for primary ventilation only for a short time period during initial development. Once portal development progresses to the point where full ventilation crosscuts have been established, a temporary mine fan will be installed on the northernmost portal entry and this fan along with conventional full or temporary stoppings will provide adequate ventilation volume and control for the initial portal and main entry development. This fan will be used for approximately one year, or until development has progressed to the point where a second continuous miner can be placed in service. Use of the temporary mine fan will allow Carbon Resources the time to complete the permanent main mine ventilation fan installation and associated structures.

Permanent ventilation for the permit area will be provided by a 6 ft diameter exhausting axial vane fan with a 300 HP motor operating at 1160 rpm (or equivalent). Temporary or auxiliary fans will be used in either blowing or exhausting mode with vet tubing to assist mining while setting up airways for the permanent ventilation system.

The main mine fan installation will include fan drive units, fan shroud structures, blow-out doors, heaters, and fan control systems located on Portal No. 1, as shown on Map 4.5.1.2-3, Mine Surface Facilities Map. The main mine fan will provide adequate ventilation for all development and mine workings planned during the first five years of mining.

Effective ventilation of mine workings will involve control of airflow within the mine workings to provide adequate airflow volumes and flow rates in all active working areas. Airflow will be

controlled, under mine ventilation plans submitted to and approved by MSHA, by maintaining a pressure differential which will force the air to follow a pre-determined path through the mine workings. The pressure differential and desired airflow will be maintained by isolating intake and return airways with air-tight stoppings and utilizing the network of mine entryways to effectively route both clean (intake) and used (return) air through the mine.

The mine fan is not intended to be a life of mine fan per se. However, it is sufficient for all of the needs for this permit application and from this standpoint it is deemed to be permanent. From the longer-term viewpoint with respect to the life of the reserves it is more or less a temporary installation and will need to be replaced at some future date as the permit is revised and the mine is extended.

As shown, mine intake air from this fan will enter through the underground mine workings through the Intakes Portal Openings No. 4 and No. 5 Entries. Intake air will be drawn through the mine to the working places and mining faces by the network of main, sub-main, and bleeder entries the negative pressures exerted by the exhausting fan. Air will be coursed through the mine and controlled by both permanent and temporary stoppings, curtains and regulators. From mine working areas, exhaust airflow will be carried by bleeder, sub-main, and main entry exhaust airways discharging from the Mine Portal No. 1 entry through the fan.

The mine ventilation system will meet all applicable MSHA requirements and according to an MSHA approved Ventilation Plan. The Ventilation plan will provide continuous effective ventilation of the active mine workings at all times. The Ventilation plan will also provide for regular inspections as required by CFR 30 Part 75 regarding pre-shift and on shift inspections and fire-boss inspections of outby workings.

Based on the planned extent of the mine workings, anticipated methane liberation and dust generation rates, and probable mining conditions the primary ventilation fan will provide adequate ventilation capacity for at least the first five years of mine development and production. It is expected that subsequent mine expansion will require development of additional ventilation facilities to assure continued effective airflow and ventilation of the underground workings. These will be addressed in future revisions of the permit as needed.

Dewatering and Mine Drainage Control - Given the relatively low overall permeability of the geologic sequence, limited recharge, extensive historic mining in the area both north and south of the proposed Kinney No. 2 Mine in multiple seams, and consequent lack of a significant ground water aquifer in the area to be mined, ground water inflow to the active mine workings is expected to be limited. Ground water accumulations in abandoned underground workings in the area may result in localized increases in the amount and availability of ground water, particularly in down-dip areas to the north and east. CR is not expecting any significant amounts of water to be encountered during the permit term, other than possible minor amounts of perched localized water.

Any significant ground water inflows to the active mine workings will be controlled by intercepting the water near the point of inflow with either shallow ditches or sumps and transferring the water to either abandoned mine areas or temporary holding areas. Minor ground water inflows will not be addressed unless they interfere with mine operations or pose a potential safety hazard. Mine drainage will be transferred within the mine utilizing a series of ditches in combination with intermediate sumps and submersible pumps and pipelines. If adequate quantities of mine drainage are available to justify use of mine drainage as a

supply source for operational mine water requirements, temporary holding areas within the mine may be developed and utilized as mine drainage storage areas and clarification basins.

Maintenance and Miscellaneous Support Activities - A number of support activities including rock dusting; extension of mine electrical, communications, and water systems; equipment maintenance and repair; and material and equipment supply and storage are necessary to maintain safe, efficient underground operations, to prevent or minimize potential mining related environmental impacts, and to effect ongoing compliance with applicable regulatory provisions and requirements. Generally, mining support activities will occur either concurrently and as a part of ongoing mining operations or on a scheduled or as needed basis. Many of the necessary mining support functions including electrical distribution, mine ventilation, underground communications, and health and safety considerations are governed and monitored by MSHA under applicable provisions of the Coal Mine Health and Safety Act of 1969, and will be conducted under specific MSHA plan approvals. The following briefly describe planned support activities which CR will undertake in conjunction with the proposed Kinney No. 2 Mine mining activities:

Rock dusting - Rock dusting will occur in all applicable development areas and mining sections and will involve mechanical or pneumatic distribution of powdered limestone to cover exposed coal surfaces to limit generation distribution of potentially explosive mixtures of coal dust in the mine environment

Extension of mine utilities - Recognizing that mining advance will be a continuous ongoing process, mine utilities including electrical, communications, and water systems have been designed and will be installed to facilitate extension with mining advance. Typically, these systems will consist of modular components which will permit progressive connection of additional segments either in a series or parallel configuration.

Equipment maintenance and repair - Normally, equipment maintenance will occur in the working area during scheduled maintenance shifts. Minor repairs will occur in the working area either in conjunction with scheduled maintenance or, if immediate repairs are required, during temporary shut-down periods on scheduled operating shifts. If major repairs or equipment overhauls are required, the equipment may be transported to either centralized underground or surface shop areas. All underground maintenance and repair activities will be conducted in compliance with applicable health and safety requirements

Material and Equipment Supply and Storage - Materials and equipment required in conjunction with underground mining operations will generally be supplied from the surface warehouse and storage facilities. Limited quantities of certain consumable supplies including roof bolts, timbers, hydraulic fluid, rock dust, electrical cable, and similar materials may be stored in temporary underground storage areas near active working areas.

In addition to the specific production equipment previously listed for development mining, or first mining, a variety of maintenance and support equipment and systems will be required in conjunction with the proposed underground mining operations including the following:

- Personnel carriers
- Supply tractors and trailers
- Lubrication trailers

- Rock dust distribution system
- Electrical distribution system
- Underground communications systems
- Personnel first aid and safety equipment
- Miscellaneous equipment

Pillar Sizes

The primary means of support for any underground mine plan is the pillar itself and the Kinney No. 2 Mine is no exception. CR has taken special care and precaution to ensure that all of the pillars within the permit application area are sized with dimensions to provide sufficient stiffness to withstand post mining vertical stresses and deterioration for the prescribed duty intended to so that they will stand for the long-term full life of the mine with a high degree of integrity and confidence in safety against mining bumps.

Based on comparison with the empirical data from mine maps of historic production at this location and based on experience at other mines in the area[1], CR has selected a conservative rate of extraction and pillar configuration for the given the depth of cover[2], geotechnical considerations of the coal and overburden, and other conditions[3] present.

Planimetric extraction rates are limited to less than 45% with-in the permit application area by design with a view toward long term stability, safety and utility service for the Kinney No. 2 Mine.

Pillars dimensions in the mains are set at 65 ft wide by 100 ft long (i.e. 75 by 120 ft entry and oss centers with 20 ft. wide openings).

This will ensure a stable opening and permit productive place change mining operations with mining and bolting.

Pillars in the 2 adjacent panels are 55 ft wide by 100 ft long (i.e. 65 ft by 120 ft entry and crosscut centers respectively). W/h ratio for mains pillars is 65/8 = 8.125. Pillars of this shape are stronger than the "intermediate range" of the empirical pillar classification and, considering that it is not adjacent to any active retreat pillaring or caving activity and that it is under relatively shallow cover it is expected to provide ample support serve the duty intended for the five entries throughout the duration of the life of the mine.

W/h ratio for pillars in the two designated backfill panels is 65/8 = 6.88. This ratio is well within the "Intermediate range" of empirical classification. The 60 degree chevron called for in the back-fill panels is not expected to result in failure of the pillar corners at the intersections until after backfill has taken place. However, if failure should occur, secondary support will be installed to decrease the effective roof span and support the pillar where it is needed.

Adequate and ample barrier pillars will be left between new workings and mined-out workings as shown and as otherwise needed.

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[1] RE: Columbine Mine and Skyline Mine maps; See also Empirical Methods for Coal Pillar Design – Christopher Mark PhD.

[2] The maximum depth of cover in the permit application area above the Hiawatha Seam is 1000 ft. The average depth of cover is about 700 ft for most of the workings and for the mains. The minimum depth is zero at the outop portal location.

[3] Other conditions include dynamic conditions present with the structural complexities of the area (i.e. faulting).

Approach of Old Workings

CR has obtained the maps of old mine workings in the Hiawatha Seam in the Permit application area. However, these maps may or may not be accurate and reliable and the workings are abandonded and sealed and so can not be accessed to verify their reliability. In areas where new mining activities are likely to approach within 500 ft of abandoned, sealed or unventilated mined out workings MSHA rules CFR 30 Part 75 will be strictly followed concerning the approach of old workings.

CR will work with MSHA and the state of Utah to devise plans to precisely locate old mine workings prior to approaching them that will safeguard all persons. This may involve drilling ahead with an in-mine drill, possibly injecting cocrete into old workings to pre-stabilize them and other measures to prevent inundation and/or the introduction of gob gas to the active mine atmosphere should the drilling reveal the old mine workings will be unavoidably encountered in the planned mains.

Development rock backfill will be placed into designated panel areas and will further serve to encapsulate pillars. This will passively stabilize pillars in those areas with some confinement. Development rock backfill areas will be ventilated until they are filled and have been monitored for products of combustion for a period of 1 year after backfill operations are complete. If no significant products of combustion have been found the area will be sealed and monitored according to an approved ventilation plan.

If products of combustion are found in the area, the area will be promptly sealed and injected with an inert heavy gas such as Carbon Dioxide CO_2 specific gravity = 1.53. Once sealed and injected with CO_2 , no mining will be planned down dip that may breach into these sealed areas. Monitoring of gas in the area will be a continuing part of an approved ventilation plan.

Finally, CR will commit the professional resources necessary to actively examine actual pillar and rib conditions in areas adjacent to old workings and evaluate the need for additional roof or pillar support and other geo-mechanical needs on a periodic and as needed basis. Carbon Resources is dedicated to effectively addressing any need for design changes in pillar size or changes required for the safe operation of the Kinney No. 2Mine.

Maintenance of mine openings will involve regular inspections of the openings and surrounding surface areas, removal of any material or debris from the immediate area of the openings, and repair or replacement of ground control, protective structures, or other structures associated with the mine openings. Mine openings and the immediate surrounding areas will be kept clear of equipment, materials, and supplies, and no coal, mine waste, or potentially flammable materials will be placed or stored in the immediate vicinity.

Explosive Storage and Blasting

Due to the potential explosion hazards related to both methane and coal dust blasting, any underground blasting activities will be limited and will be conducted in full compliance with applicable MSHA requirements. Limited surface blasting will be necessary in conjunction with the proposed construction activities and on an occasional basis during operations. Construction related blasting requirements may include the drilling and blasting activities

necessary to construct the various pads, and for the proposed surface conveyor system, and limited blasting to fragment resistant rock in order to establish the design facilities area configuration, and small-scale blasting to fracture any large rocks so that they can be moved during the construction/development phase. Occasional operational blasting requirements may include small-scale surface blasting to fracture large rocks that may fall or roll from the adjacent steep cliffs and slopes into operating areas or onto roads, clear clogged chutes, or address potentially hazardous rock or slope conditions. Because of the nature of the required blasting, construction related blasting activities may require the use of more than 5 pounds of explosive, however, it is anticipated that operational blasting will generally not require more than 5 pounds of explosive.

Any surface blasting required in conjunction with the underground mining operation will be conducted in compliance with applicable provisions of Rule R645-301-524. All blasting will be conducted by a certified blaster and the responsible blaster will either carry documentation of blaster certification or the appropriate certificates will be retained on file at the mine or construction office. The responsible blaster and at least one other person will be present for all blasts and the responsible blaster or an individual under his direct supervision will load, connect, and initiate all blasts. Because the proposed Kinney No. 2 Mine surface facilities, where any required surface blasting would occur, are located within 1,000 feet of State Highway 96, and within 500 feet of abandoned coal mines in the areas, a general blasting plan is included in this permit application. Given the general nature of the blasting plan, it provides a framework for all anticipated blasting activities, however, if a blast will require more than five pounds of explosives, CR will submit specific blast design information to UDOGM prior to the blast. Persons responsible for blasting operations will be familiar with site conditions and the explosive handling and blasting procedures as outlined by Exhibit 4.5.2.1-2, Kinney No. 2 Mine Blasting Plan.

Explosives and detonating caps will be stored separately in secure locked structures and explosive storage and handling will be conducted in accordance with all applicable State and Federal standards under current valid Bureau of Alcohol, Tobacco, and Firearms permits. It is anticipated that portable skid-mounted explosive magazines will be utilized and that any required explosives may be supplied and handled by an independent explosives contractor. Given this consideration and very limited anticipated operational blasting requirements, explosives may not be maintained on site at all times. For construction related blasting operations and any temporary or long term explosive storage during the operations phase, the designated explosive storage area will be located as shown on Map 4.5.1.2-3, Mine Surface Facilities Map providing adequate distances from surface structures and facilities as designated by the applicable regulatory requirements.

Subsidence Control

Coal extraction by underground mining typically results in a void where the coal has been removed, and possibly partial collapse of the immediate overlying units, deformation of the units above the mined area, and potential deformation or settlement of the overlying ground surface, termed subsidence. Subsidence typically only occurs at the surface where pillars are extracted, or where longwall mining methods remove substantial blocks of coal. No second mining, or pillar extraction, or longwall mining that would result in subsidence is planned for the Kinney No. 2 Mine, therefore no subsidence is anticipated. Portals have been designed to be stable indefinitely, with a combination of steel, wood, and concrete

support structures that will prevent subsidence of the shallow cover over the mine entries near the surface.

4.5.2.3 Mine Structures and Facilities

The proposed underground mining and related activities will require limited surface support facilities. The facilities to be utilized in conjunction with the proposed operations will include new facilities to be constructed in the proposed Kinney No. 2 Mine surface facilities area. These facilities will provide the necessary infrastructure for effective management and handling of personnel, equipment, materials and supplies, and both coal and mine development rock materials, and will include a number of structures specifically designed to control or mitigate potential mining related impacts.

Construction of required surface structures and facilities has previously been discussed in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements. The surface structures and facilities will be operated, maintained, and ultimately reclaimed in a manner that prevents or controls erosion and siltation, water pollution, and damage to public or private property; and to the extent possible using the best technology currently available, minimizes damage to fish, wildlife, and related environmental values, and minimizes additional contributions of suspended solids to streamflow or runoff outside the permit area. Any contributions of suspended solids from mine disturbance areas will not exceed applicable effluent limitations under Utah or Federal law.

Required surface facilities are shown and identified on Map 4.5.1.2-3, Mine Surface Facilities Map, and include the following:

- Conveyor SB-1
- Conveyor Transfer Tower
- Conveyor SB-2
- Non-Spec Coal Pile & Stacking Tube
- Conveyor SB-3
- Spec Coal Pile & Stacking Tube
- Conveyor SB-4
- Screening & Crushing Building
- Sediment Pond Road – Primary P6
- Truck Loadout Building
- Lodout Road – Primary P5
- Storage Sheds – 5 each
- Shop – Warehouse
- Fueling Facility
- Main Access Road – Primary P1
- Office Road – Primary P2
- Portal Access Road Primary P3
- Storage Area Access Road P4
- Mine Office – Bathouse
- Topsoil Stockplie

- Water Tank
- Electrical Substation
- Sedimentation Pond
- North Access Road – Primary P7
- Explosives Magazine
- Explosives Cap Magazine

The following sections describe design and construction details and operation and maintenance plans for the identified structures.

Drainage and Sediment Control Structures

The drainage and sediment control structures which will be constructed and utilized in conjunction with the proposed mining and related activities will effectively route natural drainage through the mine surface disturbance area, intercept and route undisturbed drainage from upslope areas around surface disturbance areas, and collect and route disturbed area drainage to sedimentation structures to allow settlement of suspended solids prior to discharge to the natural drainages. Drainage and sediment control structures required under the proposed plans will include Sedimentation Pond 1, a number of undisturbed drainage diversion ditches, disturbed area collection ditches, drainage culverts, containment berms, and various alternative drainage and sediment control measures including small sediment basins, silt fences, straw bales, and other localized control measures as appropriate. The proposed drainage and sediment control structures are shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan Map, and design information and calculations are discussed in Section 4.7 Hydrologic Resource Protection and PHC, and the background information and calculations are included in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Design - The design and location of all required drainage and sediment control structures is based on maximum anticipated storm runoff flows, site topographic conditions, and standard hydrologic design practices and addresses full compliance with all applicable regulatory provisions. Recognizing that the area is subject to relatively high-intensity, short-duration storm events and that due to the rugged terrain and limited vegetation runoff is frequently rapid and concentrated, essentially all structures have been over-designed to provide an additional margin of safety.

The applicable UDOGM regulatory provisions specify that all impoundments must be designed to contain or treat the runoff resulting from the 10-year, 24-hour storm event and that spillways for MSHA ponds must be capable of discharging runoff flows from the 100-year, 6-hour event and non-MSHA ponds must have designed principal and emergency spillways with a combined capability of discharging the 25-year, 6-hour storm event. However these spillways were designed to safely discharge the 100-year, 6-hour event to provide additional safety due to the close proximity of the sedimentation pond to the highway. The applicable regulations also specify that temporary and permanent diversions of miscellaneous flows be designed for the 2-year and 10-year, 6-hour events, respectively and that temporary and permanent diversions of perennial and intermittent streams be designed for the 10-year and 100-year, 6-hour storm events, respectively.

Hansen Allen and Luce, Engineers (HAL) completed a runoff evaluation for representative watershed areas using the Army Corps of Engineers Hydrologic Modeling System (HEC-HMS) Version 3.1.0 computer modeling software to determine conditions for design of the proposed Kinney No. 2 Mine drainage and sediment control structures. Sedimentation Pond 1 has been designed to contain or treat the runoff from the 10-year, 24-hour storm event and total design capacity includes storage for at least five years accumulation of sediment. The pond spillway structures have been designed to safely pass the runoff from the 100-year, 6-hour storm event.

Temporary diversion ditches in disturbed areas are designed to safely pass the peak discharge from the 10-year, 6-hour storm event. All diversions have been designed and will be constructed to remain stable under design flow conditions. All collection ditches have been conservatively sized to carry the peak runoff flows from the 25-year, 24-hour storm event in order to provide a significant margin of safety and accommodate the brief, high-intensity storms common to this area. In order to assure effective collection and routing of disturbed drainage flows and minimize both erosion and sedimentation, required culverts have been sized to safely pass the peak flow from the contributing inlet ditches with a significant factor of safety and culvert inlets, outlets, diversion channels, and those areas where one or more channels intersect have been designed and will be constructed using properly sized and placed riprap or other erosion control materials, as required. In all cases, ditch designs also included an evaluation of the need for channel protection to prevent or minimize erosion. The general criteria for channel protection was any flows greater than or equal to 4 feet per second would require channel protection in the form of riprap or grouted riprap to maintain adequate safety factors. Appropriate riprap sizing was determined using riprap design calculation spreadsheet prepared by HAL. Designs for all required ponds and ditches include adequate freeboard to provide a reasonable margin of safety. Designs for the permanent Kinney No. 2 Mine drainage structures and facilities have been prepared by or under the direction of and certified by a qualified Registered Professional Engineer in accordance with Rules R645-301-742.324. Culvert sizing is consistent with the ditch design basis (i.e., 10-year, 6-hour and 100-year, 6-hour storm flows, respectively for temporary and permanent diversions), the minimum culvert size to be used is 18 inch diameter due to potential clogging and maintenance considerations, however all have been over-designed to provide an additional measure of safety, and culvert installations will include a pre-fabricated inlet structure and riprap protection at both the headwall and discharge points.

In order to assure effective conveyance of undisturbed drainage flows and minimize both erosion and sedimentation, required culverts have been sized to safely pass the peak flow from the contributing inlet ditches with a significant factor of safety and culvert inlets, outlets, diversion channels, and those areas where one or more channels intersect have been designed and will be constructed using properly sized and placed riprap or other erosion control materials, as required. Specific information on culvert design and erosion protection measures is also provided in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Sedimentation Pond 1 has been designed and will be constructed to meet the following regulatory design criteria:

- Located as close as possible to the disturbed area and out of perennial streams unless approved by the Division
- Provide adequate sediment storage
- Provide adequate detention time to meet applicable effluent standards

- Provide a non-clogging dewatering device
- Minimize short circuiting
- Facilitate periodic sediment removal
- Foundation structures will be stable under all conditions of construction and operation

In addition, Sedimentation Pond 1 design has been prepared by or under the direction of and certified by a qualified Registered Professional Engineer in accordance with Rules R645-301-512.200 and 240.

In all cases, the design basis for the proposed drainage and sediment control structures meets or exceeds the applicable regulatory design requirements. Designs for drainage and sediment control structures, along with a discussion of design assumptions, methodology, and design calculations are presented in Section 4.7 Hydrologic Resource Protection and PHC, and the background information and calculations are included in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Construction - As previously noted in Section 4.5.2.1, General Description of Mine Construction and Development Activities, the required drainage and sediment control structures will be constructed prior to any other significant site disturbance, and as soon as possible in the overall site construction plan. As a first step to construction, a silt fence will be placed at the extreme western edge of all site construction running from the southwest corner of the site adjacent to the highway and adjacent to the old railroad bed from the pre-existing access road into the site running northward to the northwest corner of the site. Construction of required undisturbed runoff diversion ditches and disturbed area collection ditches will involve removal and placement in stockpile of soil or clean soils materials, excavation of the design ditch configuration, placement of riprap and bedding material or geotextile where required, and seeding of ditch sideslopes with the temporary revegetation seed mix. The constructed ditch configuration is illustrated by the typical design configuration figures included on Map 4.7.2.2-2, Runoff Control Details. Culvert installation will involve excavation and grading of the culvert foundation area, placement and compaction of gravel or similar bedding materials, placement and adjustment of the culvert and inlet structure to the design grade and alignment, placement and compaction of suitable fill materials around and over the culvert, placement of rock protection in the culvert headwall and discharge areas, and installation of debris fences upgradient of culverts where required. Culvert installation practices are illustrated by the typical design configuration figures included on Map 4.7.2.2-2, Runoff Control Details.

Construction of sedimentation pond impoundments will involve recovery and placement in stockpile of soil or substitute materials, preparation of embankment foundation areas, excavation of impoundment basin areas and construction of embankment structures, installation of principal and emergency discharge structures; grading of embankment outslopes, and seeding of outslopes with the temporary revegetation seed mix to minimize erosion. Impoundments will be inspected at regular intervals during construction and on completion of construction by a professional engineer or specialist experienced in impoundment construction. An impoundment inspection report certified by a Registered Professional Engineer will be provided to UDOGM promptly following each inspection. The report will verify construction in accordance with design plans and will note and discuss any apparent instability, structural weakness, or other hazardous conditions. A copy of the report will be retained on file at the minesite for inspection by authorized agency representatives.

Required foundation preparation will include removal of any vegetative material, coal, potentially acid-forming coal waste, frozen material, or other deleterious materials from embankment foundation areas and excavation of any keyways specified in the design. Embankment construction will involve controlled placement and compaction in horizontally continuous lifts no greater than 12 inches in thickness of suitable embankment fill material. Fill material will not contain any significant quantities of coal, vegetative material, frozen material, or other deleterious materials. Fill will be placed and spread using either tractor scrapers or rear dump trucks and tracked dozers and design compaction of 95 percent of maximum dry density will be achieved by compacting each successive lift with a sheepsfoot or vibratory roller. Compaction will be periodically checked during construction using standard compaction testing procedures and if testing reveals inadequate compaction, the lift or lifts in question will be ripped and reworked until adequate compaction is achieved. During compaction, water trucks may be utilized as necessary to achieve optimal moisture content for effective compaction. The actual construction height for all pond embankments will be 5 percent greater than the design height to provide for long-term consolidation and settling of the embankment.

Installation of principal and emergency discharge structures will occur at appropriate stages in the embankment construction process. Installation of vertical riser structures will include compaction of an adequate base area for the foot of the riser and installation, alignment, and placement and compaction of fill material around the lower portion of the riser structure. Installation of horizontal discharge structures will involve basically the same construction procedures previously described for culvert installations, including preparation of a base area, placement and compaction of bedding material, placement and alignment of the discharge pipe, and placement and compaction of fill material around the pipe.

Operation and Maintenance - Operation and maintenance of drainage and sedimentation control structures will involve periodic inspection of all ditches and culverts, quarterly inspection and annual certification of impoundments and related structures, ongoing discharge monitoring for all impoundments, and any necessary maintenance or repair of problems noted during the inspections.

Ditches have been designed and will be constructed to provide an adequate cross-sectional flow area to pass runoff flows from the design storm event. During active operations, normal siltation and minor erosion may result in changes in ditch configuration. As discussed previously, however, all ditches have been designed for the 25-year, 24-hour storm event rather than the 2-year or 10-year, 6-hour event as required, therefore, minor siltation will not affect the capacity of the ditches to perform as designed. CR's ditch inspection and maintenance procedures will focus on identification and repair of any significant ditch erosion, removal of any trash or debris from ditches, and maintenance of an adequate cross-sectional flow area, regardless of actual ditch configuration, to pass the design flows. In practice this will mean that CR will not modify, recut, or clean out a ditch simply because the physical ditch dimensions are not the same as the original design or originally constructed configuration so long as the actual ditch configuration is adequate to pass the design flow. Culvert maintenance will involve removal of trash or debris from culvert inlets and any upgradient debris fences, repair of any significant erosion at culvert inlets, outlets, or of the cover material, and repair or replacement of any damaged culverts.

Sedimentation pond maintenance and operation procedures will include ongoing sampling and discharge monitoring under applicable provisions of a UDWQ permit; quarterly inspections of pond embankments, impoundment areas, discharge structures, and inlet/outlet structures and areas and reporting; notification of any hazardous conditions and development of emergency remedial control measures; maintenance or repair of any problems noted during the inspections; and periodic removal of accumulated sediment. The sedimentation pond has been designed and will be operated and maintained to effectively retain storm runoff to allow settlement of suspended solids prior to discharge. Control of potential water quality impacts from pond discharge is monitored through compliance with applicable effluent standards under a UDWQ discharge permit. Effluent sampling and reporting will occur as outlined in Section 4.7, Hydrologic Resource Protection and PHC, and under the provisions of the UPDES permit which will be included in Exhibit 2.1.3-1, Other Permits when it is received.

The sedimentation pond will be inspected quarterly by a qualified person for any indication of structural weakness or other hazardous condition, instability, and any erosion or other problems; the depth and elevation of any impounded water will be measured; based on the depth measurements storage capacity will be estimated; and any required structural monitoring will be performed. Copies of the quarterly inspection reports discussing each of the noted inspection categories and verifying that the pond has been constructed and maintained as designed will be prepared, certified by a qualified Registered Professional Engineer, and submitted promptly to UDOGM. Copies of the inspection reports will also be maintained on file at the minesite. Any minor problems noted during the inspection will be addressed in a timely manner. This may involve repair of any minor localized erosion, clean-out or minor repair of discharge structures, reseeding of embankment slopes, mowing weeds which may interfere with pond inspection, or other minor maintenance and repair as necessary. If the inspection identifies any structural weakness or other conditions which could pose a hazard to the public, the person who conducted the inspection will notify UDOGM promptly of the hazardous condition and any emergency procedures which may be appropriate to protect the public and address the hazardous condition. In consultation with and with approval from UDOGM, appropriate remedial measures will be implemented as soon as is reasonably practicable to address any hazardous condition.

The pond has been designed to provide adequate capacity for at least three years accumulation of sediments, however, the pond will periodically need to be cleaned out to removed the accumulated sediment in order to maintain adequate stormwater storage capacity consistent with design requirements. A fixed staff gauge in the pond will be used to monitor sediment accumulation. Generally, it is anticipated that the sedimentation pond will be essentially dry during late summer or early fall each year and the gauges will be checked during the corresponding pond inspections. In the unlikely event that the staff gauges cannot be checked during a dry period, an alternative means of monitoring sediment accumulation levels will be utilized.

Before sediment accumulations reach the point where they would encroach on stormwater storage capacity, CR will schedule and implement measures to remove the accumulated sediments. The pond has been designed to facilitate access for pond clean-out with a concrete ramp for equipment access to the pond bottom. The pond will have a reinforced concrete bottom to facilitate cleaning by equipment without damaging the pond integrity. Generally, clean-out would be scheduled during a relatively dry period when any pond water levels would be low. Any water remaining in the pond would be pumped into water

trucks for use in minesite dust control. The sediments would be allowed to dry so that they could be readily removed and they would then be removed and transported to a temporary storage area located on one of the mine pad areas until dry, then would be transported into the mine and placed in the areas designated for mine development rock as discussed in Section 4.5.2.2 General Description of Mine Plans, Mining Methods, and Related Design Requirements.

Description of Individual Structures - The following sections provide more detailed information for specific drainage and sediment control structures:

Sedimentation Pond 1 - Sedimentation Pond 1, which will be located at the northern end of the mine site, as shown on both Map 4.7.2.1-3, Drainage and Sediment Control Plan Map, and Map 4.5.1.2-3, Mine Surface Facilities Map, will be the only sedimentation pond for the proposed mine surface facilities area. The vast majority of disturbed area runoff and minor amounts of undisturbed area runoff from those facilities and areas upgradient from the pond location will be routed to Pond 1. The total contributing drainage area for Pond 1 is approximately 28 acres. The pond has been designed to provide adequate total retention capacity at an elevation of 7686.90 feet of 3.15 acre-feet which includes a 5.3 year accumulation of sediment (1.12 acre-feet) based on sediment discharge modeling for the contributing drainage areas and the 10-year, 24-hour storm runoff (2.06 acre-feet) from the contributing drainage areas.

Pond 1 is designed with vertical risers (primary spillway and emergency spillway) connected to a horizontal discharge culvert running through the pond embankment and discharging to a culvert crossing beneath Highway 96 and thus to the area west of the highway. One orifice in the primary spillway vertical riser at an elevation of 7683.80 feet, will be used to dewater the pond and discharge stormwater inflows. The top of the riser will be at an elevation of 7686.90 feet, at the invert of the emergency spillway. The orifice outlet will be fitted with gooseneck pipe extension to act as oil skimmer to prevent discharge of any minor amounts of oil or other petroleum products which may enter the pond and the top of the riser will be fitted with a trash rack. The Pond 1 emergency spillway will be a 24 inch diameter pipe, with a crest elevation of 7686.90 feet. The invert elevation of the emergency spillway and pond embankment are designed to provide a minimum freeboard of 2.0 feet. In order to provide access for clean-out and haulage of accumulated pond sediments a primary road (P6) will be constructed from the Loadout Pad to the pond.

Map 4.7.2.1-3, Sedimentation Pond 1 Sections & Details shows the proposed Pond 1 layout and provides specific pond design information including the primary discharge, sediment storage volume, 10-yr 24-hr runoff volume, 100-tr 6-hr runoff volume, primary and emergency spillways, and pond embankment, and design details for the discharge structures. Figure 4.7.2.2-1, Pond 1 Stage-Volume Curve shows the stage storage curve; storage capacity information; design elevations for the pond bottom, sediment storage elevation. A detailed description of pond design assumptions and methodology, actual pond design calculations, and additional design information are provided in Section 4.7 Hydrologic Resource Protection and PHC, and the background information and calculations are included in Exhibit 4.7.2.2-1, Runoff Control Design Details. Pond construction, operation, and maintenance practices will be consistent with the previous descriptions presented in this section. Sedimentation Pond 1 will be a new pond and pond construction will involve both excavation of a portion of the pond basin and construction of a compacted fill embankment.

Alternative Drainage and Sediment Control Measures - Alternative drainage and sediment control measures will be utilized for initial construction activities as discussed in Section 4.5.2.1, General Description of Mine Construction and Development Activities, and in areas where the isolated nature of the area or specific site conditions would result in excessive disturbance for full scale drainage and sediment control or where full-scale controls are infeasible. Alternative drainage and sediment controls will be utilized in the following specific areas:

- Initial Construction Areas
- Topsoil Stockpile
- Main Access Road (Primary Road P1), a short section at the entrance from Highway 96

Detailed descriptions of these areas, discussion of the alternative sediment control measures to be implemented, and requests for individual small area exemptions, as appropriate, are included below. It should be noted that alternative sediment controls for road fill and embankment outslope areas will consist of silt fencing and will only be required as a interim control measure until temporary vegetative cover is established.

Initial Construction Areas – Initial construction will be done before runoff controls are possible, therefore alternative controls will be used to control sedimentation off of the site. Controls to be used may include one or more of the controls discussed in Section 4.7, including, silt fencing, straw bales, berms, sediment traps, vegetative filters, mulch, and other effective appropriate drainage controls. Before construction begins, a silt fence will be placed at the extreme western edge of the site running parallel to the old railroad grade and including the area from the existing access road to the site and then running south to the southwest corner of the mine permit area adjacent to Highway 96.

Topsoil Alternative Materials Stockpile - The topsoil/alternative materials stockpile is located adjacent to Highway 96 at the south end of the mine site, where the runoff from the site cannot be routed to the sedimentation pond. Since the stockpile will be vegetated with interim vegetation and should stabilize within a two to three year period, there should be little sediment loss. Runoff from the stockpile will be controlled by a berm at it's western edge as can be seen on Map 4.7.2.1-3, Drainage and Sediment Control Plan. This berm will catch runoff and sediment from the face of the stockpile. A silt fence, or straw bale outlet from the lowest point of the berm near the highway culvert will filter any runoff from the pile prior to flowing into a sediment trap near the inlet end of the highway culvert. A silt fence, or straw bale outlet from the sediment trap will catch any overflow from the trap prior to discharge into the environment and thus into the highway culvert.

Main Access Road - Primary Road P1 – A short section of the access road approximately 115 feet long from it's intersection with Highway 96 eastward to a cattle guard cannot be routed to the Sedimentation Pond 1. Runoff from this small road section will be controlled by sediment traps on each side of the road as shown on Map 4.7.2.1-3. Drainage and Sediment Control Plan. A silt fence, or straw bale outlet from the sediment trap will catch any overflow from the trap prior to discharge into the highway side ditches.

Soil Stockpiles

Soil stockpiles will be utilized for temporary storage of those materials which will be used as vegetative growth media in reclaiming mining related disturbance. Stockpile location and construction will, to the extent operationally feasible, minimize exposure to wind and water erosion and protect the soil resource from loss, contamination, or further disturbance prior to final use for site reclamation. One new soil/substitute stockpile will be constructed using available material from the proposed Kinney No. 2 Mine surface facilities area. The new soil stockpile will be located at the southwest corner of the mine permit area adjacent to Highway 96 as shown on Map 4.5.1.2-3, Mine Surface Facilities Map. A cross section of the topsoil stockpile can be seen on Map 4.5.2.3-1A, Mine Surface Facilities Area, Pre-Mining, Mining & Post-Mining Cross Sections. This area is isolated from the proposed surface disturbance and operations, and is located generally upwind from the mine facilities, and as far away from the coal piles as possible. The proposed soil stockpile will cover an area of approximately 2.1 acres and can contain a maximum of approximately 54,760 cubic yards of material (see documentation in Exhibit 3.1.1.3-1, Soils Information).

To isolate the topsoil/alternative materials from highway salt, a 6 foot thick base constructed with clean fill material from subsoil materials will be placed at ground level, upon which the topsoil/alternative materials will be placed (see Map 4.5.2.3-1A, Mine Surface Facilities Area, Pre-Mining, Mining & Post-Mining Cross Sections). This elevates the topsoil/alternative materials above a point which could be contaminated by salt from highway salting operations by UDOT. The topsoil/alternative materials will be placed in horizontal lifts over the base material, and will be placed on the face of the fill for the Mine Office Pad. The detail can be seen on the mining Cross-Section A-A'. As can be seen on this section, the topsoil/alternative materials pile can be built up from the 6 foot base material to the toe of the Mine Office Pad fill before the Mine Office Pad fill is started, then the topsoil/alternative materials pile can be built up concurrently with the fill for the Mine Office Pad. Temporary stockpiling of subsoils and topsoil/alternative materials may be necessary to stage construction of both the topsoil/alternative materials, and the Mine Office Pad fill.

Basic soil handling and stockpile construction practices are desibed in Section 4.2.2, Soil Salvage, Handling, and Storage. The stockpiled material will be protected from erosion, contamination, and loss by placement in a controlled manner with sideslopes at 2H:1V or less, seeding with a temporary vegetative cover, posting with durable signs reading "Soil Stockpile - Keep Off", and the use of appropriate drainage control measures as discussed previously.

Roads

In conjunction with the proposed mining and related operations CR will construct, operate and maintain a number of new roads and will operate and maintain several existing roads. Both new and existing roads will be utilized to access existing and proposed facilities and for transportation of personnel, equipment, and supplies. All roads are classified as primary roads. The primary road classification includes any road used for transporting coal or spoil, roads which are used frequently for periods exceeding 6 months, and roads which will be retained to support the postmining land use. All roads will be utilized on a frequent, long-term basis to support the proposed mining and related operations. Proposed roads which will be used in conjunction with the proposed mining and related operations include the following:

Proposed Roads in Kinney No. 2 Mine Facilities Area

PR-1 Primary mine access road for the proposed surface facilities area
PR-2 Primary mine access road to Mine Office Pad
PR-3 Primary mine access road to the Portal Pad
PR-4 Primary mine access road to the Storage Area Pad
PR-5 Primary mine access road to the Loadout Pad
PR-6 Primary mine access road to Sedimentation Pond No. 1
PR-7 Primary mine access road to the North Access Road

All proposed roads are shown on, Map 4.5.1.2-3, Mine Surface Facilities Map. Road profiles can be seen on Maps 4.5.2.3-2A through 4.5.2.3-2C, Mine Road Profiles.

Design and Construction - All roads have been or will be located and constructed to the extent operationally feasible in the most stable areas available and outside of the channel of intermittent or perennial streams. Road design and construction plans will prevent damage to public or private property; minimize the potential for downstream flooding or sedimentation; reflect consideration of the size of vehicles which will be using the road, traffic volume, and normal speeds; and to the extent possible, using the best technology currently available, minimize adverse impacts on fish, wildlife and related environmental values.

All roads have been designed to provide for effective drainage, long-term stability, and safe vehicle operations under varying weather conditions. Design and construction of all primary roads will be certified by a qualified Registered Professional Engineer as meeting these criteria. All roads will meet MSHA safety requirements including either a berm or guard rail on the outside edges where the slope is downward.

Design and construction practices for specific roads will be dependent primarily on site conditions and the nature and frequency of anticipated use. The primary mine access road (PR-1) will provide access to the mine surface facilities and will be utilized for transportation of personnel, equipment, coal, and supplies. Because it will handle a relatively heavy traffic volume and must provide safe operating conditions year-round, Road PR-1 will be a paved asphalt road with all-weather travel surface from Highway 96 to the Shop-warehouse building. Primary Road P2 will also be paved to the Mine Office building; in addition, the Mine Office Pad will be paved. The other primary roads will also be utilized on a year-round basis but the associated traffic levels will be significantly lower so these roads have been designed and will be constructed with an adequate compacted road base and gravel or similar durable granular surfacing.

Road construction will involve cut and fill earthwork operations using tractor sapers, tracked dozers, and motor graders. No potential acid or toxic-forming materials will be utilized in road construction or as road surfacing materials. Cut and fill slopes will be established at maximum grades up to 0.8H:1V, with the steepest grades in rock dependent on the characteristics of the rock in conjunction with the geotechnical recommendations found in Exhibit 4.5.2.1-1, Geotechnical Investigations. Typical road construction practices, road configuration, and dimensions are illustrated by Figure 4.5-3, Typical Primary Road Configuration. Road gradients will vary from flat to a maximum of approximately 14.5% percent for the main roads and any required road embankments will be constructed and

compacted in a controlled manner to provide a minimum static factor of safety of 1.3. Only one road (P6), which accesses Sediment Pond 1 has a gradient above 14.5%, at 18.8%. This road will be used on a limited basis to access and clean out the sediment pone. All road cut and fill slopes will be revegetated as soon as reasonably practical following construction using the temporary revegetation seed mixture to stabilize the slopes and minimize erosion potential. Road surfaces will be graded or owned to prevent accumulations of water on the road surface and adequately sized ditches and culverts will be installed and maintained to effectively carry road and other disturbed area drainage. Adequate cover will be provided over all culvert crossings to prevent damage or collapse of the culverts and culverts have been designed and will be installed to prevent plugging, erosion at the culvert inlet or outlet, and any drainage over the road surface. The locations of all proposed ditches are shown on Map 4.7.2.1-3, Drainage and Sediment Control Plan Map, and ditch designs are included in Section 4.7, and in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Operation and Maintenance - Operation and maintenance procedures for all mine roads are designed to provide a smooth operating surface, assure safety, and minimize dust emissions. Road maintenance will involve periodic grading to provide a smooth surface, remove rocks or debris, and maintain effective drainage; repair and resurfacing as necessary; inspection, clean-out, and repair of ditches and drainage structures; and watering or application of surfactants to control dust during dry periods. Generally, speeds on roads and in active operating areas will be limited to 15 miles per hour by posted speed limits both as a safety consideration and to minimize dust emissions from unpaved roads. In the unlikely event that any road is damaged by a catastrophic event such as an earthquake or flood, CR will make appropriate repairs as soon as reasonably practicable and will limit the use of the road or provide an alternate access if unsafe conditions exist.

Description of Individual Structures - The following sections provide more detailed information for specific roads and associated structures:

Primary Road P1 will receive the most traffic, therefore it will be paved. From Highway 96 to the cattle guard as shown on Map 4.7.2.1-3, Drainage and Sediment Control Plan, the road will be owned in the center with drainage flowing to the sides in both directions. The purpose of the cattle guard is not to control cattle, but to provide a drainage trench to catch runoff containing fines from the road, preventing them from being washed downgradient on the road and bypassing Sedimentation Pond 1. Below the cattle guard, drainage from the road will flow to sediment traps on both sides of the road as shown on Map 4.7.2.1-3, Drainage and Sediment Control Plan. For the remainder of Primary Road P1, the design will be as shown on Figure 4.5-3, Typical Primary Road Configurations for sloping terrain and level terrain.

All other roads will be constructed as shown on Figure 4.5-3, Typical Primary Road Configurations for sloping terrain and level terrain.

Excavated Slopes

Site grading and excavation for the mine facilities and road construction activities will require some slope excavation work. Slope excavation areas stand out on Map 4.5.1.2-3, Mine Surface Facilities Map due to the closely spaced contours. In some areas, required

slope excavations will occur in weathered rock or other competent material where the potential for any consequent upslope stability problems is minimal. Cut slopes have been designed at gradients varying from 2H:1V to 0.8H:1V, dependent on rock type and construction requirements. Slope excavation will involve removal of material using tracked dozers, tractor scrapers, or backhoes to achieve the design slope configuration. In most cases, it is anticipated that required excavation can be accomplished without the need for blasting to loosen the material, however if blasting is required, any blasting operations will be conducted in accordance with the blasting plans previously described in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements.

During progressive excavation activities, the excavated slopes will be graded or scaled to establish a stable configuration and remove any loose material which could pose a potential hazard. Where slope excavation occurs in material which can be revegetated, the finished slopes will be seeded with the temporary seed mixture as outlined in Section 5.3, Revegetation and Habitat Restoration Plans, to stabilize the graded surface and minimize runoff and potential erosion. In the portal face-up area, where a potential rock fall hazard exists, wire mesh, or chain link fencing material may be anchored to the steep rock wall with roof bolts and concrete-steel portal structures will provide additional protection for both personnel and equipment. Maintenance of excavated slope will include periodic inspection of slope areas and removal of loose rocks or other potential hazards.

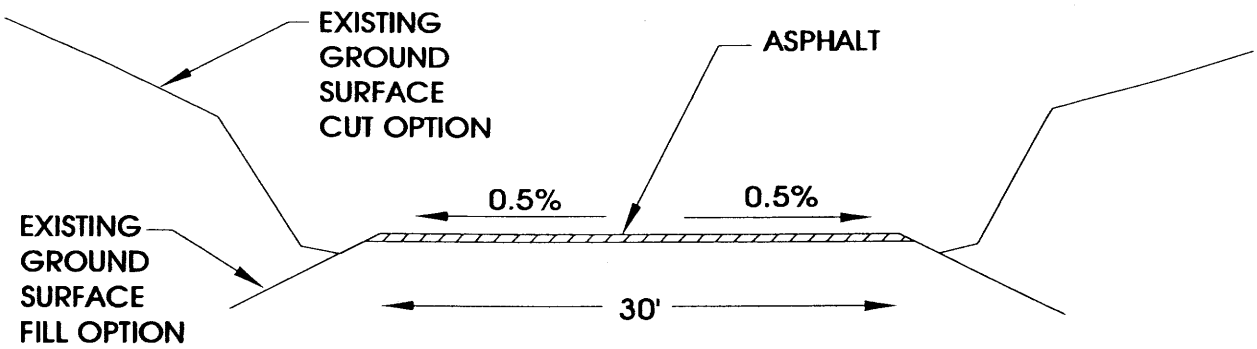
Excess Spoil Material

As an underground mining operation, the proposed mining and related activities will not result in generation of spoil materials. In addition, all related surface disturbance required for construction of the necessary surface support facilities has been carefully planned to balance material cuts and fills so that no excess material is generated. Since no excess spoil will be generated as a result of the proposed construction or operations activities, regulatory provisions relating to handling and disposal of excess spoil are not applicable.

Mine Openings

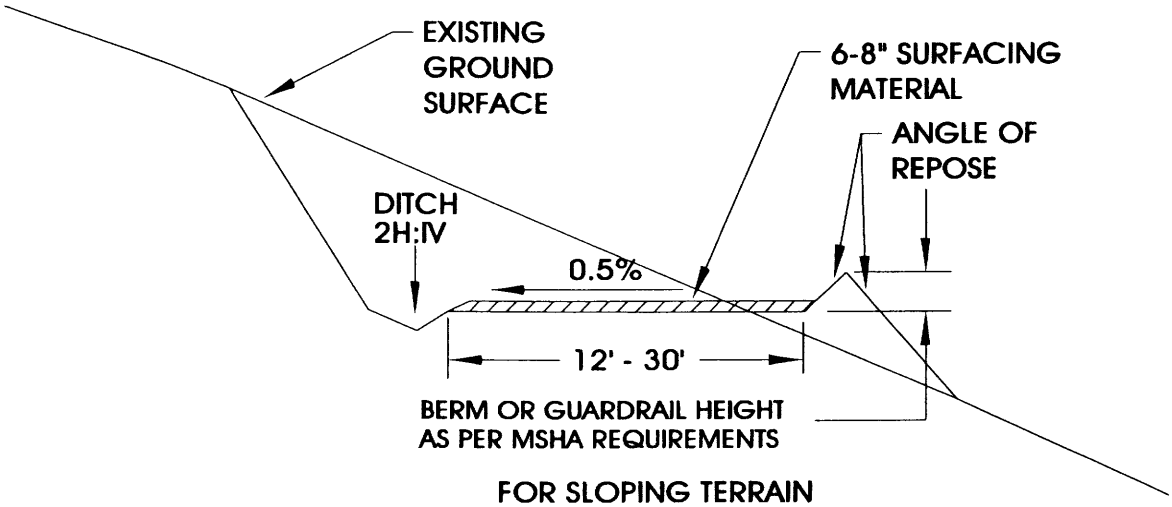
The proposed underground mining operations will require several mine openings which will provide underground access for personnel, equipment, and supplies; be utilized for conveyor haulage of both coal and limited quantities of mine development rock; and will serve as mine intake and return airways for ventilation of the underground mine workings. Mine openings required in conjunction with the currently proposed and anticipated future operations will include a 5 entry system.

Because the mine openings will provide long-term access for the proposed operations, they have been located and designed to facilitate effective access and assure long-term stability. As described in Section 4.5.2.1, General Description of Mine Construction and Development Activities, the mine portals will be developed in the Hiawatha Coal Seam using continuous miners and conventional room development (first mining) methods. The portal entries will be approximately 20 to 25 feet wide and 6 to 10 feet high. Appropriate sizing of the support pillars along with supplemental roof control, including roof bolts and other roof support systems, will provide for effective ground control and long-term stability of mine entries in the portal area. The portal entries will be protected from potential rock fall hazards by steel portal structures on concrete foundations which will provide a full protective canopy on the manway and belt entry portals.



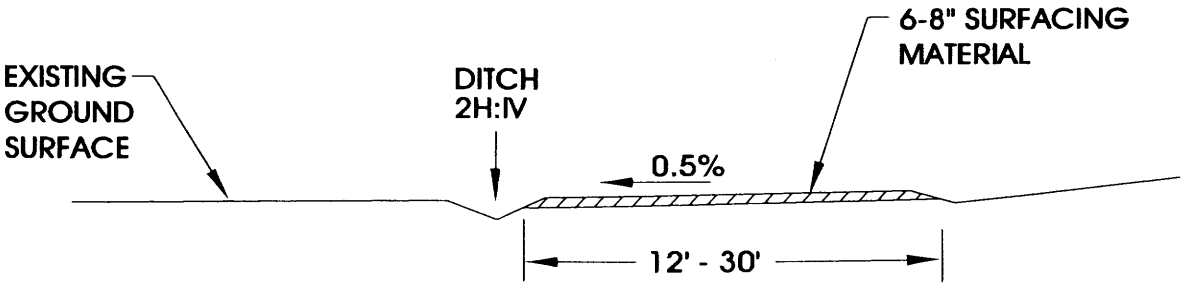
PRIMARY ROAD P1
ENTRANCE TO GUARDRAIL

N.T.S.



FOR SLOPING TERRAIN

N.T.S.



FOR LEVEL TERRAIN

N.T.S.

LEGEND

THESE ROAD CONFIGURATION SECTIONS ARE BASED ON THE GEOTECHNICAL INVESTIGATION RECOMMENDATIONS FOR CUT & FILL SLOPES, AND ON STANDARD ROAD DESIGN CRITERIA. DETAILED DESIGNS WILL BE FORTHCOMING UPON FINAL DESIGN OF MINE FACILITIES.

PROFESSIONAL ENGINEER No. 171930-2202 STATE OF UTAH

FIGURE 4.5-3

Carbon Resources LLC

KINNEY NO. 2 MINE

TYPICAL PRIMARY ROAD CONFIGURATION

DRAWN BY: B.G.	DATE: 1/08
APPROVED BY: G.H.	DATE: 1/08

HANSEN ALLEN & LUCE INC. ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

FILE:

Maintenance of mine openings will involve regular inspections of the openings and surrounding surface areas, removal of any material or debris from the immediate area of the openings, and repair or replacement of ground control, protective structures, or other structures associated with the mine openings. Mine openings and the immediate surrounding areas will be kept clear of equipment, materials, and supplies, and no coal, mine waste, or potentially flammable materials will be placed or stored in the immediate vicinity.

Mine Development Rock

Mine development, ongoing mining operations, and ancillary operations such as development of overcasts for mine ventilation and coal haulage will result in production of mine development rock including carbonaceous shale, weathered coal, floor clay, and parting material. Where it is operationally feasible to separate these material from the coal during development and mining, the mine development rock will be removed and handled separately from the coal. Where separation is not operationally feasible, mine development rock will be handled with the coal and will be removed in the surface facilities, separated from the coal product and temporarily stockpiled until it can be returned to the mine as discussed previously.

Generally, the same mining equipment and haulage systems used for coal production will be used to remove and handle mine development rock. Continuous miners, electric shuttle cars, and LHD scoops may be used to load and haul mine waste to the mine conveyor system. Normally mine development rock haulage will occur on a scheduled rock handling shift when the conveyor belt system will be cleared of coal. Typically, any development rock produced during periods other than on a scheduled development rock handling shift will be temporarily stockpiled in an inactive area underground for later handling and haulage from the mine. Once the mine rock is placed on a belt at the loading point, it will be transferred to the main haulage belt running from the mine. From the main haulage belt, the mine rock will transfer to the surface coal haulage system which will carry the rock to the primary usher building.

The surface coal haulage system has been designed to facilitate mine development rock handling in two ways:
One; The stacking tube at the off spec coal stockpile can be emptied by a direct feed chute in its base allowing rock to bypass the coal stockpile and feed directly to Conveyor SB-3. In the primary crusher building a flop-gate and diversion chute will allow mine development rock to bypass the primary crusher and feed directly to the truck loadout where it can be transported to a segregated location on the off speck coal pile prior to returning the rock to the mine.
Two; Development rock may simply be dumped onto the off spec coal pile, via the flop gate atop the stacking tube, if circumstances are favourable. That is, if there is sufficient rock volume to warrant temporarily converting the entire off spec coal pile to a temporary development rock storage pile prior to returning the rock to the mine.

Noncoal Waste Disposal

Noncoal wastes generated in conjunction with mining and related activities will including but not limited to used oil and lubricants, garbage, paper waste, machinery parts, tires, cable, wood waste, and other miscellaneous debris. All smaller noncoal solid wastes will be

collected and stored in dumpsters or similar closed containers. Larger solid waste materials including such items as used equipment, machinery parts, tires, and cable will be temporarily stored in designated sap yards located in areas as shown on Map 4.5.1.2-3, Surface Facilities Map. Dumpsters will be located primarily near buildings during mine operations, however, during construction they may be located throughout the disturbed area. Used oil will be handled according to Utah State and EPA requirements. Any waste other used oil and lubricants and any used oil not meeting the applicable EPA requirements will be collected and stored in either closed drums or in the waste oil storage tank located in the maintenance shop building. Temporary storage areas for used oil and lubricants will provide full containment to prevent accidental release of petroleum products to the surface drainage system.

CR does not currently plan or anticipate that any materials classified as "hazardous waste" will be utilized or generated in conjunction with the proposed mining and related operations. In the unlikely event that hazardous materials storage or disposal become necessary, CR will comply with all applicable storage, labelling, and documentation requirements, and disposal will occur off-site at a licensed hazardous waste disposal facility.

A contract disposal service will regularly collect and haul the noncoal solid wastes from the dumpsters to the permitted Carbon County municipal landfill, or to the East Carbon Development Corporation (ECDC) facility. Dependent on the market for sap materials, the larger noncoal solid waste and sap will be collected periodically either by a salvage contractor for salvage and recycling or by a contract disposal firm which will haul these material off-site and dispose of it in a suitable disposal site. Any used oil, lubricants, or other potentially combustible materials will be collected and either recycled or disposed of by a licensed disposal contractor in accordance with all applicable Utah and EPA regulations. No noncoal wastes will be disposed of on site during active operations.

Mine Ventilation

The primary mine ventilation fan will be large diameter blowing axial vane fans capable of delivering over 600,000 cubic feet per minute of fresh air to the underground mine workings. From mine working areas, exhaust airflow will be carried by bleeder, sub-main, and main entry exhaust airways discharging from the mine portals. The mine ventilation system has been designed using accepted mine ventilation design and engineering practices to meet all applicable MSHA requirements and provide for continuous effective ventilation of the active mine workings. Based on the planned extent of the mine workings, anticipated methane liberation and dust generation rates, and probable mining conditions the primary ventilation fan should provide adequate ventilation capacity for at least the first five years of mine development and production. Subsequent mine advance and expansion may require development of additional ventilation facilities to assure continued effective airflow and ventilation of the underground workings.

Mine ventilation facilities will include steel fan doors, the primary ventilation fan and electric drives, fan control and monitoring systems, fan shroud structure with pressure relief panels, dual propane-fired fan heaters, the mine fan electrical substation, and propane storage tanks. The location and configuration of these structures are shown on Map 4.5.1.2-3, Mine Surface Facilities Map. Operation and maintenance of the mine ventilation system will involve regular inspection and monitoring of the ventilation fans and associated systems and structures to assure that they continue to operate at all times as designed and in compliance

with applicable MSHA requirements. The mine fans will be controlled and monitored by automated systems which will provide a warning of any fan malfunctions.

Mine Drainage Control and Dewatering

As described in both Sections 3.7.2, Ground Water Information, and 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, potential mine inflows are expected to be minimal and there will be sufficient storage capacity in both the existing abandoned underground mine workings and in inactive working areas that transfer of mine drainage to the surface water system is unlikely.

Coal Handling Systems and Facilities

The coal handling system will consist of both the underground coal haulage system and the surface coal handling components which will transfer the coal from the mine to the truck loadout. Components of the surface portion of the coal handling system are shown on Map 4.5.1.2-3, Mine Surface Facilities Map and include the following:

- Conveyor SB-1
- Conveyor Transfer Tower
- Conveyor SB-2
- Non-Spec Coal Pile & Stacking Tube
- Conveyor SB-3
- Spec Coal Pile & Stacking Tube
- Conveyor SB-4
- Screening & crushing Building
- Sediment Pond Road – Primary P6
- Truck Loadout Building

Design - The coal handling system has been designed using the best current technology and accepted engineering practices to provide the coal and mine development rock carrying capacity to readily handle the maximum projected mine production volumes with sufficient excess carrying capacity to handle potential surges in system feed rates. System design also provides the storage capacity to address any normal fluctuations in coal production, shipping schedules, or market demand and reflects the design and construction considerations necessary to minimize potential adverse environmental impacts, including but not limited to minimizing erosion and additional contributions of sediment to surface runoff.

The Surface Coal Haulage System which consists of:

The MB-1 conveyor discharge onto the tail loading section of SB-1 located in the transfer tower. MB-1 will be elevated to accommodate mine vehicle and equipment traffic to pass beneath it where MB-1 it exits the mine and will be enclosed to mitigate airborne dust and spillage onto the roadway. From MB-1 coal will be transferred to a series of 42" overland surface conveyors beginning with SB-1. At the transfer building, a coal sampling system will be installed between the head pulley of MB-1 coming from the mine and the tail pulley of SB-1 that will transfer coal overland to conveyor SB-2 located in the enclosed Conveyor Gallery atop the two stacking tubes. Depending on whether ROM product is determined to

be spec coal or non-spec coal Overland Conveyor SB-1 will divert discharge ROM coal through a flop-gate to direct the segregation to the appropriate stockpile stacking tube (i.e., spec or off-spec).

ROM Coal will be reclaimed using programmable vibrating apron pan feeders via Reclaim Conveyor SB-3. The design capacity of the non-spec coal stockpile is 17,000 tons and is separated from the spec coal pile with a 10 ft high concrete wall. Similarly, design capacity for the spec coal stockpile is also 17,000 tons total capacity with a practical 12,000 tons live capacity with equipment. The off spec pile will accommodate classification and sorting of 6,000 tons on either side of a dividing wall using a front end loader or dozer to sort coal from rock into the feed area for either of the two apron feeders that reclaim from the off-spec pile.

The off-spec pile will be managed and reclaimed so that rock and coal is kept segregated by size and type in the pile as much as practicable for product blending through ratio feeding at the apron feeder and/or rock disposal using dozers, front end loaders, grizzlies for classification and sorting, with common surface coal handling equipment.

Coal will feed to Reclaim Conveyor SB-3 from vibrating pan feeders located in a reclaim tunnel beneath the ROM stockpiles. Spec coal and non-spec coal will be delivered by conveyor SB-3 to a primary double deck vibrating screen that will screen oversize material of 8" – 2" to a primary crusher that will reduce coal to a nominal 2" minus size. Coal from the crusher will pass to conveyor SB-4. Coal that passes the screen at 2" minus will be diverted from the crusher by a chute to conveyor SB-4. Conveyor SB-4 will transport 2" minus coal to the truck load out structure.

Construction - Construction of the coal handling system will involve excavation and grading to establish the conveyor alignment; excavation and grading of the spec coal, and non-spec stockpile area; construction of conveyor support structure, stacking tubes, and reclaim tunnel foundations; erection and installation of modular conveyor support structures, idler support frames, feeders and chutes, and transfer points; and installation of conveyor drives, take-ups, idlers, belting, covers, control systems, and dust control equipment. The conveyor alignment , and other facilities will be as shown on Map 4.5.1.2-3, Surface Facilities.

The conveyor components including support structures, idlers, take-ups, drives, belting, covers, transfer points, and dust control components will be standard off-the-shelf components supplied by major conveyor manufacturers. Support structures, take-ups, drives, and transfer points will be mounted on either poured concrete footing or spread footings as appropriate based on the nature of the installation and site conditions. Conveyor covers will be conventional half-shell covers which bolt onto the conveyor framework and are removable for maintenance access and all transfer points will be partially or fully enclosed and will incorporate water sprays or surfactant applicators to control fugitive dust emissions. All conveyors have been designed and will be installed to provide adequate clearance for passage of big game animals under the conveyor support structures.

Operation - The underground coal handling system will transport the coal from the working sections to the coal stacking tubes. The underground coal haulage system will consist of 42 inch section and panel conveyors with a capacity of 1,200 tons per hour. The main haulage conveyor will carry the coal to the surface where it makes one transfer to Conveyor SB-1 which will then transfer the coal to the coal stacking tubes. Depending on if the ROM

product is spec coal or non-spec coal Overland Conveyor SB-2 will discharge ROM coal through a flop gate directly to the non-spec coal stockpile stacking tube or onto conveyor SB-3 that will discharge spec coal into the spec coal stockpile stacking tube. The coal stacking tubes will be pre-fabricated structural steel or reinforced concrete mounted on reinforced concrete foundations directly adjacent to the reclaim tunnel. Openings in the sides of the stacking tubes will have flexible covers and discharge coal to create a conical ROM coal stockpile surrounding the stacking tubes. The ROM coal reclaim tunnel will be constructed of cast in place reinforced concrete with a 48" diameter buried culvert which daylights from the rear of the tunnel for emergency egress to the outside and as well as for ventilation to the reclaim tunnel. The reclaim tunnel will be equipped with vibrating apron-type pan feeders to discharge ROM coal from the stockpiles to the reclaim conveyor belt SB-3. A coal sampling system between MB-1 and SB-1 will be provided at the transfer structure to verify spec and non-spec coal. Spec and non-spec coal will be stored in separate stockpiles.

Four vibrating apron feeders in the reclaim tunnel directly under the coal stockpiles will serve as the blending mechanism for the mine whereby spec coal and non-spec coal will be drawn from the spec coal stockpile and the non-spec stockpile in proportioned quantities as specified by a Programmable Logic Control System (PLC) designed for this operation. At times ROM coal blending will not be utilized whereas the vibrating pan feeders under the non-spec coal stockpile will not be operated. With the versatility of feed rates from these feeders coupled with the PLC any combination of spec and non-spec coal can be delivered to screening, crushing and truck load out.

At times mine development rock from the mine will be hauled from the workings using the conveying system. Development rock material would be directed to a portion of the non-spec coal stockpile using the coal conveying system where it will be culled from the stockpile into haul trucks using a front end loader. The coal haulage system will direct ROM coal to the spec coal and non spec coal stockpiles where it will be reclaimed using programmable vibrating pan feeders and Reclaim Conveyor SB-4. The design capacity of the non-spec coal stockpile will be 17,000 tons. Design capacity for the spec coal stockpile will be 17,000 tons.

The surface coal handling system will transport the coal from the stacking tubes to the crushing and screening building using conveyor belt SB-3 where the coal will be sized to product size, generally ¾" minus. This system will also provide for the handling of mine development rock material resulting from ongoing mine development and production operations. Coal will feed to Conveyor SB-4 from vibrating feeders located in a reclaim tunnel beneath the coal stockpiles. Conveyor SB-4 will carry the coal to the truck loadout, which will in turn load the coal into trucks.

All surface coal handling conveyors will be 36 inch conveyors with a capacity of 1,000 tons per hour. Operation of the surface coal handling system is graphically illustrated by Figure 4.5-4, Coal Handling Flow Sheet.

Maintenance - Maintenance of the coal handling system will include regular inspect and repair of conveyor belts, support structures, transfer points, drive components, and dust control systems; lubrication of idlers and drive components; adjustment of belt take-ups to maintain proper belt tensions; periodic replacement of critical conveyor components under

a regular preventative maintenance program; and periodic cleanup of any coal or waste spillage at feed points, transfer points, and under the conveyors.

Coal Stockpiles - Two separate coal stockpiles will be utilized in conjunction with the proposed mining and related operations; the 12,500 ton spec coal stockpile , and the non-spec coal pile which is designed to be 9,500 tons. The coal stockpiles have been designed to provide storage and surge capacity to accommodate anticipated normal fluctuations in coal production, coal blending, shipment schedules, minor market fluctuations, and any unanticipated temporary shutdowns of components of the coal production, handling, and processing systems. The coal stockpiles have been located and designed to minimize potential adverse environmental impacts including but not limited to fugitive dust emissions, and sedimentation due to drainage from the piles or pile areas. Both coal stockpiles reflect similar design with the coal delivered to the pile by Conveyor SB-1 and SB-2.

The adjacent cut slope east of the spec coal, and non-spec coal stockpiles will not be vegetated so that coal can be pushed back against the slope to provide additional storage capacity when necessary. The coal stacking tubes will be pre-fabricated concrete or reinforced steel tube mounted on a reinforced concrete foundation with a direct discharge chute in its base. Openings in the sides of the stacking tubes with flexible covers will create conical coal stockpiles surrounding the tubes. The coal reclaim tunnel under the stacking tubes will be a sub-grade reinforced concrete structure supporting vibratory feeders which will draw coal from the base of the piles and feed it through gaged feed chutes to Conveyor SB-3.

Operation and maintenance of the coal stockpiles will involve controlled discharge to the piles and movement of coal within the pile using tracked dozers or wheel loaders to keep the coal within the defined pile limits, maximize storage capacity when necessary, and provide for effective feed to the reclaim points. Coal piles will be periodically inspected for any excessive oxidation or burning coal and if any is found it will be separated from the main stockpile and extinguished either by burying the coal with dirt or by using a mine water truck to spray the coal with water.

Coal Crushing - Spec coal and non-spec coal will be delivered by conveyor SB-3 to a primary double deck vibrating seen in the crushing and screening building that will seen oversize material of 8" – 2" to a primary usher that will reduce coal to a nominal 2" minus size. Coal from the usher will pass to conveyor SB-4. Coal that passes the seen at 2" minus will be diverted from the usher by a chute to conveyor SB-4. Conveyor SB-4 will transport 2" minus coal to the truck load out structure. Planned operation of the surface coal handling system from the mine portal to the truck load out is graphically shown on Figure 4.5-4A, Coal Handling Flowsheet, and Figure 4.5-4B, Schematic Elevation Looking East.

Maintenance - The coal crushing and screening process is controlled and monitored by an automated process system which adjusts and maintains flow rates and monitors each component of the system to assure maximum coal recovery and identify any system malfunctions in a timely manner. In addition to the automated control and monitoring system, CR will have a regular inspection and preventative maintenance program for the crushing and screening facilities and equipment which will include regular inspection, clean-up, lubrication, repair, and periodic replacement of critical operating components. Potential fugitive dust emissions from crushing, stockpiling, and conveying will be controlled by partial or full enclosures on all transfer points and at the usher, by baghouses, or water

sprays or surfactant applicators, sub-grade coal reclaim systems, and the use of stacking tubes in stockpile areas.

Loadout Facilities

The coal product from the coal crushing and screening building will be transferred to the truck loadout facility which will weigh the coal and load it into trucks for delivery to utility, industrial, and other coal users. The truck loadout facility is designed to load on road coal trucks for transport to market. Conveyor SB-4 transfers 2" minus coal from the screening and crushing building where it is discharged through a flop gate chute to (2) 50 ton coal silos. The truck loading facility is designed to allow the loading of double tandem coal trailers. Coal will be discharged directly to the trailers. Operation of the coal loading facility will be connected to the surface facilities Control Instrumentation and PLC that will include load cells at the coal silos to regulate surge capacities at the loading facility. Discharge and loading of the coal will be provided by the drivers of the coal haul trucks. Coal will discharge from the silos to the trucks through a regulated discharge telescoping chute that will extend to the top of the truck trailer to provide controlled loading and contain fugitive dust. The truck loading facility will allow for truck traffic to pass around and under the load out silos for loading.

Support Structures and Facilities

A number of structures and facilities will be required to support the proposed mining and related operations. These structures and facilities will generally be used to provide storage, maintenance, and support services for mine personnel, equipment, and materials and supplies and will specifically include the following:

- Storage Sheds – 5 each
- Shop – Warehouse
- Fueling Facility
- Mine Office – Bathouse (Mine Dry)
- Water Tank
- Electrical Substation
- Explosives Magazine
- Explosives Cap Magazine

These structures and facilities are shown on Map 4.5.1.2-3, Mine Surface Facilities Map, and are described in the following sections.

Figure 4.5-4A Coal Handling Flow Sheet

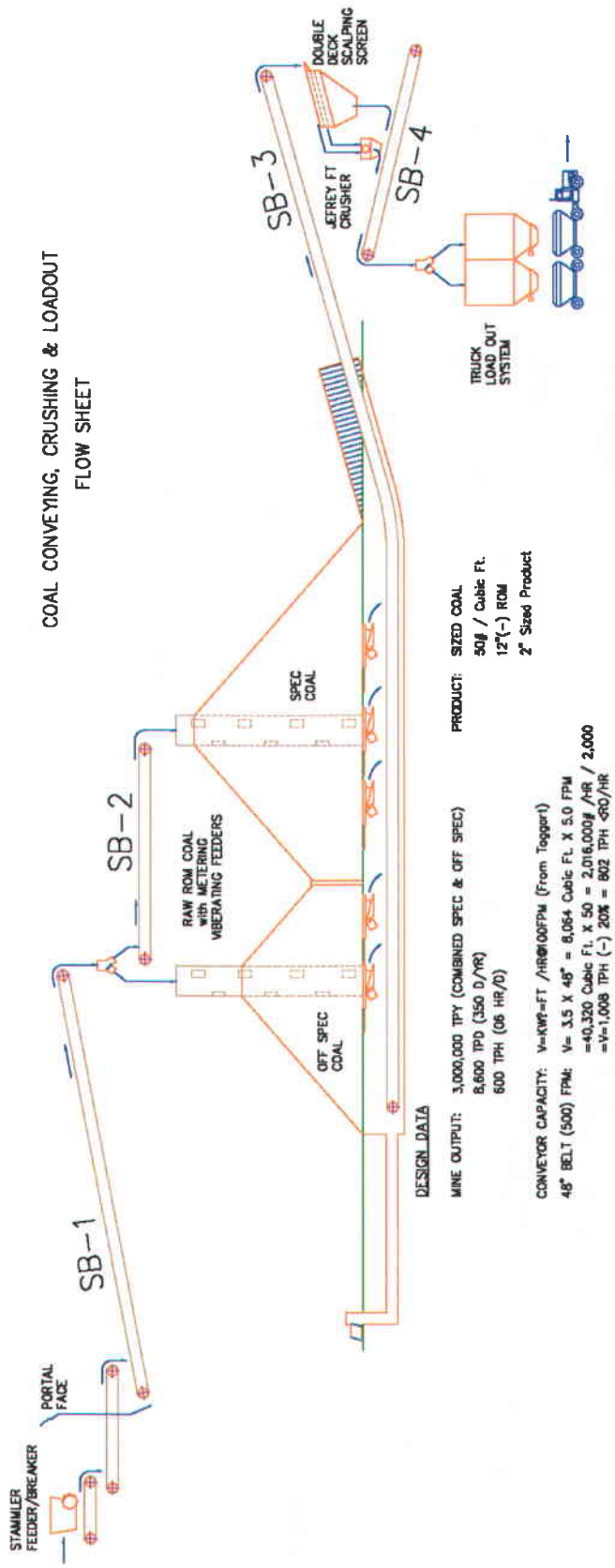
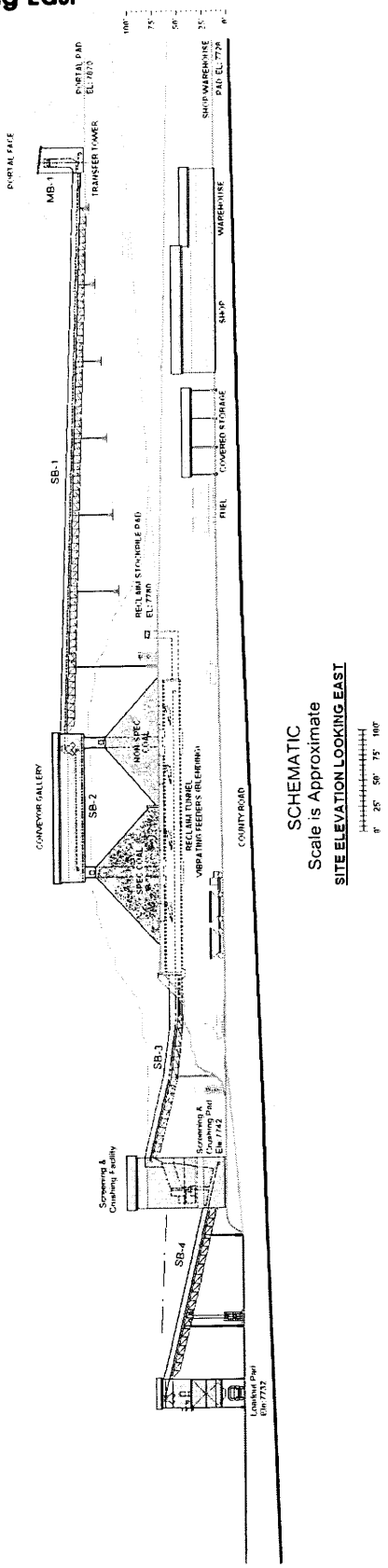


Figure 4.5-4B Schematic Elevation Looking East



Design and Construction - All support facilities are located within or in close proximity to the associate operations areas. Mine support buildings are steel frame buildings with concrete footers, spread footings, or slab foundations and metal exterior walls. These buildings have been designed for ease of erection, long-term structural integrity, and minimal maintenance. To the extent possible, building locations, configuration, and exterior colors have been selected to minimize visual contrasts with surrounding natural areas.

Building construction will generally involve grading and preparation of foundation areas, excavation and installation of foundations, building erection, interior and exterior finish work, and connection of utilities. Storage areas will generally be open graded areas providing outside storage for miscellaneous large parts and supplies. Both building sites and storage areas will be graded to assure effective drainage, with drainage from these areas flowing to the designed disturbed area collection ditches previously described in the sub-section titled Drainage and Sediment Control Structures. Due to the anticipated level and frequency of use, employee parking areas adjacent to the Administration/Bathhouse building will be surfaced with asphalt paving materials and other frequent use areas including the area around the maintenance shop and warehouse facilities will be surface with gravel or similar durable granular material.

Operation and Maintenance - General operation and maintenance of support structures and facilities will involve regular grading of facility areas and inspection, cleaning, and repairs as required. In addition to the equipment required for mine production operations the following equipment will be utilized for surface support, maintenance and general utility use:

- Tracked dozers
- Wheel loaders
- Rear dump trucks
- Motor grader
- Water truck
- Street Sweeper
- Fork lifts
- Skid steer loaders
- Mobile cranes
- Bucket truck
- Fuel/Lube truck
- Air compressors
- Welders
- Generators

Specific operation and maintenance requirements for individual facilities are described in the following descriptions of individual facilities.

Description of Individual Structures - The following sections provide more detailed information for specific support structures and facilities:

Office-Bathhouse Building - The Office-Bathhouse building will provide office space for mine management, accounting/payroll, engineering, environmental, production, and safety staff; meeting and training rooms; and shower and changing facilities for mine employees. The

Office-Bathhouse facility will be a two-story steel frame building approximately 60 feet wide by 160 feet long and 30 feet high at the peak of the roof with concrete slab floor and steel siding and roof. An asphalt paved parking area will be provided on the pad for the building. The configuration and layout of the Office-Bathhouse facility is illustrated by Figures 4.5-5A through 4.5-5D, Office-Bathhouse Building.

Maintenance Shop Facility - The Maintenance Shop facility will be located immediately adjacent to the mine portals in the portal area and will provide cleaning and repair facilities for both underground production and surface support equipment. The Maintenance Shop will be a steel frame building with reinforced spread footing foundation and heavy reinforced slab floor, and steel siding and roof. The main shop building will be approximately 75 feet wide by 175 feet long and 32 to 42 feet high at the roof peak. The configuration and layout of the Maintenance Shop is illustrated by Figures 4.5-6A through 4.5-6C, Warehouse & Shop Facility. The Maintenance Shop will include the following service and support areas:

- Drive-in equipment wash bay and clean-out sump
- A split bay for light vehicle and small equipment maintenance
- Welding bay
- Electrical repair bay
- Belt repair bay
- Machine shop
- Battery charging area
- Maintenance office, computer area, and restrooms
- Waste oil heating boiler
- Compressor room
- Storage area for waste oil, fuel oil, and mixing tanks
- Bulk oil and lubricant storage area
- Metal storage area
- Equipment fueling station

Equipment coming into the shop for periodic preventative maintenance, repair, or rebuild will first be washed in the wash bay. The wash bay may have both fixed spray heads and flexible high pressure hoses to clean coal, dirt, grease and oil from the equipment prior to equipment inspection, maintenance, and repair. Drainage from the wash bay will go to collection sump which has been designed to collect oil and grease. A float operated pump will transfer water from the decant sump to the portal area collection sump which will also be equipped with an oil skimmer.

Within the Maintenance Shop, all petroleum products including oil, hydraulic fluid, grease and other lubricants, and used oil will be handled by a pressurized collection/distribution system running through the shop facility. Oil, hydraulic fluid, and lubricants will be stored in bulk in large tanks within storage containment areas and will be distributed to hose reel systems in each repair/maintenance bay area. Any parts washing stations will use non-toxic citrus-based solvents and uses only propylene glycol based anti-freeze so handling and disposal of these materials is not a concern. Used oil will also be collected in each bay by a negative pressure hose system with the used oil being transferred to used oil storage tanks in a storage containment area and then handled and disposed of according to Utah and EPA requirements.

There will be two separate used oil storage and feed tanks with all used oil from the shop going to one designated tank. Once the storage tank reaches capacity it will be sampled and tested for compliance with applicable EPA standards for waste oil. Any used oil which does not meet used oil specifications will be collected by a license contract disposal firm and hauled off-site for recycling or proper disposal. All petroleum storage tanks will be located within curbed concrete containment areas providing sufficient containment capacity for the entire contents of the largest storage tank within the containment area. Storage tanks, associated piping, and containment areas will be inspected on a regular schedule for any deterioration, damage, leakage, spills, or water accumulations. Any problems will be promptly addressed with repairs, replacement, recovery of spilled product, and removal of any accumulated water. Any water accumulations which contain petroleum residues will either be recovered and transferred to the wash bay sump or will be recovered by a licensed disposal contractor.

Warehouse Facility - The Warehouse facility will provide storage for small equipment parts and operating supplies. The warehouse will be in conjuction with the Shop building. The configuration and layout of the Warehouse is illustrated by Figure 4.5-6A through 4.5-6C, Warehouse & Shop Facility. Larger equipment parts and supplies such as mine timbers, cable, culvert, and roof bolts will be stored in the equipment storage areas and drum lubricants and tires will be stored in a covered storage area near the Maintenance Shop.

Utilities

The proposed mining and related operations will utilize new utility installations including electrical distribution, telephone, potable and raw water, and sewer systems. The proposed underground mining and related surface disturbance activities have been planned, designed, and will be conducted in a manner which minimizes the potential for damage or destruction of utility installations, or disruption of services provided by those utilities existing within the permit area unless otherwise approved by the owner of the utility.

Heat for the buildings will initially be provided by propane, and may be converted to more cost efficient natural gas if it becomes available.

All existing and proposed utility installations are shown on Map 4.5.1.2-3, Mine Surface Facilities Map. It should be noted that all utilities either are or will be owned, constructed, operated, and maintained by the respective utility companies up to the actual point of service which in the case of electricity will be the main mine substation and in the case of telephone, potable water, and sewer service will be to the metering point which will be located at the mine permit boundary line.

Figure 4.5-5A Office - Bathhouse Configuration

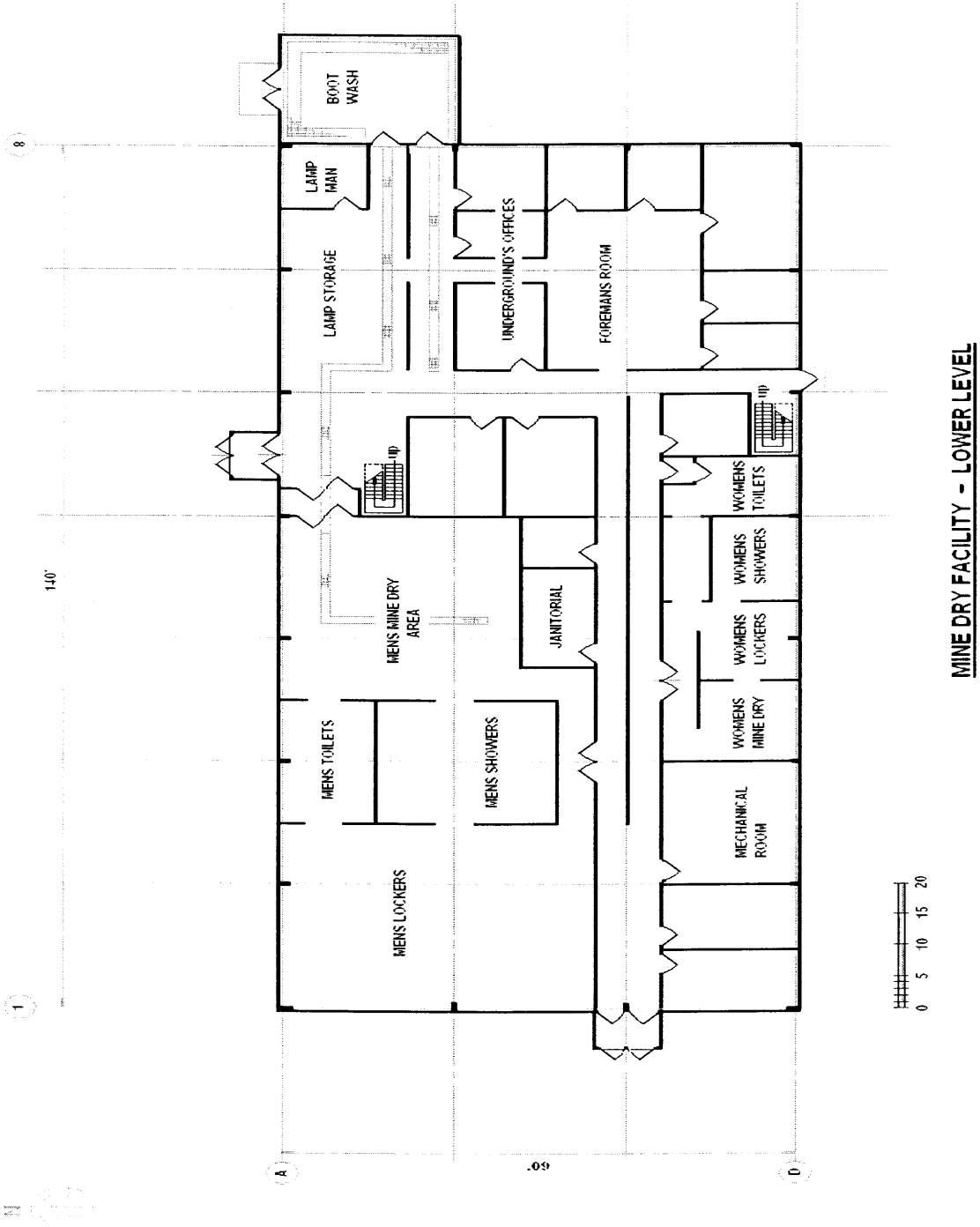


Figure 4.5-5B Office - Bathhouse Configuration

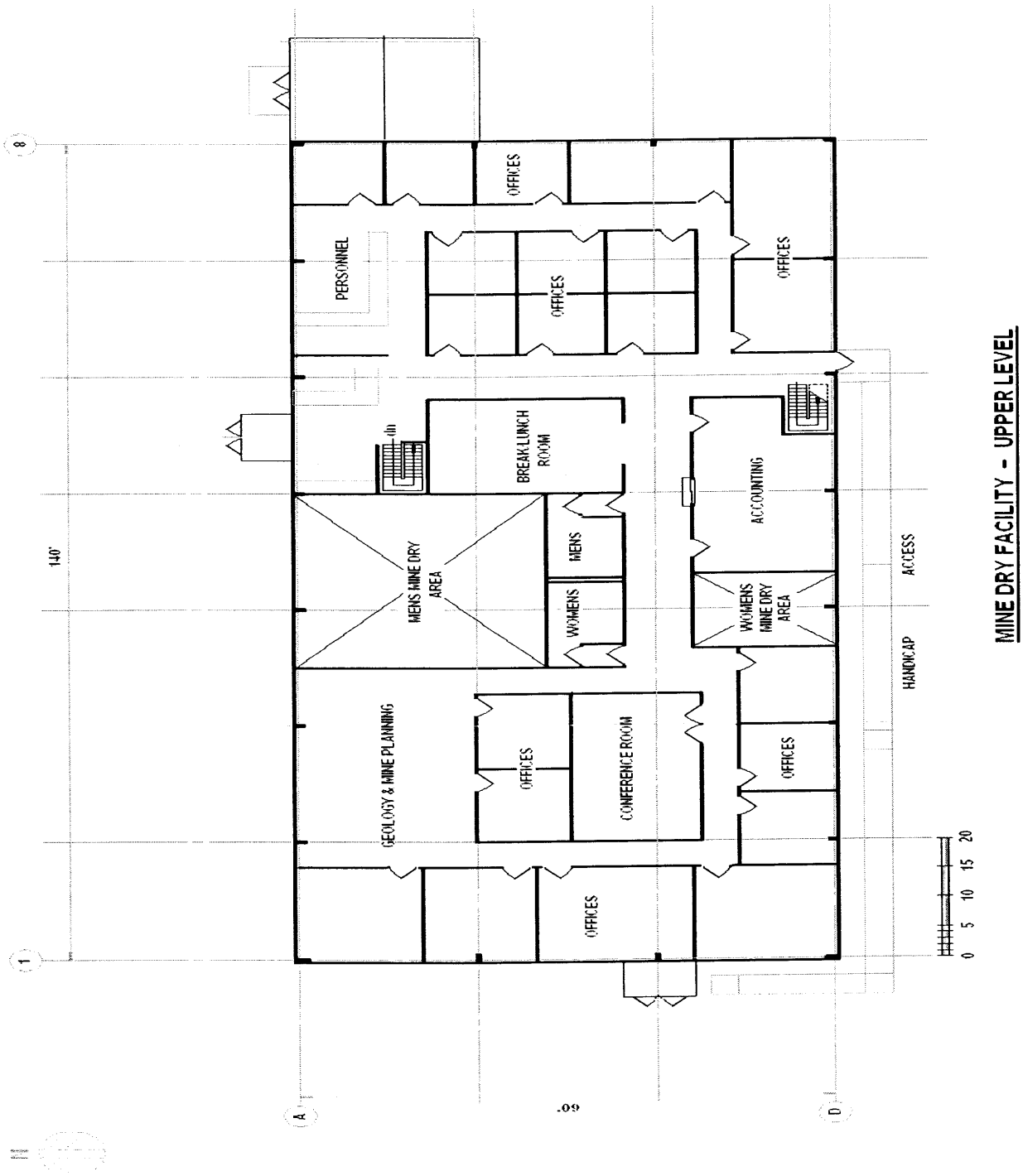
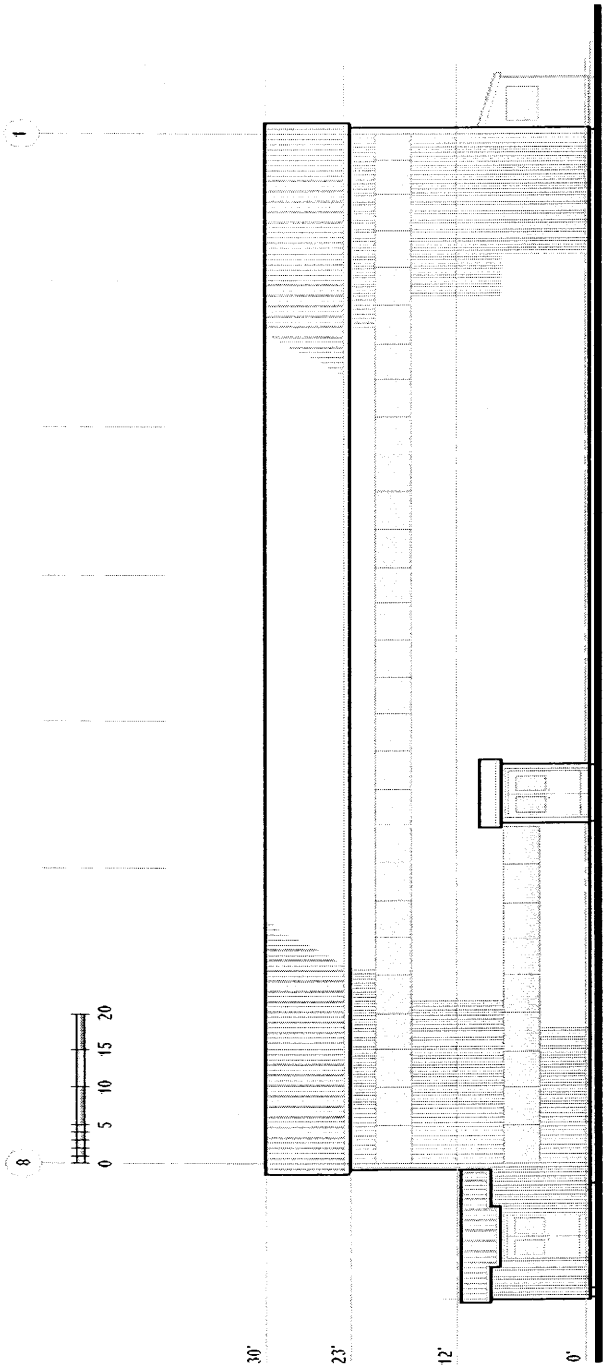
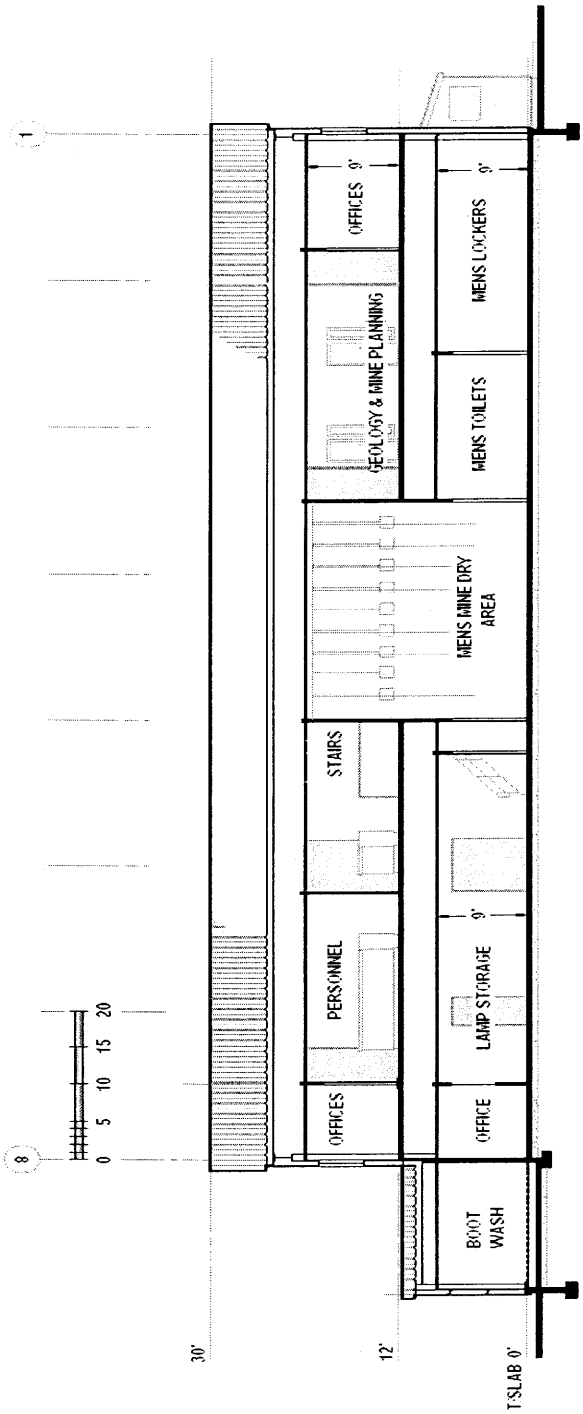


Figure 4.5-5C Office - Bathhouse Configuration



MINE DRY FACILITY - NORTH EXTERIOR ELEVATION

Figure 4.5-5D Office - Bathhouse Configuration



MINE DRY FACILITY - BUILDING SECTION

Electrical Systems – Electrical power for the mining operation will come from an existing power line running north-south immediately east of the portal area; this power line is shown on Map 4.5.1.2-1, Regional Surface Ownership Map, and on Map 3.4.1.4-1, Regional Land Use Map. Electrical voltage will be reduced from the existing power line at a substation located at the Portal Pad as shown on Map 4.5.1.2-3, Surface Facilities. The new substation to be owned, constructed, and operated by PacifiCorp. The mine substation will, in turn, feed the mine fan, the surface coal handling system, the underground mine electrical system, and the other surface facilities.

All proposed electrical components have been designed and will be constructed and operated in accordance with accepted engineering practice and in full compliance with all applicable regulatory provisions. Any new powerlines will be constructed with "raptor-proof" power poles as shown by Figure 4.3-1, Typical Raptor-Proof Power Pole Configuration, to minimize the potential for electrocution of raptors and other large birds. All substations, electrical transformers, switchgear, and electrical control components will either be located so that it is not readily accessible to either wildlife or the public or appropriate fences with locked gates or other enclosures will be utilized to limit access to authorized personnel. Where appropriate, signage identifying and warning of electrical hazards will be posted and maintained.

Telephone Lines - Buried or overhead telephone lines will be extended by US West from Highway 96 to provide telephone service for the mine facilities.

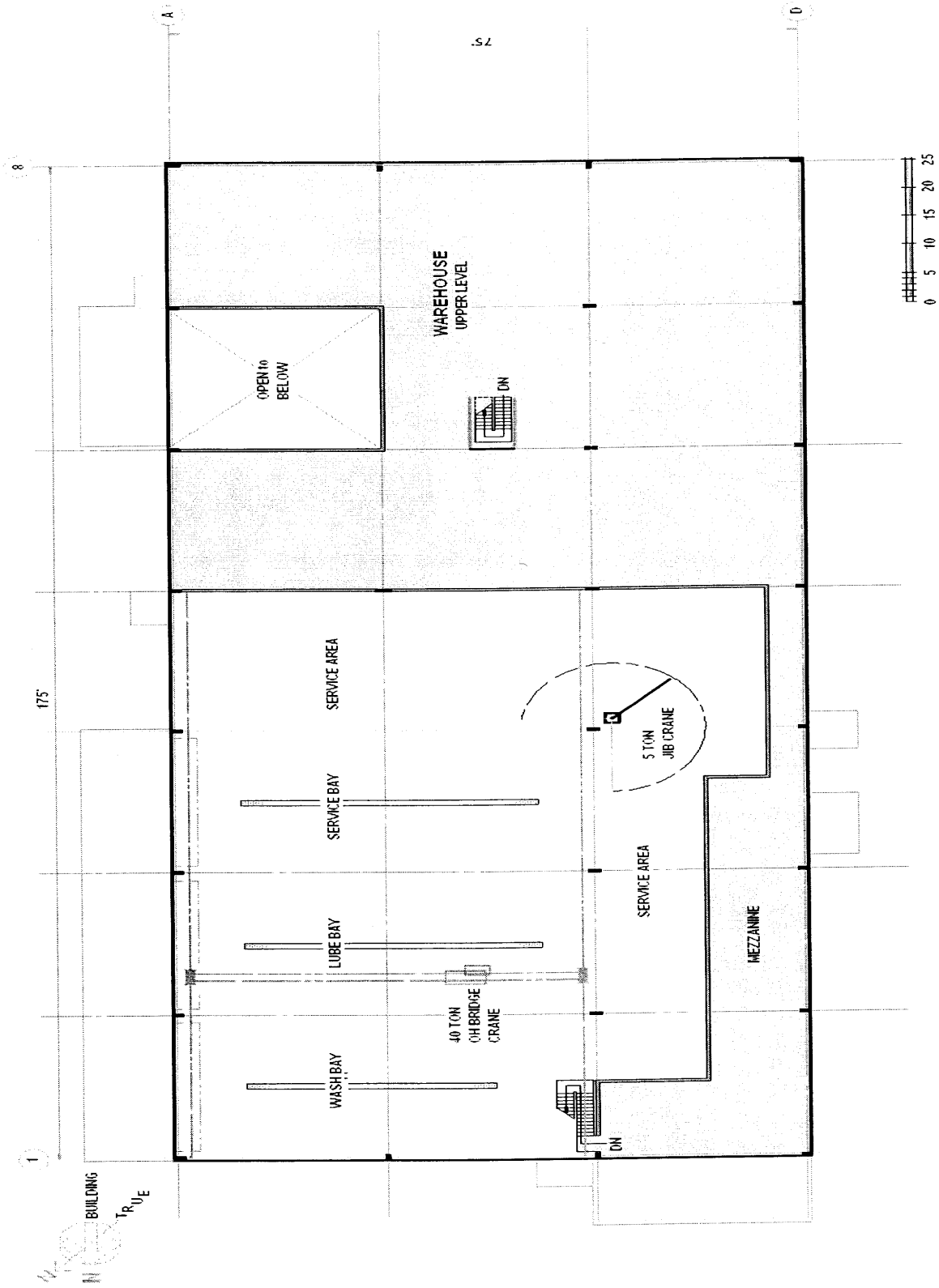
Water and Sewer Systems - Potable water, raw water, and sewer connections will be provided by Scofield Town. The connection points for water and sewer to the mine site are shown on Map 4.5.1.2-3, Surface Facilities, and are located at the south side of the permit boundary just south of the Mine Office building.

Mine water and a reserve water storage supply for emergency fire-fighting purposes will be stored in a 50,000 gallon mine water storage tank located near the north end of the Portal pad. This tank and the associated water system will be supplied by Scofield Town. Water supply, use levels, and water rights consideration are addressed in greater detail in Section 4.7, General Description of Hydrologic Protection Plans.

Signs and Markers

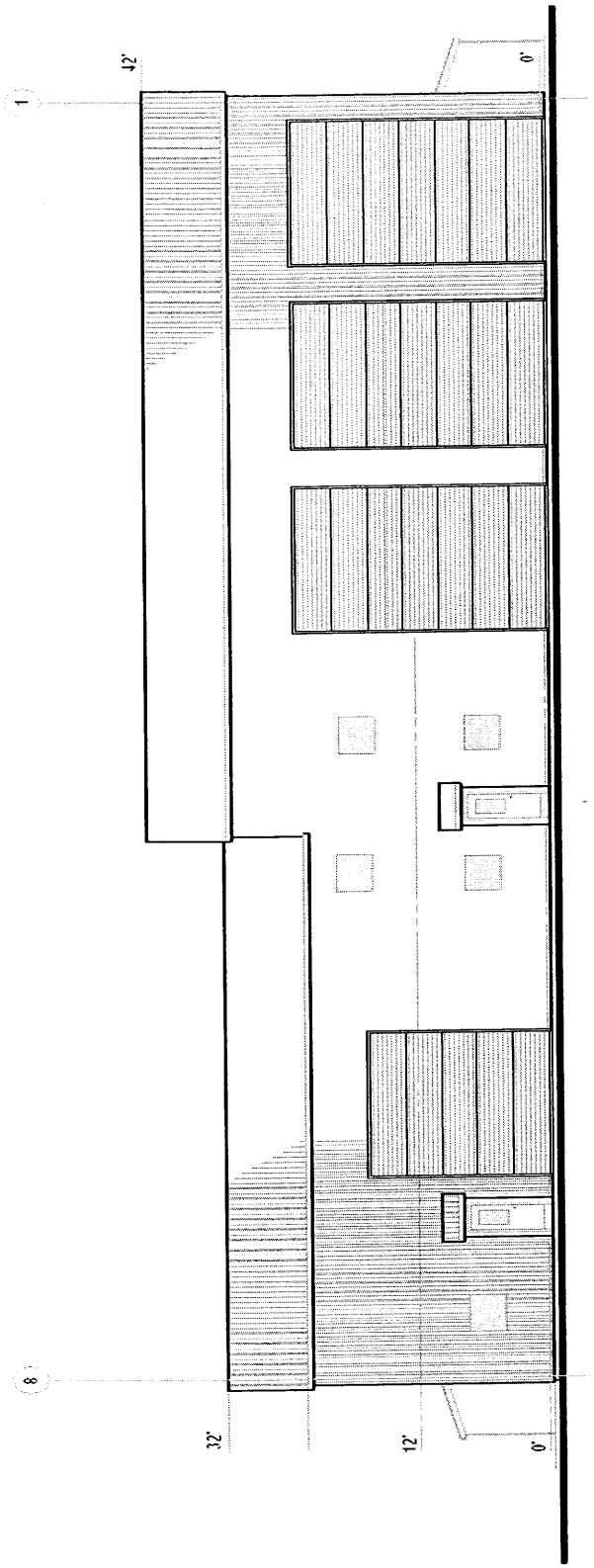
CR will post and maintain all required signs and markers in compliance with applicable regulatory provisions of Rule R645-301-521.200. Signs and markers will be constructed of durable materials and will be posted so as to be clearly visible. Mine identification signs listing the name, business address, and telephone number of the permittee and the permit number for the permanent program permit authorizing mining and reclamation operations will be posted at each point of access to the permit area from a public road. Perimeter markers will be posted outlining all areas affected by surface operations or facilities prior to initiation of mining, and soil/substitute stockpiles will be clearly marked for identification and to limit access and potential disturbance. Signs reading "Blasting Area" will be posted along the edge of any blasting area which comes within 100 feet of any public road right-of-way and at the point where any other road(s) provides access to the blasting area. All required signs and markers will be maintained or replaced during the period of active operations, site reclamation, and until final bond release is approved for all areas within the permit boundaries.

Figure 4.5-6A Warehouse & Shop Configuration



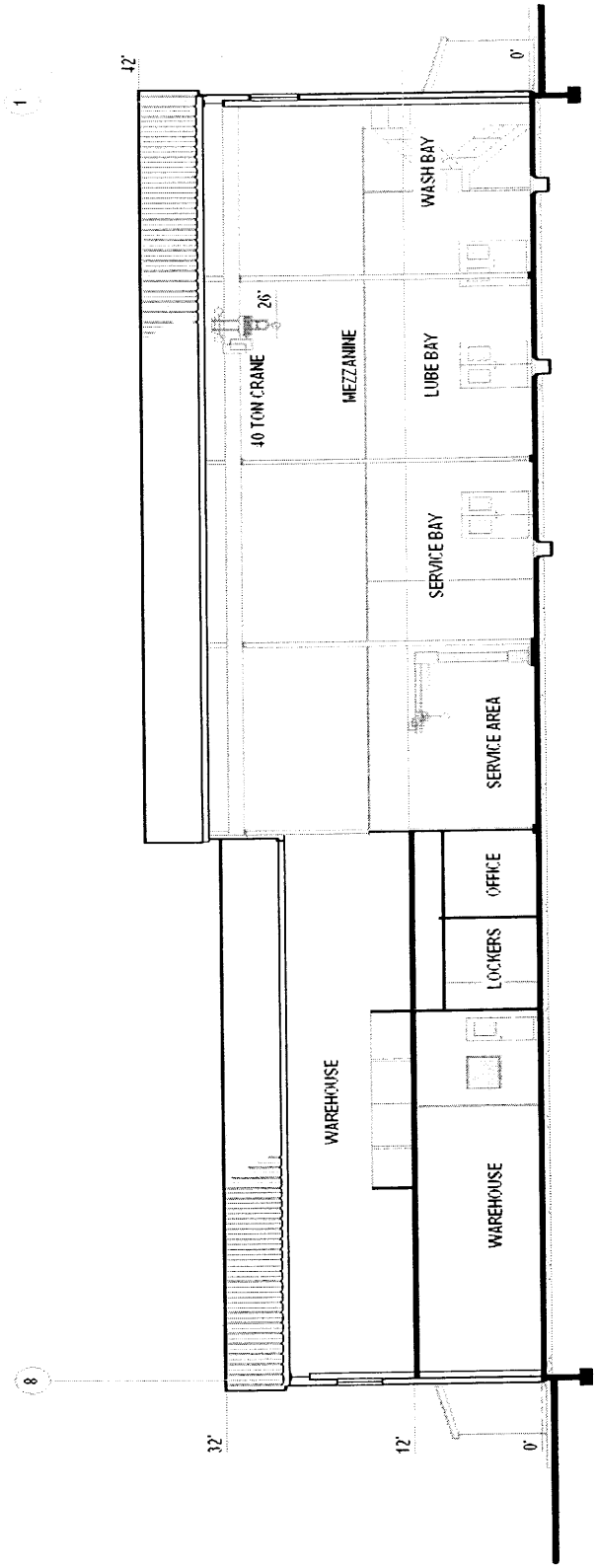
WAREHOUSE & SHOP FACILITY - UPPER LEVEL

Figure 4.5-6B Warehouse & Shop Configuration



WAREHOUSE/SHOP - EAST EXTERIOR ELEVATION

Figure 4.5-6C Warehouse & Shop Configuration



4.5.2.4 Temporary Cessation

Designs and plans for the proposed mining and related operations are based not only on geologic, environmental, and engineering information but also on existing coal contracts and conservative projections of future coal market demand. Given this consideration, CR does not anticipate any temporary cessation of the proposed mining operations prior to the end of the projected mine life. In the unlikely event that temporary cessation of operations becomes necessary, the mine surface facilities would be secured to minimize potential public health and safety hazards and to prevent or minimize potential related adverse impacts on the environment. Specifically, entrances to the mine, mine facilities, and loadout facilities would be barricaded and locked, buildings, equipment, fuel storage facilities and other support facilities would be locked and the site would be put on extended maintenance and care status until operations could be reactivated or a decision is made to permanently close the operation. In order to prevent unauthorized access to underground mine workings during any period of temporary cessation, mine openings including the mine portals and ventilation shaft will be secured by locked barricades. Dependent on the anticipated period of temporary closure, access to mine portals would be restricted by either temporary concrete block walls or fabricated locking metal gates. Maintenance and care status would involve the use of mine or contract security personnel to control site access, regularly inspect the site to identify any hazardous conditions, and conduct routine maintenance and repair to prevent significant deterioration or damage to the existing structures and facilities.

If, for any unanticipated reason, temporary cessation of mining and/or reclamation operations for a period of 30 days or more becomes necessary, CR will submit a notice of intention to UDOGM to temporarily cease or abandon operations. The notice will include a statement of the exact number of acres which have been disturbed prior to cessation, the nature and extent of any reclamation completed, and any reclamation, environmental monitoring, water treatment, or other activities which will continue during the period of temporary cessation.

The mine site provides access to private property to the north and east, therefore, the private property owners involved will have keys to the site gates to access their property during any cessation period, and during the reclamation bond period. Roads have been designed into the reclamation plan for post mining land use to allow the private property owners access.

4.6 GEOLOGIC PROTECTION PLANS

4.6.1 General Description of Geologic Protection Plans

This section describes the geologic protection measures and practices which will be utilized to case and seal any exploration holes or boreholes developed as a result of the proposed mining and related operations and also addresses subsidence monitoring plans and identification and reporting of slides. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-630 and 640) for coal mining in the State of Utah.

4.6.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-630 through 642. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section		Applicable Regulatory Provisions
4.6.1		
	4.6.1.1	General Introductory Information
	4.6.1.2	R645-301-631 and 632
4.6.2		
	4.6.2.1	R645-301-631 through 631.200, and 641
	4.6.2.2	R645-301-632 through 632.200, and 642
	4.6.2.3	R645-301-515.100
Maps		R645-301-632.200

4.6.1.2 General Geologic Protection Requirements

In order to minimize any potential hazards to humans or livestock associated with open exploration holes or boreholes and to prevent potential mixing between ground water aquifers, Rules R645-301-631 and 641 require that all exploration holes and boreholes be cased, if used for water monitoring, or permanently sealed, if not used for monitoring or if no longer required for ongoing monitoring activities. Applicable regulatory provisions (R645-301-515.100 and 632.100 and 200) also require subsidence monitoring for underground coal mining operations to determine the commencement and degree of subsidence so that appropriate control and mitigation measures can be implemented to prevent or minimize potential material damage and reporting of slides and other damage.

4.6.2 Geologic Protection Practices

Generally, the planned geologic protection measures are based on and consistent with standard engineering and geologic practice and are designed to affect full compliance with all applicable regulatory provisions.

4.6.2.1 Casing and Sealing Exploration Holes and Boreholes

Generally, a determination will be made either prior to or during completion of any exploration holes or boreholes of whether or not the hole(s) will be utilized for ground water monitoring purposes. If the hole is to be utilized for monitoring it will be cased, completed, and developed as a monitoring well consistent with Figure 4.1-1, Typical Well Completion Diagram, and as described in Section 4.1.2.5, Completion as Ground Water Monitoring Wells. If the hole(s) is not to be utilized as a monitoring well or when an existing well is no longer required for ongoing monitoring, it will be sealed by filling the borehole or casing with cement to form a plug from the bottom of the hole to at least 20 feet above any zone of completion or water-bearing zone; filling the remainder of the hole to within 20 feet of the ground surface; and filling the remainder of the hole to the ground surface with cement to form a surface plug. A steel fence post will be placed in the center of the surface plug before the cement sets-up to provide a permanent marker for the hole location.

4.6.2.2 Subsidence Monitoring

No full extraction mining, or pulling of pillars is planned at the Kinney No. 2 Mine, therefore subsidence will not take place. No subsidence monitoring is necessary.

4.6.2.3 Reporting of Slides

The potential for slides and similar earth movements exists in excavated areas; fill slopes; soil material, coal, and mine development rock stockpiles; pond embankments; and in some cases, in undisturbed areas. At any time that a slide or similar earth movement occurs and is identified by mine personnel which poses an immediate hazard or may have potential adverse effects on health, safety, property, or the environment it will be immediately reported to UDOGM. Notification would typically involve a telephone call with follow-up written documentation. Based on an assessment of site-specific conditions and circumstances, CR will then coordinate with UDOGM to develop and implement appropriate remedial measures.

4.7 HYDROLOGIC RESOURCE PROTECTION AND PHC

4.7.1 Hydrologic Resource Protection

This section describes plans for protection of hydrologic resources, including surface and ground water quantity and quality, and recharge, storage, and discharge relationships, for the permit and adjacent areas that could potentially be affected or impacted by the proposed mining and reclamation activities. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-700) for coal mine permitting in the State of Utah.

4.7.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Operational Plans (Rules R645-301-730 through R645-301-750) and Probable Hydrologic Consequences (Rule R645-301-728). The following table cross-references the headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provisions Addressed
4.7.1	
4.7.1.1	General Introductory Information
4.7.1.2	R645-301-731
4.7.1.3	R645-301-731
4.7.1.4	R645-301-731.610 through 620
4.7.1.5	R645-301-731.700 through 760
4.7.2	
4.7.2.1	R645-301-731.110 through 112
4.7.2.2	R645-301-731.120 through 122
4.7.2.3	R645-301-731.200 through 225
4.7.2.4	R645-301-731.300 through 320
4.7.2.5	R645-301-731.500 through 522
4.7.2.6	R645-301-731.600 through 620 and 731.700 through 760
4.7.2.7	R645-301-731.800 and 731.900
4.7.2.8	R645-301-732 and 732.100
4.7.2.9	R645-301-742.300 through 333
4.7.2.10	R645-301-742.300 through 333
4.7.2.11	R645-301-732.200 through 420, 733.100 through 420, and 742.220 through 225.2
4.7.2.12	R645-301-733.100 through 240
4.7.2.1	R645-301-735, 736, and 737
4.7.2.4	R645-301-738
4.7.3	
4.7.3.1	R645-301-742.100 through 126
4.7.3.2	R645-301-742.200 through 240, and 750.752 and 752.100
4.7.3.3	R645-301-742.300 through 333
4.7.3.4	R645-301-742.400 through 423, and 752.200 through 250
4.7.3.5	R645-301-743.100 through 300
4.7.3.6	R645-301-744.100 through 200, and 753
4.7.3.7	R645-301-745.100 through 400, and 754
4.7.3.8	R645-301-746.100 through 430, and 754

	4.7.3.9	R645-301-747.100 through 300, and 754
	4.7.3.10	R645-301-750 and 751
	4.7.3.11	R645-301-748 and 755
4.7.4		
	4.7.4.1	R645-301-728.200
	4.7.4.2	R645-301-728.310
	4.7.4.3	R645-301-728.320
	4.7.4.4	R645-301-728.330 through 335
	4.7.4.5	R645-301-728.340
4.7.5		R645-301-729.100 and 729.200

4.7.1.2 General Hydrologic Protection Requirements

Mining and related activities may result in temporary changes in runoff and infiltration characteristics for surface disturbance areas; additional contributions of sediment to surface runoff; ground water drainage to and storage in underground mine workings; some dewatering of perched aquifers and localized dewatering of the regional water table aquifer due to direct mining and indirect subsidence related effects; minor modification of infiltration and recharge characteristics in subsidence areas; and limited localized changes in surface and ground water chemistry and quality. Based on available information, the potential mining related impacts will be localized, temporary, and will not involve any significant long-term adverse impacts. The hydrologic control and mitigation measures proposed in conjunction with mining and related activities should effectively mitigate any potential adverse hydrologic impacts.

As described in Section 3.7, Hydrologic Information, Carbon Resources (CR) both researched the extensive existing information on the hydrologic environment of permit and adjacent areas and collected additional supplemental hydrologic information in order to accurately characterize existing conditions and develop an overall understanding of hydrologic systems and relationships. The hydrologic protection plans have been developed with consideration of the resource values and relationships described in Section 3.7 and CR plans for mining and related activities, as outlined in Section 4.0, Operating Plans and Design Criteria. The plans, therefore, reflect site-specific conditions and the nature and extent of anticipated mining related impacts in order to assure effective compliance with the following applicable regulatory requirements and consistency with overall environmental objectives:

- Minimize disturbances to the hydrologic balance
- Prevent material damage outside of the permit area
- Support the approved post-mining land use(s)
- Comply with applicable provisions of the Clean Water Act
- Meet applicable Federal and State water quality regulations

Detailed discussions of specific potential impacts and proposed control and mitigation measures are presented in the following sections.

4.7.1.3 Components of the Hydrologic Protection Plans

The hydrologic protection plans outline specific measures for the Kinney Mine that will be taken to:

- Avoid acid or toxic drainage
- Prevent additional contributions of suspended solids to area drainages
- Control runoff and erosion
- Protect or replace affected water rights
- Restore approximate pre-mining recharge capabilities

Specific prevention, control, and mitigation measures will include limiting the area of surface disturbance; construction, operation, and maintenance of an effective drainage and sediment control system; controlled collection, storage, use, and recycling of mine drainage; and effective reclamation of surface disturbance areas and restoration of surface drainage patterns. In addition to descriptions of specific hydrologic control and mitigation measures, compliance with specific applicable design standards and requirements are addressed, and potential adverse hydrologic consequences specific to the site are identified in the Probable Hydrologic Consequences (PHC) determination prepared under R645-301-728.

4.7.1.4 Specific Resources Requiring Special Protection Measures

As a surface water reservoir located adjacent to the mine surface disturbance area, special protection measures will be required relative to Scofield Reservoir to prevent or mitigate potential adverse impacts on associated hydrologic, aquatic, fisheries, and riparian habitat and resource values. It is important to note that Mud Creek, the major perennial surface water drainage, does not come into direct contact with any portion of the mine permit area. Surface runoff from mined or disturbed areas are not directly tributary to Mud Creek, but are tributary to Scofield Reservoir. The existing Scofield Reservoir and the associated environmental conditions and values reflect the effects of the previous historic disturbance.

Specific protection measures to be implemented for Scofield Reservoir within and adjacent to the surface facilities area will include establishment and maintenance of runoff control ditches and culverts, grading of surface disturbed areas, the installation of erosion protection in appropriate ditches and hillslopes, and the construction of a runoff control sedimentation pond. Scofield Reservoir will be protected from direct or indirect mining construction, operation, and maintenance or impacts via an effective drainage and sediment control system.

4.7.1.5 Mapping of Hydrologic Resource Protection Information

Information presented on mapping included within this permit addresses hydrologic protection issues including:

- Receiving surface water drainages
- Diversion, collection, treatment, storage, and discharge facilities and structures
- Water monitoring locations and elevations
- The proposed sedimentation pond impoundment and coal processing waste embankments
- Cross-sections for sedimentation ponds, impoundments, and coal processing waste embankments

4.7.2 Protection of Hydrologic Balance

In order to minimize potential mining related impacts to existing hydrologic systems in the permit and adjacent areas, CR has incorporated specific monitoring, operational, and mitigation measures into the mining and reclamation plans for the Kinney Mine. These measures are based on historic and baseline monitoring information for the site, modeling of hydrologic systems, the experience of similar mining operations in controlling hydrologic impacts, applicable regulatory requirements, and the results of ongoing monitoring programs. Historic and baseline monitoring data have been used to characterize current hydrologic conditions as described in Section 3.7, Hydrologic Information. During the operation of the mine, monitoring will be performed to determine if any mining-related impacts to the hydrologic balance have occurred and remedial actions taken, if necessary. Measures that may be taken to remediate any mining-related impacts to the hydrologic balance are addressed in the hydrologic restoration plans presented in Section 5.7, Hydrologic Resource Restoration.

Operational plans for the Kinney mine include standard hydrologic controls and mitigation measures that are designed to prevent significant changes in the quantity and quality of surface and ground water resources, preserve existing hydrologic functions, comply with regulatory requirements, and limit adverse impacts to surface water or ground water users. These measures include:

- Limiting surface disturbance areas
- Proper design, construction, and grading of facilities areas and roads
- Construction of drainage and sediment control structures to divert undisturbed runoff around disturbance areas, collect and route disturbed area runoff to sedimentation ponds to allow settlement of suspended solids, and provide any treatment which may be necessary to meet applicable discharge effluent limitations
- Interim re-vegetation of disturbed cut and fill slopes not used for operations and re-vegetation of topsoil stockpiles, pond outslopes, alternate sediment control areas, and other unused areas.
- Utilization of localized erosion control measures, as appropriate, in any areas having high erosion potential
- Initiation of reclamation operations as soon as practical following completion of mining
- Effective reclamation to minimize gradients, re-establish surface drainage patterns, restore pre-mining runoff and infiltration characteristics, and establish an effective and self-sustaining vegetative cover.
- Post-reclamation land use management

CR has incorporated specific control and mitigation measures in mining, processing, and reclamation plans in order to prevent any significant impacts on surface or ground water quantity and quality. All mining related activities including soil/substitute removal, mine development, coal recovery, mine sealing, backfilling and grading, soil/substitute replacement, and re-vegetation are designed and sequenced to minimize disturbance and progress in a logical manner towards effective restoration of disturbed areas to a condition and configuration consistent with conditions which existed prior to development of the Kinney Mine and applicable regulatory provisions for remining of previously disturbed areas.

The following sections discuss the details of the various components of the hydrologic protection plan.

4.7.2.1 Ground Water Protection Measures

CR has incorporated specific control and mitigation measures in the proposed mining, processing, and reclamation plans to effectively prevent or minimize significant mining related impacts on groundwater quantity, quality, and recharge, storage and discharge relationships. Ground water systems will be protected by limiting surface disturbance and mining related subsidence both of which can alter runoff and infiltration characteristics; controlling mine drainage and recycling any significant mine inflow volumes in the operational mine water system; handling earth materials, mine drainage, and runoff in a manner that minimizes acidic, toxic, or other harmful infiltrations to groundwater; and managing excavations and other disturbances to prevent or control discharge of pollutants to the ground water system.

CR's mining operations and related activities have the potential to effect ground water quantity through limited inflows to the mine workings from the subsidence of local perched aquifer systems, and the alteration of surface infiltration characteristics. Mining within a regional aquifer is not anticipated, however, if it were to occur, a reduction in the amount of water available within the aquifer due to in-mine pumping and extraction, would result in a temporary localized depression of the piezometric surface. Although believed to be minor (due to the general lack of water identified within the planned mining area) mining and related operations may also effect ground water quality by modifying ground water chemistry, altering pH, and increasing concentrations of TDS and specific chemical constituents. Specific activities which may potentially impact ground water quantity and quality include the following:

- Underground coal removal
- Retention of drainage in sedimentation pond structures

Operational measures that will be implemented to mitigate these impacts are discussed below.

Underground Coal Removal - CR's planned underground mining operations may result in passive drainage requiring handling of mine inflows from proposed mine workings. Potential ground water inflow sources include the stratigraphic units directly disturbed by mining, and the overlying perched aquifer system due to downward leakage through fractures. According to information available, historic mining operations located within the general Kinney mine permit area did not encounter significant quantities of water, and it is anticipated that mine inflows may be limited. Any significant mine inflows encountered will be collected and routed to either abandoned mining areas or temporary underground storage areas for recycling to the operational mine water system. As mining proceeds, any significant disturbance has the potential of fracturing the natural seals supporting local perched aquifers, resulting in the localized release of perched water. Following the cessation of mining, mine inflows and outflows will stabilize as water collects within down gradient abandoned mine sections.

Specific mine design and operation including layout and sizing of mine openings based on retention of barrier pillars and first mining only, with no pillar extraction, is projected to prevent subsidence. Mine design and operational control measures, when combined with

mining depth should eliminate fracture propagation at or near the ground surface in areas overlying the underground workings, effectively prevent the drainage of perched aquifers and alteration of surface infiltration characteristics.
Underground mining operations will expose coal, floor, and roof materials to oxidation and increased leaching as mining is completed and working areas are abandoned. Natural caving will also expose substantial quantities of broken coal and roof material to oxidation, and although not anticipated, by the leaching of local groundwater. It is anticipated that pH may increase slightly and the local ground water chemistry may evolve toward a sodium sulfate water type with increases in TDS and certain mineral constituents including iron and manganese. A similar evolution appears to have occurred within Mud Creek as upstream mining and transport has advanced. In order to effectively prevent or mitigate these impacts, underground mining operations will be limited to development and disturbance of the minimum area necessary to provide for effective coal extraction. CR will also keep all development (except ramping and overcasts) in the minable coal seams to the extent operationally practical. While there will undoubtedly be some impacts on localized ground water quality, these impacts will generally be confined to the mine and immediately adjacent areas by the relatively low flows and volumes of water historically encountered as we as due to the low permeability of the geologic units and the limited hydrologic connection with other more permeable units.

Minor changes in ground water quality will not effect any ground water users since all existing ground water use in the immediate area is limited to units which are stratigraphically above the interval to be mined, and since no mine water discharge is anticipated following the closure and sealing of the mine. It should be noted that anticipated changes in ground water quality are anticipated to be relatively small and localized, and not so significant as to preclude beneficial use of affected ground water resources. This contention is supported by historic monitoring data for other Central Utah mines which receive some mine water drainage from old mine workings while showing no significant adverse long-term effects.

Surface Placement of Coal, Mine Waste - Surface placement of coal has the potential to affect ground water quantity and quality as a result of increased runoff from the associated disturbance areas and from the subsurface infiltration and leaching of the stockpiled materials. The great majority of leachate from the stockpile will be conveyed via the surface water runoff control system to the sediment pond located at the downstream end of the disturbed mine area.

Coal mine rock from fault crossings will be placed in developed entries and cross cuts specifically designated for that purpose. There is no mine rock anticipated to be placed on the surface. In similar manner, mine waste will be contained underground and will not be brought to the surface. No wash plant is planned and therefore no coal refuse will be generated as part of the mining operation. Analyses of both actual existing and potential future coal materials, including incidental roof and floor rock, are described in Section 3.6.3, Coal and Overburden/Interburden Characteristics. Based on analyses of coal, roof, and floor samples, overall sulfur content is low with organic sulfur as the dominant form. Buffering capacity is relatively high due to the presence of significant quantities of calcium. Consequently, the acid-producing potential from this mine is low. Similarly, chemical analyses indicate low concentrations of most potentially toxic components, including a low alkalinity potential.

Available analysis results for existing surficial mine waste and stockpiles, which have been in place a number of years and have had ample opportunity to weather and oxidize, offers an

expanded and probably more accurate perspective of potential water quality impacts than chemical analysis results for fresh coal, roof, and floor samples. The weathered reclaimed coal samples show no significant acid. alkaline, or toxicity potentials. Leaching of mine waste and coal refuse materials has the potential to cause a shift in the ground water chemical type towards a sodium sulfate water type and may also cause minor increases (quantify) in concentrations of iron, manganese, and TDS.

With reference to the potential impacts of surface coal placement on ground water quantity and quality, similar considerations apply to coal stockpiling in the mine, process, and loadout areas. Stockpile areas will be constructed to provide effective drainage of both runoff from stockpile surfaces and infiltration through coal stockpiles. Runoff from stockpile areas will be collected and routed to nearby sedimentation ponds. CR will also limit stockpiled coal inventory for operational and environmental reasons.

Limited inventory results in rapid stockpile turnover, which minimizes the potential for weathering or leaching of coal materials.

Retention of Drainage in Sedimentation Pond Structures - CR will utilize a single sedimentation pond and associated drainage structures to intercept and route runoff from disturbed areas, retain runoff for sediment control, and to control discharges to stream drainages. Map 4.7.2.1-1, Drainage and Sediment Control Plan – Undisturbed Drainage Areas, Map 4.7.2.1-2, Drainage and Sediment Control Plan – Disturbed Drainage Areas, and Map 4.7.2.1-3, Sedimentation Pond 1 – Section and Details, provide information related to the identification and control of surface water runoff. The regional drainage basins identify those undisturbed areas not tributary to the mining operation and their discharge locations. The drainage and sediment control plan provides specific ditch, culvert, erosion control, and pond design information and locations used to controls runoff within the active surface mining area. Operation of the sedimentation pond has some limited potential to affect both ground water quantity and quality by altering the timing and volume of discharge flows, providing additional recharge to alluvial/colluvial ground water systems, causing changes in water chemistry, increasing TDS levels, decreasing TSS levels and increasing the concentrations of specific mineral components.

Disturbed area runoff flowing into the sedimentation pond will be retained to allow suspended sediment to settle out prior to discharge to the downstream natural drainage. During the time that water is retained in the sedimentation structure, some evaporation will occur, resulting in reduction of overall water volume and inherently increasing concentrations of TDS and individual chemical constituents. Since the proposed sedimentation pond is located in lowland areas, any infiltration losses through the bottom of the ponds will have similar effects on surface discharge volumes and chemical characteristics. Any changes in surface water quality or chemistry have the potential to effect groundwater resources since surface flows are a component of the limited down-gradient groundwater recharge.

Effects of evaporation will be minimized by limiting detention time in the sedimentation structure to that interval required for effective reduction of suspended solids. Because runoff typically occurs only in response to snowmelt and major storm events, evaporation will be further limited by cold temperature during spring when the majority of snowmelt occurs. Pond design, as outlined in Exhibit 4.7.2.2-1 Runoff Control Design Details, provide for both minimal detention times and effective pond routing so any delay in discharge to the receiving drainages will be limited to the maximum detention time of 24 hours. With pond

routing, discharge will occur continuously once the water reaches the discharge orifice and 25-Year overflow discharge elevation so effects on downstream flows will likewise be minimal.

Infiltration will similarly be limited by minimal detention times, by compaction of the pond base during construction, and accumulations of fine suspended solids which tend to further limit overall base permeability. Both TSS, and TDS and various chemical constituents tend to accumulate in the sediment in the bottom of sedimentation ponds due to natural settling and chemical precipitation. Regular periodic removal of sediment accumulations from the sedimentation ponds will eliminate a significant source of concentrated TDS and other constituents, minimizing TDS and chemical buildup. CR will monitor sedimentation pond discharge in order to detect any significant changes in surface water quality. If significant changes are noted, CR may, with consultation from the UDOGM, develop and implement appropriate water treatment plans.

Upon completion of mining, all mine disturbance areas will be reclaimed. Reclamation and establishment of effective vegetative cover will minimize disturbed area runoff to the sedimentation pond, limiting potential effects of surface leaching and evaporation. Reclamation will also result in restoration of natural drainage and direct discharge to the receiving drainages once the sedimentation pond is removed at the end of the extended liability period. Given this consideration, any potential ground water impacts will be both limited in scope and of a temporary nature.

4.7.2.2 Surface Water Protection Measures

CR has incorporated specific control and mitigation measures in the proposed mining, processing, and reclamation plans to effectively prevent or minimize significant mining related impacts on surface water quantity and quality. Surface water systems will be protected by limiting surface disturbance; controlling surface runoff and erosion; handling earth materials, any ground water discharges, and runoff in a manner that minimizes the formation of acidic or toxic drainage, prevents additional contributions of suspended solids to stream flow outside of the permit area, and otherwise prevents pollution of surface water. Surface water treatment facilities needed to protect surface water are not anticipated.

CR's mining operations and related activities have the potential to effect surface water quantity through modification of surface runoff characteristics and increased sediment contributions from surface disturbance areas; consumptive use of surface water for mining and processing operations; and discharge of sediment and other potential pollutants from mining related surface activities. Mining and related operations may also effect surface water quality by modifying surface water chemistry, altering pH, and increasing concentrations of TSS, TDS, and specific chemical constituents. Specific activities which may potentially impact surface water quantity and quality include the following:

- Removal of vegetation and soil materials from disturbance areas
- Surface placement of coal• Mine water supply withdrawals
- Operation of drainage and sediment control structures

Operational measures that will be implemented to mitigate these impacts are discussed below.

Removal of Vegetation and Soil Materials from Disturbance Areas_- In order to conserve available soil resources, vegetation and soil materials will be removed from all mine facilities areas prior to disturbance. While beneficial in terms of soil conservation and provision of a suitable growth medium to support final reclamation and revegetation efforts, this practice exposes underlying materials to potential erosion and loss, can increase suspended sediment levels in the runoff water, and may increase sediment contributions to area drainages. To maintain effective surface drainage, mitigate erosion, prevent loss of surficial materials, and minimize additional contributions of suspended solids to area drainages CR will route undisturbed drainage around disturbance areas, grade and stabilize disturbed areas to provide for effective drainage control, establish a drainage and sediment control network to collect and retain runoff from disturbed areas, reclaim disturbance areas as soon as operationally practical, and utilize other specific localized drainage and erosion control methods as necessary. These activities are discussed further in the following sections.

In conjunction with mine development, facility installation, and ongoing coal refuse placement, CR will grade, stabilize, and maintain all disturbed areas to provide for effective drainage and minimize potential erosion. Where appropriate, CR will utilize localized grading and stabilization measures to effectively control and route drainage and minimize flow velocities. Examples would include graveled surfaces and the yard area drainage system in the mine facilities area; temporary sumps and ditches in active coal refuse placement areas; and the placement of drainage control berms which will isolate disturbed area drainage in the Kinney Mine loadout area.

Localized drainage control and grading measures will be supplemented by CR's drainage and sediment control network. This network consists of diversion ditches which route undisturbed runoff around or through disturbance areas, collection ditches which intercept disturbed area runoff and route it to the sedimentation pond, the sedimentation pond, and associated discharge structures. Design information and calculations are provided in Map 4.7.2.1-1, Drainage and Sediment Control Plan Map – Undisturbed Drainage Areas, Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas, Map 4.7.2.1-3, Sedimentation Pond 1 – Section and Details, and by Exhibit 4.7.2.2-1 Runoff Control Design Details. Design details regarding runoff hydrology, ditches, culverts, energy dissipation, and the sedimentation pond are included within Exhibit 4.7.2.2-1, Runoff Control Design Details. The drainage and sedimentation control network will collect and retain disturbed area runoff allowing settlement of suspended solids and any necessary treatment prior to release to natural drainages. The sedimentation pond will be operated under applicable provisions of CR's UPDES discharge permit. Compliance with the terms of these permits will assure that downstream water quality impacts are minimized.

Basic components of the drainage and sediment control plan follow:

- Undisturbed area runoff within the main drainage channel located toward the south end of the operation area will be conveyed beneath the mine surface facilities and across Highway 96 via culvert UDC-1.

- Undisturbed area runoff control ditches (UDD-1 and UDD-2) located along the eastern edge of the disturbed area is part of a property access road constructed for the property owner. A check of the road cross section shows that discharges from the up-gradient undisturbed area can be safely conveyed to a culvert (UDC-2) that conveys the undisturbed area runoff beneath the mine site to an existing 36" culvert located

beneath Highway 96. Water conveyed beneath Highway 96 is then discharged onto an energy dissipation pad before continuing toward Scofield Reservoir.

- A series of operation pads and runoff control ditches and culverts. In general terms, storm water tributary to each operation pad is controlled and directed to the back of the pad, then conveyed toward a runoff ditch or culvert which in turn conveys the water to a downstream pad, ditch, or culvert. Specifics related to each runoff segment and any variances follow. A visual reference for the runoff system described is shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan – Disturbed Drainage Areas.

- Portal Pad (Pad A) runoff flows to ditch DA-1, to the Coal Pile Pad (Pad B). Water enters culvert CB-1, goes beneath the coal stockpile,, then enters a junction box connected to culvert CB-2. Culvert CB-2 discharges to ditch DC-2, to ditch DC-3, joins with ditch DC-4, is conveyed under the adjacent property owner access road via culvert CC-1, to ditch DC-5, then goes into Pond 1 via ditch DC-6.

- Storage Pad (Pad D) runoff combines with road ditch DD-1 and road ditch DD-2, goes through culvert CD-1, to ditch DD-3, joins with Pad D runoff, enters culvert CD-2 to Pad E and ditch DE-1, joins with road ditch DE-2, enters culvert CE-1, then enters Pond 1 via ditch DE-4.

- Office Pad (Pad F) drainage enters ditch DF-3 where it joins with road ditch DF-1 before entering culvert CF-1, joins with road ditches DF-2, goes to ditch DF-4, joins with road drainage via the cattle guard, goes to ditch DF-5, to ditch DE-3, joins with culvert CE-1, then enters Pond 1 via ditch DE-4.

- Ditch and culvert design details including design criteria, flows and other appropriate information is provided in Table 4.7.2.2-1, Ditch Design Details and Table 4.7.2.2-2, Culvert Design Details. Figure 4.7.2.2-1, Pond 1 Stage-Volume Curve provides data regarding pond volume. Map 4.7.2.1-2, Drainage and Sediment Control Plan – Undisturbed Drainage Areas and Map 4.7.2.1-4, Drainage and Sediment Control Plan – Disturbed Drainage Sub Basins, have been prepared to show runoff drainage areas represented in Table 4.7.2.2-2, Culvert Design Details.

All areas disturbed by mining and related operations will be reclaimed as soon as operationally practical following completion of mining. Reclamation will involve removal of mine structures and facilities, backfilling and regrading disturbance areas, replacement of soil and substitute materials, and revegetation. These activities are designed to re-establish drainage patterns similar to those which existed prior to development of the Kinney Mine and develop a self-sustaining vegetative community. As a result of effective reclamation, infiltration and runoff relationships will be restored, limiting the time interval over which water quality impacts may occur. Where appropriate, CR will utilize drainage control measures to prevent or mitigate potential impacts from ongoing operations. Such measures may include use of surface binders and dust suppressions agents on haulage roads, soil/substitute stockpiles, and in active working areas the placement of straw bales, sediment fence, erosion netting, mulch berms, stilling basins, sumps and other small structures to control and route drainage, limit surface erosion, minimize flow velocities, and reduce suspended sediment levels.

Surface Placement of Coal, Mine Waste - Surface placement of coal, mine waste, may effect surface water quantity and quality in several ways. Surface runoff from the related disturbance areas may increase resulting in increased erosion and sediment loss, and surface flows may infiltrate through stockpiled materials generating leachate with both sediment laden runoff and leachate potentially discharging to surface drainages. Although believed to be of minimal impact, Leachate not collected by an underdrain system may impact ground water, which may later discharge to the sedimentation pond or to the alluvial/colluvial aquifer.

Coal stockpile areas will be constructed to provide effective drainage of both runoff from stockpile surfaces and infiltration through coal stockpiles. Designed ditches will collect and route runoff from coal stockpile areas to the sedimentation pond. The locations of the designed ditches and sedimentation pond on disturbed mine areas are shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas, Map 4.7.2.1-3, Sedimentation Pond 1 – Section and Details, and detailed design calculations are presented in Exhibit 4.7.2.2-1, Runoff Control Design Details. CR will also limit stockpiled coal inventory for operational and environmental reasons. Limited inventory results in rapid stockpile turnover, which minimizes the potential for weathering or leaching of coal materials.

Operation of the sedimentation pond for the coal stockpile area under CR's UPDES permits will assure compliance with applicable water quality regulations and effectively mitigate any potential surface water quality impacts.

Coal stockpile areas will be reclaimed as soon as operationally practical after they are no longer required to support ongoing mining and related operations. The initial step in reclamation of coal stockpile areas will involve removal of stockpiled coal materials and any associated structures. Subsequent reclamation of the coal stockpile area will involve removal, re-grading of the disturbance areas to the final design configuration, replacement of soil and substitute materials, and re-vegetation. These activities are designed to establish effective surface drainage, stabilize the effected areas, and develop a self-sustaining vegetative community.

Discharge of Mine Water to Surface Drainages – No surface discharge of mine water is anticipated. Direct and/or indirect drainage from any perched aquifers intercepted by fractures may serve as potential sources of ground water inflow to the Kinney Mine workings. In order to facilitate ongoing mining operations and assure safe operating conditions, CR will collect any significant mine inflows and transfer the resulting mine drainage to either abandoned mining areas or temporary underground storage areas. If sufficient quantities of mine drainage are available, stored mine drainage will be utilized to supplement the operational mine water supply. Plans for handling mine drainage are described in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements.

Based on preliminary estimates of anticipated mine inflow volumes and mine water use requirements, it is anticipated that all mine inflows can be either recycled through the operational mine water system or stored underground. The previous discussion in Section 4.7.2.1, Ground Water Protection Measures, indicated that based on available sampling data mine water, no mine water discharges are expected. If it becomes necessary to discharge any excess mine drainage to the surface, a revision to the mine permit will be made and coordinated with the Division.

Mine Water Supply Withdrawals - Mining, related coal processing operations, and support activities will require a consistent water supply with adequate capacity to meet all operational mine water supply requirements. Potable and sanitary water requirements will be provided through a water supply connection to the existing Scofield Town water system located adjacent to the mine site. Mine water requirements will be supplied from Scofield Town via Mud Creek, and from possible water sources encountered during mining, which are anticipated to be small.

Recycling of in-mine drainage to supplement the operational mine water system will help reduce water supply requirements. Dependent on the actual rate of mine inflows, mine drainage could provide the water required for dust control applications in the underground operations. CR plans to construct a surface mine water storage tank and may be able to develop additional mine water storage capacity in inactive areas of the underground mine workings. This storage capacity may be utilized to good advantage during seasonal low flow periods to limit required stream withdrawals. CR's existing water rights provide additional water supply capacity beyond that acquired from Scofield Town.

Coal Preparation Activities – No coal preparation activities are planned.

Operation of Drainage and Sediment Control Structures - The Kinney Mine drainage and sediment control network is designed to function as the primary mitigation system to prevent significant impacts on surface water quality. Operation of the sedimentation pond may, however, result in some delay in water discharge to the receiving drainages potentially altering discharge volume and consequently streamflow entering Scofield Reservoir, and may increase concentrations of TDS and other constituents in the runoff retained in the pond due to evaporation. Both delays in discharge and potential evaporative effects and related mitigation considerations were previously discussed in Section 4.7.2.1, Ground Water Protection Measures. Significant overall increases in TDS and other chemical constituents for the receiving drainages are not expected because runoff volumes from disturbed areas will be limited by upstream diversion of undisturbed drainage, surface disturbance areas will be of limited size, and reclamation of disturbance areas will be occurring. CR will monitor all discharges from the sedimentation structure to ensure compliance with UPDES requirements. If problems are noted with TDS or any other discharge constituent, CR will coordinate with the regulatory agency regarding acceptable solutions to effectively control and mitigate the problems.

Mine disturbance areas will be reclaimed on completion of mining or when they are no longer required to support ongoing mining and related operations. Reclamation, re-establishment of vegetative cover, and restoration of effective surface drainage will minimize disturbed area runoff to the sedimentation pond, limiting the potential effects of surface leaching and evaporation. Restoration of natural drainage and direct discharge to the receiving drainages once the sedimentation pond is removed at the end of the extended liability period will effectively eliminate any potential surface water impacts related to the sedimentation pond.

4.7.2.3 Water Monitoring Plan

CR currently maintains, and will continue, a program to monitor surface and groundwater quality and quantity for the duration of the proposed mining, processing, and reclamation operations. The Hydrologic Monitoring Plan consists of monitoring stations identified in Tables 3.7-1, Kinney Mine Baseline Monitoring Stations, and 3.7-2, Kinney Mine Operational

Monitoring Stations, according to the parameter sampling schedule shown in Table 4.7.2.3-1, Monitoring Schedule. Baseline monitoring has been conducted on a monthly basis. Operational monitoring is planned to be conducted on a quarterly basis as follows.

Samples will be collected quarterly for parameters shown in Table 4.7.2.3-1, Monitoring Schedule, for all surface and ground water stations when the sites are accessible. At some sampling sites, winter conditions may create inaccessible or unsafe conditions. To help ensure as complete a data set as possible, first and fourth quarter samples will be collected during the time periods wherein there is the greatest likelihood of collecting a valid sample. This is believed to be in March and October respectively. Second and third quarter samples will be collected at a convenient time for the mine operator within the respective quarter.

The monitoring program thus instated serves as an integral part of CR's efforts to protect the hydrologic balance by providing an accurate and timely method of identifying and quantifying any possible concerns with respect to surface and ground water resources. The monitoring network is shown on Map 3.7.1.3-1, Surface and Ground Water Monitoring Sites. Table 3.7-1, Kinney Mine Baseline Monitoring Stations, and Table 3.7-2, Kinney Mine Operational Monitoring Stations, when combined with Map 4.7.2.3-1, summarizes the type and location of monitoring sites. The frequency, density and accuracy of monitoring will allow CR to evaluate and determine the success of mine plans, drainage and sediment control facilities, and reclamation for the purpose of minimizing disturbance to the hydrologic balance. The monitoring data and resulting evaluations will be used to identify any potential problems and develop necessary mitigation measures.

Hydrologic information submitted in Section 3.7 of this permit application includes an identification of surface drainages and general flow characteristics, modeling of corresponding peak flows and annual runoff volumes, identification of ground water aquifers, and a general description of aquifer characteristics including ground water levels, movements, and recharge/discharge/storage characteristics.

The Hydrologic Monitoring Plan for the Kinney Mine provides for a frequency and distribution of both baseline and operational monitoring data collection adequate to identify and document baseline conditions and trends and fluctuations in the quantity and quality of surface water, the level and quality of ground water, and the overall effects of mining and reclamation activities on the hydrologic balance. As shown on Table 4.7.2.3-1, Monitoring Schedule, water quality parameters include field measurements for water level or flow, pH, specific conductance, dissolved oxygen, and temperature. Laboratory measurements include a significant list covering general water quality characteristics such as TDS, nutrients, major ions, and trace metals. Both surface and ground water quality samples will be collected, labeled and transported to a qualified analytical laboratory for analyses. Proper sample collection, preservation, handling, and storage methods will be utilized at all times to preserve the integrity of the samples and ensure validity of the analytical results.

The ongoing monitoring network consists of 1 spring/seep location, 4 ground water wells having the capability of sampling from 8 different water zones, and 3 surface or stream locations. Data from one additional well (CR-06-03-ABV) was drilled as part of the mine water monitoring program and was sampled between April and September 2006. However, due to legal issues related to the well it has been ordered abandoned and is not part of the ongoing water monitoring program. In a similar fashion, monitoring from Angle Springs has been terminated due to access limitations. Each of the historic and current sampling locations are identified on Table 3.7-1, Kinney Mine Baseline Monitoring Stations, and on Map 4.7.2.3-1, Surface and Ground Water Monitoring Sites. The spring/seep locations and monitoring wells will be used to evaluate the occurrence of ground water and the hydraulic characteristics of the aquifers. The surface water monitoring sites will be used to evaluate the quality and quantity of surface water.

Baseline and operational monitoring will be performed for the Kinney Mine at the following frequency:

Spring - Discharge measurements, field water quality parameters, and laboratory samples were collected monthly between May 2005 and May 2007 with the exception of February and September 2006. Baseline data having been collected, Eagle and Sulfur Springs will now be monitored for operational mining parameters.

Stream Stations - Flow and field water quality parameters were measured on Mud Creek on a monthly basis from May 2005 through May 2007. Operational monitoring will continue. Flow and field water quality parameters were measured on Scofield Reservoir and Miller Outlet beginning in May and June 2006 respectively. Baseline monitoring for these sites extended through May 2007 after which time operational monitoring will continue.

Monitoring Wells - Groundwater level measurements, field water quality parameters, and laboratory samples were taken following well installation and development for wells CR-06-01 and CR-06-02 beginning in March 2006. Baseline sampling for well CR-06-05 began in September 2006 andcontinued through May 2007 after which time operational monitoring began. Baseline sampling of different zones within well CR-06-09 began as early as August 2006, with all three zones being sampled simultaneously beginning in October 2006. Operational monitoring began for well CR-06-09 in July 2007.

All water monitoring analysis results will be recorded, reviewed to identify potential problems or trends, and filed at the mine so as to be available for future inspection and review. In addition, and following initiating of development activities, CR will file copies of both field data and laboratory analysis sheets on a quarterly basis with the UDOGM. At the end of each annual year, CR will also tabulate all water monitoring data for the year, review the data with respect to changes in surface and groundwater hydrology systems, and provide a summary Annual Hydrology Report in compliance with the UDOGM schedule. CR will continue to collect and evaluate hydrologic monitoring data during the operations and reclamation phases. If the additional data resulting from ongoing hydrologic monitoring indicates that any significant changes in general baseline characterizations are appropriate or that any assumptions or projections used to evaluate potential impacts are not accurate, CR will review potential changes with UDOGM and modify any sections of the mining and reclamation permit application as appropriate to reflect necessary changes.

Following baseline monitoring, operational monitoring will be conducted for each sample location quarterly in accordance with the requirements of R645-301-731-212 and R645-301-731-223. In general, samples will be collected four times a year with one sample being taken within each quarter period. Ideally the samples will be taken in February, May, August and November. However, sample dates may be shifted one month earlier or later depending upon weather and environmental conditions. If the analysis of any surface water or groundwater sample indicates noncompliance with the permit conditions, then CR shall promptly notify the Division and immediately implement expanded monitoring for the site in question. Expanded monitoring will include a single sample for the noncompliant parameter to be taken within 15 days of learning of the noncompliant event. The new sample will then be evaluated to determine the magnitude and seriousness of the event, and with the Division, determine whether additional sampling is warranted. If monthly monitoring is warranted, sampling of the parameter will continue until the cause is identified and rectified, appropriate action is taken to the satisfaction of the Division, or the cause is determined to be non-mine related.

Carbon resources will file for, and meet any provisions of UPDES permit(s). In addition, CR will prepare and submit quarterly UPDES compliance reports to the UDOGM and UDWQ in compliance with Part 4.05.13 (2) (ii) (b). If non-compliance with a UPDES permit effluent

limitation does occur, CR will forward the analytical results concurrently with the written notification of non-compliance.

CR will continue surface and ground water monitoring activities after completion of reclamation operations to document restoration of pre-mining hydrologic characteristics. All surface and groundwater monitoring installations and associated structures and equipment will be properly installed, maintained, and operated to assure the accuracy and consistency of monitoring data. Surface water monitoring will be discontinued when untreated surface runoff meets applicable effluent limitations and the UDOGM approves removal of drainage and sediment control structures. Groundwater monitoring wells will be abandoned and removed in accordance with UDOGM guidelines following UDOGM approval to discontinue groundwater monitoring.

4.7.2.4 Acid or Toxic Forming Materials

This section is not applicable to Kinney Mine because no waste materials, nor incidental roof and floor rock will be shipped out with the coal.

4.7.2.5 Discharges

The Kinney mine workings will progress down dip from the outcrop area and mine drainage will be controlled during active operations so there is little or no potential for direct gravity discharge of water from the mine. The minor amounts of water encountered within the mine will be controlled underground and pumped, if necessary, to mined out areas. Upon completion of mining and related activities in-mine drainage control operations will cease and portions of the mine workings (especially the mine workings furthest down dip) may either partially or gradually fill as ground water inflows discharge to the mined-out areas. No post cessation flow is anticipated and CR will seal and backfill the mine portals. Sealing practices are discussed in Section 5.4.2.3, Reclamation Practices, and Section 5.5.2.6, Casing and Sealing of Wells and Mine Openings.

There are no plans to develop, divert, or discharge any surface water into any underground mine in conjunction with ongoing mining and reclamation operations at the Kinney Mine.

Possible alternatives for the disposal of any in-mine water encountered are 1) discharge the water into remote or abandoned mine workings, 2) request a new NPDES discharge permit for surface discharge, 3) construct shallow or deep injection wells, 4) treat and discharge the water into Mud Creek, and 5) evaporate through new ponds. The feasibility and cost associated with these alternative will be investigated in the unlikely event that mine discharges are required.

All temporary and permanent diversions within the Kinney mine and loadout areas have been designed and will be constructed to maintain effective flow under all anticipated conditions. Upon completion of mining and related activities, mine openings will be sealed and backfilled to further preclude any potential ground water discharge or surface water inflows in mine portal areas or boreholes.

4.7.2.6 Stream Buffer Zones

No streams requiring a buffer zone are located within the immediate or adjacent surface disturbed areas.

4.7.2.7 Water Rights and Replacement

As discussed in Section 3.7.9.1, Potential Impacts on Surface and Ground Water Sources, CR's mining and related operations are not expected to adversely impact any surface or ground water sources or water rights. Consequently, there is no need to explicitly address provisions for replacement of impacted water rights at this time. In the unlikely event however, that proximate contamination, diminution, or interruption does occur and can be documented as resulting from the Kinney mining and related operations, CR will mitigate the associated water rights impacts through discussion and development of a cooperative agreement with any effected water rights holder. Potential mitigation options may include but will not be limited to replacement or augmentation of effected water rights, monetary compensation, development of alternative watering facilities such as guzzlers.

The primary postmining land use in the mine, loadout, and adjacent areas will be undeveloped wildlife habitat, requiring minimal supporting water requirements. The discussions presented in Section 3.7, Hydrology Information, indicate that while surface and ground water resources are limited in those areas to be affected by the Kinney Mine operations, they will be adequate in terms of both quantity and quality to support the designated postmining land use. Given the proposed postmining use, CR currently has no plans to transfer any exploration boreholes or monitoring wells for subsequent use as water wells for the current mine plan. It is however anticipated that new ground water monitoring wells will be constructed to define subsurface conditions east of the current mine plan area in the future. Details regarding this need will be coordinated with DOGM in advance of any action.

4.7.2.8 Erosion and Sediment Control Measures

As previously discussed in the introduction to this section, operational plans for the Kinney Mine include standard hydrologic controls and mitigation measures that are designed to prevent significant changes in the quantity and quality of surface and ground water resources, preserve existing hydrologic functions, comply with regulatory requirements, and limit adverse impacts to surface water or ground water users. These measures include:

- Limiting surface disturbance areas
- Proper design, construction, and grading of facilities areas and roads
- Construction, operation, and maintenance of drainage and sediment control structures to divert undisturbed runoff around disturbance areas, collect and route disturbed area runoff to sedimentation ponds to allow settlement of suspended solids, and facilitate any treatment which may be necessary
- Utilization of localized erosion control measures in any areas having high erosion potential
- Initiation of reclamation operations as soon as practical following completion of mining or when the associated facilities are no longer required to support ongoing mining and related operations
- Effective reclamation to minimize gradients, re-establish surface drainage patterns, restore pre-mining runoff and infiltration characteristics, and establish an effective and self-sustaining vegetative cover
- Post-reclamation land use management

During active operations, the designed drainage and sediment control system along with appropriate surface grading and stabilization measures will be the primary mechanism used to provide effective erosion and sediment control. A detailed discussion of this system was provided in Section 4.7.2.2, Surface Water Protection Measures. The locations and configuration of disturbed area drainage and sediment control structures are shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas, and design information and calculations are provided in Exhibit 4.7.2.2-1, Runoff Control Design Details. Because of limited surface disturbance area available for the Kinney Mine, the surface facilities have been laid out in a series of elevated pads as shown on the map.

Following completion of mining operations reclamation of surface disturbance areas, restoration of effective drainage, and revegetation as described in Section 5.4, Reclamation of Mining Disturbance, will be the primary means of establishing both effective short and long-term erosion and sediment control.

4.7.2.9 Diversions and Associated Structures

Surface facilities diversions will be constructed to intercept and divert surface runoff flows from undisturbed upgradient areas around the mine surface facilities areas. Diversion of undisturbed drainage will minimize additional sediment contributions, prevent impacts from the undisturbed drainage on mine disturbance areas, and limit requirements for retention and treatment of surface runoff to disturbed area drainage flows. All temporary diversions related to the mine facilities area are shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan – Disturbed Drainage Areas. The permanent re-establishment of the ephemeral drainage through the disturbed mining area is shown on Map 4.7.2.9-1, Mine Surface Facilities Area - Postmining Topography. Design calculations for temporary and permanent diversions are provided in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Diversion structures utilized in conjunction with the Kinney Mining and related operations will include both temporary diversions to control undisturbed runoff during active mining and reclamation operations and the permanent diversions which will be constructed in order to restore effective surface drainage following completion of ongoing mining and related operations.

To provide for effective transmission of runoff flow through reclaimed culverted channel USC-1, side-slopes will be graded to blend with both upstream and downstream channel segments and the overall diversion channel gradient will approximate the natural stream gradient. The original and post-mining alignments of the channel UDC-1 are similar in nature in both the horizontal as well as the vertical directions. As can be seen in Map 4.7.2.9-1, Mine Surface Facilities Area – Post Mining Topography, the reclaimed channel is in reality short, and thus has little potential for significant alignment variation. Given the relatively arid climate of this area and ephemeral nature of channel UDC-1, aquatic habitat values are non-existent.

4.7.2.10 Collection Ditches and Associated Structures

Collection ditches for disturbance areas associated with the proposed Kinney Mine surface facilities diversions will be established to collect and route disturbed area runoff flows to a

designed sedimentation pond. The locations of disturbed area collection ditches in the mine facilities areas are shown on Map 4.7.2.2-2, Drainage and Sediment Control Plan – Disturbed Drainage Area and corresponding design calculations are provided in Exhibit 4.7.2.2-1, Runoff Control Design Details.

All collection ditches have been conservatively sized to carry the peak runoff flows from the 25-year, 24-hour storm event in order to provide a significant margin of safety and accommodate the brief, high-intensity storms common to this area. In order to assure effective collection and routing of disturbed drainage flows and minimize both erosion and sedimentation, required culverts have been sized to safely pass the peak flow from the contributing inlet ditches with a significant factor of safety and culvert inlets, outlets, diversion channels, and those areas where one or more channels intersect have been designed and will be constructed using properly sized and placed riprap or other erosion control materials, as required. Specific information on culvert design and erosion protection measures is also provided in Exhibit 4.7.2.2-1, Runoff Control Design Details.

4.7.2.11 Sedimentation Pond and Associated Structures

Sediment control measures for the Kinney Mine operations have been designed to meet or exceed all applicable State effluent limitations under the provisions of the required UPDES discharge permit. Primary long-term sediment control measures include re-grading and re-vegetating mine disturbance areas to control runoff and siltation and increase infiltration, and use of localized sediment control measures including mulching, erosion netting, sediment fences, check dams, sediment traps, straw bales and other means as appropriate. Short-term operational sediment control measures include the use of localized sediment control measures as noted above, construction of collection and diversion ditches where necessary to intercept and route runoff flows, and the use of a sedimentation pond to retain runoff and allow suspended solids to settle out prior to discharge to natural drainages. Major sediment control structures for the Kinney Mine are shown on Map 4.7.2.1-1, Drainage and Sediment Control Plan Map – Undisturbed Drainage Areas, and Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas. The runoff control pond is shown on Map 4.7.2.1-3, Sedimentation Pond 1 – Section and Details. These facilities have been designed utilizing the best technology currently available and will result in effective compliance with both the requirements of Kinney Mine's UPDES permit and all other applicable regulatory requirements.

One new sedimentation pond will provide effective sediment control for the Kinney mine facilities area. This pond is located in the northern end of the surface disturbed area east of and adjacent to Highway 96. This sedimentation pond is located as close as possible to the contributing disturbed areas and is not located within the floodplains of any perennial streams.

Complete detailed plans, calculations, and design specifications for sedimentation ponds are presented in Exhibit 4.7.2.2-1, Runoff Control Design Details. This design documentation include discussion of design methodology and assumptions, descriptions of specific drainage and sediment control structures or types of structures, hydrologic and hydraulic design calculations, and design specifications for all structures. In addition to compliance with applicable design standards and requirements under the Utah Coal Mining Regulations, the Kinney Mine sedimentation pond will be constructed, operated, and maintained to

effect compliance with applicable UPDES discharge effluent standards. The pond has been designed to provide a minimum detention time of 24 hours, and longer if necessary, to meet applicable effluent limitations with respect to TSS and is sized to control pond discharge rates so that adequate detention times are maintained.

The proposed sedimentation pond has been designed to provide adequate storage for anticipated sediment accumulations from contributing drainage areas. Sediment storage calculations are conservative, reflecting the maximum anticipated disturbance acreage for each drainage area over the mine life. In addition to designing for adequate sediment storage capacity, CR will monitor the sediment level in the sedimentation pond, and as necessary to maintain adequate storage capacity, will remove accumulated sediment and dispose of it within abandoned mine sections. Sediment removal volumes will be minimal and should not have any significant effect on refuse stockpile stability, overall volume, or overall storage issues within the mine. It is anticipated that sediment removal will be only be required on an occasional basis.

As sediment removal becomes necessary, CR, in order to facilitate removal, minimize the potential for additional contributions of sediment to downstream waters, and prevent any potential adverse impacts on coal refuse stockpile stability, will schedule sediment removal during the portion of the year when sedimentation ponds are normally dry. Any water retained in the ponds at this time will be utilized for mine dust control application and pond surfaces will be allowed to dry out prior to initiation of equipment operations and sediment removal. If runoff occurs during pond cleanout, sediment removal operations will be temporarily suspended until any accumulated water can be discharged and effective operating conditions for sediment removal reestablished as described in section 4.5.2.2 General description of Mine Plans, Mining Methods, and Related Design Requirements.

The sedimentation pond, unless otherwise required by Federal or State law, will be completely removed and effected area reclaimed upon completion of mining and related activities and restoration of contributing drainage areas. Restoration criteria include a re-vegetation success determination as described by Section 5.3.2.6, Re-vegetation Success - Criteria and Evaluation Methods, and effective restoration of drainage characteristics such that the quality of untreated runoff from reclaimed areas is approximately equal to the quality of receiving drainages before the initiation of any mining activity as established by baseline water quality data.

Sedimentation pond reclamation will involve removal of any man-made discharge structures, removal and disposal of any riprap and bedding materials which will not be utilized in conjunction with re-establishment of postmining drainages, grading of embankment fill into pond basin areas, and re-grading associated disturbance areas to blend with surrounding reclaimed and undisturbed terrain. Replacement of soil/substitute materials and re-vegetation as described in Section 5.4.2.3, Reclamation Practices, will complete pond reclamation.

4.7.2.12 Impoundments and Associated Structures

CR does not propose any permanent impoundments within the mine or loadout areas. Upon restoration of disturbed areas, the sedimentation pond will be removed and associated disturbance areas reclaimed. In addition, all reclaimed areas will be re-graded to re-establish natural drainage patterns and eliminate any significant depressions which could impound water.

As described and referenced in Section 4.5.2.3, Mine Structures and Facilities, all impoundments will be designed and constructed with stable perimeter side-slopes, inlets, the tops of pond embankments, and embankment outslopes will be protected against erosion by vegetation or riprap as necessary. With the exception of downstream embankment slopes, all embankment areas will drain to the impoundment basins providing inherent sediment control. Runoff from downstream embankment slopes will be effectively limited by the semi-arid climate, minimal slope angles, and re-vegetation so that no additional sediment control will be necessary.

CR has developed a pond maintenance program designed to assure continued safe and effective operation of the Sediment Detention pond and surface water control system. The sedimentation pond will be inspected at regular intervals during construction and on completion of construction by a professional engineer or specialist experienced in impoundment construction. An impoundment inspection report certified by a Registered Professional Engineer will be provided to UDOGM promptly following each inspection. The report will verify construction in accordance with design plans and will note and discuss any apparent instability, structural weakness, or other hazardous conditions. A copy of the report will be retained on file at the mine site for inspection by authorized agency representatives.

Operation and Maintenance - Operation and maintenance of drainage and sedimentation control structures will involve periodic inspection of all ditches and culverts, quarterly inspection and annual certification of the impoundment and related structures, ongoing discharge monitoring for the impoundment, and any necessary maintenance or repair of problems noted during the inspections.

CR's ditch inspection and maintenance procedures will focus on identification and repair of any significant ditch erosion, removal of any trash or debris from ditches, and maintenance of an adequate cross-sectional flow area, regardless of actual ditch configuration, to pass the design flows. In practice this will mean that CR will not modify, recut, or clean out a ditch simply because the physical ditch dimensions are not the same as the original design or originally constructed configuration so long as the actual ditch configuration is adequate to pass the design flow. Since the ditches and culverts have been designed to a larger runoff event than is required by UDOGM regulations, there is excess capacity in the ditches and culverts. This approach allows for some siltation, and erosion without affecting the capacity of the ditches and culverts to carry the regulatory required flow. Culvert maintenance will involve removal of trash or debris from culvert inlets and any upgradient debris fences, repair of any significant erosion at culvert inlets, outlets, or of the cover material, and repair or replacement of any damaged culverts.

Sedimentation pond maintenance and operation procedures will include ongoing sampling and discharge monitoring under applicable provisions of a UDWQ permit; quarterly inspections of pond embankments, impoundment areas, discharge structures, and inlet/outlet structures and areas and reporting; notification of any hazardous conditions and development of emergency remedial control measures; maintenance or repair of any problems noted during the inspections; and the periodic removal of accumulated sediment. The sedimentation pond has been designed and will be operated and maintained to effectively retain storm runoff to allow settlement of suspended solids prior to discharge. Control of potential water quality impacts from pond discharge is monitored through compliance with applicable effluent standards under a UDWQ discharge permit. Effluent sampling and reporting will occur as outlined in Section 4.7.2.3, Water Monitoring Plan, and

under the provisions of the UPDES permit which will be included in Exhibit 2.1.3-1, Other Permits when it is received.

The sedimentation pond will be inspected quarterly by a qualified person for any indication of structural weakness or other hazardous condition, instability, and any erosion or other problems; the depth and elevation of any impounded water will be measured; based on the depth measurements storage capacity will be estimated; and any required structural monitoring will be performed. Copies of the quarterly inspection reports discussing each of the noted inspection categories and verifying that the pond has been constructed and maintained as designed will be prepared, certified by a qualified Registered Professional Engineer, and submitted promptly to UDOGM. Copies of the inspection reports will also be maintained on file at the minesite. Any minor problems noted during the inspection will be addressed in a timely manner. This may involve repair of any minor localized erosion, clean-out or minor repair of discharge structures, reseeding of embankment slopes, mowing weeds which may interfere with pond inspection, or other minor maintenance and repair as necessary. If the inspection identifies any structural weakness or other conditions which could pose a hazard to the public, the person who conducted the inspection will notify UDOGM promptly of the hazardous condition and any emergency procedures which may be appropriate to protect the public and address the hazardous condition. In consultation with and with approval from UDOGM, appropriate remedial measures will be implemented as soon as is reasonably practicable to address any hazardous condition.

CR has no plans for future construction of any additional ponds beyond that addressed in this mining and reclamation plan submittal. If changes in mine plans or effected areas dictate the necessity for additional sedimentation control structures, CR will evaluate requirements, complete the necessary designs, and submit the designs as technical revisions to the approved permit for UDOGM review and approval prior to initiating any construction work.

4.7.2.13 Spoil and Waste Disposal

As described in Section 4.5.2, Engineering Designs and Operating Plans, mining and related operations will not result in the generation of any excess spoil and, in fact, reclamation activities will be limited to backfilling and re-contouring utilizing the limited spoil materials available on the site. Plans for handling and disposal of non-coal wastes are presented in Section 4.5.2.3, Mine Structures and Facilities, under the subheading of Noncoal Waste Disposal. The specific handling and disposal methods described in the referenced permit sections will effectively protect ground and surface water resources by minimizing the potential for pollution or contamination from placement and handling of waste materials generated by mining and related operations.

4.7.2.14 Casing and Sealing of Wells

All exploration boreholes and any boreholes which have been converted to monitoring wells following completion of drilling within the Kinney Mine permit area will be plugged and sealed during mining reclamation. In the case of the boreholes, plugging and sealing will occur as soon as drilling, sampling, and logging operations are completed. In the case of

monitoring wells, the wells will be plugged and sealed when no longer needed for ongoing ground water monitoring. Standardized procedures for plugging and sealing are detailed in Section 4.6.2.1, Casing and Sealing Exploration Holes and Boreholes. Measures to plug and seal boreholes and water monitoring wells will minimize the potential for mixing of surface and ground water sources and will also limit the potential for communication and mixing between various but locally limited ground water aquifers.

4.7.3 Design Standards and Requirements

This section presents detailed information on the design standards and requirements which have been or will be utilized in the design, construction, operation, maintenance, and reclamation of drainage and sediment control structures and facilities for disturbed and undisturbed areas.

4.7.3.1 Sediment Control Measures

CR has designed and will construct, operate, and maintain drainage and sediment control structures to minimize erosion, control surface runoff, and prevent, to the extent possible, increased contributions of suspended solids to area drainages. By effectively accomplishing these objectives CR will also effect full compliance with all applicable discharge effluent limitations under any required UPDES discharge permit(s). Discussions of drainage and sediment control practices are presented in Section 4.5.2.1, General Description of Mine Construction and Development Activities and in Section 4.5.2.3, Mine Structures and Facilities, under the subheading of Drainage and Sediment Control Structures. In addition, a description of design methodology and all design calculations for drainage and sediment control structures to be constructed in the mine facilities area are presented in Exhibit 4.7.2.2-1, Runoff Control Design Details.

During construction, active mining operations, and reclamation, drainage from all disturbance areas will be effectively controlled by the drainage and sediment control network. To the extent reasonably feasible, runoff from undisturbed areas will be diverted and routed around the effected areas, and all disturbed area runoff will be intercepted and routed to a sedimentation pond except for the small area south of the main mine access road where alternate sediment control measures will be utilized. Operation of the drainage and sediment control network will effectively control disturbed area runoff and retain sediment from disturbed area runoff within mine disturbance areas. In addition to the engineered drainage and sediment control structures site specific drainage control and surface stabilization measures will be utilized on an as needed basis. These may include the use of temporary berms, straw bales, mulch, sediment traps, vegetative filters, silt fence, and other appropriate drainage localized drainage and sediment control measures.

Upon completion of mining and related activities, all disturbance areas will be reclaimed, with reclamation activities designed to restore drainage conditions and land use capabilities comparable to those existing prior to the Kinney mining related disturbance. Disturbance areas will be backfilled where necessary and re-graded to establish an undulating configuration with relatively short gradual slopes which will blend with surrounding undisturbed terrain. Re-graded surfaces will be left in a roughened condition to limit runoff and provide for an effective bond between the re-graded materials and subsequently placed topsoil. Reclamation will be completed by replacing available topsoil resources and re-vegetating disturbance areas to establish an effective vegetative cover which will

control runoff, erosion, and provide effective habitat and grazing/forage values for wildlife and domestic livestock.

4.7.3.2 Siltation Structures

The purpose of siltation structures is to prevent additional contributions of suspended solids from disturbed area watersheds to receiving drainages. Consistent with applicable regulatory requirements, siltation structures should represent the best control technology currently available and are intended to be constructed prior to initiation of any mining related disturbance within the contributing watershed. As described in Section 4.5.2.2, General Description of Mine Construction and Development Activities, CR will construct required drainage and sediment control structures as one of the initial development activities prior to other construction related surface disturbance. Generally, the downstream sedimentation pond will be utilized as the primary siltation structure and the design criteria and other requirements for the sedimentation pond will therefore be applicable as described in the following section. In the following case where routing of disturbed area drainage to the sedimentation pond is not practical, siltation structures will consist of appropriate alternative sediment control measures:

Outslope of Office Pad (Pad F) (see Map 4.7.2.1-2, Drainage and Sediment Control Plan – Disturbed Drainage Areas) - Siltation control for the outslope of Pad F and areas adjacent to the mine entrance will be achieved through the use of silt traps, vegetative matting and perimeter silt fencing which will intercept and contain runoff sediment. If vegetative matting and perimeter silt fencing prove inadequate to control erosional runoff, straw bales and/or additional silt fencing will be placed on contours to further better local silt movement.

4.7.3.3 Sedimentation Ponds

One sedimentation pond will provide effective sediment control for the Kinney mine facilities disturbance areas. This pond is located near the north end of the mine facilities Loadout Pad (Pad C) as shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas and is located as close as possible to the contributing disturbance area(s). The proposed sedimentation pond is not located within the floodplain of any perennial streams as documented by the classification of streams within the permit areas described in detail in Section 3.7, Hydrology Information.

The sedimentation pond has been designed to be constructed to provide adequate storage for anticipated sediment contributions from contributing drainage areas. Sediment storage calculations reflect the maximum anticipated disturbance acreage for each drainage area over the mine life. The design also reflects a basin capacity sufficient to retain the flood routed volume equal to the runoff resulting from a 10-year, 24-hour storm event. Design calculations are presented and design methodology for the sedimentation pond are discussed in Exhibit 4.7.2.2-1, Runoff Control Design Details. Generally, mining and related activities will result in the direct hydrologic impacts associated with initial site disturbance and facility construction but will not result in significant further changes in hydrologic conditions for disturbed area drainages. Runoff from undisturbed areas will be diverted around or under disturbance areas and is not considered in sedimentation pond design.

The pond has been designed to provide a minimum detention time of 24 hours, and longer if necessary, to meet applicable effluent limitations with respect to TSS. Pond outlet structures

are sized to control pond discharge rates so that adequate detention times are maintained. Inflow to the sedimentation pond will be routed through the pond and discharged through the outlet structure. The principal/emergency spillway structure is designed to pass the peak flows resulting from a 100-year, 6-hour storm event.
The discharge structure for the sedimentation pond is sized based upon calculated flows for the design storm events. Invert elevations for principal spillways are set above design sediment levels and the pond is designed with adequate freeboard consistent with applicable regulatory requirements. CR has designed the sedimentation pond to minimize the potential for short circuiting, and constructed it so that the primary outlet structure is located as far as possible from pond inlets. The pond outlet structure is also specifically designed to insure adequate retention time, prevent short circuiting, and minimize erosion with vegetation or riprap lined spillway and discharge channels as appropriate based on discharge flow velocities.

Pond design for the Kinney mine facilities have been developed under the supervision of a qualified Registered Professional Engineer. Consistent with applicable regulatory requirements, construction of the pond will be certified by a Registered Professional Engineer. Pond certifications for the new pond will be included as an appendix to Exhibit 4.7.2.2-1, Runoff Control Design Details.

Pond construction will also be consistent with applicable regulatory construction requirements. Foundation areas will be cleared, soil and incorporated vegetative materials removed, and foundation areas graded prior to embankment construction. Embankments will be constructed of materials specifically selected to exclude vegetation, roots, frozen soil, coal or other unsuitable materials. The selected embankment fill materials will then placed and compacted in a controlled manner in thin horizontally continuous lifts. As previously noted, embankments will be designed and constructed to provide a minimum of one (1) foot of freeboard between the emergency spillway design flow level and the top of the embankment. Actual embankment construction height (except for excavated portions) will be increased by approximately 5 percent to allow for any potential settlement, and upstream and downstream embankment slopes will be established at slopes no greater than 2H:1V. Upon completion of construction, all embankment slopes as well as exposed basin areas will be graded, scarified and seeded to stabilize the slopes, prevent erosion, and establish an effective vegetative cover.

The sedimentation pond will be completely removed and effected areas reclaimed upon completion of mining and related activities and restoration of contributing drainage areas. Pond reclamation will occur following a determination by UDOGM of re-vegetation success and hydrologic restoration. Sedimentation pond reclamation will involve removal of any man-made discharge structures, removal and disposal of any riprap and bedding materials which will not be utilized in conjunction with re-establishment of post-mining drainages, grading of embankment fill into pond basin areas, and re-grading associated disturbance areas to blend with surrounding reclaimed and undisturbed terrain. Replacement of soil/substitute materials and re-vegetation will complete pond reclamation.

As shown in Figure 4.7.2.2-1, Pond 1 Stage-Volume Curve, the sedimentation pond has an embankment height and storage volume of 8 feet and 4.82 acre-feet respectively, and therefore does not fall within the jurisdiction of the State Engineer requiring additional regulatory submittals. Pond 1 is therefore designated an MSHA pond and will be inspected on a quarterly basis at a minimum for structural weakness, erosion and other hazardous conditions. Consistent with applicable regulations, UDOGM will be notified of any hazardous

conditions. Should any such conditions be identified, remedial measures will be initiated and appropriate modifications will be completed in a timely manner.

4.7.3.4 Impoundments

The sedimentation pond described in the preceding section is the only impoundment which will be utilized for drainage and sediment control purposes in conjunction with the Kinney mining and related operations. Applicable regulatory requirements for impoundments essentially duplicate the specified requirements for sedimentation ponds addressed above. Given limited pond size and capacity, the minimum design freeboard of 1 foot is more than adequate to resist overtopping of the embankment due to wave action or sudden increases in inflow.

4.7.3.5 Discharge Structures

Flow rates and velocities for temporary diversion ditches and discharge calculations for the sedimentation pond outlet are presented in Exhibit 4.7.2.2-1, Runoff Control Design Details. Where specific constraints imposed by the natural terrain result in steeper gradients, flows may exceed five feet per second and placement of riprap and bedding material may be necessary to limit flow velocities, assure channel stability, and prevent any significant erosion. Design calculations include information on riprap sizing where required and the descriptive text in Exhibit 4.7.2.2-1, Runoff Control Design Details addresses standard procedures to be utilized in placing and securing riprap and bedding materials, and can be seen on Map 4.7.2.2-2, Runoff Control Details.

Generally, discharge structures have been designed at minimum gradients to limit discharge flow energy. Any potential for erosion at the outflow of discharge structures will be effectively controlled by placement of riprap and bedding materials in an apron configuration at the outflow. Generally, once the initial discharge energy is dissipated in these apron areas, erosion from the discharge flow will not be a problem since most receiving drainages have established a stable bed configuration and most drainages are effectively armored by exposed cobble and gravel materials. Because of limited space, grouted riprap has been utilized where hydraulic calculations show the need for ditch erosion control. Riprap aprons have also been utilized to dissipate energy as undisturbed area flows exit culverts west of Highway 96. Use and placement of riprap and bedding materials as designed herein should provide adequate channel protection and erosion control.

4.7.3.6 Other Treatment Facilities

Other than the sedimentation pond and alternative sediment control measures discussed in the preceding sections, no additional treatment facilities will be necessary or will be utilized to provide effective drainage and sediment control and meet applicable discharge effluent limitations.

4.7.3.7 Diversions

Temporary diversion ditches will be constructed and maintained to intercept and route drainage from undisturbed areas around the area of surface disturbance. As described in this section, these ditches have been designed and will be constructed to minimize potential contributions of suspended solids to surface water flows. These diversion structures are designed at the minimum allowable gradient given the topographic configuration and channel configuration and lining reflect erosion control considerations as dictated by calculated flow velocities.

All temporary diversion structures are designed and constructed to pass the peak runoff from a precipitation event with at least a two year recurrence interval with a minimum of 0.5 feet of freeboard. Ditch configuration, gradient and lining requirements reflect hydrologic design calculations and will be effective in preventing erosion and minimizing additional contributions of suspended sediment to runoff flows. Design methodology and hydrologic calculations for the new temporary diversion structures in the mine facilities area are presented in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Temporary diversion ditches in disturbed areas are designed to safely pass the peak discharge from the 10-year, 6-hour storm event. All diversions have been designed and will be constructed to remain stable under design flow conditions. Calculated flow velocities based on channel configuration, slope and flow volume have been utilized as the basis for design of either vegetative channel linings or specification of riprap and bedding materials to assure channel stability. Locations of all temporary diversions are shown on Map 4.7.2.1-1, Drainage and Sediment Control Plan Map – Undisturbed Drainage Areas , and on Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas. Design calculations for the mine facilities area are included and design methodologies discussed in Exhibit 4.7.2.2-1, Runoff Control Design Details.

Upon completion of mining and related activities all temporary diversions will be removed (with the exception of ditches DE-2, and DE-3) and the effected lands reclaimed when no longer required for sediment control. Ditches DE-2 and DE-3 will remain to divert and control runoff and from the reclaimed areas into the sediment pond. Ditches De-2 and DE-3 will be reclaimed along with the sediment pond. When it occurs, reclamation will consist of full or partial filling of the diversion ditches with material from adjacent areas consistent with the design post mining drainage configuration, grading to blend ditch areas with surrounding terrain, replacement of available soil/substitute materials, and reseeding.

None of the planned diversions will drain into underground mines. The potential for subsidence will generally be limited and is not expected to impact surface structures. Because of location, there is no potential for drainage from Mud Creek to enter underground workings. In addition, upon completion of mining and related activities, CR will seal and backfill the mine portals and other mine openings to prevent any significant exchange between surface and ground water systems. Details of portal sealing are discussed in Section 5.4.2.2, Reclamation Plan, under the subheading of Stabilization and Sealing of Mine Openings.

4.7.3.8 Road Drainage

All roads have been designed to be constructed, operated, and maintained to provide for effective control of drainage from road surfaces, associated cuts and fills, and other related

areas. Road construction in perennial and intermittent streams has been avoided except where a road crossing for UDC-1 was necessary, and road alignments and designs minimize the potential for downstream sedimentation or flooding and uncontrolled drainage over the road surface.

Road designs incorporate grading or crowning to promote effective drainage off the road surface, road surfaces will generally be protected from erosion and damage by appropriate surfacing materials and regular maintenance, roadside ditches have been designed to effectively collect and convey runoff from road areas, and culverts are provided where appropriate to convey drainage flows under or around designed roads. All road ditches and culvert structures have been designed to pass the flows from the 10-year, 6-hour storm event. Road culverts have been located and sized to avoid plugging or collapse and culvert installations will incorporate inlet and outlet protection and trash racks as appropriate to minimize both plugging and erosion. Roads, ditches, and associated culverts are shown on Map 4.7.2.1-2, Drainage and Sediment Control Plan Map – Disturbed Drainage Areas.

Flows from the 100 year, 6 hour storm were used to check the design capacity of undisturbed area drainage road ditches UDD-1 and UDD-2. In fact, the design is slightly conservative for UDD-1 since the area used also includes that area tributary to UDD-2. In a similar fashion, the design for UDD-2 is conservative since it also includes flows from the area tributary to UDD-1. Details regarding ditch design are provided within Section 4.7.2.1.

4.7.3.9 Disposal of Excess Spoil

As described in Section 4.5.2, Engineering Designs and Operating Plans, mining and related operations will not result in the generation of any excess spoil and, in fact, reclamation activities will be limited to backfilling and re-contouring utilizing the limited spoil materials available on the site. The provisions of Rule R645-301-745 are, therefore, not applicable.

4.7.3.10 Coal Mine Waste

No coal mine waste is projected to be generated as part of the Kinney Mine operation.

4.7.3.11 Disposal of Noncoal Waste

As described in Section 4.5.2.3, Mine Structures and Facilities, under the subheading of Noncoal Waste Disposal, noncoal wastes generated as a result of mining and related operations will be collected in either closed containers or suitable temporary storage areas for pick-up and either salvage or off-site disposal by independent contractors. CR will assure that noncoal wastes are properly stored and handled and that disposal is in a suitable permitted landfill facility.

4.7.3.12 Water Quality Standards and Effluent Limits

Discharges of water from areas disturbed by coal mining and reclamation activities will be in compliance with all applicable Utah and Federal water quality laws and regulations. Additionally, discharges will comply with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency as set forth in 40 CFR Part 434.

Water quality standards and effluent limitations for discharges from the Kinney Mine permit area will be regulated by the UDWQ under the terms of UPDES discharge permit(s) for the Kinney Mine. As part of the mine permitting process, CR will prepare and submit a discharge permit application to the UDWQ for review and approval. Following approval, a copy of the UPDES Permit will be provided to UDOGM for insertion in Exhibit 2.1.3-1, Other Permits. Compliance with applicable UPDES effluent limitations will involve diversion of runoff from undisturbed areas around areas effected by mining operations, collection of disturbed area runoff which will be routed through the sedimentation pond prior to discharge, other localized drainage and sediment control measures, reclamation practices designed to effectively restore effected areas, and implementation of a comprehensive ongoing discharge monitoring program to verify compliance.

Drainage from mine and loadout areas, after retention in the sedimentation pond, is not anticipated to exceed applicable effluent limitations or any other Federal or State water quality limitations or standards. No acid or toxic mine drainage is anticipated from surface runoff and no mine drainage discharge is anticipated.

4.7.3.13 Casing and Sealing of Wells

All exploration drillholes established by CR within the Kinney Mine permit area will either be completed as monitoring wells or sealed following completion of drilling, sampling, and logging. Well completion methods are described in Section 4.1.2.5, Completion as Ground Water Monitoring Wells, and in Figure 4.1-1, Typical Well Completion Diagram. Similar to exploration drillholes, monitoring wells will be plugged and sealed when they are no longer needed for ongoing ground water monitoring activities. Standardized procedures for plugging and sealing are detailed in Section 4.6.2.1, Casing and Sealing Exploration Holes and Boreholes. Measures to plug and seal boreholes and water monitoring wells will minimize the potential for mixing of surface and ground water sources and will also limit the potential for communication and mixing between various ground water aquifers.

4.7.4 Probable Hydrologic Consequences Determination

In order to assess the probable hydrologic consequences of the planned mining and related activities CR has reviewed and evaluated all available information on baseline hydrologic conditions as presented and described in Section 3.7, Hydrologic Information, in order to accurately characterize the existing surface and ground water environments. Within the context of the existing hydrologic conditions, CR then considered potential hydrologic impacts, both positive and negative, which could occur as a result of the planned mining and related activities based on the operation and reclamation plans presented in Section 4.0, Operating Plans and Design Criteria, and Section 5.0, Reclamation Plans. Both direct and indirect mining related impacts were identified and evaluated and the effectiveness of operational protection and control measures and reclamation activities in mitigating potential impacts were considered in the assessment of probable hydrologic impacts. The following sections present summary descriptions of the probable hydrologic consequences of the planned Kinney mining and related activities.

4.7.4.1 Summary of Baseline Conditions

Detailed discussion of surface and ground water occurrence, quality, use, and relationships is presented in Section 3.7, Hydrologic Information. The following briefly summarize general

surface and ground water conditions as a reference for the discussions of probable hydrologic consequences which follow in the subsequent sections.

Ground Water Baseline Conditions

Ground water resources in the permit and adjacent areas are limited in both extent and quantity. Ground water occurrences are limited to; 1) Shallow alluvial/colluvial valley fill deposits in valley areas west of the mine and in area drainages overlying mining zones east of the surface disturbance area; 2) Potential perched ground water occurring in thin laterally discontinuous sedimentary units in the Blackhawk Formation; 3) Ground water which has accumulated over time in existing underground mine workings; and 4) a regional water table aquifer occurring in the deeper portions of the Blackhawk Formation and extending into the underlying Star Point and Mancos Formations.

Ground water movement is limited by generally low transmissivities, the lack of significant secondary permeability, and limited recharge due to arid conditions, limited outcrop exposures, and relatively mountainous terrain. While volumes of water may have accumulated over time in abandoned underground mine workings, mine inflow rates are expected to be relatively low.

Only limited ground water quality data is available due to the general dry nature of the explored geologic units. Data from Sulfur Spring, Angle Spring and Well CR-06-03-ABV show similar calcium bicarbonate water qualities (see Map 3.7.2.4-1, Regional Water Quality), a moderately alkaline pH, and moderate to low TDS concentrations. Ground water use is limited to isolated use of perched ground water issuing from springs or seeps for stock watering.

Surface Water Baseline Conditions

Other than Mud Creek and Scofield Reservoir, surface water resources in the permit and adjacent areas are limited. The principal perennial drainages located adjacent to the permit area include; 1) Mud Creek, the principal drainage in this area and Miller Canyon, both tributary to Scofield Reservoir. Some intermittent and ephemeral drainages occur within the permit area, most if not all of which normally exhibit flow only in response to spring snowmelt and high intensity thunderstorms.

Surface water quality is typical of mountainous regions of the western United States exhibiting chemical characteristics including calcium bicarbonate types with neutral to moderately alkaline pH, and moderate to moderately high TDS and TSS values. It is believed that water quality within Mud Creek is influenced by surface mine operations and mine discharges within Eccles Canyon. Seasonal flow increases or peak flow resulting from storm events tend to dilute geochemical constituents concentrations while during low flow periods these concentrations tend to increase. Surface water uses in the general area are mostly used for agricultural and recreational use, however surface waters are also used downstream for culinary and industrial purposes. All surface water use is outside the permit area boundaries. More information on surface water resources is presented in Section 3.7.3, Surface Water Information.

4.7.4.2 Potential for Adverse Impacts

Surface and ground water hydrologic systems may potentially be impacted by mining, processing, and related operations. These impacts are not expected to be significant, will not effect either surface or groundwater users, and are expected to be localized and temporary in nature. Operational mitigation measures and reclamation of disturbance areas will result in effective restoration of surface and ground water conditions similar to those existing prior to initiation of the Kinney mining and related disturbance.

Ground Water Consequences

CR's planned mining, processing, and related activities have the potential to cause localized and temporary impacts to ground water. These potential, although likely limited ground water hydrologic consequences include:

- Alterations of local ground water flow patterns
- Drainage of seeps/springs
- Alterations of recharge/storage/discharge relationships
- Localized increases in concentrations of TDS and certain individual chemical constituents

Mining related probable hydrologic consequences for ground water resources in the Kinney Mine permit area will be limited by the lack of significant ground water recharge in the area, the general lack of ground water identified during exploratory drilling, the presence of low permeability geologic strata between the coal seams to be mined and the ground surface, the general lack of significant regional ground water movement due the absence of well defined regional aquifers, and very limited beneficial ground water use in the permit and adjacent areas. Probable ground water consequences are discussed in the following sections.

Alterations to Ground Water Flow Patterns - Although mining is not expected to enter a regional aquifer system, alterations of ground water flow patterns will occur as a result of underground mining excavation and consequent drainage of localized perched aquifer systems resulting from subsidence fracturing. Mining operations therefore have the potential to induce ground water flow into the underground workings as the hydrologic system adjusts to mining. A shift in ground water flows toward the mine workings will occur when perched aquifers are intercepted, thus altering existing ground water storage and flow patterns. This may result in partial or full drainage of the perched aquifers and may affect the discharge of springs and seeps. Impacts on perched aquifers and associated springs and seeps due to secondary subsidence effects are not expected to be significant since only very limited ground water was encountered during exploratory drilling, and the perched aquifers are believed to be very limited in aerial extent. Captured flows will thereafter flow down dip within the mine, and serve as a source of recharge within mined sections to the adjacent environment.

Upon completion of operations and final mine reclamation and closure, it is expected that the underground workings may partially fill with water encountered during mining, resulting in the re-establishment of a stable and ongoing hydrologic environment. No significant changes (if any) in the regional potentiometric surface are expected to occur since the regional ground water aquifer is believed to be below target mining zones. Reductions in the quantity and availability of ground water as a result of alterations to the ground water

flow patterns are expected to represent only a minor percentage of total ground water flows within the region or basin and will be limited in areal extent.

In addition, reductions in groundwater flows are not expected to adversely impact ground water users since, as is shown on Figure 3.7.2.5-1, Ground Water Right Locations, there are no ground water rights shown in the vicinity of the mine permit area. Primary beneficial ground water uses in the vicinity of the permit area are all concentrated along the south eastern shoreline of Scofield Reservoir, and likely take water from the shallow ground water - surface water interface adjacent to the reservoir. With stratigraphic units dipping to the east, these locations are effectively hydraulically isolated from potential mining impacts. Potential impacts to springs and seeps discharging from the perched aquifer system are discussed below.

Drainage of Seeps and Springs - Kinney No. 2 Mine mining activities may result in some drainage and dewatering of overlying perched ground water aquifers as a result of vertical seepage through mining related fractures. Consequently, springs and seeps discharging from the stratigraphic units containing the perched ground water may be effected. CR will attempt to minimize fracturing to the extent possible while maximizing recovery of available coal resources. Fracturing will be controlled through the maintenance of barrier pillars, limiting extraction to first or development mining, and proper mining and roof control design and operations practices. Effective control of fracturing will limit stress on the overlying strata and the consequent potential for drainage through fractures. Additional discussion of potential mining effects is presented in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, under the subheading of Subsidence Control.

If discharge from seeps or springs is documented to decrease below historic conditions as a result of mining related activities, CR will mitigate these impacts through the purchase of and subsequent augmentation of effected water rights, monetary compensation, development of alternative watering facilities such as guzzlers, or other appropriate mitigation measures.

Alterations to Recharge/Storage/Discharge Relationships - CR's planned mining, processing, and related activities are not expected to have any significant long-term effect on recharge, storage, or discharge relationships. As described in Section 3.7, Hydrology Information, recharge within the ground water basin occurs primarily as a result of direct precipitation and infiltration. CR's operations are both limited in areal extent and are not located within any major recharge area, nor are mining operations expected to interfere with existing stored mine water in adjacent abandoned mines. Upon completion of operations and mine reclamation and closure, ground water will accumulate in the mine workings, thereby increasing localized ground water storage. Discharge relationships are also expected to be minimally effected with some temporary reduction in downgradient ground water flows during filling of the underground mine workings and re-establishment of a hydrologic balance, as well as localized alterations in ground water flow patterns. The quantity of ground water discharge which will be effected is a relatively small percentage of the total volume within the ground water basin.

Increases In Chemical Constituents - As ground water encounters freshly exposed subsurface materials in the mine, oxidation and weathering will cause changes in ground water chemistry including increases in TDS and the concentrations of individual chemical constituents. Over time these increases will stabilize and start to decrease as available soluble chemical constituents are depleted and chemical concentrations in the mine water and the exposed rock reach equilibrium. Any filling of the mine workings by perched ground

water would also have a beneficial water quality effect, displacing oxygen and reducing the oxidation potential in any flooded abandoned workings.

As described in Section 3.7, Hydrology Information, ground water in both the Kinney Mine permit and adjacent areas is a calcium bicarbonate chemical type. Increases in both sodium and sulfate may occur within the mine, although they are not expected to change the ground water type. While various chemical constituents of the ground water may increase as a result of mining, these increases will not effect ground water use. Due to the limited volume of ground water drainage relative to total flows within the ground water basin, minor changes in ground water chemistry and levels of certain constituents are not expected to significantly effect overall ground water quality.

Surface Water Consequences

CR's planned mining and related activities have the potential to generate temporary impacts to surface water resources. These impacts will typically be localized, being confined to those segments of area drainages directly impacted by mining activities, although in some cases impacts may have the potential to also effect downstream drainage areas. The primary mining related activities which may specifically impact surface water resources include:

- Temporary increases in runoff from surface disturbance areas
- Minor reductions in surface flows and alteration of surface flow patterns due to operation of the sedimentation structure
- Changes in surface water chemistry
- Increases in the levels of TDS, TSS, and certain individual chemical constituents

In general, probable hydrologic consequences for surface water resources resulting from CR's mining operations will be limited by the relatively small surface disturbance area near the town of Scofield, and will be effectively mitigated by operation of the drainage and sediment control system and ultimate reclamation of mine disturbance areas. Section 4.5.1.5, Affected Areas and Timing of Disturbance, describes the extent of proposed mining related surface disturbance. Probable surface water impacts and their significance relative to the hydrologic system are discussed in the following sections.

Temporary Increases in Runoff from Surface Disturbance Areas_- Proposed new mining related surface disturbance will be limited to the mine facilities areas and will involve removal of vegetation and soil/substitute materials and grading of disturbance areas for specific mining related uses. These disturbance activities will reduce infiltration potential and evapotranspiration due to elimination of vegetation and will increase surface runoff and erosion potential. In order to effectively control erosion and increased runoff from disturbance areas, CR will divert runoff from undisturbed upgradient areas around the area of mining disturbance, grade disturbance areas to minimize runoff and erosion, and collect runoff as close as possible to its source and route it to a sedimentation pond for retention and settlement of suspended solids prior to discharge to natural drainages. CR will control and mitigate potential increased runoff from surface disturbance areas using a number of commonly accepted surface management and drainage control practices. Specifically, disturbed areas will be graded to minimize runoff and to the extent operationally feasible surface flow velocities will be controlled through the use of appropriate surfacing materials and runoff will be collected as close to disturbance source areas as possible to minimize erosion and increased sediment loading.

In addition to specific drainage control practices, CR will effectively minimize the area of surface disturbance by keeping all surface facilities within a relatively limited area. Provisions for minimizing mine related surface disturbance are detailed in Section 4.5.1.5, Affected Areas and Timing of Disturbance. Increases in runoff from disturbance areas may result in minor increases in stream flows for the receiving drainages, however, any increases will not be significant given the very limited area of surface disturbance relative to total drainage basin areas for the potentially effected drainages. Potential flow increases will also be partially mitigated by operation of the sedimentation pond which will retain disturbed area runoff providing some buffering effect.

As documented in Section 4.7.2.1 and on Figure 4.7.2.2-1, Pond 1 Stage-Volume Curve, total runoff volume for the 10-year, 24-hour storm event for mine facilities disturbance areas is approximately 2.03 acre feet (3.15 acre-foot – 1.12 acre-feet sediment storage). Comparing this runoff volume with a calculated total average annual runoff volume of 6,500 acre feet for the receiving drainage of Mud Creek, it is evident that total runoff from the disturbed area, even under storm conditions, constitutes a relatively small portion of total watershed runoff.

On completion of mining operations, disturbed areas will be reclaimed. Reclamation will involve backfilling and grading, re-establishment of natural drainage patterns, soil/substitute replacement, and re-vegetation. It is anticipated that reclamation will effectively restore infiltration and runoff patterns to approximate the baseline conditions currently existing for the surface disturbance areas.

Minor Reductions in Surface Flows and Alteration of Surface Flow Patterns Due to Operation of the Sedimentation Structure - Although sedimentation ponds are integral to mitigating mining related impacts on the surface hydrologic system, operation of sedimentation ponds tends to reduce discharge flow volumes and extend the period of effective flow for runoff from both snowmelt and thunderstorm events. In effect, sedimentation ponds function as limited capacity flood control structures reducing the effective discharge rate for large volume flows through temporary storage and flow routing. The sedimentation pond is designed to gradually release impounded runoff following required retention for sediment control. Given provisions for retention and gradual discharge of retained storm flows, most of the runoff is returned to the surface drainage system with only a short lag time corresponding to the design retention time for the pond.

Operation of the drainage and sediment control network, and specifically the sedimentation pond that retain runoff from disturbance areas, has the potential to alter flow patterns in receiving drainages. Because the Kinney Mine operations are located in a relatively arid climate, runoff contributions to most of the drainages occur only as a result of snowmelt and large storm events. As previously noted, the retained runoff volume for the sedimentation pond represents a relatively small percentage of normal flow volumes for the receiving drainage, and should not adversely impact flow volumes even during low flow periods. Additionally, operation of the sedimentation structure will not result in significant discharge delays since the maximum design detention time is only 24 hours for the design storm runoff volume and discharge will be occurring continuously once the pond level reaches the discharge orifices.
The pond has been designed such that discharge structure is above the design sediment level and any runoff accumulations in the pond below this discharge elevation will be retained in the pond as dead storage (note that dead storage will not effect pond capacity since the design sediment storage capacity is being utilized for dead storage). Similar to the pond capacity comparison discussed previously, the design sediment storage volume available for temporary runoff storage represents a negligible amount relative to area stream discharge volumes and so does not constitute a significant potential flow reduction.

Changes in Surface Water Chemistry - Exposure of surficial materials by mining related surface disturbance and contact of disturbed area runoff with these materials may result in changes in runoff water chemistry. Surface water in the mine area is almost exclusively a calcium bicarbonate type. The most probable potential change in runoff water chemistry would be a shift from a strong calcium bicarbonate type toward a sodium sulfate type due to the weathering and leaching of exposed surface coal materials.

CR's proposed surface drainage and sediment control measures, specific limitations on total surface disturbance, and the collection of disturbed areas runoff as close as reasonably feasible to the disturbance source area, will be effective in limiting runoff exposure to surficial materials and consequent leaching. The fact that none of the materials which will be exposed, including overburden, soils, coal refuse, and mine waste materials, have been conclusively documented to be potentially acid or toxic forming is an important factor which will also limit the potential for any significant changes in surface water chemistry. While minor changes in runoff water chemistry may occur as a result of mining and related operations, limited surface disturbance areas and corresponding limited disturbed area runoff volumes will minimize any potential for significant changes in water chemistry for the receiving drainages since disturbed area runoff flows will be buffered by significantly greater volumes of normal runoff from adjacent drainage basin areas.

Increases in the Levels of TDS, TSS, and Individual Chemical Constituents - Similar to the potential mining related impacts discussed above relative to surface water chemistry, contact between disturbed area runoff and surficial materials exposed to weathering and oxidation, may result in increases in TDS and individual chemical constituents in surface runoff flows. In addition, one of the natural consequences of surface disturbance and the minor erosion which results will be increases in sediment loading and TSS levels for the disturbed area runoff. Surface water in the mine area is generally neutral to moderately alkaline with low to moderate levels of TDS, TSS, sulfate, iron, and phenols. Mining and related activities will probably not result in any significant change in surface water pH although TDS, TSS, and sulfate levels may increase slightly in the disturbed area runoff. The same considerations and mitigation measures previously discussed for potential changes in surface water chemistry are also applicable for potential increases in TDS and individual chemical constituents. Potential increases in TSS levels will be effectively addressed on a short-term basis by establishment and operation of the drainage and sediment control system and compliance under the required UPDES permits with applicable monitoring requirements and discharge effluent limitations. Reclamation and restoration of effective surface drainage conditions will address all potential mining and related surface water impacts over the long-term.

4.7.4.3 Presence of Acid or Toxic Forming Materials

Not applicable to Kinney Mine because no waste materials – incidental roof and floor rock- will be shipped out with the coal.

4.7.4.4 Contamination, Diminution, or Interruption of Ground or Surface Water Sources with Current Beneficial Use Within the Permit and Adjacent Areas

Within the Kinney Mine area, only the off-site alluvial/colluvial aquifer system and the perched aquifer systems yield adequate quantities of ground water of suitable quality for

beneficial use, and use within the permit area is limited to small scale seasonal stock watering. As discussed in Section 3.7, Hydrology Description, under the subheading Water Rights and Replacement, and in Section 4.7.4.2, Potential for Adverse Affects, CR's mining and related operations are not expected to adversely impact any surface or ground water rights. Consequently, there is no need to explicitly address provisions for replacement of impacted water rights at this time. In the unlikely event, however, that proximate contamination, diminution, or interruption does occur, CR will mitigate these impacts through the purchase and augmentation of effected water rights, monetary compensation, development of alternative watering facilities such as guzzlers, or other appropriate mitigation measures. The amount of water owned by CR is believed adequate to mitigate any potential impacts to beneficial water use as a result of potential consequences to the hydrologic balance. The primary postmining land use in the mine, loadout, and adjacent areas will be wildlife habitat, requiring minimal supporting water requirements, consistent with existing demands. The discussions presented in Section 3.7, Hydrology Information, indicate that while surface and ground water resources are limited in areas affected by the Kinney Mine operations, they will be adequate in terms of both quantity and quality to support the proposed postmining use.

4.7.5 Cumulative Hydrologic Impacts

Ground water impacts resulting from the planned mining and related activities will be minimal due to limited ground water occurrence, low overall permeabilities and consequent limitations on the effective area of influence, and the lack of beneficial ground water use in the area. Similarly, surface disturbance associated with the Kinney mining and related operations will involve such a small area that potential mining related surface water impacts will be negligible. Any potential surface water impacts will be effectively mitigated through effective control of mine water supply withdrawals, operation of a comprehensive drainage and sediment control system, compliance with applicable monitoring requirements and discharge effluent standards under the required UPDES permits, and reclamation of surface disturbance areas and restoration of surface drainage characteristics. In order to fully evaluate potential hydrologic impacts, the cumulative impact of any mining related ground or surface water impacts when combined with potential impacts resulting from other development or land use activities must be considered. Utilizing the information presented in this mining and reclamation plan submittal along with other available information for the general mine area, UDOGM will complete a Cumulative Hydrologic Impact Assessment (CHIA), which on completion will be inserted in Exhibit 4.7.5-1, Hydrologic Information.

A cumulative impact area for evaluation of potential cumulative ground water impacts will include the permit area along with any upgradient areas which could be impacted by mining related drawdown and downgradient areas which could be impacted by any mining related changes in ground water flow or quality. Given the characteristic low permeability of the geologic sequence, the limited volume and flow of ground water, and the downward dip of the geologic units to the north-east, the ground water cumulative impact area can be defined by the surface disturbance area associated with the mine on the west, UP canyon on the south, Miller Canyon on the north, and Eagle Canyon on the east. Beyond that distance, we believe impacts would be undeterminable. Other activities which could result in possible contributing ground water impacts within this area are believed to be limited to possible contributions from existing abandoned underground mine working in the area.

A cumulative impact area for evaluation of potential cumulative surface water impacts will include the permit and adjacent areas and downstream waters which could be impacted

by mining related changes in surface water flows or quality. Given these constraints and the nature of general surface drainage patterns in the area, the surface water cumulative impact area can be defined as a boundary extending on the west from Scofield Reservoir to Eagle Canyon on the east, and from UP canyon on the south to Miller Canyon on the north. There are a number of activities within the cumulative impact area which could result in potential contributing surface water impacts including public access to wildlife and fishing areas, community impacts from the Town of Scofield, private cattle operations and recreation within Eagle, Miller, and other tributary canyons, railroad operations that run along the western border of the permit area, surface runoff contributions from U.S. Highway 96, and mine discharge and surface runoff from historical mining operations in the area.

TABLE 4.7.2.2-1 - Ditch Design Details

Drainage Ditch	10yr-6hr Design Flow (cfs)	Side Slope m1 (H:1)	Side Slope m2 (H:1)	Ditch Slope Max (%)	Ditch Slope Min (%)	Manning's n	Max Velocity (fps)	Flow Depth (ft)	Freeboard (ft)	Minimum Ditch Depth[1] (ft)	Bottom Width (ft)	Top Width (ft)	Riprap D_{50}[2] (inches)	Grout (yes/no)
DA-1	0.6	2	2	14.0	5.0	0.02	6.64	0.32	0.48	0.8	0.0	3.2	0.25	Yes
DC-1	1.0	2	2	0.5	0.5	0.02	1.90	0.32	0.48	0.8	1.0	4.2	n/a	n/a
DC-2	2.9	2	2	15.0	0.6	0.02	8.68	0.52	0.48	1.0	1.0	5.0	0.25	Yes
DC-3	2.9	2	2	0.8	0.8	0.02	3.05	0.48	0.52	1.0	1.0	5.0	n/a	n/a
DC-4	1.0	2	2	9.3	9.3	0.02	5.86	0.29	0.51	0.8	0.0	3.2	0.25	Yes
DC-5	2.9	2	2	0.8	0.8	0.02	3.01	0.49	0.51	1.0	1.0	5.0	0.25	Yes
DC-6	3.5	2	2	12.3	12.3	0.02	8.88	0.44	0.46	0.9	0.0	3.6	0.25	Yes
DD-1	0.2	2	2	3.8	3.8	0.02	2.8	0.19	0.51	0.7	0.0	2.8	n/a	n/a
DD-2	0.2	2	2	13.0	13.0	0.02	4.44	0.15	0.55	0.7	0.0	2.8	0.25	Yes
DD-3	0.3	2	2	3.8	3.8	0.02	3.10	0.22	0.48	0.7	0.0	2.8	n/a	n/a
DE-1	0.6	2	2	0.9	0.9	0.02	2.15	0.37	0.53	0.9	0.0	3.6	n/a	n/a
DE-2	0.2	2	2	2.0	2.0	0.02	2.18	0.21	0.49	0.7	0.0	2.8	n/a	n/a
DE-3	4.1	2	2	1.0	1.0	0.02	2.55	0.53	0.47	1.0	2.0	6.0	n/a	n/a
DE-4	4.2	2	2	1.0	1.0	0.02	2.57	0.53	0.47	1.0	2.0	6.0	n/a	n/a
DF-1	0.4	2	2	14.3	3.3	0.02	5.47	0.25	0.55	0.8	0.0	3.2	0.25	Yes
DF-2	0.4	2	2	6.1	6.1	0.02	3.97	0.22	0.48	0.7	0.0	2.8	n/a	n/a
DF-3	1.3	2	2	10.0	10.0	0.02	6.42	0.32	0.48	0.8	0.0	3.2	0.25	Yes
DF-4	1.7	2	2	5.7	5.7	0.02	5.56	0.39	0.51	0.9	0.0	3.6	0.25	Yes
DF-5	1.7	2	2	5.7	5.7	0.02	5.56	0.39	0.51	0.9	0.0	3.6	0.25	Yes
UDD-1	9.4[3]	50	4	7.0	7.0	0.02	5.18	0.26	0.00	0.26	0.0	15.0	n/a	n/a
UDD-2	9.4[3]	50	4	7.0	7.0	0.02	5.18	0.26	0.00	0.26	0.0	15.0	n/a	n/a

1 - Includes 0.5 foot freeboard.
2 - Maximum riprap size is 1.5 times D_{50}. All Riprap to be installed over 1.0 foot Type II Granular Filter.
3 - 100 Year, 6 Hour runoff.

TABLE 4.7.2.2-2 - Culvert Design Details

Culvert	Tributary Sub-Basins[1]	Area (acre)	Weighted CN	Peak Flow (cfs)	Total Design Flow (cfs)	Diameter (in)
CB-1	A1	4.09	83	0.9	2.0	18
	B1	3.50	86	1.1		
CB-2	A1	4.09	83	0.9	2.0	18
	B1	3.50	86	1.1		
CC-1	A1	4.09	83	0.9	2.9	18
	B1	3.50	86	1.1		
	C1	4.18	84	1.0		
CD-1	D2	1.97	79	0.2	0.4	18
	D3	1.34	80	0.2		
CD-2	D1	2.79	81	0.3	0.6	18
	D2	1.97	79	0.2		
	D3	1.34	80	0.2		
CE-1	D1	2.79	81	0.3	2.4	18
	D2	1.97	79	0.2		
	D3	1.34	80	0.2		
	E1	4.44	88	1.6		
	E2	1.68	82	0.2		
CF-1	F1	3.72	87	1.3	1.7	18
	F2	1.27	85	0.4		
UDC-1	UDC-1	99.37	75	14.3	14.3	30
UDC-2	UDD-1, UDD-2	64.96	75	9.4	9.4	24
CP-1	Pond 1 100 Yr, 6 Hr Discharge			22.5	22.5	24
CP-2	UDD-1, UDD-2	64.96	75	9.4	33.8	42
	Pond 1 100 Yr, 6 Hr Discharge			22.5		
	G1	4.56	78	1.9		

1 - See Map 4.7.2.1-2, Drainage and Sediment Control Plan – Undisturbed Drainage Areas, and Map 4.7.2.1-5, Drainage and Sediment Control Plan – Disturbed Drainage Sub Basins.

Table 4.7.2.3-1 Monitoring Schedule

Field Measurements	Reported As	Baseline		Operational & Post-Mining	
		Surf	GW	Surf	GW
Water Level or Flow	Depth, Flow				
pH	Std Units				
Specific Conductivity	umhos/cm @ 25 °C				
Temperature	°C				

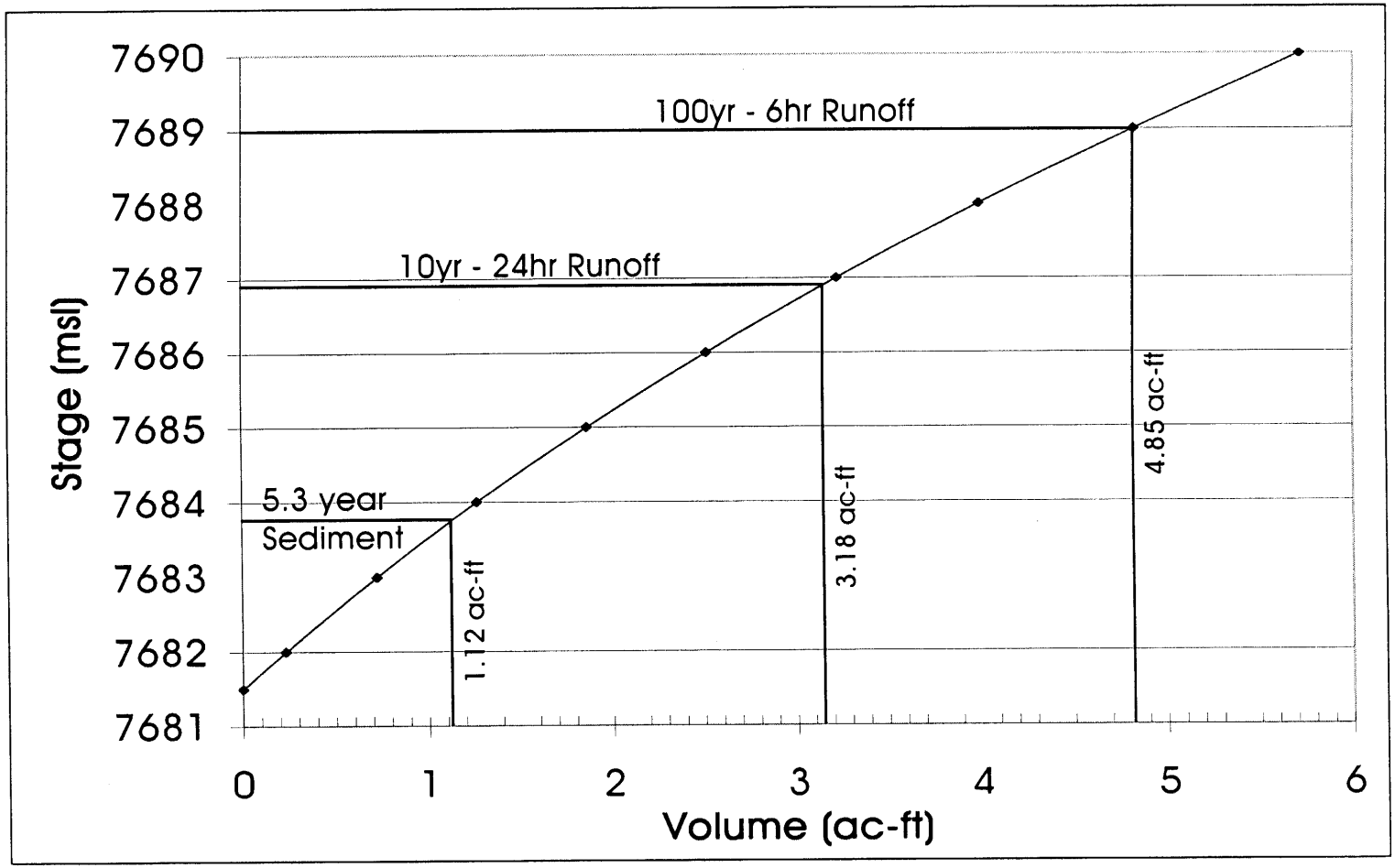
Laboratory Measurements	Reported As	Baseline		Operational & Post-Mining	
		Surf	GW	Surf	GW
Total Dissolved Solids	mg/l				
Total Suspended Solids	mg/l				
Total Hardness ($CaCO_3$)	mg/l				
Total Alkalinity	mg/l				
Acidity	mg/l				
Aluminum (Dissolved)	mg/l				
Arsenic (Dissolved)	mg/l				
Boron (Dissolved)	mg/l				
Carbonate	mg/l				
Bicarbonate	mg/l				
Cadmium (Dissolved)	mg/l				
Calcium (Dissolved)	mg/l				
Chloride	mg/l				
Copper (Dissolved)	mg/l				
Iron (Dissolved)	mg/l				
Iron (Total)	mg/l				
Lead (Dissolved)	mg/l				
Magnesium (Dissolved)	mg/l				
Manganese (Dissolved)	mg/l				
Manganese (Total)	mg/l				
Molybdenum (Dissolved)	mg/l				
Ammonia	mg/l				
Nitrates	mg/l				
Nitrites	mg/l				
Potassium (Dissolved)	mg/l				
Phosphate (Ortho)	mg/l				
Selenium (Dissolved)	mg/l				
Sodium (Dissolved)	mg/l				
Sulfate	mg/l				
Zinc	mg/l				
Oil & Grease					
Settleable Solids	UPDES				
Cations	meq/l				
Anions	meq/l				

Data submittals will be made to UDOGM on the following Basis:

Quarterly – Lab water quality results will be submitted within 90 days of the end of the quarter.

Annually – Hydrologic review and summary of data will be submitted on or before June 1st.

Figure 4.7.2.2-1, Kinney Mine Sedimentation Pond 1 Stage-Volume Curve



5.0 RECLAMATION PLANS

This section of the Kinney No. 2 Mine Permit Application provides both general and specific information relative to the plans and practices which will be utilized to reclaim and restore surface disturbance areas resulting from mining and related operations to condition and productivity comparable to or better than their condition prior to the Kinney No. 2 Mine disturbance consistent with a postmining land use of wildlife habitat, and watershed. Information sources utilized in developing the reclamation plans presented in this section include the baseline environmental investigations, detailed mining plans, conceptual and detailed facility layouts and designs, detailed drainage and sediment control plans, an specific plans for control, monitoring, and mitigation of mining related impacts. The reclamation design information and discussions of reclamation practices presented in this section have been prepared in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to provide a reasonable description of the nature, timing, and anticipated results of planned reclamation activities. The reclamation plans presented in this section reflect consideration of the environmental resource information presented in Section 3.0, Environmental Information, and the mining plans presented in Section 4.5, Engineering Design and Operations Plans, and are designed to effectively mitigate to the extent operationally practicable the potential effects of mining.

The various information categories addressed in the subsections which make up the Reclamation Plans Section are consistent with the information categories outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

5.1 Reclamation of Exploration Disturbance
5.2 Soil Replacement Plans
5.3 Habitat Restoration Plans
5.4 Reclamation of Mining Disturbance
5.5 Hydrologic Restoration

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps and exhibits, is referenced in the text and provided in the separate map and exhibit volumes.

5.1 RECLAMATION OF EXPLORATION DISTURBANCE

5.1.1 General Description of Reclamation Plans

This section presents and describes reclamation plans and practices to be used to reclaim disturbed areas resulting from exploration and related activities. Information in this section was developed in accordance with applicable regulatory requirements (R645-202-240) for coal mine permitting in the State of Utah.

5.1.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-201-225, 323, and 327, and 202-240 through 244.425. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
5.1.1	
5.1.1.1	General Introductory Information
5.1.1.2	R645-201-225, 323.200 through 400, 327.100 through 900, and 202-240 through 244.300
5.1.2	
5.1.2.1	R645-202-244
5.1.2.2	R645-201-225, 323.200 through 400, 327.100 through 900, and 202-240 through 244.300

5.1.1.2 General Reclamation Objectives and Activities

Reclamation will be an integral part of any exploration and related activities. Reclamation of surface disturbance areas resulting from exploration activities will occur as soon as reasonably feasible following the completion of exploration drilling and other related activities.

Objectives of the planned reclamation activities will include stabilization of disturbed areas, minimizing erosion, limited potential surface water impacts, and restoring disturbed areas to a safe, stable condition. Plans for reclamation of exploration disturbance have been designed to successfully meet these objectives and will result in effective stabilization, and a reclaimed configuration which blends with the surrounding terrain and provides for effective surface and erosion control.

Reclamation will involve a logical sequence of activities designed to achieve the overall reclamation objectives in an organized progressive manner. The following represents the general steps for reclamation of any exploration disturbance areas:

- Completion of the borehole as a monitoring well or plugging and sealing the borehole
- Drainage and backfilling of any mud pits
- Collection and removal of any trash or debris
- Grading of pad areas to establish the final configuration
- Drainage reestablishment
- Road removal
- Soil replacement
- Revegetation

These activities are discussed in detail in the following sections.

5.1.2 Reclamation Plans and Practices

The specific reclamation plans developed for exploration areas and the proposed reclamation practices reflect the overall reclamation objectives, site specific conditions and constraints, and the best current reclamation techniques and methods. The following sections describe the timing and sequencing of reclamation activities, general reclamation requirements, and specific reclamation practices.

5.1.2.1 Reclamation Timing and Sequencing

CR will reclaim exploration related surface disturbance areas as soon as operationally practicable following completion of exploration activities. Typically, reclamation will be initiated immediately on completion of all exploration activities under a given exploration program to accommodate effective mobilization and use of reclamation equipment or an independent reclamation contractor. CR will normally schedule all exploration activities under a given exploration program during the same field season and reclamation would occur on completion of the program or at the end of the field season and no later than the next normal field season (typically May through October). It is anticipated that final reclamation of exploration areas would be completed within 3 to 6 months from the time exploration activities at any given site are completed.

Final reclamation will involve removal of all exploration equipment and materials, closure and sealing of any boreholes not completed as monitoring wells, backfilling and grading of pad areas and roads, drainage reestablishment, road removal, placement of soil materials, and revegetation. Generally, soil replacement and revegetation efforts will be coordinated so that soil materials are revegetated as soon as practically possible following placement. Normally this will involve placement of soil and immediate reseeding at the end of the exploration project or field season in late fall. This approach allows the seed to "winter over" with germination in the spring when soil moisture conditions are elevated due to winter snow accumulations and spring melt.

5.1.2.2 Reclamation Plans and Practices

The reclamation plans and practices described in this section reflect consideration of site reclamation potential and any important limitations, and application of the best current reclamation technology and both CR's and other coal operators extensive operating experience in this area. The following sections describe the specific reclamation practices proposed for exploration surface disturbance areas.

Completion as a Monitoring Well or Plugging and Sealing Boreholes

As described in Section 4.6.2.1, Casing and Sealing Exploration Holes and Boreholes, a determination will be made either prior to or during completion of any exploration holes or boreholes of whether or not the hole will be utilized for ground water monitoring purposes. If the hole is to be utilized for monitoring it will be cased, completed, and developed as a monitoring well consistent with Figure 4.1.1, Typical Well Completion Diagram, and as described in Section 4.1.2.5, Completion as Ground Water Monitoring Wells. If the hole is not to be utilized as a monitoring well or when an existing well is no longer required for ongoing monitoring, it will be sealed by filling the borehole or casing with cement to form a plug from the bottom of the hole to at least 20 feet above any zone of completion or water-bearing zone; filling the remainder of the hole to within 20 feet of the ground surface; and filling the remainder of the hole to the ground surface with cement to form a surface plug. A steel fence post will be placed in the center of the surface plug before the cement sets-up to provide a permanent marker for the hole location.

Drainage and Backfilling of any Mud Pits

If mud pits were utilized during Drilling, they will be allowed to dry out and will be backfilled with drill cuttings and/or the material originally excavated from the pits. Fill material will be placed and compacted by normal equipment traffic to minimize voids and provide and limit any potential future settlement. Any remaining excess drill cuttings will be spread over the drill pad surface.

Collection and Removal of any Trash or Debris

Any trash or debris resulting from drilling operations including used drill bits, mud or additive bags, core boxes and other materials will be collected and removed from the drill site for disposal in the local municipal landfill. In addition, all exploration equipment and related materials and supplies will be removed from the site.

Grading of pad areas to establish the final configuration

Drill pad surface areas will be regraded to their approximate original configuration. Grading will involve the use of a tracked dozer, wheel loader, or backhoe to move, place, and grade fill materials. Generally, the material utilized in constructing the pad will be pulled back onto the cut bench from downslope fill areas and the fill will be graded and contoured to blend with the surrounding terrain and provide for effective drainage. On completion of grading the regraded surface will be ripped along the contour to control drainage and provide a good bond with the replaced soil material. Fill slopes will be limited to a maximum slope of approximately 3H: I V and graded slopes in native material will vary dependent on material from less than 5H: I V to as much as 0.5H: 1 V in competent rock.

Drainage Reestablishment

In conjunction with grading activities, CR will establish a drainage configuration which is compatible with the natural drainage pattern of the surrounding terrain. If upgradient drainage would pose a potential erosion hazard for the regraded area, drainage will be routed around the regraded surface or erosion control materials will be utilized as appropriate.

Road Removal

Where existing roads are utilized for exploration access, water bars will be constructed where appropriate to minimize erosion and natural drainage patterns will be reestablished. Any

new road segments constructed specifically for exploration access will be reclaimed by ripping the road surface and grading to reestablish the approximate original configuration and drainage pattern. Cut/fill areas will be reclaimed by pulling the fill material upslope into the cut and grading any remaining cut slope, the fill material, and disturbed downslope areas to a stable configuration consistent with natural drainage patterns and blending with the surrounding terrain.

Soil Replacement

Following completion of backfilling, grading, and drainage reestablishment, available soil material will be replaced on the regraded areas as a growth medium for subsequent revegetation. Soil will be replaced as soon as operationally practicable following completion of the other necessary activities in the reclamation sequence, however, the timing of soil placement will also reflect the need to reestablish vegetation as soon as possible to stabilize and prevent loss or erosion of the soil. Soil bladed off the pad area and roads during construction will typically be windrowed along the perimeter of the disturbance areas. This material will be recovered and spread across the regraded areas to establish a relatively uniform thickness of growth medium.

As the final step in the reclamation process, all exploration surface disturbance areas will be revegetated. Typically revegetation seeding will occur in late fall in order to allow the seed to lie dormant over the winter and take advantage of increased soil moisture levels resulting from snowmelt and runoff during the spring. Seeding may occur at other times where appropriate to minimize erosion due to location, aspect, or other site specific factors. Any required shrub or woody species transplanting will occur in late spring to minimize the potential for frost-kill.

Seedbed preparation will involve ripping the resoiled surface to prepare the surface to receive seed. Seed may be placed using either a rangeland seed drill or broadcast methods. Following seed placement, weed free straw or native hay mulch or other erosion control materials will be placed and crimped or anchored to protect the soil, minimize erosion, prevent seed loss and help trap and retain moisture. Exploration area will be seeded with the permanent seed mixture as discussed in Section 5.3, Habitat Restoration Plans.

5.2 SOIL REPLACEMENT PLANS

5.2.1 General Description of Soil Replacement Plans

This section presents and describes soil material replacement plans and practices to be used in reclaiming disturbed areas resulting from mining and related activities. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-240 and 250) for coal mine permitting in the State of Utah.

5.2.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-240, 241 through 244.320, and 250. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Requirements
5.2.1	
5.2.1.1	General Introductory Information
5.2.1.2	R645-301-240, 241, and 250
5.2.2	
5.2.2.1	R645-301-242.130
5.2.2.2	R645-301-242.100 through 310
5.2.2.3	R645-301-243
5.2.2.4	R645-301-244.100 through 320

5.2.1.2 General Soil Replacement Requirements

The Kinney No. 2 Mine surface facilities area will be the only new surface disturbance area resulting from the planned mining and related activities. During mine construction and development, all available soil and substitute material will be recovered from this area and stockpiled for use in future reclamation. A description of proposed soil recovery and stockpiling plans for this area is presented in Section 4.2, Soil Handling Plans.

Consistent with applicable regulatory requirements, CR will utilize all of the available stockpiled reserves of soil material to establish a relatively uniform thickness of soil material on all reclaimed areas. Soil replacement will follow final backfilling, grading, and drainage reestablishment and replacement plans are designed to provide both suitable growth media and favorable surface conditions for vegetative reestablishment on the reclaimed areas. Soil materials will be placed and handled to protect the soil/substitute resource and minimize loss or degradation to the extent operationally feasible. Following placement soil materials will be sampled and tested to verify suitability for reclamation, any appropriate mitigation measures based on the testing will be implemented, and appropriate surface treatments will be utilized to stabilize and protect the replaced soil materials.

5.2.2 Soil Replacement Plans and Practices

Generally, soil replacement practices will be essentially the same for all surface disturbance areas and will not vary between soil replacement and soil substitute replacement. Typical soil replacement activities will involve:

- Preparation of the regraded surface
- Soil recovery from stockpile, placement, and grading
- Soil sampling, testing, and evaluation
- Mitigation of any suitability concerns and application of soil amendments, if required
- Soil stabilization measures

The following sections describe these specific soil and substitute replacement, testing, and stabilization practices.

5.2.2.1 Timing of Soil Replacement Activities

Generally, soil replacement and revegetation efforts will be coordinated so that soil materials are revegetated as soon as practically possible following placement. Normally this will involve placement of soil and immediate reseeding at the end of the operating field season in late fall. This approach allows the seed to "winter over" with germination in the spring when soil moisture conditions are elevated due to winter snow accumulations and spring melt.

5.2.2.2 Soil Replacement Practices

Following completion of final backfilling, grading, and drainage reestablishment for surface disturbance areas, soil materials will be recovered from the previously established stockpiles and will be hauled, placed, and spread on the regraded areas. As noted in Section 5.4.2.3, Reclamation Practices, the regraded surface will be left in a roughened condition to control runoff, provide a good bond with the replaced soil/substitute material, and promote moisture infiltration. Prior to soil replacement, regraded surfaces will be deep ripped to alleviate compaction and enhance soil bonding and finely chopped native hay from the current years crop will be applied to increase organic content, provide soil biota, and increase infiltration and moisture holding capacity.

Typically either tractor-scrapers or wheel loaders will be utilized to recover and load the materials from stockpile and either scrapers or trucks will be utilized to haul and place the material. Where tractor scrapers are utilized for recovery, haulage, and placement, the soil material will be spread in thin horizontal lifts as it is placed. If trucks are used for haulage, a tracked dozer or motor grader will be used to spread and distribute the soil material at a relatively uniform thickness. Replacement thickness will generally be controlled visually by the equipment operators but will also be checked and monitored for general consistency by the CR operations supervisor responsible for reclamation activities. Based on the available existing soil stockpile volumes and the soil recovery plans as outlined in Section 4.2, Soil Handling Plans, the following summarizes approximate soil replacement thicknesses for the general disturbance areas:

Based on the field measurements, soil volumes for each soil map unit can be found on Table 8 of the Soils Report found in Exhibit 3.1.1.3-1, Soils Information, for a total volume of 182,216 cubic yards. This volume includes the entire 36.7 acres shown on Figure 1, in the soils report included in Exhibit 3.1.1.3-1, Soils Information . Actual proposed disturbance is proposed on 27.3 acres as shown on Map 4.5.1.2-3, Surface Facilities Map, labeled Disturbance Boundary. The topsoil volume estimate of 68,092 cubic yards included in Section 3.1 has been estimated from the 36 soils backhoe pits, hand dug pits, and road cut excavations (see Figure 1, in the soils report included in Exhibit 3.1.1.3-1, Soils Information). The topsoil stockpile maximum volume is 54,760, therefore this amount is the total that can be salvaged for final reclamation. This will provide 1.24 feet, or 14.9 inches of topsoil available for reclamation as follows:

$$\frac{\dfrac{54{,}760 \text{ CY X } 27 \text{ CF/CY}}{27.3 \text{ ACRES}}}{43{,}560 \text{ SF/ACRE}} = 1.24 \text{ FT or } 14.92 \text{ INCHES}$$

Soil placement thickness will vary somewhat dependent on terrain and practical operating constraints, however, every effort will be made to establish a uniform, stable soil layer on all regraded areas. To the extent operationally feasible, efforts will be made during placement to limit equipment traffic in order to minimize compaction. On gently sloping areas soil will be replaced parallel to the natural land contour to establish linear contour line features which help to minimize erosion potential.

5.2.2.3 Soil Suitability and Testing

As described in Section 4.2.2.2, Soil Suitability and Testing, both natural soils and the disturbed soils which will be utilized as soil material are generally considered to be suitable materials for use as a revegetation growth medium for the purposes of site reclamation. The primary limitations are the available water holding capacity of soils containing greater than 50% rock content, slope gradients of over 50 percent affecting use of soil replacement machinery, soil materials with sandy textures, and an accurate determination of the quantity of coal found within the mixture of alternative reclamation materials located in Disturbed Lands Map Units DA and DB. While noted as a concern relative to the UDOGM Topsoil/Overburden Suitability Parameters, these limitations do not seem to be a deterrent to the existing natural vegetation which exists on these soils in the mine area.

In order to optimize overall reclamation success with the materials available, CR will, immediately following soil replacement, collect soil samples from the resoiled areas, complete suitability analysis of the samples, and evaluate the analysis results to assess the need for any corrective measures or soil amendments. Soil samples will be collected at a sampling density of 1 sample for every four acres with sampling grids established to fit the configuration of the reclaimed area. A soil auger or shovel will be used to obtain samples to a depth of approximately 6 to 12 inches, dependent on soil replacement depth. Samples will be analyzed for the suitability parameters included in current UDOGM regulations and guidelines.

If soil analyses result in an indication of potential suitability concerns for any given area, confirmation sampling will be completed at an increased sampling density of one sample for every two to three acres. If confirmation sampling verifies a potential suitability concern, CR will in consultation with UDOGM develop and implement specific remediation plans for

the area of concern. Remediation may include the application of soil modifiers or amendments, capping of potentially unsuitable materials with other suitable material, removal and burial of the suspect materials and replacement with known suitable materials, or combinations of these or other measures as appropriate.

In addition to the soil suitability evaluation, CR will utilize the fertility parameters data to determine the need for any soil amendments to promote effective revegetation. One of the problems with long-term storage of soil materials in stockpile is that soil organic material and beneficial mycorrhizal fungi are lost. In order to address this problem, CR proposes to deep rip (up to 3 feet) the regraded surface prior to soil replacement and follow ripping with application of finely chopped native hay from the current years hay crop. Based on mine reclamation experience in the area, this technique has proven very effective in increasing organic content, providing soil biota, and enhancing moisture infiltration and retention with noticeable benefits relative to vegetative reestablishment and overall reclamation success. Based on the results of soil fertility analysis, CR will also develop site specific recommendations addressing the type and application rates for any indicated soil amendments. These recommendations will be reviewed with UDOGM prior to implementation of any soil amendment programs.

5.2.2.4 Soil Stabilization Measures

Soil materials will be left in a roughened condition to control runoff, limit erosion and soil loss, and promote moisture infiltration. CR will also selectively apply alternative sediment control measures as described in Section 4.7, Hydrologic Resource Protection Plan. Generally revegetation seeding will occur within a short (15 to 45 days) period following soil material placement so additional stabilization measures will not be required prior to seeding. In conjunction with seeding operations, the soil material will be plowed or disked to prepare the seedbed. Following seeding, the reseeded areas will be mulched with straw or native hay at a rate of two tons per acre and the mulch will be crimped into the soil to minimize wind loss.

5.3 HABITAT RESTORATION PLANS

5.3.1 General Description of Habitat Restoration Plans

This section presents and describes plans and practices to be used following the completion of mining to restore habitat values for those surface areas disturbed by mining and related activities. The habitat restoration plans presented in this section address both general vegetative reestablishment and specific habitat enhancement measures. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-340 and 350) for coal mine permitting in the State of Utah.

5.3.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-341, 342, 351 through 357.300, and 358. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Requirements
5.3.1	
5.2.1.1	General Introductory Information
5.2.1.2	R645-301-341, 342, 352, 353 and 358
5.3.2	
5.3.2.1	R645-301-341.100 and 354
5.3.2.2	R645-301-341.220
5.3.2.3	R645-301-341.210 and 342.200 through 230
5.3.2.4	R645-301-341.230 and 355
5.3.2.5	R645-301-341.240 and 357.300
5.3.2.6	R645-301-341.250, 300, 353.100 through 300, 356.100 through 400, and 357.100 through 300
5.3.3	
5.3.3.1	R645-301-342.100 and 358.400 through 530
5.3.3.2	R645-301-342.200 through 400
5.3.3.3	R645-301-358.100 and 400
5.3.3.4	R645-301-358.200, 300, and 510

5.3.1.2 General Habitat Restoration Requirements

The Kinney No. 2 Mine surface facilities area will be the only surface disturbance area resulting from the planned mining and related activities. As described in Section 4.3.1.2, General Biological Resource Protection Requirements, the majority of the mine facilities area has been extensively disturbed by previous mining related activities resulting in destruction,

elimination, or significant modification of vegetation and habitat values. Beyond the practical limitations on habitat value and use relating to the previous disturbance, wildlife use of both existing and proposed surface disturbance areas is also limited by current levels of human activity in the immediate area due to the proximity of Highway 96, and Scofield Town.

From a practical standpoint, the mine surface facilities area because of the extensive previous disturbance and their proximity to other development activities are not particularly well suited for many uses other than mining. Given, however, that these areas and the surrounding lands were in all probability undeveloped lands utilized for wildlife habitat, CR will reclaim surface disturbance areas to a postmining land use of wildlife habitat and watershed. Consistent with the proposed postmining use, backfilling and grading will focus on restoration of a land configuration consistent with applicable provisions for remining of previously disturbed areas with a preexisting highwalls (R645-301-553.500 through 524) and the general configuration which existed prior to mine development, soil and substitute materials will be replaced to provide a vegetative growth media similar to the natural soils existing in the area, and planned revegetation efforts are designed to provide a self-sustaining postmining vegetation community which will effectively stabilize disturbed areas and provide suitable wildlife forage and browse. In addition to site revegetation measures, CR will also implement specific habitat mitigation and enhancement measures, as further described in this section, to effectively address potential mining related impacts and provide some long-term mining related benefits.

5.3.2 Revegetation Plans and Practices

CR's planned revegetation practices are specifically designed to provide or promote:

- Rapid vegetative reestablishment following completion of soil/substitute replacement
- Establishment of adequate plant density and cover to effectively control runoff and erosion
- Establishment of a reclaimed plant community consisting primarily of indigenous plant species with any introduced species having proven adaptability for site conditions
- Adequate plant species diversity and vigor to assure effective ongoing vegetative propagation and a self-sustaining vegetation community
- Palatable wildlife browse and forage species consistent with the postmining land use

Revegetation seed mixtures, plantings, and seeding, planting and stabilization/management practices have all been selected and designed to achieve these objectives. Generally, actual revegetation methods will be similar for all surface disturbance areas and will typically include the following specific activities:

- Seedbed preparation
- Seeding
- Woody species transplanting
- Mulching and surface stabilization
- Management and revegetation success monitoring

The following sections describe these specific revegetation practices.

5.3.2.1 Timing of Revegetation Activities

Generally, seeding of areas where soil/substitute materials have been replaced will occur as soon as practically possible following the cessation of mining activities and soil/substitute placement in order to minimize the potential for both soil/substitute loss and erosion. Normally this will involve placement of soil/substitute and immediate reseeding at the end of the operating field season in late fall. This approach allows the seed to "winter over" with germination in the spring when soil moisture conditions are elevated due to winter snow accumulations and spring melt.

While late fall plantings represent the preferred schedule for revegetation and will be implemented in most situations, there may be occasions where prompt revegetation of small construction or other disturbance areas may be desirable to minimize erosion and sedimentation potential. Cases where this exception may apply could include newly established soil/substitute stockpiles, road cuts, newly constructed diversion and collection ditches, and small areas where erosion or other repairs have occurred. In such cases, revegetation activities may occur at any time provided that site and climatic conditions offer a reasonable potential for successful vegetative reestablishment.

5.3.2.2 Revegetation Practices

As previously described, revegetation of surface disturbance areas will involve a logical sequence of activities including seedbed preparation, seeding, woody species transplanting, mulching and surface stabilization, and management and revegetation success monitoring. Localized adaptations of specific revegetation practices will be utilized where appropriate to address any limiting site conditions and constraints such as steep slopes, rocky soils, increased erosion potential, and other factors.

Seedbed Preparation

Prior to seeding, CR will prepare regraded and resoiled areas to provide a firm but uncompacted seedbed. As described in Section 5.2.2.3, Soil Suitability and Testing, and in Section 5.4.2.3, Reclamation Practices, under the sub-headings of Backfilling and Grading to Establish Final Configuration, Soil/Substitute Replacement, and Revegetation; backfilling, grading, and soil/substitute replacement activities will be conducted so as to minimize compaction. Following backfilling and grading and prior to soil/substitute replacement CR will deep rip (up to 3 feet) the regraded surface and apply finely chopped hay from the current years hay crop at a rate of approximately 2.0 tons per acre. This is done to improve soil structure for aeration purposes, increase micropore space, and improve the water

holding capacity of the soil. Incorporation of the mulch will occur either by plowing along the contour, deep gouging/roughening, or a combination of those methods. Hay purchases will be based on specifications which minimize the potential for introduction of any noxious weed species. While this treatment is intended primarily to increase soil organic content and provide soil biota, it will also be effective in alleviating compaction and promoting moisture infiltration and retention.

Given that seeding will normally follow soil/substitute replacement within a very short time period and that the soil/substitute surface will be left in a roughened condition, seedbed preparation requirements will be minimal. In order to limit mixing of soil/substitute and underlying backfilled materials, surface manipulations will be minimized and will generally be limited to appropriate gouging/roughening techniques.

Seeding

CR will generally use one of three seeding methods, either drill seeding, broadcast seeding, or hydromulching dependent on the nature and aspect of the area to be revegetated. Broadcast seeding using a conventional rangeland seed drill will be utilized for reseeding of most areas. For construction disturbance, roadcuts, ditches, sedimentation pond embankments, soil/substitute stockpiles and other areas which require temporary vegetation to stabilize the disturbed surface and control runoff, erosion, and sedimentation, the temporary seed mixture will be drill seeded at a rate of 20.4 pounds of pure live seed (PLS) per acre or broadcast seeded at twice this rate (40.8 lbs. PLS/acre). Similarly, for all areas to be revegetated on a permanent basis, the permanent seed mixture will be drill seeded at a rate of 46.33 pounds of PLS/acre or broadcast seeded at twice this rate (92.66 lbs. PLS/acre). To the extent operationally feasible, CR will drill seed along the contour on sloping areas.

Following deep gouging or other roughening process, the resoiled areas will be seeded with the appropriate seed mixture and rates. Shortly after the seeding, an additional 1 to 1.5 tons per acre of certified noxious weed free straw will be spread over the seeded growth media by mechanical blowers or hand spreading. This mulch will be sprayed with a tackifier and mulch mixture at a rate of 0.25 tons per acre or crimped with the track hoe bucket or shovel following spreading to retain it on the reseeded slopes. Commercial seed purchases will be based on specifications which minimize the potential for introduction of noxious weed species.

Woody Species

The proposed permanent seed mixture for the Kinney No. 2 Mine surface facilities area includes several woody plant species which can be effectively established from seed including Utah serviceberry, mountain big sagebrush, winterfat, antelope bitterbrush, and mountain snowberry.

Mulching and Surface Stabilization

Surface stabilization measures have been incorporated as an integral part of CR's specific reclamation procedures for backfilling and grading, drainage reestablishment, soil/substitute replacement, seedbed preparation, and revegetation seeding activities. In addition to specific surface stabilization measures, CR will also selectively apply alternative sediment control measures as appropriate to control erosion and apply weed-free straw or native hay

mulch to most re-seeded surface disturbance areas and will utilize other surface protection/stabilization measures in conjunction with or as an alternative to mulching for any areas having increased erosion potential. A detailed description of specific surface stabilization and mulching practices is presented in Section 5.3.2.4, Mulching and Stabilization Practices.

Management and Revegetation Success Monitoring

Re-seeded areas will be managed to achieve the revegetation objectives previously noted in this section. Management practices will include regular periodic inspection of reseeded areas; appropriate erosion control or repair activities; weed/pest control operations; re-seeding, if required; and revegetation success sampling and evaluations.

As part of the postmining management program, reclaimed areas will be qualitatively inspected on a regular quarterly basis at a minimum for any indications of significant erosion, siltation, surface instability, drainage problems, seeding failure, weed infestations, or other conditions which could adversely impact reclamation success. Inspections will continue throughout the extended liability period to assure effective reclamation. Any problems identified as a result of these regular inspections will be addressed in a timely manner consistent with overall reclamation plans and practices.

The reclamation plan for the Kinney No. 2 Mine has been designed to prevent or minimize erosion and restore disturbed areas to a stable and productive condition. If despite CR's best efforts, inspection of the reclaimed areas indicates that natural erosional processes are creating significant rills or gullies, CR will implement appropriate remedial/protective measures. In order to minimize any associated surface disturbance, the proposed erosion mitigation measures reflect consideration of the nature and extent of erosional damage and are designed to be implemented in phases dependent on the severity of or potential for damage. Specific erosion mitigation measures are described in Section 5.4.2.3, Reclamation Practices, under the sub-heading of Post-Reclamation Management and Monitoring.

Any seeding failures or weed infestations identified by the post-reclamation management inspections will be addressed during appropriate time periods to achieve optimal mitigation. Any areas where partial or complete seeding failure is indicated by limited vegetative reestablishment or excessive dominance of one or more species will be addressed by reseeding the effected areas during either the early spring or late fall. Essentially the same seeding methods will be utilized as for initial seeding with the exception of seedbed preparation. Any significant weed infestations will be addressed through consultation with UDOGM to determine appropriate control measures. A detailed description of specific weed and pest control measures is presented in Section 5.3.2.5, Irrigation and Pest Control.

In addition to regular periodic inspections of re-seeded areas, CR will also implement a revegetation success monitoring program to quantify and document the progression of vegetative reestablishment for all reclaimed areas. The ultimate objectives of the revegetation success monitoring program will be to allow timely identification and remediation of any vegetative reestablishment problems and to provide the verification required for a revegetation success determination and final bond release. A detailed discussion of the revegetation success monitoring program is provided in Section 5.3.2.6, Revegetation Success - Criteria and Evaluation Methods.

5.3.2.3 Revegetation Species and Amounts

CR will use two separate revegetation seed mixtures for the new Kinney No. 2 Mine surface facilities disturbance areas; one for temporary vegetative establishment on construction disturbance areas, roadcuts, ditches, sedimentation pond embankments, soil/substitute stockpiles and other areas requiring interim erosion control and stabilization, and one for permanent revegetation of reclaimed upland areas. The species selected for inclusion in both the temporary and permanent revegetation seed mixtures are native and adapted species which occur within the surface disturbance and adjacent areas and which have a proven adaptability and compatibility to site conditions. Selection of specific plant species for inclusion in the revegetation seed mixtures involve consideration of natural occurrence as documented by vegetative baseline studies, ease of establishment from seed, seed availability, adaptability and vigor, contribution to vegetative diversity, and forage and browse value for various wildlife species.

The proposed temporary seed mixture presented as Table 5.3.2.3-1, Temporary Seed Mixture, consists of adapted species which germinate rapidly, are effective sod formers, and so are well suited to establish an effective temporary vegetative cover. The temporary seed mixture will be used for those disturbed areas which will not be utilized on an ongoing basis as active operating areas but will be disturbed prior to or in conjunction with final site reclamation. The temporary seed mixture may also be used as a stubble mulch to stabilize areas which are particularly subject to potential erosion.

The proposed permanent seed mixture for the Sagebrush/Grass and Rabbitbrush/Grass Plant Communities is presented in Table 5.3.2.3-2, Final Revegetation Seed Misture for Sagebrush/Grass and Rabbitbrush/Grass Plant Communities. The permanent seed mixture consists of a variety of predominantly native grasses, forbs, and shrubs with proven site adaptability and good hardiness which have been specifically selected for their value as browse and forage species consistent with the postmining land use of wildlife habitat as recommended by the UDWR. The permanent mixture will be utilized for revegetation of all surface disturbance areas and includes a variety of species found in both the grass-sage and rabbitbrush-grass vegetation communities. Based on their occurrence in natural plant communities in the area, available agronomic and wildlife research, and actual operating experience at coal mines in the Price, Utah area, the selected species included in the permanent reclamation seed mixture will provide an effective self-sustaining vegetative cover which will control surface runoff and erosion, provide sufficient diversity to assure the long-term stability of the revegetated community, and is compatible with CR's wildlife habitat mitigation, restoration, and enhancement objectives.

To the extent reasonably feasible consistent with both site stabilization and reclamation objectives, CR has selected revegetation species which are native species. CR will assure acceptable purity and germination standards for all seed mixtures and will require that suppliers certify seed shipments as meeting the standard specifications and being free of noxious weed seed.

In order to assure that seeding and planting stocks are of suitable quality for effective revegetation, CR will attempt to obtain native seed material from those sources which most closely approximate site conditions and will deal only with established reputable seed suppliers. CR will assure acceptable purity and germination standards for all seed mixtures

TABLE 5.3.2.3-1 TEMPORARY SEED MIXTURE		
Group/Species	**PLS (Drill) lbs/acre***	**Number of Seeds/FT^2**
Grasses		
Thickspike Wheatgrass (Elymus lanceolatus)	4.0	14.14
Western Wheatgrass (Elymus smithii)	5.0	14.46
Bluebunch Wheatgrass (Elymus spicatus)	6.0	19.28
Kentucky Bluegrass (Poa pratensis)	0.40	19.99
Forbs		
Utah Sweetvetch (Hedysarum boreale)	5.0	3.86
TOTALS	20.40	71.74
* Based on drill seeding methods. Rates should be doubled in areas that are broadcast seeded.		

TABLE 5.3.2.3-2 FINAL REVEGETATION SEED MIXTURE FOR SAGEBRUSH/GRASS AND RABBITBRUSH/GRASS PLANT COMMUNITIES		
Species	**PLS (Drill) lbs/acre***	**Number of Seeds/FT^2**
Grasses Bluebunch Wheatgrass (Elymus spicatus)	1.50	4.82
Kentucky Bluegrass (Poa pratensis)	2.00	4.0
Sandberg Bluegrass (Poa secunda)	0.20	4.25
Needle-and-thread (Stipa comata)	1.00	2.64

TABLE 5.3.2.3-2 FINAL REVEGETATION SEED MIXTURE FOR SAGEBRUSH/GRASS AND RABBITBRUSH/GRASS PLANT COMMUNITIES		
Forbs Common Yarrow (Achillea millefolium)	0.03	1.91
Utah Sweetvetch (Hedysarum boreale)	5.00	3.86
Lewis Flax (Linum lewisii)	0.70	4.47
Silky Lupine (Lupinus sericeus)	8.00	4.51
Meadow Penstemon (Penstemon rydbergii)	1.50	4.54
Goldeneye (Viguiera multiflora)	0.20	4.84
Shrubs Utah Serviceberry (Amelanchier utahensis)	6.00	3.55
Mountain Big Sagebrush (Artemisia tridentate vaseyana)	0.10	5.74
Winterfat (Ceratoides lanata)	4.00	5.05
Antelope Bitter Brush (Purshia tridentate)	15.00	5.17
Mountain Snowberry (Symphoricarpos oreophilus)	3.00	5.17
TOTALS	46.33	65.51
* Based on drill seeding methods. Rates should be doubled in areas that are broadcast seeded.		

and will require that supplies certify seed shipments as meeting the standard specifications and being free of noxious weed seed.

5.3.2.4 Mulching and Stabilization Practices

As described in Section 5.4.2.3, Reclamation Practices, under the sub-heading of Backfilling and Grading to Establish Final Configuration, and Drainage Reestablishment; and in this section under the sub-heading of Seedbed Preparation; reclaimed areas will be graded to a stable configuration with reestablishment of effective surface drainage patterns; regraded surfaces will be deep ripped, chopped native hay will be applied, and the surface will be left in a roughened condition to enhance soil bonding; soil/substitute materials will be prepared for seeding and left in a roughened condition; and soil replacement, seedbed preparation, and seeding will be conducted along the contour wherever operationally feasible. All of these reclamation practices contribute to effective stabilization of the reclaimed surface.

In addition to the specific stabilization practices, following reclamation seeding, straw or native hay mulch will be applied to most re-seeded areas at a rate of approximately 2 tons per acre and crimped or anchored using a disk or similar agricultural implement to protect the soil, minimize erosion, prevent seed loss, and help trap and retain moisture. In certain areas where there may be increased potential for erosion and soil loss due to steep slopes or localized drainage conditions, other suitable stabilization materials and methods including alternative sediment control measures may be substituted for or combined with mulching.

Such methods may include dozer tracking, application of geotextiles, hydromulching (at a rate of approximately 1.5 tons per acre), or other suitable stabilization and erosion control measures.

5.3.2.5 Irrigation and Pest Control

While irrigation can potentially facilitate initial vegetative establishment it is not a practical long-term management practice and may actually reduce long-term revegetation success. For these reasons, and because irrigation is incompatible with both the postmining land use of wildlife habitat and the objective of a self-sustaining vegetation community, CR does not to propose to utilize irrigation in conjunction with site revegetation efforts.

Regular periodic inspections of revegetated areas will include inspection for any noxious weed infestations or insect damage. If noxious weed infestations or insect problems are identified which have the potential to adversely impact revegetation success, CR will consult with both UDOGM and Carbon County Weed Control to develop and implement appropriate control measures. If the controls determined through this consultation process involve the application of herbicides or insecticides, only those chemicals approved for use by the appropriate State and Federal agencies will be considered and control practices will be limited to spot application at the appropriate time period for best control of the problem species.

5.3.2.6 Revegetation Success - Criteria and Evaluation Methods

In order to accurately and objectively evaluate the effectiveness of revegetation efforts and provide a quantitative determination of ultimate revegetation success, CR will conduct field revegetation success sampling and will evaluate the resulting field data. The following discussion outlines revegetation success monitoring practices and evaluation criteria for those new disturbance areas associated with the Kinney No. 2 Mine surface facilities area. Sampling of revegetated areas will be conducted at intervals of four, eight, nine, and ten years following initial permanent revegetation seeding. Consistent with the baseline and reference area approaches for evaluation of revegetation success as outlined in the UDOGM Vegetation Information Guidelines, and the baseline vegetation sampling program as discussed in Section 3.2.2.3, Vegetation Parameters, CR will sample cover and productivity for all permanently revegetated areas and will evaluate revegetation success on the basis of these two primary parameters.

Revegetation success sampling and evaluation methods for ground cover and productivity will be essentially the same as previously utilized for baseline data collection. These methods, as described in Section 3.2.1.2, Sources of Vegetation Information, will include the use of randomly located sampling transects, measurement of cover using an inclined ten-point frame, and measurement of productivity by clipping randomly located sample plots. For revegetation success evaluations, woody plant density will be measured by counting all woody plants rooted within one meter on either side of the 50 meter random transects utilized for cover sampling and extrapolating the corresponding woody plant density to determine density on a "stems per acre" basis. Sample adequacy for all revegetation success sampling will be evaluated using the formulae presented in Appendix A of the UDOGM Vegetation Information Guidelines and will be based on the objective of achieving a 90 percent confidence interval within 10 percent of the mean.

The purpose of revegetation sampling efforts during years three and seven of the extended liability period will be to determine and evaluate the effectiveness of site revegetation efforts and to determine trends for vegetative reestablishment. The resulting data and evaluation results will be utilized as appropriate to identify any potential areas of concern and to guide post-reclamation management efforts in order to meet specific requirements for a revegetation success determination and ultimately achieve the overall reclamation objectives. Revegetation success monitoring during years nine and ten of the extended liability period will focus on data collection and development of the necessary documentation to allow for effective comparison of reclaimed and baseline conditions as the basis for a revegetation success determination.

The original baseline sampling involved collection of cover and production data for two distinct vegetation types: 1) Previously Disturbed AMR (now Rabbitbrush/grass; 2) Native Sagebrush/grass. All reclaimed areas will be revegetated using essentially the same methods and seed mixture. In order to evaluate revegetation success for reclaimed areas, areas identified as Disturbed or Reclaimed and native Sagebrush/grass types will be sampled together as a unit.

Cover and production values resulting from the revegetation success monitoring for the areas will be compared with weighted average values based on the reference area values. Weighting will be based on the corresponding acreages of each of the vegetation type.

The statistical comparison utilized to evaluate revegetation success will be based on the "t-test comparison" method. If the absolute values for cover and production for the reclaimed areas are greater than or equal to the calculated 90 percent confidence interval for the baseline data then the mean values for the designated revegetation success parameters can be considered to be statistically equivalent and it can be concluded that the applicable revegetation success criteria have been achieved.

For woody plant density, revegetation success monitoring data will be compared with a reclamation standard of 1,700 plants per acre for areas identified in the baseline sampling. Consistent with cover and production sampling, if the absolute values for woody plant density for the reclaimed areas are greater than or equal to the calculated 90 percent confidence interval for the numeric standards then the mean values for the designated revegetation success parameters can be considered to be statistically equivalent and it can be concluded that the applicable revegetation success criteria have been achieved.

General revegetation requirements under applicable UDOGM regulations include consideration of erosion control, and vegetative diversity, seasonality, and permanence. In order to address these secondary considerations relative to revegetation success, CR proposes the following secondary success standards:

Erosion Control - Formation of rills and gullies on reclaimed areas will be limited to a maximum of 0.75 feet in depth. General erosion will be evaluated using Mark H. Humphrey's Erosion Condition Classification System (Draft 12/5/90) as adapted from BLM's Erosion Condition Classification System (BLM Technical Note - Number 346)

Vegetative Diversity and Permanence - Premining and postmining values will be compared using Sorenson's Similarity Index as outlined in the UDOGM Vegetation Guidelines

Seasonality - Seasonality of reclaimed plant communities relative to premining conditions will be evaluated by comparing percent composition of warm season plant species

Success evaluations for these secondary criteria will be based on the same weighting approach as previously discussed for the evaluation of the primary parameters of vegetative cover and production.

5.3.3 Habitat Enhancement Plans

Given the proposed postmining land use of wildlife habitat, watershed, and commercial and the extent of existing site disturbance with the related constraints on wildlife habitat values, CR as part of their overall reclamation plans will restore and enhance where reasonably possible site conditions and habitat values which will support and benefit wildlife use, watershed and commercial uses. In addition to the general reclamation measures and practices which will be implemented on completion of mining as described in the preceding sections, CR will implement supplemental wildlife habitat enhancement measures as discussed in the following sections.

5.3.3.1 Habitat Restoration and Enhancement Measures

Restoration of surface disturbance areas will ultimately be achieved by backfilling, grading, drainage reestablishment, soil/substitute replacement, and revegetation to a configuration and condition consistent with the postmining land uses. Plans for reclamation and revegetation activities are discussed in the preceding section.

5.3.3.2 Revegetation Measures for Wildlife Habitat Enhancement

The UDWR has developed a variety of seed mixes and seeding recommendations for various areas, conditions, and wildlife habitat restoration objectives. These recommendations were reviewed in developing the proposed permanent reclamation seed mixture and a number of the species selected for the proposed seed mix were included because of their value for habitat restoration as outlined by the UDWR recommendations.

Placement of Rock Piles - Piles of rocks and large boulders would be randomly placed on the reclaimed surface to serve as shelter for reptiles and small mammals and temporary perches for raptors and other birds.

5.3.3.3 Provisions for Protection and Reporting of any Threatened, Endangered, or Sensitive Species

Compliance with the Endangered Species Act

Based on available baseline and other resource information, there are no known threatened, endangered, or sensitive plant or animal species or related critical habitat values within the Kinney No. 2 Mine permit area or adjacent areas which would be impacted by planned mining and related activities. In the event that TES occurrences are identified in the future or if new designations result in classification of existing species occurrences, appropriate provisions for protection or minimization of impacts to TES species will be developed and implemented. The specific protection and mitigation measures presented in Section 4.3.3.3, Measures to Stabilize and Minimize Erosion from Mine Disturbance Areas, will effectively limit the effects of sedimentation and erosion on threatened and endangered fish species in downstream portions of the Price, Green, and Colorado Rivers. Since the closest known occurrence for any listed fish species is in the Green River which is approximately 100 miles from the mine area, any minor increases in sedimentation due to planned mining and related activities would result in negligible impacts.

Based on mine water supply requirements, which will involve utilization of existing active water rights on Mud Creek (through Scofield Town water system), it is anticipated that mining and related operations would not result in any significant incremental depletion or flow reduction in either the Price or Green Rivers. In the unlikely event that changes in water supply requirements or other factors would result in any significant depletion to the Green River, appropriate conservation or mitigation measures would be developed for consideration and approval by UDWR, USFWS, and UDOGM.

Compliance with the Bald (and Golden) Eagle Protection Act

As described in Section 4.3.4.2, Compliance with the Bald Eagle Protection Act, the permit area provides minimal potential for bald and golden eagle nesting because the area does not contain any cliffs or large conifer trees that would be typical nesting habitat for eagles. A detailed discussion of compliance measures is provided in Section 4.3.4.2, however in summary, CR will either not initiate new activities within one-half mile of an active golden eagle nests during the spring breeding season or will, in consultation with UDOGM and UDWR, initiate appropriate monitoring and mitigation measures. Monitoring of eagle nesting activity will consist of annual visual searches of the trees in the area of the mine operations. In the event large stick nests are found, the UDWR will be contacted and a formal monitoring plan will be implemented. Mitigation may include adjustments in the scheduling of certain activities, or other measures developed in cooperation with the responsible wildlife management agencies. CR will also immediately report any observed golden eagle nesting activity within the permit area, and especially in proximity to active surface disturbance areas, to the UDWR.

5.4 RECLAMATION OF MINING DISTURBANCE

5.4.1 General Description of Reclamation Plans

This section presents and describes reclamation plans and practices to be used to restore disturbed areas resulting from mining and related activities to productive self-sustaining use. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-500) for coal mine permitting in the State of Utah.

5.4.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-511, 541 through 553, and 560. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Requirements
5.4.1	
5.4.1.1	General Introductory Information
5.4.1.2	R645-301-511.300 and 541.100 through 400
5.4.1.3	R645-301-553.500 through 524, and 553.600 through 653
5.4.1.4	R645-301-512.200 through 260 and 515.320 through 322
5.4.1.5	R645-301-512.200 through 260 and 542.200 through 320
5.4.2	
5.4.2.1	R645-301-542.100 and 500
5.4.2.2	R645-301-541.100 through 400 and 542.200
5.4.2.3	R645-301-542.300 through 800, 550 through 553.900, and 560
5.4.3	R645-301-542.800
Maps	R645-301-512.200 through 260 and 542.200 through 320
Exhibits	R645-301-542.800

5.4.1.2 General Reclamation Objectives and Activities

Reclamation will be an integral part of the Kinney No. 2 Mine mining and related activities, however, because the mine will be an underground mine and the surface facilities and related surface disturbance areas will remain in place until the end of the mine life, mining

and reclamation will not occur concurrently or, in the case of progressive mining activities, sequentially. Reclamation of surface disturbance areas will generally occur following the cessation of mining operations to complete the mining and reclamation cycle although CR will implement temporary stabilization measures in certain areas following initial construction or during ongoing operations.

Objectives of the planned reclamation activities will be twofold; 1) For construction disturbance, temporary stabilization and contemporaneous reclamation will serve to stabilize disturbance areas, minimize erosion, and limit potential surface water impacts; 2) For long-term use areas, final reclamation is designed to restore disturbed areas to a safe, stable condition and to reestablish the productivity of the land consistent with the postmining land use(s). The proposed postmining land uses of wildlife habitat, water shed, and commercial use reflects the predisturbance use of this and adjacent areas, existing land use plans and policies, the desires of affected surface landowners, and practical constraints relative to land use capability and condition. Specific land use considerations and constraints are discussed in Section 3.4, Land Use Information. The Kinney No. 2 Mine reclamation plan has been designed to successfully meet these objectives and will result in effective temporary stabilization, and a postmining configuration which blends with the surrounding terrain and provides environmental values consistent with or superior to those which existed prior to mining.

The Kinney No. 2 Mine reclamation plan has been developed utilizing available information on the existing environmental resources as described in Section 3.0, Environmental Information. In addition, CR has incorporated both available information on current successful reclamation technology and practices and their extensive operating experience in the area. While the plans presented in this permit represent what CR feels to be the most effective reclamation practices for this site, it is important to note that successful reclamation must be a dynamic process, incorporating new information to optimize overall effectiveness. In order to meet the reclamation objectives these plans may be modified as appropriate to reflect changing conditions, revised regulatory requirements, advances in reclamation technology, and the results on ongoing research and experience relative to the long-term effectiveness of various reclamation practices. Any future plan modifications will be
Reclamation will involve a logical sequence of activities designed to achieve the overall reclamation objectives in an organized progressive manner. The following represent the general steps for reclamation of any mine or mine related surface disturbance areas:

- Facility Demolition and Removal
- Stabilization and Sealing of Mine Openings
- Disposal of Non-Coal Wastes, and Mine Waste Materials
- Backfilling and Grading to Establish the Final Design Configuration
- Drainage Reestablishment
- Road Removal
- Soil/Substitute Replacement
- Revegetation
- Post-Reclamation Management, Maintenance, and Monitoring
- Removal and Reclamation of Sedimentation Ponds and Associated Structures
- These activities are discussed in detail in the following sections.

5.4.1.3 Proposed Variances from Regulatory Standards

The Kinney No. 2 Mine area was mined by numerous mining companies as discussed in other sections of this permit application. These mining operations left numerous roads, operations areas and structures in the area, as well as a highwall at the old Kinney Mine portal area. This area was reclaimed by the Utah AML program in the 1980's, however, the highwall was not fully reclaimed, leaving a near vertical face of exposed rock and soils.

Due to previous mining and other disturbance of the area there is not sufficient available spoil to completely backfill this highwall, and the other old mining roads and disturbances. Given that the Kinney No. 2 Mine development activities effectively constitute remining of the previously disturbed areas which included a preexisting highwall, and other roads and disturbances, under the applicable regulatory provisions dealing with remining of previously mined areas (R645-301-553.500 through 524). Since the requirements of Rule R645-301-553.500 apply, a variance from the AOC restoration requirements is not necessary. The disturbed area for the Kinney No. 2 Mine will be reclaimed to the approximate original contour as it exists as of December, 2007, the state it was left in by the Utah AML reclamation project.

5.4.1.4 Certification and Reporting

Rule R645-301-512 specifies that certain designated cross-sections, maps, and plans be prepared by or under the direction of a qualified Registered Professional Engineer (PE) and that certain maps and design plans be certified by a PE. Consistent with this requirement, the following components which relate to this permit section meet the regulatory supervision and certification requirements:

- Previous Mining Activity Map, (Map 3.4.1.4-2)
- Regional Land Use Map, (Map 3.4.1.4-1)
- Surface Facilities Map, (Map 4.5.1.2-3)
- Sedimentation Pond Map, (Map 4.7.2.1-4)
- Pre-Mining, Mining & Post Mining Cross Sections (Map 4.5.2.3-1A through D)
- Geologic cross sections and maps (Figures 3.6-1, 3.6-3, 3.6-5, 3.6-6, 3.6-7, 3.6-8, 3.6-9, & 3.6-10)

5.4.1.5 Mapping of Reclamation Information

Information presented on the reclamation maps and cross-sections includes:

- Anticipated final surface configuration
- Postmining drainage features
- Location of any structures and facilities which will be retained as permanent structures following the completion of mining
- Any roads to be retained in conjunction with the postmining land use

5.4.2 Reclamation Plans and Practices

The specific reclamation plans developed for the Kinney No. 2 Mine area and the proposed reclamation practices reflect the overall reclamation objectives, site specific conditions and constraints, and the best current reclamation techniques and methods. The following sections describe the timing and sequencing of reclamation activities, general reclamation requirements, and specific reclamation practices.

5.4.2.1 Reclamation Timing and Sequencing

CR will reclaim mining related surface disturbance areas as soon as operationally practicable following completion of mining and related activities. For construction related disturbance, this commitment translates into regrading, establishment of effective drainage and sediment control, and temporary vegetation of the disturbed areas to stabilize these areas and prevent erosion or uncontrolled runoff.

With the exceptions of temporary stabilization of construction disturbance, other mining related disturbance areas are expected to remain in a disturbed condition until after the completion of mining and related activities. Reclamation of mine surface facilities areas following completion of mining will be initiated as soon as operationally feasible after mining ceases and no later than the next normal field season (typically May through October). It is anticipated that final reclamation would be completed within 24 months from the time the last coal is either produced or shipped from the property, whichever is later. Figure 5.4.2.1-1, Reclamation Timetable - Mine Facilities Area, outlines the specific sequence and anticipated timing of final site reclamation activities.

Final reclamation will involve removal of all mine related structures and facilities, closure and sealing of portals and mine openings, disposal of waste materials, backfilling and grading, drainage reestablishment, road removal, placement of soil or substitute materials, and revegetation. Generally, soil/substitute replacement and revegetation efforts will be coordinated so that soil materials are revegetated as soon as practically possible following placement. Normally this will involve placement of soil/substitute and immediate reseeding at the end of the field season in late fall. This approach allows the seed to "winter over" with germination in the spring when soil moisture conditions are elevated due to winter snow accumulations and spring melt.

Following final reclamation of mine facilities areas, the facilities to remain for postmining land use include the roads shown on Map 4.7.2.9-1, Postmining Topography and Interim Drainage Control Map. Also remaining will be some disturbed area collection ditches, the sedimentation pond and associated soil/substitute stockpile, any roads required to access these features, and any permanent drainage or other structures. These structures will remain in place to provide access and short-term drainage and sediment control during the extended liability period. The proposed interim drainage and sediment control plan includes four areas where CR proposes to utilize alternative sediment control methods as the primary means of controlling erosion and sediment contributions. The Postmining Topography and Interim Drainage Control Map (Map 4.7.2.9-1), shows the drainage and sediment control features which will be retained during the reclamation liability period, including the four areas which will utilize alternative sediment control. Components of the interim drainage and sediment control plan are identified and discussed in detail in Section 4.7 Hydrologic Resource Protection and PHC. Upon receipt of a determination of final

reclamation success and bond release from UDOGM for vegetation reestablishment and drainage restoration, collection ditch, sedimentation ponds, and associated soil/substitute stockpile areas and access roads will be removed and reclaimed. CR proposes to control sediment contributions during reclamation of the interim drainage and sediment control structure using a combination of silt fences, hay bales, and other appropriate alternative sediment control measures. These temporary controls will be installed prior to any reclamation activities and serve as a protective barrier between the reclamation areas and . The alternative sediment controls will remain in place during backfill/regrading operations, placement of soil material, reseeding, and re-establishment of vegetation, and will be removed following vegetative re-establishment. CR anticipates that reclamation of these features will be completed within 6 to 9 months following receipt of a reclamation success determination, dependent on the time of year that the determination is issued.

5.4.2.2 Reclamation Plan

Beyond the general reclamation objectives of restoring disturbed areas to a safe, stable condition and reestablishing the productivity of the land consistent with the postmining land use(s), this reclamation plan is designed to achieve the following specific operational and environmental objectives:

- Removal of Mining Related Structures and Facilities
- Eliminate Potential Hazards
- Establish a Stable Postmining Configuration
- Restore Effective Drainage
- Establish a Productive Self-Sustaining Vegetation Community

The following sections briefly describe important considerations and the rationale behind each of these specific objectives.

Removal of Mining Related Structures and Facilities

Given that the proposed mining and related surface structures are not generally compatible with the proposed postmining land use of wildlife habitat and watershed, these structures and facilities will be removed following completion of mining. All or portions of the surface facilities may be reclaimed at any given time dependent on the location and nature of potential future mining operations in this general area. When surface facilities are no longer required to support ongoing mining and related operations they will be removed and the associated surface disturbance areas reclaimed.

Mine structures will be removed and associated disturbance areas reclaimed, effectively eliminating any potential associated hazards. As part of the final reclamation activities, all portals and other mine openings will be stabilized, sealed, and the associated disturbance areas backfilled, graded, and reclaimed. Similarly, steep slopes and highwall areas will be partially or fully backfilled, regraded, and reclaimed eliminating or minimizing potential related hazards.

RECLAMATION TIMETABLE

RECLAMATION ACTIVITY	QUARTERS FOLLOWING COMPLETION OF MINING RELATED ACTIVITIES																																													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Facility Demolition & Removal																																														
Stabilization & Sealing of Mine Openings																																														
Disposal of Non-Coal Wastes, and Mine Waste Materials																																														
Backfilling & Grading to Establish Final Design Configuration																																														
Drainage Restablishment																																														
Road Removal																																														
Soil/Substitute Replacement																																														
Revegetation																																														
Post-Reclamation Management, Maintenance & Monitoring																																														
Removal & Reclamation of Sedimentation Pond & Associated Structures																																														

HANSEN ALLEN & LUCE inc
ENGINEERS

DATE: 12/07	Carbon Resources LLC	FIGURE 5.4-1
DRAWN BY: B.G.	KINNEY NO.2 MINE	
APPROVED BY: G.H.	RECLAMATION TIMETABLE	
SCALE: N/A	MINE FACILITIES AREA	

Evaluation of coal roof and floor materials and overburden/interburden materials indicates no significant toxicity concerns relative to these materials. As described in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, under the subtitle of Non-Coal Waste Disposal, all non-coal wastes will be collected and stored in appropriate containers and will be disposed of off-site by a licensed contract disposal firm. These disposal plans include any non-coal wastes remaining on completion of mining operations with the exceptions of concrete demolition debris and road surfacing materials resulting from facility removal which will be placed and buried in the deepest cut areas of the reclaimed area. Off-site disposal of most non-coal wastes and the planned disposal measures for demolition debris will effectively eliminate any potential associated hazards.

Establish a Stable Postmining Configuration

Following removal of mining related structures and facilities and closure and sealing of portals and mine openings the associated surface disturbance areas will be backfilled and regraded to establish a stable postmining configuration which blends with the surrounding terrain, provides for effective drainage, and is consistent with the postmining land use of wildlife habitat. Given that approximately 74% of the proposed disturbance area has been previously disturbed by pre-SMCRA mining, backfilling will be limited to the materials available consistent with applicable remaining provisions of the State of Utah Coal Mining Rules (R645-301-553.500 through 524). To the extent possible using all available material disturbed areas will be backfilled and regraded to blend with the surrounding terrain, and any exposed coal seams will be covered with a minimum of 4 feet of suitable cover material. The highwall remaining at the pre-SMCRA Kinney Mine portal faceup area will for the most part not be disturbed by the Kinney No. 2 Mine operations. The south end of the old faceup area will be disturbed by Kinney No. 2 Mine operations but this disturbance will only include a small portion of the old faceup disturbance and will not result in a new highwall. This new disturbance will be reclaimed to the approximate original contour as it exists at the beginning of the Kinney No. 2 Mine construction.

Restore Effective Drainage

In conjunction with final backfilling and regrading activities, permanent drainage features, designed to pass the peak flows from the 100-year, 6-hour event, will be established to effectively pass natural drainage through the reclaimed areas and provide for effective control of runoff from reclaimed areas while minimizing the potential for any significant erosion. During the interim period between reclamation and final bond release some temporary drainage structures may be retained and modified as necessary to carry disturbed area drainage flows from permanent drainages to the sedimentation pond which will also be retained to provide ongoing sediment control through the extended liability period.

Establish a Productive Self-Sustaining Vegetation Community

Consistent with the postmining land use of wildlife habitat, CR will reestablish a self-sustaining vegetation community composed primarily of indigenous native species but also including adaptive introduced species as appropriate to provide for rapid reestablishment, productivity, and species diversity. Activities related to vegetative reestablishment will include replacement of available soil or substitute materials, addition of any necessary soil amendments, seedbed preparation, seeding with the appropriate revegetation seed mixture, and selective application of mulch or other

erosion control materials to minimize erosion and provide an opportunity for initial vegetative establishment.

5.4.2.3 Reclamation Practices

The reclamation practices described in this section reflect CR's detailed review of information on the existing site configuration and environmental values, consideration of site reclamation potential and any important limitations, and application of the best current reclamation technology and both CR's and other coal operators extensive operating experience in this area. The following sections provide a detailed description of the specific reclamation practices proposed for surface disturbance areas associated with the Kinney No. 2 Mine.

Hydrologic Monitoring

CR will continue its comprehensive program to monitor surface and groundwater quality and quantity over the duration of the proposed reclamation operations and through the extended liability period. Postmining hydrologic monitoring activities are outlined in Section 4.7 Hydrologic Resource Protection Plan and PHC. The reclamation phase monitoring compliance list is presented in Table 4.7.2.3-1, Hydrologic Monitoring Schedule.

CR currently maintains, and will continue, a program to monitor surface and groundwater quality and quantity for the duration of the proposed mining, processing, and reclamation operations. The Hydrologic Monitoring Plan consists of monitoring stations identified in Tables 3.7-1, Kinney No. 2 Mine Baseline Monitoring Stations, and 3.7-2, Kinney No. 2 Mine Operational Monitoring Stations, according to the parameter sampling schedule shown in Table 4.7.2.3-1, Hydrologic Monitoring schedule. Baseline monitoring has been conducted on a monthly basis. Operational monitoring is planned to be conducted on a quarterly basis as follows.

Samples will be collected quarterly for parameters shown in Table 4.7.2.3-1, Hydrologic Monitoring Schedule, for all surface and ground water stations when the sites are accessible. At some sampling sites, winter conditions may create inaccessible or unsafe conditions. To help ensure as complete a data set as possible, first and fourth quarter samples will be collected during the time periods wherein there is the greatest likelihood of collecting a valid sample. This is believed to be in March and October respectively. Second and third quarter samples will be collected at a convenient time for the mine operator within the respective quarter.

The monitoring program thus instated serves as an integral part of CR's efforts to protect the hydrologic balance by providing an accurate and timely method of identifying and quantifying any possible concerns with respect to surface and ground water resources. The monitoring network is shown on Map 4.7.2.3-1, Surface and Ground Water Monitoring Sites. Table 3.7-1, Kinney No. 2 Mine Baseline Monitoring Stations, and Table 3.7-2, Kinney No.2 Mine Operational Monitoring Stations, when combined with Map 4.7.2.3-1, summarizes the type and location of monitoring sites. The frequency, density and accuracy of monitoring will allow CR to evaluate and determine the success of mine plans, drainage and sediment control facilities, and reclamation for the purpose of minimizing disturbance to the hydrologic balance.

The monitoring data and resulting evaluations will be used to identify any potential problems and develop necessary mitigation measures.

Facility Demolition and Removal

All existing structures and facilities and those structures and facilities constructed specifically to support the mining and related activities will be utilized and will remain in place until the mining and related activities which they support have been completed. At that time, all structures and facilities will be demolished or salvaged in order to reclaim the site and establish the postmining land uses.

At the current time the effective mine life is projected at 15 to 20 years, although mine life could be extended significantly with development of additional reserves to the east. Dependent on age and condition, much of the equipment which will be utilized for the mining and related operations, including conveyors and associated coal handling components, the primary crusher, process equipment, maintenance equipment, and some of the smaller prefabricated buildings or building components may be salvageable for continued beneficial use at the end of the mine life. Any equipment which is not salvageable will be dismantled and any buildings or other structures not salvaged will be demolished. Structures and facilities to be salvaged or demolished are identified in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, under the subtitle of Mine Structures and Facilities.

Equipment and facilities to be salvaged will be dismantled and removed from the site by CR, a buyer, or private salvage contractors. Disassembly and demolition of remaining equipment and structures will involve dismantling or cutting equipment, steel structures, and other large components into pieces which can be readily handled by mobile equipment; using heavy equipment, explosives; and cutting torches to break-up structural concrete members, exposed foundations, and masonry structures; ripping and removal of road surfacing materials; and removal of buried foundations and utilities to at least 2 feet below the design reclaimed surface. It is anticipated that all demolition debris except for concrete debris and road surfacing materials will be moved to one or more temporary storage areas from which the steel and other salvageable debris may be reclaimed for salvage and the remaining debris will be loaded into trucks for removal and off-site disposal in a permitted landfill facility.

Concrete debris resulting from facility demolition will be broken up into pieces small enough to be readily handled by mobile equipment and will be placed in deep fill area sites in the mine facilities area. These disposal sites have been selected to provide adequate disposal capacity for anticipated debris volumes at a level well above the normal water table. Proposed solid construction debris disposal sites include the following:

- Mine portal pad
- Office pad
- Operations pad
- Coal pile pad
- Loadout pad

The location of the designated disposal sites is shown on the Surface Facilities Map, (Map 4.5.1.2-3). Concrete and road surfacing materials will be placed in the designated disposal areas to minimize voids to the extent operationally practicable, a minimum of four feet of fill material will be placed over the disposal sites, and a tracked dozer or other heavy equipment will make multiple passes over the disposal area during cover placement to consolidate the debris.

Stabilization and Sealing of Mine Openings

On completion of mining and related activities, all mine openings including portals, shafts, raises, boreholes, and wells will be stabilized if required and sealed unless they are to be utilized for ongoing monitoring or in conjunction with the postmining land use. Methods and

requirements for sealing wells and boreholes are presented and described in Section 4.6.1, Geologic Protection Plans.

Current plans call for five underground mine openings (the five main portals). These openings will be permanently sealed on completion of mining to prevent access to the underground workings and, in the case of the mine openings, to provide an effective hydraulic seal to prevent surface drainage and infiltration through the backfill from entering the underground mine workings. Portals will be sealed and stabilized by constructing a concrete block wall approximately 10 to 25 feet in by the portal openings. The two layer thick solid block wall, which will be constructed as illustrated by Figure 5.4-2, Typical Portal Seal, will be keyed into the mine entry at least 6 inches on all sides and, for the mine portals, an MSHA approved sealant will be applied to the outer surface of the barrier to provide a positive water seal.

In order to assure the long-term integrity of the mine portal seals, CR, as part of the MSHA roof control plan, will maintain adequate barrier pillars and will utilize appropriate roof support including timber or concrete cribs, posts, roof bolts, trusses, or other supports to minimize subsidence and collapse or caving of the mine workings in the vicinity of the portal seals. Once the portals seals are in place, the remaining void space between the seals and the portal opening will be backfilled using a LHD or small backhoe to assure proper backfill placement.

Disposal of Mine Waste, and Non-Coal Waste

All non-coal wastes will be collected and stored in appropriate containers and will be disposed of off-site by a licensed contract disposal firm as described in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, under the subtitle of Non-Coal Waste Disposal. These disposal plans include any non-coal wastes remaining on completion of mining operations with the exception of concrete demolition debris as previously discussed.

Backfilling and Grading to Establish Final Configuration

Following completion of mining and related operations and subsequent facility removal and sealing of mine openings the associated surface disturbance areas will be backfilled and regraded. As previously noted in Section 5.4.2.2, Reclamation Plan,

approximately 74% of the planned disturbance area has been disturbed by previous mining disturbance.

Backfilling and grading will involve selective placement of all reasonably available spoil material consistent with applicable regulatory provisions for backfilling and grading (R645-301-553 through 553.200), and previously mined areas (R645-301-553.500 through 524), and based on the following priorities:

1) Cover exposed coal seams, sealed mine openings, and any solid waste disposal sites with a minimum of 4 feet of suitable material
2) Backfill and/or regrade disturbed slopes to establish a stable configuration which provides for effective drainage and minimizes erosion potential
3) Backfill and regrade steep cuts and highwall areas to eliminate cut or highwall exposures

The land configuration in the mine facilities area prior to development of the CR Kinney No. 2 Mine operations is illustrated by the Mine Surface Facilities Area, Pre-Mining Topography Map, (Map 4.5.1.2-4). This map shows that the mine surface facilities area consists of a gently sloped area at the southwest portion of the area transitioning to a steep slope on the eastern and northern portions of the area. The area has an existing road running from the highway up the mountain on the south, and a road running northward through the area to the Smith property on the north. There is also an existing railroad grade along the west side adjacent to, and parallel to the highway. Portions of this railroad grade still has tracks remaining, and portions of the tracks and ties have been removed, but the general railroad grade remains. This railroad grade will not be impacted by Kinney No. 2 Mine operations and will be left as it exists in it's pre-mining configuration.

The designed postmining configuration for the facilities area is based on utilization of all available spoil material to achieve the stated reclamation objectives within the constraints of site topography, drainage considerations, and the noted backfilling and regrading priorities. The limits of available fill material were determined by identifying from the available mapping, topsoil pits, trenches, and the geotechnical boring logs. Final backfilling and grading of the mine surface facilities area will require the movement of a total of approximately 221,877 cubic yards of material. Comparison of the land configuration prior to site development with the designed postmining topography based on the Mine Surface Facilities Area Pre-Mining Topography Map, (Map 4.5.1.2-4), the Postmining Topography & Interim Drainage Control Map, (Map 4.7.2.9-1), and the Mine Surface Facilities Area Premining and Postmining Cross-Sections, (Map 4.5.2.3-1), indicates that the design postmining topography will result in stable slopes, reduce cut exposures, provide for more effective drainage, and offer better blending of the area with the surrounding terrain. Reclamation Contours have been prepared to match as closely as possible those that existed prior to disturbance. A considerable volume of pre-SMCRA coal exist in the mine area from historic mining. These coal fines have primarily been removed from their operational locations by the Utah AML reclamation project and placed in low lying areas and covered by reclamation soils. Kinney No. 2 Mine soils investigations and geotechnical investigations have identified some of this pre-SMCRA coal material, but identifying all of this material is not possible. Based on calculations from the previously mentioned investigations, it is estimated there are

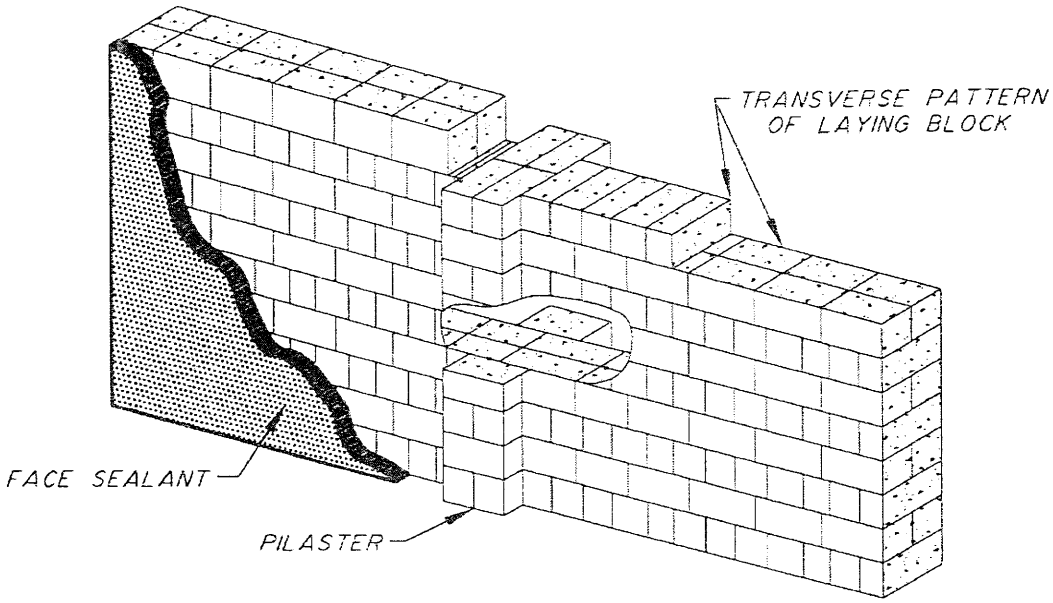
approximately 12,000 tons of coal fines that will be encountered during construction of the mine facilities. This material will be removed and sold as discussed previously, and will not be used for final reclamation. This reduced volume will result in a slightly lower overall land surface upon final reclamation. The final reclamation land surface can be seen on Map 4.7.2.9-1, Postmining Topography & Interim Drainage Control Map and on Map 4.5.2.3-1A through 4.5.2.3-1D, Premining, Mining & Postmining Cross-Sections.

During final backfilling and grading operations, drainage and sediment will be controlled by those components of the drainage and sediment control network retained as part of the interim drainage system or by site-specific alternative sediment control practices.

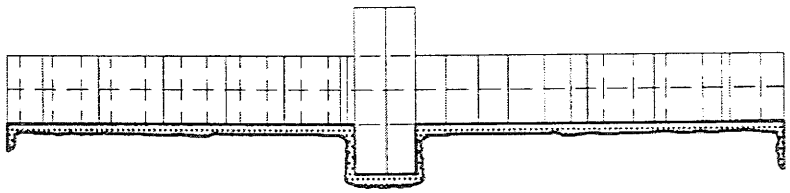
Backfilling and grading will involve the use of tractor scrapers, tracked dozers, wheel loaders and trucks, and motor graders, as necessary to recover, move, place, grade, and compact backfill materials. Generally, backfill material will be placed in relatively uniform lifts and will be compacted by normal equipment traffic. Backfilled areas will be sloped and graded to promote effective drainage and to the extend operationally feasible long unbroken fill slopes will be avoided to minimize sheet flow and potential resultant erosion. Fill slopes will replicate the pre-mining slopes generally, and graded slopes in native material will vary dependent on material from less than 5H:1V to as much as 0.5H:1V in competent rock consistent with slope stability considerations as documented in Exhibit 4.5.2.1-1, Geotechnical Investigations. Recommended slope limitations for final cut and fill slopes will result in slope configurations having a static factor of safety of at least 1.3. The designed safety factor for any benched slopes is 1.5.

Graded areas will incorporate undulations consistent with the surrounding terrain and the postmining drainage configuration and the surface of graded areas will be left in a roughened condition to minimize runoff and erosion in the interim before soil/substitute replacement, improve bonding between the regraded surface and soil/substitute materials, and increase infiltration to maximize soil moisture levels and promote revegetation. Regraded surfaces will be deep (up to 3 feet) ripped and finely chopped native hay from the current seasons crop will be applied to increase organic content, provide soil biota, and increase infiltration and moisture holding capacity.

Under the applicable regulatory provisions dealing with remining of previously mined areas (R645-301-553.500 through 524), the planned backfilling and grading operations will utilize all available spoil material to eliminate remaining highwall and cut slope exposures to the maximum extent technically practical. Fill material placed against highwall and cut slope areas will be placed and graded to assure long-term stability and final slopes will provide for effective drainage and be compatible with both natural slopes in the area and the postmining land use of wildlife habitat, and watershed.



SECTIONAL ELEVATION VIEW



TOP VIEW

NOTES:

1 - 16" X 8" X 8" CONCRETE BLOCKS TO BE USED IN CONSTRUCATION

2 - PILASTER TO BE USED IF NECESSARY FOR SOLID CONSTRUCATION.

Carbon Resources LLC

KINNEY NO. 2 MINE

TYPICAL PORTAL SEAL

DRAWN BY: B.G DATE: 12/07

APPROVED BY: G.H. DATE: 12/07

KAISER ALLEN & LUCE

25 S. Carbon Ave., Suite 21
Price, UT 84501

FIGURE 5.4-2

Drainage Reestablishment

In conjunction with final backfilling and grading activities, CR will establish a postmining drainage configuration which is compatible with the natural drainage pattern of the surrounding terrain, will effectively route natural drainage from upgradient areas through the reclaimed area with minimal erosion or increase in sediment concentrations, and will effectively control drainage and erosion in the reclaimed areas. The designed postmining drainage configuration is shown by the Postmining Topography & Interim Drainage Control Map, (Map 4.7.2.9-1). Permanent diversions carrying undisturbed drainage have been designed and will be constructed through the reclaimed area to route undisturbed flow directly to the west. During the extended liability period, disturbed area runoff from the reclaimed areas will continue to be collected and routed to the sedimentation pond which will be retained until UDOGM issues a determination of reclamation success based on successful vegetative reestablishment and restoration of pre-disturbance surface runoff water quality. Following this determination, all temporary ditches, and the sedimentation pond will be removed and reclaimed. Additional discussion of postmining drainage reestablishment is provided in Section 5.5, Hydrologic Restoration.

Road Removal

Certain roads within the mine facilities area will continue to provide access to specific areas during both reclamation and the extended liability period, although most roads will be removed and reclaimed during final site reclamation. Generally, the primary access roads will be removed and reclaimed in two phases. The first phase will involve ripping of these roads and removal of the associated road surfacing materials. This phase will occur in conjunction with facility demolition and removal and the surfacing materials removed will be placed in the designated solid waste disposal areas as previously discussed. The second phase of road removal for primary roads will be sequenced to coincide with backfilling and grading of the areas that the roads either provide access to or pass through. When roads are no longer needed, they will be removed and the associated disturbance areas will be regraded and reclaimed.

Road reclamation will generally involve the use of tracked dozers to rip the road surface and grade any surfacing material into piles which will normally be recovered by wheel loader and either hauled directly or loaded into trucks for haulage to one of the designated disposal areas. Road surfaces will then be ripped to alleviate any compaction and the road area will be graded to blend with surrounding reclaimed areas. During final grading, any culverts will be removed and transported to a temporary steel debris storage site for either salvage or disposal off-site. Cut/fill areas will be reclaimed by pulling the fill material upslope into the cut and grading any remaining cut slope, the fill material, and disturbed downslope areas to a stable configuration consistent with natural drainage patterns and blending with the surrounding terrain. Any major road cuts will be reclaimed by partially backfilling the cut and grading any remaining cut slope exposures so that they are stable as described in the backfilling and grading plan discussion. Any major road fills which would interfere with postmining drainage will be removed and the associated disturbance areas regraded in conjunction with overall site grading activities.

In order to provide access to drainage and sediment control structures, soil/substitute stockpiles, and monitoring sites, a temporary road accessing Sediment Pond 1 will

remain during the bonding period as shown on Map 4.7.2.9-1, Mine Surface Facilities Area Postmining Topography & Interim Drainage Control Map. Removal and reclamation of this road will occur following the extended liability period and determination of final bond release for the mine surface facilities area. The sediment pond will also be removed and the area reclaimed at the end of the extended liability period.

Soil/Substitute Replacement

Following completion of backfilling, grading, and drainage reestablishment, available soil material will be replaced on the regraded areas as a growth medium for subsequent revegetation. Soil will be replaced as soon as operationally practicable following completion of the other necessary activities in the reclamation sequence, however, the timing of soil placement will also reflect the need to reestablish vegetation as soon as possible to stabilize and prevent loss or erosion of the topsoil.

Available soil will be recovered from the stockpile established during site development for placement on disturbed areas. Prior to soil replacement, graded areas will be ripped to alleviate compaction, promote moisture infiltration, and provide a good bond between the soil and underlying materials and chopped native hay will be applied. Given limited soil availability, ripping and hay application will also enhance overall ground conditions to provide for effective root penetration and enhance soil water holding capacity. Tractor scrapers or wheel loaders, trucks, and tracked dozers will be utilized to recover and place the available soil material at a uniform thickness. Replaced soil materials will be left in a roughened condition to control runoff, limit erosion and soil loss, and promote moisture infiltration.

Following placement the material will be sampled to verify suitability and determine the need for any soil amendments and specific mitigation measures will be implemented if indicated to address any suitability or nutrient deficiency concerns. Additional discussion of soil replacement plans and practices is provided in Section 5.2, Soil Replacement Plans. CR will selectively apply alternative sediment control measures and necessary to limit erosion potential. Areas where soil has been replaced will be reseeded as soon as operationally feasible following placement. Reseeded areas will be mulched with straw or native hay and the mulch will be crimped into the soil to minimize wind loss.

Revegetation

Backfilling and grading will address establishment of a stable topographic configuration which provides for effective drainage and blends effectively with the surrounding terrain. Soil replacement will provide an effective vegetative growth medium. Revegetation will be the final step in restoring disturbed lands to productive, self-sustaining use. As the final step in the reclamation process, all surface disturbance areas except those associated with roads which will be retained to support the postmining land use will be revegetated. Revegetation plans are designed to restore a postmining land use of wildlife habitat consistent with pre-disturbance land use patterns in the area.

Revegetation efforts will focus on establishment of effective vegetative cover as soon as reasonably possible following placement of soil/substitute material in order to

prevent loss or erosion of these materials. CR has selected the proposed revegetation seed mixture to promote rapid vegetative establishment; assure good site adaptability; provide vegetative cover and production values consistent with effective erosion control and postmining land use requirements; and establish a healthy self-sustaining vegetative community. Typically seeding will occur in late fall in order to allow the sees to lie dormant over the winter and take advantage of increased soil moisture levels resulting from snowmelt and runoff during the spring. Seeding may occur at other times where appropriate to minimize erosion due to location, aspect, or other site specific factors. Any required shrub or woody species transplanting will occur in late spring to minimize the potential for frost-kill.

Seedbed preparation will normally involve chisel plowing, tine harrowing, or shallow discing to prepare the surface to receive seed. Seed may be placed using either a rangeland seed drill for relative large flat areas or broadcast methods for smaller areas or steeper slopes which may not be readily accessible to equipment. Following seed placement, weed free straw or native hay mulch or other erosion control materials will be placed and crimped or anchored to protect the soil, minimize erosion, prevent seed loss and help trap and retain moisture. Additional discussion of revegetation plans and practices is provided in Section 5.3, Habitat Restoration Plans.

Post-Reclamation Management and Monitoring

CR's objectives in managing reclaimed areas include interim inspection and maintenance to address any minor erosion, seeding failures, drainage problems, or other measures necessary to achieve the long-term goal of successful revegetation and drainage restoration consistent with the postmining land use of wildlife habitat and watershed. As part of the postmining management program, the reclaimed area will be inspected on a regular quarterly basis at a minimum for any indications of significant erosion, siltation, surface instability, drainage problems, seeding failure, weed infestations, or other conditions which could adversely impact reclamation success. Inspections will continue throughout the extended liability period to assure effective reclamation. Any problems identified as a result of these regular inspections will be addressed in a timely manner consistent with overall reclamation plans and practices.

The reclamation plan for the Kinney No. 2 Mine has been designed to prevent or minimize erosion and restore disturbed areas to a stable and productive condition. If despite CR's best efforts, inspection of the reclaimed areas indicates that natural erosional processes are creating significant rills or gullies, CR will implement appropriate remedial/protective measures within 60 days following identification of erosional features meeting specific depth criteria. In order to minimize any associated surface disturbance, the proposed erosion mitigation measures reflect consideration of the nature and extent of erosional damage and are designed to be implemented in phases dependent on the severity of or potential for damage.

The lowest level of mitigation will be designed to prevent further damage and either repair damaged areas or establish surface controls which will facilitate repair through natural ongoing processes. For any areal erosion problems, where high overland

flow velocities, steep slopes, or poor vegetative reestablishment have resulted in numerous rills and gullies nine inches or more in depth, evaluation and mitigation will focus on upslope drainage control and stabilization of eroded areas. Various control measures may be implemented to limit upgradient flow volumes and velocities and stabilize eroded areas dependent on site specific conditions including supplemental grading of small upgradient areas to distribute flows over a larger area, placement of large riprap or other velocity dissipators, selective placement of straw bales or sediment fences, application of erosion control netting or other materials, supplemental seeding, mulching, or combinations of these methods.

By limiting flow volume and velocities and stabilizing the effected areas, sediment loss will be reduced, features such as sediment fences and straw bales will trap and hold sediment to help repair erosional features, and problem areas can be stabilized over time. If inspection subsequent to application of the initial mitigation measures indicated that erosional problems are continuing, the number and density of control structures may be increased or more intensive controls including contour furrowing, upslope diversion, or additional backfilling and grading of problem areas may be implemented.

For isolated erosional problems, where channelization of surface runoff has resulted in the creation of one or more gullies one foot or greater in depth, both upslope drainage and the nature of the erosional damage will be evaluated and addressed as appropriate. If upslope drainage is the primary causative factor, localized measures to control flow velocities or distribute flow will be implemented including placement of straw bales or large riprap to break up concentrated flows; establishment of berm or contour furrows to temporarily divert flows away from problem areas; and localized placement of fill, reseeding, and placement of straw bales, sediment fences, or erosion control materials to allow the damaged area(s) to stabilize.

Any seeding failures or weed infestations identified by the post-reclamation management inspections will be addressed during appropriate time periods to achieve optimal mitigation. Any areas where partial or complete seeding failure is indicated by limited vegetative reestablishment or excessive dominance of one or more species will be addressed by reseeding the effected areas during either the early spring or late fall. Essentially the same seeding methods will be utilized as for initial seeding with the exception of seedbed preparation. Any significant weed infestations will be addressed through consultation with UDOGM to determine appropriate control measures. If the controls determined through this consultation process involve the application of herbicides, only those chemicals approved for use by the appropriate State and Federal agencies will be considered and control practices will be limited to spot application at the appropriate time period for best control of the problem species.

Removal of Drainage and Sediment Control Structures

Those drainage and sediment control structures necessary to collect and control disturbed area drainage from reclaimed areas will remain in place until the end of the extended liability period when UDOGM issues a determination that the site has

been successfully reclaimed based on revegetation success and restoration of runoff water quality. Generally, reclamation of drainage and sediment control structures will involve backfilling and grading all temporary ditches to conform to the established grade of the surrounding terrain; draining the sedimentation pond, removing the discharge structures, pushing any pond berms into the open basin area, and regrading the pond area to blend with the surrounding terrain; replacing stockpiled soil/substitute materials on the regraded areas; and revegetating the reclaimed areas. During final pond removal and reclamation, drainage and sediment from the pond areas will be controlled by alternative sediment control measures including temporary berms, straw bales, silt fences, or other appropriate site specific control measures.

5.4.3 Reclamation Cost Estimate

Consistent with applicable regulatory provisions (R645-301-542.800 and R645-301-800) which require that reclamation bonding calculations be based on an approved reclamation plan, CR has developed a detailed reclamation cost estimate based on the preliminary UDOGM determination that the reclamation plan is acceptable. The detailed estimate includes costs for all activities described in the approved plan with specific consideration of the areas to be reclaimed and the nature and difficulty of required reclamation efforts. Additional information on the reclamation cost estimate and related bonding considerations is provided in Section 6.1, Bonding Information, and the detailed bond reclamation cost estimate has been provided for insertion as Exhibit 5.4.3-1, Bonding and Insurance Information.

5.5 HYDROLOGIC RESOURCE RESTORATION

This section describes the plan for restoration of hydrologic resources in the permit and adjacent areas that could potentially be affected or impacted by the mining and reclamation activities. Information in this section was developed in accordance with applicable regulatory guidelines (R645-301-700) for coal mine permitting in the State of Utah.

5.5.1 General Description of the Hydrologic Restoration Plan

5.5.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Reclamation Plans (Rule R645-301-760). The following table cross-references the headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Regulatory Provision Addressed
5.5	R645-301-700
5.5.1	R645-301-700
5.5.1.1	Not Applicable
5.5.1.2	R645-301-760 and 761
5.5.2	R645-301-760, 764
5.5.2.1	R645-301-761 and 764
5.5.2.2	R645-301-761
5.5.2.3	R645-301-762.100 and 764
5.5.2.4	R645-301-762.200 and 764
5.5.2.5	R645-301-763.100, 763.200, and 764
5.5.2.6	R645-301-764 and 765

5.5.1.2 General Hydrologic Restoration Requirements

Before abandoning the Kinney No. 2 Mine area or seeking final bond release, CR will remove and reclaim temporary structures and take appropriate actions to assure that any permanent sedimentation ponds, diversions, impoundments, and treatment facilities meet applicable regulatory requirements.

5.5.2 Hydrologic Restoration Plans

All areas disturbed by mining and related operations will be reclaimed as soon as operationally practical following completion of mining. CR has incorporated specific control and mitigation measures in mining, processing, and reclamation plans in order to prevent any significant impacts on surface or ground water quality. All mining related activities including soil/substitute removal, mine development, coal recovery, mine sealing, backfilling and grading, topsoiling, and revegetation are designed and sequenced to minimize disturbance and progress in a logical manner towards effective restoration of disturbed areas to pre-disturbance conditions. Reclamation will involve backfilling and regrading disturbance areas, replacement of soil or substitute materials, and revegetation, re-establishment of drainage patterns similar to those

existing in the premining environment, and development of a self-sustaining vegetative community. As a result of effective reclamation, infiltration and runoff relationships will be restored, limiting the time interval over which water quality impacts may occur.

As a component of the planned reclamation activities CR will remove some temporary operational drainage structures, establish designed permanent postmining drainage structures, and modify some of the existing temporary drainage structures to provide for effective drainage and sediment control during the extended reclamation liability period. Details of the interim drainage control plan addressing the period between site reclamation and final bond release are discussed in Section 5.4.2.1, and illustrated by the Mine Surface Facilities Area – Post Mining Topography & Interim Drainage Control Map, (Map 4.7.2.9-1).

5.5.2.1 Removal and Reclamation of Temporary Structures

When no longer required for sediment control, all temporary diversions will be removed and the affected lands reclaimed. Reclamation will consist of filling of the diversion ditches with material from adjacent areas consistent with the design postmining drainage configuration, grading to blend ditch areas with surrounding terrain, replacement of available soil and reseeding.

Sedimentation pond reclamation will involve removal of any man-made discharge structures, removal and disposal of any riprap, concrete, and bedding materials which will not be utilized in conjunction with reestablishment of post-mining drainages, grading of embankment fill into pond basin area, and regrading associated disturbance areas to blend with the surrounding terrain. Replacement of soil and revegetation as described in Section 5.0, Reclamation Plan, will complete pond reclamation. Upon restoration of disturbed areas, all sedimentation ponds and water storage and treatment impoundments will be removed and associated disturbance areas reclaimed. In addition, all reclaimed areas will be regraded to reestablish natural drainage patterns and eliminate any significant depressions which could impound water.

5.5.2.2 Compliance of Permanent Structures

In conjunction with reclamation of all areas disturbed by mining and related activities, CR will reestablish an effective postmining drainage configuration as shown on the Mine Facilities Area Post Mining Topography & Interim Drainage Control Map, (Map 4.7.2.9-1). Postmining drainages have been designed in compliance with requirements for permanent diversions and provide drainage distribution and density characteristics similar to the pre-disturbance environment. Anticipated runoff characteristics and site geomorphic considerations have been incorporated in postmining drainage designs to assure long-tern stability, minimize erosion, and prevent significant additional contributions of suspended solids to area drainages. CR will continue to operate and maintain sedimentation ponds and associated drainage structures until contributing drainage areas are effectively restored through application of the reclamation practices. Effective restoration will include a determination of revegetation success and restoration of surface drainage characteristics such that contributions of suspended solids from untreated disturbed area runoff are within applicable water quality limitations.

5.5.2.3 Reclamation of Roads

Roads that will not be retained for use under an approved postmining land use will be reclaimed immediately after they no longer needed for coal mining and reclamation activities.

Reclamation of roads will include reshaping of all cut and fill slopes to be compatible with post-mining land use and to compliment the drainage pattern of the surrounding terrain.

5.5.2.4 Restoration of Natural Drainage Patterns

As an underground mining operation, surface disturbance associated with CR's mining activities will be minimal relative to the overall permit area. However, where disturbance does occur, CR will reclaim disturbed areas using reclamation practices that restore normal infiltration and runoff characteristics to conditions that are comparable to premining conditions. This will be done as soon as operationally feasible following completion of mining and related activities.

Reclamation will involve backfilling and grading to stabilize the slopes, reestablishment of natural drainage patterns, topsoil replacement, and revegetation. CR has also designed the postmining topography and associated backfilling and grading plans to effectively utilize available materials and minimize disturbance of adjacent areas.

Permanent postmining drainages have been located and designed to generally duplicate premining drainage patterns and densities and to effectively convey surface drainage flows. Postmining drainage patterns and designs are illustrated by the Mine Surface Facilities Area – Post Mining Topography & Interim Drainage Control Map, (Map 4.7.2.9-1) and Exhibit 4.7.2.2-1 Runoff Control Design Details.

Disturbance areas will be backfilled where necessary and regraded to establish a stable undulating configuration with relatively short gradual slopes which will blend with surrounding undisturbed terrain. Regraded surfaces will be left in a roughened condition to limit runoff and provide for an effective bond between the regraded materials and subsequently placed topsoil. Soil replacement and reseeding will be scheduled to minimize the period of time during which soil materials will be exposed without a protective vegetative cover.

Reclamation will be completed by replacing available soil resources and revegetating disturbance areas to establish an effective vegetative cover which will control runoff, erosion, and provide effective habitat and grazing/forage values for wildlife.

Under applicable regulatory provisions, one of the conditions for final bond release is documentation of restoration of premining drainage conditions. CR will develop and provide this documentation to UDOGM using one of two methods or by a combination of the two; 1) Comparisons of post-reclamation water monitoring data with premining baseline data and applicable effluent standards; 2) Runoff and sedimentation modeling utilizing measured reclamation cover values to determine runoff curves and sediment contributions and comparison with model results developed using baseline cover values.

5.5.2.5 Maintenance of Siltation Structures

Postmining drainages and temporary ditches will route any disturbed area runoff to the sedimentation pond through the post-reclamation period to the point of bond release.
Runoff from the area south of the site access road cannot flow to the sedimentation pond and therefore will be controlled by alternative sediment control measures as shown on Map 4.7.2.9-1, Mine Facilities Area Post Mining Topography & Interim Drainage Control Map. Following determination of reclamation success, sedimentation ponds and temporary diversion ditches will be reclaimed and postmining drainages will be connected to existing natural drainages. Where postmining drainages intersect existing natural drainages, the transition channel will be constructed to provide a smooth transition of both channel configuration and flow. Siltation structures will be maintained until removal is authorized by UDOGM and the disturbed area has been stabilized and revegetated. Structures will not be removed within two years after the last augmented seeding.

5.5.2.6 Casing and Sealing of Wells and Mine Openings

All exploration drillholes completed by CR within the Kinney No. 2 Mine permit area will either be completed as monitoring wells or sealed following completion of drilling, sampling, and logging. Well completion and sealing methods are described in Section 4.6, Geologic Protection Plans.

CR does not intend to transfer title of any monitoring wells to a second party following the cessation of mining and reclamation activities.

Following a finding by the UDOGM that exploration drillholes completed by CR as monitoring wells are no longer needed for monitoring, CR will be sealed and backfilled in accordance with regulatory guidelines.

6.0 BONDING

This section of the Kinney No. 2 Mine Permit Application provides information relative to reclamation bonding requirements and provisions required under Rule R645-301-800. The information presented in this section is generally based on and responds to specific regulatory requirements. The insurance information presented in this section have been prepared in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to verify compliance with applicable regulatory requirements.

The information categories addressed in the subsections which make up the Bonding Section is consistent with the information categories outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

6.1 Bonding Information

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps and exhibits, is referenced in the text and provided in the separate map and exhibit volumes.

6.1 BONDING INFORMATION

6.1.1 General Bonding Information

This section defines the requirements for filing and maintenance of performance bonds, addresses requirements for determination of bond amounts, identifies acceptable bond forms and required bond terms and conditions, describes requirements for replacement of bonds, and defines specific actions and requirements for bond release. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-800) for coal mine permitting in the State of Utah.

6.1.2 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-820 through 880.932. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section	Applicable Regulatory Provisions
6.1.1	General Introductory Information
6.1.2	General Introductory Information
6.1.3	R645-301-820.100 through 352
6.1.4	R645-301-830.100 through 500
6.1.5	R645-301-840.100 through 520
6.1.6	R645-301-850.100 through 320
6.1.7	R645-301-860.100 through 380
6.1.8	R645-301-870.100 through 200
6.1.9	R645-301-880.100 through 932
Maps	None
Exhibits	R645-301-830.100 through 300

6.1.3 Requirement to File a Bond

After approval but prior to issuance of the mining permit, CR will file a reclamation bond payable to UDOGM. The bond will be provided on a form prescribed and provided by UDOGM and will be conditioned on faithful performance of the permit plans, and applicable

requirements of the State of Utah Coal Mining Rules. As an underground coal mining operation, the bond will cover long-term surface facilities and structures and surface disturbance areas associated with the mining and related activities. Bond coverage may be for a specific term but will be maintained to provide continuous bonding coverage over the entire period of active mining and reclamation and for the extended liability period following completion of reclamation. Under the bond, CR's liability will be limited to those obligations or commitments under the approved permit specifically including reclamation of surface disturbance to return the land to a condition and productive capacity capable of supporting the approved postmining land use.

6.1.4 Determination of Bond Amount

Under Rule R645-301-830.120, the bond amount will depend on the requirements of the approved permit and reclamation plan. Consistent with this requirement, bond reclamation calculations do not accompany this initial permit application submittal. Once UDOGM has had opportunity to review and comment on the permit application and reclamation plan and any related issues have been effectively resolved, CR will proceed with preparation of a detailed bond reclamation cost estimate. This estimate, which will be submitted to UDOGM for insertion in Exhibit 5.4.3-1, Bonding and Insurance Information, will be based on the approved reclamation plan; reflect the anticipated level of effort required to reclaim all surface disturbance given site topography, geology, hydrologic conditions, revegetation potential, and other relevant factors; and will reflect any appropriate inflation factors to address potential increases in reclamation cost over the permit term.

Generally, the method used in calculating the bond reclamation cost estimate is consistent with the guidance provided by the Handbook for Calculation of Reclamation Bond Amounts (USDI-OSMRE, [latest version]) and will involve the following sequential steps:

- Determine the maximum disturbance scenario relative to reclamation requirements
- Identify, delineate, and determine disturbance area acreages
- Determine required reclamation functions and sequencing
- Calculate material handling requirements and volumes
- Delineate haulage routes and determine material haul or push distances
- Select and specify appropriate reclamation equipment
- Calculate equipment productivities
- Calculate equipment and manpower schedules and project time requirements
- Develop equipment, labor, material, demolition, and revegetation unit costs
- Calculate project profit and indirect, overhead, management and other costs
- Develop cost summary for total estimated bond reclamation cost
- Develop and present bond reclamation cost estimate documentation including description of methodology, summary calculations, and supporting volumetric, productivity, and cost data

With the exception of the text description included in the summary report, reclamation calculations will be developed and presented in computer format to facilitate review and any necessary future modifications.

Following submission of CR's detailed bond reclamation cost estimate, UDOGM will determine the appropriate bond amount which will be based on but not necessarily limited to CR's bond estimate. If the cost of reclamation and corresponding bond coverage increases or decreases due to changes in the method of operation or other factors, CR may request or UDOGM may determine that an adjustment in the bond amount is appropriate. CR and the bond surety will be notified by UDOGM of any proposed adjustment in bond amount and will have opportunity for review of the proposed adjustment and an informal conference to discuss the adjustment and related matters. If CR elects to request an adjustment in bond amount, the request will be accompanied by appropriate documentation supporting the request. Adjustments involving undisturbed lands or revised reclamation costs are not considered a bond release.

6.1.5 Bond Terms and Conditions

In compliance with applicable regulatory provisions, the reclamation bond submitted prior to permit issuance and initiation of development, construction, and operations will be in the amount determined by UDOGM and will be payable to UDOGM. Other specific required bond terms and conditions will include the following:

- The bond will be conditioned on faithful performance of all applicable requirements of the State Program and the approved permit, including completion of the reclamation plan
- Continuous bonding coverage will be provided for the latter of, the period of active mining and reclamation and the extended liability period following completion of reclamation, or until the reclamation requirements under the State Program and permit are achieved
- The bond will provide for prompt notification of UDOGM and CR by the surety in the event of any action which would render the surety incapable of providing continuing, valid bond coverage including insolvency or bankruptcy of the surety or CR, or alleged violations which could result in suspension or revocation of the surety's charter or business licenses
- If the surety is incapable of providing continuing, valid bond coverage, CR will promptly notify UDOGM and UDOGM will, in turn, provide written notification to the CR that replacement bond coverage must be obtained within a specified period not to exceed 90 days. If replacement coverage is not obtained prior to the end of the specified period, the CR will cease coal mining operations and will comply with applicable requirements for temporary cessation. Mining operations will not resume until a suitable replacement bond has been posted.

6.1.6 Bonding for Underground Coal Mining and Reclamation Activities

Specific reclamation bonding requirements and provisions which are applicable to underground coal mining and reclamation operations include limitation of bonding coverage to surface facilities and structures and surface disturbance areas associated with the underground mining operations and designation of a "long-term period of liability" in recognition of the extended period of use which is typical for such facilities and areas.

The long-term liability period will begin with permit issuance and will continue until the bond has been released, replaced, or extended in compliance with applicable regulatory provisions.

In order to maintain continuous bonding coverage, the bond will be conditioned on extension, replacement, or payment in full 30 days prior to expiration of the permit term. If the bond does not provide coverage for the entire reclamation liability period or alternatively, if a bond for the new permit term is not filed 30 days prior to expiration of the permit term, UDOGM may act to initiate bond forfeiture.

6.1.7 Form of Bond

The applicable regulations provide several alternatives for compliance with requirements for reclamation bonding coverage. Each specific alternative or bond form has a number of associated compliance requirements. Once the bond amount is determined, CR will evaluate potential bonding alternatives and will select and submit a bond in a form which meets all applicable compliance criteria.

6.1.8 Replacement of Bond

Under regulatory provisions for bond replacement, CR may elect to replace any existing bond(s) with another bond(s) providing equivalent coverage, however, existing bond(s) will not be released until UDOGM has approved as acceptable the replacement bond and bond replacement will not constitute bond release.

6.1.9 Bond Release

The applicable UDOGM regulations provide specific guidance relative to procedures for release of reclamation performance bonds. On completion of mining and related activities, CR anticipates that all associated surface disturbance will be reclaimed consistent with the approved reclamation plan in order to restore the effected lands to a condition and capability consistent with the approved postmining land use. Upon completion of reclamation and surface restoration CR will file application for bond release consistent with the following bond release process:

- CR files application for bond release
- Within 30 days of the application date, CR will file a public notice in a local newspaper of general circulation with publication at least once per week over a period of four weeks
- CR mails notices of bond release inspection to surface owners
- Within 30 days of the application filing UDOGM will conduct a bond release inspection which may also include interested surface owners or agents
- Persons with a valid legal interest which could be effected by bond release or responsible officials of jurisdictional agencies can submit written comments or objections and may request a hearing within 30 days following the date of last publication of the public notice
- If a hearing is requested it will be held within 30 days of receipt of the hearing request

- If no public hearing is held UDOGM, within 60 days of the application filing, will notify CR, the bond surety, and other interested persons of its determination on the bond release request
- At least 30 days prior to bond release UDOGM will notify, by certified mail, the municipality in which the mining activities are located of the pending bond release

6.2 LIABILITY INSURANCE

Prior to approval of this permit application, CR will provide UDOGM with a certificate of insurance verifying that CR has a valid existing public liability insurance policy in form for the Kinney No. 2 Mine. The insurance policy will be issued by a firm authorized to conduct business in Utah and will provide personal injury and property damage protection of at least $300,000 for each occurrence and $500,000 aggregate. The policy will be maintained in force during the life of the permit including the extended liability period and will include a rider providing for notification of UDOGM of any substantive change in the policy including termination or failure to renew.

In lieu of a public liability policy, CR will also have the alternative of verifying that it can satisfy applicable state self-insurance requirements.

6.2 LIABILITY INSURANCE

This section of the Kinney No. 2 Mine Permit Application provides information requirements for public liability insurance required under Rule R645-301-800. The information presented in this section is generally based on and responds to specific regulatory requirements. The insurance information presented in this section have been prepared in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to verify compliance with applicable regulatory requirements.

The information categories addressed in the subsections which make up the Insurance Section are consistent with the information categories outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

6.2 Liability Insurance

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps and exhibits, is referenced in the text and provided in the separate map and exhibit volumes.

7.0 SPECIAL CATEGORIES AND MINING AREAS

This section of the Kinney No. 2 Mine Permit Application provides both general and specific information on design, construction, operation, maintenance, and reclamation for mining and related operations which fall under the categories of either "Special Categories of Mining", as defined by Rule R645-302-200, or "Special Areas of Mining", as defined by Rule R645-302-300. Information sources utilized in developing the descriptions presented in this section include baseline investigations, particularly with respect to evaluation of areas as potential alluvial valley floors or prime farmlands; detailed mining plans developed by the CR team; conceptual and detailed facility layouts and designs; and specific plans for control, monitoring, and mitigation of mining related impacts. The information presented in this section has been prepared in compliance with applicable provisions of the State of Utah Coal Mining Rules and are intended to address the applicability of the regulatory definitions and provisions under the two designated special categories. The discussions presented in this section reflect consideration of the environmental resource information presented in Section 3.0, Environmental Information, and the mining plans presented in Section 4.5, Engineering Design and Operation Plans, and are designed to address prevention, control, and mitigation of the potential effects of mining for areas or activities falling within the defined categories.

The various information categories addressed in the subsections which make up the Special Categories and Areas Section are consistent with the information categories outlined in the State of Utah Coal Mining Rules. The following are the subsection titles and designations included in this section:

7.1 Experimental Practices
7.2 Mountaintop Removal
7.3 Steep Slope Mining
7.4 Auger Mining
7.5 In-Situ Processing
7.6 Coal Processing Plants Not Within the Mine Permit Area
7.7 Variances from AOC Restoration Requirements
7.8 Variances for Delay In Contemporaneous Reclamation
7.9 Small Operator Assistance Programs
7.10 Operations on Prime Farmlands
7.11 Operations on Alluvial Valley Floors

Each subsection identifies the applicable regulatory provisions addressed and sources for the information presented and includes related supporting tables and figures. Other supporting documentation, including maps and exhibits, is referenced in the text and provided in the separate map and exhibit volumes.

This section also provides information on the applicability of the designated regulatory categories of either "Special Categories of Mining", as defined by Rule R645-302-200, or "Special Areas of Mining", as defined by Rule R645-302-300 relative to the Kinney No. 2 Mine mining and related operations. For any categories which are applicable, design, construction, operation, maintenance, and reclamation information is provided for mining

and related operations which fall under the categories. Information in this section was developed in accordance with applicable regulatory requirements (R-645-302-200 and 300) for coal mine permitting in the State of Utah.

Specifically, this section addresses Rules R645-302-210, 220, 230, 240, 250, 260, 270, 280, 290, 310 and 320. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section	Applicable Regulatory Provisions
7.1	R645-302-211 through 218
7.2	R645-302-221 through 227.900
7.3	R645-302-231 through 234.400
7.4	R645-302-241 through 245.500
7.5	R645-302-251 through 254.620
7.6	R645-302-261 through 264.900
7.7	R645-302-271 through 275
7.8	R645-302-281 through 284
7.9	R645-301-291 through 299.400
7.10	R645-302-311 through 317.628.2
7.11	R645-302-321 through 324.330

7.1 EXPERIMENTAL PRACTICES

CR has no current plans to implement or utilize experimental practices in conjunction with planned mining and related activities for the Kinney No. 2 Mine Mine. In addition, all of CR's planned operations will affect full compliance with applicable regulations without a variance from the environmental protection performance standards for experimental or research purposes or alternative postmining land uses. Since CR does not plan to conduct experimental practices in conjunction with planned mining and related operations the provisions of Rule R645-302-210 are not applicable.

7.2 MOUNTAINTOP REMOVAL

As described in Section 4.5.2.2, Mine Plans, Mining Methods, and Related Design Considerations, the Kinney No. 2 Mine operations will be exclusively underground coal mining operations. Since no surface mining activities are planned in conjunction with the Kinney No. 2 Mine operations, the provisions of Rule R645-302-220 are not applicable.

7.3 STEEP SLOPE MINING

The only areas where steep slopes exist in the planned surface disturbance area which will be affected by mining and related activities are along the eastern margin of the facilities area and disturbance in these areas will be limited. Consistent with Rule R645-301-231.100, most of the planned surface disturbance will occur on terrain condusive to topsoil salvage,

and planned reclamation efforts will result in a configuration similar to that which existed prior to the Kinney No. 2 Mine disturbance. Reclamation considerations relative to the existing land configuration and final reclamation will be addressed under the applicable provisions for remining of previously mined areas (R645-301-553.500). Given these considerations, the provisions of Rule R645-302-230 are not applicable.

7.4 AUGER MINING

As described in Section 4.5.2.2, Mine Plans, Mining Methods, and Related Design Considerations, the Kinney No. 2 Mine operations will be conventional underground coal mining operations utilizing continuous underground mining methods. The planned mining operations will result in significantly higher production levels and greater resource recovery and conservation than would be possible using auger mining methods. Given these considerations, CR has no present plans to conduct auger mining in conjunction with the Kinney No. 2 Mine operations and the provisions of Rule R645-302-240 are not applicable.

7.5 IN-SITU PROCESSING

CR has no current plans to implement or utilize in-situ extraction or processing methods in conjunction with planned mining and related activities for the Kinney No. 2 Mine Mine. Since CR does not plan to conduct any type of in-situ activities in conjunction with planned mining and related operations the provisions of Rule R645-302-250 are not applicable.

7.6 COAL PROCESSING PLANTS NOT WITHIN THE MINE PERMIT AREA

The Kinney No. 2 Mine mining and related operations will not utilize a coal processing plant at the mine site, all coal will be sold FOB mine site.

7.7 VARIANCES FROM AOC RESTORATION REQUIREMENTS

Planned final backfilling and grading activities will result in a reclaimed land configuration which is similar to that which existed prior to the Kinney No. 2 Mine disturbance. The area which will be affected by construction of the required mine surface facilities is a previously mined area consisting of an existing face-up area which has been partially reclaimed by the Utah AML program. An old railroad grade exists at the western edge of planned surface facilities and had very limited reclamation done by the AML project, if any. This railroad grade will not be affected by the Kinney No. 2 Mine operations. Given this previous mining related disturbance, the planned mine construction activities constitute remining of a previously mined area under applicable provisions of Rule R645-301-553.500. These provisions take into consideration the practical reclamation limitations associated with previously mined areas and encourage effective restoration by allowing final backfilling and grading utilizing all available spoil material and partial retention of highwall exposures if the volume of available spoil material is not sufficient to provide for total highwall elimination.

The planned postmining topography for the mine surface facilities areas effects compliance with all applicable provisions of Rule R645-301-553.500 and will result in a stable regraded configuration which provides for effective drainage, is compatible with the planned postmining land use, and minimizes the height and extent of any highwall remnant which remains. Under the applicable provisions of Rule R645-301-553.500 a variance from AOC restoration requirements is not necessary for remining of previously mined areas, therefore, the provisions of Rule R645-301-270 are not applicable. The remaining highwall at the pre-SMCRA mine was partially backfilled and will not be disturbed by the Kinney No. 2 Mine, however small pre-SMCRA cuts may be disturbed by Kinney No. 2 Mine operations in the general mine area. These small cuts may be reclaimed back to similar configurations as existed pre-Kinney No. 2 Mine.

7.8 VARIANCES FOR DELAY IN CONTEMPORANEOUS RECLAMATION

As described in Section 4.5.2.2, Mine Plans, Mining Methods, and Related Design Considerations, the Kinney No. 2 Mine operations will be exclusively underground coal mining operations and will not include surface mining operations or combined surface and underground mining operations. Under Rule R645-301-553, requirements for contemporaneous reclamation are only applicable to surface coal mining operations. Since no surface mining activities are planned in conjunction with the Kinney No. 2 Mine operations, the provisions of Rule R645-302-280 are not applicable.

7.9 SMALL OPERATOR ASSISTANCE PROGRAMS

The small operator assistance program (SOAP) is designed to provide financial, technical, and permitting assistance to operators who qualify under specific production threshold limits and other eligibility criteria. CR does not qualify under the SOAP eligibility guidelines and is not seeking assistance under SOAP, therefore the provisions of Rule R645-301-900 are not applicable.

7.10 OPERATIONS ON PRIME FARMLANDS

As described in Section 3.1.1.6, Prime Farmland Investigation, formal consultation with the USDA-NRCS resulted a determinations that prime farmlands do not exist in the Kinney No. 2 Mine permit area. Documentation of these determinations is provided in Exhibit 3.1.1.3-1, Soils Information. Given the determination that prime farmlands do not exist in the Kinney No. 2 Mine permit area and, therefore will not be effected or impacted by the planned mining and related operations, the provisions of Rule R634-302-310 are not applicable.

7.11 OPERATIONS ON ALLUVIAL VALLEY FLOORS

While limited areas downstream from the study area contain resource values consistent with the AVF criteria, future mining activities will not change the status or condition of the geology, or soils in the AVF for the following reasons:

1. Mining will not interrupt or cause significant diminution of surface or ground water flows.
2. Irrigation water supplying the AVF area comes from Mud Creek diversion points well upstream of the proposed mine site.
3. The only ditch supplying water to the AVF area that is near the proposed mine site has not been used for many years and appears not to be used due to maintenance neglect.
4. Surface runoff water from the proposed mine site will be diverted through sedimentation controls including the sedimentation pond, and alternative sediment controls including but not limited to silt fences, straw bales, and sediment traps.
5. Water quality discharges from the mine site are required to meet effluent standards that would prevent adverse impacts.
6. Discharge from the sediment pond must meet NPDES requirements.
7. Runoff water from the mine site historically flows to the AVF area. The proposed mine operations will not stop this flow from reaching the area.
8. Drill hole data, data from geotechnical drilling, and data from soils pits dug during soils investigations did not indicate any ground water in the alluvium in the mine site area that could be contaminated by mining operations. Since the mine site is upgradient from the AVF area, it would be expected that the ground water would flow towards the AVF, and since no ground water was encountered, there is little risk of contamination from mining operations.

Water supply for use in the AVF area includes irrigation water from Mud Creek through irrigation ditches well upstream from the proposed mining operations. One irrigation ditch flows through the southwestern corner of the proposed mine permit area, and will be culverted through the operations area, thus preventing possible diminution of the irrigation water quality. It should be noted however that this irrigation ditch has not been used for many years as evidenced by the condition of the ditch and culvert crossing Highway 96 at the location of the proposed mine entrance road at Highway 96. The irrigation ditch is very overgrown with vegetation and has partially silted in from non-use over an extended period of time. The irrigation ditch culvert crossing Highway 96 is almost complete silted closed, thus evidencing non-use for an extended period of time. Surface runoff controls have been designed to collect all surface runoff from mining operations. The sedimentation pond will prevent siltation of the downstream environment. An oil/grease skimmer has been included in the pond outlet design to prevent any floating oil or grease from exiting the pond. The pond discharge will meet UPDES discharge requirements and thus adverse downstream impacts will be prevented. Relatively small areas at the topsoil stockpile and very small areas at the entrance road to the site from Highway 96 will be controlled by alternative sediment controls including, but not limited to silt fences, berms, straw bales, an/or sediment traps. These areas are very small and will not include mining operations that would create any significant discharge volumes containing harmful substances.

Risk To AVF Area

The information above demonstrates that there is negligible risk of material damage to quantity or quality of water flowing to the AVF area from the proposed mining operations at the Kinney No. 2 Mine. Historic mining by several mines in the area, and reclamation work completed by the Utah AML program have not adversely impacted the AVF area. New

mining operations by CR would provide runoff controls and other controls of air quality, and control of chemical contamination that were not considered or attempted by historic mining and reclamation by AML. In addition, reclamation completed at the end of the Kinney No. 2 Mine life would be conducted in a more comprehensive manner, with more controls, and with full vegetative cover and diversity requirements. Therefore, the Kinney No. 2 Mine will have negligible impact on the AVF area.

Monitoring of water discharges, and monitoring of air quality during mining operations will document any adverse impacts, and regulatory requirements will dictate that any negative impacts must be corrected.

8.0 PERMIT DOCUMENTATION

This section is intended to provide a location for documentation of future permit revisions, and amendments, reference information including transmittal letters, application forms, new text, revised text, maps, tables, figures, exhibits and etc. Correspondence with UDOGM, and/or other regulatory agencies regarding these permit revisions and amendments can be logged on the following table to provide a location for a comprehensive gathering of permitting actions. In addition, copies of these permit actions can be inserted in Exhibit 8.0, Permit Documentation.

Revision, or Amendment No.	Date	Description & Comments

Mining and Reclamation Permit Application
Kinney No. 2 Mine

Volume 2

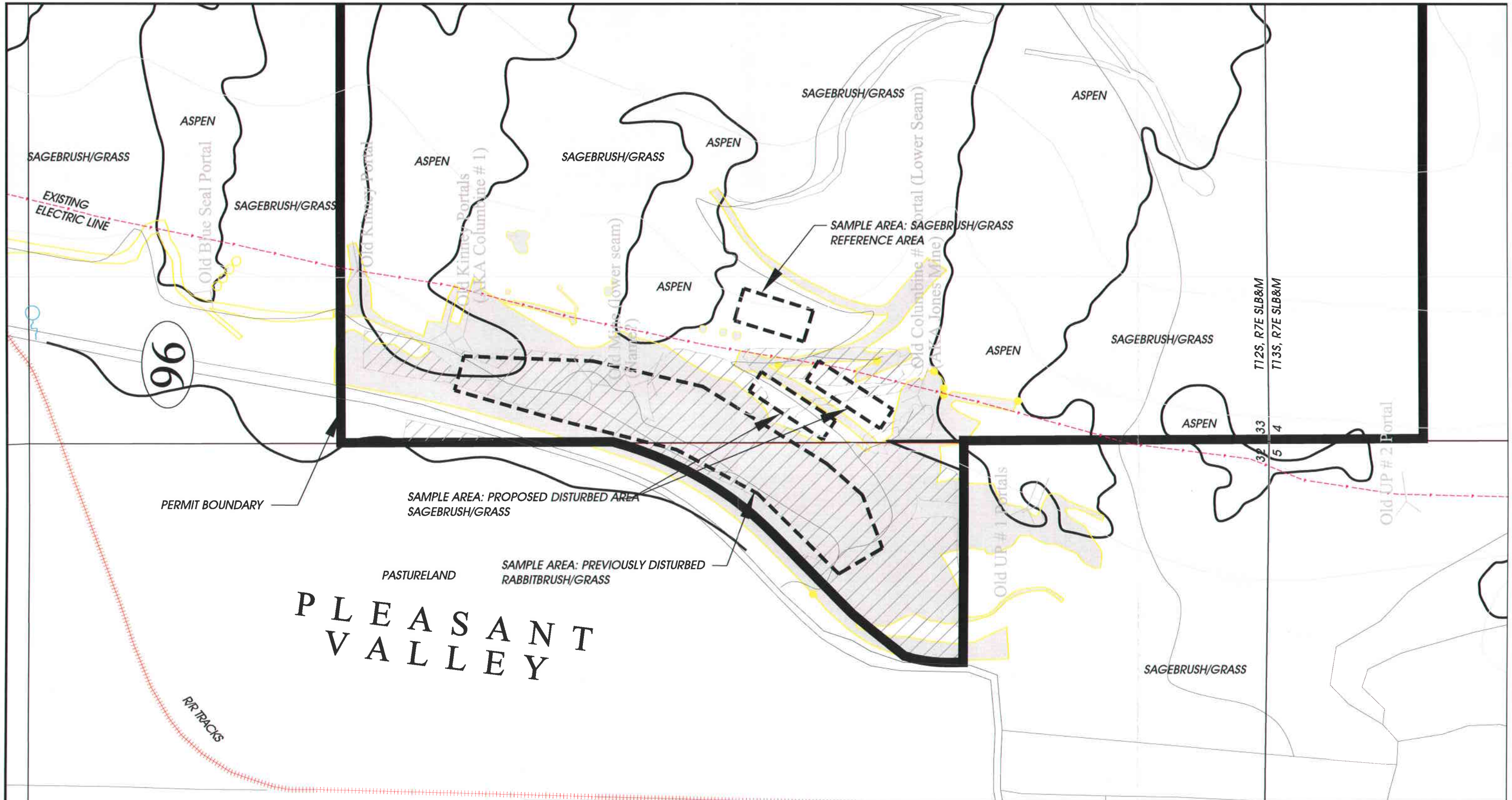
Prepared By:

HANSEN ALLEN & LUCE inc
ENGINEERS

Carbon Resources LLC

P.O. Box 11789
Albuquerque, NM 87192
505-286-1253

☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No 0002 Date 02/9/2008
In C/00 70047.2008. Incoming
For additional information



LEGEND

- PRE - MINING ROADS
- PRE-SMCRA DISTURBED AREA
- KINNEY MINE NO. 2 MINE DISTURBANCE
- VEGETATION COMMUNITY BOUNDARY LINE

N

0 100 200 300 ft

SCALE
Contour Interval 200 ft

This map is in the Kinney Coordinate System (NCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047827. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

Carbon Resources LLC

KINNEY NO. 2 MINE

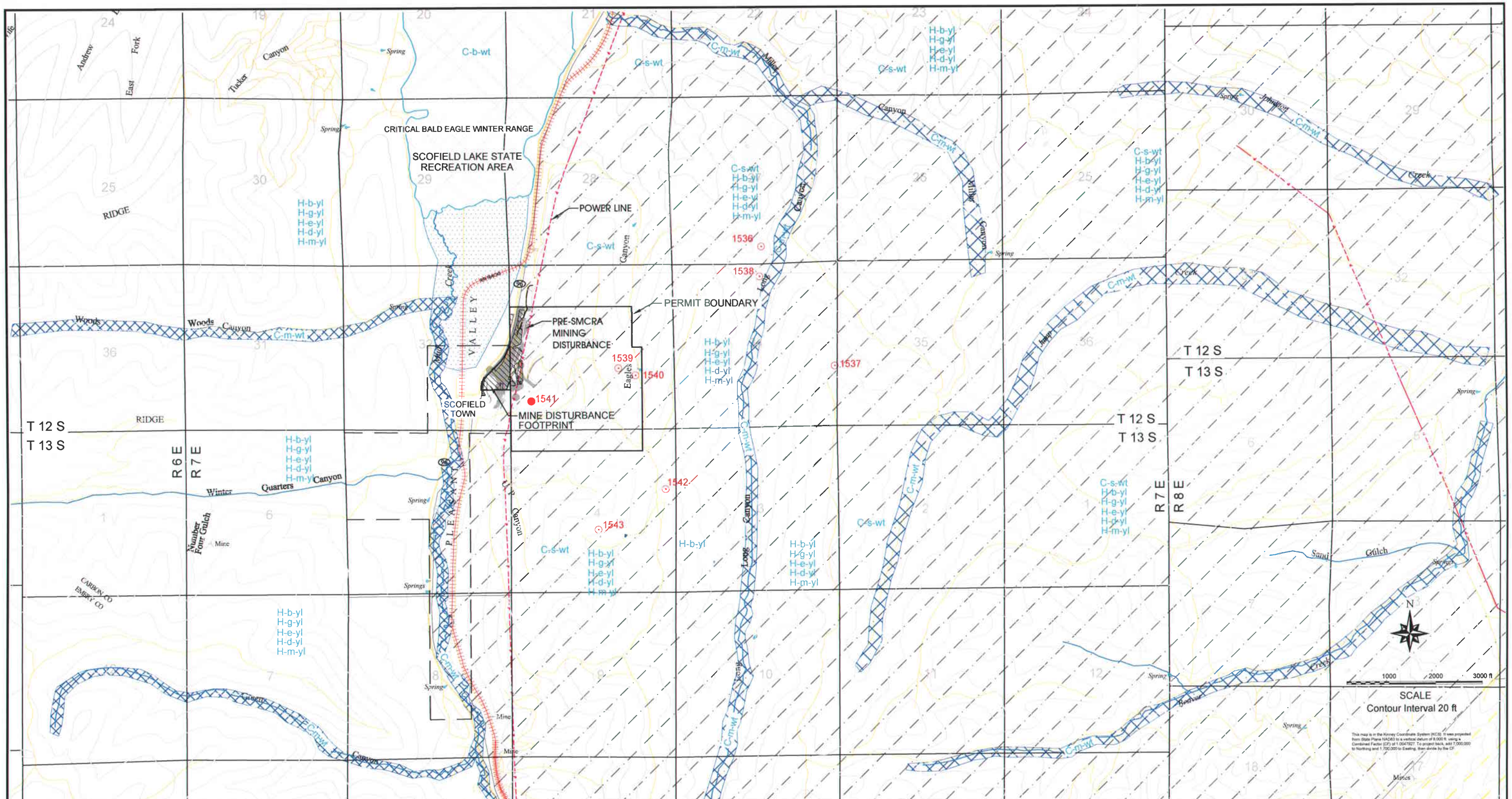
MAP 3.2.1.2-1
FACILITIES AREA
VEGETATION MAP

DRAWN BY: P.C., B.G. DATE: 11/07
APPROVED BY: G.H. DATE:

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

DWG. NAME: MAP 3.2.1.2-1

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No C002 Date 02/19/08
In C0070047, 2008, Incoming
For additional information ✓ Confidential



LEGEND

- SAGE GROUSE WINTER AND BROODING
- WETLAND AREAS
- MOOSE WINTER
  NOTE: ENTIRE MAP AREA EXCEPT WINTER IS MOOSE YEAR ROUND
- SCOFIELD TOWN BOUNDARY
- STICK NESTS 1/06 INVENTORY W/DWR INVENTORY NUMBER
- C-d-wt USE DESIGNATION (CRITICAL/HIGH PRIORITY - DEER/ELK/SAGE GROUSE/MOOSE/GOLDEN EAGLE/ BALD EAGLE - WINTER/SUMMER/YEAR LONG
- KINNEY NO. 2 MINE DISTURBED AREA FOOTPRINT
- PRE-SMCRA MINING DISTURBANCE

NOTES:

1. THE AREAS DESIGNATED AS MOOSE WINTER RANGE ALSO CORRESPOND TO RIPARIAN ZONES ALONG CANYON BOTTOMS.
2. HABITAT INFORMATION FROM UTAH DIVISION OF WILDLIFE RESOURCES CONSERVATION DATABASE CENTER
3. SCOFIELD RESERVOIR IS CRITICAL BALD EAGLE WINTER RANGE
4. THE ENTIRE MAP IS ELK SUMMER RANGE. NONE OF THE MAP INCLUDES ELK WINTER RANGE
5. ENTIRE MAP IS GOLDEN EAGLE HABITAT
6. ENTIRE MAP IS MULE DEER SUMMER HABITAT

NO.	REVISION	DATE	BY	CHKD
8				
7				
6				
5				
4				
3				
2				
1				

Carbon Resources LLC

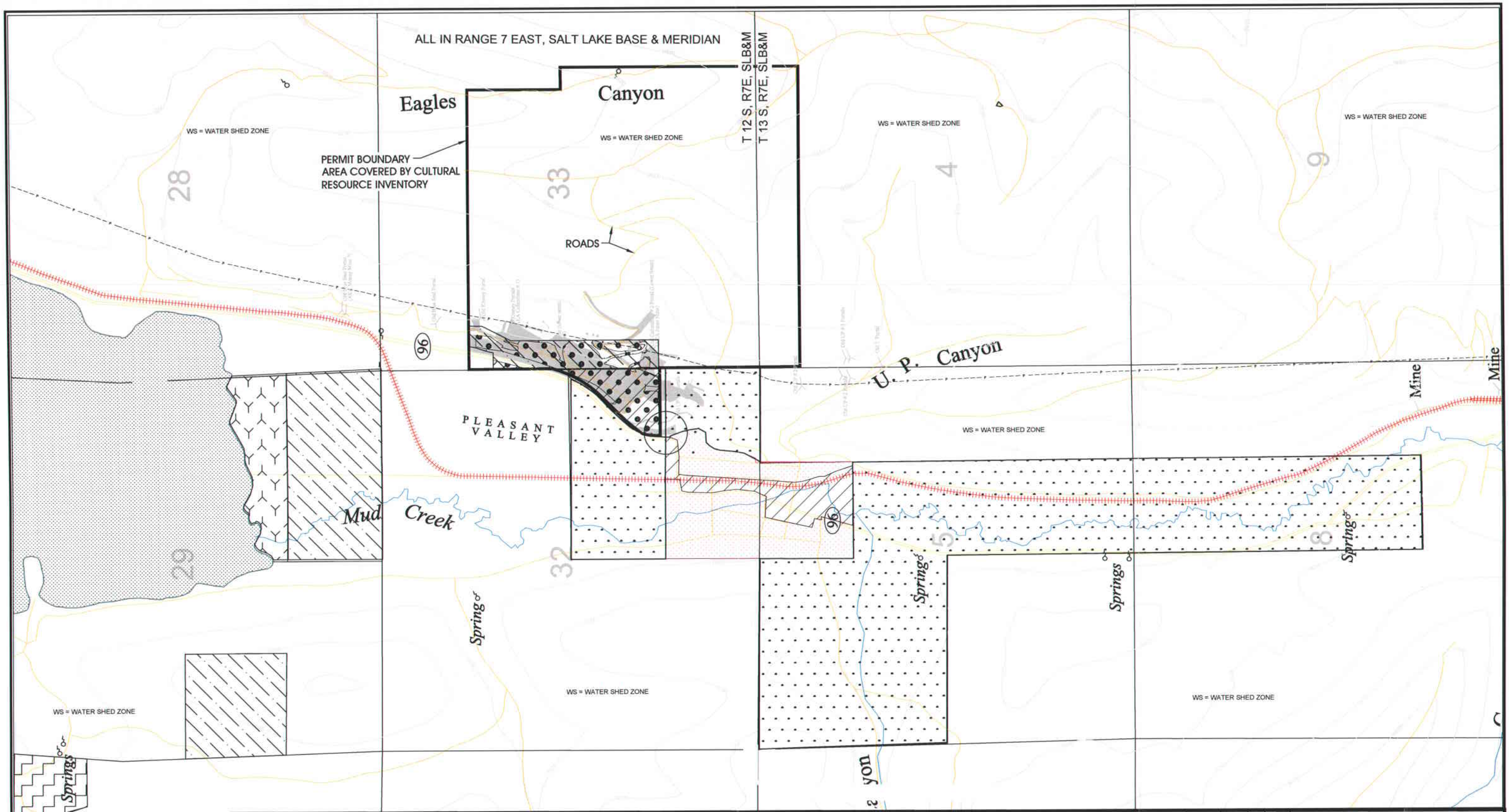
KINNEY NO. 2 MINE

MAP 3.3.1.4
REGIONAL
WILDLIFE MAP

DRAWN BY: G.H., B.G. DATE: 8/07
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE INC ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: MAP 3.3.1.4



N

0 1000 2000

SCALE
Contour Interval 200 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 6,000 ft., using a Combined Factor (CF) of 1.0047907. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

LEGEND

LEGISLATED ZONES

- CARBON COUNTY WS = WATER SHED ZONE ALL OF MAP EXCEPT AS SHOWN BELOW
- CARBON COUNTY MR = MOUNTAIN RANGE ZONE
- CARBON COUNTY PV = PLEASANT VALLEY ZONE
- SCOFIELD COMMERCIAL ZONE
- SCOFIELD AGRICULTURAL ZONE
- SCOFIELD RESIDENTIAL ZONE

LAND DESIGNATIONS

- PRE-SMCRA MINING DISTURBANCE
- BOR = BUREAU OF RECLAMATION PROPERTY & SCOFIELD RESERVOIR
- BLM PROPERTY
- KINNEY MINE PROPOSED DISTURBANCE FOOTPRINT

NOTES

1. PERMIT BOUNDARY AREA COVERED BY CULTURAL RESOURCE INVENTORY.

NO.	REVISION	DATE	BY	CHKD
8				
7				
6				
5				
4				
3				
2				
1				

Carbon Resources LLC

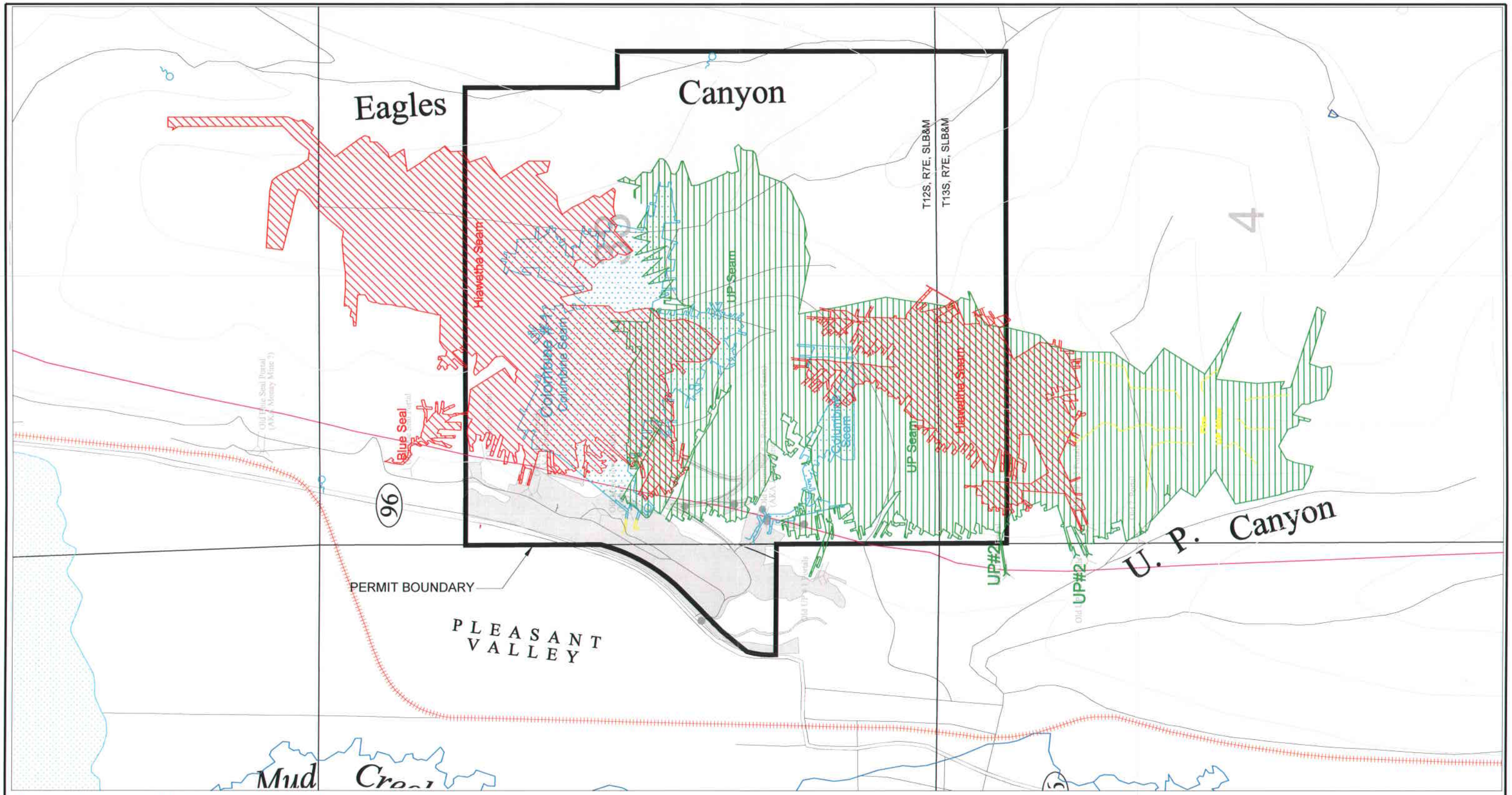
KINNEY NO. 2 MINE

MAP 3.4.1.4-1
REGIONAL
LAND USE MAP

DRAWN BY: B.G. DATE: 8/07
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE INC. ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: MAP 3.4.1.4-1



I, BENJAMIN A. GRIMES, BEING A REGISTERED PROFESSIONAL SURVEYOR, DO STATE THAT THIS MAP HAS BEEN PREPARED UNDER MY DIRECTION, AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND INFORMATION. THE LOCATION OF THE OLD MINE WORKINGS ON THIS MAP REPRESENT MINING AS OF THE DATE OF THIS SIGNING ACCORDING TO THE INFORMATION GIVEN TO ME, AND ACCORDING TO THE OLD MINE MAPS OBTAINED FROM THE STATE OF UTAH.

BENJAMIN A. GRIMES P.L.S. NO. 167246

REGISTERED LAND SURVEYOR 167246 BENJAMIN A. GRIMES 2/24/08 STATE OF UTAH

LEGEND

- HIAWATHA SEAM
- COLUMBINE SEAM
- UP SEAM
- GROUND SURFACE CONTOUR
- PERENNIAL STREAM
- ROADS
- PRE-SMCRA DISTURBANCE AREA

N

0 500 1000 1500 2000 ft

SCALE

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

NO.	REVISION	DATE	BY	CHKD
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Carbon Resources LLC

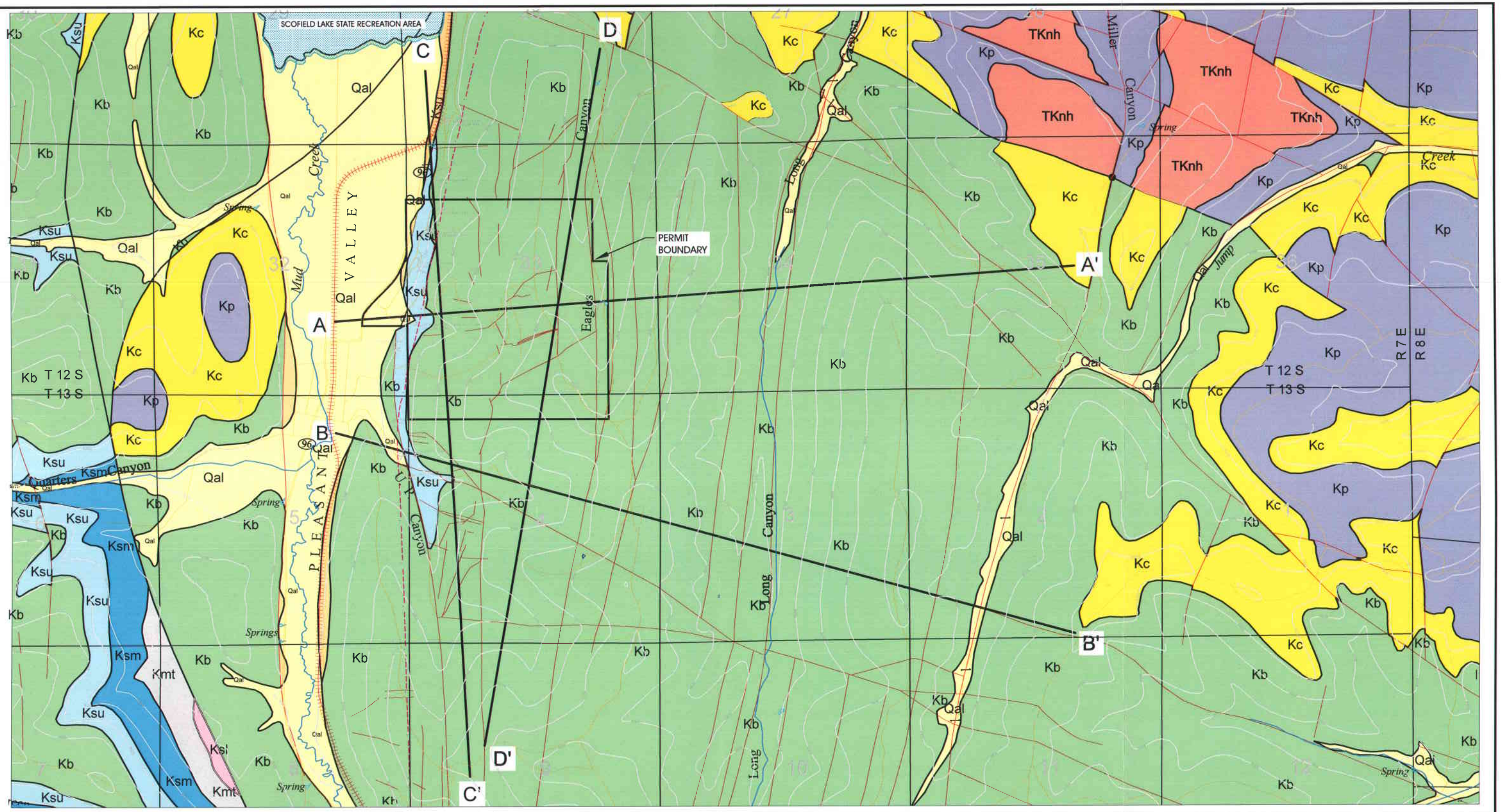
KINNEY NO. 2 MINE

MAP 3.4.1.4-2
PREVIOUS
MINING ACTIVITY

DRAWN BY: G.H., B.G. DATE: 8/07
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: KINNEY/HALPERMIT/MAPS



N

0 1000 2000 3000 ft

SCALE

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 6,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

☐ Confidential
☒ Shelf
☐ Expandable

Refer to Record No 0002 Date 02/92008
In C/ 0070047, 2008, Incoming
For additional information + Confidential

LEGEND

- TKns = NORTH HORN FORMATION
- Kp = PRICE RIVER FORMATION
- Kc = CASTLE GATE SANDSTONE
- Ksu = STAR POINT SANDSTONE UPPER
- Ksm = STAR POINT SANDSTONE MIDDLE
- Kb = BLACKHAWK FORMATION
- Qal = ALLUVIUM
- FAULTS
- CROSS SECTION LOCATIONS SEE MAPS 13 A THRU 13 D

NO.	REVISION	DATE	BY	CHKD
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Carbon Resources LLC

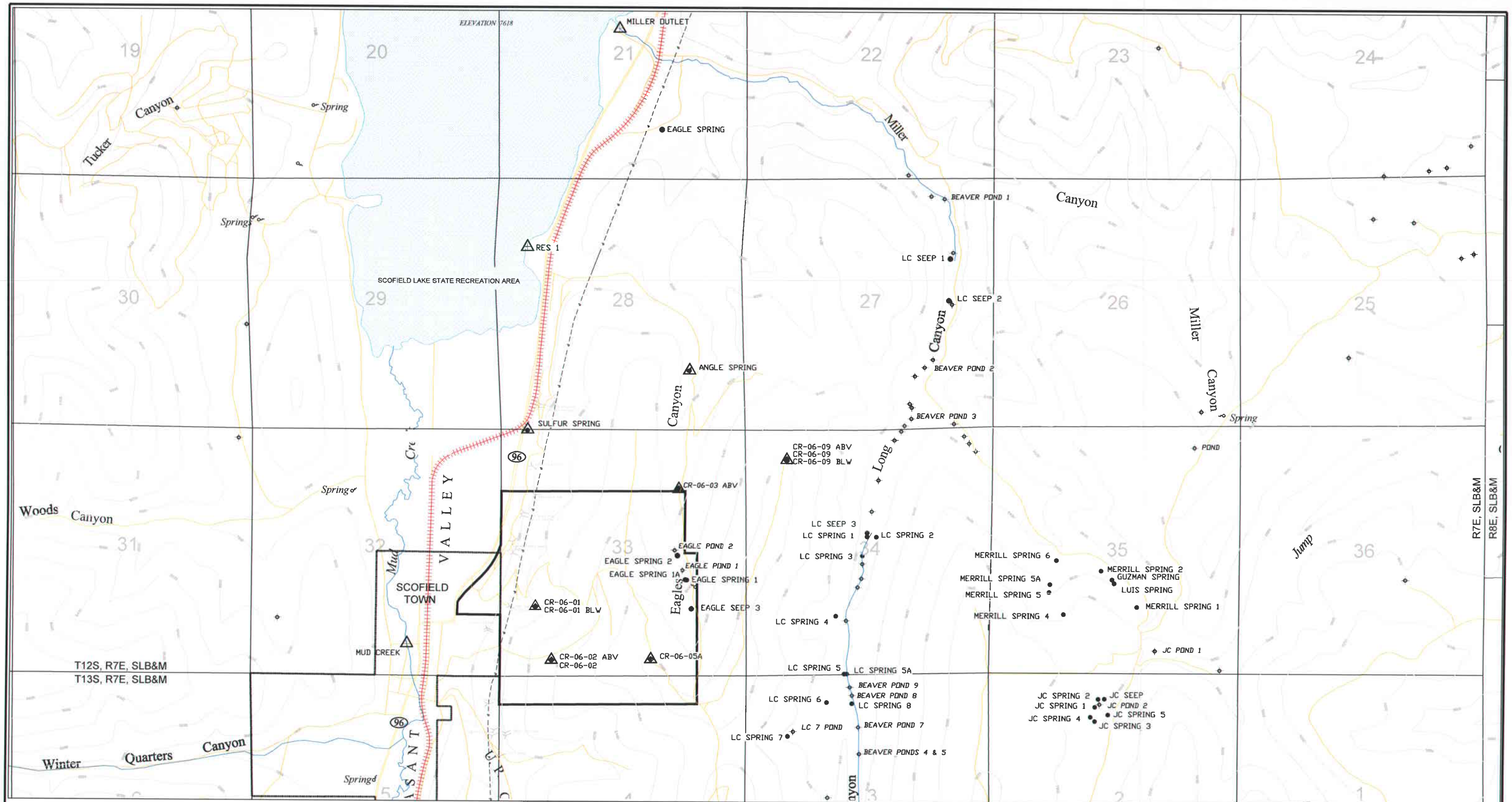
KINNEY NO. 2 MINE

MAP 3.6-1
REGIONAL SURFACE
GEOLOGY MAP

DRAWN BY: G.H., B.G. DATE: 8/07
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE INC ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: MAP 3.6-1



N

0 1000 2000 3000 ft.

SCALE

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

LEGEND

- △ WATER MONITORING STATION GROUND WATER OR SURFACE WATER
- ● GROUND WATER SOURCE
- ○ POND
- ◆ GROUND WATER WELL
- ⌖ SURFACE WATER SOURCE
- PERENNIAL STREAM
- ROADS
- SCOFIELD TOWN BOUNDARY

NO.	REVISION	DATE	BY	CHKD
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Carbon Resources LLC

KINNEY NO. 2 MINE

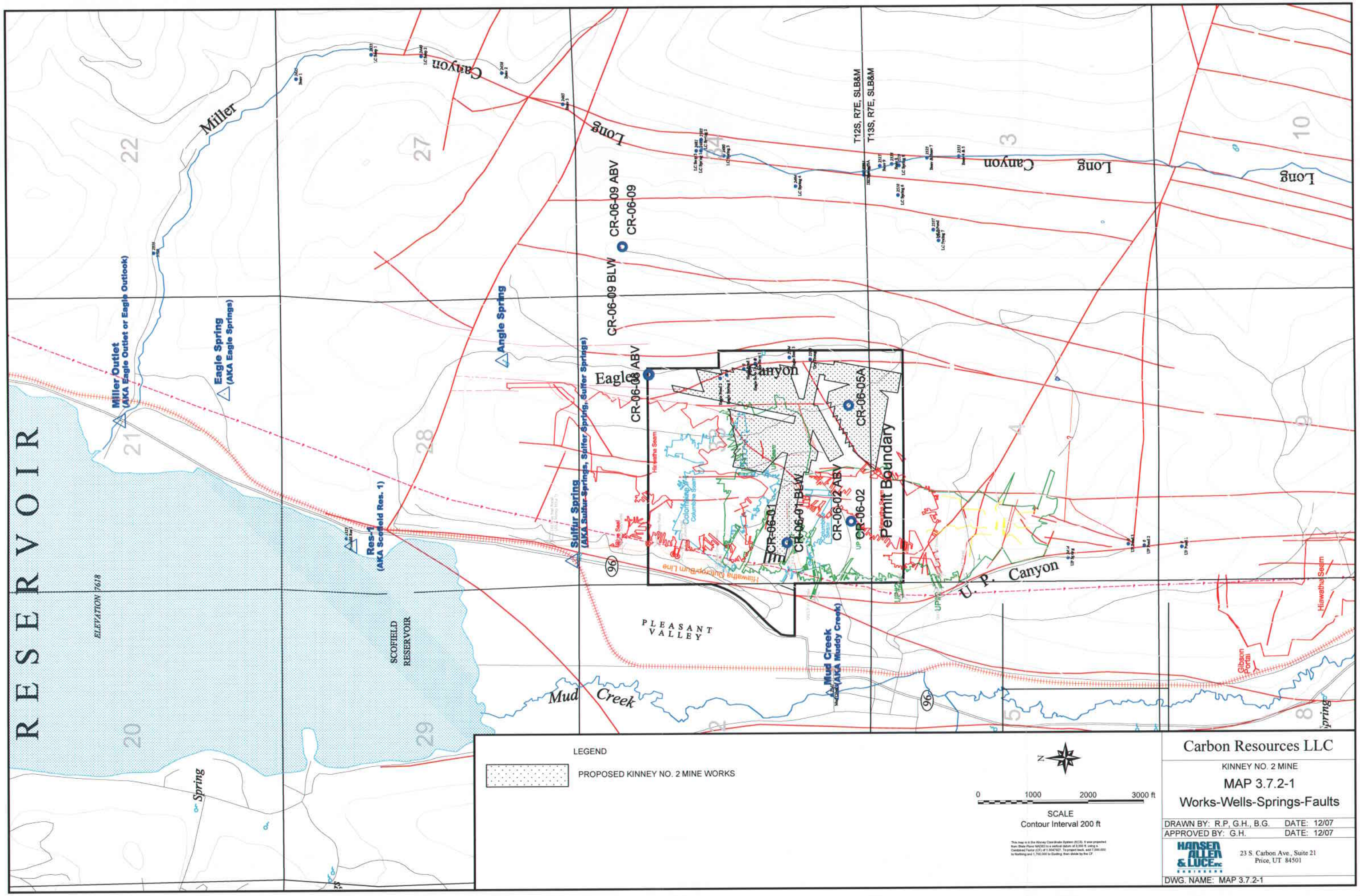
MAP 3.7.1.3-1
REGIONAL HYDROLOGY

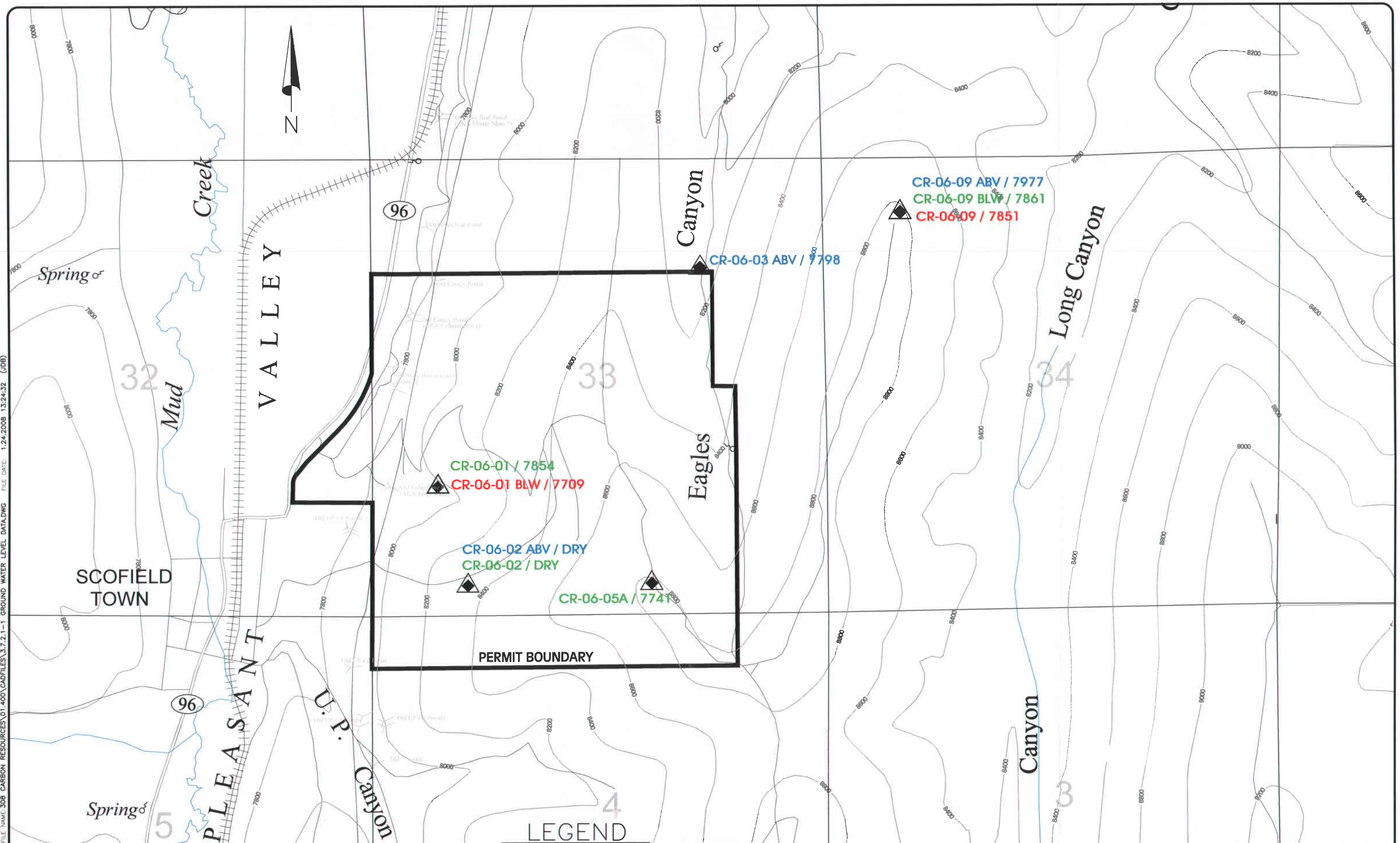
DRAWN BY: G.H., B.G. DATE: 8/07
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE inc. ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

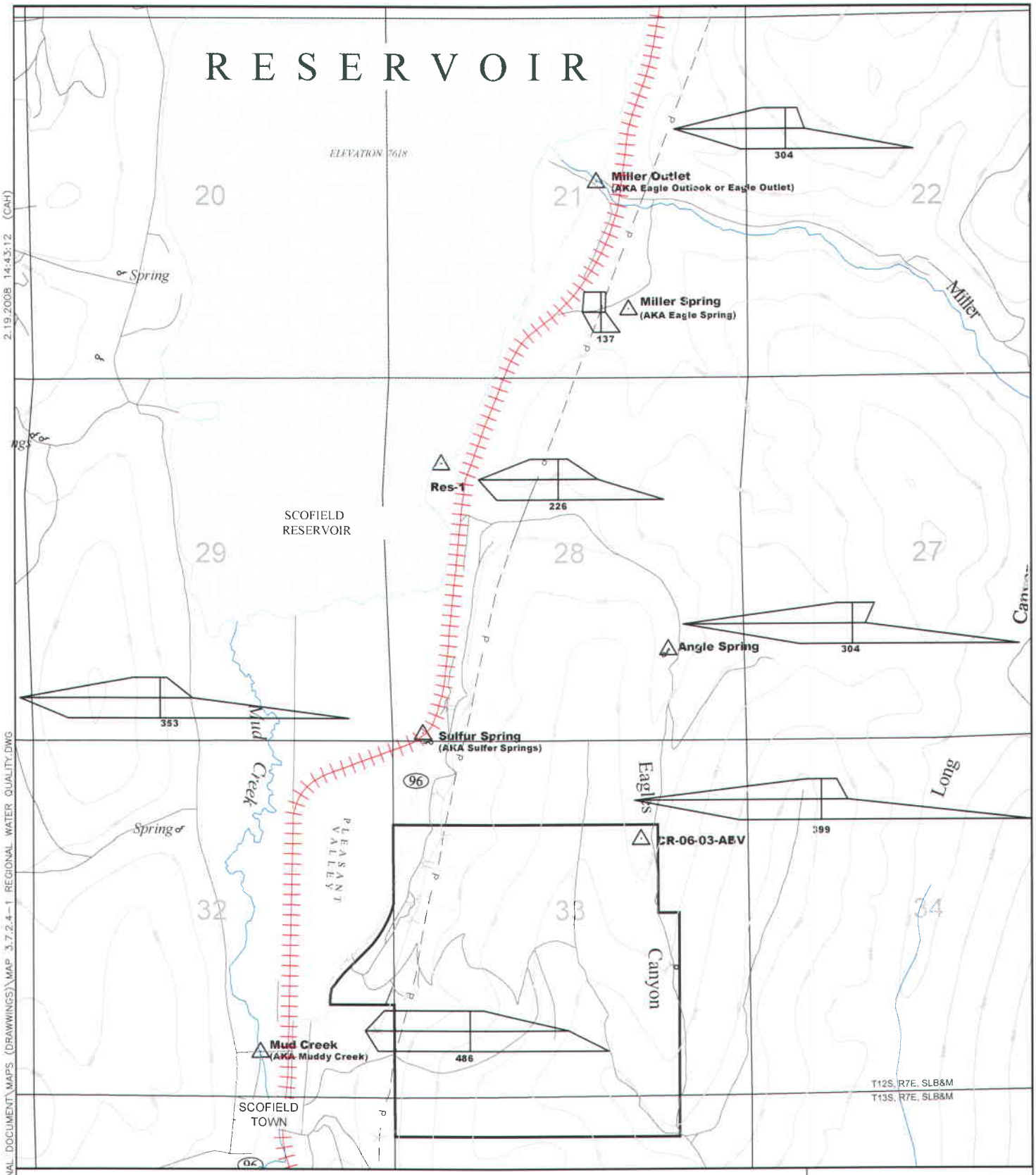
DWG. NAME: MAP 3.7.1.3-1


RESERVOIR
SCOFIELD RESERVOIR
ELEVATION 7618
Miller Canyon
Long Canyon
Mud Creek
U. P. Canyon
PLEASANT VALLEY
Miller Outlet (AKA Eagle Outlet or Eagle Outlook)
Eagle Spring (AKA Eagle Springs)
Angle Spring
Sulfur Spring (AKA Sulfur Springs, Sulfer Springs)
Res-1 (AKA Scofield Res. 1)
Mud Creek (AKA Muddy Creek)
Gibson Portal
Hiawatha Seam
Permit Boundary
CR-06-09 ABV
CR-06-09
CR-06-09 BLW
CR-06-08 ABV
CR-06-05A
CR-06-01
CR-06-01 BLW
CR-06-02 ABV
CR-06-02
T12S, R7E, SLB&M
T13S, R7E, SLB&M
LEGEND
PROPOSED KINNEY NO. 2 MINE WORKS
0 1000 2000 3000 ft
SCALE
Contour Interval 200 ft
Carbon Resources LLC
KINNEY NO. 2 MINE
MAP 3.7.2-1
Works-Wells-Springs-Faults
DRAWN BY: R.P, G.H., B.G. DATE: 12/07
APPROVED BY: G.H. DATE: 12/07
HANSEN ALLEN & LUCE INC ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501
DWG. NAME: MAP 3.7.2-1



GROUND WATER LEVEL DATA

MAP 3.7.2.1-1

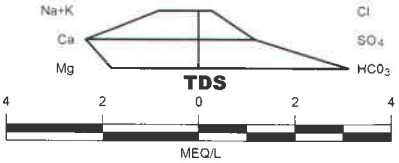


2.19.2008 14:43:12 (CAH)

308 CARBON RESOURCES\FINAL DOCUMENT\MAPS (DRAWINGS)\MAP 3.7.2.4-1 REGIONAL WATER QUALITY.DWG

LEGEND

Surface Water Monitor Site



N

0 2,000 ft

SCALE: 1:24,000 or 1" = 2,000'

Contour Interval 200 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft using a Combined Factor (CF) of 1.0047907. To project back, add 1,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

Carbon Resources LLC

KINNEY NO. 2 MINE

MAP 3.7.2.4-1

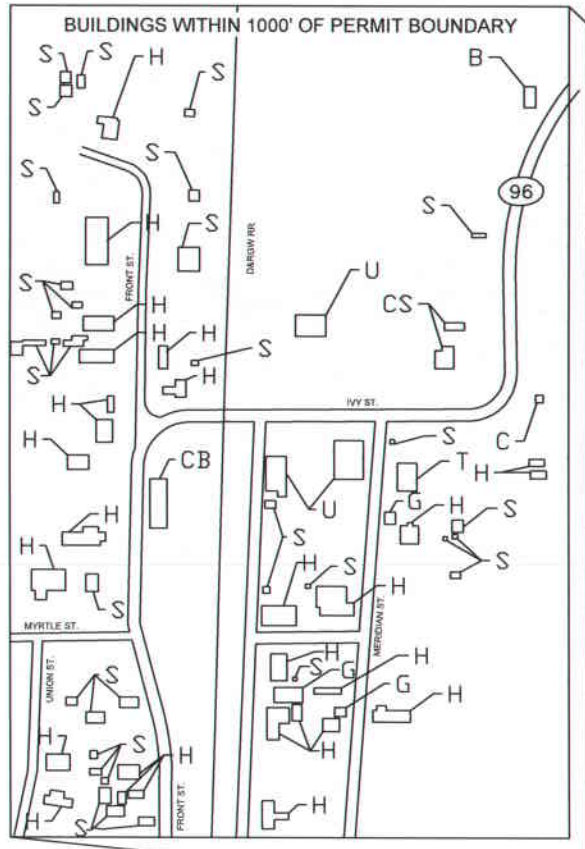
REGIONAL WATER QUALITY

DRAWN BY: B.L., J.B.	DATE: 5/2/07
APPROVED BY: G.H.	DATE: 5/3/2007

HANSEN ALLEN & LUCE INC

23 S. Carbon Ave., Suite 21
Price, UT 84501

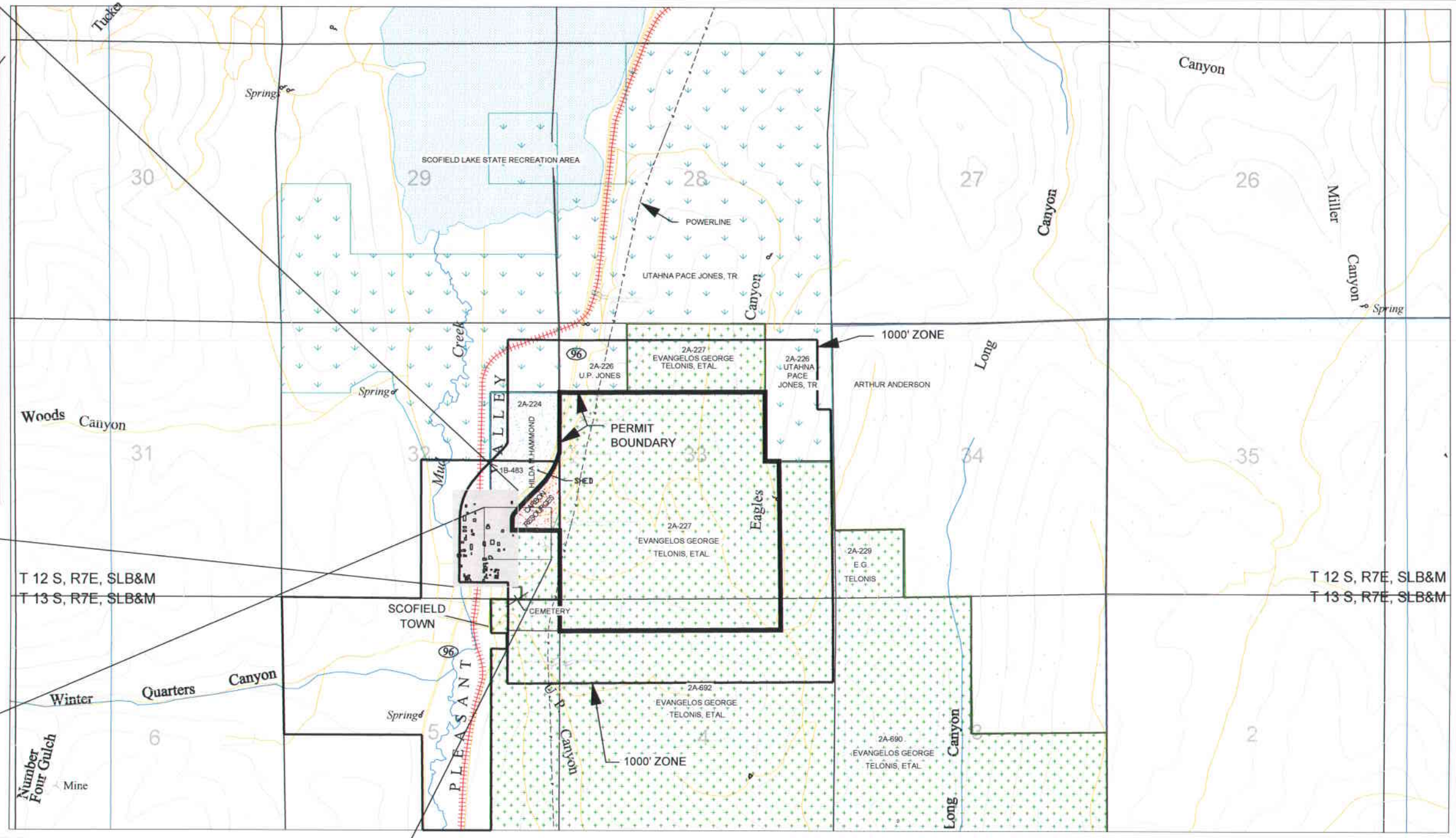
FILE: MAP 3.7.2.4-1



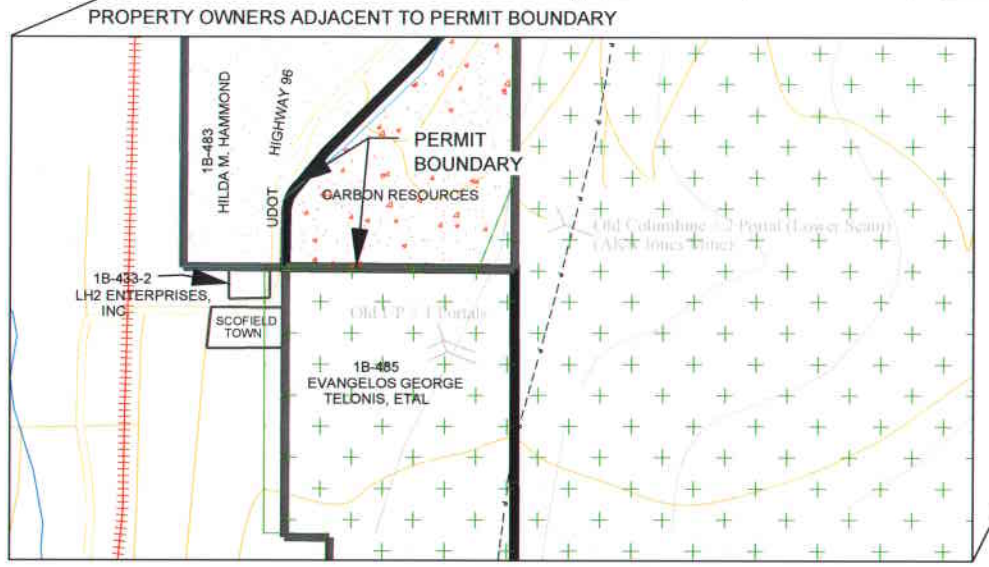
NOTE:
ONLY PERMANENT STRUCTURES ARE SHOWN

KEY TO BUILDING USES

- H HOUSE
- S SHED
- G GARAGE
- B BARN
- U UDOT BUILDING
- T SCOFIELD TOWN BUILDING
- C CAMPGROUND OFFICE
- CS CONVIENCE STORE
- CB COMMERCIAL BUILDING



PROPERTY OWNERS ADJACENT TO PERMIT BOUNDARY



LEGEND

- ADJACENT PROPERTY OWNERS BOUNDARY LINES WITH PROPERTY OWNER'S NAME AND TAX ID NUMBER FROM CARBON COUNTY RECORDERS OFFICE
- POWERLINES
- SCOFIELD TOWN BOUNDARY
- 1000 FOOT ZONE AROUND PERMIT BOUNDARY

N

0 1000 2000 3000 ft

SCALE
Contour Interval 20 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 6,300 ft using a Combined Factor (CF) of 1.0007627. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

REGISTERED LAND SURVEYOR
STATE OF UTAH

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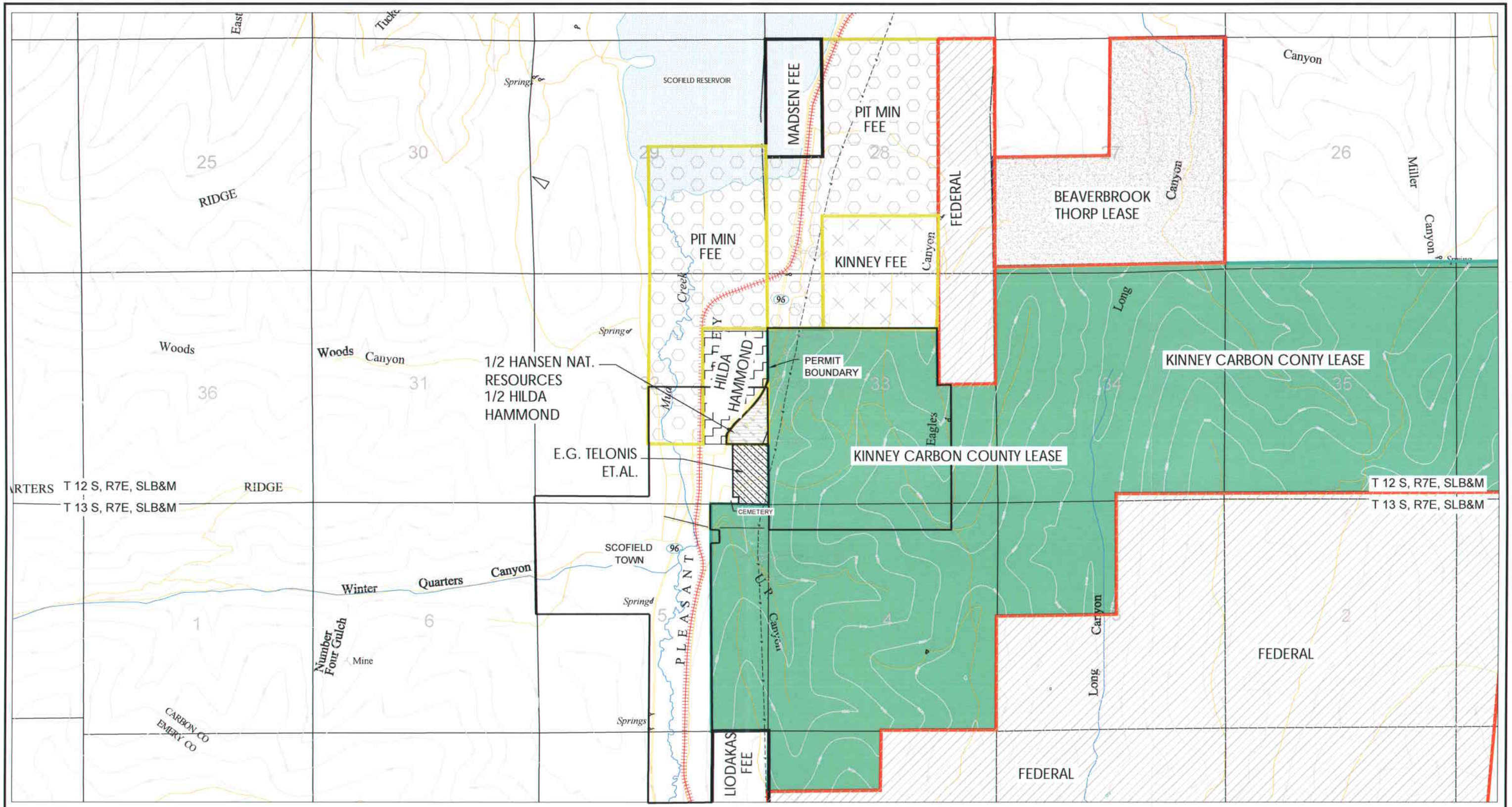
Carbon Resources LLC

KINNEY NO. 2 MINE
MAP 4.5.1.2-1
REGIONAL SURFACE
OWNERSHIP MAP

DRAWN BY: B.G. DATE: 8/07
APPROVED BY: G.H. DATE: 2/08

HANSEN ALLEN & LUCE inc ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: KINNEY MAP 4.5.1.2-1



LEGEND

POWERLINES

SCOFIELD TOWN BOUNDARY

N

0 1000 2000 3000 ft

SCALE

Contour Interval 200 ft

NO.	REVISION	DATE	BY	CHKD
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Carbon Resources LLC

KINNEY NO. 2 MINE

MAP 4.5.1.2-2

REGIONAL COAL OWNERSHIP MAP

DRAWN BY: B.G. DATE: 8/07

APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE INC ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: MAP 4.5.1.2-2

File in:

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☒ Shelf

☐ Expandable

Refer to Record No 0002 Date 02/19/2008

In C/0070047.2008, Incoming

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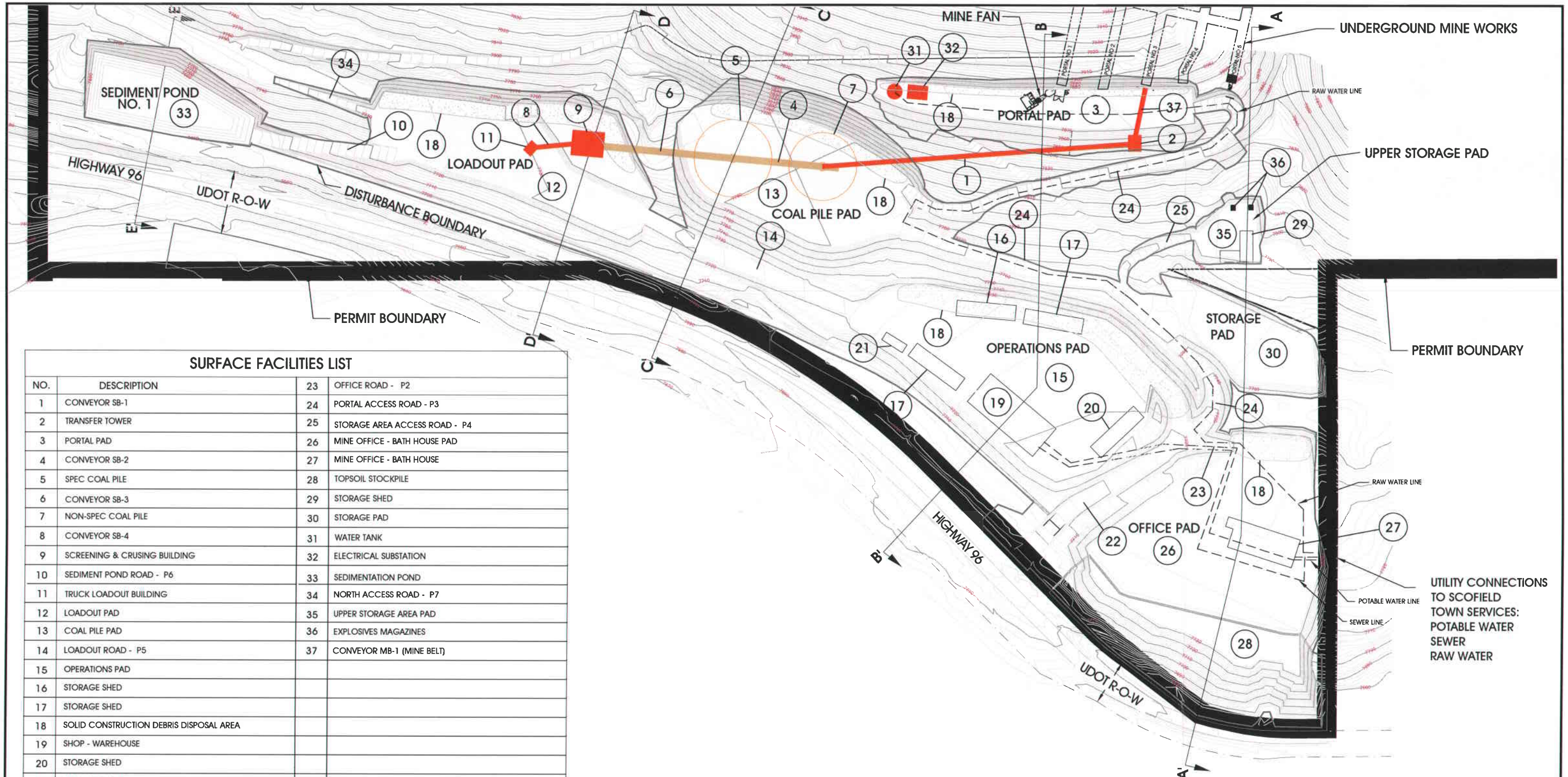
File in:



SURFACE FACILITIES LIST

NO.	DESCRIPTION		
1	CONVEYOR SB-1	23	OFFICE ROAD - P2
2	TRANSFER TOWER	24	PORTAL ACCESS ROAD - P3
3	PORTAL PAD	25	STORAGE AREA ACCESS ROAD - P4
4	CONVEYOR SB-2	26	MINE OFFICE - BATH HOUSE PAD
5	SPEC COAL PILE	27	MINE OFFICE - BATH HOUSE
6	CONVEYOR SB-3	28	TOPSOIL STOCKPILE
7	NON-SPEC COAL PILE	29	STORAGE SHED
8	CONVEYOR SB-4	30	STORAGE PAD
9	SCREENING & CRUSING BUILDING	31	WATER TANK
10	SEDIMENT POND ROAD - P6	32	ELECTRICAL SUBSTATION
11	TRUCK LOADOUT BUILDING	33	SEDIMENTATION POND
12	LOADOUT PAD	34	NORTH ACCESS ROAD - P7
13	COAL PILE PAD	35	UPPER STORAGE AREA PAD
14	LOADOUT ROAD - P5	36	EXPLOSIVES MAGAZINES
15	OPERATIONS PAD	37	CONVEYOR MB-1 (MINE BELT)
16	STORAGE SHED		
17	STORAGE SHED		
18	SOLID CONSTRUCTION DEBRIS DISPOSAL AREA		
19	SHOP - WAREHOUSE		
20	STORAGE SHED		
21	FUELING FACILITY		
22	MAIN ACCESS ROAD - P1		

REGISTERED LAND SURVEYOR 167249 BENJAMIN A. CARLSON 2/2/08 STATE OF UTAH

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File in:

LEGEND

A A CROSS SECTION LOCATION

NOTES:
1. FOR CROSS SECTIONS REFER TO MAPS 4.5.3-1A THRU 1D

N

0 100 200 300 ft.
SCALE
Contour Interval 2 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

NO.	REVISION	DATE	BY	CHKD
8				
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Carbon Resources LLC

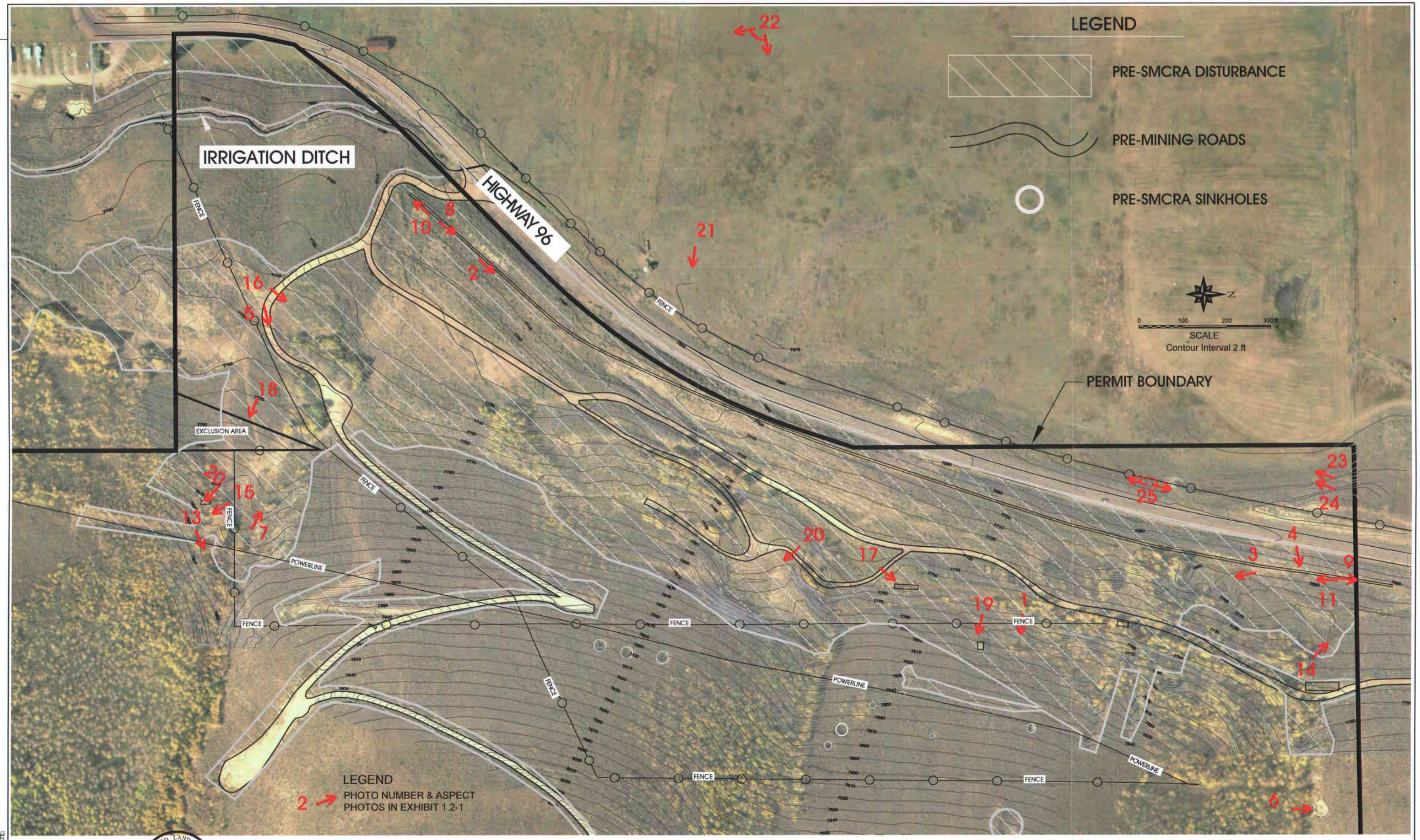
KINNEY NO. 2 MINE

MAP 4.5.1.2-3
SURFACE FACILITIES

DRAWN BY: G.H., B.G. DATE: 8/07
APPROVED BY: G.H. DATE: 1/08

HANSEN ALLEN & LUCE inc ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: MAP 4.5.1.2-3



This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

FILE NAME:
FILE DATE:

HANSEN ALLEN & LUCE inc ENGINEERS

REGISTERED LAND SURVEYOR 167246 BENJAMIN A. GRIMES 2/26/08 STATE OF UTAH

DESIGNED	3					
DRAFTED J.B., B.G.	2					
CHECKED G.H.	1					
DATE JANUARY 2008	NO.	DATE	REVISIONS	BY	APVD.	

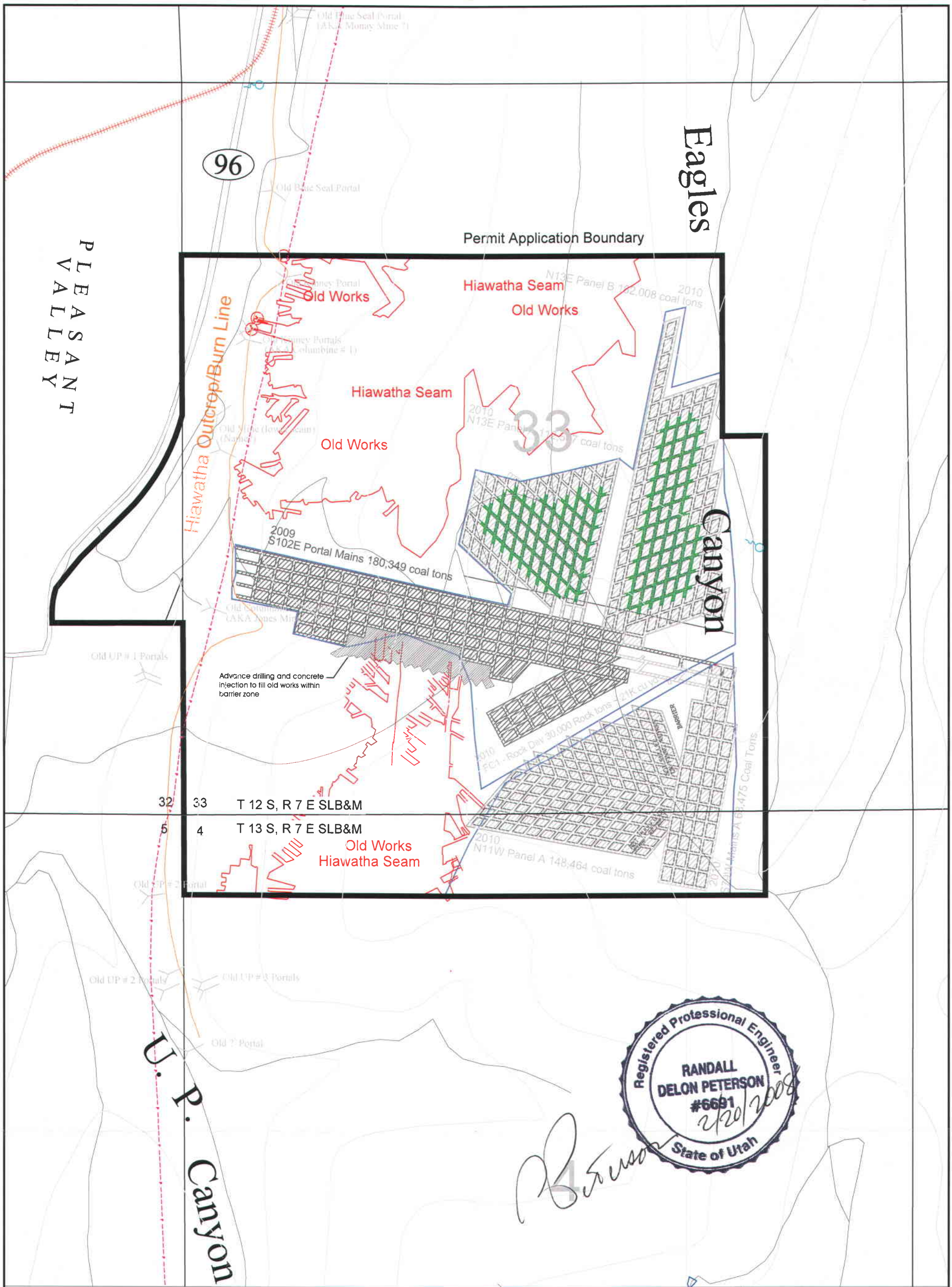
SCALE: AS SHOWN

Carbon Resources LLC
KINNEY NO. 2 MINE

MINE SURFACE FACILITIES AREA
PRE-MINING TOPOGRAPHY

MAP 4.5.1.2-4

3/04



LEGEND

2009 | 2010 | Old Works | Hiawatha Reserve Block

Development Rock Backfill Areas

NOTE: NO PILLAR EXTRACTION PLANNED - FIRST MINING ONLY

N

0 200 400 600 ft

Contour Interval 200 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 6,000 ft, using a Combined Factor (CF) of 1.0047827. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

Carbon Resources LLC

KINNEY NO. 2 MINE

MAP 4.5.1.2-5

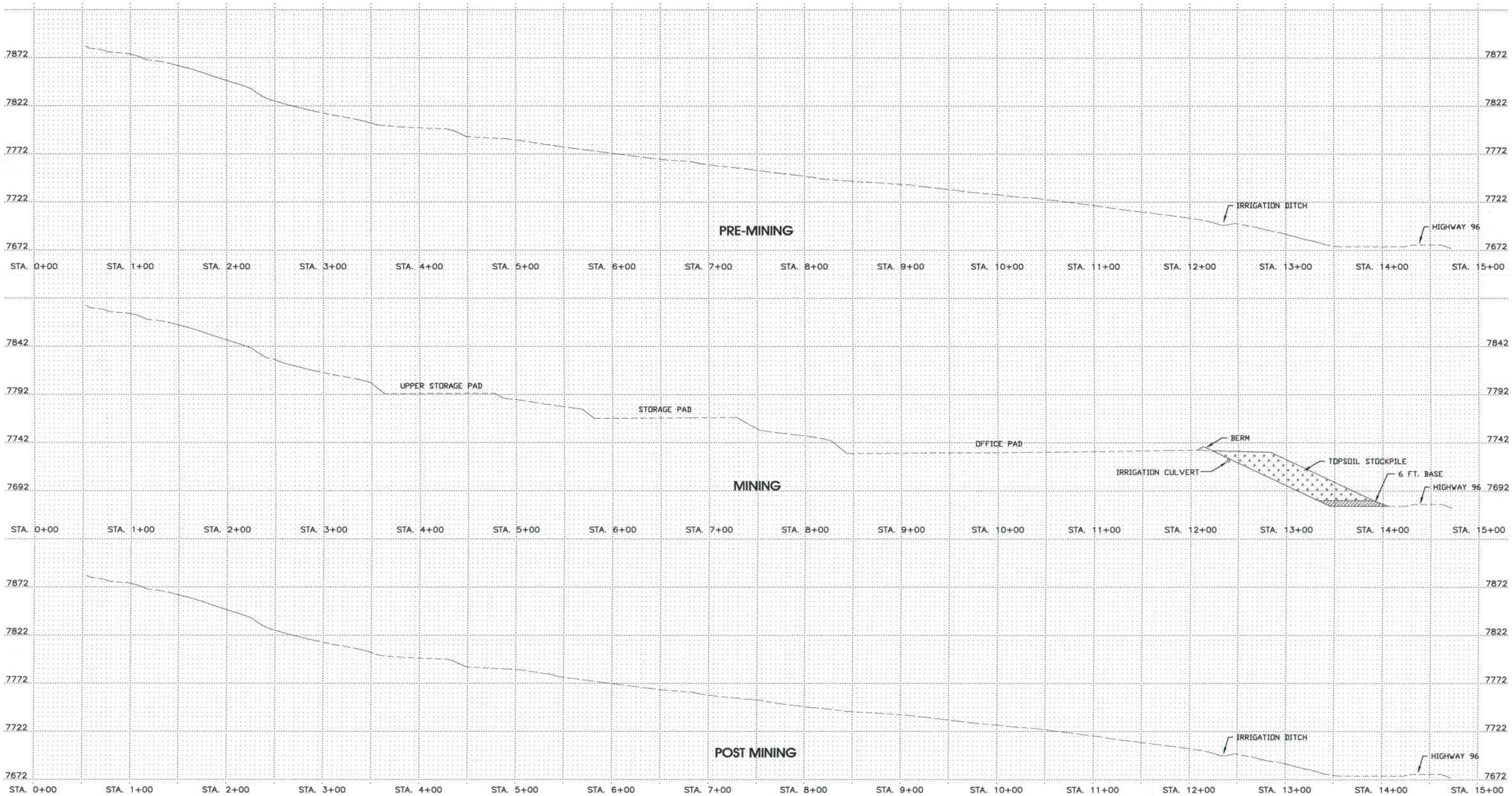
MINE PLAN LAYOUT AND PRODUCTION SCHEDULE

DRAWN BY: R.P.	DATE: 1/08
APPROVED BY: G.H.	DATE: 1/08

HANSEN ALLEN & LUCE inc ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME: MAP 4.5.1.2-5



NOTES:
1. SEE MAP 4.5.1.2-3 FOR CROSS SECTION LOCATIONS

SCALE AS SHOWN

SECTION A-A'

NO.	REVISION	DATE	BY	CHKD
8				
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Carbon Resources LLC

KINNEY NO. 2 MINE
MAP 4.5.2.3-1A
MINE SURFACE FACILITIES AREA
PRE-MINING, MINING & POST MINING
CROSS SECTIONS

DRAWN BY: J.B, B.G. DATE: 2/08
APPROVED BY: G.H DATE: 2/08

HANSEN ALLEN & LUCE inc
23 S. Carbon Ave., Suite 21
Price, UT 84501

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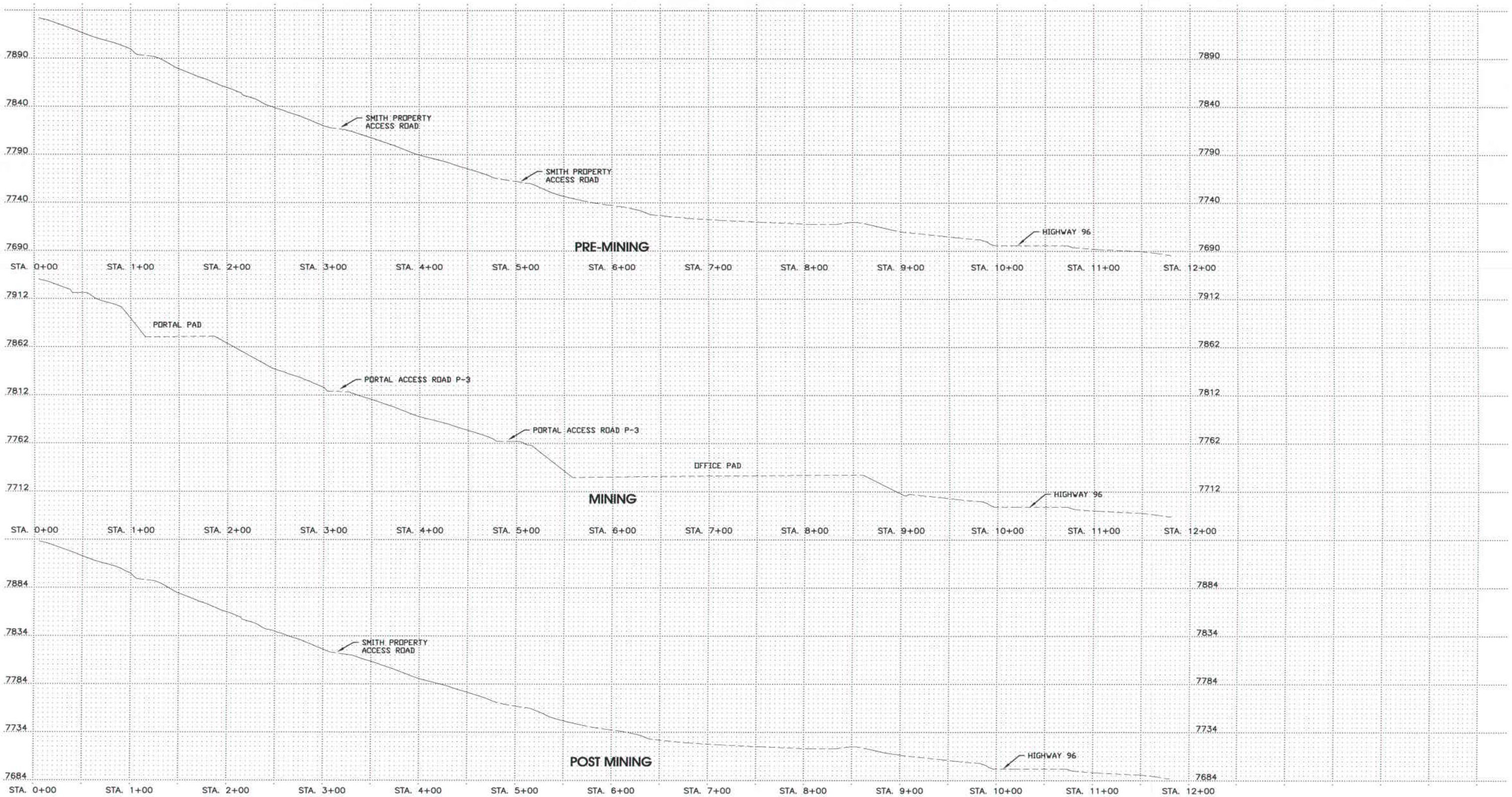

NOTES:
1. SEE MAP 4.5.1.2-3 FOR CROSS SECTION LOCATIONS

SCALE AS SHOWN

SECTION B-B'

NO.	REVISION	DATE	BY	CHKD
8				
7				
6				
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3				
2				
1				

Carbon Resources LLC

KINNEY NO. 2 MINE
MAP 4.5.2.3-1B
MINE SURFACE FACILITIES AREA
PRE-MINING, MINING & POST MINING
CROSS SECTIONS

DRAWN BY: J.B, B.G. DATE: 2/08
APPROVED BY: G.H DATE: 2/08

HANSEN ALLEN & LUCE inc ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:

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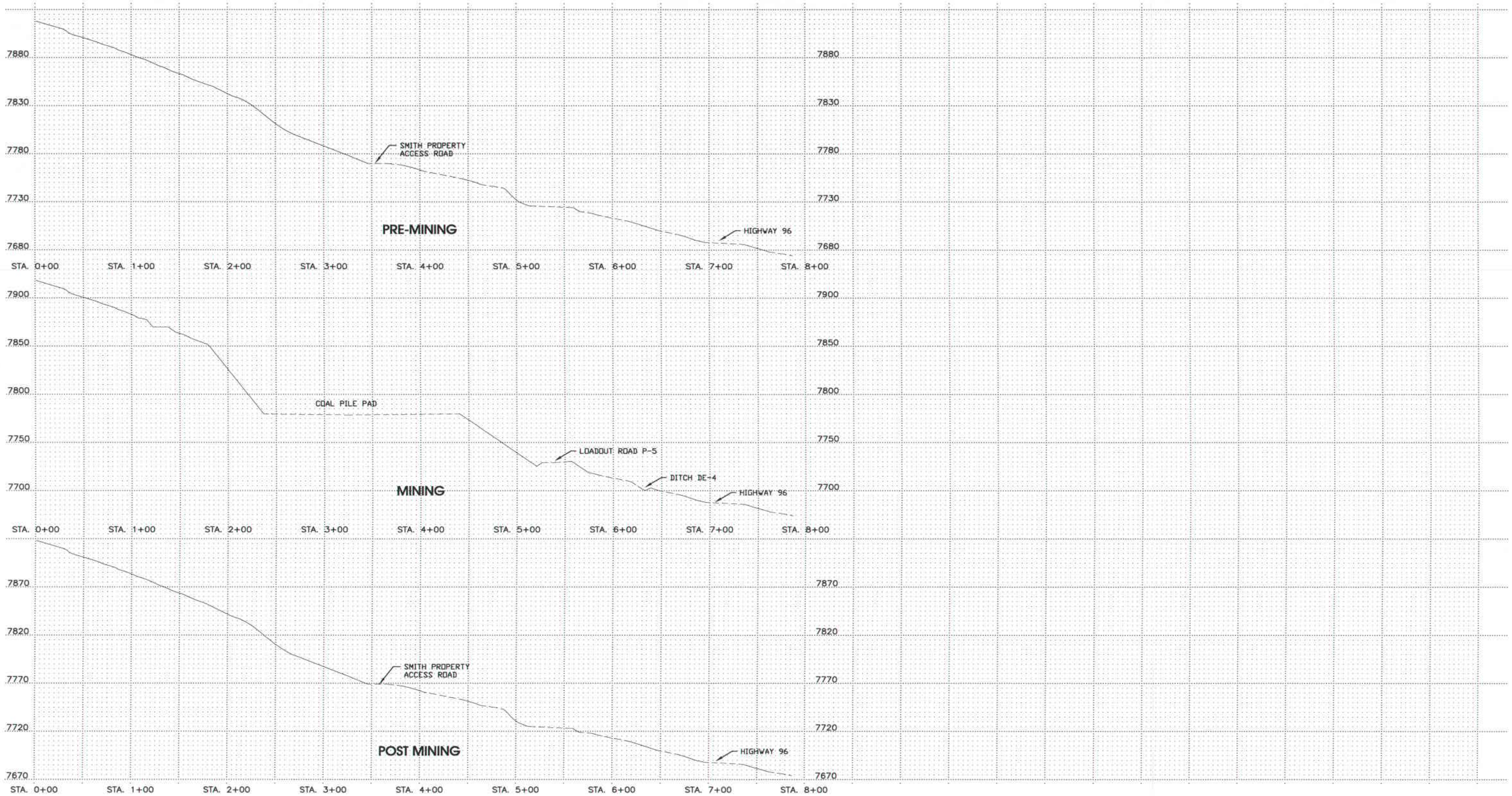
- ☐ Confidential
- ☒ Shelf
- ☐ Expandable

Refer to Record No 0002 Date 02/19/2008
In C/0070047, 2008, Incoming
For additional information: Confidential



NOTES:
1. SEE MAP 4.5.1.2-3 FOR CROSS SECTION LOCATIONS

SCALE AS SHOWN

SECTION C-C'

NO.	REVISION	DATE	BY	CHKD
8				
7				
6				
5				
4				
3				
2				
1				

Carbon Resources LLC

KINNEY NO. 2 MINE

MAP 4.5.2.3-1C
MINE SURFACE FACILITIES AREA
PRE-MINING, MINING & POST MINING
CROSS SECTIONS

DRAWN BY: J.B, B.G. DATE: 2/08
APPROVED BY: G.H DATE: 2/08

HANSEN ALLEN & LUCE inc
ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:

File in:
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☒ Shelf
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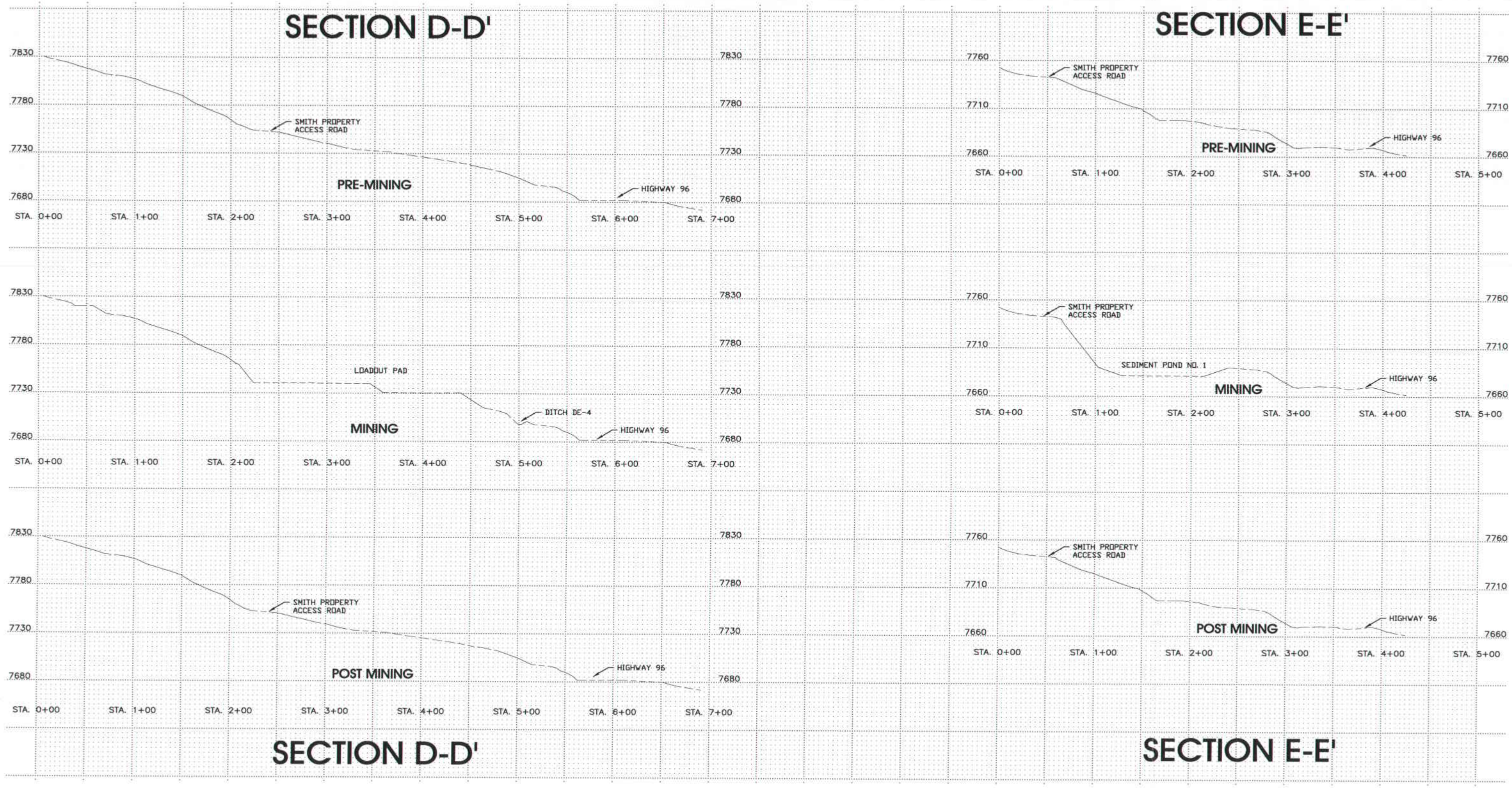
In C/0070047, 2008, Incoming
For additional information
File in:



NOTES:
1. SEE MAP 4.5.1.2-3 FOR CROSS SECTION LOCATIONS

SCALE AS SHOWN

SECTION D-D' & SECTION E-E'

NO.	REVISION	DATE	BY	CHKD
8				
7				
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Carbon Resources LLC

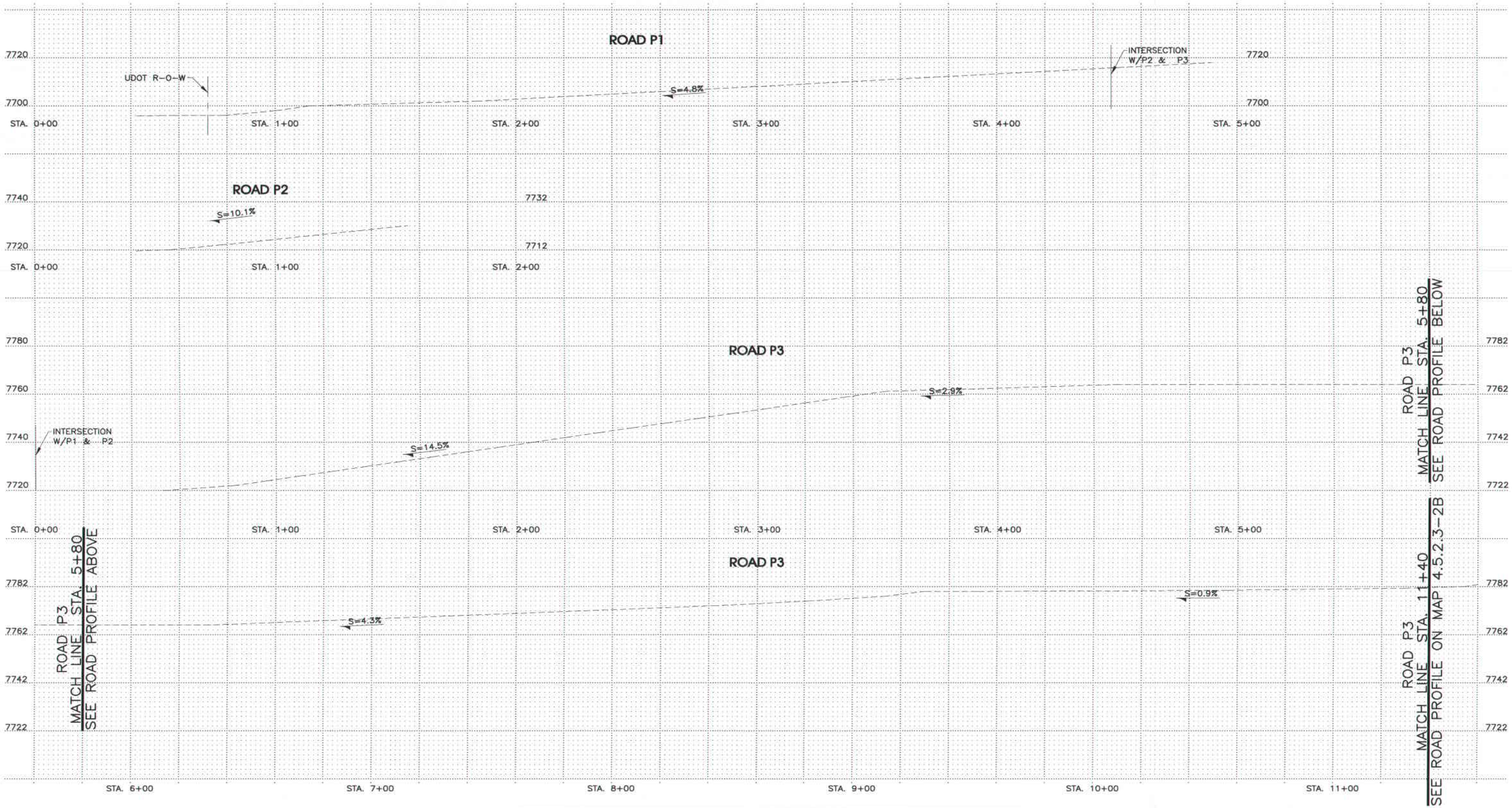
KINNEY NO. 2 MINE
MAP 4.5.2.3-1D
MINE SURFACE FACILITIES AREA
PRE-MINING, MINING & POST MINING
CROSS SECTIONS

DRAWN BY: J.B, B.G. DATE: 2/08
APPROVED BY: G.H DATE: 2/08

HANSEN ALLEN & LUCE INC. ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No. 0002 Date 2/19/2008
In C0070047, 2008, Incoming
For additional information + Confidential



NOTES:

1. PROFILES ARE AT CENTERLINE OF ROAD.
2. SEE MAP 4.5.1.2-3 FOR ROAD LOCATIONS.

SCALE AS SHOWN

ROADS P1, P2 & P3

NO.	REVISION	DATE	BY	CHKD
8				
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Carbon Resources LLC

KINNEY NO. 2 MINE
MAP 4.5.2.3-2A
MINE SURFACE FACILITIES
ROAD PROFILES

DRAWN BY: JDB, BAG DATE: 1/2008
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE INC. ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:

File in:
- ☐ Confidential
- ☒ Shelf
- ☐ Expandable

Refer to Record No. 0002 Date 1/19/2008
In C0070047.2008, Incoming
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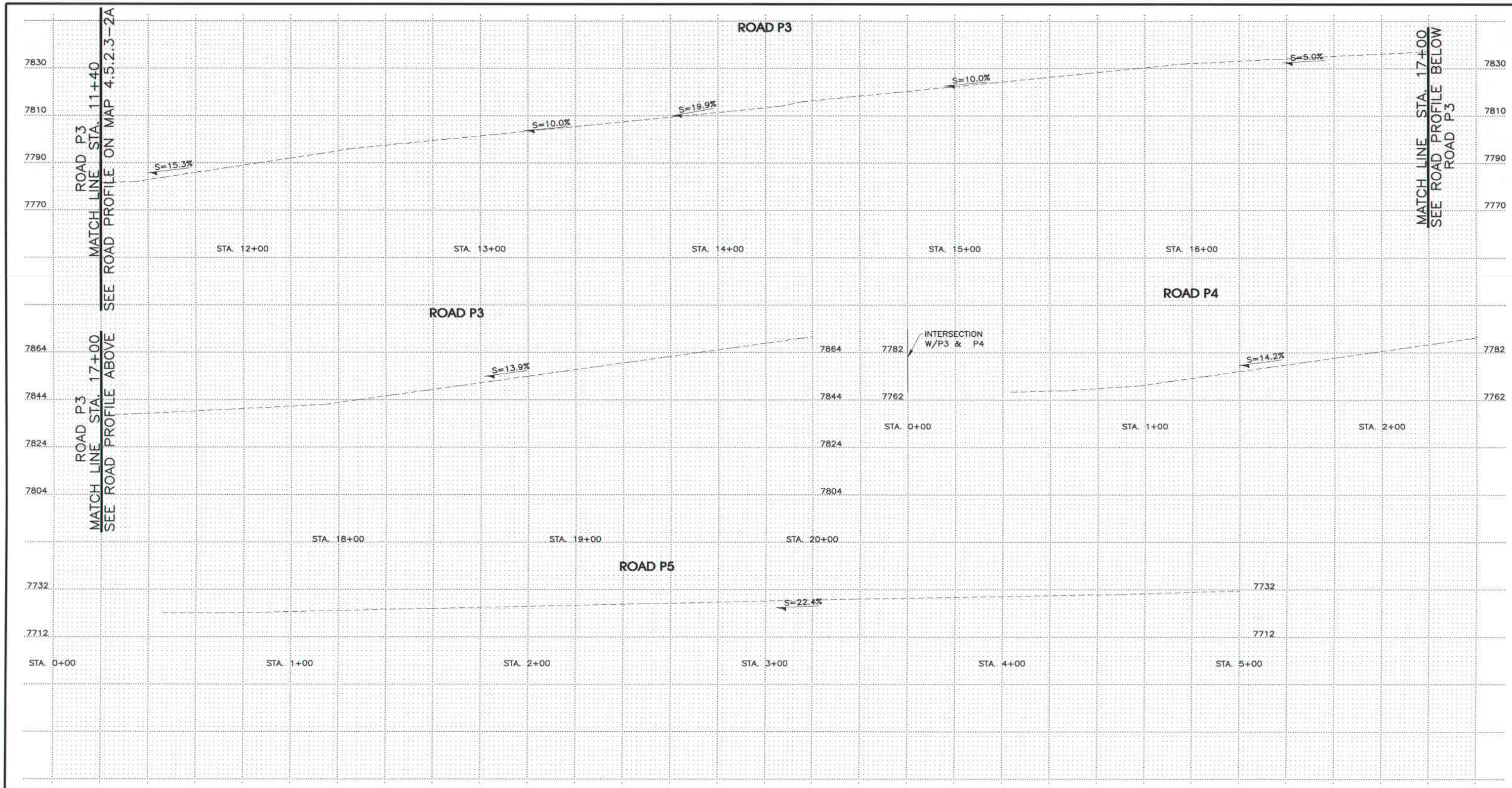

NOTES:

1. PROFILES ARE AT CENTERLINE OF ROAD.
2. SEE MAP 4.5.1.2-3 FOR ROAD LOCATIONS.

SCALE AS SHOWN

ROADS P3, P4 & P5

NO.	REVISION	DATE	BY	CHKD
8				
7				
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2				
1				

Carbon Resources LLC

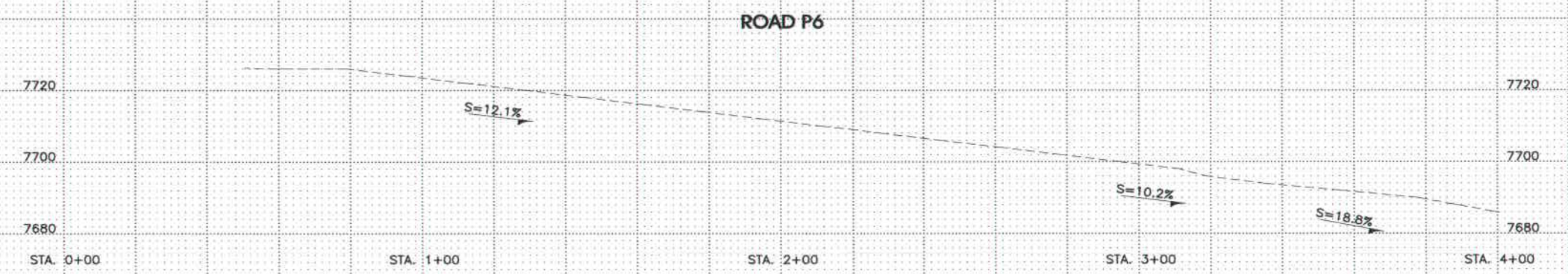
KINNEY NO. 2 MINE
MAP 4.5.2.3-2B
MINE SURFACE FACILITIES
ROAD PROFILES

DRAWN BY: JDB, BAG DATE: 1/2008
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE INC ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No 0002 Date 2/19/2008
In C/007/0047/2008, Incoming
For additional information Confidential



File in:
❑ Confidential
☒ Shelf
❑ Expandable
Refer to Record No. 0002 Date 2/19/2008
In C/0070047, 2008, Incoming
For additional information + Confidential

NOTES:

1. PROFILES ARE AT CENTERLINE OF ROAD.
2. SEE MAP 4.5.1.2-3 FOR ROAD LOCATIONS.

SCALE AS SHOWN

ROADS P6 & P7

NO.	REVISION	DATE	BY	CHKD
8				
7				
6				
5				
4				
3				
2				
1				

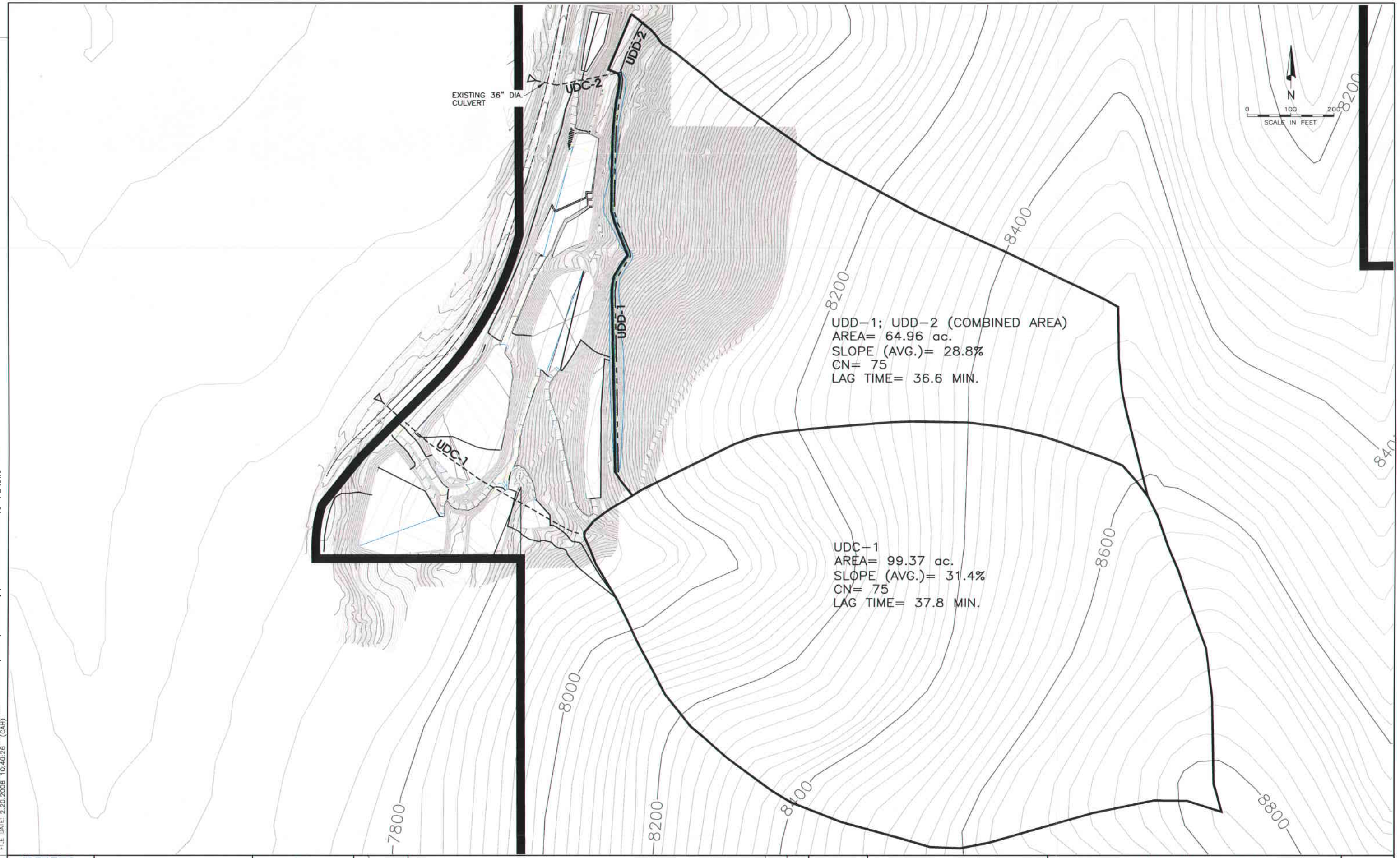
Carbon Resources LLC

KINNEY NO. 2 MINE
MAP4.5.2.3-2C
MINE SURFACE FACILITIES
ROAD PROFILES

DRAWN BY: JDB, BAG DATE: 1/2008
APPROVED BY: G.H. DATE:

HANSEN ALLEN & LUCE inc ENGINEERS
23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:



FILE NAME: 308 CARBON RESOURCES\FINAL DOCUMENT\MAPS (DRAWINGS)\MAP 4.7.2.1-1DRAINAGE AREA.DWG
FILE DATE: 2.20.2008 10:40:26 (CAH)

HANSEN ALLEN & LUCE inc. ENGINEERS

PROJECT ENGINEER

DESIGNED	TDS	3		
DRAFTED	JDB	2		
CHECKED	GH	1		
DATE	JANUARY 2008	NO.	DATE	REVISIONS

BY | APVD.

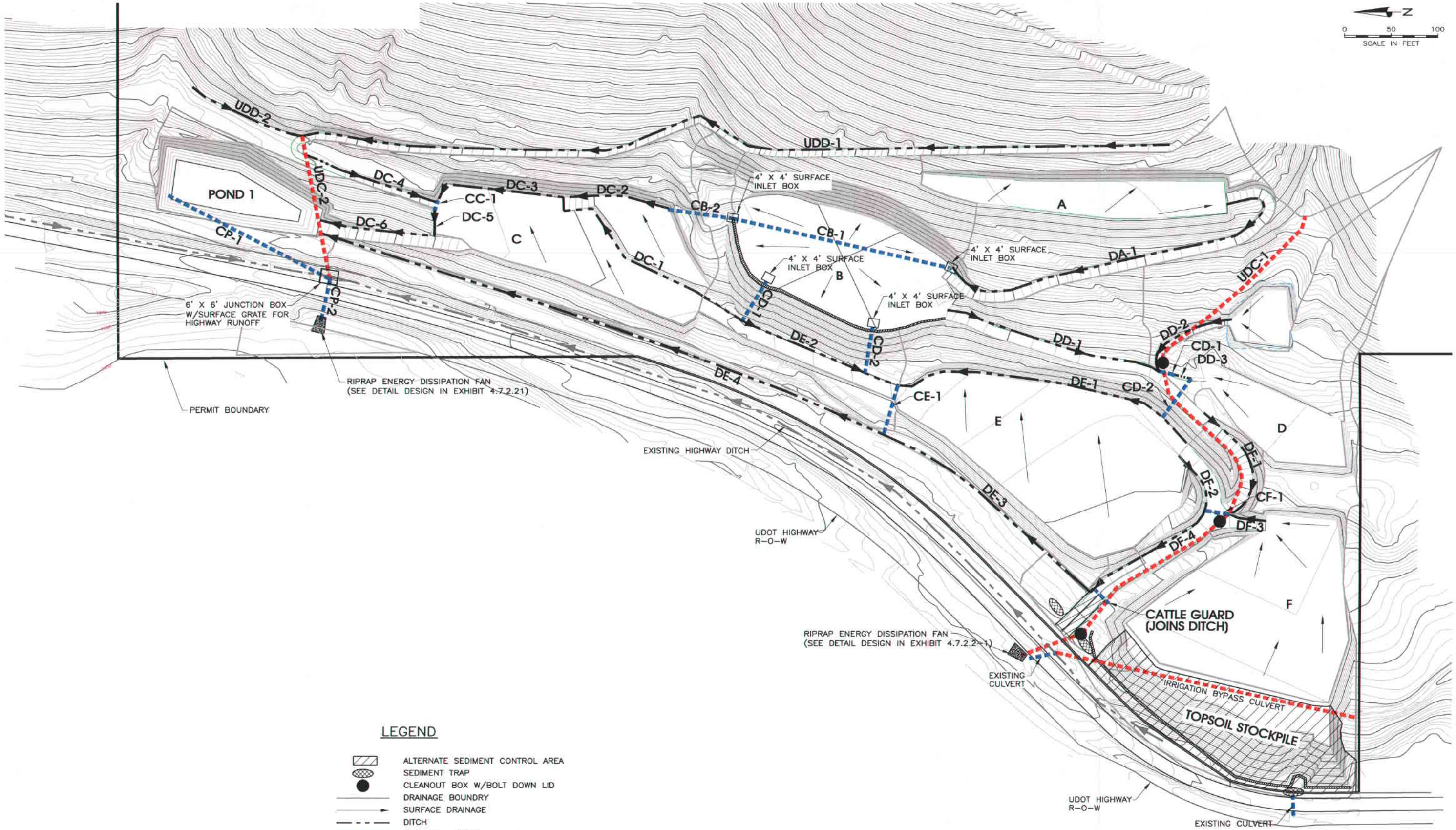
SCALE: AS SHOWN

KINNEY NO. 2 MINE
DRAINAGE AND SEDIMENT CONTROL PLAN
UNDISTURBED DRAINAGE AREAS

SHEET 4.7.2.1-1

308.01.400

3/04



LEGEND

- ALTERNATE SEDIMENT CONTROL AREA
- SEDIMENT TRAP
- CLEANOUT BOX W/BOLT DOWN LID
- DRAINAGE BOUNDRY
- SURFACE DRAINAGE
- DITCH
- CULVERT – ROAD
- CULVERT – UNDISTURBED DRAINAGE
- POND
- BERM
- INLET BOX

GENERAL NOTE:
PAD GRADING TO CONTROL AND DIRECT FLOW TO DITCH OR CULVERT

FILE NO. PRICE 308.01.400 FINAL
FILE DATE: 2.13.2008 13:36:29 (BAG)

HANSEN ALLEN & LUCE INC. ENGINEERS

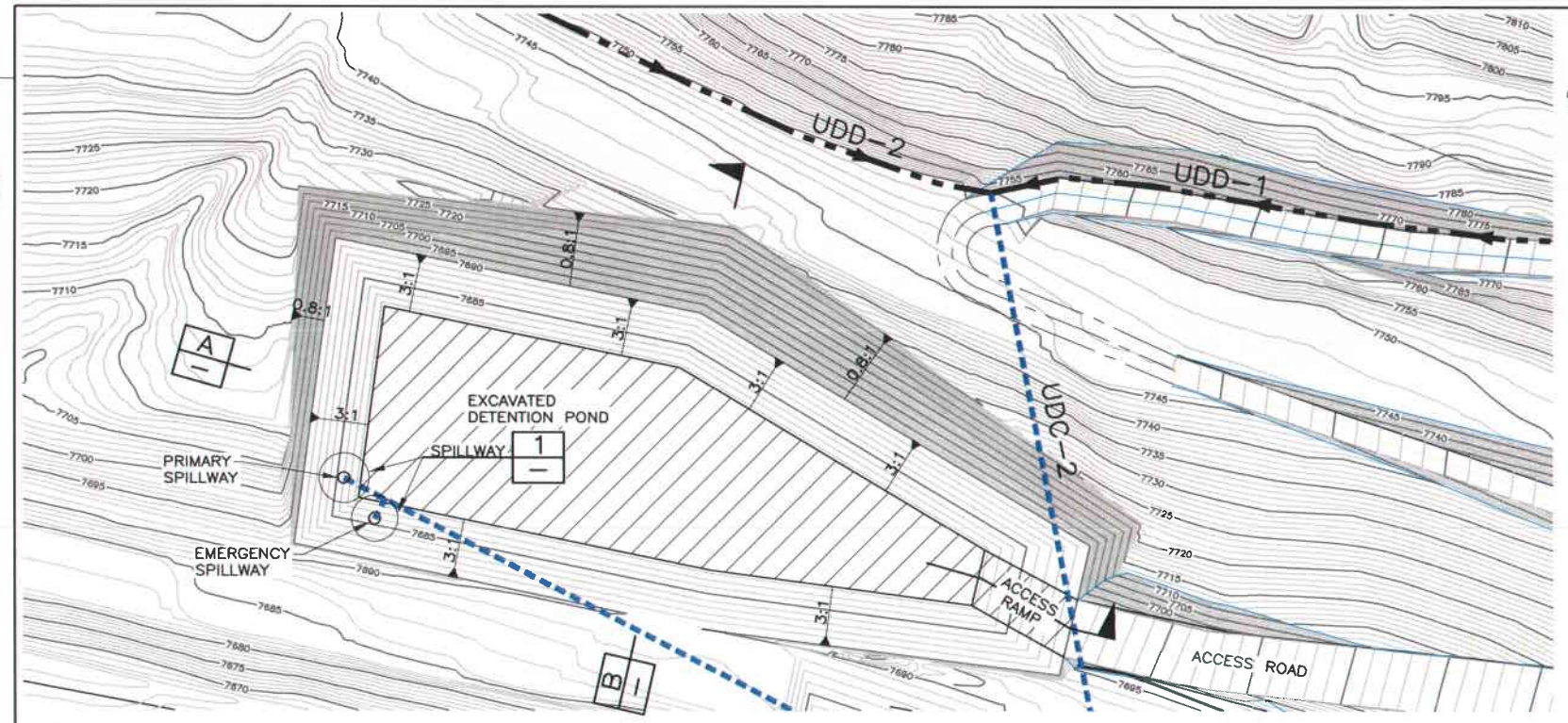
DESIGNED TDS	3				
DRAFTED JDB	2				
CHECKED GH	1				
DATE JANUARY 2008	NO.	DATE	REVISIONS	BY	APVD.

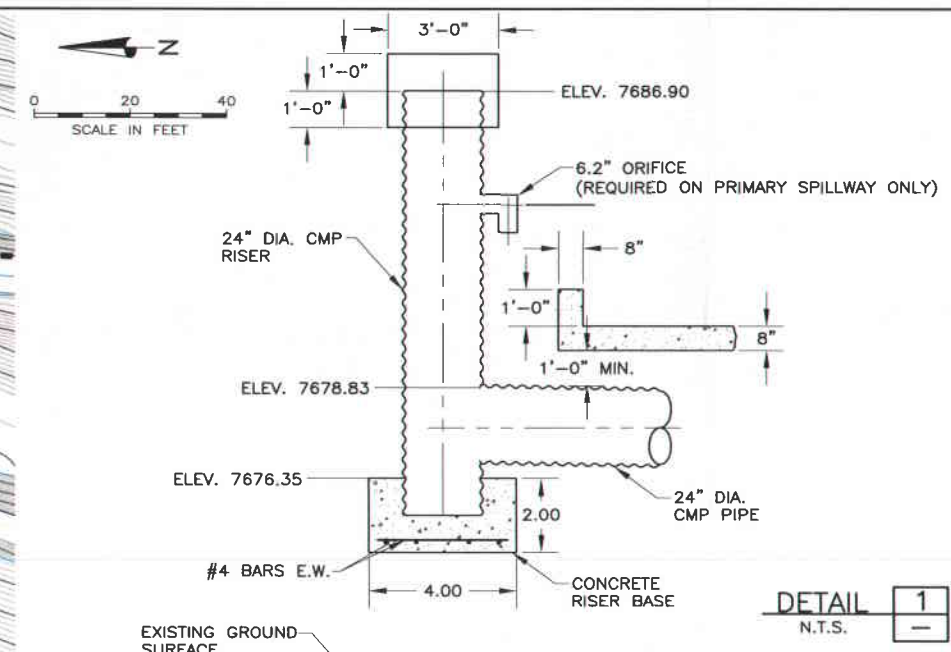
SCALE: AS SHOWN

KINNEY NO. 2 MINE
DRAINAGE AND SEDIMENT CONTROL PLAN
DISTURBED DRAINAGE AREAS

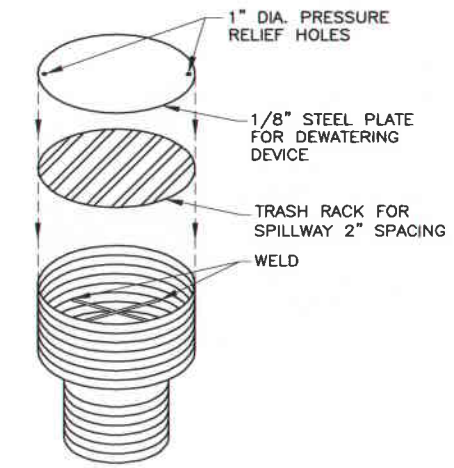
MAP 4.7.2.1-2

3/04

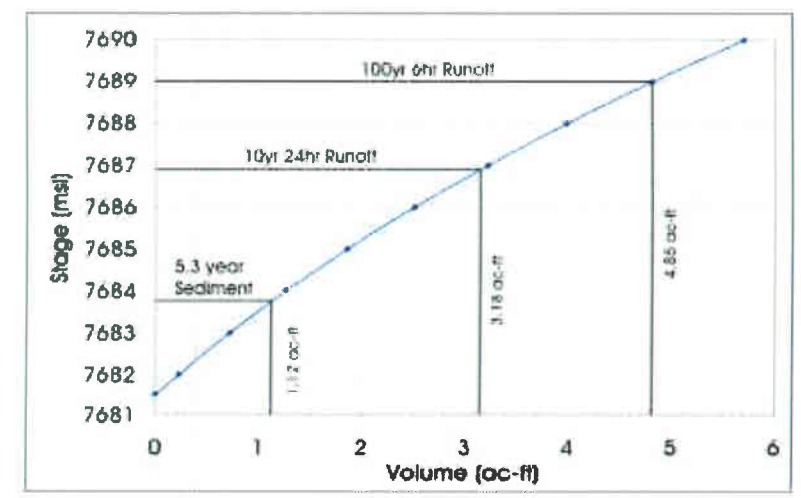


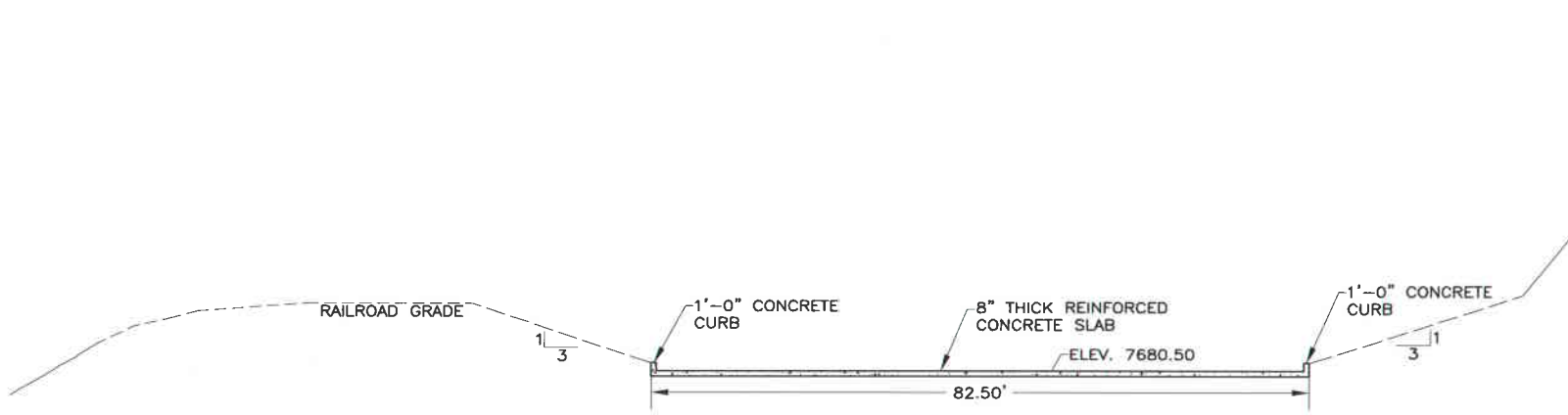


DETAIL 1
N.T.S.

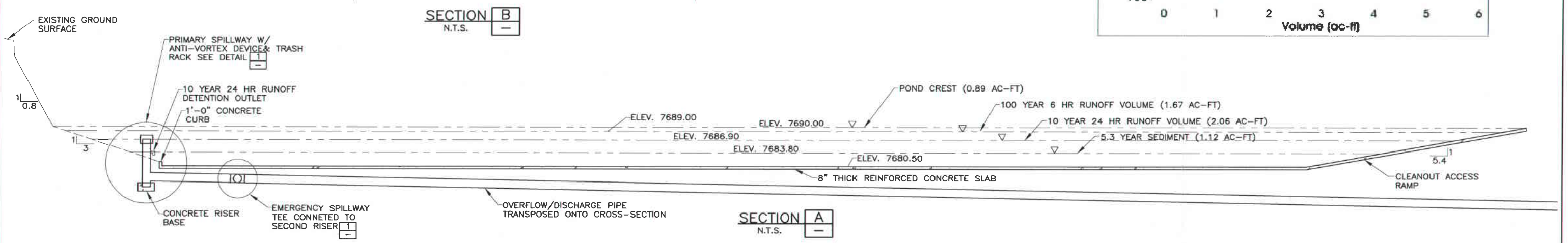


NOTES:
1. CYLINDER SHOULD BE WELDED TO THE TOP OF THE RISER.
2. SUPPORT BARS AND TRASH RACK ARE #6 REBAR.
3. TRASH RACK FOR SPILLWAY SHOULD BE WELDED TO CYLINDER.





SECTION B
N.T.S.



SECTION A
N.T.S.

FILE: 308 CARBON RESOURCES\01.400\CADFILES\4.7.2.1-3 RUNOFF DETENTION POND.DWG
FILE DATE: 1.24.2008 13:39:49 (JDB)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER DAVID E. HANSEN STATE OF UTAH

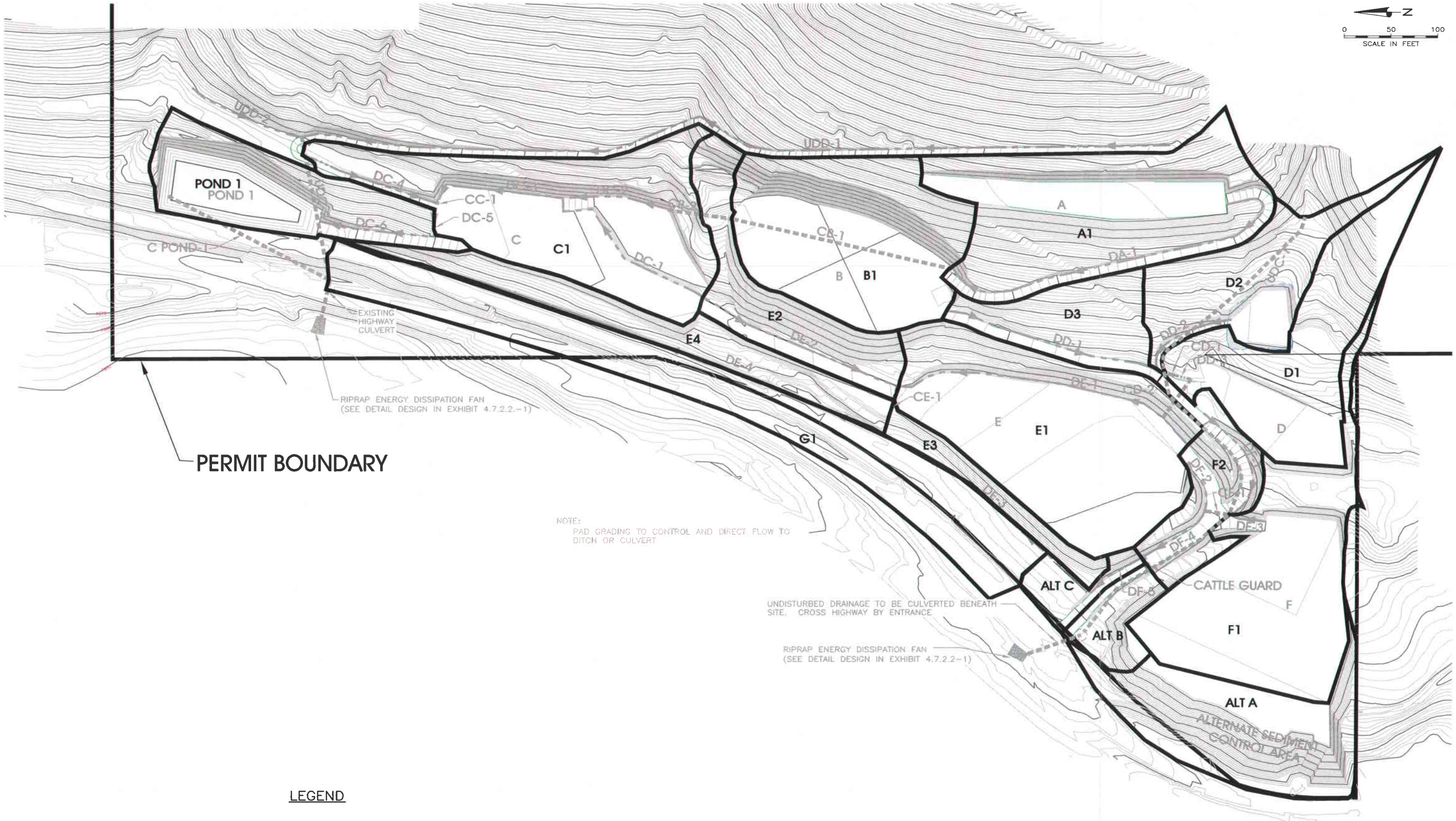
DESIGNED TDS	3					
DRAFTED JDB	2					
CHECKED GH	1					
DATE JANUARY 2008	NO.	DATE	REVISIONS	BY	APVD.	

SCALE: AS SHOWN

KINNEY NO. 2 MINE
SEDIMENTATION POND 1
SECTIONS & DETAILS

MAP 4.7.2.1-3

3/04



LEGEND

- DRAINAGE BOUNDRY
- DITCH
- CULVERT – ROAD
- CULVERT – UNDISTURBED DRAINAGE
- POND
- BERM

FILE 308 CARBON RESOURCES\01.400\CADFILES\4.7.2.1-4 DIST. DRAINAGE SUBBASINS.DWG
FILE DATE 1.24.2008 13:47:13 (JDB)

HANSEN ALLEN & LUCE INC. ENGINEERS

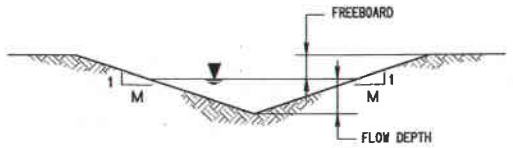
DESIGNED TDS	3			
DRAFTED JDB	2			
CHECKED GH	1			
DATE JANUARY 2008	NO.	DATE	REVISIONS	BY / APVD.

SCALE: AS SHOWN

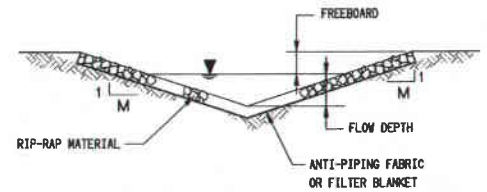
KINNEY NO. 2 MINE
DRAINAGE AND SEDIMENT CONTROL PLAN
DISTURBED DRAINAGE SUB-BASINS

MAP 4.7.2.1-4

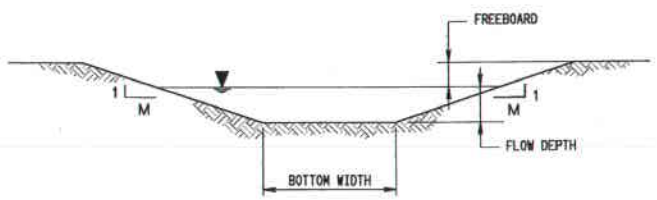
3/04



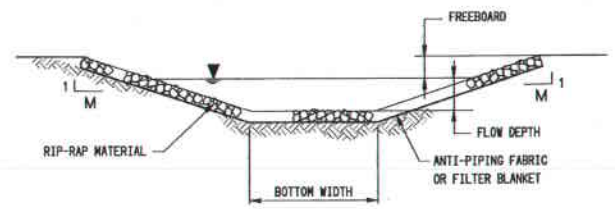
TYPICAL TRIANGULAR CHANNEL SECTION



TYPICAL TRIANGULAR CHANNEL SECTION



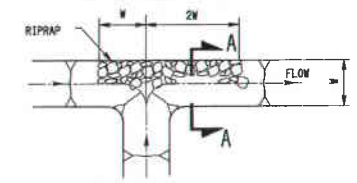
TYPICAL TRAPEZOIDAL CHANNEL SECTION



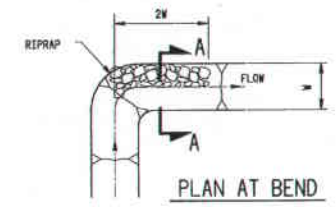
TYPICAL TRAPEZOIDAL CHANNEL SECTION

TYPICAL EARTHEN DRAINAGE STRUCTURE DETAIL

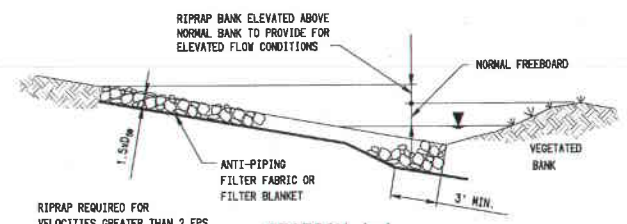
TYPICAL EARTHEN DRAINAGE WITH RIPRAP STRUCTURE DETAIL



PLAN AT "TEE" JUNCTION

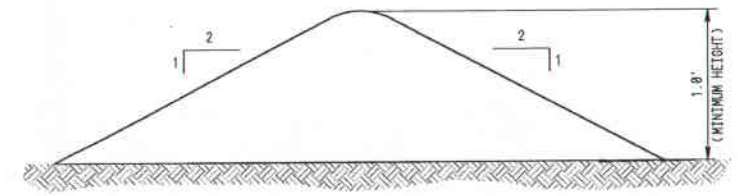


PLAN AT BEND



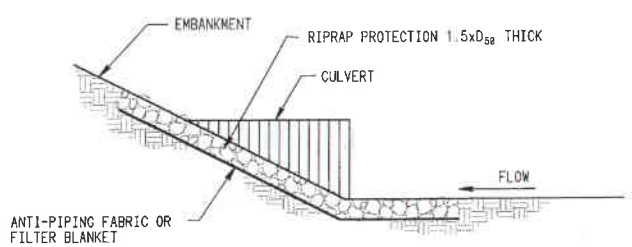
SECTION A-A

TYPICAL CHANNEL BANK RIPRAP DETAIL

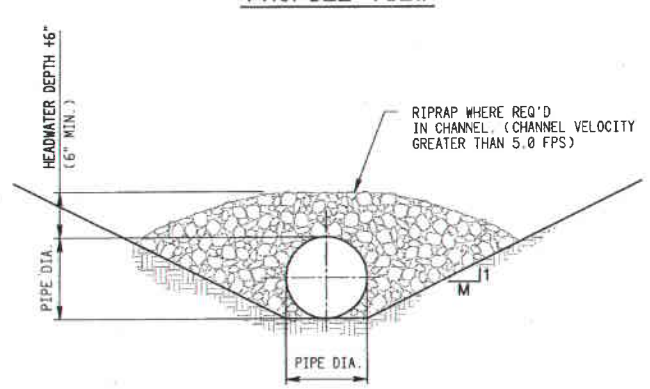


DRAINAGE BERM DETAIL

NOTE: EARTHEN BERM SHALL CONSIST OF ON SITE NATIVE SOILS. BERMS SHALL BE REGULARLY MAINTAINED.

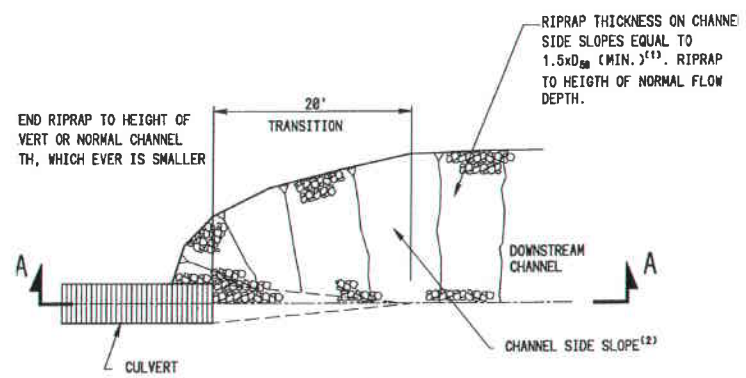


PROFILE VIEW



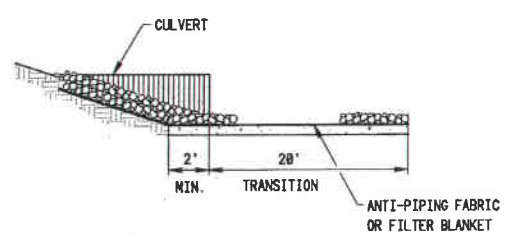
FRONT VIEW

TYPICAL RIPRAP HEAD WALL PROTECTION DETAIL



PLAN VIEW

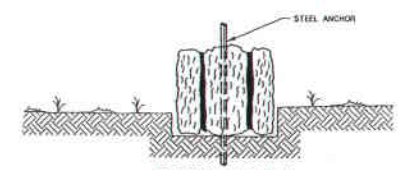
FOR VELOCITIES GREATER THAN 5 FPS (3)



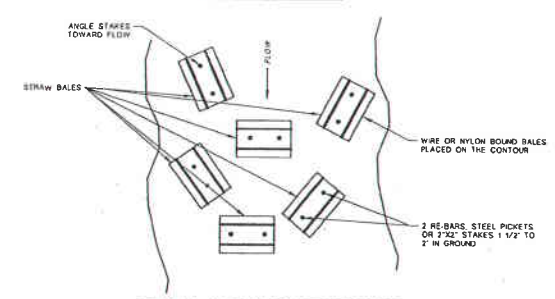
SECTION A-A

NOTES:
1. RIPRAP ON DOWNSTREAM CHANNEL ONLY APPLICABLE FOR LINED

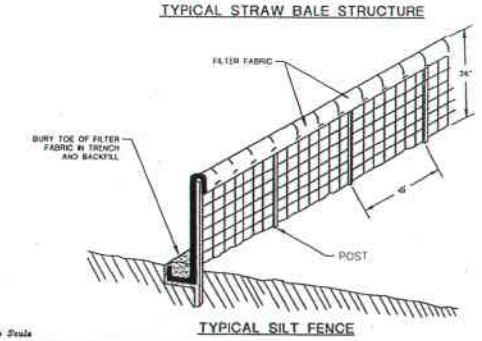
TYPICAL CULVERT OUTLET EROSION PROTECTION DETAIL



EMBEDDING DETAIL



TYPICAL STRAW BALE STRUCTURE



Not to Scale

TYPICAL SILT FENCE

TYPICAL SEDIMENT CONTROL DETAIL

FILE NAME: 308 CARBON RESOURCES\FINAL DOCUMENT\MAPS (DRAWINGS)\MAP 4.7.2.2-2 RUNOFF CONTROL DETAILS.DWG
FILE DATE: 2.20.2008 10:11:06 (CAH)

HANSEN ALLEN & LUCE INC. ENGINEERS

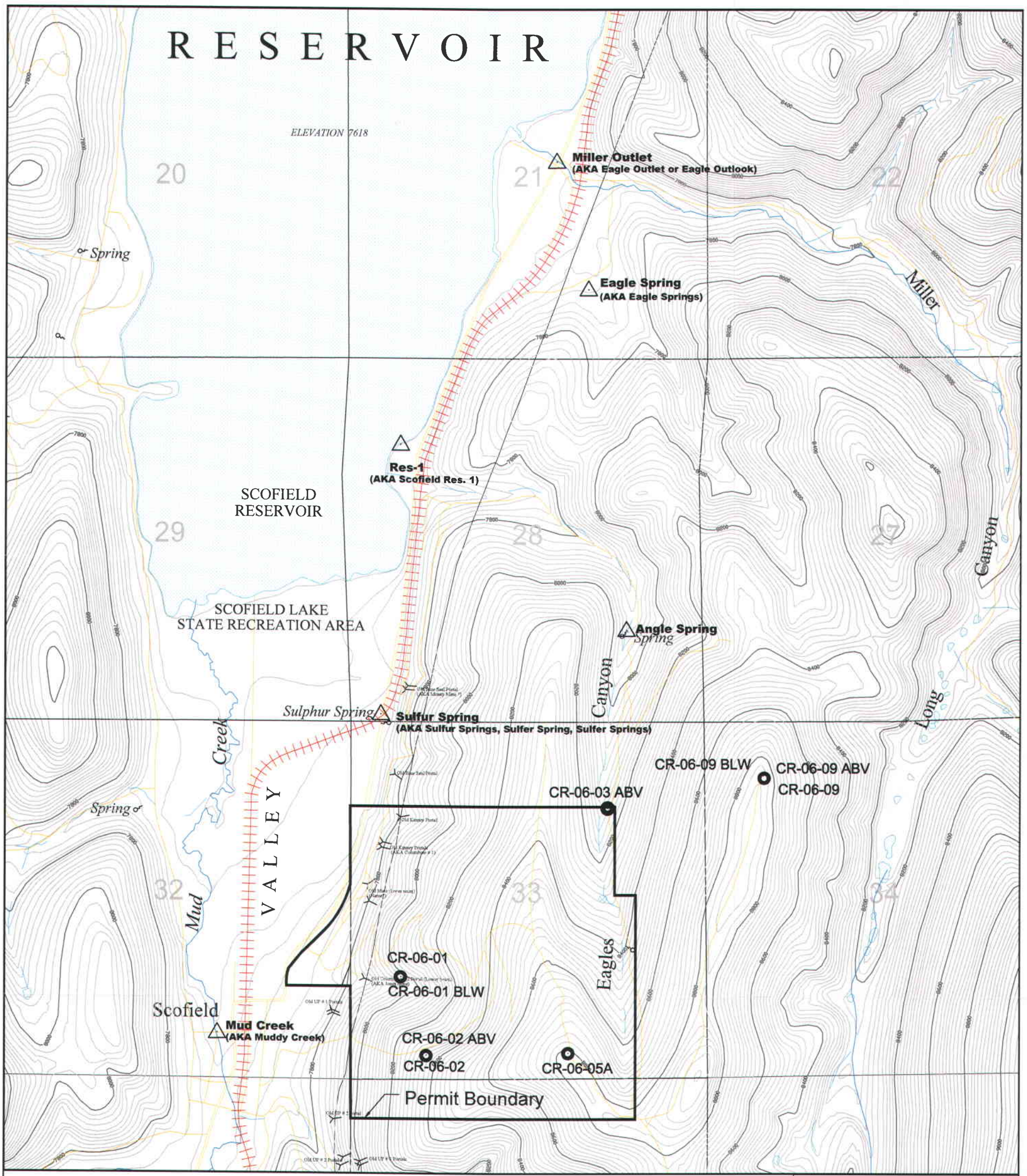
DESIGNED BG	3					
DRAFTED JDB	2					
CHECKED GH	1					
DATE JANUARY 2008	NO.	DATE	REVISIONS	BY	APVD.	

SCALE NOT TO SCALE

KINNEYNO. 2 MINE
RUNOFF CONTROL DETAILS

MAP 4.7.2.2-2

3/04



LEGEND

△	**Mud Creek** AKA Muddy Creek	Surface Water Monitor Location
●	**CR-06-02**	Ground Water Monitor Location

REGISTERED LAND SURVEYOR
167246
BENJAMIN A. GRIMES
2/20/08
STATE OF UTAH

N

0 2,000 ft

SCALE: 1:24,000 or 1" = 2,000'

Contour Interval 20 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then multiply by the CF.

Carbon Resources LLC

KINNEY NO. 2 MINE

MAP 4.7.2.3-1

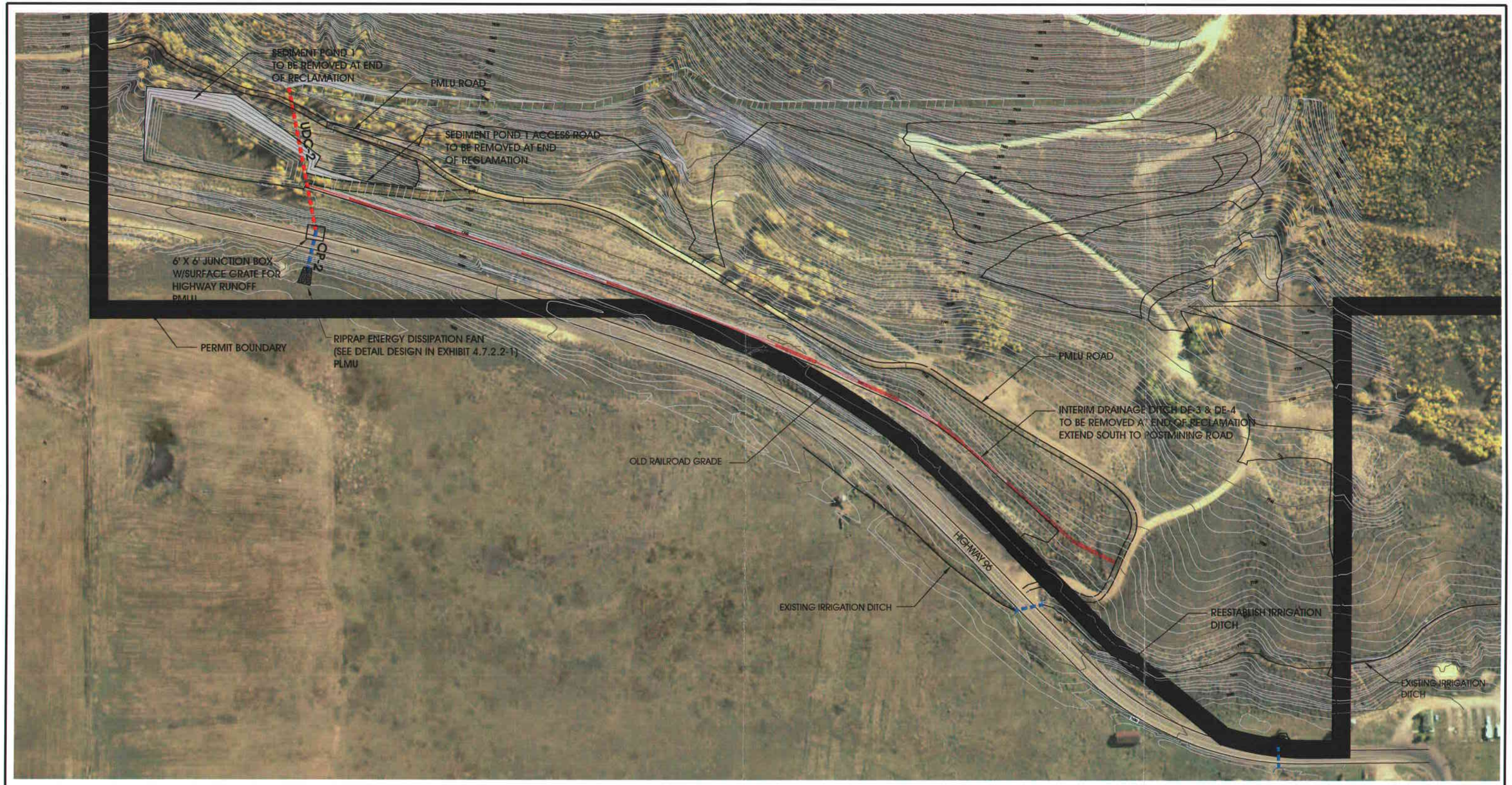
Surface & Ground Water Monitoring Sites

DRAWN BY: GLH	DATE: 8/2/07
APPROVED BY: GLH	DATE: 8/12/2007

HANSEN ALLEN & LUCE inc ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

FILE: Surf & GW Mon Loc 8-12-07



NOTES:

1. ALTERNATIVE SEDIMENT CONTROLS TO BE REMOVED AT END OF BOND PERIOD
2. SEDIMENT POND AND ACCESS ROAD TO BE REMOVED AT END OF BOND PERIOD

LEGEND

PMLU	POST MINING LAND USE WHERE APPLICABLE
	SEDIMENT TRAP
	CULVERT – UNDISTURBED DRAINAGE PMLU
	ALTERNATIVE SEDIMENT CONTROL
	INLET BOX PMLU
	PRE–MINING CULVERTS
	MINING DISTURBANCE FOOTPRINT

N

0 100 200 300 ft

SCALE
Contour Interval 2 ft

This map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 5,000 ft, using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then divide by the CF.

Carbon Resources LLC

KINNEY NO. 2 MINE
MAP 4.7.2.9-1
MINE SURFACE FACILITIES AREA
POST MINING TOPOGRAPHY
& INTERIM DRAINAGE CONTROL

DRAWN BY:	J.B., B.G.	DATE:	1/08
APPROVED BY:	G.H.	DATE:	1/08

HANSEN ALLEN & LUCE Inc. ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

DWG. NAME:

Exhibit 1.2-1

Documentation of Existing Site Conditions

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No 0002 Date 2/19/2008
In C/ 007-0047, 2008, Incoming
For additional information: Confidential

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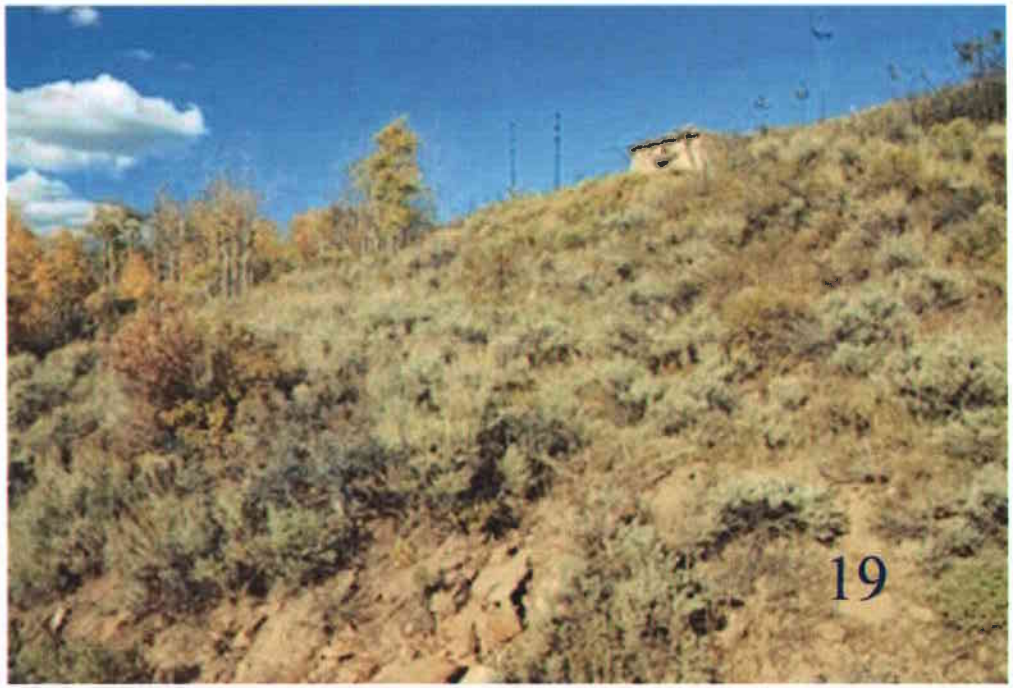
19

20

21

22

180 Degree Panorama

Exhibit 1.5-1

Prime Farmland Determination

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
240 West Highway 40 333-4
Roosevelt, UT 84066
(435) 722-4621
FAX (435) 722-9065

March 9, 2006

Ben Grimes
Hansen, Allen & Luce Engineers
23 South Carbon Avenue, Suite #21
P.O. Box 777
Price, UT 84501

Re: Prime, State Important and Unique Farmlands Determination for Kinney No. 2 Mine, near Scofield, UT; Job # 308.01.100

Dear Mr. Grimes:

We have reviewed your request for a determination of prime, state important and unique farmlands.

The soils do not meet the criteria for prime, state important or unique farmlands for one or more of the following reasons:

1. The soils have a temperature regime that is Cryic. The mean summer temperature is less than 59 degrees F. (15 degrees C.); and or

2. The product of K (erodibility factor) x percent slope is greater than 2.0 for prime farmlands, and is greater than 5.0 for state important farmlands; and or

3. More than 10 percent of the surface layer (upper 6 inches) in these soils consists of rock fragments coarser than 3 inches (7.6 cm); and or

4. The soils have a pH of greater than 8.6 in some horizons within a depth of 20 inches; and or

5. The area does not have a developed irrigation system that is of adequate quality or quantity to grow the commonly grown crops adapted to the region in 7 or more years out of 10; and or

6. The area is urban land.

7. Carbon County has not designated any lands as unique farmlands.

I am enclosing a Form AD-1006, FARMLAND CONVERSION IMPACT RATING for your use.

Robert H. Fish
Soil Scientist

Cc: Wayne Greenhalgh, DC, NRCS, Price, UT

Enclosure

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Natural Resources Conservation Service (NRCS) local field office and retain copy D for their files. (Note: NRCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the NRCS State Conservationist in each state).

Step 3 – NRCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

Step 4 – In cases where farmland covered by the FPPA will be converted by the proposed project, NRCS field offices will complete Parts II, IV and V of the form.

Step 5 – NRCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for NRCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in § 658.5 (b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will, be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned relative adjustments must be made to maintain the maximum total weight points at 160.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points, and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 3/8/06
Name Of Project Kinney No. 2 Mine (Scofield, UT)	Federal Agency Involved
Proposed Land Use Coal Mine	County And State Carbon County, Utah
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 3/8/06

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☐	No ☑	Acres irrigated / Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %		Amount Of Farmland As Defined in FPPA Acres: %
Name Of Land Evaluation System Used	Name Of Local Site Assessment System		Date Land Evaluation Returned By NRCS

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly				
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	0.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland				
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value				
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	0	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area					
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	0	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

Form AD-1006 (10-83)

This form was electronically produced by National Production Services Staff

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2.1.2.2-1 Confidential Information

This material held as confidential. DOGM has only copy.

Exhibit 2.1.3-1

Other Permits

Air Quality

Notice of Intent To Construct Application to Utah DAQ

NOTICE OF INTENT TO CONSTRUCT

Prepared for:

CARBON RESOURCES

KINNEY NO. 2 MINE

SCOFIELD, UTAH

Submitted to:

Richard W. Sprott, Direector
UTAH DIVISION OF AIR QUALITY
150 North 1950 West
P.O. Box 144820
Salt Lake City, UT 84114-4820

Prepared by:

GAULT GROUP INC.
2200 EAST CAMELBACK ROAD, SUITE 217
PHOENIX, ARIZONA 85016

February 2008

GAULT GROUP INC.

CREATING PARADIGMS IN RESOURCE MANAGEMENT

February 19, 2007

Mr. Richard W. Sprott, Director
Division of Air Quality
150 North 1950 West
Post Office Box 144820
Salt Lake City, Utah 84114-4820

Subject: Notice of Intent for Carbon Resources, Kinney No.2 Mine, Schofield, Utah

Dear Mr. Sprott:

Please find enclosed a Notice of Intent (NOI) prepared by Carbon Resources, Kinney No.2 Mine for an Approval Order to construct an underground coal mine with surface coal handling, storage, and loadout facilities in Carbon County, near Schofield, Utah. The enclosed NOI provides the data and information prescribed in the Utah Division of Air Quality's publication, *Preparing a Notice of Intent [NOI] – The NOI Guide*, Eighth Edition.

Form 1 provides general facility and project information, including identification and contact information of the facility operator, mine location, and other required information. Appendix A and Appendix B provide a site plan and process flow diagram, respectively. Appendix C contains a brief narrative description of the proposed surface operations shown in the flow diagram, a Form 02 completed for each process, one Form 1d that summarizes the potential to emit (PTE) regulated pollutants, and a printout of the PTE spreadsheet containing detailed emissions calculations and documentation. Appendix D contains a summary of air pollution control equipment, and one Form 10 for each fabric filter baghouse. Because monitoring devices/equipment will not be necessary, no Appendix E is attached. Appendix F is the best available control technology (BACT) analysis, and Appendix G provides results of the dispersion modeling conducted to evaluate potential air quality impacts of the proposed project.

In addition to the NOI package, please find enclosed Kinney Coal Mine's $500 check for the new minor source Application Filing Fee. Please feel free to contact us if you have any question regarding the enclosed application package.

Sincerely,

Major Kindsfater
Project Engineer

2200 E. CAMELBACK ROAD, SUITE 217
PHOENIX, ARIZONA 85016
602/294-6652 FAX 602/294-6659

36 WEST MAIN STREET
CORTEZ, COLORADO 81321
970/565-1222 FAX 970/565-1226

Utah Division of Air Quality
New Source Review Section

Date: February 11, 2008

Form 1
General Information

Application for: ■ Initial Approval Order ☐ Approval Order Modification

AN APPROVAL ORDER MUST BE ISSUED BEFORE ANY CONSTRUCTION OR INSTALLATION CAN BEGIN. This is not a stand alone document. Please refer to the Permit Application Instructions for specific details required to complete the application. Please print or type all information requested. All information requested must be completed and submitted before an engineering review can be initiated. If you have any questions, contact the Division of Air Quality at (801) 536-4000 and ask to speak with a New Source Review Engineer. Written inquiries may be addressed to: Division of Air Quality, New Source Review Section, P.O. Box 144820, Salt Lake City, Utah 84114-4820.

Applicable base fee for engineering review and filing fee must be submitted with the application.

General Owner and Facility Information	
1. Company name and address: *Carbon Resources – Kinney No. 2 Mine* *Mine Site Location: Scofield, UT* *Manager Contact: Gregory Hunt* Phone No.: (970) 856 9477; (970) 260 0448 Fax No.: (970) 856 9478	2. Company contact for environmental matters: Ben Grimes Hansen Allen and Luce 23 S. Carbon Avenue Price, Utah 84501 Phone No.: (453) 653 2304 Fax No.: ( )
3. Facility name and address (if different from above): *Kinney No. 2 Mine* *Scofield, UT* Phone no.: n/a Fax no.: n/a	4. Owners name and address: Carbon Resources, LLC P.O. Box 11789 Albuquerque, New Mexico 87192 Phone: (505) 286-1253 Cell no.: (505) 980 1841
5. County where the facility is located in: *Carbon County*	6. Latitude & longitude, and/or UTM coordinates of plant: Lat- 39 deg 43 min 34 sec, Long -111 deg 09 min 28 sec
7. Directions to plant or Installation (street address and/or directions to site) (include U.S. Coast and Geodetic Survey map if necessary): Mine Site Portal access and Surface facilities are located between the town of Scofield, Utah and the Scofield Reservoir East and adjacent to Highway.	
8. Identify any current Approval Order(s): AO#_____ Date_____ AO#_____ Date_____ AO#_____ Date_____ AO#_____ Date_____ AO#_____ Date_____ AO#_____ Date_____	
9. If request for modification, permit # to be modified: DAQE #_____ DATED: ____/____/____	
10. Type of business at this facility: *Underground coal mine & surface coal handling facilities*	
11. Total company employees greater than 100? ☐ Yes X No, Not to begin with. Maybe later	12. Standard Industrial Classification Code *1222*

Approval Order Application
Form 1 (Continued)

13. Application for:

- ■ New construction
- ☐ Existing equipment operating without permit
- ☐ Change of permit condition
- ☐ Modification
- ☐ Permanent site for Portable Approval Order
- ☐ Change of location

14. For new construction or modification, enter estimated start date: Feb 1, 2009 Estimated completion date: Feb 1, 2010

15. For change of permittee, location or condition, enter date of occurrence:

16. For existing equipment in operation without prior permit, enter initial operation date:

17. Has facility been modified or the capacity increased since November 29, 1969: ☐ Yes ■ No

Process Information

18. Site plan of facility (Attach as Appendix A): *attached*

19. Flow diagram of entire process to include flow rates and other applicable information (Attach as Appendix B): *attached*

20. Detailed written process and equipment description. (Attach as Appendix C) - *attached*
Description must include:
Process/Equip specific form(s) identified in the instructions
Fuels and their use
Raw materials used
Production rates
Equipment used in process
Operation schedules
(including daily/seasonal variances)
Description of product(s)
Description of changes to process (if applicable)

21. Does this application contain justifiable confidential data? ☐ Yes ■ No

Emissions Information

22. Complete and attach Form 1d, Emissions Information - *attached*
Include Material Safety Data Sheets for all chemicals or compounds that may be emitted to the atmosphere.

23. Identify on the site plan (see #18 above) all emissions points, building dimensions, stack parameters, etc.

Air Pollution Control Equipment Information

24. List all air pollution control equipment and include equipment specific forms identified in the instructions.
Attach as Appendix D. *attached*

25. List and describe all compliance monitoring devices and/or activities (such as CEM, pressure gages). Attach as Appendix E. *(na)*

26. Submit modeling for the project if required. See attached instructions. *attached*

27. Attach as Appendix F your proposal of what air pollution control devices, if any, or operating practices represents Best Available Control Technology. Discuss and evaluate all air pollution control technologies relevant to your situation or process. *Attached*

28. I hereby certify that the information and data submitted in and with this application is completely true, accurate and complete, based on reasonable inquiry made by me and to the best of my knowledge and belief.

Authorized Company Agent:

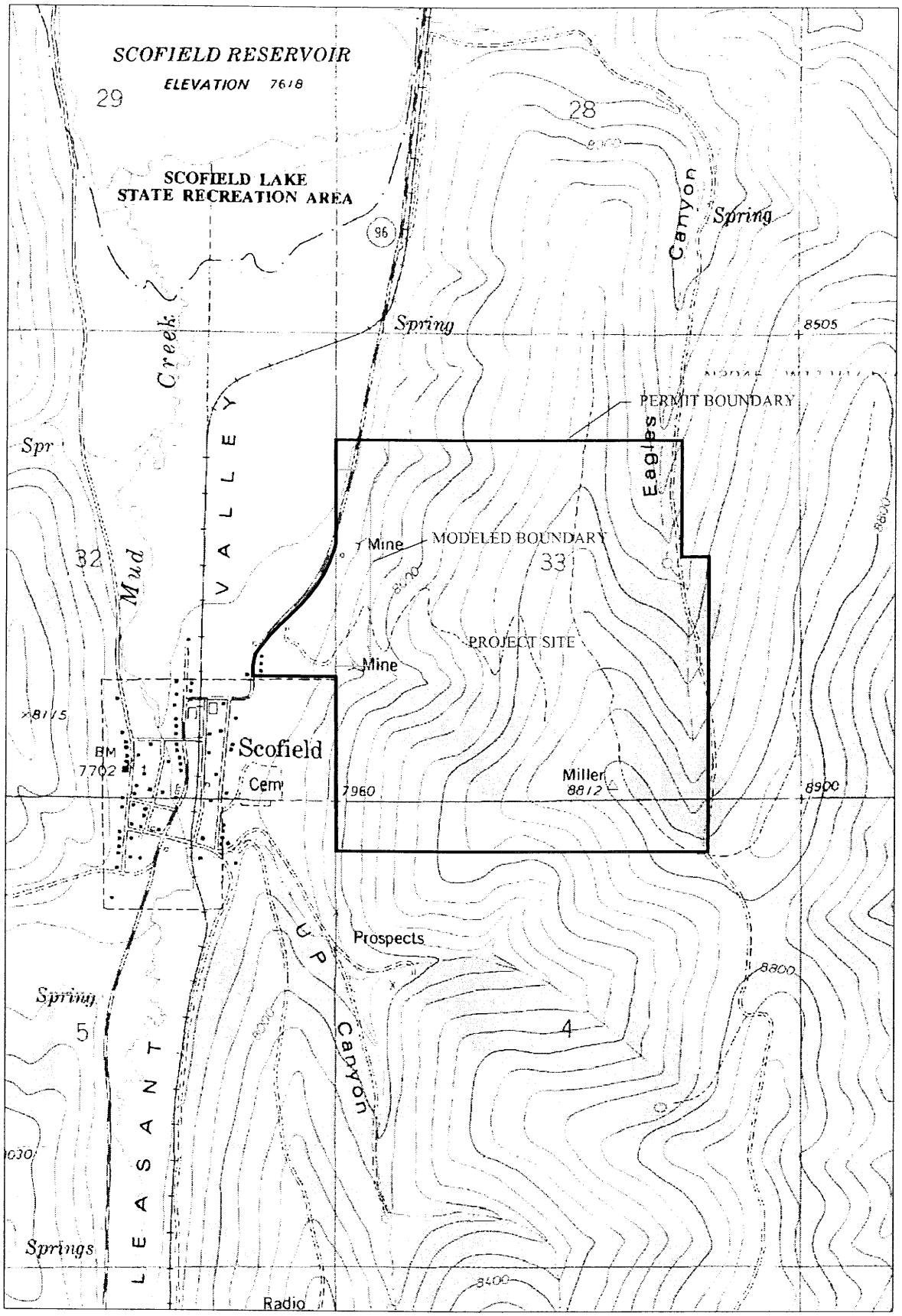
Signature: Title: CFO

29. Clay Wisdom Name (Type or print)	30. Telephone Number: (605) 250 1253	30. Date: 2-14-08

APPENDIX A

Figure 1 – Vicinity Map

Figure 2 – Site Layout



0 500' 1000'
SCALE

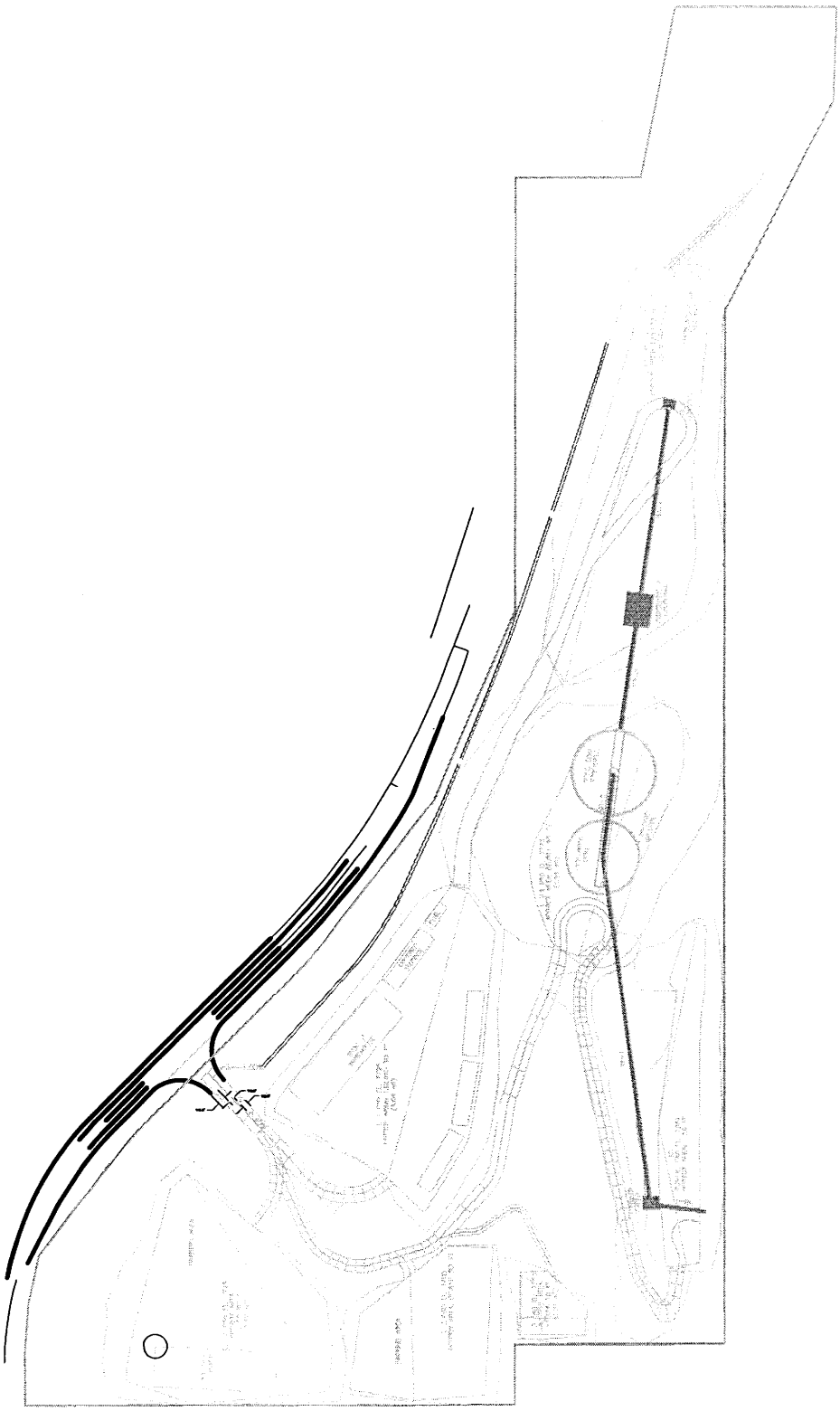
PREPARED BY:
GAULT GROUP INC.

CARBON RESOURCES - KINNEY NO.2 MINE
NOTICE OF INTENT TO CONSTRUCT

VICINITY MAP

REV: ①2 3 4 5 | PROJECT NO. 07-11A

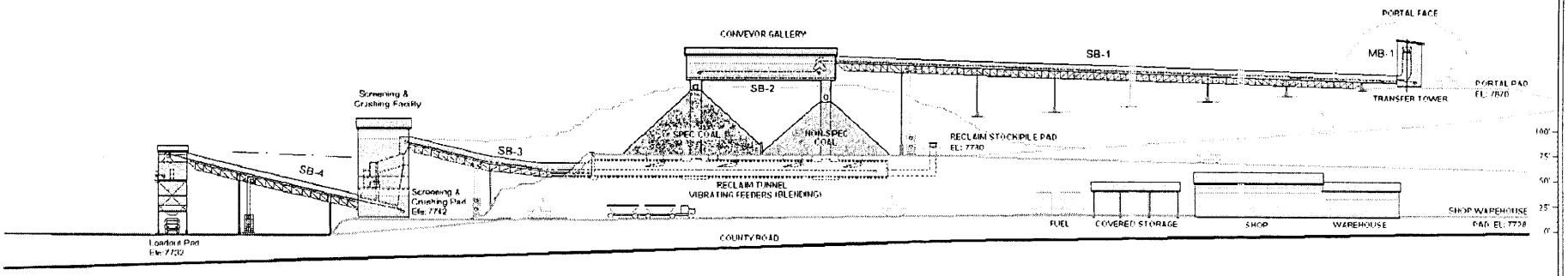
DATE: 14-FEB-08 | FIGURE: 1



0 100' 200' SCALE	CARBON RESOURCES - KINNEY NO. 2 MINE NOTICE OF INTENT TO CONSTRUCT	SITE LAYOUT
PREPARED BY: GAULT GROUP INC.		REV: ①2 3 4 5 — PROJECT NO. 07-11A
		DATE: 14-FEB-08 — FIGURE: 2

APPENDIX B

Figure 3- Process Flow and Site Elevation Schematic



SCHEMATIC
Scale is Approximate

SITE ELEVATION LOOKING EAST

0' 25' 50' 75' 100'

CARBON RESOURCES - KINNEY NO. 2 MINE NOTICE OF INTENT TO CONSTRUCT	PREPARED BY: GAULT GROUP INC.	REV:	①2 3 4 5	PROCESS FLOW AND SITE ELEVATION SCHEMATIC
	PROJECT NO. 07-11A	DATE: 14-FEB-08		FIGURE: 3

APPENDIX C

Narrative Description of Processes and Equipment

Equipment / Process Summary

Form 1d – Emissions Information

PTE Calculations

Forms 02 - Process Information Forms

NARRATIVE OF PROCESSES AND EQUIPMENT

Coal Handling Systems and Facilities

The coal handling operations consist of the underground coal hauling equipment and a surface coal handling system that will transfer coal from the underground mining operations through the mine portal to the coal stockpiles, reclaim system, screening, crushing and load out facilities. Equipment for the surface portion of the coal handling operations is described below and shown on the site plans, site elevations and support building plans included with this narrative. Summarized, this shall include the following:

- Conveyor MB-1[1] (Run-Of-Mine (ROM) SB-1 coal transfer from underground feeder/breaker to above ground transfer building.)
- Transfer Building
- Conveyor SB-1 (Overland conveyor to stockpile gallery)
- Stockpile Gallery
- Conveyor SB-2 (Conveyor in gallery)
- Stacking Tubes
- Reclaim Tunnel with vibrating feeders for coal blending
- Conveyor SB-3 (Reclaim conveyor to screening/crushing)
- Screening/Crushing Building
- Conveyor SB-4 (conveyor to truck load out structure)
- Truck Load Out Structure
- Fuel Tank Farm
- Warehouse/Shop Building
- Covered Storage
- Administration/Mine Dry Building

Design – The surface coal handling system has been designed using best available current technologies and accepted practical engineering practices.

No processing of coal will be required. ROM coal will only be screened and crushed prior to point of sale. Spec coal, non-spec coal and waste capacities have been ascertained on an operational needs and space availability basis and equipment with adequate throughput capacity to handle the maximum anticipated mine production volumes during peak production surge periods have been accounted for in design. The coal handling layout and design provides site storage capabilities to handle normal fluctuations in coal production, shipping schedules and market demand that include design and construction requirements necessary to minimize potential adverse environmental impacts and to minimize dust, erosion, sediment accumulation and surface runoff.

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[1] Conveyor Nomenclature Syntax: Relative to the Mine Portal. MB-X = Mine Belt Designation where X = consecutively larger numbers with inby progression toward the mining face or in a direction opposite to the direction of flow; likewise:

SB-Y Surface Belt Designation where Y = consecutively larger numbers with outby progression toward the point of sale i.e., (load-out) or in the direction of flow away from the Mine Portal.

Construction – All phases of construction will follow a predetermined critical path construction schedule developed specifically for this project. Construction of the surface coal handling system includes excavation, grading, trenching, backfilling and compaction of existing site conditions for conveyor corridors, reclaim tunnel, coal sizing, load out and mine support facilities. This shall include excavation and grading using a cut and fill method to prepare and establish areas for the ROM coal stockpiles, screening/crushing and truck load-out, warehouse, maintenance shop, fuel farm, parts bone yard, administration mine dry facility, employee parking and access roads and Portal site bench.

A drainage culvert system will be installed under the ROM stockpiles. Required drainage will be constructed as required for this site to control and direct runoff. After suitable excavation and grading is provided construction of footings, foundations and structures for the overland conveyor, reclaim tunnel, stacking tubes, galleries, reclaim conveyor, screening/crushing building and truck load out structure will be constructed as per a critical path schedule. Thereafter, erection and installation of modular conveyor support structures and frames, stacking tubes, conveyor gallery, feeders, screens, crushers, dust suppression equipment and truck load-out system will begin. Coinciding with the construction of the coal handling system the mine's support facilities such as the warehouse, shop, fuel farm, administration and mine dry facilities will be underway as well.

The overland conveyor corridor will traverse the natural slope from the transfer structure west of the mine portal northerly to the stockpile gallery as shown on the site plans See Map 18.

New surface disturbance for the overland conveyor will be kept to a minimum by utilizing a single lane maintenance road, undisturbed runoff diversion and disturbed area collection ditches. Excavation for the reclaim tunnel may require limited blasting activity, which will be conducted in accordance with applicable MSHA regulations and the Blasting Plan, included in the permit application if required.

Adjacent slopes on the east side of the ROM coal stockpiles will be cleared and graded so that coal can be pushed back against the slopes to provide additional storage capacity when necessary. In the final design perimeter earthen berms may be utilized to contain the ROM coal stockpile's natural angle of repose.

A diversion culvert will be installed under the ROM stockpiles. This culvert will have a drop inlet and clean out box to effectively pass flows from the up-gradient drainage under the stockpile area. This culvert and the associated structures is a temporary diversion designed to safely pass the peak flows from the 25-year, 24-hour storm event as documented in the Drainage and Sediment Control Plans. The coal stacking tubes will be pre-fabricated structural steel or reinforced concrete mounted on reinforced concrete foundations directly adjacent to the reclaim tunnel. Openings in the sides of the stacking tubes will have flexible covers and discharge coal to create a conical ROM coal stockpile surrounding the stacking tubes. The ROM coal reclaim tunnel will be constructed of cast in place reinforced concrete with a 48" diameter buried culvert which daylights from the

rear of the tunnel for emergency egress to the outside and as well as for ventilation to the reclaim tunnel. The reclaim tunnel will be equipped with vibrating apron-type pan feeders to discharge ROM coal from the stockpiles to the reclaim conveyor belt SB-3. A coal sampling system between CV-1 and SB-1 will be provided at the transfer structure to verify spec and non-spec coal. Spec and non-spec coal will be stored in separate stockpiles.

Four vibrating apron feeders in the reclaim tunnel directly under the coal stockpiles will serve as the blending mechanism for the mine whereby spec coal and non-spec coal will be drawn from the spec coal stockpile and the non-spec stockpile in proportioned quantities as specified by a Programmable Logic Control System (PLC) designed for this operation. At times ROM coal blending will not be utilized whereas the vibrating pan feeders under the non-spec coal stockpile will not be operated. With the versatility of feed rates from these feeders coupled with the PLC any combination of spec and non-spec coal can be delivered to screening, crushing and truck load out.

The conveyor components including structures, framing, idlers, pulleys, drives, belting, chutes and take-ups will be designed using standard practices and off-the-shelf components.

During the final design phase, a search for good suitable used equipment may be sought and implemented if economical. If used equipment is utilized it will be refurbished and cleaned as required to insure there are no environmental impacts to the site from their use and any solvents used in cleaning and refurbishment will be handled and disposed of properly at a site permitted to do such work. Appropriate MSDS sheets and safeguards will be maintained of all solvents and chemicals used on site for cleaning and refurbishment of any used coal handling and mining equipment.

The surface conveyor structures will be installed on reinforced concrete footings and foundations. The overland conveyor SB-1, the reclaim conveyor SB-3 (that is outside of the reclaim tunnel) and truckload out feed conveyor SB-4 will have three-quarter round continuous covers standard to the industry. Said covers will be attached to the conveyor frames and shall be removable in sections for maintenance. Maintenance walkways on both sides of the conveyors will be provided on all elevated sections of conveyors. All transfer points on the conveyors will be enclosed. Chutes and enclosed skirt boards at the transfer points will be fitted with dust suppression equipment and fire suppression equipment as per state and federal law.

All conveyors are designed to provide adequate clearance for wildlife and persons to pass under. All conveyors and equipment are designed with proper safety devices, controls and guards as specified by MSHA safety regulations. The screening and crushing operation and the overhead stockpile conveyor SB-2 will be located in an enclosed conveyor gallery. Access to and egress from the gallery is via conveyor SB-1. The entire coal handling operation will be properly lighted and ventilated as per MSHA regulations.

Operation - The underground mining operation will provide ROM coal and waste material from working sections or mining panels where primary breaking of coal will be is done by the mining machines. Coal and/or rock will be transported to a feeder/breaker

and where secondary breaking will take place to reduce the ROM coal stream to minus 8" material. ROM coal will be conveyed to the mine portal and transfer building at the remote head-roller discharge of the MB-1. The mechanical belt drive for MB-1 will be located on the surface in the transfer building. A gravity loop take-up will be provided for MB-1 between the transfer building and the mine portal.

The underground coal haulage system consists of the following flow of coal:

1. Shuttle cars carry the coal from the mining face in the mining section to a feeder breaker, which feeds the coal onto:

2. Panel or Section conveyors that transfer coal onto a: →
3. submain or mainline conveyor which conveys and transfers coal onto a: →
4. a mainline belt system which conveys and transfers coal to: →
5. MB-1 which conveys and transfers coal to: →

The Surface Coal Haulage System, which consists of:

6. The MB-1 conveyor discharge onto the tail loading section of SB-1[2] located in the transfer tower. MB-1 will be elevated to accommodate mine vehicle and equipment traffic to pass beneath it where MB-1 it exits the mine and will be enclosed to mitigate airborne dust and spillage onto the roadway. From MB-1 coal will be transferred to a series of 42" overland surface conveyors beginning with SB-1. At the transfer building, a coal sampling system will be installed between the head pulley of CV-1 coming from the mine and the tail pulley of SB-1 that will transfer coal overland to: →
7. Conveyor SB-2 located in the enclosed Conveyor Gallery atop the two stacking tubes. Depending on whether ROM product is determined to be spec coal or non-spec coal Overland Conveyor SB-1 will divert discharge ROM coal through a flop-gate to direct the segregation to the appropriate stockpile stacking tube (i.e., spec or off-spec) →
8. ROM Coal will be reclaimed using programmable vibrating apron pan feeders via Reclaim Conveyor SB-3. The design capacity of the non-spec coal stockpile is 17,000 tons and is separated from the spec coal pile with a 10 ft high concrete wall. Similarly, design capacity for the spec coal stockpile is also 17,000 tons total capacity with a practical 12,000 tons live capacity with equipment. The off spec pile will accommodate classification and sorting of 6,000 tons on either side of a dividing wall using a front end loader or dozer to sort coal from rock into the feed area for either of the two apron feeders that reclaim from the off-spec pile. →
9. The off-spec pile will be managed and reclaimed so that rock and coal is kept segregated by size and type in the pile as much as practicable for product blending through ratio feeding at the apron feeder and/or rock disposal using dozers, front end loaders, grizzlies for classification and sorting, with common surface coal handling equipment.

---

[2] Conveyor SB-1 will be elevated and supported on trussed sections and structural steel bents.

The 42 inch wide underground mine conveyors extending from the mine workings will sustain a throughput of 1200 tph. However, it is unlikely that rate will be reached so 1000 tph is set as the design rate for the surface handling system for dust liberation and handling design calculation purposes.

All underground equipment and motors shall be designed to meet MSHA Safety regulations and standards. The underground coal hauling system will carry coal to the surface where it will make one transfer to the Overland Conveyor SB-1.

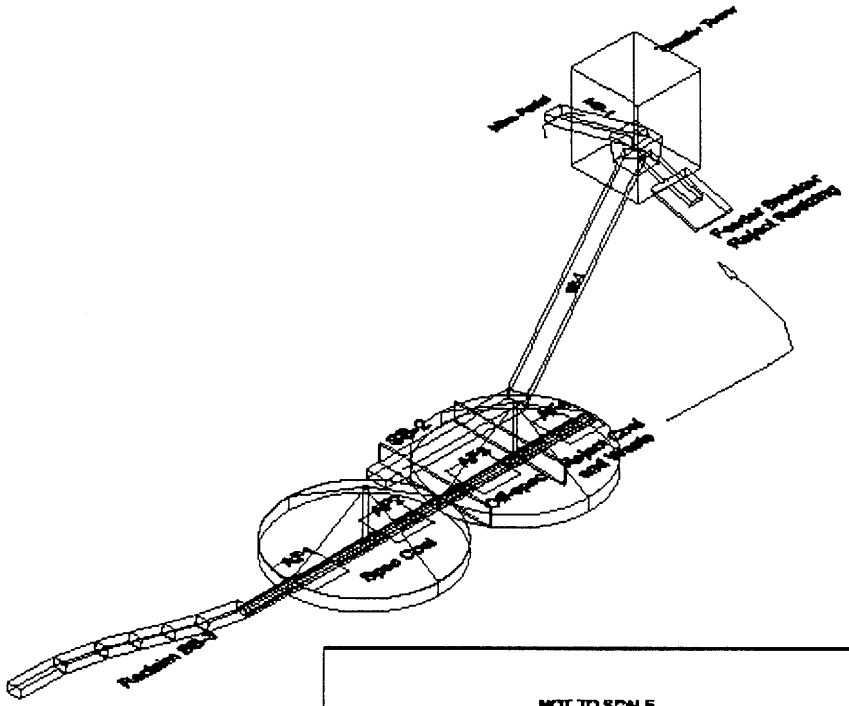
At times waste material from the mine will be hauled from the workings using the coal conveying system. Waste material would be directed to a portion of the non-spec coal stockpile using the coal conveying system where it will be segregated from the stockpile into haul trucks using a front end loader and/or grizzly or pushed to apron feeder No 4 or No 3 as necessary depending upon the composition of the material and the operations requirements for blending. Oversized rock material that will not pass the apron feeder and require resizing, will either be loaded and transported back to the transfer tower where it will be re-introduced to the ROM stream after passing through a feeder breaker for a second time, or will be dispatched for disposal as waste. See the sketch in Figure A.

Mining, conveying, stockpiling, reclaiming, screening and crushing represent the total amount of processing that the ROM coal will receive prior to loading into trucks for market.

An operational component of the coal handling is the coal reclaim and conveying system from the coal stockpiles for final screening and sizing. The reclaim system reclaims coal from the stockpiles and serves as the primary means to blend spec coal and non-spec coal for feed to point of sale. A secondary and an optional means would be to reintroduce off-spec materials into the ROM stream at the transfer tower[3].

---

[3] See Figure A, this option may be chosen in the event that the rock apron feeder beneath at the off-spec pile were to become jammed or otherwise out of order. In this case, the rock would be loaded into trucks and hauled to the feeder-breaker located at the transfer tower where it could then be re-sized and re-introduced into the ROM coal stream.



NOT TO SCALE

NOT FOR CONSTRUCTION,

FOR ILLUSTRATION PURPOSES ONLY

Carbon Resources LLC

FIGURE A

Operational Pile Reclamation of ROM Coal/Refuse

Coal will feed to Reclaim Conveyor SB-3 from vibrating pan feeders located in a reclaim tunnel beneath the ROM stockpiles. Spec coal and non-spec coal will be delivered by conveyor SB-3 to a primary double deck vibrating screen that will screen oversize material of 8" – 2" to a primary crusher that will reduce coal to a nominal 2" minus size. Coal from the crusher will pass to conveyor SB-4. Coal that passes the screen at 2" minus will be diverted from the crusher by a chute to conveyor SB-4. Conveyor SB-4 will transport 2" minus coal to the truck load out structure.

All surface coal conveyors will be 42" wide with a design rating of 1000 TPH. Planned operation of the surface coal handling system from the mine portal to the truck load out is graphically shown on the Flow Sheet, Drawing No. 070102-F-001.

Accommodations will be included at the truck load-out facility for a future Overland Conveyor SB-5 that will provide coal to a future unit rail car loading facility.

* This narrative lists conveyor sizes based on a design rate for a 3M TPY mine. However, larger conveyors may be utilized in the final layout if good used equipment is available and found to be more cost effective at the time of purchase.

Maintenance – The mine will employ a full maintenance staff of trained personnel to service the coal handling system that will include regular inspection and repair of the conveyor, screening, crushing and truck load out operations. Support structures, transfer points, drive components and dust control equipment will be serviced and inspected on a regular basis as well. This shall include the lubrication of idlers and drive mechanisms; adjust of belt take-ups to maintain proper belt tensions. A scheduled maintenance program will be implemented so that on regular intervals equipment can be inspected and cleanup of any coal or waste spillage can be achieved. Apart from scheduled maintenance periodic replacement of critical conveyor and equipment components will be undertaken to maintain proper operation of the coal handling system.

Coal Stockpiles

Two separate coal stockpiles will be utilized with the planned coal mining operations. A third future coal stockpile will service a future unit rail car load-out facility. Included in the present proposal are stockpiles of 17,000 tons spec coal and 17,000 tons of non-spec. As mentioned, spec coal and non-spec coal will be conveyed to the screening and crushing building for further sizing to produce a 2" minus product. The coal stockpiles have been designed to provide storage and surge capacity to accommodate anticipated normal fluctuations in coal production, coal processing, shipment schedules, minor market fluctuations, and any unanticipated temporary shutdowns of components of the coal production, handling and processing systems. The coal stockpiles have been located and designed to minimize potential adverse environmental impacts including but not limited to fugitive dust emission and sedimentation due to drainage from the piles or pile areas.

Both coal stockpiles and the third future coal stockpile has coal delivered to the pile by conveyors to coal stacking tubes and reclaim by sub-grade vibrating apron pan feeders and chutes to the reclaim conveyor SB-3. Operation and maintenance of the coal

stockpiles will involve controlled discharge to the stockpiles and movement upon the stockpiles using front end loaders and dozers to keep the coal within the defined pile limits, maximize storage capacity when necessary and provide for the effective feed to the reclaim points. Coal stockpiles will be periodically inspected for any excessive oxidation or burning coal and if any is found it will be separated from the main stockpile and extinguished either by burial with dirt or other means to cool the coal. Once extinguished, the burned coal will be transported to a temporary mine waste or coal refuse stockpile for future placement and burial in the refuse disposal area.

Coal Preparation

Coal preparation and processing is minimal. A wash plant will not be utilized. ROM coal will be transferred from the mine to the spec and non-spec stockpiles. From the stockpiles spec and non-spec coal will be reclaimed and blended in proper proportions and conveyed to the screening and crushing building where it will be sized to 2" minus. From the screening and crushing building the sized coal will be conveyed to the truck load out facility where it will be loaded into on road haul trucks for transport to market.

Coal Screening and Crushing – Reclaim Conveyor SB-3 will transport spec and non-spec coal to the screening and crushing building for processing 8" minus coal to 2" minus coal. In the screening and crushing building coal will be discharged from Conveyor SB-3 through a transfer chute to an 8ft x 20ft vibrating coal sizing screen. The vibrating screen is designed to separate 8" minus coal from 2" minus coal. Two inch minus will by-pass the crusher and feed directly onto Conveyor SB-4. Oversized coal above 2" passing will be fed to a flex-tooth rotary crusher or a roll crusher for sizing. Sized coal from the crusher will feed directly onto Conveyor SB-4. Conveyor SB-4 will transport 2" minus sized coal to the truck loading facility. Magnets will be strategically located at locations on the conveyors ahead of the crusher to remove tramp iron from the ROM coal stream to protect the crusher and other equipment.

Maintenance – The screening and crushing process will be controlled and monitored by an automated process PLC that will adjust and maintain flow rates for each section of the coal handling system to assure that maximum coal conveying, recovery, screening, crushing and loading identify any systems malfunction that may occur. In addition to the automated control and monitoring system the surface facilities will have a regular inspection and preventative maintenance program for the screening and crushing operations. Potential fugitive dust emissions from the conveying, stockpiling, reclaiming, screening and crushing will be controlled by partial or full enclosures and dust collection equipment at all transfer points that meet industry and government standards and MSHA Regulations.

Coal Loading Facility

The loading facility is designed to load on road coal trucks for transport to market. Conveyor SB-4 transfers 2" minus coal from the screening and crushing building where it will discharged through a flop gate chute to (2) 50-ton coal silos. The truck loading facility is designed to allow the loading of double tandem coal trailer haulers. Coal will be discharged directly to the trailer haulers. Operation of the coal loading facility will be

connected to the surface facilities Control Instrumentation and PLC that will include load cells at the coal silos to regulate surge capacities at the loading facility.

Discharge and loading of the coal will be provided by the drivers of the coal haul trucks. Coal will discharge from the silos to the trucks through a regulated discharge telescoping chute that will extend to the top of the truck trailer to provide controlled loading and contain fugitive dust. The truck loading facility will allow for truck traffic to pass around and under the load out silos for loading.

Unit Rail Car Load Out (Future)

Provisions for a future truck loading facility are included in the design, which allows for a transfer of coal from the top of the coal silos to a unit train rail car loading facility, which would be located north of the surface coal handling facility.

This would be accomplished by adding an additional Conveyor SB-5, which would be loaded at its tail section at the top of the truck loading facility inside a new enclosure, which would be added atop of the truck loading facility. The enclosure would be fitted with bag-house dust collection, fire suppression and all additional statutory requirements in effect at the time. The purpose of the conveyor would be to transfer 2" sized product coal to a live coal stockpile adjacent to the proposed train unit rail car loading facility and the rail spur as the point of sale should later change to that location.

Similar to the ROM coal stockpiles, coal will be discharged from the future overland conveyor SB-5 to stacking tubes via conveyor SB-6. The design capacity for the train loading stockpile will have a capacity of 20,000 tons. From beneath the stockpile, 2" minus coal be reclaimed with vibrating pan feeders onto a reclaim conveyor belt SB-7. SB-7 will be a 60" high-speed belt that will transfer coal to an automated weigh batch unit rail car loading facility where it will discharge to an enclosed 100 ton feed hopper.

Feed from the hopper would be monitored and controlled from the load out control room to discharge a predetermined amount of coal to the unit train load out batch weigh bin. The coal would be weighted and then loaded into rail cars passing beneath the weigh bin by telescoping discharge chutes which would extend into the rail cars to provide controlled loading and fugitive dust emissions.

The loading capacity of this future system is approximately 4000 TPH allowing for a full unit train to be loaded in approximately 2 to 2.5 hours. As with the surface coal handling operations, the unit train load-out would utilize automated controls, instrumentation, PLC, dust suppression equipment, scheduled maintenance and construction practices to minimize environmental impacts.

Mine Support Facilities

Mine service facilities are planned to provide support infrastructure for the mine. They will include a full service equipment maintenance shop to service mine equipment and vehicles, a warehouse, fuel tank farm and outside storage. Included is a combination modern mine/dry locker shower facility and administration offices as shown on the

drawings attached herewith. All facilities will be constructed as per engineered documents that meet city, county, state, federal, building codes and regulations. All of the major facilities will be constructed of suitable building materials standard to the mining industry and shall be operated in accordance with a permit issued for the mine, coal hauling, preparation and loading system from which its operation results.

EQUIPMENT / PROCESS SUMMARY
CARBON RESOURCES – KINNEY No. 2 MINE

Process ID	Name	Description	PTE PM_{10} (tpy)
001	Transfer Tower	Material transfer – conveyor MB-1 to conveyor SB-1	N/A – Wet Process
002	Conveyor Gallery	Material transfer – conveyor SB-1 to SB-2 and/or to stockpile stacking tube	N/A – Wet Process
003	Screening & Crushing Building	a) Material transfer – SB-3 to screen - oversize material to crusher then to SB-4 - undersize material to SB-4; b) Screening; c) Crushing	7.8
004	Truck Loadout Facility	Material transfer – conveyor SB-4 to truck loadout silo	2.0
007	Reclaim Tunnel Vent	Material transfer from stockpiles via 4 feeders to SB-3	0.23
008	Ventilation Shaft	Air exhaust for underground mining activities	N/A – Wet Process
F-1	Spec & Off-Spec Coal Stacking Tubes	Material transfer from conveyor gallery to coal stockpiles	0.70
F-3	Waste Loading /Unloading	Waste rock truck loading and unloading at waste rock pile	0.18
F-4	Truck Loadout	Coal truck loading from silo via telescoping chute	0.70
F-5	Unpaved Roads	Coal haul truck traffic on unpaved haul roads	2.8
F-6	Unpaved Roads	Waste haul truck traffic on unpaved haul roads	0.45
F-7	Spec Coal Stockpile	Wind erosion of stockpiled material	1.7
F-8	Off-Spec Coal Stockpile	Wind erosion of stockpiled material	1.7
F-10	Waste Rock Storage Pile	Wind erosion of stored material	0.42

Utah Division of Air Quality
New Source Review Section
Utah

Company___Carbon Resources
Site/Source: Kinney No.2 Mine; Schofield,

Date: February 6, 2008

Form 1d
Emissions Information

Please print neatly or type all information requested. All information must be truthful, accurate and complete before we can process your application. If you have any questions, call (801) 536-4000 and ask to speak with a New Source Review engineer. Written inquiries may be addressed to: Division of Air Quality, NSR Section, P.O. Box 144820, Salt Lake City, Utah 84114-4820.

Table 1. Proposed Emissions

Pollutant	Permitted Emissions (tons/year)	Emissions Increases (tons/year)	Proposed Emissions (tons/year)
PM_{10}	0	19	19
SO_2	n/a	n/a	n/a
NO_x	n/a	n/a	n/a
CO	n/a	n/a	n/a
VOC	n/a	n/a	n/a
Hazardous Air Pollutants (total)	n/a	n/a	n/a
Hazardous Air Pollutants (list individually) (attach additional sheet if needed)	n/a	n/a	n/a
other pollutants (list) (attach additional sheet if needed)			

Utah Division of Air Quality
Approval Order Application
Form 1d
Emissions Information

Table 2. Controlled and Uncontrolled Emissions

Pollutant	Controlled Emissions (tons/year)	Uncontrolled Emissions (tons/year)
PM_{10}	19	105
SO_2	n/a	n/a
NO_x	n/a	n/a
CO	n/a	n/a
VOC	n/a	n/a
Hazardous Air Pollutants (total)	n/a	n/a
Hazardous Air Pollutants (list individually) (attach additional sheet if needed)	n/a	n/a
other pollutants (list) (attach additional sheet if needed)		

Utah Division of Air Quality
Approval Order Application
Form 1d
Emissions Information

Table 3. Hourly HAP Emissions

Hazardous Air Pollutants (list individually)	Maximum emission rate (lbs/hour)
n/a	n/a

Utah Division of Air Quality
Approval Order Application
Form 1d
Emissions Information

Instructions

Table 1. Fill out the table. Attach additional sheets if necessary. Provide potential emissions from your entire facility in units of tons per year, expressed to at least two decimal places. Emissions of individual Hazardous Air Pollutants may require more precision; contact a New Source Review Engineer. If you do not now have an Approval Order and you are applying for your first Approval Order, the emissions in "Existing Emissions" column will be zero and the "Emissions Increases" will be equal to the "Proposed "Emissions. If you do have an Approval Order, the emissions in the "Existing Emissions" column will be the emissions listed in your Approval Order. All emissions should be those emissions occuring **after** any air pollution control devices. Provide emissions that would result if you operated 24 hours per day, 8760 hours per year, **unless** you are also proposing operating hour limits. If you are proposing operating hour limits, state what these limits are and provide emissions based on these limits. Provide emissions that would result from your potential production or potential raw material consumption, **unless** you are also proposing production or raw material consumption limits. If you are proposing production or raw material consumption limits, state what these limits are and provide emissions based on these limits. **Attach additional sheets with detailed calculations or stack testing information showing how all of the above emission numbers were determined.**

Table 2. Fill out the table. Attach additional sheets if necessary. Provide potential emissions from your entire facility in units of tons per year, expressed to at least two decimal places. Emissions of individual Hazardous Air Pollutants may require more precision; contact a New Source Review Engineer. The Hazardous Air Pollutants should be the same Hazardous Air Pollutants listed in Table 1. The emissions in the "Controlled Emissions" column shoud be those emissions occuring **after** any air pollution control devices. The emissions in the "Uncontrolled Emissions" should be those emissions occuring **before** any air pollution control devices (in other words, emissions that would result if you did not have any air pollution control devices at all. Provide emissions that would result if you operated 24 hours per day, 8760 hours per year, **unless** you are also proposing operating hour limits. If you are proposing operating hour limits, state what these limits are and provide emissions based on these limits. Provide emissions that would result from your potential production or potential raw material consumption, **unless** you are also proposing production or raw material consumption limits. If you are proposing production or raw material consumption limits, state what these limits are and provide emissions based on these limits. **Attach additional sheets with detailed calculations or stack testing information showing how all of the above emission numbers were determined.**

Table 3. List all Hazardous Air Pollutants emitted by your facility. They should be the same Hazardous Air Pollutants listed in tables 1 and 2. For each HAP provide its maximum emission rate in units of pounds per hour. The emission rates should be those rates occuring **after** any air pollution control devices. **Attach additional sheets with detailed calculations or stack testing information showing how all of the above emission numbers were determined.**

Depending on other conditions unique to each facility, additional emissions information may be required.

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Revised 1/23/03

Utah Division of Air Quality
New Source Review Section

Company Carbon Resources
Site/Source: Kinney No.2 Mine; Schofield, Utah
Date: February 6, 2008

Form 2
Process Information

Process Data

1. Name of process: *003a. 3 Conveyor Transfer Points* in Screening & Crushing Facility

2. End product of this process: Coal

3. Primary process equipment: conveyor belts Manufacturer: unknown (TBD)
Make or model: unknown (TBD) Identification #: unknown (TBD)
Capacity of equipment (lbs/hr): Year installed: 2008
Rated 2,000,000 Max. 2,400,000
(Add additional sheets as needed)

4. Method of exhaust ventilation:
■ Stack ☐ Window fan ☐ Roof vent ☐ Other, describe _____

Are there multiple exhausts: ☐ Yes ■ No

Operating Data

5. Maximum operating schedule:
24 hrs/day
7 days/week
52 weeks/year

6. Percent annual production by quarter:
Winter 25 Spring 25
Summer 25 Fall 25

7. Hourly production rates (lbs.):
Average 2,000,000 Maximum 2,400,000

8. Maximum Annual production (indicate units):
3,000,000 tons per year (tpy)
Projected percent annual increase in production:
(na)

9. Type of operation: ■ Continuous ☐ Batch ☐ Intermittent

10. If batch, indicate minutes per cycle n/a
Minutes between cycles n/a

11. Materials Used in Process

Raw Materials	Principal Use	Amounts (Specify Units)
Coal	3 Conveyor transfer points. SB-3 to scalping screen, screen to SB-4 or crusher, crusher to SB-4	3,000,000 tpy

Process
Form 2 (Continued)

12. **Control Equipment** (attach additional pages if necessary)

Item	Primary Collector	Secondary Collector
a. Type	Fabric filter baghouse	n/a
b. Manufacturer	Unknown (TBD)	
c. Model	Unknown (TBD)	
d. Year installed	2008	
e. Serial or ID#	Unknown (TBD)	
f. Pollutant controlled	PM_{10}	
g. Controlled pollutant emission rate (if known)	0.005 gr/dscf	
h. Pressure drop across control device	Unknown (TBD)	
i. Design efficiency	99.5%	
j. Operating efficiency	99.5%	

Stack Data
(attach additional pages if necessary)

13. Stack identification: Source ID 003

14. Height: Above roof (TBD) ft
Above ground (TBD) ft

15. Are other sources vented to this stack:
■ Yes ☐ No

If yes, identify sources: 003b (scalping screen) & 003c (crusher)

16. ■ Round, top inside diameter dimension (TBD)
☐ Rectangular, top inside dimensions length _____ x width _____

17. Exit gas: Temperature 68 °F Volume 41,600 acfm Velocity (TBD) ft/min

18. Continuous monitoring equipment: ☐ yes ■ no
If yes, indicate: Type n/a Manufacturer n/a
Make or Model n/a Pollutant(s) monitored n/a

Emissions Calculations (PTE)

19. Calculated emissions for this device
PM_{10} 1.8 Lbs/hr 7.8 Tons/yr NO_x 0 Lbs/hr 0 Tons/yr
SO_x 0 Lbs/hr 0 Tons/yr VOC 0 Lbs/hr 0 Tons/yr
HAPs 0 Lbs/hr (speciate) 0 Tons/yr (speciate)
Submit calculations as an appendix.

Instructions

Note: 1. **Submit this form in conjunction with Form 1.**
2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

This is a general form regarding processes and should be completed by all sources.

Please answer all questions. If the item does not apply to the source operation write "n/a". If the answer is not known write "unknown".

1. Indicate the generally accepted name for the process (i.e., asphalt batching, glass manufacturing, oil refining, etc.).
2. Specify the end product of this process (i.e., asphaltic concrete, benzene, soaps, etc.).
3. Indicate the specific process equipment for this form along with the manufacturer, model number, identifying name or code year it was or will be installed, and rated (normal) and maximum capacity of equipment.
4. Indicate the method of exhaust ventilation and indicate if there are more than one exhausts.
5. Complete the process equipment's normal operating schedule in hours per day, days per week, and weeks per year.
6. Complete the percent annual production by season for a years production of finished units. The four seasons should total to 100%.
7. Specify the average and maximum hourly production rates in pounds. The average is the year's production rate divided by the total yearly hours of production or operation.
8. Specify the annual production for this process equipment and indicate the appropriate units. Estimate the annual increase in production.
9. Check whether the process is continuous, intermittent, or batch. A batch operation normally has significant down time between completion and startup of each operation or cycle.
10. If batch, complete the minutes per production cycle and minutes between the production cycles. A "cycle" refers to the time the equipment is in operation.
11. List all general types of raw materials employed in the process, indicate the principle use (i.e., product, binder, catalyst, fuel, etc.) and specify the normal amount used in pounds per hours, tons per year, etc.
12. If your control device is not listed below complete items a through j. If your process includes any of the control devices listed below, please indicate which ones and submit the associated forms with your application. The primary collector and secondary collector refer to separate control devices or equipment for collecting similar or different air pollutants. If there is a third collector, complete the same data for that collector on a separate sheet. Addition information may be attached.

    Complete the proper form listed below for any air pollution control device:

___	Form 3	Afterburners
___	Form 4	Flares
___	Form 5	Adsorption Unit
___	Form 6	Cyclone
___	Form 7	Condenser
___	Form 8	Electrostatic Precipitators
___	Form 9	Scrubber
___	Form 10	Fabric Filter (Baghouse)

13. Indicate the company's identification for the stack or exhaust.
14. Specify the stack's or exhaust's height, in feet (ft.) above ground and above the attached roof.
15. Indicate if other sources are also vented to this same stack or exhaust and identify those sources.
16. Specify the inside dimensions of the stack or exhaust at the outlet to the atmosphere.
17. Complete the specifications of the stack's or exhaust's exit gas. (Temperature in degrees Fahrenheit, volume flow rate in actual cubic feet per minute, and velocity in feet per minute.) If the properties of the exit gas vary, use the average values.
18. Indicate if the stack or exhaust is equipped with air pollution monitoring equipment. If so, specify the type, manufacturer, make or model, and the pollutant or pollutants monitored.
19. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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Revised 5-9-06

Utah Division of Air Quality
New Source Review Section

Company Carbon Resources
Site/Source Kinney No.2 Mine; Schofield, Utah
Date: February 6, 2008

Form 2
Process Information

Process Data

1. Name of process: coal handling: *003b. Scalping Screen* in Screening & Crushing Facility

2. End product of this process: coal

3. Primary process equipment: Conveyor belts Manufacturer: unknown (TBD)
Make or model: unknown (TBD) Identification #: unknown (TBD)
Capacity of equipment (lbs/hr): Year installed: 2009 or (TBD)
Rated 2,000,000 Max. 2,400,000
(Add additional sheets as needed)

4. Method of exhaust ventilation:
■ Stack ☐ Window fan ☐ Roof vent ☐ Other, describe _____

Are there multiple exhausts: ☐ Yes ■ No

Operating Data

5. Maximum operating schedule:
24 hrs/day
7 days/week
52 weeks/year

6. Percent annual production by quarter:
Winter 25 Spring 25
Summer 25 Fall 25

7. Hourly production rates (lbs.):
Average 2,000,000 Maximum 2,400,000

8. Maximum Annual production (indicate units):
3,000,000 tons per year (tpy)
Projected percent annual increase in production:
(na)

9. Type of operation: ■ Continuous ☐ Batch ☐ Intermittent

10. If batch, indicate minutes per cycle n/a
Minutes between cycles n/a

11. Materials Used in Process

Raw Materials	Principal Use	Amounts (Specify Units)
coal	Scalping Screen	3,000,000 tpy

Process
Form 2 (Continued)

12. **Control Equipment** (attach additional pages if necessary)

Item	Primary Collector	Secondary Collector
a. Type	Fabric filter baghouse	n/a
b. Manufacturer	Unknown (TBD)	
c. Model	Unknown (TBD)	
d. Year installed	2008	
e. Serial or ID#	Unknown (TBD)	
f. Pollutant controlled	PM_{10}	
g. Controlled pollutant emission rate (if known)	0.005 gr/dscf	
h. Pressure drop across control device	Unknown (TBD)	
i. Design efficiency	99.5%	
j. Operating efficiency	99.5%	

Stack Data
(attach additional pages if necessary)

13. Stack identification: Source ID 003

14. Height: Above roof (TBD) ft
Above ground (TBD) ft

15. Are other sources vented to this stack:
■ Yes ☐ No

If yes, identify sources: 003a (conveyor TPs) & 003c (crusher)

16. ■ Round, top inside diameter dimension (TBD)
☐ Rectangular, top inside dimensions length _____ x width _____

17. Exit gas: Temperature 68 °F Volume 41,600 acfm Velocity (TBD) ft/min

18. Continuous monitoring equipment: ☐ yes ■ no
If yes, indicate: Type n/a Manufacturer n/a
Make or Model n/a Pollutant(s) monitored n/a

Emissions Calculations (PTE)

19. Calculated emissions for this device
PM_{10} included in "Screening & Crushing Facility" – same control device (see previous Form 2)
NO_x 0 Lbs/hr 0 Tons/yr
SO_x 0 Lbs/hr 0 Tons/yr VOC 0 Lbs/hr 0 Tons/yr
HAPs 0 Lbs/hr (speciate) 0 Tons/yr (speciate)
Submit calculations as an appendix.

Instructions

Note: 1. **Submit this form in conjunction with Form 1.**
2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

This is a general form regarding processes and should be completed by all sources.

Please answer all questions. If the item does not apply to the source operation write "n/a". If the answer is not known write "unknown".

1. Indicate the generally accepted name for the process (i.e., asphalt batching, glass manufacturing, oil refining, etc.).
2. Specify the end product of this process (i.e., asphaltic concrete, benzene, soaps, etc.).
3. Indicate the specific process equipment for this form along with the manufacturer, model number, identifying name or code year it was or will be installed, and rated (normal) and maximum capacity of equipment.
4. Indicate the method of exhaust ventilation and indicate if there are more than one exhausts.
5. Complete the process equipment's normal operating schedule in hours per day, days per week, and weeks per year.
6. Complete the percent annual production by season for a years production of finished units. The four seasons should total to 100%.
7. Specify the average and maximum hourly production rates in pounds. The average is the year's production rate divided by the total yearly hours of production or operation.
8. Specify the annual production for this process equipment and indicate the appropriate units. Estimate the annual increase in production.
9. Check whether the process is continuous, intermittent, or batch. A batch operation normally has significant down time between completion and startup of each operation or cycle.
10. If batch, complete the minutes per production cycle and minutes between the production cycles. A "cycle" refers to the time the equipment is in operation.
11. List all general types of raw materials employed in the process, indicate the principle use (i.e., product, binder, catalyst, fuel, etc.) and specify the normal amount used in pounds per hours, tons per year, etc.
12. If your control device is not listed below complete items a through j. If your process includes any of the control devices listed below, please indicate which ones and submit the associated forms with your application. The primary collector and secondary collector refer to separate control devices or equipment for collecting similar or different air pollutants. If there is a third collector, complete the same data for that collector on a separate sheet. Addition information may be attached.

    Complete the proper form listed below for any air pollution control device:

___	Form 3	Afterburners
___	Form 4	Flares
___	Form 5	Adsorption Unit
___	Form 6	Cyclone
___	Form 7	Condenser
___	Form 8	Electrostatic Precipitators
___	Form 9	Scrubber
___	Form 10	Fabric Filter (Baghouse)

13. Indicate the company's identification for the stack or exhaust.
14. Specify the stack's or exhaust's height, in feet (ft.) above ground and above the attached roof.
15. Indicate if other sources are also vented to this same stack or exhaust and identify those sources.
16. Specify the inside dimensions of the stack or exhaust at the outlet to the atmosphere.
17. Complete the specifications of the stack's or exhaust's exit gas. (Temperature in degrees Fahrenheit, volume flow rate in actual cubic feet per minute, and velocity in feet per minute.) If the properties of the exit gas vary, use the average values.
18. Indicate if the stack or exhaust is equipped with air pollution monitoring equipment. If so, specify the type, manufacturer, make or model, and the pollutant or pollutants monitored.
19. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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Revised 5-9-06

Utah Division of Air Quality
New Source Review Section

Company Carbon Resources
Site/Source Kinney No.2 Mine; Schofield, Utah
Date: February 6, 2008

Form 2
Process Information

Process Data

1. Name of process: coal handling: *003c. Primary Crusher*

2. End product of this process: coal

3. Primary process equipment: Coal Crusher Manufacturer: unknown (TBD)
Make or model: unknown (TBD) Identification #: unknown (TBD)
Capacity of equipment (lbs/hr): Year installed: 2009 (TBD)
Rated 2,000,000 Max. 2,400,000
(Add additional sheets as needed)

4. Method of exhaust ventilation:
■ Stack ☐ Window fan ☐ Roof vent ☐ Other, describe _____

Are there multiple exhausts: ☐ Yes ■ No

Operating Data

5. Maximum operating schedule:
24 hrs/day
7 days/week
52 weeks/year

6. Percent annual production by quarter:
Winter 25 Spring 25
Summer 25 Fall 25

7. Hourly production rates (lbs.):
Average 2,000,000 Maximum 2,400,000

8. Maximum Annual production (indicate units):
3,000,000 tons per year (tpy)
Projected percent annual increase in production:
(na)

9. Type of operation: ■ Continuous ☐ Batch ☐ Intermittent

10. If batch, indicate minutes per cycle n/a
Minutes between cycles n/a

11. Materials Used in Process

Raw Materials	Principal Use	Amounts (Specify Units)
coal	Primary Crusher	3,000,000 tpy

Process
Form 2 (Continued)

12. **Control Equipment** (attach additional pages if necessary)

Item	Primary Collector	Secondary Collector
a. Type	Fabric filter baghouse	n/a
b. Manufacturer	Unknown (TBD)	
c. Model	Unknown (TBD)	
d. Year installed	2009 (TBD)	
e. Serial or ID#	Unknown (TBD)	
f. Pollutant controlled	PM_{10}	
g. Controlled pollutant emission rate (if known)	0.005 gr/dscf	
h. Pressure drop across control device	Unknown (TBD)	
i. Design efficiency	99.5%	
j. Operating efficiency	99.5%	

Stack Data
(attach additional pages if necessary)

13. Stack identification: Source ID 003

14. Height: Above roof (TBD) ft
Above ground (TBD) ft

15. Are other sources vented to this stack:
■ Yes ☐ No

If yes, identify sources: 003a (conveyor TPs) & 003b (screen)

16. ■ Round, top inside diameter dimension (TBD)
☐ Rectangular, top inside dimensions length _____ x width _____

17. Exit gas: Temperature 68 °F Volume 41,600 acfm Velocity (TBD) ft/min

18. Continuous monitoring equipment: ☐ yes ■ no
If yes, indicate: Type n/a Manufacturer n/a
Make or Model n/a Pollutant(s) monitored n/a

Emissions Calculations (PTE)

19. Calculated emissions for this device
PM_{10} included in "Screening & Crushing Facility" – same control device (see previous Form 2)
NO_x 0 Lbs/hr 0 Tons/yr
SO_x 0 Lbs/hr 0 Tons/yr VOC 0 Lbs/hr 0 Tons/yr
HAPs 0 Lbs/hr (speciate) 0 Tons/yr (speciate)
Submit calculations as an appendix.

Instructions

Note: 1. **Submit this form in conjunction with Form 1.**
2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

This is a general form regarding processes and should be completed by all sources.

Please answer all questions. If the item does not apply to the source operation write "n/a". If the answer is not known write "unknown".

1. Indicate the generally accepted name for the process (i.e., asphalt batching, glass manufacturing, oil refining, etc.).
2. Specify the end product of this process (i.e., asphaltic concrete, benzene, soaps, etc.).
3. Indicate the specific process equipment for this form along with the manufacturer, model number, identifying name or code year it was or will be installed, and rated (normal) and maximum capacity of equipment.
4. Indicate the method of exhaust ventilation and indicate if there are more than one exhausts.
5. Complete the process equipment's normal operating schedule in hours per day, days per week, and weeks per year.
6. Complete the percent annual production by season for a years production of finished units. The four seasons should total to 100%.
7. Specify the average and maximum hourly production rates in pounds. The average is the year's production rate divided by the total yearly hours of production or operation.
8. Specify the annual production for this process equipment and indicate the appropriate units. Estimate the annual increase in production.
9. Check whether the process is continuous, intermittent, or batch. A batch operation normally has significant down time between completion and startup of each operation or cycle.
10. If batch, complete the minutes per production cycle and minutes between the production cycles. A "cycle" refers to the time the equipment is in operation.
11. List all general types of raw materials employed in the process, indicate the principle use (i.e., product, binder, catalyst, fuel, etc.) and specify the normal amount used in pounds per hours, tons per year, etc.
12. If your control device is not listed below complete items a through j. If your process includes any of the control devices listed below, please indicate which ones and submit the associated forms with your application. The primary collector and secondary collector refer to separate control devices or equipment for collecting similar or different air pollutants. If there is a third collector, complete the same data for that collector on a separate sheet. Addition information may be attached.

    Complete the proper form listed below for any air pollution control device:

___	Form 3	Afterburners
___	Form 4	Flares
___	Form 5	Adsorption Unit
___	Form 6	Cyclone
___	Form 7	Condenser
___	Form 8	Electrostatic Precipitators
___	Form 9	Scrubber
___	Form 10	Fabric Filter (Baghouse)

13. Indicate the company's identification for the stack or exhaust.
14. Specify the stack's or exhaust's height, in feet (ft.) above ground and above the attached roof.
15. Indicate if other sources are also vented to this same stack or exhaust and identify those sources.
16. Specify the inside dimensions of the stack or exhaust at the outlet to the atmosphere.
17. Complete the specifications of the stack's or exhaust's exit gas. (Temperature in degrees Fahrenheit, volume flow rate in actual cubic feet per minute, and velocity in feet per minute.) If the properties of the exit gas vary, use the average values.
18. Indicate if the stack or exhaust is equipped with air pollution monitoring equipment. If so, specify the type, manufacturer, make or model, and the pollutant or pollutants monitored.
19. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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Revised 5-9-06

Utah Division of Air Quality
New Source Review Section

Company Carbon Resources
Site/Source: Kinney No. 2 Mine; Schofield, Utah
Date: February 6, 2008

Form 2
Process Information

Process Data

1. Name of process: coal handling: *004. Truck Load-out Facility*

2. End product of this process: Coal

3. Primary process equipment: loading silos & conveyor belts Manufacturer: unknown(TBD)
Make or model: unknown (TBD) Identification #: unknown (TBD)
Capacity of equipment (lbs/hr): Year installed: 2009 (TBD)
Rated 2,000,000 Max. 2,400,000
(Add additional sheets as needed)

4. Method of exhaust ventilation:
■ Stack ☐ Window fan ☐ Roof vent ☐ Other, describe _____

Are there multiple exhausts: ☐ Yes ■ No

Operating Data

5. Maximum operating schedule:
24 hrs/day
7 days/week
52 weeks/year

6. Percent annual production by quarter:
Winter 25 Spring 25
Summer 25 Fall 25

7. Hourly production rates (lbs.):
Average 1,650,000 Maximum 2,000,000

8. Maximum Annual production (indicate units):
3,000,000 tons per year (tpy)
Projected percent annual increase in production:
(na)

9. Type of operation: ■ Continuous ☐ Batch ☐ Intermittent

10. If batch, indicate minutes per cycle n/a
Minutes between cycles n/a

11. Materials Used in Process

Raw Materials	Principal Use	Amounts (Specify Units)
coal	Conveyor SB-4 to truck loadout silos.	3,000,000 tpy

Process
Form 2 (Continued)

12. **Control Equipment** (attach additional pages if necessary)

Item	Primary Collector	Secondary Collector
a. Type	Fabric filter baghouse	n/a
b. Manufacturer	Unknown (TBD)	
c. Model	Unknown (TBD)	
d. Year installed	2008	
e. Serial or ID#	Unknown (TBD)	
f. Pollutant controlled	PM_{10}	
g. Controlled pollutant emission rate (if known)	0.005 grdscf	
h. Pressure drop across control device	Unknown (TBD)	
i. Design efficiency	99.5%	
j. Operating efficiency	99.5%	

Stack Data
(attach additional pages if necessary)

13. Stack identification: Source ID 004

14. Height: Above roof (TBD) ft
Above ground (TBD) ft

15. Are other sources vented to this stack:
☐ Yes ■ No

If yes, identify sources: n/a

16. ■ Round, top inside diameter dimension (TBD)
☐ Rectangular, top inside dimensions length _____ x width _____

17. Exit gas: Temperature 68 °F Volume 10,400 acfm Velocity (TBD) ft/min

18. Continuous monitoring equipment: ☐ yes ■ no
If yes, indicate: Type n/a Manufacturer n/a

Make or Model n/a Pollutant(s) monitored n/a

Emissions Calculations (PTE)

19. Calculated emissions for this device

PM_{10} 0.45 Lbs/hr 2.0 Tons/yr NO_x 0 Lbs/hr 0 Tons/yr

SO_x 0 Lbs/hr 0 Tons/yr VOC 0 Lbs/hr 0 Tons/yr

HAPs 0 Lbs/hr (speciate) 0 Tons/yr (speciate)

Submit calculations as an appendix.

Instructions

Note: 1. **Submit this form in conjunction with Form 1.**
2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

This is a general form regarding processes and should be completed by all sources.

Please answer all questions. If the item does not apply to the source operation write "n/a". If the answer is not known write "unknown".

1. Indicate the generally accepted name for the process (i.e., asphalt batching, glass manufacturing, oil refining, etc.).
2. Specify the end product of this process (i.e., asphaltic concrete, benzene, soaps, etc.).
3. Indicate the specific process equipment for this form along with the manufacturer, model number, identifying name or code year it was or will be installed, and rated (normal) and maximum capacity of equipment.
4. Indicate the method of exhaust ventilation and indicate if there are more than one exhausts.
5. Complete the process equipment's normal operating schedule in hours per day, days per week, and weeks per year.
6. Complete the percent annual production by season for a years production of finished units. The four seasons should total to 100%.
7. Specify the average and maximum hourly production rates in pounds. The average is the year's production rate divided by the total yearly hours of production or operation.
8. Specify the annual production for this process equipment and indicate the appropriate units. Estimate the annual increase in production.
9. Check whether the process is continuous, intermittent, or batch. A batch operation normally has significant down time between completion and startup of each operation or cycle.
10. If batch, complete the minutes per production cycle and minutes between the production cycles. A "cycle" refers to the time the equipment is in operation.
11. List all general types of raw materials employed in the process, indicate the principle use (i.e., product, binder, catalyst, fuel, etc.) and specify the normal amount used in pounds per hours, tons per year, etc.
12. If your control device is not listed below complete items a through j. If your process includes any of the control devices listed below, please indicate which ones and submit the associated forms with your application. The primary collector and secondary collector refer to separate control devices or equipment for collecting similar or different air pollutants. If there is a third collector, complete the same data for that collector on a separate sheet. Addition information may be attached.

    Complete the proper form listed below for any air pollution control device:

___	Form 3	Afterburners
___	Form 4	Flares
___	Form 5	Adsorption Unit
___	Form 6	Cyclone
___	Form 7	Condenser
___	Form 8	Electrostatic Precipitators
___	Form 9	Scrubber
___	Form 10	Fabric Filter (Baghouse)

13. Indicate the company's identification for the stack or exhaust.
14. Specify the stack's or exhaust's height, in feet (ft.) above ground and above the attached roof.
15. Indicate if other sources are also vented to this same stack or exhaust and identify those sources.
16. Specify the inside dimensions of the stack or exhaust at the outlet to the atmosphere.
17. Complete the specifications of the stack's or exhaust's exit gas. (Temperature in degrees Fahrenheit, volume flow rate in actual cubic feet per minute, and velocity in feet per minute.) If the properties of the exit gas vary, use the average values.
18. Indicate if the stack or exhaust is equipped with air pollution monitoring equipment. If so, specify the type, manufacturer, make or model, and the pollutant or pollutants monitored.
19. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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Revised 5-9-06

Utah Division of Air Quality
New Source Review Section

Company: Carbon Resources
Site: Kinney No. 2 Mine; Schofield, Utah
Date: February 6, 2008

Form 2
Process Information

Process Data

1. Name of process: coal handling: *007 Underground Reclaim Tunnel*

2. End product of this process: Coal

3. Primary process equipment: 4 underground feeders Manufacturer: unknown (TBD)
Make or model: unknown (TBD) Identification #: unknown (TBD)
Capacity of equipment (lbs/hr): Year installed: 2009 (TBD) per schedule
Rated 2,000,000 Max. 2,400,000
(Add additional sheets as needed)

4. Method of exhaust ventilation:
☐ Stack ☐ Window fan ☐ Roof vent ■ Other, describe tunnel vent

Are there multiple exhausts: ☐ Yes ■ No

Operating Data

5. Maximum operating schedule:
24 hrs/day
7 days/week
52 weeks/year

6. Percent annual production by quarter:
Winter 25 Spring 25
Summer 25 Fall 25

7. Hourly production rates (lbs.):
Average 2,000,000 Maximum 2,400,000

8. Maximum Annual production (indicate units):
3,000,000 tons per year (tpy)
Projected percent annual increase in production:
(na)

9. Type of operation: ■ Continuous ☐ Batch ☐ Intermittent

10. If batch, indicate minutes per cycle n/a
Minutes between cycles n/a

11. Materials Used in Process

Raw Materials	Principal Use	Amounts (Specify Units)
Coal	Transfer coal from stockpiles to conveyor belt SB-3	3,000,000 tpy ROM Coal

Process
Form 2 (Continued)

12. **Control Equipment** (attach additional pages if necessary)

Item	Primary Collector	Secondary Collector
a. Type	Fabric filter	n/a
b. Manufacturer	Unknown (TBD)	
c. Model	Unknown (TBD)	
d. Year installed	2009 Planned	
e. Serial or ID#	Unknown (TBD)	
f. Pollutant controlled	PM_{10}	
g. Controlled pollutant emission rate (if known)	0.0533 lb/hr	
h. Pressure drop across control device	Unknown (TBD)	
i. Design efficiency	> 90%	
j. Operating efficiency	> 90%	

Stack Data
(attach additional pages if necessary)

13. Stack identification: Source ID 007

14. Height: Above roof (TBD) ft
Above ground (TBD) ft

15. Are other sources vented to this stack:
☐ Yes ■ No

If yes, identify sources: n/a

16. ■ Round, top inside diameter dimension (TBD)
☐ Rectangular, top inside dimensions
length _____ x width _____

17. Exit gas: Temperature 68 °F Volume (TBD) acfm Velocity (TBD) ft/min

18. Continuous monitoring equipment: ☐ yes ■ no
If yes, indicate: Type n/a Manufacturer n/a

Make or Model n/a Pollutant(s) monitored n/a

Emissions Calculations (PTE)

19. Calculated emissions for this device

PM_{10} 0.0533 Lbs/hr 0.23 Tons/yr NO_x 0 Lbs/hr 0 Tons/yr

SO_x 0 Lbs/hr 0 Tons/yr VOC 0 Lbs/hr 0 Tons/yr

HAPs 0 Lbs/hr (speciate) 0 Tons/yr (speciate)

Submit calculations as an appendix.

Instructions

Note: 1. **Submit this form in conjunction with Form 1.**
2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

This is a general form regarding processes and should be completed by all sources.

Please answer all questions. If the item does not apply to the source operation write "n/a". If the answer is not known write "unknown".

1. Indicate the generally accepted name for the process (i.e., asphalt batching, glass manufacturing, oil refining, etc.).
2. Specify the end product of this process (i.e., asphaltic concrete, benzene, soaps, etc.).
3. Indicate the specific process equipment for this form along with the manufacturer, model number, identifying name or code year it was or will be installed, and rated (normal) and maximum capacity of equipment.
4. Indicate the method of exhaust ventilation and indicate if there are more than one exhausts.
5. Complete the process equipment's normal operating schedule in hours per day, days per week, and weeks per year.
6. Complete the percent annual production by season for a years production of finished units. The four seasons should total to 100%.
7. Specify the average and maximum hourly production rates in pounds. The average is the year's production rate divided by the total yearly hours of production or operation.
8. Specify the annual production for this process equipment and indicate the appropriate units. Estimate the annual increase in production.
9. Check whether the process is continuous, intermittent, or batch. A batch operation normally has significant down time between completion and startup of each operation or cycle.
10. If batch, complete the minutes per production cycle and minutes between the production cycles. A "cycle" refers to the time the equipment is in operation.
11. List all general types of raw materials employed in the process, indicate the principle use (i.e., product, binder, catalyst, fuel, etc.) and specify the normal amount used in pounds per hours, tons per year, etc.
12. If your control device is not listed below complete items a through j. If your process includes any of the control devices listed below, please indicate which ones and submit the associated forms with your application. The primary collector and secondary collector refer to separate control devices or equipment for collecting similar or different air pollutants. If there is a third collector, complete the same data for that collector on a separate sheet. Addition information may be attached.

    Complete the proper form listed below for any air pollution control device:

___	Form 3	Afterburners
___	Form 4	Flares
___	Form 5	Adsorption Unit
___	Form 6	Cyclone
___	Form 7	Condenser
___	Form 8	Electrostatic Precipitators
___	Form 9	Scrubber
___	Form 10	Fabric Filter (Baghouse)

13. Indicate the company's identification for the stack or exhaust.
14. Specify the stack's or exhaust's height, in feet (ft.) above ground and above the attached roof.
15. Indicate if other sources are also vented to this same stack or exhaust and identify those sources.
16. Specify the inside dimensions of the stack or exhaust at the outlet to the atmosphere.
17. Complete the specifications of the stack's or exhaust's exit gas. (Temperature in degrees Fahrenheit, volume flow rate in actual cubic feet per minute, and velocity in feet per minute.) If the properties of the exit gas vary, use the average values.
18. Indicate if the stack or exhaust is equipped with air pollution monitoring equipment. If so, specify the type, manufacturer, make or model, and the pollutant or pollutants monitored.
19. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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Revised 5-9-06

Kinney Coal Mine - PTE Calculations

NON-FUGITIVE EMISSIONS SOURCES

Source ID No.	Process Name	Process Description	Control	Flowrate[10] (dscfm)	PM (gr/dscf)[11]	PM (lb/hr)	PM (tpy)	PM_{10} (gr/dscf)[11]	PM_{10} (lb/hr)	PM_{10} (tpy)
003	Screening & Crushing Facility	3 Conveyor TPs[1] Scalping Screen Primary Crusher	FF Baghouse	41,600	0.010	3.6	16	0.005	1.8	7.8
004	Truck Load-Out Facility	1 Conveyor TP[2]	FF Baghouse	10,400	0.010	0.89	3.9	0.005	0.45	2.0
007	Reclaim Tunnel Vent - ROM Stockpiles	5 Feeder TPs[3]	Filter Vent[3]	n/a	n/a	0.110	0.48	n/a	0.0533	0.23
	POINT SOURCE TOTAL						20			10

FUGITIVE EMISSIONS SOURCES

Source ID	Fugitive Processes	Process Rate (tph)	Control	Control Eff[12]	PM (lb/ton)	PM (lb/hr)	PM (tpy)	PM_{10} (lb/ton)	PM_{10} (lb/hr)	PM_{10} (tpy)
F-1	Spec & Non-Spec Coal Stacking Tubes[4]	1,000	Enclosure	70%	0.00113	0.34	1.5	0.000533	0.16	0.70
F-3	Waste Loading/Unloading[4,5]	75	n/a		0.00113	0.085	0.37	0.000533	0.040	0.18
F-4	Truck Load-Out[4]	1,000	Bottom Fill	70%	0.00113	0.34	1.5	0.000533	0.16	0.70
	Unpaved Roads - Haul Trucks	**Distance (VMT/yr)**			**(lb/VMT)**	**(lb/hr)**	**(tpy)**	**(lb/VMT)**	**(lb/hr)**	**(tpy)**
F-5	Coal Trucks[6,7]	31,818	Water Spray	90%	6.74	10	11	1.74	1.5	2.8
F-6	Waste Material Trucks[6,8]	9,125	Water Spray	90%	3.85	1.7	1.8	0.99	0.35	0.45
	Storage Piles	**Size (acre)**			**(lb/acre/hr)**	**(lb/hr)**	**(tpy)**	**(lb/acre/hr)**	**(lb/hr)**	**(tpy)**
F-7	Spec Coal Stockpile[9]	0.50	Water Spray	75%	6.12	0.77	3.4	6.12	0.38	1.7
F-8	Non-Spec Coal Stockpile[9]	0.50	Water Spray	75%	6.12	0.77	3.4	6.12	0.38	1.7
F-10	Waste Material Pile[9,13]	0.25	Water Spray	75%	6.12	0.38	1.7	6.12	0.10	0.42
	FUGITIVE SOURCE TOTAL						24			8.6

	PTE TOTAL: POINT SOURCE + FUGITIVE						44			19

Process Data:

Throughput capacity (short -term)	1,000 tph
Moisture content	6.0 %
Average wind speed	8.5 mph
Spec coal storage pile	0.50 acre
Non-spec coal storage pile	0.50 acre
Waste material pile	0.25 acre

Notes:

[1]Conveyor SB-3 transfer to scalping screen, scalping screen transfer to SB-4 or to primary crusher, primary crusher transfer to SB-4: total of 3 transfers or less of all material inside Screening & Crushing Facility (see Process Flow Diagram in Appendix B)

[2]Conveyor SB-4 transfer to truck load-out silos: total of 2 transfers of all material inside Truck Load-out Facility (see Process Flow Diagram in Appendix B)

[3]Reclaim tunnel - all coal handling occurs underground, tunnel exit under slight negative pressure, tunnel air vented through a fabric vent with > 90% control efficiency (Nevada Bureau of Air Pollution Control: *Emission Control Technology - Control Efficiency Ratings* (2001)

Controlled reclaim tunnel emissions based on maximum hourly throughput = 1,000 tph, 90% fabric-vent control, and uncontrolled emission factors:

lb/PM = (0.00113 lb/ton)(1,000 tph)(1 - 0.90) = 0.11 lb/hr

lb-PM_{10}/hr = (0.000533 lb/ton)(1,000 tph)(1 - 0.90) = 0.053 lb/hr

Where: 0.00113 lb/ton and

0.000533 are uncontrolled emission factors from Section 13.2.4, AP-42, "Aggregate Handling and Storage Piles" (Jan 1995):

$$E = k(0.0032)[(u/5)^{1.5}/(M/2)^{1.4}]$$

where E = emission factor (lb/ton); u = average wind speed (mph); M = moisture content (%), and

k = particle-size factor: k = 0.74 for PM, and k = 0.35 for PM_{10}

[4]Predictive emission factor equation for loading to stockpiles and truck loadout, continuous or batch, from Section 13.2.4, AP-42, "Aggregate Handling and Storage Piles" (Jan 1995):

$$E = k(0.0032)[(u/5)^{1.5}/(M/2)^{1.4}]$$

where E = emission factor (lb/ton); u = average wind speed (mph); M = moisture content (%) and k is particle-size factor: k = 0.74 for PM, and k = 0.35 for PM_{10}

[5]Maximun hourly waste rock handling based on 15-ton haul truck payload & 5 truck loads per hour

[6]Unpaved road fugitive dust emissions based on predictive emission factor, Equation 2 in AP-42, Section 13.2.2.2:

$$E = k\,(s/12)^a\,(W/3)^b\,[(365-P)/365]$$

where E = emission factor (lb/VMT); k = 4.9 for PM and k = 1.5 PM_{10}, a = 0.7 for PM and a = 0.9 for PM_{10}, and b = 0.45 for both;

s = surface material silt content (%), W = mean vehicle weight (tons), and P = no. precip. days/yr = 90 (Figure 13.2.2-1)

Surface material silt content =	5.1 % (AP-42 Table 13.2.2-1, typical value for plant road, western surface coal mine)
Mean Wt - coal trucks =	43.25 ton, calculated as: [21.5 ton empty + (21.5 + 43.5) ton loaded] / 2
Mean Wt - waste trucks =	12.5 ton (assuming 5-ton empty & 20-ton loaded results in 12.5-ton mean wt)

[7]Maximum coal truck distance on unpaved roads estimated as:

VMT = (0.7 mi/truck) (2,000,000 ton/yr) / (43.5 ton/truck) = 32,184 mi/yr

Where 2,000,000 ton/yr = maximum expected coal production; 0.7 mi = RT distance between highway & truck loadout; 43.5 ton = truck payload

Hourly emissions were based on annual VMT occurring during 10 hr/d and 7 d/wk

[8]Maximum waste-rock haul distance estimated as:

VMT = (0.5 mi/truck) (75 ton/hr) (10 hr/d) (365 d/yr) / (15 ton/truck) = 9,125 mi/yr

Where: 75 ton/hr = max waste-rock handling rate, 15 ton = estimated truck payload; 0.5 = estimated haul distance

Note: Highly conservative, overestimate of VMT (waste rock will not be handled on a continuing, daily basis)

Hourly emissions based on annual VMT occurring during 10 hr/d and 5 d/wk

[9]Predictive emission factor equation (TSP) for wind erosion of active storage piles from AP-42 Table 11.9-1, "...Open Dust Sources at Western Surface Coal Mines":

E = 0.72(u)

where E = TSP emission factor (lb/acre/hr); u = average wind speed; and PM_{10} assumed to be 100% of TSP

[10]Estimated maximum baghouse flowrate (based on similar processes) assumed = 10,400 dscfm per 1,000 tph of material handled or processed:

- Truck loadout encloses 1 conveyor TP, handling up to 1,000 tph each (10,400 dscfm baghouses)
- Screening & crushing facility encloses 3 TPs handling 2,000 tph total, 1 crusher that processing up to 1,000 tph, 1 screen processing up to 1,000 tph (4 x 10,400 dscfm = 41,600 dscfm baghouse)

[11]Fabric filter baghouse emissions based on rated flowrate (dscfm) and BACT emission level of 0.01 gr-PM/dscf; and PM_{10} BACT level of 0.005 gr/dscf

[12]Control efficiency based on

Partial Enclosure:	70%	(EPA draft Tech. Background Doc. for Control of Fugitive Dust at Cement Manf. Plants 1998)
Bottom filling - truck & rail car:	70%	(assumed equal to partial enclosure)
Water sprays:	75%	(Nevada BAPC, Emission Control Technology - Control Efficiency Ratings 2001)
Water Truck:	90%	(assumed control effeciency based on regular road wetting)

[13]Waste Pile shares Non-Spec Pad

Kinney No. 2 Coal Mine - PTE Calculations - Uncontrolled*

*PTE assuming no add-on controls (i.e., baghouses & water sprays) and no control effectiveness for partial enclosures

Process ID No.	Process Name	Process Description	Control	Control Eff	PM (lb/ton)	PM (lb/hr)	PM (tpy)	PM_{10} (lb/ton)	PM_{10} (lb/hr)	PM_{10} (tpy)
003	Screen & Crush Facility[1, 2]	2 Conveyor TPs[5]	Enclosure	0%	0.00113	3.4	14.8	0.000533	0.53	2.3
		Scalping Screen		0%	0.025	25	110	0.0087	8.7	38
		Primary Crusher		0%	0.0054	5.4	24	0.0024	2.4	11
004	Truck Load-Out Facility	1 Conveyor TP	Enclosure	0%	0.00113	1.1	4.9	0.000533	0.53	2.3
	POINT SOURCE TOTAL						153			53

Source ID	Fugitive Process	Process Rate (tph)	Control	Control Eff	PM (lb/ton)	PM (lb/hr)	PM (tpy)	PM_{10} (lb/ton)	PM_{10} (lb/hr)	PM_{10} (tpy)
F-0	Reclaim Tunnel Vent - ROM Stockpiles	4 Feeder TPs[6]	Enclosure	0%	0.00113	1.1	4.9	0.000533	0.53	2.3
F-1	Spec & Off-Spec Coal Stacking Tube[1]	1,000	Enclosure	0%	0.00113	1.1	4.9	0.000533	0.53	2.3
F-3	Waste Loading/Unloading[1]	75	none	0%	0.00113	0.085	0.37	0.000533	0.040	0.18
F-4	Truck Load-Out[1]	1,000	none	0%	0.00113	1.1	4.9	0.000533	0.53	2.3
	Unpaved Roads - Haul Trucks	**Distance (VMT/yr)**			**(lb/VMT)**	**(lb/hr)**	**(tpy)**	**(lb/VMT)**	**(lb/hr)**	**(tpy)**
F-5	Coal Trucks[3]	31,818	none	0%	6.74	103	107.2	1.74	15	28
F-6	Waste Material Trucks[3]	9,125	none	0%	3.85	17	17.6	0.99	3.5	4.5
	Storage Piles	**Size (acre)**			**(lb/ acre/hr)**	**(lb/hr)**	**(tpy)**	**(lb/ acre/hr)**	**(lb/hr)**	**(tpy)**
F-7	Spec Coal Stockpile[4]	0.50	none	0%	6.12	1.5	6.7	6.12	1.5	6.7
F-8	Off-Spec Coal Stockpile[4]	0.50	none	0%	6.12	1.5	6.7	6.12	1.5	6.7
F-10	Waste Material Pile[4]	0.25	none	0%	6.12	0.38	1.7	6.12	0.38	1.7
	FUGITIVE SOURCE TOTAL						150			52

PTE TOTAL: POINT SOURCE + FUGITIVE	303	105

Process Data:

Throughput capacity (short -term)	1,000 tph
Moisture content -	6.0 %
Average wind speed	8.5 mph
Spec coal storage pile	0.50 acre
Off-spec coal storage pile	0.50 acre
Waste material pile	0.25 acre

[1]Predictive emission factor equation formaterial transfer points, loading to stockpiles and truck loadout, continuous or batch, from Section 13.2.4, AP-42, "Aggregate Handling and Storage Piles" (Jan 1995):

$$E = k(0.0032)[(u/5)^{1.5}/(M/2)^{1.4}]$$

where E = emission factor (lb/ton); u = average wind speed (mph); M = miosture content (%)
and k is particle-size factor: k = 0.74 for PM, and k = 0.35 for PM_{10}

[2]Screening & crushing emission factors from AP-42, Table 11.19.2-2

[3]Unpaved road fugitive dust emissions based on predictive emission factor, Equation 2 in AP-42, Section 13.2.2.2:

$$E = k\,(s/12)^{a}\,(W/3)^{b}\,[(365-P)/365]$$

where E = emission factor (lb/VMT); k = 4.9 for PM and k = 1.5 PM_{10}, a = 0.7 for PM and a = 0.9 for PM_{10}, and b = 0.45 for both;
s = surface material silt content (%), W = mean vehicle weight (tons), and P = no. precip. days/yr = 90 (Figure 13.2.2-1)

Surface material silt content =
Mean Wt - coal trucks =
Mean Wt - waste trucks =

[4]Predictive emission factor equation (TSP) for wind erosion of active storage piles from AP-42 Table 11.9-1, "...Open Dust Sources at Western Surface Coal Mines":

$$E = 0.72(u)$$

where E = TSP emission factor (lb/acre/hr); u = average wind speed; and PM_{10} assumed to be 100% of TSP

[5]Screening & Crushing Facilility emissions based on 3 conveyor transfers of total throughput

[6]Uncontrolled feeder material transfers inside reclaim tunnel - would be fugitive emissions at tunnel exit.
Reclaimed material undergoes 1 material transfer in tunnel.

APPENDIX D

Air Pollution Control Equipment

Forms 10 - Fabric Filter Forms

LIST OF AIR POLLUTION CONTROL EQUIPMENT

Source ID	Location	Control Device Type
003	Screening & Crushing Facility	Fabric Filter Baghouse
004	Truck Load-Out Facility	Fabric Filter Baghouse
007	Reclaim Tunnel - ROM Stockpile	Fabric Vent Filter
F-7	Spec Coal (ROM) Stockpile	Water Sprays
F-8	Non-Spec Coal (ROM) Stockpile	Water Sprays
F-10	Waste Material Pile	Water Sprays

Utah Division of Air Quality
New Source Review Section

Form 10
Fabric Filters (Baghouses)

Company: Carbon Resources
Site: Kinney No. 2 Mine; Scofield, Utah
Date: February 6, 2008

Baghouse Description

1. Briefly describe the process controlled by this baghouse:

(Source ID 003). Controls particulate emissions from conveyor belt transfer SB-3 to scalping screen, screening, transfer to primary crusher and/or SB-3, crushing, and transfer to SB-4; inside the Screening and Crushing Facility.

Gas Stream Characteristics

2. Flow Rate (acfm):		3. Water Vapor Content of Effluent Stream (lb. water/lb. dry air)	4. Particulate Loading (grain/scf)	
Design Max 41,600	Average Expected 41,600	Unknown (ambient air)	Inlet unknown	Outlet 0.005 gr-PM_{10}/scf
5. Pressure Drop (inches H_2O) High TBD Low TBD		6. Gas Stream Temperature (°F): Ambient	7. Fan Requirements (hp) (ft^3/min) 41,600 cfm	

Equipment Information and Filter Characteristics

8. Manufacturer and Model Number: Unknown (TBD)

9. Bag Material:	10. Bag Diameter (in.)	11. Bag Length (ft.)	12. Number of Bags:	13. Stack Height
☐ Nomex nylon ☐ Polyester ☐ Acrylics ☐ Fiber glass ☐ Cotton ☐ Teflon ■ TBD	Unknown (TBD)	Unknown (TBD)	Unknown (TBD)	TBD feet Stack Inside Diameter TBD inches
	14. Filtering Efficiency Rating: 99.5 %	15. Air to Cloth Ratio: TBD : 1	16. Hours of Operation: Max Per day 24 Max Per year 8760	17. Cleaning Mechanism: ☐ Reverse Air ☐ Shaker ☐ Pulse Jet ☐ Other: TBD

Emissions Calculations (PTE)

18. Calculated emissions for this device

PM_{10} 1.8 Lbs/hr 7.8 Tons/yr NO_x n/a Lbs/hr n/a Tons/yr
SO_x n/a Lbs/hr n/a Tons/yr VOC ____ Lbs/hr ____ Tons/yr
HAPs n/a Lbs/hr (speciate) n/a Tons/yr (speciate)
Submit calculations as an appendix.

Instructions - Form 10 Fabric Filters (Baghouses)

NOTE: 1. **Submit this form in conjunction with Form 1 and Form 2.**

2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

1. Describe the process equipment that the filter controls, what product is being controlled, particle size data (if available), i.e., cement silo, grain silo, nuisance dust in work place, process control with high dust potential, etc.
2. The *maximum* and *design* exhaust gas flow rates through the filter control device in actual cubic feet per minute (ACFM). Check literature or call the sales agent.
3. The water/moisture content of the gas stream going through the filter.
4. The amount of particulate in the gas stream going into the filter and the amount coming out if available. Outlet default value = 0.016 grains PM_{10}/dscf.
5. The pressure drop range across the system. Usually given in the literature in inches of water.
6. The temperature of the gas stream entering the filter system in degrees Fahrenheit.
7. The horse power of the fan used to move the gas stream and/or the flow rate of the fan in ft^3/min.
8. Name of the manufacturer of the filter equipment and the model number if available.
9. Check the type of filter bag material or fill in the blank. Check literature or call the sales agent.
10. The diameter of the bags in the system. Check literature or call the sales agent.
11. The length of the bags in the system. Check literature or call the sales agent.
12. The number of bags. Check literature or call the sales agent.
13. The height to the top of the stack from ground level and the stack inside diameter.
14. The filtering efficiency rating that the manufacturer quotes. Check literature or call the sales agent.
15. The ratio of the flow rate of air to the cloth area (A/C).
16. The number of hours that the process equipment is in operation, maximum per day and per year.
17. The way in which the filters bags are cleaned. Check the appropriate box.
18. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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revised 05-22-06

Utah Division of Air Quality
New Source Review Section

Form 10
Fabric Filters (Baghouses)

Company: Carbon Resources
Site: Kinney No. 2 Mine; Scofield, Utah
Date: February 6, 2008

Baghouse Description

1. Briefly describe the process controlled by this baghouse:

(Source ID 004). Controls particulate emissions from conveyor belt transfer SB-4 to loading silos inside the Truck Loading Facility.

Gas Stream Characteristics

2. Flow Rate (acfm):		3. Water Vapor Content of Effluent Stream (lb. water/lb. dry air)	4. Particulate Loading (grain/scf)	
Design Max 10,400	Average Expected 10,400	Unknown (ambient air)	Inlet unknown	Outlet 0.005 gr-PM_{10}/scf
5. Pressure Drop (inches H_2O) High TBD Low TBD		6. Gas Stream Temperature (°F): Ambient	7. Fan Requirements (hp) (ft^3/min) 10,400 cfm	

Equipment Information and Filter Characteristics

8. Manufacturer and Model Number: Unknown (TBD)

9. Bag Material:	10. Bag Diameter (in.)	11. Bag Length (ft.)	12. Number of Bags:	13. Stack Height
☐ Nomex nylon ☐ Polyester ☐ Acrylics ☐ Fiber glass ☐ Cotton ☐ Teflon ■ TBD	Unknown (TBD)	Unknown (TBD)	Unknown (TBD)	TBD feet Stack Inside Diameter TBD inches
	14. Filtering Efficiency Rating: 99.5 %	15. Air to Cloth Ratio: TBD : 1	16. Hours of Operation: Max Per day 24 Max Per year 8760	17. Cleaning Mechanism: ☐ Reverse Air ☐ Shaker ☐ Pulse Jet ☐ Other: TBD

Emissions Calculations (PTE)

18. Calculated emissions for this device

PM_{10} 0.45 Lbs/hr 2.0 Tons/yr NO_x n/a Lbs/hr n/a Tons/yr

SO_x n/a Lbs/hr n/a Tons/yr VOC _____ Lbs/hr _____ Tons/yr

HAPs n/a Lbs/hr (speciate) n/a Tons/yr (speciate)

Submit calculations as an appendix.

Instructions - Form 10 Fabric Filters (Baghouses)

NOTE: 1. **Submit this form in conjunction with Form 1 and Form 2.**

2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

1. Describe the process equipment that the filter controls, what product is being controlled, particle size data (if available), i.e., cement silo, grain silo, nuisance dust in work place, process control with high dust potential, etc.
2. The *maximum* and *design* exhaust gas flow rates through the filter control device in actual cubic feet per minute (ACFM). Check literature or call the sales agent.
3. The water/moisture content of the gas stream going through the filter.
4. The amount of particulate in the gas stream going into the filter and the amount coming out if available. Outlet default value = 0.016 grains PM_{10}/dscf.
5. The pressure drop range across the system. Usually given in the literature in inches of water.
6. The temperature of the gas stream entering the filter system in degrees Fahrenheit.
7. The horse power of the fan used to move the gas stream and/or the flow rate of the fan in ft^3/min.
8. Name of the manufacturer of the filter equipment and the model number if available.
9. Check the type of filter bag material or fill in the blank. Check literature or call the sales agent.
10. The diameter of the bags in the system. Check literature or call the sales agent.
11. The length of the bags in the system. Check literature or call the sales agent.
12. The number of bags. Check literature or call the sales agent.
13. The height to the top of the stack from ground level and the stack inside diameter.
14. The filtering efficiency rating that the manufacturer quotes. Check literature or call the sales agent.
15. The ratio of the flow rate of air to the cloth area (A/C).
16. The number of hours that the process equipment is in operation, maximum per day and per year.
17. The way in which the filters bags are cleaned. Check the appropriate box.
18. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

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revised 05-22-06

Utah Division of Air Quality
New Source Review Section

Company Carbon Resources .
Site/Source Kinney No.2 Mine, Schofield, Utah .
Date February 6, 2008 .

Form 10
Fabric Filters (Baghouses)

Baghouse Description

1. Briefly describe the process controlled by this Filter Vent:

(Source ID 007). Fabric Filter Vent controls particulate emissions from 4 feeder belt transfers to SB-3 inside the reclaim tunnel beneath two ROM coal stockpiles

Gas Stream Characteristics

2. Flow Rate (acfm):		3. Water Vapor Content of Effluent Stream (lb. water/lb. dry air)	4. Particulate Loading (grain/scf)	
Design Max 10,400	Average Expected 10,400	Unknown (ambient air)	Inlet unknown	Outlet 0.05 lb/hr
5. Pressure Drop (inches H_2O) High TBD Low TBD		6. Gas Stream Temperature (°F): Ambient	7. Fan Requirements (hp) (ft^3/min) 10,400 cfm	

Equipment Information and Filter Characteristics

8. Manufacturer and Model Number: Unknown (TBD)

9. Bag Material:	10. Bag Diameter (in.)	11. Bag Length (ft.)	12. Number of Bags:	13. Stack Height
☐ Nomex nylon ☐ Polyester ☐ Acrylics ☐ Fiber glass ☐ Cotton ☐ Teflon ■ TBD	Unknown (TBD)	Unknown (TBD)	Unknown (TBD)	TBD feet Stack Inside Diameter TBD inches
	14. Filtering Efficiency Rating: 90.0 %	15. Air to Cloth Ratio: TBD : 1	16. Hours of Operation: Max Per day 24 Max Per year 8760	17. Cleaning Mechanism: ☐ Reverse Air ☐ Shaker ☐ Pulse Jet ■ Other: Filter replacement

Emissions Calculations (PTE)

18. Calculated emissions for this device

PM_{10} 0.05 Lbs/hr 0.23 Tons/yr NO_x n/a Lbs/hr n/a Tons/yr
SO_x n/a Lbs/hr n/a Tons/yr VOC _____ Lbs/hr _____ Tons/yr
HAPs n/a Lbs/hr (speciate) n/a Tons/yr (speciate)

Submit calculations as an appendix.

Instructions - Form 10 Fabric Filters (Baghouses)

NOTE: 1. **Submit this form in conjunction with Form 1 and Form 2.**

2. Call the Division of Air Quality (DAQ) at **(801) 536-4000** if you have problems or questions in filling out this form. Ask to speak with a New Source Review engineer. We will be glad to help!

1. Describe the process equipment that the filter controls, what product is being controlled, particle size data (if available), i.e., cement silo, grain silo, nuisance dust in work place, process control with high dust potential, etc.
2. The *maximum* and *design* exhaust gas flow rates through the filter control device in actual cubic feet per minute (ACFM). Check literature or call the sales agent.
3. The water/moisture content of the gas stream going through the filter.
4. The amount of particulate in the gas stream going into the filter and the amount coming out if available. Outlet default value = 0.016 grains PM_{10}/dscf.
5. The pressure drop range across the system. Usually given in the literature in inches of water.
6. The temperature of the gas stream entering the filter system in degrees Fahrenheit.
7. The horse power of the fan used to move the gas stream and/or the flow rate of the fan in ft^3/min.
8. Name of the manufacturer of the filter equipment and the model number if available.
9. Check the type of filter bag material or fill in the blank. Check literature or call the sales agent.
10. The diameter of the bags in the system. Check literature or call the sales agent.
11. The length of the bags in the system. Check literature or call the sales agent.
12. The number of bags. Check literature or call the sales agent.
13. The height to the top of the stack from ground level and the stack inside diameter.
14. The filtering efficiency rating that the manufacturer quotes. Check literature or call the sales agent.
15. The ratio of the flow rate of air to the cloth area (A/C).
16. The number of hours that the process equipment is in operation, maximum per day and per year.
17. The way in which the filters bags are cleaned. Check the appropriate box.
18. Supply calculations for all criteria pollutants and HAPs. Use AP42 or Manufacturers data to complete your calculations.

APPENDIX E

Compliance Monitoring Devices

(Reserved)

APPENDIX F

BACT Analysis

BACT ANALYSIS

1.0 BACT Methodology

The UDAQ's document, *Preparing a Notice of Intent [NOI], The NOI Guide* states that "every facility, operation, or process that proposes any activity that would emit an air contaminant into the air, must by law consider the best control of all the emissions." Section I of *The NOI Guide* specifically instructs all applicants to conduct a BACT analysis. The BACT is defined in the Utah Air Quality Rules as follows:

> **R307-101-2**: "Best Available Control Technology (BACT)" means an emissions limitation and/or other controls to include design, equipment, work practice, operation standard or combination thereof, based upon a maximum degree of reduction of each air pollutant subject to regulation under the Clean Air Act and/or the Utah Air Conservation Act emitted from or which results from any emitting installation, which the Air Quality Board, on a case-by-case basis taking into account energy, environmental and economic impacts and other costs, determines is achievable for such installation through application of production process and available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of BACT result in emissions of pollutants, which will exceed the emissions allowed by section 111 or 112 of the Clean Air Act.

The BACT analysis follows a "top-down" approach required by UDAQ for NOI submittals.

The first step in a "top-down" BACT analysis is to identify all available control options. Available control options are those air pollution control technologies or techniques with a practical potential for application to the emissions unit and the regulated pollutant under evaluation. Air pollution control technologies and techniques include the application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of the affected pollutant. The control alternatives must include not only existing controls for the source category in question, but also (through technology transfer) controls applied to similar source categories and gas streams, and innovative control technologies.

In the second step, the technical feasibility of each control option is evaluated with respect to source-specific factors. A demonstration of technical infeasibility must be clearly documented and show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emissions unit under review. Technically infeasible control options are then eliminated from further consideration in the BACT analysis. In some cases the level of control specified in a permit is not achieved in practice (e.g., a source has received a permit but the project was canceled, or every operating source at the permitted level has been physically unable to

achieve compliance with the limit). If supporting documentation has been provided which shows why such limits are not technically feasible, then the level of control (but not necessarily the technology) may be eliminated from further consideration.

In step 3, all remaining control alternatives not eliminated in step 2 are ranked and then listed in order of over-all control effectiveness for the pollutant under review, with the most effective control alternative at the top.

After the identification and ranking of available and technically feasible control options, the top-ranked alternative is evaluated for energy, environmental, and economic impacts that may affect its selection or rejection. Beneficial and adverse impacts are discussed and quantified where possible. In general, the BACT analysis focuses on the direct impacts of the control alternative.

The energy impacts analysis considers the energy requirements of the control technology and determines whether its use would result in any significant or unusual energy penalties or benefits. The analysis estimates the direct energy consumption on an absolute and incremental basis.

The environmental impacts analysis identifies any significant or unusual environmental impacts caused by the control alternative. Some control technologies may have adverse, secondary environmental impacts such as generation of toxic air emissions and/or liquid, solid, or hazardous wastes.

The economic impacts analysis involves assessing the costs associated with installation and operation of the BACT alternative. The annualized operating cost is determined according to the procedures outlined in the UDAQ's *NOI Guide*.

In the event that the top candidate is shown to be inappropriate, due to energy, environmental, or economic impacts, then the next most stringent alternative in the listing becomes the new control candidate and is similarly evaluated. This process continues until the technology under consideration is not eliminated by any source-specific environmental, energy, or economic impacts which demonstrate that the alternative is inappropriate as BACT. The most effective control option not eliminated is proposed as BACT for the pollutant and emission unit under review.

2.0 PM and PM_{10} BACT Analysis

The surface coal handling system transfers coal from the underground mining operations through the mine portal to the coal stockpiles, reclaim system, screening, crushing and truck loadout facilities. These surface handling and processing activities will generate particulate emissions. Control of particulate emissions is achieved by the collection of particulates from the point sources, and by prevention of particulate emissions from fugitive sources.

2.1 Non-Fugitive Emissions Sources

2.1.1 Available and Technically Feasible Control Technology

Non-fugitive emissions sources include the scalping screen, primary crusher, and the conveyor transfer points located downstream of the reclaim tunnel (up to and including transfer to the stockpiles, all material is wet and does not emit particulate matter). Typical control alternatives include partial or total enclosure of the process, water sprays, and fabric filter baghouses. In the USEPA's RACT/BACT/LAER Clearinghouse (RBLC), each of these control alternatives is listed as BACT for one or more coal handling, conveying, screening, and/or crushing processes (based on a RBLC database search for process 90.011-coal handling/processing/preparation/cleaning, from 1997 to 2007). No other control technologies were listed for non-fugitive sources in the surface coal-handling system. For the purposes of this NOI, it is assumed that any other particulate control approaches are either technically infeasible or would not be considered BACT.

2.1.2 Ranking of Control Alternatives

Table 2-1 presents the ranking of available and technically feasible control alternatives for non-fugitive emissions sources based on control efficiency.

Fabric filter baghouses can achieve 99.5 to 99.9 percent control efficiency and are considered the top-ranked alternative for this analysis. The processes that can reasonably be enclosed and controlled by a baghouse include the aboveground conveyor belt to conveyor belt transfer points, the scalping screen, primary crusher and associated feed belts or transfer points, the material transfers from conveyors to the stockpile stacking tubes, and the truck loadout facility.

TABLE 2-1

Ranking of Control Alternatives – Non-Fugitive Emissions Sources

Control Alternative	Control Efficiency (%)
Enclosure Vented to Fabric Filter Baghouse[1]	99.5 to 99.9
Enclosure with Water Spray[2]	87.5
Water Spray[3]	75
Enclosure[3]	50

[1]Baghouse control efficiencies represent the range of values listed in USEPA's RBLC database for Process No. 90.011 between 1997 and 2007.

[2]Calculated as the combined control efficiency of enclosure and water spray (See note 3 below)

[3]Control efficiency ratings provided by Nevada Bureau of Air Pollution Control (Dec. 2001)

2.1.3 Energy, Environmental and Economic Impacts

Because fabric filter baghouses have been commonly and successfully applied to coal conveyor transfer points, and screening and crushing facilities, it is assumed that no significant energy, environmental or economic impacts will prevent their selection as BACT.

2.1.4 BACT Proposed for Non-Fugitive Emissions Sources

Carbon Resources Kinney No.2 Mine (CRKM) proposes to enclose the following aboveground processes, and to vent these enclosures through fabric filter baghouses:

- Source 003: SB-3 transfer to the scalping screen, and scalping screen transfer to primary crusher or SB-4, enclosed in the screening and crushing facility; and
- Source 004: SB-4 transfer to truck loadout silos enclosed in the loading facility.

The non-fugitive BACT alternative consists of two enclosures with baghouses controlling PM_{10} emissions from screening, crushing, and conveyor transfer points. In addition, the material transfer operations located inside the reclaim tunnel will be vented through a fabric filter with control efficiency that is comparable to a fabric filter baghouse.

CRKM proposes a PM and PM_{10} BACT emission limit of 0.01 gr-PM/dscf and 0.005 gr-PM_{10}/dscf for each baghouse. A conservative control efficiency of 90 percent is assumed for the reclaim tunnel's fabric vent filter. These values are consistent with recent BACT determinations for coal handling processes listed in the RBLC Database.

2.2 Fugitive Emissions Sources

2.2.1 Available and Technically Feasible Control Technology

Fugitive emissions sources include truck loading, unpaved haul roads, and coal storage piles. Based on the RBLC database search referenced in Section 2.1.1 above, the following control alternatives are considered available and technically feasible for fugitive emissions sources: water sprays, telescoping chute (truck loading only), dust suppressants, partial enclosure, wind fence, and work practices that minimize visible emissions. No other control alternatives were listed for any fugitive emissions sources from coal handling and storage activities. For the purposes of this NOI, it is assumed that any other particulate control approaches are either technically infeasible or would not be considered BACT.

2.2.2 Ranking of Control Alternatives

In Table 2-2, the available and technically feasible control alternatives for fugitive emissions sources are ranked according to control efficiency.

The use of water sprays, the top-ranked control alternative, is also the most commonly listed BACT determination for fugitive emissions from coal handling, hauling, and storage activities. For truck loading, it is assumed that a regulated discharge, telescoping chute designed for bottom-loading of coal is at least as efficient as use of water sprays (this process-specific design prevents product-loss and is necessarily very efficient).

TABLE 2-2
Ranking of Control Alternatives – Fugitive Emissions Sources

Control Alternative	Control Efficiency (%)
Water Sprays[1]	75
Telescoping Chute (truck loading only)[2]	70
Partial Enclosures[1]	70
Wind Fence[2]	< 50
Work Practices[2]	< 50

[1]Control efficiency ratings from Nevada Bureau of Air Pollution Control: *Emission Control Technology – Control Efficiency Ratings*; and USEPA draft *Technical Background Doc. for Control of Fugitive Dust at Cement Manufacturing Plants* (1998).
[2]Control efficiency is estimated (assumed to be similar to partial enclosure).

2.2.3 Energy, Environmental and Economic Impacts

Because water sprays have been commonly and successfully applied to control fugitive emissions from coal handling and storage piles, and unpaved road surfaces, it is assumed that no significant energy, environmental or economic impacts will prevent their selection as BACT.

The regulated discharge, telescoping chute is part of the truck-loading facility design. Because it is not an "add-on" technology, the telescoping chute adds no additional energy burden or economic impact. Additionally, it has the environmental benefit of eliminating virtually all fugitive dust emissions from this process.

2.2.4 BACT Proposed for Fugitive Emissions Sources

CRKM proposes to control fugitive particulate emissions from the coal storage piles and unpaved haul roads by applying water or other dust suppressant(s) as needed to maintain surface moisture and/or prevent excessive visible emissions.

The use of the regulated discharge, telescoping chute is proposed as BACT for the bottom-loading of coal into trucks at the loading facility.

APPENDIX G

NOx Analysis

Model Emission Rates

Figure 4 - Emission Source Locations

CD - Modeling Files

NAAQS Analysis

Modeling was performed for applicable criteria pollutants (PM_{10} is the only criteria pollutant emitted from the proposed facility) to demonstrate that impacts from emissions from facility activities neither cause nor contribute to violations of the national ambient air quality standards. Based on discussions with the Division of Air Quality (DAQ), the EPA ISCST model was used to assess impacts from the proposed project. Representative meteorological data was provided by the DAQ from data collected and processed at the Hunter Power Plant. In order to reduce modeling time and because of missing data for years 1997 (days missing in January and February), 2000 (days missing in November and December) and 2001 (entire year missing), modeling was completed for 5 years in separate model runs corresponding to each met-data year. Annual impacts were only assessed for 1998, 1999, and 2003, for which complete datasets were available. All proposed emission sources were represented as point, pseudo-point, volume or area sources corresponding to the nature of the emissions from the source. Emissions resulting from unpaved roads were modeled as a series of volume sources following the proposed roads within the site. The heights of the volumes were set as twice the height of transport trucks generating emissions and the widths were adjusted to road-width plus 6 meters.

Receptors were placed at the following intervals to determine impacts:

- 25 meters along property/process boundary
- 100 meter spacing from boundary to 2 kilometers
- 250 meter spacing from 2 kilometers to 5 kilometers
- 500 meter spacing from 5 kilometers to 10 kilometers
- 1000 meter spacing from 10 kilometers to 50 kilometers

Modeled concentrations for the highest 24-hour and annual impact in the 5 years were used to determine compliance with NAAQS. The potential PM_{10} emission rates used to assess 24-hour and annual impacts are provided in Appendix C. The following table summarizes the modeling results.

NAAQS Modeling Analysis Results

Pollutant	Averaging Period	Modeled Concentration[1] ($\mu g/m^3$)	Background[2] ($\mu g/m^3$)	TOTAL w/Background	NAAQS Standard ($\mu g/m^3$)	Standard Exceeded? (Yes/No)
PM_{10}	24-Hour	58.6	66.0	124.6	150	No
PM_{10}	Annual	22.5	22.5	45.0	50	No

[1] Modeled concentrations are based on high 1st high model result in 5 years.
[2] Data is from Utah Monitoring Database for years 2004, 2005 and 2006 for nearest monitor in Provo. Highest 4th highest in 3 years for 24-hour PM_{10}; and period average for annual PM_{10}.

Kinney No. 2 Coal Mine - Model Emission Rates

NON-FUGITIVE EMISSIONS SOURCES

Source ID No.	Process Name	Process Description	PM_{10} (lb/hr)	PM_{10} (g/s)	Baghouse Stack Parameters (m^3/min)[a]	Baghouse Stack Parameters (m)[b]	Baghouse Stack Parameters (m/s)[c]
003	Screen & Crush Facility	3 Conveyor TPs Scalping Screen Primary Crusher	1.8	0.22	1,178	0.51	96
004	Truck Load-Out Facility	1 Conveyor TP	0.45	0.056	294	0.51	24
007	ROM Reclaim Tunnel Vent	5 Feeder TPs	0.053	0.0067	n/a	n/a	0.001

FUGITIVE EMISSIONS SOURCES

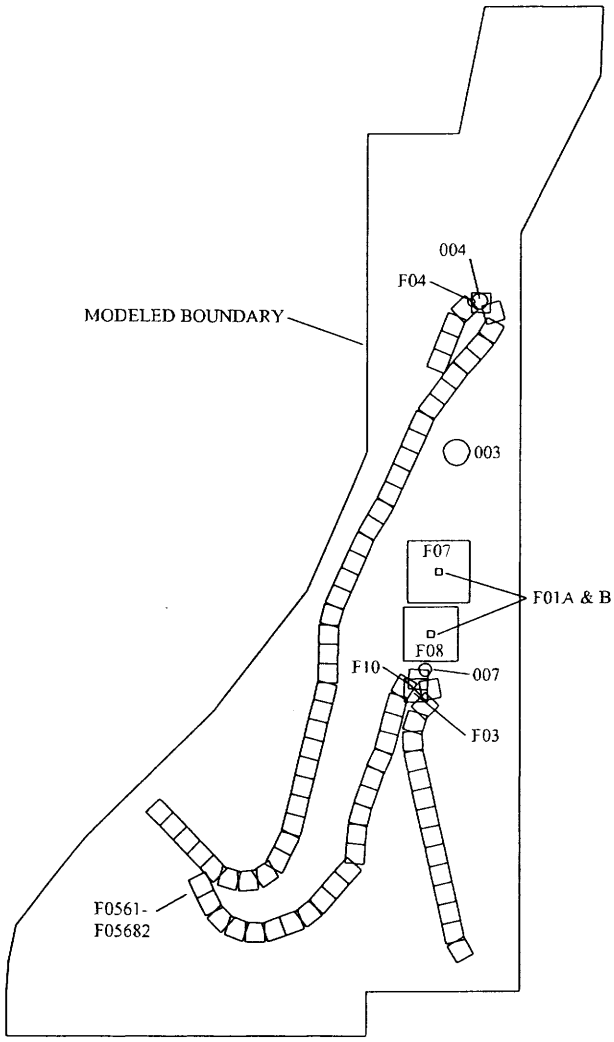
Source ID	Fugitive Processes	(lb/hr)	(g/s)
F-1	Spec & Non-Spec Coal Stacking Tubes	0.16	0.020
F-3	Waste Loading/Unloading	0.040	0.0050
F-4	Truck Load-Out	0.16	0.020
	Unpaved Roads - Haul Trucks	**(lb/hr)**	**(g/s)**
F-5	Coal Trucks	1.5	0.19
F-6	Waste Material Trucks	0.3	0.04
	Storage Piles	**(lb/hr)**	**(g/s)**
F-7	Spec Coal Stockpile	0.38	0.048
F-8	Non-Spec Coal Stockpile[11]	0.38	0.048
F-10	Waste Material Pile	0.10	0.012

[a]Estimated flowrate converted to m^3/min (see Note 10 in PTE calculation table)

[b]Estimated diameter based on similar baghouse (see Note 10 in PTE calculation table)

[c]Velocity (m/s) = [(flowrate, m^3/min) / (cross-section area, m^2)] / (60 s/min)

and cross-section area = $(D^2)(\pi) / 4$



0 150' 300'
SCALE

PREPARED BY:

GAULT GROUP INC.

CARBON RESOURCES - KINNEY NO. 2 MINE
NOTICE OF INTENT TO CONSTRUCT

EMISSION SOURCE LOCATIONS

REV: 1 2 3 4 5

PROJECT NO. 07-11A

DATE: 04-FEB-08

FIGURE: 4

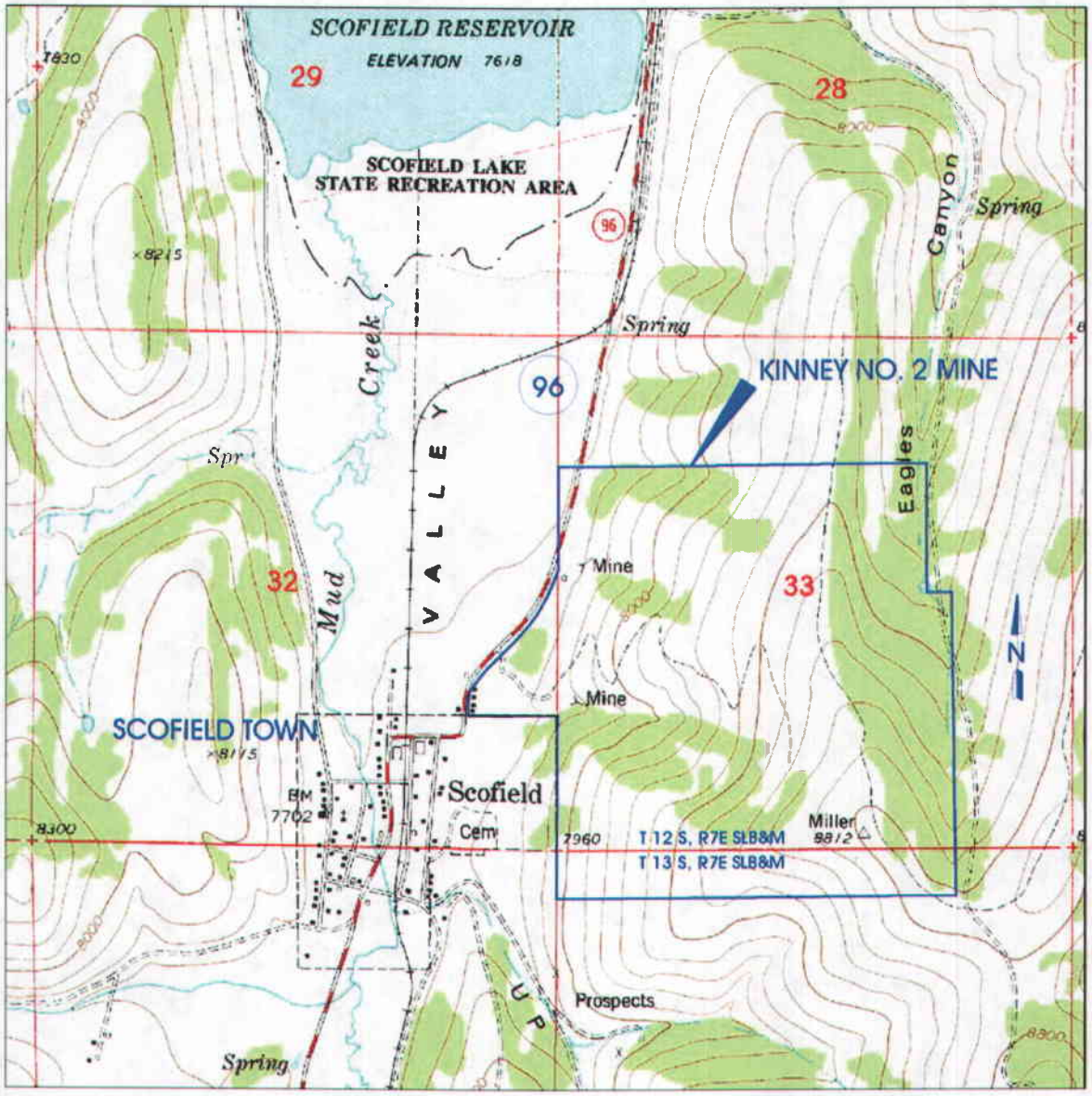
Exhibit 2.3

Public Notice and Proof of Publication – Hearing Notices and Decumentation

PUBLIC NOTICE

Application for Permit To Mine Coal
Under Utah Coal Mining Regulations R645
Carbon Resources, LLC
Carbon County, Utah

Notice is hereby given that Carbon Resources, LLC., P.O. Box 11789, Albuquerque, New Mexico 87192, with Ronald C. Barker as Resident Agent, 2870 S. State Street, Salt Lake City, Utah 84225-3624, has filed an application with the Utah Department of Natural Resources, Division of Oil, Gas and Mining for a Permit to mine coal pursuant to R645 of the Utah Coal Program Regulations. The permit area is shown on the Scofield U.S. Geologic Survey 7.5-minute Quadrangle map.



The permit area affected is located in Carbon County, Utah as follows:

Township 12 South, Range 7 East, Salt Lake Base & Meridian

Section 32
E2SE4

Section 33
S2, S2N2

Township 13 South, Range 7 East,
Salt Lake Base & Meridian

Section 4
N2N2

Copies of the application can be reviewed at the following locations:

Carbon County Recorder's Office
120 East Main Street
Price, Utah 84501

Utah Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84116

Mining operations will be conducted within 100 feet of Utah Highway 96.

Written comments, objections, or requests for informal conferences on the application may be submitted to the Division of Oil, Gas and Mining at the address above.

Closing date for submission of such comments, objections and requests for an informal conference on this proposal must be submitted by_____.

Published in the Sun Advocate Newspaper:

_____.

Exhibit 3.1.1.3-1

Soils Information

SOIL SURVEY REPORT

KINNEY No. 2 MINE

CARBON COUNTY, UTAH

Prepared for:
Carbon Resources, LLC
PO Box 1789
Albuquerque, NM 87192

Prepared by:
Bruce Chesler
PO Box 355
Escalante, Utah 84726

November 6, 2007

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Objectives	page 3
Soil Survey Setting	page 4
Previous Soil Surveys	page 5
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Soil Survey Results	page 8
Soil Salvage	page 12
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Primary Growth Medium	page 15
Seed and Microbial Innoculum	page 15
Summary	page 16
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Figure 1. Soil Map Unit ID Legend with Sampled Soil profile locations
Figure 2. Prime Farmland Map, from WEB Soil Survey

Table 1 Soil Analysis and Analytical Methods
Table 2 Utah Oil Gas and Mining Soil Suitability/Unsuitability Evaluation Guidelines
Table 3 Soil Map Unit Descriptions and Physical Parameters
Table 4 Soil Family Classifications by Pedon Location
Table 5 Proposed Surface Disturbances by Soil Map Unit
Table 6 Soil Suitability Data
Table 7 Erodibility Factor Calculations and Input Parameters
Table 8 Summary of Soil Limitation, Salvage Depths, and Salvageable Volumes

Appendix 1 ACZ Laboratories, Inc. Lab Analysis Spreadsheets (2006)

Appendix 2 Intermountain Laboratories, Inc. Lab Analyses Spreadsheets (2007)

Appendix 3 Soil Profile Descriptions

Appendix 4 Soil Profile Photographs

Appendix 5 Soil Micromonolith Box Photographs

Appendix 6 Official Soil Series Descriptions

Introduction

During October, 2006, 23 soil profiles were excavated by backhoe within an area containing previous underground coal mining disturbances on approximately 21 acres. An adjacent soil survey and sampling of 13 additional soil profiles was made during September, 2007 on an additional 16 acres to the south west. The southern portion of the survey area is dominantly comprised of disturbed lands containing reclaimed soil with alternative reclamation materials provided through the State of Utah Division of Oil Gas, and Mining Abandoned Mine Lands Program (AML) around 1986. The entire soil survey area, referred to in this report as Kinney No.2 Mine Soil Survey, is 36.7 acres in extent found along a 700 feet wide by approximately 1 mile long strip of private land adjacent to Highway 96. It is located approximately one quarter mile to the northeast of Scofield, Utah. The 27.3 acres shown on Figure 1 is that portion (sub-set) of the 36.7 acres survey area where disturbance is planned for construction of the surface facilities of the mine. The soil survey and sampling of soil profiles were made as part of Carbon Resources, LLC application to mine coal in this area, and is intended to identify and characterize the major soil types found within 36.7 acres of the coal mine permit area. The fieldwork portion of this soil survey was conducted by Bruce Chesler, an independent soil survey contractor, with the assistance of Greg Hunt of Carbon Resources, LLC. As a guide in planning the scope of work to be addressed in this soil survey report, Utah Division of Oil, Gas, and Mining (UDOGM) Guidelines of Management for Topsoil and Overburden (UDOGM, 2005) were consulted.

Objectives:

Map soils at Order 2 level on approximately 37 acres of the Kinney No.2 Mine Permit Area.

Describe and sample representative soil profiles at 6 inch to 24 inch depth increments in previously disturbed (AML) sites. Sample by horizon, and describe and classify soils to family level, in areas with undisturbed soil profiles.

Analyze soil physiochemical parameters for each sample according to methodologies suggested in 2005 UDOGM Guidelines for Management of Topsoil and Overburden.

Rate the soil's ability to be used as plant growth medium in soil reclamation for each soil map unit based on UDOGM guidelines.

Calculate an average salvageable topsoil or alternative reclamation material volume, for each soil map unit within the approximately 37 acres of the Mine Permit Area.

Make recommendations for management practices which may overcome any deficiencies in the quality and quantity of topsoil and alternative reclamation material which may be feasibly salvaged within the Mine Permit Area.

Soil Survey Setting

The survey area is located within portions of Sections 33 and 28, T 12 S, R 7 E, approximately one quarter mile northeast of Scofield, Utah. Elevations range between 7500 and 7900 feet. Previous coal mining in this area has affected over half of the natural landscape with abandoned mine portal and staging areas, coal mine dumps, roads and abandoned railroad grades, cut slopes and haul routes. There have been no previous attempts to salvage topsoil from the previous mining disturbance activities in this area. The present soil and alternate reclamation materials found on-site represents the extent of material available for post mining reclamation efforts at the Kinney No.2 permit area. As the AML alternative reclamation materials comprise a significant proportion of the materials found within the southern half of the survey area, a primary focus of this report will be to address their chemical properties and their plant re-growth potential. The 1986 AML reclaimed acreage generally contains coal/spoil/soil mixtures which I will refer to in this report as alternative reclamation materials. Soil Map Units used to describe these lands are referenced as either Mine Dumps (SCS, 1988) or Disturbed Lands, in this report. The alternative reclamation materials found in this area's backhoe excavations reveal layers of AML- placed subsoil materials covering coal that was historically dumped or spilled during mining, transport, or storage of coal and or coal abandoned in the old stock pile, along with buried natural subsoil horizons. This coal buried by AML will be referred to throughout this report as "reclaimed coal".

Access throughout the survey area was made by driving graded dirt roads on private lands, one which switchbacks up toward a ridgeline from the south end of the property, and one which leads south to north along the axis of the two mile long permit area. The geomorphology of the surrounding landscape is dominated by a fault block graben valley which contains Mud Creek drainage to the west, flowing north into Scofield Reservoir. Along the Mud Creek floodplain is an approximately one acre slice of the Kinney No.2 property, containing alluvial soils which I've sampled to represent the floodplain terrace soil types west of Highway 96. Steeper slopes comprised of colluvium and mass wasted landslide materials derived from Black Hawk Formation sedimentary rocks are the dominant and primary soil forming materials within the Order 2 soil survey area.

The colluvial material may contain less rock fragment content and finer soil materials in concave slope positions and at junctions of several side canyons, which dissect slopes within the survey area from the east. The sedimentary rock parent materials include limestone, calcareous sandstones, and siltstones. Mass wasting soil and colluvial deposits are noticeable within all soil map units and on various slope gradients across the soil survey area. These ancient landslide deposits have randomly distributed soil and geologic parent materials across the survey area in a way which makes predicting soil depths, rock content, and textures of soil profiles challenging for me. The vegetation is characterized by sagebrush on west to southerly aspects of the mountainsides, and pockets of aspen forest with snowberry understory located on north to easterly facing

slopes. The previously disturbed AML reclamation lands are dominated by Rubber Rabittbush and Wyoming Big Sagebrush. Slope gradients are steepest along the east side of the survey area, with moderate to gently sloping areas along the lower side slope and toeslope positions to the west. Soils with rock fragment contents of over 40 percent in their profiles are common within the survey area on all aspects and across all slope shapes.

Previous Soil Surveys

The Order 3 soil survey which includes the Kinney No.2 Mine permit area was reviewed (SCS, 1988). Sheet #6 of the Carbon Area Soil Survey provides 4 map unit delineations mapped by SCS in the Kinney No.2 permit area, which includes six soil map unit components, or Soil Series, and one Miscellaneous Land type. The Trag-Croyden complex (Map Unit 117) represents much of the steeper mountain slope positions, and Trag-Bege-Senchert complex (Map Unit 118) occurs to a lesser extent on toeslope positions along the southern edge of the permit area. Silas loam and Silas-Brycan loams (Map Units 108, 109) are mapped along the one acre of the permit area found within alluvial bottomlands along Mud Creek. One Miscellaneous Land Type, Mine Dumps, was described in the SCS Soil Survey Report for the areas with previous coal mining disturbance.

Trag Series has recently been revised in its extent by NRCS soil scientists in the Carbon County Area, to characterize soil types found with granitic parent material. Tie Creek Series, classified as a Fine-loamy, Typic Argiustoll, is a Soil Series which has been established in other portions of Carbon County. This Series is currently being used to represent sedimentary rock influenced soils found with sagebrush vegetation in frigid soil temperature regimes (personal communications, Leland Sasser, NRCS Price Field Office). Sagebrush vegetation and a frigid soil temperature regime represent the dominant soil ecotypes and climate in this area. The Tie Creek soil profile is very deep, has an argillic subsoil horizon, and includes some calcium carbonate accumulations in its subsoil. Croyden Series, a fine-loamy, Typic Argicryoll, is mapped by SCS on aspen forested sites in this area, and is usually about 50 inches to weathered sandstone bedrock and has an argillic horizon in the subsoil. The Bege soil Series is shallow to sandstone bedrock, and was not found within backhoe excavations to be a representative soil type along colluvium dominated lower side slopes. Senchert Series is a moderately deep to bedrock (20 to 40 inches) soil found under aspen understory, and occurs occasionally on spurs of ridges in this survey area. Official Soil Series descriptions from Carbon Area Soil Survey of several of these related soil types are included in Appendix 6.

There has been no attempt in this report to match soil profile descriptions described in the field to the Soil Series level of soil classification. The focus of this report is to identify

and rate soil properties as they affect feasible topsoil salvage operations. Soil family level classifications were used in documenting soil types.

Methods

In October 2006, 1:24,000 aerial photographs and mine plan schematic maps were reviewed. On a 1:6,000 scaled base map of the survey area, preliminary soil map unit boundaries were drawn. These map units were designed primarily with the intent to separate areas of previous surface disturbances (mainly alternative soil reclamation materials) from natural soil areas. The remote sensing effort was further refined during October 2007, with use of Utah State's (AGRC) high resolution aerial orthophotographs, which examination of has provided more accurate determinations for the extent of AML and other surface disturbances (Ben Grimes, personal comm.). Other factors influencing soil map unit design are slope gradients, aspect, and vegetation changes. The soil map units are designed to accommodate the intent of this project's objective of evaluating the major soil type's ability to be salvaged feasibly and then to be used as a plant growth medium in reclaiming this site. Slopes with steeper than 50 percent gradient, or soils with greater than 50 percent coarse fragments in their profile are regarded as impractical for conventional bulldozer scraping and feasible topsoil salvage practices, and were therefore not sampled in this survey.

On October 15, I met with Greg Hunt of Carbon Resources LLC and backhoe operator Mike Erkkila of Scofield, and began a field reconnaissance of pre-delineated soil map units by driving two access roads which bisect the survey area. Where available, road cut exposures were taken advantage of by cutting back with shovels and backhoe, to sample and describe soils within the survey area. A minimum of one representative soil profile was chosen for each map unit, and in the case of previously disturbed areas, the density of soil backhoe pits was increased due to the greater variability of these soil types. A total of 18 soil profiles were excavated and recorded during the following three days according to A Field Guide for Describing and Sampling Soils Version 2.2 (Schoeneberger, et al., 2005). Photographs were taken of each soil pit, and micromonolith sample boxes were assembled from each soil profile, photographed, and then stored for reference.

An average of 4 to 5 sample increments of soil materials and coal samples were taken from each soil profile, placed in gallon-sized plastic bags, and shipped to ACZ Laboratories, Inc. (ACZ) in Steamboat Springs. The amount of soil samples sent to the lab total 96 increments, and the number of coal samples sampled within five of the soil profiles total six. On November 3, 2006, all 102 of the samples had been received by ACZ. Samples were analyzed according to UDOGM Guidelines (Topsoil Guidelines, Tables 2 and 3, 2005) and results were reported on December 21, 2006.

An additional sampling and soil survey trip was made to Kinney No.2 soil survey area during September, 2007. This 3 day sampling excursion was dedicated to describing the

soil resources of the Hansen Surface (about 15.3 acres) located to the south and west of the 2006 sampling area. During this trip, a partial review of the soil profiles excavated during 2007 was made on-site with UDOGM soil scientist Priscilla Burton. Thirteen additional soil profiles were excavated by backhoe, and a total of 52 soil horizons, including 2 coal buried samples, were delivered to Intermountain Laboratories, Inc. (IML), Sheridan Wyoming on September 8. Results of the IML lab analyses were made available on Sept. 18, 2007.

Laboratory Analysis and Data Interpretation

Laboratory analysis of soil samples collected from 31 backhoe pits, hand-dug holes, and road cut excavations were conducted to determine chemical and physical properties of soils within the 36.7 acre Kinney No.2 soil survey area. Areas of previously disturbed land found within the southern portion of the soil survey area containing a majority of the planned coal mining building facilities were given closer scrutiny by increasing the soil sampling frequency. The laboratory analyses performed on all of the soil samples and the associated coal samples are provided in Table 1. In addition to the standard UDOGM lab parameter for topsoil suitability, Acid-Base Potential, Boron, Selenium, and Sulfur, and Total Organic Carbon percentages were analyzed for coal samples taken at 9 sample locations and for the 13 associated soil horizons (AML) at the following sites: D-3, D-4, D-9A, D-9B, and D-11, 06 –SP-07, 13-SP-07.

These data, along with soil profile and map unit descriptions, were used to classify soil types (USDA, 2006) and to assess the suitability of soils as primary plant growth medium for reclamation. The Utah Division of Oil, Gas, and Mining topsoil suitability ratings are listed in Table 2. Soil suitability criteria and four rating categories are also provided in Table 2. Based on numeric values assigned to each category (1 to 4), an average (or overall), cumulative, and maximum (highest) score determines the ultimate rating for each sample. However, some parameters are more important than others and some plant growth limiting factors may be readily overcome using proper management practices. For instance, available water holding capacity and soil erodibilty (K-factor), when adjusted for the higher coarse fragment content of these particular soils, is often rated less than if only the fine earth fraction of the soils are considered. The higher percentage of rock volume found in these soils may contain additional pockets of moisture beneath them, which are stored and used by plants during dryer periods of the year. Also, the higher coarse fragment contents of soil effectively shelter silty and other finer-textured soil particles from wind and water erosion.

Estimates of soil available water holding capacity (AWHC) were made using Saxton, et al. SPAW Soil Modeling Calculator, available on the Web. Permeability class (Rawls et al. 1982), and hydrologic group (Rawls et al. 1982) were based on soil texture of the major component of each soil map unit and adjusted for coarse fragment contents. The procedures found in Soil Survey Manual (USDA 1993b) were used to estimate surface

runoff class. The estimated root restricting depths were based on soil profile observation in the field, by such characteristics rock distribution, or bedrock layers.

The soil erodibility factors (K factors) were calculated based on the numerical representation of the nomographs typically used to calculate the erodibility of the fine earth fraction (Kf) and entire soil including rock fragments (Kw). This calculation involves the use of several variables including: the percentage of silt and very fine sand, soil organic matter, soil structure, and permeability. The procedures and calculation used to estimate the soil erodibility factors are provided in the National Soil Survey Handbook (USDA 1993a pages 618-30 and 618-32). The higher the K value, the more susceptible the soil is to sheet and rill erosion by water.

Soil Survey Results

Six soil map units were identified at the Order 2 level on 36.7 acres of the permit area. Figure 1 shows the location of the Kinney No.2 Mine Order 2 Soil Survey area, Soil Map Unit Identification Legend, and 31 of 36 soil sample site locations. Five locations are north of the present permit application boundary and not shown on this map. The Soil Map Unit ID Legend includes 5 natural soil map units and two previously disturbed map units. Family level soil classifications are provided for each of the natural soil map unit components. Three slope breaks, A: 0-35 percent, and B: 35-70 percent, C: 0-3 percent, were used to differentiate natural soil mapping units. Two slopes breaks, 0-20 percent, and 20-50 percent were used to differentiate the Disturbed Lands (DA, DB) map units. Of the 31 soil sample locations, 16 are located within previously disturbed/reclaimed areas and 15 were sampled from non-disturbed, natural soil landscapes.

Important and prime farmland determinations for this area were assessed during September 2007 using the NRCS WEB SOIL SURVEY. Figure 2. Contains a page printed form this website listing the Soil Map units found in the area of this soil survey, and their Prime Farmland suitability ratings (NRCS, 2007). There are no prime farmland soils or soils of statewide importance found within areas of concern in this soil survey report, primarily limited by a cold climate (growing season length), slope steepness and rock fragment contents.

The laboratory data from ACZ (2006 sampling, including 5 sample sites located outside of present permit application) are presented in Appendix 1. Intermountain Laboratories, Inc. data (from 2007) are shown in Appendix 2. Soil pedon descriptions for the 36 profiles are provided in Appendix 3. Soil profile photographs with sampled depth increments are shown in Appendix 4. Soil micromonolith box samples for the 36 sites are provided in Appendix 5. Appendix 6 contains three Official Soil Series Descriptions which closely resemble soils described in this report, and are published in the Soil Survey of Carbon Area, Utah Report (SCS, 1988).

Table 1 lists the soil analyses and the laboratory methods used by ACZ and IML to determine soil physiochemical properties. Table 3 shows the six Map Units, their major components, and the physical parameters typically used to assess impacts to soil resources and feasible soil management and handling options. Table 4 identifies each soil sample site with its family taxonomic classification. Classifications for profiles described within previously disturbed areas are listed as Disturbed Area Soils. Table 5 lists the soil map unit delineations by their acreage. Table 6 contains the laboratory data used to assess soil suitability and the various rating (highest, average, and cumulative ranking) based on comparison with the UDOGM topsoil suitability rating guideline provided in Table 2. Table 7 contains soil erodibility (K factor) calculations and input parameters. Table 8 is a summary of all of the identified soil limitations, and estimated soil salvage depth and salvage volumes by soil map unit.

Two Soil Orders were described within the undisturbed lands (Map Units 1B, 2A, 2B, 3A) of Kinney No.2 Mine Order 2 soil survey area, Mollisol, and to a lesser extent, Alfisol. Inclusions of Inceptisols were also noted. A 10 –15 inch dark topsoil layer (A horizon) with 2 to 3 feet of very stony to bouldery coarse textured subsoil (B to C horizons) characterize the soils of these areas. Soils with over 10 percent coal fines on the surface are common in the disturbed/reclaimed area of the survey area, and these "reclaimed coal" dump areas are identified in this report as Disturbed Area Soils (Map Units DA and DB). It has proven difficult for me to model or predict the depths to and extent of "reclaimed coal" fines and chunks that occurs within the previously disturbed area. Soils located within Disturbed Areas contain a highly variable mixture of soil and rock material, mixed with "reclaimed coal" deposits. A common feature of both undisturbed and reclaimed sites across the survey area is the high percentage of coarse fragments found throughout these profiles. Exceptions to this case are found in soils located on concave lower slope positions (Map Unit 1B), and along floodplain terraces and drainages (map unit 3A).

Following are brief descriptions of the six map units.

DA. Disturbed area soils, 0-20 percent slopes

This map unit occurs in previously disturbed AML reclamation area throughout the soil survey area which includes former dumps, portals, and staging areas, and along abandoned haul and rail roads. The entire area appears to have been regraded since 1986 to conform to the moderate to slightly sloping toeslopes in context with the adjacent natural slope gradients. Mixtures of soil with alternative reclamation materials from the area are combined with "reclaimed coal" chunks and fines, and are distributed in a way making soil taxonomy inapplicable. Vegetation is a mixture of seeded grasses and Rubber rabbitbrush. Slope gradients are between 0 and 20 percent, the soil is well drained, and has a moderate permeability. Some concrete foundations of abandoned structures are found within this map unit. Eighty percent of the map unit are classified

Disturbed land soils, and 10 percent each are Fine-loamy and Loamy-skeletal, Typic Haploxerolls found on undisturbed soil landscapes with sagebrush and grass vegetation.

DB. Disturbed area soils, 20-50 percent slopes

This map unit is also located within previously disturbed AML reclamation areas, located primarily in the southern portion of the survey area. Parent materials include sandstone, limestone, and mudstones, Slopes range between 20 and 50 percent and soils are well drained and have a moderate permeability. There is a mixture of reclaimed materials, up to 20 inches depth comprised of subsoil with "reclaimed coal" covering the natural soil profiles. Depths of the reclaimed material covering the natural soils profile vary considerably across the map unit, and are not easily predicted by surface features. Eighty percent of this map unit is comprised of Disturbed land soil containing "reclaimed coal" and alternative reclamation materials. Vegetation is comprised of seeded grasses and Rubber Rabbitbrush, with a small proportion of sagebrush and aspen trees. Included are 10 percent Loamy-skeletal Typic Haploxeroll soils on undisturbed lands, with a mix of sagebrush and aspen vegetation. Another ten percent inclusion are Fine-loamy Typic Argixeroll soils on undisturbed land found on concave slope positions.

1B. Typic Haplocryoll loamy skeletal – Typic Argicryoll, coarse-loamy Complex, 35-70 percent slopes

This soil map unit is found on steeper mountain side slopes of the permit area with aspen vegetation and slopes above 35%. The parent materials are colluvial sandstones, shale, and limestones from the Blackhawk Formation. Soils are moderately deep to deep, well drained, and have a moderate permeability. Typic Haplocryoll, loamy-skeletal comprise 50 percent of this map unit. Typic Argicryoll, coarse-loamy comprise 40 percent of this map unit. Included in the map unit are ten percent Pachic Haplocryoll fine loamy soils located on concave slope positions.

2A. Typic Argixeroll, loamy-skeletal – Typic Haploxeroll, loamy-skeletal Complex, 0-35 percent slopes

This map unit is located on colluvial side slopes and toeslopes with sagebrush vegetation and slopes less than 35%. Soils are deep to very deep, well drained, and have a moderate permeability. Soils with south to westerly aspects under sagebrush vegetation types in this area have a frigid temperature regime. Loamy–skeletal, Typic Argixerolls comprise 50 percent of this map unit, and Fine-loamy Typic Haploxeroll comprise 35 percent of the map unit on concave slopes. Included in the map unit are 10 percent soils with pachic epipedons on concave lower sideslopes (Senchert Series), and 5% soils that are shallow to bedrock on ridges and convex sideslopes (Bege Series).

2B. Typic Argixeroll, loamy-skeletal Consociation, 35 - 70 percent slopes

This map unit is found on steep colluvial sideslopes with sagebrush and grass dominated vegetation. Mixed sedimentary rocks are the parent materials. The south to westerly aspects have a frigid temperature regime. Slopes are between 35% and 70% and soils are moderately deep to deep and well drained, with a moderate permeability. Loamy-skeletal Typic Argixerolls comprise 80 percent of this map unit. Included in the map unit are 10 percent shallow to bedrock soils on convex slopes, and 10 percent Pachic Haploxerolls on concave slope positions.

3A. Cumulic Argicryoll Fine-loamy, Consociation, 0-3 percent slopes

This map unit is of limited extent (0.8 acre) within the Kinney No.2 permit area, and is located west of Highway 96 on alluvial terrace bottomlands of the Mud Creek drainage. No backhoe pits were excavated in this map unit; soil sampling was by hand-excavated pits to 40 inches. The area is characterized by seasonally moist subsoil resulting from groundwater and Scofield Reservoir level fluctuations in the area. Soils are very deep, with stratified loam to silt loam textures, and are faintly mottled below 40 inches. Vegetation includes grass, sedges, and weeds. Ninety percent of this map unit is Silas Series soil types. Included in this map unit are five percent soils with 20 inches cover of coal fines with alternative reclamation material, found along depositional areas adjacent to the highway berms and associated drainage culverts, and five percent soils with a coarse- loamy particle size class in their control section.

Soil Salvage

The determination of soil suitability depends on the intended use of the soil. Soil intended for reclamation should have a sufficient depth and quantity to permit economic salvage and be of suitable quality and texture. Soils management considerations include the development of practical methods for soil salvage, stockpile construction, redistribution onto regraded spoil, seedbed preparation, erosion protection, and the rapid establishment of perennial and permanent vegetation.

Soil map unit salvageability, plant growth limiting factors, and the estimated volume of plant growth medium within the 27.3 acre Kinney No.2 Mine planned disturbance area provided in Table 8 which is a subset of the 36.7 soil survey area within the controlled property. These estimates were based on soil profile descriptions (Appendix 3), comparison of the suitability rating guidelines (Table 2) with physicochemical soils data (Table 6), size of the map unit within the proposed disturbance (Table 5), estimated depths of suitable soil in each map unit component, and the proportion of each map unit component for which soil salvage was considered feasible.

The factors limiting soil suitability in the 27.3 acre Kinney No.2 Mine Order 2 soil survey include Total Organic Carbon content (found in most alternative reclamation materials), available water holding capacity in the soils with over 40% coarse fragments, K-factor of the fine-earth fraction soil material of A horizons with minimal coarse fragment content, and slope gradients of over 50%. These limitations were identified based on the review of laboratory data and field description of coal distribution around and within the soil profiles, soil texture, and the ocular estimation for percentage rock content observed in the soil profiles. Slope gradients were determined using hand held clinometer.

Of the 154 samples tested within the 31 soil profiles, all tested good for electrical conductivity, SAR, and CaC03 percentage. All samples tested good for pH, with the exception of one sample (13-SP-07) which had pH values of slightly less then 6.5.

The water content, at saturation, of 151 of the samples rated good. Two sample increments from one site (1B-1) rated poorly, and one from site 13-SP-07 was fair, with saturation percentage of between 67 and 80 percent. The calculated available water capacity (AWHC), when corrected for coarse fragment content, for 87 of the soils rated good, 49 rated fair, and 18 were rated poor. The calculated soil erodibilty or K-factor for the fine earth fraction includes 123 rated good, 16 rated fair, and 15 rated poor. When coarse fragment contents are factored into the K-factor calculations, 144 samples are rated good, 3 are rated fair, and 7 are rated poor.

Soil textures of 152 of the coal and soil samples rated fair to good, with the majority of soils having a sandy loam, loam, or silt loam textures. Two of the subsurface soils rated poor with textures of silty clay (sites D-10, and 2A-5) and 2 coal samples (sites D-3 and 13-SP-07) had a poorly rated sand texture. The amount of very fine sand as proportion of total sand was generally between 15 and 30 percent.

Of 21 coal and coal- affected soil samples that were tested from 7 separate locations, all results for Boron results were good. They range between 0.46 and 2.30 mg/kg, well below the 5 mg/kg UDOGM acceptable limit. Of all of the selenium samples tested, 20 of 21 tested below lab detected limits. One sample, D-11 tested .007 mg/kg, below UDOGM acceptable standard of .15 mg/kg. Soil materials, alternative reclamation materials, and coal samples from 7 of the sample sites, are thus considered nonseleniferous and non-boroniferous.

The Acid- Base Potential for these 21 samples all rated good, with a lab calculations of between 5 and 38 available tons CaCo3 per1000 tons overburden in the samples. Total Organic Carbon for the 8 coal samples tested between 5 and 63 percent TOC. All of the "reclaimed coal" found buried within soil profiles, and mixed into the alternative reclamation material of soils of disturbed sites within the survey area, notwithstanding their distribution and thickness within soil profiles, are regarded as poorly rated in their topsoil suitability because of Total Organic Carbon percentages of over 10 percent. The issue of addressing the segregation and disposition of these coal fines is outside the scope of this soil survey report and will be a topic found in the topsoil salvage plan and the reclamation plan.

Based on these laboratory results and soil profile observations for 27.3 acres of the Kinney No. 2 Mine Order 2 soil survey area, the natural soil landscapes represented by Map units 2A, 2B, 1B, and 3A contain suitable growth medium of between 8 and 24 inches thickness that can be salvaged for reclamation of mine-related disturbances when found in contiguous areas of over an acre in extent. Map Units 1B and 2B, found on over 35 percent slopes, pose mechanical limitations in separating potential topsoil increments of less than 8 inch depth without inclusion of subsoil. Experience has shown that where less than about one foot of suitable materials are found on steep, rocky slopes, or close to shallow bedrock contacts, it would be impractical to strip, salvage and transport any of the suitable soils without including some subsoil material (B or C horizons) located at depths between one to two feet.

An exception to the available topsoil reclamation suggestion above is found within areas of disturbed land (map units DA and DB), where some of the alternative reclamation materials are mixed with varying amounts of "reclaimed coal" containing Total Organic Carbon contents of over 10 percent, and containing coal fines on the surface in excess of 15%. These soils are regarded as unsuitable for reclamation purposes, yet comprise significant proportions of the survey area. The variably-sized, buried bodies of "reclaimed coal" located within map units DA and DB may contain acid forming materials and should be contained separately from other suitable topsoil growth medium. However, based on the sample sites located within disturbed areas of this survey, the establishment of certain plants has successfully occurred in much of the previously disturbed area reclaimed by AML. The alternative topsoil materials used in 1986 may be argued as having had some success in providing adequate neutralizing affects when used in association with small amounts of coal fines (less than 15%) so that these materials

may repeatedly used, if necessary, as a source for additional alternative topsoil materials.

The exact extent of coal buried within previously disturbed Map units DA and DB cannot be precisely estimated by methodologies used to prepare this soil survey report. Additional core drilling in areas of previous disturbances and located within AML 1986 reclamation is recommended. This core drilling would allow for modeling of a better estimate of the quantities of "reclaimed coal" located in this area. Such an estimate of coal volumes could provide the information needed to decide whether economics of the stripping/ recovery of buried coal is feasible. In my judgment, potential additional reclamation materials could be made available from within map Units DA and DB if the isolation and recovery of "reclaimed coal" are deemed feasible. Separation of, and salvage for resale of the larger bodies of the "reclaimed coal" is perhaps an economically feasible management alternative. The removal from the AML areas of any potential acid toxicity resulting from "reclaimed coal" products provides assurance that buried "reclaimed coal" is isolated and separate from other nearby, suitable alternative reclamation topsoil materials.

According to the results of 154 soil sample analyses and a field survey of soil resources, an estimated 66.5 thousand cubic yards (yds^3) of suitable soil is salvageable within the 27.3 acres of Kinney No.2 Mine Order 2 soil survey area for use as plant growth medium for reclamation. Additional soil salvage volume may be possible if marginal soils (poorly rated soils by UDOGM Guidelines), along with use of some of the alternative reclamation materials mixed with coal fines, are considered necessary for overcoming deficiencies in topsoil balance. The plants presently growing on-site attest to the abilities of these previously disturbed lands alternative reclamation materials to grow vegetation.

Salvageable soil quantities may be more precisely estimated when detailed plans for the scheduling and mine development are completed. At that time, the detailed balance of salvaged soil materials and substrates can be calculated, and their storage or distribution can be determined and become part of the reclamation planning. Experience in soil salvage on large-scale mining projects has shown that field determination of soil salvage and suitability at the time of construction may be necessary. My recommendation is for a trained soil scientist to be present at time of soil salvage operations.

Potential Soil management Alternatives

Two potential reclamation uses for soils salvaged from Kinney No.2 Order 2 Soil Survey are:

1. Primary plant growth medium;
2. Seed, organic matter, and soil inoculum source

1. Primary Plant Growth Medium

Soils capable of acting as a primary plant growth medium for revegetation and reclamation are generally composed of soil materials rated as 1 or 2 according to the UDOGM guidelines. These soils are currently capable of supporting, in this case, native plant species that are adapted to conditions in the area. The physical and chemical properties of texture, pH, soluble salts content, sodium content, organic matter, etc. are in general not limiting for plant growth of native species. In some instances, soil material below the zone of active pedogenic processes should be suitable for reclamation.

2. Seed and Microbial Innoculum

The second subsidiary use of the surface soils is as a source for seed and plant propagules and microorganism inoculum. Seeds are generally contained in the top few inches of soils and are more abundant in the late summer and fall after flowering and seed set. Microbial inoculum is also contained in the top 2 to 8 inches of growth medium. Root propagules are typically found within the top 2 feet of the soil profile. Stockpiling of these plant propagules and microbial active materials significantly reduces their viability over time. If mine planning allows, soils should be applied within a short time following salvage and placed directly on regraded surfaces ('live handled').

Summary

There are some limitations to soil salvage in the proposed disturbed area within the Kinney No.2 Mine Order 2 soil survey area. The primary limitations are the available water holding capacity of soils containing greater than 50% rock content, slope gradients of over 50 percent affecting use of soil salvage machinery, soil materials with sandy textures, and an accurate determination of the quantity of coal found within the mixture of alternative reclamation materials located in Disturbed Lands Map Units DA and DB. Soil salinity, pH, calcium carbonate percentage, and plant nutrition do not pose any limitations to plant growth medium at the Kinney No.2 soil survey area. To ensure maximum utilization of the soils resource, soil salvage should be coordinated with the planning and construction phases of mining operations. A soil reclamation plan, at a later date, will have to address the issue of separation of the previous coal mining affected surfaces from natural topsoil, in the stripping and salvage operations.

Based on the soil descriptions in this report, the stripping, handling, storage, and application of the salvaged material can be estimated for reclamation planning. The estimated amount of salvageable soils was calculated based on depth and extent of soils found within the 36.7 acres within the Kinney No.2 Mine Order 2 soil survey area. All of the soil salvage estimates in this report are approximations.

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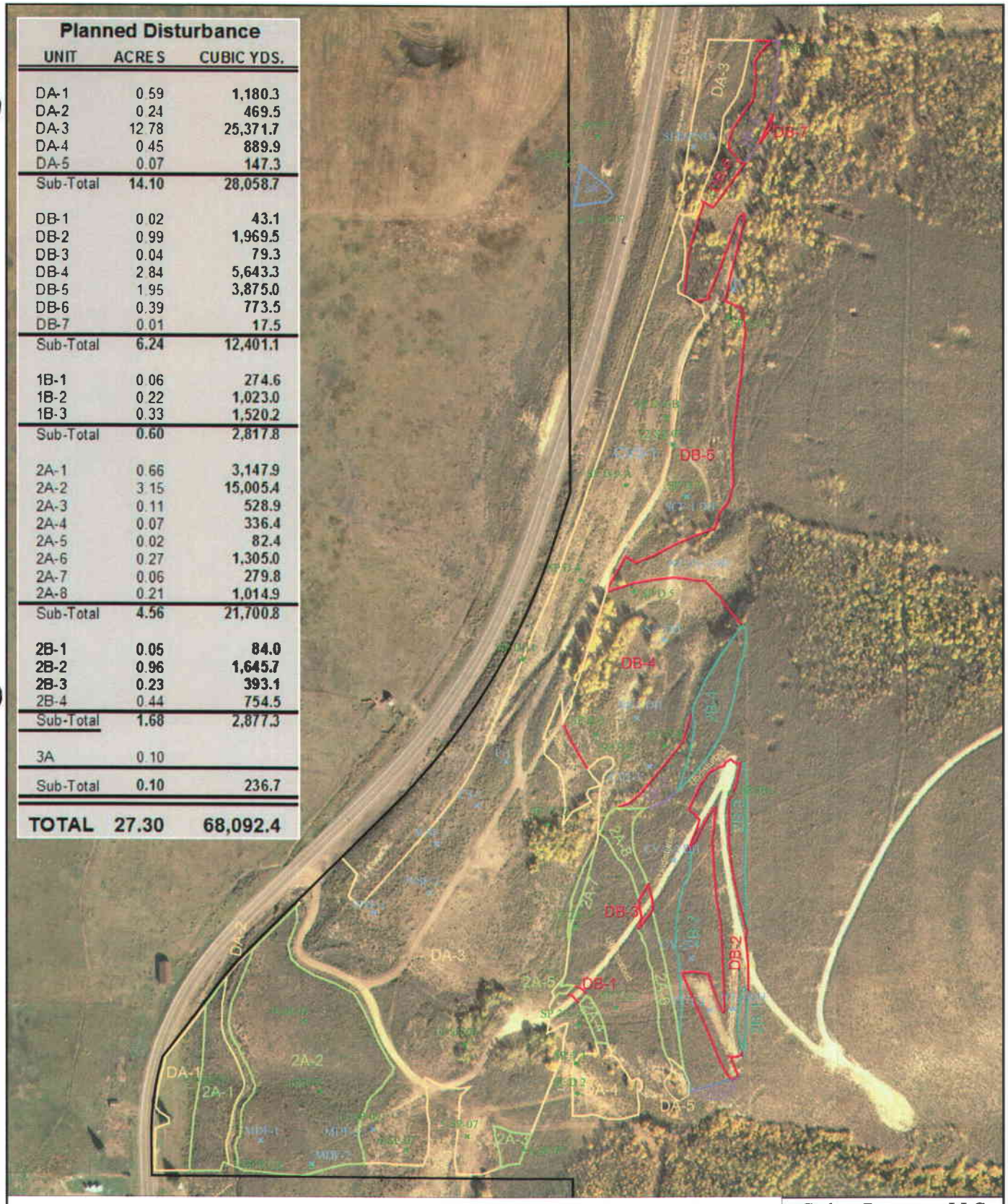
REPORT TABLES

Planned Disturbance

UNIT	ACRES	CUBIC YDS.
DA-1	0.59	1,180.3
DA-2	0.24	469.5
DA-3	12.78	25,371.7
DA-4	0.45	889.9
DA-5	0.07	147.3
Sub-Total	14.10	28,058.7
DB-1	0.02	43.1
DB-2	0.99	1,969.5
DB-3	0.04	79.3
DB-4	2.84	5,643.3
DB-5	1.95	3,875.0
DB-6	0.39	773.5
DB-7	0.01	17.5
Sub-Total	6.24	12,401.1
1B-1	0.06	274.6
1B-2	0.22	1,023.0
1B-3	0.33	1,520.2
Sub-Total	0.60	2,817.8
2A-1	0.66	3,147.9
2A-2	3.15	15,005.4
2A-3	0.11	528.9
2A-4	0.07	336.4
2A-5	0.02	82.4
2A-6	0.27	1,305.0
2A-7	0.06	279.8
2A-8	0.21	1,014.9
Sub-Total	4.56	21,700.8
2B-1	0.05	84.0
2B-2	0.96	1,645.7
2B-3	0.23	393.1
2B-4	0.44	754.5
Sub-Total	1.68	2,877.3
3A	0.10	
Sub-Total	0.10	236.7
TOTAL	**27.30**	**68,092.4**



LEGEND

SOIL TYPES and Planned Disturbance Areas

DB Disturbed Lands, 20-50% Slopes

2A Typic Argixeroll-Typic Haploxeroll Complex, 0-35% Slopes

1B Typic Argicryoll Consociation, 35-70% Slopes

2B Typic Argixeroll Consociation, 35-70% Slopes

SP 2A1 • Soil Survey Sample Pit 2006 Field Work w/Lab Analysis

6 SP 07 × Soil Survey Sample Pit 2007 Field Work w/Lab Analysis

WSF-2 Soil Stability Sample Pit 2007 Field Work Soil Horizion Data Only, NO /Lab Analysis

Permit Boundary (Portal Block)

N

0 300 ft

SCALE: 1:3,600 or 1" = 300'

Contour Interval 20 ft

The map is in the Kinney Coordinate System (KCS). It was projected from State Plane NAD83 to a vertical datum of 8,000 ft. using a Combined Factor (CF) of 1.0047927. To project back, add 7,000,000 to Northing and 1,700,000 to Easting, then multiply by the CF.

Carbon Resources LLC

KINNEY NO. 2 MINE

FIGURE 1

Planned Disturbed Area Soil Map

DRAWN BY: BC & GLH DATE: 9/20/-7

APPROVED BY: Gregory Hunt DATE: 12/31/2007

HANSEN ALLEN & LUCE INC ENGINEERS

23 S. Carbon Ave., Suite 21
Price, UT 84501

FILE: Fig 1 Soil Chemistry 07

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Intro to Soils | Suitabilities and Limitations for Use | Soil Properties and Qualities | Soil Reports

Suitabilities and Limitations Ratings

Open All | Close All

- Building Site Development
- Construction Materials
- Disaster Recovery Planning
- **Land Classifications**
  - Conservation Tree and Shrub Group
  - Ecological Site ID
  - Ecological Site Name
  - **Farmland Classification**

View Description | View Rating

View Options

Map ✓

Table ✓

Description of Rating ✓

Rating Options

Detailed Description

Advanced Options

View Description | View Rating

- Forage Suitability Group ID (Component Table)
- Hydric Rating by Map Unit
- Irrigated Capability Class
- Irrigated Capability Subclass
- Nonirrigated Capability Class
- Nonirrigated Capability Subclass

- Land Management
- Military Operations
- Recreational Development
- Sanitary Facilities
- Vegetative Productivity
- Waste Management
- Water Management

Map — Farmland Classification

Scale (not to scale)

Tables — Farmland Classification — Summary By Map Unit

Summary by Map Unit — Carbon Area, Utah, Parts of Carbon and Emery Counties

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
99	Dumps,mine	Not prime farmland	17.0	19.7%
108	Sitas loam	Not prime farmland	32.1	37.2%
109	Sitas-Bryan loams	Not prime farmland	13.0	15.1%
117	Trag-Beje-Senchert complex	Not prime farmland	0.5	0.6%
118	Trag-Croydon complex	Not prime farmland	23.7	27.5%
Totals for Area of Interest (AOI)			**86.2**	**100.0%**

Description — Farmland Classification

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options — Farmland Classification

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

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TABLE 1

Kinney #2 Mine - Soil Analyses and Analytical Methods

ANALYSES	METHOD
Boron, soluble (Hot Water)	M6010B ICP
Calcium, soluble (Sat. Paste)	M6010B ICP
Magnesium, soluble (Sat. Paste	M6010B ICP
Potassium, extractable (AB-DTP	M6010B ICP
Potassium, soluble (Sat. Paste	M6010B ICP
Selenium, soluble (Hot Water)	SM3500-Se.C
Sodium Absorption Ratio	Calculation
Sodium, soluble (Sat. Paste)	M6010B ICP
Acid Generation Potential (cal	M600/2-78-054 1.3
Acid Neutralization Potential	M600/2-78-054 1.3
Acid-Base Potential (calc on S	M600/2-78-054 1.3
Carbon, total organic (TOC)	ASA No.9 29-2.2.4 Co
Clay	ASTM D 422 Hydromete
Conductivity @25C	M120.1 - Meter, w/ S
Neutralization Potential as Ca	M600/2-78-054 3.2.3
pH, Saturated Paste	USDA No. 60 (21A)
Sand	ASTM D 422 Hydromete
Saturation Percent	USDA No. 60 (2)
Sieve- 53 um (270 mesh)	ASA No.9, 15-4.2.2
Sieve- 2000 um (2.0 mm)	ASA No.9, 15-4.2.2
Silt	ASTM D 422 Hydromete
Solids, Percent	CLPSOW390, PART F, D
Sulfur Organic Residual	M600/2-78-054 3.2.4
Sulfur Pyritic Sulfide	M600/2-78-054 3.2.4
Sulfur Sulfate	M600/2-78-054 3.2.4
Sulfur Total	M600/2-78-054 3.2.4
Texture Classification	ASTM D 422 Hydromete
Total Sulfur minus Sulfate	M600/2-78-054 3.2.4
Nitrate as N, extractable (KCL	Calculation: NO3NO2
Nitrate/Nitrite as N, extracta	M353.2 - Automated C
Nitrite as N, extractable (KCL	M353.2 - Automated C
Nitrogen, total Kjeldahl	M351.2 - TKN by Bloc
Phosphorus, extractable (AB-DT	M365.1 - Automated A

Table 2

Utah Oil Gas and Mining Soil Suitability/Unsuitability Evaluation Guidelines [1]

Criteria	Suitability Rating[2]			
	Good (G)	Fair (F)	Poor (P)	Unacceptable(U)
Saturation %	25 to 55	≥56 to 80	<25, >80	
pH	6.5 to 8.1	6.0 to 6.4, 8.2-8.5	5.5 to 6.0, 8.6 to 9.0	<5.5, >9.0
EC (mS/cm 25^0 C)	0 to 4	4 to 8	8 to 15	>15
SAR (Sodium Adsorption Ration)[a,b]	0 to 4	5 to 10	10 to 14	>14[a]
%$CaCO_3$	<15	15-30	>30	
Texture [c]	sl, l, sil, scl, sc, ls, lfs	cl, c, sicl, sc, ls, lfs	sic, s, sc, cos, fs, vfs	g, vcos
Total Organic Carbon	<10%			≥10%
Available Water Capacity [d]	>0.10, moderate	0.05 to 0.10, low	<0.05, very low	
K factor [e]	<0.37	0.37	>0.37	

[1] Utah Oil Gas and Mining, October, 2005. Guideline for Management of Topsoil and Overburden R645-301-200 Soils - Table 4

[a] For clay textured soils unacceptable SAR > 14. For sandy textured soils unacceptable is >20.

[b] For most Western soils, the SAR to ESP relationship is usually 1:1, up to ESP ≈ 20. If SAR> 20, then determine ESP (Evangelou, 2000).

[c] s=sand, l=loam, si=silt, c=clay, v=very, f=fine, co=coarse, g=gravel

[d] Available Water Capacity is adjusted for texture and coarse fragment percentage, and SAR

[e] K factor recommendations from the USDA Soil Conservation Service, 1978. National Soils Handbook Notice 24 (3/31/78). NSH Part II-403.6 (a). For prime farmland soils, the K factor times the percent slope should be a value of five or less for minimal erosion hazard.

Table 3
Kinney #2 Mine Order 2 Soil Survey - Soil Map Unit Descriptions and Physical Parameters

Map Unit ID #	Map Unit	Map Unit Component	% of Map Unit[1]	Landform	Depth to Bedrock Inches	Parent Material	Drainage[2]	Bulk Density g/cm^3	AWHC[3] in/in	Perm Class[4]	Hydro Soil Group[4]	Surface Runoff Class[5]	Root Restriction Depth[8]	Soil Depth Class[8]
DA	Disturbed Lands, 0-20 percent slopes	Disturbed Soil	90%	toeslopes	40-60 plus	Coal Waste and reclaimed Topsoil	W	1.4	.02-.12	3	B	M	None	60 plus
		Lo-sk Typic Haploxeroll	10%					N/A	N/A	N/A	N/A	N/A	N/A	N/A
DB	Disturbed Lands, 20-50 percent slopes	Disturbed Soils	80%	lower sideslopes	60 plus	Coal Waste and reclaimed Topsoil	MW- W	1.4	.01-.13	3	B	M	None	60 plus
		Lo-sk Typic Haploxeroll	10%					N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fi-lo Typic Argixeroll	10%					N/A	N/A	N/A	N/A	N/A	N/A	N/A
1B	Coarse-loamy Typic Argicryoll Consociation, 35-70 percent slopes	Co-lo Typic Haplocryoll	80%	sideslopes	60 plus	Mixed Colluvium from Black Hawk Fm.	EW-W	1.50	.06-.12	2	A	H	None	40-60
		Disturbed Soils	10%		40-60			1.4	.02-.12	3	B	H	None	60 plus
		Lo-sk Typic Argicryoll	10%		40-60			1.35	.03-.16	3	B	H	None	40-60
2A	Typic Argixeroll - Typic Haploxeroll Complex, 0-35 percent slopes	Lo-sk Typic Argixeroll	50%	toeslopes	40-60	Mixed Colluvium from Black Hawk Fm	MW-W	1.40	.03-.15	3	B	M	None	40-60
		Lo-sk Typic Haploxeroll	35%					1.40	.05-.11	3	B	M	None	40-60
		Inclusions	15%		40-60			1.4	.11-.15	3	B	M	None	40-60
2B	Typic Argixeroll Consociation, 35-70 percent slopes	Lo-sk Typic Argixeroll	80%	sideslopes	40-60	Mixed Colluvium from Black Hawk Fm	MW-W	1.35	.08-.14	3.00	B	H	None	40-60
		Disturbed Soils	10%		40-60			N/A	N/A	N/A	N/A	N/A	N/A	N/A
		shallow to bedrock inclusion	10%		10 to 20									

[1] Percentage of components in map unit.
[2] Drainage: E=excessively drained ; W=well drained; MW=moderately well drained; P=poorly drained
[3] AWHC estimated with coarse fragment Reduction (UDOGM Guidelines, page 11)
[4] See explanation Table 7 , footnote 2
[5] Surface Runoff Class: L=low; M=moderate; H=high; VH=very high
[7] Soil Erosion Hazard: K<0.37 = Low (L); K = 0.37 = Moderate (M); K > 0.37 = High (H)
[8] VS= very shallow (0-10 inches); S=shallow (10-20 inches); MD=moderately deep (20-40 inches); D=deep (40-60 inches); VD=very deep (>60 inches)

Table 4

Kinney #2 Mine Order 2 Soil Survey - Soil Family Classification by Pedon Location

Pedon ID Number	Map Unit	Soil Classification
D-1	Disturbed Area Soils, 0-20 percent slopes	N/A Disturbed Land Soils
D-2	Disturbed Area Soils, 0-20 percent slopes	N/A Disturbed Land Soils
D-9A	Disturbed Area Soils, 0-20% percent slopes	N/A Disturbed Land Soils
D-9B	Disturbed Area Soils, 0-20 % percent slopes	N/A Disturbed Land Soils
D-10	Disturbed Area Soils, 0-20 % percent slopes	N/A Disturbed Land Soils
D-11	Disturbed Area Soils, 0-20% percent slopes	N/A Disturbed Land Soils
05-SP-07	Disturbed Area Soils, 0-20 percent slopes	N/A Disturbed Land Soils
06-SP-07	Disturbed Area Soils, 0-20 percent slopes	N/A Disturbed Land Soils
13-SP-07	Disturbed Area Soils, 0-20 percent slopes	N/A Disturbed Land Soils
D-3	Disturbed Area Soils, 20-50 percent slopes	N/A Disturbed Land Soils
D-4	Disturbed Area Soils, 20-50 percent slopes	N/A Disturbed Land Soils
D-5	Disturbed Area Soils, 20-50 percent slopes	N/A Disturbed Land Soils
D-6	Disturbed Area Soils, 20-50 percent slopes	N/A Disturbed Land Soils
D-7	Disturbed Area Soils, 20-50 percent slopes	N/A Disturbed Land Soils
D-12	1A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argicryoll
1A-1	1A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argicryoll
1B-1	1A Complex, 0 -35 percent slopes	Coarse-loamy, mixed, superactive, Typic Haplocryoll
1A-2	1A Complex, 0-35 percent slopes	Fine-loamy, mixed, superactive, Pachic Haplocryoll
10-SP-07	1A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argicryoll
D-8	1B Consociation, 35-70 % slopes	Coarse-loamy, mixed, superactive, Typic Haplocryoll
2A-1	2A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argixeroll
2A-2	2A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argixeroll
2A-3	2A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argixeroll
2A-5	2A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argixeroll
2A-6	2A Complex, 0-35 percent slopes	Fine-loamy, Mixed, superactive, Pachic Palexeroll
2A-7	2A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Haploxeroll
04-SP-07	2A Complex, 0-35 percent slopes	Loamy-skeletal,mixed, superactive, Typic Haplustoll
07-SP-07	2A Complex, 0-35 percent slopes	Loamy-sleletal, mixed superactive, Typic Haplustoll
08-SP-07	2A Complex, 0-35 percent slopes	Fine-loamy, mixed, superactive, Typic Argixeroll
11-SP-07	2A Complex, 0-35 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argixeroll
09-SP-07	2A Complex, 0-35 percent slopes	Fine-loamy, mixed, superactive, Typic Argixeroll
12-SP-07	2A Complex, 0-35 percent slopes	Coarse-loamy, mixed, superactive, Typic Haplustoll
2B-1	2B Consociation, 35-70 percent slopes	Loamy-skeletal, mixed, superactive, Typic Argixeroll
01-SP-07	3A Consociation, 0-3 percent slopes	Coarse-loamy, mixed, superactive, Cumulic Endoaquoll
02-SP-07	3A Consociation, 0-3 percent slopes	Fine-loamy, mixed, superactive, Cumulic Haplocryoll
03-SP-07	3A Consociation, 0-3 percent slopes	Fine-loamy, mixed, superactive, Cumulic Haplocryol

Table 5
Kinney #2 Mine Order 2 Soil Survey - Surface Disturbance by Soil Map Unit

Map Unit ID	Map Unit Name	Disturbance Acres
DA	Disturbed Lands, 0-20 percent slopes	14.1
DB	Disturbed Lands, 20-50 percent slopes	6.1
1B	Typic Argicryoll Consociation, 35-70 percent slopes	0.8
2A	Typic Argixeroll - Typic Haploxeroll Complex, 0-35 percent slopes	4.5
2B	Typic Argixeroll Consociation, 35-70 percent slopes	1.6
3A	Cumulic Haplocryoll, fine-loamy, 0-3 percent slopes	0.1
	Total	**27.3**

Table 6

Kinney #2 Order 2 Soil Survey - Soil Suitability Data

Lab	Sample	pH (Sat Paste)	R[1]	E.C. @25°C	R[1]	SAR	R[1]	Sand	Silt	Clay	VFS	USDA Texture Class[2]	R[1]	Saturation Percent	R[1]	Available Water Capacity[5]	R[1]	Organic Matter	Organic Carbon (calculated)	R[1]	Erodibility Factor (K-Factor)[4]	R[1]	$CaCO_3$	R[1]	Boron	R[1]	Se (Hot H_2O sol)	R[1]	Cumulative Rating	Most Limiting Suitability Rating[1]	Average Suitability Rating[1]	Calcium, soluble (Sat. Paste)	Magnesium, soluble (Sat. Paste)	Sodium, soluble (Sat. Paste)	Potassium, soluble (Sat. Paste)	Nitrogen-Nitrate	Phosphorus	boron	selenium	total sulfur	Acid-Base Potential
ID	ID	units		dS/m		unitless		%	%	%	%			%		in/in		%	%		unitless		%		mg/Kg		mg/Kg					meq/L	meq/L	meq/L	meq/L	mg/Kg	mg/Kg	meq/L	mg/kg	mg/kg	T Ca / 1KT overburden
L59731-01	D-1 0-6"	6.8	1	0.25	1	0.23	1	72.5	11.3	16.3	8.6	sl	1	34.8	1	0.04	3	2.4	1.4	1	0.1	1	2.3	1	*		*		11	3	1.22	1.57	0.12	0.22	0.32	1.1	28	*	*	*	*
L59731-02	D-1 6-16	6.4	2	0.22	1	0.11	1	70	15	15	12.2	sl	1	53.4	1	0.08	2	4	23.3	4	0.05	1	1.2	1	*		*		14	4	1.55	1.28	0.15	0.1	0.07	1.1	36	*	*	*	*
L59731-03	D-1 6-25"	6.7	1	0.18	1	0.08	1	76.3	7.5	16.3	6.1	sl	1	35.8	1	0.09	2	1.2	0.7	1	0.1	1	3.4	1	*		*		10	2	1.11	0.82	0.14	0.06	0.1	1.8	14	*	*	*	*
L59731-04	D-1 25-40"	7	1	0.16	1	0.11	1	73.8	12.5	13.8	11.4	sl	1	34.6	1	0.08	2	1.5	0.9	1	0.1	1	0.2	1	*		*		10	2	1.11	0.76	0.15	0.08	0.08	0.9	29	*	*	*	*
L59731-05	D-1 40-65"	6.5	1	0.21	1	0.11	1	80	7.5	12.5	8.6	sl	1	30.2	1	0.06	3	1	0.6	1	0.1	1	0.2	1	*		*		11	3	1.22	1.04	0.22	0.09	0.08	U	20	*	*	*	*
L59731-06	D-1 65-90"	7.2	1	0.26	1	0.15	1	83.8	3.8	12.5	31.8	sl	1	31.1	1	0.07	3	0.9	0.5	1	0.05	1	0.5	1	*		*		11	3	1.22	1.36	0.24	0.14	0.05	U	20	*	*	*	*
L59731-07	D-2 0-6"	7.3	1	0.18	1	0.08	1	77.5	7.5	15	8.9	sl	1	33.6	1	0.12	1	1.9	1.1	1	0.02	1	0.6	1	*		*		9	1	1	0.8	0.16	0.06	0.11	0.2	15	*	*	*	*
L59731-08	D-2 6-24"	7.5	1	0.5	1	0.05	1	78.8	7.5	13.8	1.9	sl	1	33.3	1	0.11	1	0.5	0.3	1	0.02	1	0.4	1	*		*		9	1	1	0.16	0.13	0.02	0.08	U	13	*	*	*	*
L59731-09	D-3 0-10"	7.5	1	0.27	1	0.08	1	72.5	8.8	18.8	7.8	sl	1	40.7	1	0.08	2	4	2.3	1	0.15	1	1.4	1	0.57	1	U	1	11	2	1	1.2	0.21	0.07	0.33	1.5	29	0.57	U	0.02	15
L59731-10	D-3 10-20"	7.4	1	0.27	1	0.09	1	71.3	11.3	17.5	7.4	sl	1	35.3	1	0.07	2	2.9	1.7	1	0.1	1	1.5	1	0.66	1	U	1	11	2	1	1.52	0.24	0.09	0.18	0.9	20	0.66	U	0.02	10
L59731-11	D-3 20-40"	6.9	1	0.17	1	0.09	1	72.5	8.8	18.8	8.9	sl	1	37	1	0.07	2	2.7	1.6	1	0.1	1	1	1	0.65	1	U	1	11	2	1	0.68	0.14	0.08	0.07	0.4	16	0.65	U	0.02	18
L59731-12	D-3 40-60"	6.3	2	0.25	1	0.08	1	72.5	10	17.5	6.9	sl	1	38.9	1	0.05	2	3.1	1.8	1	0.05	1	1.8	1	0.48	1	U	1	12	2	1.09	1.13	0.26	0.07	0.06	0.2	17	0.48	U	0.03	14
L59731-13	D-3 60-75"	6.3	2	0.16	1	0.05	1	72.5	10	17.5	7.4	sl	1	37.9	1	0.04	3	3.2	1.9	1	0.05	1	1.8	1	1.11	1	U	1	13	3	1.18	13.4	5.67	0.17	0.16	0.4	15	1.11	U	0.13	19
L59731-14	D-3 coal	6.6	1	0.16	1		1	71.3	13.8	15	1.9	sl	1	59.2	2	0.11	1	5.2	30.1	4	0.05	1	3.3	1	2.3	1	U	1	13	4	1.18	15.3	3.06	0.07	0.13	1	5	2.3	U	0.46	19
L59731-15	D-4 0-6"	6.6	1	0.2	1	0.07	1	71.3	11.3	17.5	9.1	sl	1	40.2	1	0.07	2	2.4	1.4	1	0.15	1	1.2	1	*		*		10	2	1.11	0.82	0.13	0.05	0.07	1.3	22	*	*	*	*
L59731-16	D-4 6-16"	6.7	1	0.14	1	0.05	1	68.8	12.5	18.8	9.2	sl	1	39.2	1	0.07	2	5.5	1.3	1	0.15	1	0.9	1	*		*		10	2	1.11	0.47	0.12	0.03	0.06	0.3	21	2.25	U	0.39	23
L59731-17	D-4 19-72 coal	7.5	1	0.2	1		1	77.8	8.3	16.3	2.4	sl	1	61.6	2	0.08	2	2.2	3.2	1	0.18	1	2.3	1	2.25	1	U	1	13	2	1.18	16.9	8.58	0.08	0.13	1.1	4	*	*	*	*
L59731-18	D-5 0-6	7.7	1	0.28	1	0.07	1	65	13.8	21.3	6.2	scl	2	45.9	1	0.07	2	2.8	1.5	1	0.05	1	2.3	1	*		*		11	2	1.22	1.17	0.24	0.06	0.09	0.5	24	*	*	*	*
L59731-19	D-5 6-20"	7.8	1	0.18	1	0.07	1	65	13.8	21.3	6.9	scl	2	47	1	0.02	3	2.4	1.4	1	0.02	1	2.8	1	*		*		12	2	1.09	0.81	0.15	0.05	0.06	0.8	24	*	*	*	*
L59731-20	D-5 20-40"	7	1	0.12	1	0.08	1	63.8	15	21.3	5.8	scl	2	52.2	1	0.02	3	1.7	1	1	0.05	1	2.7	1	*		*		13	3	1.44	0.34	0.1	0.04	0.08	0.9	20	*	*	*	*
L59732-01	D-5 40-60"	6.9	1	0.25	1	0.33	1	37.5	41.3	21.3	13.1	sil	1	52.3	1	0.02	3	2.7	1.6	1	0.28	1	3.3	1	*		*		11	3	1.22	1.33	0.31	0.3	0.08	7.9	18	*	*	*	*
L59732-02	D-6 0-7"	6.9	1	0.28	1	0.11	1	30	47.5	22.5	12.3	sil	1	52.1	1	0.11	1	2.7	1.6	1	0.2	1	3.7	1	*		*		9	1	1	2.48	0.38	0.14	0.45	9	15	*	*	*	*
L59732-03	D-6 24-48	7	1	0.46	1	0.21	1	40	40	20	11.3	sil	1	54.4	1	0.03	3	2.2	1.3	1	0.17	1	3.2	1	*		*		11	3	1.22	3.21	0.76	0.3	0.09	3.3	12	*	*	*	*
L59732-04	D-6 48-72	6.7	1	0.45	1	0.2	1	37.5	42.5	20	8.9	sil	1	51	1	0.13	1	2.4	1.4	1	0.28	1	3.3	1	*		*		9	1	0.81	2.96	0.69	0.28	0.09	2.3	10	*	*	*	*
L59732-05	D-7 0-6"	6.7	1	0.69	1	0.09	1	30	50	20	9.7	sil	1	48.8	1	0.12	1	2.7	1.9	1	0.2	1	2.7	1	*		*		11	3	1.22	4.92	0.72	0.16	0.67	1.9	7	*	*	*	*
L59732-06	D-7 6-20"	7.2	1	0.46	1	0.12	1	30	47.5	22.5	7.1	sil	1	47.3	1	0.01	3	1.9	1.1	1	0.24	1	3.3	1	*		*		11	3	1.22	2.98	0.56	0.17	0.15	0.4	10	*	*	*	*
L59732-07	D-7 20-42"	6.8	1	0.2	1	0.12	1	32.5	46.3	21.3	8.5	sil	1	43.3	1	0.02	3	1.8	0.9	1	0.17	1	3.3	1	*		*		11	3	1.22	0.93	0.32	0.1	0.13	0.8	8	*	*	*	*
L59732-08	D-7 42-58"	6.8	1	0.3	1	0.22	1	32.5	45	22.5	9.1	sicl	2	54.3	1	0.06	2	2.1	1.2	1	0.1	1	2.8	1	*		*		11	2	1.22	1.63	0.42	0.23	0.09	U	8	*	*	*	*
L59732-09	D-7 58-70	7	1	0.48	1	0.13	1	52.5	35	12.5	23.6	loam	1	36.8	1	0.12	1	1.4	0.8	1	0.17	1	0.8	1	*		*		9	1	1	3.35	0.83	0.2	0.11	U	18	*	*	*	*
L59732-10	D-8 0-6"	7	1	0.59	1	0.08	1	52.5	38.8	8.8	20.3	loam	1	64.6	2	0.14	1	4.3	2.5	1	0.32	1	1.2	1	*		*		10	2	1.11	3.91	0.79	0.13	1.11	2.1	25	*	*	*	*
L59732-11	D-8 6-13	7	1	0.28	1	0.14	1	55	35	10	21.3	loam	1	41.5	1	0.14	1	1.9	1.1	1	0.2	1	0.8	1	*		*		9	1	1	1.13	0.28	0.12	0.42	1.7	20	*	*	*	*
L59732-12	D-8 13-20	7	1	0.16	1	0.17	1	55	32.5	12.5	24.2	loam	1	38.8	1	0.09	2	0.7	0.4	1	0.15	1	0.6	1	*		*		10	2	1.11	0.56	0.23	0.11	0.24	0.8	20	*	*	*	*
L59732-13	D-8 20-48	7.2	1	0.18	1	0.17	1	53.8	30	16.3	23.9	loam	1	38	1	0.08	2	0.5	0.3	1	0.1	1	0.6	1	*		*		10	2	1.11	0.6	0.3	0.12	0.22	U	17	*	*	*	*
L59732-14	D-9A 0-6"	7	1	0.45	1	0.09	1	47.5	36.3	16.3	14.4	loam	1	51.6	1	0.1	2	3.4	2	1	0.2	1	2	1	*		*		10	2	1.11	3.48	0.39	0.13	0.2	1	11	*	*	*	*
L59732-15	D-9A 6-12	7.9	1	0.47	1	0.08	1	50	32.5	17.5	15.4	loam	1	47.6	1	0.09	2	3.8	2.2	1	0.1	1	1.9	1	*		*		10	2	1.11	3.25	0.54	0.12	0.09	U	11	*	*	*	*
L59732-16	D-9A 12-30	7.9	1	0.27	1	0.1	1	68.8	18.8	12.5	5.6	sl	1	37.5	1	0.12	1	51	29.6	4	0.15	1	4.2	1	2.31	1	U	1	13	4	1.18	1.33	0.28	0.09	0.1	0.7	3	2.16	U	0.62	27
L59732-17	D9A 30-68	7	1	2.11	1	0.03	1	57.5	25	17.5	2.8	sl	1	56.2	2	0.17	1	35	24.4	4	0.24	1	5.4	1	2.16	1	U	1	14	4	1.27	20.9	11	0.12	0.16	0.8	2	0.91	U	0.06	35
L59732-18	D-9A 80-95	6.7	1	0.35	1	0.07	1	53.8	31.3	15	13.9	loam	1	49	1	0.14	1	7.4	4.3	1	0.24	1	1.7	1	0.91	1	U	1	10	1	0.9	2.34	0.29	0.09	0.15	0.6	9	0.66	U	0.04	15
L59732-20	D-9A 95-115"	6.8	1	0.25	1	0.24	1	55	30	15	15.6	loam	1	51	1	0.13	1	4.1	2.4	1	0.24	1	1.3	1	0.86	1	U	1	10	1	0.8	1.35	0.29	0.22	0.05	1.3	11	0.46	U	0.02	12
L59733-01	D9A 115-145	6.8	1	1.25	1	0.1	1	50	27.5	22.5	18.8	loam	1	42.5	1	0.13	1	0.5	0.3	1	0.17	1	0.5	1	0.57	1	U	1	10	1	0.9	12.7	2.67	0.3	0.35	3.6	13	0.57	U	0.02	5
L59733-02	D-9B 0-6	6.7	1	0.43	1	0.18	1	35	40	25	18	sil	1	41.6	1	0.12	1	2.8	1.7	1	0.32	1	2.4	1	0.46	1	U	1	10	1	0.9	2.76	0.39	0.23	0.32	2.9	20	0.46	U	0.03	24
L59732-03	D-9B 6-12	7.1	1	0.37	1	0.17	1	51.3	31.3	17.5	19.4	loam	1	34.9	1	0.11	1	4.1	2.4	1	0.17	1	2.2	1	0.49	1	U	1	10	1	0.9	2.47	0.39	0.21	0.12	0.9	31	0.49	U	0.52	22
L59733-04	D-9B 12-30	7.8	1	1.81	1	0.07	1	60	26.3	23.8	3.7	loam	1	80.3	1	0.17	1	40	23.1	4	0.17	1	5.1	1	2.27	1	0.007	1	14	4	1.27	18.5	3.87	0.26	0.17	1.5	3	2.27	0.007	1.13	35
L59733-05	D-9B 30-52"	6.7	1	1.77	1	0.04	1	93.8	3.8	2.5	2.9	sand	3	59	2	0.06	2	93	54	4	0.1	1	4.6	1	1.41	1	U	1	17	4	1.54	25.1	1.48	0.16	0.06	1.2	1	1.41	U	0.05	11
L59733-06	D-9B 52-80	7.9	1	1.65	1	0.05	1	60	26.3	13.8	21.5	loam	1	38	1	0.12	1	2.4	1.4	1	0.2	1	0.7	1	1.73	1	U	1	10	1	0.91	20.1	6.54	0.21	0.42	0.4	11	1.73	U	0.03	5
L59733-07	D-9B 80-102	7.5	1	1.73	1	0.06	1	53.8	31.3	15	20.3	loam	1	37.9	1	0.11	1	1.5	0.9	1	0.17	1	0.6	1	0.86	1	U	1	10	1	0.91	19.4	6.62	0.24	0.58	0.4	11	0.86	U	0.01	6
L59733-08	D-10 0-5"	7.3	1	0.63	1	0.16	1	47.5	37.5	15	31.8	loam	1	50.7	1	0.15	1	5.7	3.3	1	0.32	1	1	1	*		*		9	1	1	3.23	0.67	0.23	1.11	1.8	21	*	*	*	*
L59733-09	D-10 5-11	7.3	1	0.28	1	0.4	1	33.8	41.3	25	8.9	sil	1	48.3	1	0.18	1	5.3	3.1	1	0.43	4	1.7	1	*		*		12	4	1.33	1.34	0.28	0.36	0.15	1.5	13	*	*	*	*
L59733-10	D-10 11-23	7.1	1	0.22	1	0.49	1	26.3	35	38.8	3	sicl	2	61.7	2	0.18	1	1.4	0.8	1	0.32	1	0.7	1	*		*		11	2	1.22	0.82	0.25	0.36	0.09	0.9	7	*	*	*	*
L59733-11	D-10 23-35	7.3	1	0.25	1	0.43	1	22.5	35	42.5	2	sic	3	69.6	2	0.17	1	1.2	0.7	1	0.28	1	1	1	*		*		12	3	1.33	0.81	0.39	0.34	0.19	2	8	*	*	*	*
L59733-12	D-11 0-12	7.3	1	0.42	1	0.2	1	42.5	32.5	25	11.7	loam	1	40.8	1	0.1	2	2.8	1.6	1	0.2	1	3.1	1	*		*		10	2	1.11	2.98	0.36	0.26	0.22	1.8	15	*	*	*	*
L59733-13	D-11 12-48	7.4	1	1.63	1	0.06	1	62.5	20	17.5	6.9	sl	1	53.2	1	0.12	1	43	25	4	0.1	1	3.5	1	1.41	1	U	1	13	4	1.18	20.5	2.88	0.23	0.11	0.7	2	1.41	U	0.039	23
L59733-14	D-11 62-82	7.3	1	1.33	1	0.08	1	51.3	30	18.8	6.3	loam	1	44.8	1	0.02	3	6.2	3.6	1	0.05	1	5.3	1	*		*		11	3	1.22	12.8	4.28	0.26	0.16	0.6	9	*	*	*	*
L59733-15	D-12 0-6"	7.3	1	0.42	1	0.18	1	50	37.5	12.5	23.4	loam	1	55.9	2	0.16	1	5.5	3.2	1	0.32	1	0.7	1	*		*		10	2	1.11	2.11	0.82	0.21	1.06	2.6	22	*	*	*	*
L59733-16	D-12 6-14	7.6	1	0.27	1	0.3	1	52.5	33.8	13.8	22.7	loam	1	42.7	1	0.15	1	1.7	1	1	0.24	1	0.7	1	*		*		8	1	1	1.23	0.41	0.26	0.38	2	16	*	*	*	*
L59733-17	D-12 14-28	7.1	1	0.21	1	0.35	1	51.3	36.3	12.5	18.8	loam	1	36.5	1	0.12	1	1.2	0.7	1	0.17	1	0.5	1	*		*		9	1	1	0.82	0.31	0.27	0.2	1.9	13	*	*	*	*
L59733-18	D-12 28-48	7.6	1	0.25	1	0.32	1	53.8	27.5	18.8	17.2	loam	1	36.4	1	0.03	3	0.7	0.4	1	0.1	1	0.6	1	*		*		11	3	1.22	1.15	0.36	0.28	0.18	1.8	11	*	*	*	*
L59733-19	D-12 48-66	6.8	1	0.3	1	0.27	1	56.3	25	18.8	23.6	loam	1	38	1	0.03	3	0.3	0.2	1	0.05	1	2.6	1	*		*		11	3	1.22	1.63	0.33	0.27	0.09	1.9	11	*	*	*	*
L59733-20	2A-1 0-10"	7	1	0.31	1	0.19	1	57.5	30	12.5	24.8	loam	1	45.8	1	0.15	1	2	1.2	1	0.32	1	0.5	1	*		*		9	1	1	1.59	0.45	0.2	0.52	4.4	14	*	*	*	*
L59734-01	2A-1 10-24	7.1	1	0.29	1	0.37	1	50	30	20	15.5	loam	1	34.6	1	0.09	2	0.7	0.4	1	0.17	1	0.5	1	*		*		10	2	1.11	1.33	0.51	0.36	0.34	7.4	39	*	*	*	*
L59734-02	2A-1 24-44	7.7	1	0.19	1	0.2	1	35	37.5	27.5	14.1	cl	2	44.3	1	0.06	2	0.7	0.4	1	0.17	1	6.1	1	*		*		11	2	1.22	1.26	0.25	0.18	0.06	34	17	*	*	*	*
L59734-03	2A-1 44-65	6.8	1	0.24	1	0.39	1	42.5	31.3	26.3	12.2	loam	1	40.6	1	0.04	3	0.3	0.2	1	0.1	1	12.2	1	*		*		11	2	1.22	1.37	0.29	0.36	0.08	7.6	8	*	*	*	*
L59734-04	2A-1 66-80	7.3	1	0.24	1	0.41	1	55	25	20	15.8	loam	1	34.3	1	0.03	3	0.3	0.2	1	0.06	1	14.8	1	*		*		11	3	1.22	1.51	0.34	0.4	0.08	6.4	9	*	*	*	*
L59734-05	2A-2 0-5"	7.3	1	0.31	1	0.33	1	47.5	36.3	16.3	19.6	loam	1	44.3	1	0.14	1	1.4	0.8	1	0.32	1	0.8	1	*		*		9	1	1	1.47	0.46	0.33	0.49	5.2	17	*	*	*	*
L59734-06	2A-2 5-14	7.3	1	0.32	1	0.33	1	48.8	36.3	15	21.9	loam	1	45.2	1	0.13	1	2.4	1.4	1	0.24	1	0.6	1	*		*		9	1	1	1.49	0.44	0.33	0.81	7	27	*	*	*	*
L59734-07	2A-2 14-25	7.6	1	0.16	1	0.43	1	35	46.3	18.8	13.1	sil	1	32.3	1	0.11	1	0.9	0.5	1	0.24	1	0.5	1	*		*		9	1	1	0.65	0.23	0.29	0.2	47	17	*	*	*	*
L59734-08	2A-2 25-38	7.5	1	0.12	1	0.37	1	37.5	36.3	26.3	15.8	sil	1	37.8	1	0.09	2	0.3	0.2	1	0.24	1	0.7	1	*		*		10	2	1.11	0.47	0.23	0.22	0.12	41.8	10	*	*	*	*
L59734-09	2A-3 0-9"	7.6	1	0.2	1	0.23	1	56.3	32.5	11.3	27.1	loam	1	45.5	1	0.13	1	2.9	1.7	1	0.32	1	0.6	1	*		*		9	1	1	0.9	0.28	0.18	0.54	9.7	14	*	*	*	*
L59734-10	2A-3 9-19	7.8	1	0.14	1	0.33	1	45	33.8	21.3	9	loam	1	33.6	1	0.1	2	1.2	0.7	1	0.17	1	0.5	1	*		*		10	2	1.11	0.47	0.23	0.2	0.21	5.1	9	*	*	*	*
L59734-11	2A-3 19-36	7.4	1	0.14	1	0.41	1	47.5	30	22.5	18	loam	1	32	1	0.07	2	0.9	0.5	1	0.15	1	0.5	1	*		*		10	2	1.11	0.54	0.19	0.25	0.11	4.1	9	*	*	*	*
L59734-12	2A-3 36-62	7.6	1	0.19	1	0.33	1	31.3	40	28.8	19.4	sil	1	42.6	1	0.04	3	0.9	0.5	1	0.15	1	0.8	1	*		*		11	3	1.22	1.08	0.31	0.28	0.07	11.1	33	*	*	*	*
L59734-13	2A-5 0-6"	7.3	1	0.36	1	0.38	1	46.3	37.5	16.3	19.3	loam	1	44.7	1	0.08	2	3.1	1.8	1	0.2	1	0.8	1	*		*		10	2	1.11	1.87	0.52	0.42	0.68	11.4	25	*	*	*	*
L59734-14	2A-5 6-12	7.8	1	0.36	1	0.33	1	46.3	32.5	21.3	12.6	loam	1	38.6	1	0.06	2	2.4	1.4	1	0.1	1	0.7	1	*		*		10	2	1.11	2.15	0.42	0.38	0.54	6.5	14	*	*	*	*
L59734-15	2A-5 12-24	7.8	1	0.11	1	0.38	1	28.8	40	31.3	7.2	sicl	2	39.2	1	0.09	2	0.9	0.5	1	0.17	1	0.5	1	*		*		11	2	1.22	0.37	0.24	0.21	0.26	4.2	7	*	*	*	*
L59734-16	2A-5 24-48	7.8	1	0.09	1	0.42	1	22.5	37.5	40	4.8	sicl/sic	3	47.3	1	0.08	2	0.7	0.4	1	0.18	1	0.7	1	*		*		12	3	1.33	0.24	0.31	0.22	0.28	7	8	*	*	*	*
L59734-17	2A-6 0-6"	7.7	1	0.23	1	0.16	1	47.5	37.5	15	18	loam	1	40.9	1	0.17	1	0.6	1.2	1	0.32	1	0.7	1	*		*		9	1	1	1.14	0.43	0.15	0.75	7.2	24	*	*	*	*
L59734-18	2A-6 6-12	7.8	1	0.19	1	0.21	1	50	33.8	16.3	24.3	loam	1	38.8	1	0.24	1	2.4	1.3	1	0.24	1	0.7	1	*		*		9	1	1	0.84	0.31	0.16	0.82	5.3	22	*	*	*	*
L59734-19	2A-6 12-24	7.5	1	0.18	1	0.43	1	45	38.8	16.3	15.5	loam	1	39.2	1	0.15	1	1.7	1	1	0.24	1	0.7	1	*		*		9	1	1	0.96	0.31	0.35	0.1	3.5	19	*	*	*	*
L59734-20	2A-6 24-40	7.5	1	0.22	1	0.42	1	45	38.8	16.3	14.9	loam	1	42.8	1	0.16	1	1.7	1	1	0.24	1	0.7	1	*		*		9	1	1	1.27	0.44	0.39	0.24	6.1	23	*	*	*	*
L59735-01	2A-6 40-60	7.4	1	0.51	1	1.39	1	50	25	25	13.6	loam	1	31.6	1	0.14	1	0.9	0.5	1	0.24	1	1.4	1	*		*		9	1	1	1.54	0.73	1.48	0.39	3.9	31	*	*	*	*
L59735-02	2A-6 60-80	7.2	1	0.35	1	1.09	1	47.5	27.5	25	19.2	loam	1	32.9	1	0.11	1	0.7	0.4	1	0.17	1	1	1	*		*		9	1	1	0.99	0.64	0.98	0.29	3.6	28	*	*	*	*
L59735-03	2A-7 0-7"	7.8	1	0.35	1	0.55	1	55	25	20	20.4	loam	1	47.8	1	0.11	1	2	1.2	1	0.2	1	0.6	1	*		*		9	1	1	1.24	0.45	0.51	0.74	4.6	17	*	*	*	*
L59735-04	2A-7 7-20	7.6	1	0.4	1	0.43	1	51.3	26.3	22.5	21.2	loam	1	37.4	1	0.1	2	1	0.6	1	0.17	1	0.6	1	*		*		10	2	1.11	1.45	0.49	0.43	0.6	3.8	17	*	*	*	*
L59735-05	2A-7 20-38	7.2	1	0.28	1	0.43	1	50	26.3	23.8	22.8	loam	1	34.2	1	0.06	2	1	0.3	1	0.1	1	0.5	1	*		*		10	2	1.11	1.06	0.41	0.37	0.3	1.9	14	*	*	*	*
L59735-06	2B-1 0-9"	7.6	1	0.3	1	0.18	1	58.8	21.3	20	9.8	l	1	49.7	1	0.15	1	2.2	1.3	1	0.2	1	0.8	1	*		*		9	1	1	1.11	0.42	0.16	0.78	7.9	17	*	*	*	*
L59735-07	2B-1 9-19	7	1	0.15	1	0.37	1	31.3	35	33.8	8.5	sicl	2	41	1	0.15	1	0.9	0.5	1	0.17	1	0.9	1	*		*		10	2	1.11	0.67	0.22	0.25	0.11	3.2	5	*	*	*	*
L59735-08	2B-1 19-33	7	1	0.29	1	0.44	1	16.3	40	43.8	15.7	sicl	2	51.6	1	0.11	1	0.9	0.5	1	0.1	1	1	1	*		*		10	2	1.11	1.42	0.35	0.42	0.08	4.2	8	*	*	*	*
L59735-09	2B-1 33-51	7.3	1	0.42	1	0.24	1	30	36.3	33.8	8.7	sicl	2	43.4	1	0.02	3	0.5	0.3	1	0.1	1	6.1	1	*		*		12	3	1.33	2.52	0.58	0.31	0.06	4.4	3	*	*	*	*
L59735-10	1A-1 0-6"	7.1	1	0.54	1	0.07	1	36.3	43.8	20	20.6	sil	1	59.2	2	0.16	1	4.8	2.8	1	0.43	4	0.8	1	*		*		13	4	1.44	3.16	0.78	0.11	1.19	5.4	32	*	*	*	*
L59735-11	1A-1 6-17	7.5	1	0.25	1	0.11	1	36.3	45	18.8	18.2	sil	1	45.8	1	0.13	1	1	0.6	1	0.24	1	0.3	1	*		*		9	1	1	1.11	0.36	0.1	0.36	4.2	27	*	*	*	*
L59735-12	1A-1 17-28	7.1	1	0.16	1	0.15	1	40	37.5	22.5	20.7	l	1	39.5	1	0.09	2	0.7	0.4	1	0.17	1	0.3	1	*		*		10	2	1.11	0.55	0.27	0.1	0.25	3.9	19	*	*	*	*
L59725-13	1A-1 28-60	7.5	1	0.22	1	0.51	1	36.3	35	28.8	19.1	cl	2	40.9	1	0.06	2	0.3	0.2	1	0.1	1	0.5	1	*		*		11	2	1.22	0.89	0.24	0.39	0.07	4.5	25	*	*	*	*
L59735-14	1A-1 80-100	7.1	1	0.27	1	0.78	1	43.8	30	26.3	18.5	l	1	42.2	1	0.08	2	0.3	0.2	1	0.1	1	0.6	1	*		*		10	2	1.11	0.96	0.23	0.59	0.07	3.1	22	*	*	*	*
L59735-15	1A-2 15-25	7.7	1	0.48	1	0.17	1	48.8	32.5	18.8	18.2	l	1	47.3	1	0.14	1	3.4	2	1	0.24	1	1	1	*		*		10	2	1.11	3.73	0.25	0.24	0.19	4.1	10	*	*	*	*
L59735-16	1A-2 25-40	7.5	1	0.62	1	0.14	1	45	38.8	16.3	18.1	l	1	47.7	1	0.15	1	2.4	1.3	1	0.24	1	0.8	1	*		*		9	1	1	4.3	0.38	0.22	0.14	4.6	23	*	*	*	*
L59735-17	1A-2 40-60	7.7	1	0.76	1	0.15	1	42.5	38.8	18.8	19.1	l	1	44.3	1	0.15	1	1.5	0.9	1	0.24	1	0.8	1	*		*		9	1	1	5.92	0.79	0.29	0.32	4	33	*	*	*	*
L59735-18	1A-2 60-75	7.4	1	0.45	1	0.16	1	46.3	35	18.8	18.1	l	1	40.9	1	0.12	1	1.7	1	1	0.17	1	0.8	1	*		*		9	1	1	3.26	0.35	0.22	0.15	3.5	34	*	*	*	*
L59735-19	1A-2 75-90	7.1	1	1.25	1	0.13	1	43.8	38.8	17.5	16.3	l	1	55.8	1	0.09	2	1.5	0.9	1	0.17	1	0.8	1	*		*		10	2	1.11	11.4	1.19	0.33	0.62	2.9	56	*	*	*	*
L59735-20	1B-1 0-7	7.1	1	0.68	1	0.11	1	41.3	42.5	16.3	16.4	l/sil	1	64.4	2	0.15	1	5.3	3.1	1	0.43	4	0.9	1	*		*		13	4	1.44	3.71	1.06	0.17	1.69	5	47	*	*	*	*
L59736-01	1B-1 7-15	7	1	0.48	1	0.57	1	42.5	40	17.5	16.6	l	1	130	4	0.15	1	1.4	0.8	1	0.24	1	0.6	1	*		*		12	4	1.33	1.81	0.46	0.61	0.82	4.1	34	*	*	*	*
L59736-02	1B-1 15-28	7.4	1	0.33	1	1.25	1	42.5	45	12.5	17.8	sil	1	86.7	3	0.11	1	0.7	0.4	1	0.24	1	0.4	1	*		*		11	3	1.22	0.71	0.21	0.85	0.38	4.4	25	*	*	*	*
L59736-03	1B-1 28-60	7	1	0.29	1	0.88	1	57.5	30	12.5	18.3	l	1	29.9	1	0.02	3	0.2	0.1	1	0.05	1	0.3	1	*		*		11	3	1.33	0.68	0.21	0.6	0.23	4.1	18	*	*	*	*

[1] R = Soil Suitability Rating (see Table 2)
Good = 1, Fair = 2, Poor = 3 Unsuitable = 4
[2] See explanation of abbreviation in footnote on Table 2
[3] See pedon descriptions in Appendix 2
[4] See K-factor, assumptions, calculations and input parameters in Table 7
[5] Ley, et al. Field Evaluation and Comparison of Techniques for Measuring Soil Water, Table 1
[6] Not analyzed/data not available
U - tested below ACZ Lab detection limits

Table 7

Kinney #2 Mine Order 2 Soil Survey - Erodibility Factor Calculations and Input Parameters

Lab ID	Sample ID	Sand	Silt	Clay	very fine sand	Organic Matter	Structure	Permeability	Fine Earth Fraction Soil Erodibility Factor	Whole Soil (includes coarse fragments) Erodibility Factor
		2.0 - 0.1 mm	0.1 - 0.002 mm	< 0.002 mm	%	(%)*	S[1]	P[2]	Kf[3]	Kw[3]
L59731-01	D-1 0-6"	73	11	34	8.5	2.4	1	2	0.24	0.05
L59731-02	D-1 6-16	70	15	15	12.2	4	2	2	0.2	0.05
L59731-03	D-1 6-25"	76	8	16	8.1	1.2	4	2	0.2	0.1
L59731-04	D-1 25-40"	85	13	14	11.4	1.5	4	2	0.2	0.1
L59731-05	D-1 40-65"	30	8	13	8.5	1	4	2	0.2	0.1
L59731-06	D-1 65-90"	31	4	13	31.8	0.9	4	2	0.15	0.05
L59731-07	D-2 0-6"	78	8	15	8.9	1.9	1	2	0.24	0.02
L59731-08	D-2 6-24"	79	8	14	1.9	0.5	2	2	0.2	0.02
L59731-09	D-3 0-10"	73	9	19	7.6	4	2	2	0.24	0.15
L59731-10	D-3 10-20"	71	11	18	7.4	2.9	4	2	0.2	0.1
L59731-11	D-3 20-40"	73	9	19	8.9	2.7	4	2	0.2	0.1
L59731-12	D-3 40-60 "	73	10	18	6.9	3.1	4	2	0.2	0.05
L59731-13	D-3 60-75"	73	10	18	7.4	3.2	4	2	0.2	0.05
L59731-14	D-3 coal	71	14	15	1.9	5.2	4	2	0.24	0.05
L59731-15	D-4 0-8 "	71	11	18	9.1	2.4	4	2	0.24	0.15
L59731-16	D-4 8-16"	69	13	19	9.2	5.5	4	2	0.24	0.15
L59731-17	D-4 19-72 coal	78	6	16	2.4	2.2	4	2	0.2	0.15
L59731-18	D-5 0-6	65	14	21	6.2	2.6	4	4	0.28	0.05
L59731-19	D-5 6-20"	65	14	21	6.9	2.4	4	4	0.24	0.02
L59731-20	D-5 20-40"	64	15	21	5.8	1.7	4	4	0.24	0.05
L59732-01	D-5 40-60"	38	41	21	13.1	2.7	4	4	0.28	0.28
L59732-02	D-6 0-7"	30	48	23	12.3	2.7	4	4	0.55	0.2
L59732-03	D-6 24-48	40	40	20	11.3	2.2	4	4	0.43	0.17
L59732-04	D-6 48-72	38	43	20	8.9	2.4	4	4	0.43	0.28
L59732-05	D-7 0-6"	30	50	20	9.7	2.7	4	3	0.55	0.2
L59732-06	D-7 6-20"	30	48	23	7.1	1.9	4	3	0.43	0.24
L59732-07	D-7 20-42"	33	46	21	8.5	1.5	4	3	0.43	0.17
L59732-08	D-7 42-58"	33	45	23	9.1	2.1	4	5	0.32	0.1
L59732-09	D-7 58-70	53	35	13	23.6	1.4	4	3	0.32	0.17
L59732-10	D-8 0-6"	53	39	9	20.3	4.3	2	3	0.37	0.32
L59732-11	D-8 6-13	55	35	10	21.1	1.9	2	3	0.32	0.2
L59732-12	D-8 13-20	55	33	13	24.2	0.7	4	3	0.32	0.15
L59732-13	D-8 20-48	54	30	16	23.9	0.5	4	3	0.32	0.1
L59732-14	D-9A 0-6"	48	36	16	14.4	3.4	4	3	0.37	0.2
L59732-15	D-9A 6-12	50	33	18	15.4	3.8	4	3	0.32	0.1
L59732-16	D-9A 12-30	69	19	13	5.6	51	4	2	0.2	0.15
L59732-17	D9A 30-68	58	25	18	2.6	35	4	3	0.32	0.24
L59732-18	D-9A 80-95	54	31	15	13.9	7.4	3	3	0.32	0.24
L59732-20	D-9A 95-115"	55	30	15	15.5	4.1	4	3	0.32	0.24
L59733-01	D9A 115-145	50	28	16	18.9	0.5	4	3	0.32	0.17
L59733-02	D-9B 0-6	35	40	25	15.0	2.9	4	3	0.55	0.32
L59732-03	D-9B 6-12	51	31	18	19.4	4.1	4	3	0.32	0.17
L59733-04	D-9B 12-30	50	26	24	3.7	40	4	1	0.1	0.17
L59733-05	D-9B 30-52"	94	4	3	2.9	93	4	2	0.15	0.1
L59733-06	D-9B 52-80	60	27	14	21.5	2.4	4	2	0.2	0.2
L59733-07	D-9B 80-102	54	31	15	20.3	1.5	4	3	0.32	0.17
L59733-08	D-10 0-5"	48	38	15	31.8	5.7	3	3	0.37	0.32
L59733-09	D-10 5-11	34	41	25	8.9	5.3	4	3	0.43	0.43
L59733-10	D-10 11-23	26	35	39	3.0	1.4	4	5	0.32	0.32
L59733-11	D-10 23-35	23	35	43	2.0	1.2	4	6	0.28	0.28
L59733-12	D-11 0-12	43	33	25	11.7	2.8	4	3	0.37	0.2
L59733-13	D-11 12-48	63	20	18	6.9	43	4	2	0.2	0.1
L59733-14	D-11 62-82	51	30	19	6.3	6.2	4	3	0.32	0.05
L59733-15	D-12 0-6"	50	36	13	23.4	5.5	2	3	0.37	0.32
L59733-16	D-12 6-14	53	34	14	22.7	1.7	2	3	0.32	0.24
L59733-17	D-12 14-28	51	36	13	18.8	1.2	4	3	0.32	0.17
L59733-18	D-12 28-48	54	28	19	17.2	0.7	4	3	0.32	0.1
L59733-19	D-12 48-66	56	25	19	23.6	0.3	4	3	0.32	0.05
L59733-20	2A-1 0-10"	58	30	13	24.3	2	2	3	0.37	0.32
L59734-01	2A-1 10-24	50	30	20	15.5	0.7	4	3	0.32	0.17
L59734-02	2A-1 24-44	35	38	28	14.1	0.7	4	4	0.32	0.17
L59734-03	2A-1 44-65	43	31	26	12.2	0.3	4	3	0.32	0.1
L59734-04	2A-1 65-80	55	25	20	13.5	0.3	4	3	0.32	0.05
L59734-05	2A-2 0-5"	48	36	16	19.6	1.4	2	3	0.37	0.32
L59734-06	2A-2 5-14	49	36	15	21.9	2.4	2	3	0.32	0.24
L59734-07	2A-2 14-25	35	46	19	13.1	0.9	4	3	0.43	0.24
L59734-08	2A-2 25-38	38	36	26	15.6	0.3	4	3	0.43	0.24
L59734-09	2A-3 0-9"	56	33	11	27.1	2.9	2	3	0.37	0.32

Table 7 **Kinney #2 Mine Order 2 Soil Survey - Erodibility Factor Calculations and Input Parameters**

L59734-10	**2A-3 9-19**	45	34	21	9.0	1.2	4	3	0.32	0.17
L59734-11	**2A-3 19-36**	48	30	23	18.0	0.9	4	3	0.32	0.15
L59734-12	**2A-3 36-52**	31	40	29	19.4	0.9	4	3	0.43	0.15
L59734-13	**2A-5 0-6"**	46	38	16	19.3	3.1	2	3	0.37	0.2
L59734-14	**2A-5 6-12**	46	33	21	12.6	2.4	4	3	0.32	0.1
L59734-15	**2A-5 12-24**	29	40	31	7.2	0.9	4	5	0.32	0.17
L59734-16	**2A-5 24-48**	23	38	40	4.8	0.7	4	6	0.28	0.18
L59734-17	**2A-6 0-6"**	48	39	15	18.0	0.6	2	3	0.37	0.32
L59734-18	**2A-6 6-12**	50	26	16	24.3	2.4	2	3	0.32	0.24
L59734-19	**2A-6 12-24**	45	39	16	15.5	1.7	4	3	0.32	0.24
L59734-20	**2A-6 24-40**	45	25	16	14.9	1.7	4	3	0.32	0.24
L59735-01	**2A-6 40-60**	50	28	25	13.6	0.9	4	3	0.32	0.24
L59735-02	**2A-6 60-80**	48	34	25	19.2	0.7	4	3	0.32	0.17
L59735-03	**2A-7 0-7"**	55	27	20	20.4	2	2	3	0.37	0.2
L59735-04	**2A-7 7-20**	51	21	23	21.2	1	4	3	0.32	0.17
L59735-05	**2A-7 20-38**	50	27	24	22.6	0.5	4	3	0.32	0.1
L59735-06	**2B-1 0-9"**	59	21	20	9.6	2.2	2	3	0.37	0.2
L59735-07	**2B-1 9-19**	31	35	34	8.5	0.9	4	5	0.32	0.17
L59735-08	**2B-1 19-33**	16	40	44	15.7	0.9	4	5	0.32	0.1
L59735-09	**2B-1 33-51**	30	36	34	8.7	0.5	4	5	0.32	0.1
L59735-10	**1A-1 0-6"**	36	44	20	20.6	4.5	2	3	0.55	0.43
L59735-11	**1A-1 6-17**	36	45	19	18.2	1	4	3	0.43	0.24
L59735-12	**1A-1 17-28**	40	38	23	20.7	0.7	4	3	0.32	0.17
L59725-13	**1A-1 28-60**	36	35	29	19.1	0.3	4	4	0.32	0.1
L59735-14	**1A-1 60-100**	44	30	27	18.5	0.3	4	3	0.32	0.1
L59735-15	**1A-2 15-25**	49	33	19	18.2	3.4	2	3	0.37	0.24
L59735-16	**1A-2 25-40**	45	39	17	18.1	2.4	4	3	0.32	0.24
L59735-17	**1A-2 40-60**	43	39	19	19.1	1.5	4	3	0.32	0.24
L59735-18	**1A-2 60-75**	46	35	19	16.1	1.7	4	3	0.32	0.17
L59735-19	**1A-2 75-90**	44	39	18	16.3	1.5	4	3	0.32	0.17
L59735-20	**1B-1 0-7**	41	43	16	16.4	5.3	3	3	0.55	0.43
L59736-01	**1B-1 7-15**	43	40	18	16.6	1.4	3	3	0.32	0.24
L59736-02	**1B-1 15-28**	43	45	13	17.6	0.7	4	3	0.43	0.24
L59736-03	**1B-1 28-60**	58	30	13	18.3	0.2	4	3	0.05	0.05

* Organic matter percentage calculated by multiplying Total Organic Carbon by 1.72

[1] Soil Structure Class

1 Very fine Granular
2 Fine granular
3 Coarse granular
4 Blocky, platy, or massive

Source: Soil Erodibility nomograph of Wischmeier et al. (1971) - Wischmeier, W.H. and Smith, D.D. (1978). Predicting rainfall erosion losses - A guide to conservative planning, Agriculture Handbook No. 537. U.S. Department of Agriculture, Washington, D.C.

[2] Permeability Class for Major Textural Class

Permeability Class	Texture	Hydrologic Soil Group
6 Very slow	Silty clay, clay	D
5 Slow	Silty clay loam, sandy cl	C-D
4 Slow to Moderate	Sandy clay loam, clay lo	C-D
3 Moderate	Loam, silt loam	B
2 Moderate to Rapid	Loamy sand, sandy loan	A
1 Rapid	Sand	A+

Source: Rawls et al. (1982) - Rawls, W.J., Brakensiek, D.L., and Saxton, K.E. (1982). Estimation of Soil Water Properties Trans. Am. Soc. Agric. Eng. 25(5): 1316-1320.

[3] Erodibility Factor (Kw and Kf) calculated based on Section 618.45, pgs. 618-30 to 618-32, National Soil Suvrey Handbook. 1993. Soil Conservation Science. Handbook Number 430. U.S. Government Printing Office, Washington, D.C.

Table 8
Kinney #2 Mine Order 2 Soil Survey - Summary of Soil Limitations, Salvage Depths, and Salvageable Volumes

Map Unit	Map Unit	Map Unit	% of Map Unit[1]	Map Unit Area in Proposed Disturbance	Soil Depth Class	Primary Limitations	Range in Depth of Salvageable Primary Plant Growth Medium[2]	Average Depth of Salvageable Primary Plant Growth Medium[2]	Estimated Volume of Salvageable Primary Plant Growth Medium within the Proposed Disturbance
ID #	Name	Component		Acres	Inches		Inches	Inches	Cubic Yards
DA	Disturbed Lands, 0-20 percent slopes	Disturbed Soil	90%	12.70	40-60 plus	available water capacity, coal fines, Total Organic Carbon %	6 to 24	15	25,611.8
		Lo-sk Typic Haploxeroll	10%	1.40		high rock fragment content, availble water capacity	6 to 20	13	2,446.9
DB	Disturbed Lands, 20-50 percent slopes	Disturbed Soils	80%	4.89	60 plus	high rock fragments, coal fines, Total Organic Carbon%	6 to 20	13	8,546.7
		Lo-sk Typic Haploxeroll	10%	0.61		high rock fragment content, steep slopes	7 to 28	17	1,394.2
		Fi-lo Typic Argixeroll	10%	0.61			25-40	30	2,460.3
1B	Coarse-loamy Typic Argicryoll Consociation, 35-70 percent slopes	Co-lo Typic Haplocryoll	80%	0.48	60 plus		20-48	34	2,194.1
		Disturbed Soils*	10%	0.16	40-60	high clay content, K factor, steep slopes	5 to 11	8	172.1
		Lo-sk Typic Argicryoll	10%	0.16	40-60	high rock fragment content, K Factor	14-28	21	451.7
2A	Typic Argixeroll - Typic Haploxeroll Complex, 0-35 percent slopes	Lo-sk Typic Argixeroll	50%	2.27	20-60	high rock content, avalable water capacity	20-60	40	12,207.6
		Lo-sk Typic Haploxeroll	35%	1.58			20-38	29	6,160.3
		Inclusions	15%	0.67	60 plus		24-60	37	3,332.9
2B	Typic Argixeroll Consociation, 35-70 percent slopes	Lo-sk Typic Argixeroll	80%	1.30	40-60	high clay content, K factor, steep slopes	9 to 19	14	2,446.9
		Disturbed Soils*	10%	0.16	40-60	coal fines, Total Carbon	6 to 20	13	279.6
		shallow to bedrock inclusion*	10%	0.16	10 to 20	bedrock less than 20 inches	0-15	7	150.6
3A	Cumulic Haplocryoll, fine-loamy , 0-3 percent slopes	Cumulic Haplocryoll, fi-lo	80%	0.08	60 plus	high silt content	12 to 24	18	193.6
		Typic Endoaquoll co-lo	20%	0.02	60 plus	Typic Endoaquoll, Disturbed surfaces	12 to 20	16	43.0
				27.3					68,092.4

[1] Percentage of components in map unit.

[2] Primary Plant Growth Medium = Suitability Ratings (See Table 2) of 1 or 2.

* Suitable topsoil for this soil map unit component estimated by interence to soils with similar gnetic characteristics found in the area

Version 1/1/2008

Appendix 1. ACZ Laboratories, Inc.

Laboratory Analysis Sheets

Results	ANALYTE																				
CLIENTID	Acid Generation Potential (cal	Acid Neutralization Potential	Acid-Base Potential (calc on S	Boron, soluble (Hot Water)	Calcium, soluble (Sat. Paste)	Carbon, total organic (TOC)	Clay	Conductivity @25C	Magnesium, soluble (Sat. Paste	Neutralization Potential as Ca	Nitrate as N, extractable (KCL	Nitrate/ Nitrite as N, extracta	Nitrite as N, extractable (KCL	Nitrogen, total Kjeldahl	pH, Saturated Paste	Phosphorus, extractable (AB-DT	Potassium, extractable (AB-DTP	Potassium, soluble (Sat. Paste	Sand	Saturation Percent	Selenium, soluble (Hot Water)
1A-1 0-6"					3.15	2.60	20.00	0.54	0.78	0.80	5.40	6.10	0.70	0.27	6.80	32.00	430.00	1.19	36.30	59.20	
1A-1 17-28"					0.55	0.40	22.50	0.16	0.27	0.30	3.90	4.50	0.60	0.04	6.40	19.00	190.00	0.25	40.00	39.50	
1A-1 28-60"					0.89	0.20	28.80	0.22	0.24	0.50	4.50	5.20	0.70	0.03	6.70	25.00	130.00	0.07	36.30	40.90	
1A-1 60-100"					0.96	0.20	26.30	0.27	0.23	0.60	3.10	3.90	0.80	0.02	7.00	22.00	90.00	0.07	43.80	42.20	
1A-1 6-17"					1.11	0.60	18.80	0.25	0.36	0.30	4.20	4.90	0.70	0.05	6.50	27.00	210.00	0.36	36.30	45.80	
1A-2 15-25"					3.73	2.00	18.80	0.48	0.25	1.00	4.10	5.00	0.90	0.19	7.20	10.00	150.00	0.19	48.80	47.30	
1A-2 25-40"					4.30	1.30	16.30	0.52	0.38	0.80	4.60	5.30	0.70	0.14	7.30	23.00	130.00	0.14	45.00	47.70	
1A-2 40-60"					5.92	0.90	18.80	0.76	0.79	0.60	4.00	4.90	0.90	0.09	7.50	33.00	200.00	0.32	42.50	44.30	
1A-2 60-75"					3.26	1.00	18.80	0.45	0.35	0.80	3.50	4.40	0.90	0.09	7.50	34.00	160.00	0.15	46.30	40.90	
1A-2 75-90"					11.40	0.90	17.50	1.25	1.19	0.80	2.90	3.50	0.60	0.08	7.40	56.00	250.00	0.62	43.80	55.80	
1B1 0-7"					3.71	3.10	16.30	0.68	1.06	0.90	5.00	5.70	0.70	0.22	6.90	47.00	520.00	1.69	41.30	64.40	
1B1 15-28"					0.71	0.40	12.50	0.33	0.21	0.40	4.40	4.90	0.50	0.07	6.30	25.00	180.00	0.38	42.50	86.70	
1B1 28-60"					0.68	0.10	12.50	0.29	0.21	0.30	4.10	4.80	0.70	0.02	6.30	18.00	90.00	0.23	57.50	29.90	
1B1 7-15"					1.81	0.80	17.50	0.48	0.46	0.60	4.10	4.80	0.70	0.07	6.60	34.00	310.00	0.82	42.50	130.00	
2A-1 0-10"					1.59	1.20	12.50	0.31	0.45	0.50	4.40	4.70	0.30	0.16	6.60	14.00	280.00	0.52	57.50	46.80	
2A-1 10-24"					1.33	0.40	20.00	0.29	0.51	0.50	7.40	8.00	0.60	0.07	6.70	39.00	220.00	0.34	50.00	34.60	
2A-1 24-44"					1.26	0.40	27.50	0.19	0.25	8.10	34.00	35.00	0.70	0.05	7.50	17.00	120.00	0.06	35.00	44.30	
2A-1 44-65"					1.37	0.20	26.30	0.24	0.29	12.20	7.60	8.40	0.80	0.02	7.70	8.00	90.00	0.08	42.50	40.60	
2A-1 65-80"					1.51	0.20	20.00	0.24	0.34	14.80	6.40	7.10	0.70	0.03	7.80	9.00	60.00	0.08	55.00	34.30	
2A-2 0-5"					1.47	0.80	16.30	0.31	0.46	0.80	5.20	6.00	0.80	0.07	7.00	17.00	290.00	0.49	47.50	44.30	
2A-2 14-25"					0.65	0.50	18.80	0.16	0.23	0.50	47.00	47.70	0.70	0.04	6.90	17.00	210.00	0.20	35.00	32.30	
2A-2 25-38"					0.47	0.20	26.30	0.12	0.23	0.70	41.80	42.50	0.70	0.05	6.90	10.00	160.00	0.12	37.50	37.80	
2A-2 5-14"					1.49	1.40	15.00	0.32	0.44	0.60	7.00	7.80	0.80	0.22	7.00	27.00	450.00	0.91	48.80	45.20	
2A-3 0-9"					0.90	1.70	11.30	0.20	0.28	0.60	9.70	9.70		0.07	6.70	14.00	320.00	0.54	56.30	45.50	
2A-3 19-36"					0.54	0.50	22.50	0.14	0.19	0.50	4.10	4.80	0.70	0.01	6.70	9.00	110.00	0.11	47.50	32.00	
2A-3 36-52"					1.08	0.50	28.80	0.19	0.31	0.80	11.10	11.80	0.70	0.04	7.20	33.00	130.00	0.07	31.30	42.60	
2A-3 9-19"					0.47	0.70	21.30	0.14	0.23	0.50	5.10	5.80	0.70	0.14	6.80	9.00	240.00	0.21	45.00	33.60	
2A-5 0-6"					1.87	1.80	16.30	0.36	0.52	0.80	11.40	11.40		0.18	6.80	25.00	340.00	0.68	46.30	44.70	
2A-5 12-24"					0.37	0.50	31.30	0.11	0.24	0.50	4.20	4.90	0.70	0.06	7.00	7.00	240.00	0.26	28.80	39.20	
2A-5 24-48"					0.24	0.40	40.00	0.09	0.31	0.70	7.00	7.70	0.70	0.05	7.00	8.00	240.00	0.25	22.50	47.30	
2A-5 6-12"					2.15	1.40	21.30	0.36	0.42	0.70	6.50	7.10	0.60	0.11	7.00	14.00	350.00	0.54	46.30	39.60	
2A-6 0-6"					1.14	1.20	15.00	0.23	0.43	0.70	7.20	7.90	0.70	0.16	7.00	24.00	410.00	0.75	47.50	40.90	
2A-6 12-24"					0.96	1.00	16.30	0.18	0.31	0.70	3.50	4.10	0.60	0.10	7.20	19.00	160.00	0.10	45.00	39.20	
2A-6 24-40"					1.27	1.00	16.30	0.22	0.44	0.70	6.10	6.80	0.70	0.11	7.00	23.00	230.00	0.24	45.00	42.80	
2A-6 40-60"					1.54	0.50	25.00	0.51	0.73	1.40	3.90	4.90	1.00	0.04	7.90	31.00	190.00	0.39	50.00	31.60	
2A-6 60-80"					0.99	0.40	25.00	0.35	0.64	1.00	3.60	4.40	0.80	0.03	7.90	28.00	180.00	0.29	47.50	32.90	
2A-6 6-12"					0.84	1.30	16.30	0.19	0.31	0.70	5.30	6.00	0.70	0.13	7.00	22.00	410.00	0.52	50.00	38.80	
2A-7 0-7"					1.24	1.20	20.00	0.35	0.45	0.60	4.60	5.10	0.50	0.15	6.70	17.00	320.00	0.74	55.00	47.80	
2A-7 20-38"					1.06	0.30	23.80	0.28	0.41	0.50	1.90	2.70	0.80	0.04	6.80	14.00	170.00	0.30	50.00	34.20	
2A-7 7-20"					1.45	0.60	22.50	0.40	0.49	0.50	3.80	4.50	0.70	0.06	6.80	17.00	260.00	0.60	51.30	37.40	
2B-1 0-9"					1.11	1.30	20.00	0.30	0.42	0.60	7.90	8.50	0.60	0.17	6.70	17.00	310.00	0.75	58.80	49.70	
2B-1 19-33"					1.42	0.50	43.80	0.29	0.35	1.00	4.20	5.10	0.90	0.07	7.10	6.00	120.00	0.08	16.30	51.60	
2B-1 33-51"					2.52	0.30	33.80	0.42	0.58	6.10	4.40	5.30	0.90	0.04	7.60	3.00	70.00	0.06	30.00	43.40	
2B-1 9-19"					0.67	0.50	33.80	0.15	0.22	0.90	3.20	4.10	0.90	0.06	6.70	5.00	150.00	0.11	31.30	41.00	
D-1 0-6"					1.57	1.40	16.30	0.25	0.12	2.30	1.10	1.10		0.15	7.90	28.00	140.00	0.32	72.50	34.60	
D-1 16-25"					0.82	0.70	16.30	0.18	0.14	3.40	1.60	1.60		0.06	7.50	14.00	70.00	0.10	76.30	35.80	
D-1 25-40"					0.76	0.90	13.80	0.16	0.15	0.20	0.90	0.90		0.06	7.30	29.00	60.00	0.08	73.80	34.60	
D-1 40-65"					1.04	0.60	12.50	0.21	0.22	0.20		0.90	0.80	0.04	7.30	20.00	50.00	0.08	80.00	30.20	
D-1 6-16"					1.28	23.30	15.00	0.22	0.15	1.20	1.10	1.10		0.30	7.10	36.00	80.00	0.07	70.00	53.40	
D-1 65-90"					1.36	0.50	12.50	0.26	0.24	0.50		0.90	0.80	0.03	7.30	20.00	70.00	0.05	83.80	31.10	
D-10 0-5"					3.23	3.30	15.00	0.53	0.67	1.00	1.80	1.80		0.31	7.30	21.00	410.00	1.11	47.50	50.70	
D-10 11-23"					0.82	0.80	38.80	0.22	0.25	0.70	0.90	1.50	0.60	0.08	7.40	7.00	130.00	0.09	26.30	61.70	
D-10 23-35"					0.81	0.70	42.50	0.25	0.39	1.00	2.00	2.70	0.70	0.06	7.30	8.00	130.00	0.19	22.50	69.60	
D-10 5-11"					1.34	3.10	25.00	0.28	0.28	1.70	1.50	2.10	0.60	0.12	7.30	13.00	180.00	0.15	33.80	48.30	

Results	ANALYTE																				
CLIENTID	Acid Generation Potential (cal	Acid Neutralization Potential	Acid-Base Potential (calc on S	Boron, soluble (Hot Water)	Calcium, soluble (Sat. Paste)	Carbon, total organic (TOC)	Clay	Conductivity @25C	Magnesium, soluble (Sat. Paste	Neutralization Potential as Ca	Nitrate as N, extractable (KCL	Nitrate/ Nitrite as N, extracta	Nitrite as N, extractable (KCL	Nitrogen, total Kjeldahl	pH, Saturated Paste	Phosphorus, extractable (AB-DT	Potassium, extractable (AB-DTP	Potassium, soluble (Sat. Paste	Sand	Saturation Percent	Selenium, soluble (Hot Water)
D-11 0-12"					2.98	1.60	25.00	0.42	0.35	3.10	1.80	2.40	0.60	0.08	7.60	15.00	230.00	0.22	42.50	40.80	
D-11 11-48"	12.00	35.00	23.00	1.41	20.50	25.00	17.50	1.63	2.88	3.50	0.70	1.50	0.80	0.24	7.10	2.00	110.00	0.11	62.50	53.20	
D-11 62-82"					12.80	3.60	18.80	1.33	4.28	5.30	0.60	1.30	0.70	0.15	7.60	9.00	140.00	0.16	51.30	44.80	
D-12 0-6"					2.11	3.20	12.50	0.42	0.62	0.70	2.60	2.60		0.25	6.80	22.00	440.00	1.06	50.00	55.90	
D-12 14-28"					0.82	0.70	12.50	0.21	0.31	0.50	1.90	2.60	0.70	0.42	7.00	13.00	170.00	0.20	51.30	36.50	
D-12 28-48"					1.15	0.40	18.80	0.25	0.36	0.60	1.80	2.50	0.70	0.05	7.10	11.00	170.00	0.16	53.80	36.40	
D-12 48-66"					1.63	0.20	18.80	0.30	0.33	2.60	1.90	2.50	0.60	0.03	7.70	11.00	140.00	0.09	56.30	38.00	
D-12 6-14"					1.23	1.00	13.80	0.27	0.41	0.70	2.00	2.70	0.70	0.11	6.80	16.00	240.00	0.38	52.50	42.70	
D-2 0-6"					0.80	1.10	15.00	0.18	0.16	0.60	0.20	0.90	0.70	0.06	7.30	15.00	90.00	0.11	77.50	33.50	
D-2 6-24"					0.16	0.30	13.80	0.50	0.13	0.40		0.90	0.80	0.03	7.30	13.00	80.00	0.08	78.80	33.30	
D-3	14.00	33.00	19.00	2.30	15.30	30.10	15.00	0.16	3.06	3.30	1.00	1.00		0.12	7.30	5.00	80.00	0.13	71.30	59.20	
D-3 0-10"	0.00	14.00	14.00	0.57	1.20	2.30	18.80	0.27	0.21	1.40	1.50	1.50		0.32	7.60	29.00	320.00	0.33	72.50	40.70	
D-3 10-20"	0.00	15.00	15.00	0.66	1.52	1.70	17.50	0.27	0.24	1.50	0.90	0.90		0.11	7.50	20.00	190.00	0.18	71.30	35.30	
D-3 20-40"	0.00	10.00	10.00	0.65	0.68	1.60	18.80	0.17	0.14	1.00	0.40	1.20	0.80	0.09	7.60	16.00	110.00	0.07	72.50	37.00	
D-3 40-60"	0.00	18.00	18.00	0.48	1.13	1.80	17.50	0.25	0.26	1.80	0.20	1.00	0.80	0.10	7.80	17.00	110.00	0.06	72.50	38.90	
D-3 60-75"	4.00	18.00	14.00	1.11	13.40	1.90	17.50	0.16	5.67	1.80	0.40	1.20	0.80	0.16	7.40	15.00	130.00	0.16	72.50	37.90	
D-4 0-8"					0.82	1.40	17.50	0.20	0.13	1.20	1.30	1.30		0.06	7.60	22.00	150.00	0.07	71.30	40.20	
D-4 19-72"	0.00	23.00	23.00	2.25	16.90	3.20	16.30	0.20	8.58	2.30	1.10	1.10		0.68	7.30	4.00	90.00	0.13	77.50	61.60	
D-4 8-16"					0.47	1.30	18.80	0.14	0.12	0.90	0.30	1.10	0.80	0.09	7.80	21.00	150.00	0.06	68.80	39.20	
D-5 0-6"					1.17	1.50	21.30	0.26	0.24	2.30	0.50	1.20	0.70	0.12	7.80	24.00	140.00	0.09	65.00	45.90	
D-5 20-40"					0.34	1.00	21.30	0.12	0.10	2.70	0.90	1.60	0.70	0.04	7.80	20.00	80.00	0.08	63.80	52.20	
D-5 40-60"					1.33	1.60	21.30	0.25	0.31	3.30	7.90	8.60	0.70	0.09	7.70	18.00	80.00	0.08	37.50	52.30	
D-5 6-20"					0.81	1.40	21.30	0.18	0.15	2.60	0.50	1.10	0.60	0.07	7.80	24.00	90.00	0.06	65.00	47.00	
D-6 0-7"					2.48	1.60	22.50	0.28	0.38	3.70	9.00	9.80	0.80	0.09	7.50	15.00	240.00	0.45	30.00	52.10	
D-6 24-48"					3.21	1.30	20.00	0.45	0.76	3.20	3.30	4.10	0.80	0.07	7.50	12.00	70.00	0.09	40.00	54.40	
D-6 48-72"					2.96	1.40	20.00	0.45	0.69	3.30	2.30	3.10	0.80	0.08	7.40	10.00	100.00	0.09	37.50	51.00	
D-7 0-6"					4.92	1.30	20.00	0.69	0.72	2.70	1.90	1.90		0.09	7.20	7.00	250.00	0.67	30.00	49.60	
D-7 20-42"					0.93	0.90	21.30	0.20	0.32	3.30	0.50	1.20	0.70	0.05	7.80	8.00	90.00	0.13	32.50	43.30	
D-7 42-58"					1.63	1.20	22.50	0.30	0.42	2.80		0.90	0.80	0.07	7.60	8.00	110.00	0.09	32.50	54.30	
D-7 58-70"					3.35	0.80	12.50	0.48	0.83	0.80		0.70	0.80	0.07	7.20	16.00	140.00	0.11	52.50	36.50	
D-7 6-20"					2.98	1.10	22.50	0.46	0.56	3.30	0.40	1.20	0.80	0.06	7.50	10.00	130.00	0.15	30.00	47.30	
D-8 0-6"					3.91	2.50	8.80	0.59	0.79	1.20	2.10	2.10		0.22	7.00	25.00	360.00	1.11	52.50	64.60	
D-8 13-20"					0.56	0.40	12.50	0.16	0.23	0.60	0.80	0.80		0.05	7.00	20.00	190.00	0.24	55.00	38.80	
D-8 20-48"					0.60	0.30	16.30	0.18	0.30	0.60		0.80	0.80	0.03	7.30	17.00	200.00	0.22	53.80	38.00	
D-8 6-13"					1.13	1.10	10.00	0.28	0.28	0.80	1.70	1.70		0.15	7.10	20.00	280.00	0.42	55.00	41.50	
D-9A 0-6"					3.48	2.00	16.30	0.45	0.39	2.00	1.00	1.80	0.80	0.12	7.50	11.00	170.00	0.20	47.50	51.60	
D-9A 115-145"	0.00	5.00	5.00	0.57	12.70	0.30	22.50	1.25	2.67	0.50	3.60	4.20	0.60	0.05	7.10	13.00	200.00	0.35	50.00	42.50	
D-9A 12-30"	15.00	42.00	27.00	2.31	1.33	29.60	12.50	0.27	0.28	4.20	0.70	0.70		1.10	7.50	3.00	80.00	0.10	68.80	37.50	
D-9A 30-68"	19.00	54.00	35.00	2.16	20.90	24.40	17.50	2.11	11.00	5.40	0.80	0.80		0.49	7.10	2.00	100.00	0.16	57.50	55.20	
D-9A 6-12"					3.25	2.20	17.50	0.47	0.54	1.90		0.90	0.80	0.12	7.70	11.00	120.00	0.09	50.00	47.60	
D-9A 80-95"	2.00	17.00	15.00	0.91	2.34	4.30	15.00	0.35	0.29	1.70	0.60	1.40	0.80	0.18	7.50	9.00	120.00	0.15	53.80	49.00	
D-9A 95-115"	1.00	13.00	12.00	0.86	1.35	2.40	15.00	0.25	0.29	1.30	1.30	1.90	0.60	0.39	7.70	11.00	150.00	0.05	55.00	51.00	
D-9B 0-6"	0.00	24.00	24.00	0.46	2.76	1.70	25.00	0.43	0.39	2.40	2.90	3.50	0.60	0.13	7.40	20.00	250.00	0.32	35.00	41.50	
D-9B 12-30"	16.00	51.00	35.00	2.27	18.50	23.10	23.80	1.61	3.87	5.10	1.50	1.50		0.73	7.10	3.00	120.00	0.17	50.00	50.30	0.01
D-9B 30-52"	35.00	46.00	11.00	1.41	25.10	54.00	2.50	1.77	1.48	4.60	1.20	1.20		1.43	7.10	1.00	30.00	0.06	93.80	59.00	
D-9B 52-80"	2.00	7.00	5.00	1.73	20.10	1.40	13.80	1.85	6.54	0.70	0.40	1.10	0.70	0.09	7.00	11.00	150.00	0.42	60.00	38.00	
D-9B 6-12"	0.00	22.00	22.00	0.49	2.47	2.40	17.50	0.37	0.39	2.20	0.90	1.60	0.70	0.24	7.40	31.00	170.00	0.12	51.30	34.90	
D-9B 80-102"	0.00	6.00	6.00	0.86	19.40	0.90	15.00	1.73	6.62	0.60	0.40	1.10	0.70	0.06	7.00	11.00	180.00	0.58	53.80	37.90	
Grand Total	6.32	23.84	17.53	1.23	3.45	3.17	19.53	0.42	0.89	1.80	4.38	4.66	0.72	0.14	7.22	17.36	183.53	0.29	50.84	45.20	0.01

Results

CLIENTID	Sieve-53 um (270 mesh)	Sieve-2000 um (2.0 mm)	Silt	Sodium Absorption Ratio	Sodium, soluble (Sat. Paste)	Solids, Percent	Sulfur Organic Residual	Sulfur Pyritic Sulfide	Sulfur Sulfate	Sulfur Total	Total Sulfur minus Sulfate
1A-1 0-6"	79.40	92.50	43.80	0.07	0.11	76.90					
1A-1 17-28"	79.40	86.20	37.50	0.15	0.10	96.10					
1A-1 28-60"	80.90	82.00	35.00	0.51	0.39	92.40					
1A-1 60-100"	81.60	76.90	30.00	0.76	0.59	88.60					
1A-1 6-17"	77.00	92.60	45.00	0.11	0.10	97.00					
1A-2 15-25"	81.70	82.80	32.50	0.17	0.24	88.00					
1A-2 25-40"	81.80	79.60	38.80	0.14	0.22	95.60					
1A-2 40-60"	81.00	84.70	38.80	0.15	0.29	96.10					
1A-2 60-75"	83.90	74.00	35.00	0.16	0.22	96.00					
1A-2 75-90"	83.60	76.00	38.80	0.13	0.33	94.70					
1B1 0-7"	83.70	79.80	42.50	0.11	0.17	75.80					
1B1 15-28"	82.30	79.30	45.00	1.25	0.85	96.80					
1B1 28-60"	81.70	82.40	30.00	0.89	0.60	97.30					
1B1 7-15"	83.30	79.90	40.00	0.57	0.61	91.70					
2A-1 0-10"	75.80	91.80	30.00	0.19	0.20	86.00					
2A-1 10-24"	84.60	72.00	30.00	0.37	0.36	94.60					
2A-1 24-44"	86.10	83.90	37.50	0.20	0.18	94.20					
2A-1 44-65"	87.70	90.60	31.30	0.39	0.36	95.00					
2A-1 65-80"	86.50	90.10	25.00	0.41	0.40	95.10					
2A-2 0-5"	80.50	88.90	36.30	0.33	0.33	87.30					
2A-2 14-25"	87.00	64.50	46.30	0.43	0.29	96.30					
2A-2 25-38"	84.40	70.70	36.30	0.37	0.22	94.10					
2A-2 5-14"	78.00	88.50	36.30	0.33	0.33	86.30					
2A-3 0-9"	72.80	86.80	32.50	0.23	0.18	87.70					
2A-3 19-36"	80.60	75.30	30.00	0.41	0.25	94.70					
2A-3 36-52"	91.00	61.30	40.00	0.33	0.28	93.50					
2A-3 9-19"	82.10	80.70	33.80	0.33	0.20	94.50					
2A-5 0-6"	80.60	80.40	37.50	0.38	0.42	87.10					
2A-5 12-24"	92.80	45.00	40.00	0.38	0.21	91.70					
2A-5 24-48"	95.20	39.30	37.50	0.42	0.22	90.70					
2A-5 6-12"	87.50	60.50	32.50	0.33	0.38	89.00					
2A-6 0-6"	80.30	91.30	37.50	0.16	0.15	84.30					
2A-6 12-24"	82.00	86.80	38.80	0.43	0.35	96.00					
2A-6 24-40"	84.40	79.30	38.80	0.42	0.39	93.60					
2A-6 40-60"	85.20	85.20	25.00	1.39	1.48	94.90					
2A-6 60-80"	86.50	76.50	27.50	1.09	0.98	93.40					
2A-6 6-12"	80.80	83.60	33.80	0.21	0.16	90.40					
2A-7 0-7"	75.80	87.60	25.00	0.55	0.51	86.40					
2A-7 20-38"	79.50	79.40	26.30	0.43	0.37	93.10					
2A-7 7-20"	77.40	86.90	26.30	0.43	0.43	91.80					
2B-1 0-9"	78.80	84.90	21.30	0.18	0.16	82.10					
2B-1 19-33"	90.50	79.60	40.00	0.44	0.42	93.10					
2B-1 33-51"	84.30	88.30	36.30	0.24	0.31	95.90					
2B-1 9-19"	91.30	39.90	35.00	0.37	0.25	94.10					
D-1 0-6"	91.50	75.60	11.30	0.23	0.22	88.10					
D-1 16-25"	91.90	70.00	7.50	0.08	0.06	91.20					
D-1 25-40"	88.60	88.70	12.50	0.11	0.08	95.50					
D-1 40-65"	91.50	78.50	7.50	0.11	0.09	94.30					
D-1 6-16"	87.80	95.40	15.00	0.11	0.10	91.50					
D-1 65-90"	93.80	67.10	3.80	0.15	0.14	94.20					
D-10 0-5"	68.20	81.60	37.50	0.16	0.23	82.60					
D-10 11-23"	97.00	23.00	35.00	0.49	0.36	91.70					
D-10 23-35"	98.00	18.90	35.00	0.43	0.34	91.20					
D-10 5-11"	91.10	47.40	41.30	0.40	0.36	87.40					

Results

CLIENTID	Sieve-53 um (270 mesh)	Sieve-2000 um (2.0 mm)	Silt	Sodium Absorption Ratio	Sodium, soluble (Sat. Paste)	Solids, Percent	Sulfur Organic Residual	Sulfur Pyritic Sulfide	Sulfur Sulfate	Sulfur Total	Total Sulfur minus Sulfate
D-11 0-12"	88.30	57.90	32.50	0.20	0.26	85.50					
D-11 11-48"	93.10	65.80	20.00	0.06	0.23	86.40	0.22	0.07	0.10	0.39	0.29
D-11 62-82"	93.70	32.80	30.00	0.08	0.26	90.30					
D-12 0-6"	76.60	91.00	37.50	0.18	0.21	79.00					
D-12 14-28"	81.20	69.50	36.30	0.35	0.27	94.70					
D-12 28-48"	82.90	67.40	27.50	0.32	0.28	94.60					
D-12 48-66"	76.50	84.40	25.00	0.27	0.27	93.90					
D-12 6-14"	77.30	84.00	33.80	0.30	0.28	84.80					
D-2 0-6"	91.40	68.80	7.50	0.08	0.06	92.20					
D-2 6-24"	91.10	72.60	7.50	0.05	0.02	91.10					
D-3	98.10	49.50	13.80		0.07	90.20	0.23		0.23	0.46	0.23
D-3 0-10"	92.40	81.10	8.80	0.08	0.07	88.80	0.01	0.01		0.02	0.02
D-3 10-20"	92.60	75.20	11.30	0.09	0.09	93.70	0.02			0.02	0.02
D-3 20-40"	91.10	81.70	8.80	0.09	0.06	95.40	0.02		0.01	0.02	0.01
D-3 40-60"	93.10	67.30	10.00	0.08	0.07	93.90	0.02		0.01	0.03	0.02
D-3 60-75"	92.60	79.80	10.00	0.05	0.17	93.80	0.02		0.11	0.13	0.02
D-4 0-8"	90.90	88.70	11.30	0.07	0.05	87.60					
D-4 19-72"	97.60	62.80	6.30		0.08	93.50	0.01	0.01		0.02	0.02
D-4 8-16"	90.80	84.60	12.50	0.05	0.03	94.90					
D-5 0-6"	93.80	76.10	13.80	0.07	0.06	90.00					
D-5 20-40"	94.20	84.70	15.00	0.08	0.04	94.30					
D-5 40-60"	86.90	84.40	41.30	0.33	0.30	91.60					
D-5 6-20"	93.10	89.10	13.80	0.07	0.05	92.20					
D-6 0-7"	87.70	87.60	47.50	0.11	0.14	87.90					
D-6 24-48"	88.70	72.40	40.00	0.21	0.30	94.70					
D-6 48-72"	91.10	61.40	42.50	0.20	0.28	93.00					
D-7 0-6"	90.30	68.20	50.00	0.09	0.16	85.80					
D-7 20-42"	91.50	67.70	46.30	0.12	0.10	92.50					
D-7 42-58"	90.90	70.30	45.00	0.22	0.23	93.00					
D-7 58-70"	76.40	94.60	35.00	0.13	0.20	95.70					
D-7 6-20"	92.90	53.90	47.50	0.12	0.17	87.40					
D-8 0-6"	79.70	92.10	38.80	0.08	0.13	80.40					
D-8 13-20"	75.80	96.90	32.50	0.17	0.11	96.50					
D-8 20-48"	76.10	92.60	30.00	0.17	0.12	95.70					
D-8 6-13"	78.90	90.50	35.00	0.14	0.12	84.90					
D-9A 0-6"	85.60	75.60	36.30	0.09	0.13	87.30					
D-9A 115-145"	81.20	81.50	27.50	0.10	0.30	89.50	0.01		0.01	0.02	0.01
D-9A 12-30"	94.40	59.80	18.80	0.10	0.09	90.90	0.18	0.07	0.23	0.48	0.25
D-9A 30-68"	97.40	51.70	25.00	0.03	0.12	89.40	0.23		0.43	0.62	0.19
D-9A 6-12"	84.60	79.30	32.50	0.08	0.12	88.70					
D-9A 80-95"	85.50	80.30	31.30	0.07	0.09	90.60	0.03		0.03	0.06	0.03
D-9A 95-115"	84.50	74.40	30.00	0.24	0.22	89.70	0.02		0.02	0.04	0.02
D-9B 0-6"	85.00	82.30	40.00	0.18	0.23	86.60	0.02			0.02	0.02
D-9B 12-30"	96.30	47.20	26.30	0.07	0.25	91.90	0.20	0.12	0.20	0.52	0.32
D-9B 30-52"	97.10	72.10	3.80	0.04	0.16	91.50	0.51	0.08	0.54	1.13	0.59
D-9B 52-80"	78.60	82.70	26.30	0.05	0.21	95.50	0.02		0.04	0.05	0.01
D-9B 6-12"	80.70	88.20	31.30	0.17	0.21	85.70	0.03			0.03	0.03
D-9B 80-102"	79.80	82.70	31.30	0.06	0.24	95.90	0.01		0.02	0.03	0.01
Grand Total	85.89	75.68	29.69	0.26	0.25	91.09	0.10	0.06	0.14	0.22	0.11

Appendix 2. IML Laboratories, Inc. Soil Analyses

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Carbon Resources

Report ID: S0709096001

Project: Kinney Mine
Date Received: 9/7/2007

Date Reported:
Work Order: S0709096

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR	Alkalinity meq/L
S0709096-001	01-SP-07	0-6	7.3	39.8	0.44	2.48	0.89	0.34	0.43	0.26	1.99
S0709096-002	01-SP-07	6-14	7.4	40.8	0.46	2.92	0.87	0.32	0.28	0.23	1.99
S0709096-003	01-SP-07	14-24	7.7	50.5	1.15	7.19	1.75	1.42	0.12	0.67	2.39
S0709096-004	02-SP-07	0-6	6.6	36.0	0.49	1.48	0.64	0.82	1.40	0.79	1.19
S0709096-005	02-SP-07	6-17	6.8	35.4	0.54	0.84	0.79	1.10	1.32	1.22	1.79
S0709096-006	02-SP-07	17-32	7.2	33.4	1.91	6.10	2.99	4.37	3.95	2.05	1.19
S0709096-007	02-SP-07	32-44	7.4	36.0	3.60	15.1	8.52	7.30	5.75	2.12	1.99
S0709096-008	03-SP-07	0-6	6.5	47.6	0.62	2.05	1.09	1.51	1.31	1.21	1.99
S0709096-009	03-SP-07	6-18	6.9	38.4	0.66	2.57	1.06	1.47	1.10	1.09	2.98
S0709096-010	03-SP-07	18-30	7.2	34.7	2.00	8.14	2.53	3.12	2.31	1.35	2.59
S0709096-011	03-SP-07	30-40	7.6	32.8	3.73	18.4	6.53	6.67	3.23	1.89	1.69
S0709096-012	04-SP-07	0-6	6.6	47.7	0.26	1.32	0.76	0.74	0.63	0.72	1.39
S0709096-013	04-SP-07	6-11	6.6	32.8	0.29	1.52	0.61	0.16	0.44	0.15	1.59
S0709096-014	04-SP-07	11-20	6.7	30.0	0.28	1.41	0.55	0.26	0.41	0.26	1.39
S0709096-015	04-SP-07	20-40	6.9	33.0	0.28	1.44	0.54	0.33	0.15	0.33	1.49
S0709096-016	05-SP-07	0-8	6.5	31.5	0.27	1.54	0.49	0.27	0.21	0.27	1.29
S0709096-017	05-SP-07	8-28	6.7	29.0	0.19	0.66	0.48	0.51	0.19	0.68	0.70
S0709096-018	05-SP-07	28-60	7.1	29.3	0.24	1.03	0.49	0.55	0.10	0.62	1.09
S0709096-019	06-SP-07	0-6	7.3	30.6	0.45	3.01	0.87	0.28	0.31	0.20	3.58
S0709096-020	06-SP-07	6-55	7.4	34.2	1.32	7.04	4.61	1.99	0.29	0.82	1.99

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Carbon Resources

Report ID: S0709096001

Project: Kinney Mine
Date Received: 9/7/2007

Date Reported:
Work Order: S0709096

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR	Alkalinity meq/L
S0709096-021	06-SP-07	55-80	6.2	32.1	1.53	10.4	5.66	0.34	0.29	0.12	0.50
S0709096-022	07-SP-07	0-6	6.6	38.4	0.37	1.74	0.67	0.27	0.70	0.24	2.29
S0709096-023	07-SP-07	6-11	6.5	34.2	0.23	0.98	0.48	0.34	0.36	0.40	1.29
S0709096-024	07-SP-07	11-28	6.6	29.6	0.23	1.23	0.50	0.24	0.30	0.26	1.19
S0709096-025	07-SP-07	28-40	7.1	27.9	0.35	2.16	0.72	0.31	0.08	0.26	2.19
S0709096-026	08-SP-07	0-9	6.5	47.6	0.26	1.21	0.45	0.18	0.55	0.20	1.39
S0709096-027	08-SP-07	9-17	6.6	37.3	0.30	1.59	0.58	0.25	0.37	0.24	1.49
S0709096-028	08-SP-07	17-36	6.6	26.2	0.18	0.84	0.35	0.16	0.27	0.21	1.09
S0709096-029	08-SP-07	36-60	6.7	24.3	0.23	0.91	0.53	0.28	0.25	0.33	0.90
S0709096-030	09-SP-07	0-6	6.5	38.6	0.30	1.42	0.54	0.16	0.57	0.16	2.09
S0709096-031	09-SP-07	6-12	6.5	28.8	0.21	1.02	0.40	0.17	0.31	0.20	1.19
S0709096-032	09-SP-07	12-30	6.5	33.0	0.19	0.91	0.49	0.28	0.15	0.34	1.00
S0709096-033	09-SP-07	30-60	6.9	34.7	0.17	0.87	0.38	0.27	0.06	0.34	1.19
S0709096-034	10-SP-07	0-7	6.9	33.4	0.37	2.44	0.76	0.16	0.29	0.13	2.79
S0709096-035	10-SP-07	7-18	6.6	28.6	0.17	0.96	0.38	0.15	0.15	0.18	1.00
S0709096-036	10-SP-07	18-40	6.7	30.0	0.15	0.82	0.23	0.18	0.07	0.25	0.80
S0709096-037	10-SP-07	40-70	7.3	29.0	0.40	2.89	0.56	0.22	0.09	0.17	2.59
S0709096-038	11-SP-07	0-5	6.8	40.8	0.33	1.74	0.64	0.22	0.68	0.20	2.59
S0709096-039	11-SP-07	5-13	6.4	31.8	0.34	1.45	0.70	0.34	0.52	0.33	1.79
S0709096-040	11-SP-07	13-33	6.6	29.4	0.26	1.46	0.55	0.23	0.28	0.23	1.39

These results apply only to the samples tested.

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Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
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Soil Analysis Report
Carbon Resources

Report ID: S0709096001

Project: Kinney Mine
Date Received: 9/7/2007

Date Reported:
Work Order: S0709096

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR	Alkalinity meq/L
S0709096-041	11-SP-07	33-55	6.8	35.4	0.20	1.11	0.50	0.27	0.13	0.30	1.79
S0709096-042	11-SP-07	55-80	7.1	37.1	0.33	1.34	0.70	0.64	0.17	0.63	2.19
S0709096-043	12-SP-07	0-6	7.1	36.3	0.42	2.19	0.77	0.13	0.89	0.11	3.18
S0709096-044	12-SP-07	6-12	7.2	34.7	0.24	0.98	0.42	0.14	0.86	0.17	1.79
S0709096-045	12-SP-07	12-24	7.2	31.5	0.26	1.22	0.45	0.13	0.70	0.15	1.99
S0709096-046	12-SP-07	24-36	7.4	33.0	0.32	2.05	0.72	0.17	0.36	0.15	1.99
S0709096-047	12-SP-07	36-52	7.4	31.0	0.40	2.45	0.75	0.23	0.32	0.18	2.79
S0709096-048	12-SP-07	52-75	7.8	29.8	0.38	2.20	0.79	0.27	0.30	0.22	2.29
S0709096-049	13-SP-07	0-8	7.0	35.0	0.45	2.49	0.99	0.22	0.54	0.16	3.28
S0709096-050	13-SP-07	8-25	6.2	67.9	0.23	1.39	0.46	0.07	0.06	0.07	0.50
S0709096-051	13-SP-07	25-41	6.8	31.7	0.35	2.46	0.56	0.08	0.20	0.07	1.69
S0709096-052	13-SP-07	41-70	6.6	25.8	0.40	1.98	0.77	0.19	0.39	0.17	1.69

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	TKN %	Phosphorus ppm	Selenium ppm
S0709096-001	01-SP-07	0-6	66.0	24.0	10.0	Sandy Loam	14.9		0.30	11.9	
S0709096-002	01-SP-07	6-14	70.0	19.0	11.0	Sandy Loam	17.6		0.46	12.7	
S0709096-003	01-SP-07	14-24	37.0	41.0	22.0	Loam	18.6		0.10	12.6	
S0709096-004	02-SP-07	0-6	47.0	37.0	16.0	Loam	22.6		0.07	30.7	
S0709096-005	02-SP-07	6-17	46.0	36.0	18.0	Loam	25.0		0.02	34.3	
S0709096-006	02-SP-07	17-32	47.0	36.0	17.0	Loam	26.4		0.06	26.8	
S0709096-007	02-SP-07	32-44	40.0	38.0	22.0	Loam	23.5		0.08	17.5	
S0709096-008	03-SP-07	0-6	46.0	35.0	19.0	Loam	25.4		0.06	35.6	
S0709096-009	03-SP-07	6-18	48.0	34.0	18.0	Loam	25.9		0.04	45.2	
S0709096-010	03-SP-07	18-30	42.0	37.0	21.0	Loam	26.8		0.06	45.2	
S0709096-011	03-SP-07	30-40	42.0	37.0	21.0	Loam	24.1		0.01	17.6	
S0709096-012	04-SP-07	0-6	54.0	29.0	17.0	Sandy Loam	23.1		0.14	15.1	
S0709096-013	04-SP-07	6-11	49.0	34.0	17.0	Loam	24.0		0.09	14.2	
S0709096-014	04-SP-07	11-20	50.0	32.0	18.0	Loam	22.4		0.03	12.0	
S0709096-015	04-SP-07	20-40	54.0	25.0	21.0	Sandy Clay Loam	21.9		0.04	14.3	
S0709096-016	05-SP-07	0-8	45.0	33.0	22.0	Loam	23.4		0.05	14.3	
S0709096-017	05-SP-07	8-28	55.0	24.0	21.0	Sandy Clay Loam	26.3		0.03	15.3	
S0709096-018	05-SP-07	28-60	52.0	28.0	20.0	Loam	18.5		0.03	9.09	
S0709096-019	06-SP-07	0-6	48.0	32.0	20.0	Loam	19.4		0.05	12.5	
S0709096-020	06-SP-07	6-55	42.0	33.0	25.0	Loam	12.6	0.79	0.18	1.60	<0.02

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Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	TKN %	Phosphorus ppm	Selenium ppm
S0709096-021	06-SP-07	55-80	50.0	30.0	20.0	Loam	21.5		0.01	15.7	
S0709096-022	07-SP-07	0-6	58.0	27.0	15.0	Sandy Loam	20.6		0.04	14.6	
S0709096-023	07-SP-07	6-11	60.0	24.0	16.0	Sandy Loam	25.0		0.04	14.6	
S0709096-024	07-SP-07	11-28	60.0	24.0	16.0	Sandy Loam	18.8		0.03	10.7	
S0709096-025	07-SP-07	28-40	52.0	30.0	18.0	Sandy Loam	17.3		0.03	5.62	
S0709096-026	08-SP-07	0-9	46.0	37.0	17.0	Loam	14.7		0.04	15.7	
S0709096-027	08-SP-07	9-17	44.0	37.0	19.0	Loam	21.9		0.06	14.2	
S0709096-028	08-SP-07	17-36	46.0	37.0	17.0	Loam	18.4		0.02	11.8	
S0709096-029	08-SP-07	36-60	52.0	33.0	15.0	Sandy Loam	21.5		<0.01	11.0	
S0709096-030	09-SP-07	0-6	60.0	26.0	14.0	Sandy Loam	25.1		0.05	18.6	
S0709096-031	09-SP-07	6-12	49.0	32.0	19.0	Loam	22.5		<0.01	9.72	
S0709096-032	09-SP-07	12-30	50.0	29.0	21.0	Loam	26.0		<0.01	10.7	
S0709096-033	09-SP-07	30-60	42.0	44.0	14.0	Loam	23.0		<0.01	15.9	
S0709096-034	10-SP-07	0-7	68.0	21.0	11.0	Sandy Loam	20.6		0.11	12.9	
S0709096-035	10-SP-07	7-18	48.0	33.0	19.0	Loam	22.5		<0.01	14.9	
S0709096-036	10-SP-07	18-40	50.0	29.0	21.0	Loam	23.4		<0.01	11.0	
S0709096-037	10-SP-07	40-70	49.0	33.0	18.0	Loam	21.8		<0.01	11.8	
S0709096-038	11-SP-07	0-5	61.0	23.0	16.0	Sandy Loam	28.3		<0.01	18.6	
S0709096-039	11-SP-07	5-13	52.0	28.0	20.0	Loam	23.5		<0.01	16.6	
S0709096-040	11-SP-07	13-33	57.0	26.0	17.0	Sandy Loam	22.2		0.01	15.6	

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Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	TKN %	Phosphorus ppm	Selenium ppm
S0709096-041	11-SP-07	33-55	46.0	30.0	24.0	Loam	24.2		<0.01	14.7	
S0709096-042	11-SP-07	55-80	40.0	34.0	26.0	Loam	26.1		0.01	11.1	
S0709096-043	12-SP-07	0-6	54.0	30.0	16.0	Sandy Loam	21.5		<0.01	18.9	
S0709096-044	12-SP-07	6-12	53.0	31.0	16.0	Sandy Loam	22.5		0.01	16.7	
S0709096-045	12-SP-07	12-24	57.0	28.0	15.0	Sandy Loam	27.7		0.05	15.9	
S0709096-046	12-SP-07	24-36	55.0	30.0	15.0	Sandy Loam	23.4		0.03	16.6	
S0709096-047	12-SP-07	36-52	56.0	30.0	14.0	Sandy Loam	29.4		0.03	17.8	
S0709096-048	12-SP-07	52-75	56.0	29.0	15.0	Sandy Loam	26.7		<0.01	18.8	
S0709096-049	13-SP-07	0-8	62.0	22.0	16.0	Sandy Loam	21.2		0.10	17.3	
S0709096-050	13-SP-07	8-25	88.0	6.0	6.0	Sand	20.9	0.77	0.38	1.44	<0.02
S0709096-051	13-SP-07	25-41	58.0	29.0	13.0	Sandy Loam	24.6		<0.01	16.7	
S0709096-052	13-SP-07	41-70	66.0	21.0	13.0	Sandy Loam	22.0		<0.01	12.7	

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths Inches	CO3 %	Total Carbon %	TOC %	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t
S0709096-001	01-SP-07	0-6	1.5	43.0	42.8				
S0709096-002	01-SP-07	6-14	1.6	43.8	43.6				
S0709096-003	01-SP-07	14-24	4.1	5.5	5.0				
S0709096-004	02-SP-07	0-6	1.4	2.4	2.3				
S0709096-005	02-SP-07	6-17	1.0	1.5	1.4				
S0709096-006	02-SP-07	17-32	1.0	1.2	1.0				
S0709096-007	02-SP-07	32-44	1.0	1.1	0.9				
S0709096-008	03-SP-07	0-6	1.6	6.6	6.4				
S0709096-009	03-SP-07	6-18	1.2	8.1	7.9				
S0709096-010	03-SP-07	18-30	1.2	2.1	1.9				
S0709096-011	03-SP-07	30-40	1.2	1.2	1.1				
S0709096-012	04-SP-07	0-6	1.2	3.5	3.3				
S0709096-013	04-SP-07	6-11	0.8	1.5	1.4				
S0709096-014	04-SP-07	11-20	0.7	0.6	0.5				
S0709096-015	04-SP-07	20-40	1.1	0.4	0.2				
S0709096-016	05-SP-07	0-8	0.8	0.7	0.6				
S0709096-017	05-SP-07	8-28	1.2	0.2	<0.1				
S0709096-018	05-SP-07	28-60	0.7	0.2	0.1				
S0709096-019	06-SP-07	0-6	2.4	3.7	3.5				
S0709096-020	06-SP-07	6-55	5.4	22.7	22.2	0.31	9.67	47.4	37.7

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths Inches	CO3 %	Total Carbon %	TOC %	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t
S0709096-021	06-SP-07	55-80	0.7	1.3	1.2				
S0709096-022	07-SP-07	0-6	1.1	2.5	2.4				
S0709096-023	07-SP-07	6-11	1.2	1.1	1.0				
S0709096-024	07-SP-07	11-28	0.8	0.7	0.6				
S0709096-025	07-SP-07	28-40	0.6	0.2	0.2				
S0709096-026	08-SP-07	0-9	1.3	14.6	14.4				
S0709096-027	08-SP-07	9-17	1.0	2.3	2.2				
S0709096-028	08-SP-07	17-36	0.5	0.4	0.3				
S0709096-029	08-SP-07	36-60	0.9	0.2	0.1				
S0709096-030	09-SP-07	0-6	0.9	1.4	1.3				
S0709096-031	09-SP-07	6-12	0.4	0.4	0.4				
S0709096-032	09-SP-07	12-30	1.0	0.3	0.2				
S0709096-033	09-SP-07	30-60	0.7	0.2	0.1				
S0709096-034	10-SP-07	0-7	1.2	17.6	17.5				
S0709096-035	10-SP-07	7-18	1.0	1.0	0.9				
S0709096-036	10-SP-07	18-40	0.6	0.4	0.3				
S0709096-037	10-SP-07	40-70	3.0	0.4	<0.1				
S0709096-038	11-SP-07	0-5	0.8	2.0	1.9				
S0709096-039	11-SP-07	5-13	1.1	0.6	0.5				
S0709096-040	11-SP-07	13-33	1.0	0.4	0.3				

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths Inches	CO3 %	Total Carbon %	TOC %	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t
S0709096-041	11-SP-07	33-55	0.8	0.2	0.1				
S0709096-042	11-SP-07	55-80	1.1	0.1	<0.1				
S0709096-043	12-SP-07	0-6	0.9	1.0	0.9				
S0709096-044	12-SP-07	6-12	1.3	4.1	3.9				
S0709096-045	12-SP-07	12-24	0.6	1.1	1.0				
S0709096-046	12-SP-07	24-36	1.2	1.0	0.8				
S0709096-047	12-SP-07	36-52	0.7	0.9	0.8				
S0709096-048	12-SP-07	52-75	0.9	0.6	0.5				
S0709096-049	13-SP-07	0-8	1.2	11.8	11.6				
S0709096-050	13-SP-07	8-25	1.5	62.9	62.7	0.36	11.4	14.1	2.72
S0709096-051	13-SP-07	25-41	1.0	2.7	2.5				
S0709096-052	13-SP-07	41-70	0.7	0.7	0.6				

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Sample ID	Begin Depth	End Depth	pH s.u.	Saturation %	Electrical Conductivity dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR
01-SP-07	0	6	7.3	39.8	0.44	2.48	0.89	0.34	0.43	0.26
01-SP-07	6	14	7.4	40.8	0.46	2.92	0.87	0.32	0.28	0.23
01-SP-07	14	24	7.7	50.5	1.15	7.19	1.75	1.42	0.12	0.67
02-SP-07	0	6	6.6	36.0	0.49	1.48	0.64	0.82	1.40	0.79
02-SP-07	6	17	6.8	35.4	0.54	0.84	0.79	1.10	1.32	1.22
02-SP-07	17	32	7.2	33.4	1.91	6.10	2.99	4.37	3.95	2.05
02-SP-07	32	44	7.4	36.0	3.60	15.1	8.52	7.30	5.75	2.12
03-SP-07	0	6	6.5	47.6	0.62	2.05	1.09	1.51	1.31	1.21
03-SP-07	6	18	6.9	38.4	0.66	2.57	1.06	1.47	1.10	1.09
03-SP-07	18	30	7.2	34.7	2.00	8.14	2.53	3.12	2.31	1.35
03-SP-07	30	40	7.6	32.8	3.73	18.4	6.53	6.67	3.23	1.89
04-SP-07	0	6	6.6	47.7	0.26	1.32	0.76	0.74	0.63	0.72
04-SP-07	6	11	6.6	32.8	0.29	1.52	0.61	0.16	0.44	0.15
04-SP-07	11	20	6.7	30.0	0.28	1.41	0.55	0.26	0.41	0.26
04-SP-07	20	40	6.9	33.0	0.28	1.44	0.54	0.33	0.15	0.33
05-SP-07	0	8	6.5	31.5	0.27	1.54	0.49	0.27	0.21	0.27
05-SP-07	8	28	6.7	29.0	0.19	0.66	0.48	0.51	0.19	0.68
05-SP-07	28	60	7.1	29.3	0.24	1.03	0.49	0.55	0.10	0.62
06-SP-07	0	6	7.3	30.6	0.45	3.01	0.87	0.28	0.31	0.20
06-SP-07	6	55	7.4	34.2	1.32	7.04	4.61	1.99	0.29	0.82
06-SP-07	55	80	6.2	32.1	1.53	10.4	5.66	0.34	0.29	0.12
07-SP-07	0	6	6.6	38.4	0.37	1.74	0.67	0.27	0.70	0.24
07-SP-07	6	11	6.5	34.2	0.23	0.98	0.48	0.34	0.36	0.40
07-SP-07	11	28	6.6	29.6	0.23	1.23	0.50	0.24	0.30	0.26
07-SP-07	28	40	7.1	27.9	0.35	2.16	0.72	0.31	0.08	0.26
08-SP-07	0	9	6.5	47.6	0.26	1.21	0.45	0.18	0.55	0.20
08-SP-07	9	17	6.6	37.3	0.30	1.59	0.58	0.25	0.37	0.24
08-SP-07	17	36	6.6	26.2	0.18	0.84	0.35	0.16	0.27	0.21
08-SP-07	36	60	6.7	24.3	0.23	0.91	0.53	0.28	0.25	0.33
09-SP-07	0	6	6.5	38.6	0.30	1.42	0.54	0.16	0.57	0.16
09-SP-07	6	12	6.5	28.8	0.21	1.02	0.40	0.17	0.31	0.20
09-SP-07	12	30	6.5	33.0	0.19	0.91	0.49	0.28	0.15	0.34
09-SP-07	30	60	6.9	34.7	0.17	0.87	0.38	0.27	0.06	0.34
10-SP-07	0	7	6.9	33.4	0.37	2.44	0.76	0.16	0.29	0.13
10-SP-07	7	18	6.6	28.6	0.17	0.96	0.38	0.15	0.15	0.18
10-SP-07	18	40	6.7	30.0	0.15	0.82	0.23	0.18	0.07	0.25
10-SP-07	40	70	7.3	29.0	0.40	2.89	0.56	0.22	0.09	0.17
11-SP-07	0	5	6.8	40.8	0.33	1.74	0.64	0.22	0.68	0.20
11-SP-07	5	13	6.4	31.8	0.34	1.45	0.70	0.34	0.52	0.33
11-SP-07	13	33	6.6	29.4	0.26	1.46	0.55	0.23	0.28	0.23
11-SP-07	33	55	6.8	35.4	0.20	1.11	0.50	0.27	0.13	0.30
11-SP-07	55	80	7.1	37.1	0.33	1.34	0.70	0.64	0.17	0.63
12-SP-07	0	6	7.1	36.3	0.42	2.19	0.77	0.13	0.89	0.11

Sample ID	Begin Depth	End Depth	pH s.u.	Saturation %	Electrical Conductivity dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR
12-SP-07	6	12	7.2	34.7	0.24	0.98	0.42	0.14	0.86	0.17
12-SP-07	12	24	7.2	31.5	0.26	1.22	0.45	0.13	0.70	0.15
12-SP-07	24	36	7.4	33.0	0.32	2.05	0.72	0.17	0.36	0.15
12-SP-07	36	52	7.4	31.0	0.40	2.45	0.75	0.23	0.32	0.18
12-SP-07	52	75	7.8	29.8	0.38	2.20	0.79	0.27	0.30	0.22
13-SP-07	0	8	7.0	35.0	0.45	2.49	0.99	0.22	0.54	0.16
13-SP-07	8	25	6.2	67.9	0.23	1.39	0.46	0.07	0.06	0.07
13-SP-07	25	41	6.8	31.7	0.35	2.46	0.56	0.08	0.20	0.07
13-SP-07	41	70	6.6	25.8	0.40	1.98	0.77	0.19	0.39	0.17

Sample ID	Alkalinity meq/L	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	TKN %
01-SP-07	1.99	66.0	24.0	10.0	Sandy Loam	14.9		0.30
01-SP-07	1.99	70.0	19.0	11.0	Sandy Loam	17.6		0.46
01-SP-07	2.39	37.0	41.0	22.0	Loam	18.6		0.10
02-SP-07	1.19	47.0	37.0	16.0	Loam	22.6		0.07
02-SP-07	1.79	46.0	36.0	18.0	Loam	25.0		0.02
02-SP-07	1.19	47.0	36.0	17.0	Loam	26.4		0.06
02-SP-07	1.99	40.0	38.0	22.0	Loam	23.5		0.08
03-SP-07	1.99	46.0	35.0	19.0	Loam	25.4		0.06
03-SP-07	2.98	48.0	34.0	18.0	Loam	25.9		0.04
03-SP-07	2.59	42.0	37.0	21.0	Loam	26.8		0.06
03-SP-07	1.69	42.0	37.0	21.0	Loam	24.1		0.01
04-SP-07	1.39	54.0	29.0	17.0	Sandy Loam	23.1		0.14
04-SP-07	1.59	49.0	34.0	17.0	Loam	24.0		0.09
04-SP-07	1.39	50.0	32.0	18.0	Loam	22.4		0.03
04-SP-07	1.49	54.0	25.0	21.0	Sandy Clay Loam	21.9		0.04
05-SP-07	1.29	45.0	33.0	22.0	Loam	23.4		0.05
05-SP-07	0.70	55.0	24.0	21.0	Sandy Clay Loam	26.3		0.03
05-SP-07	1.09	52.0	28.0	20.0	Loam	18.5		0.03
06-SP-07	3.58	48.0	32.0	20.0	Loam	19.4		0.05
06-SP-07	1.99	42.0	33.0	25.0	Loam	12.6	0.79	0.18
06-SP-07	0.50	50.0	30.0	20.0	Loam	21.5		0.01
07-SP-07	2.29	58.0	27.0	15.0	Sandy Loam	20.6		0.04
07-SP-07	1.29	60.0	24.0	16.0	Sandy Loam	25.0		0.04
07-SP-07	1.19	60.0	24.0	16.0	Sandy Loam	18.8		0.03
07-SP-07	2.19	52.0	30.0	18.0	Sandy Loam	17.3		0.03
08-SP-07	1.39	46.0	37.0	17.0	Loam	14.7		0.04
08-SP-07	1.49	44.0	37.0	19.0	Loam	21.9		0.06
08-SP-07	1.09	46.0	37.0	17.0	Loam	18.4		0.02
08-SP-07	0.90	52.0	33.0	15.0	Sandy Loam	21.5		<0.01
09-SP-07	2.09	60.0	26.0	14.0	Sandy Loam	25.1		0.05
09-SP-07	1.19	49.0	32.0	19.0	Loam	22.5		<0.01
09-SP-07	1.00	50.0	29.0	21.0	Loam	26.0		<0.01
09-SP-07	1.19	42.0	44.0	14.0	Loam	23.0		<0.01
10-SP-07	2.79	68.0	21.0	11.0	Sandy Loam	20.6		0.11
10-SP-07	1.00	48.0	33.0	19.0	Loam	22.5		<0.01
10-SP-07	0.80	50.0	29.0	21.0	Loam	23.4		<0.01
10-SP-07	2.59	49.0	33.0	18.0	Loam	21.8		<0.01
11-SP-07	2.59	61.0	23.0	16.0	Sandy Loam	28.3		<0.01
11-SP-07	1.79	52.0	28.0	20.0	Loam	23.5		<0.01
11-SP-07	1.39	57.0	26.0	17.0	Sandy Loam	22.2		0.01
11-SP-07	1.79	46.0	30.0	24.0	Loam	24.2		<0.01
11-SP-07	2.19	40.0	34.0	26.0	Loam	26.1		0.01
12-SP-07	3.18	54.0	30.0	16.0	Sandy Loam	21.5		<0.01

Sample ID	Alkalinity meq/L	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	TKN %
12-SP-07	1.79	53.0	31.0	16.0	Sandy Loam	22.5		0.01
~~12-SP-07~~	1.99	57.0	28.0	15.0	Sandy Loam	27.7		0.05
12-SP-07	1.99	55.0	30.0	15.0	Sandy Loam	23.4		0.03
12-SP-07	2.79	56.0	30.0	14.0	Sandy Loam	29.4		0.03
12-SP-07	2.29	56.0	29.0	15.0	Sandy Loam	26.7		<0.01
13-SP-07	3.28	62.0	22.0	16.0	Sandy Loam	21.2		0.10
13-SP-07	0.50	88.0	6.0	6.0	Sand	20.9	0.77	0.38
13-SP-07	1.69	58.0	29.0	13.0	Sandy Loam	24.6		<0.01
13-SP-07	1.69	66.0	21.0	13.0	Sandy Loam	22.0		<0.01

Sample ID	Phosphorus ppm	Selenium ppm	CO3 %	Total Carbon %	TOC %	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t
01-SP-07	11.9		1.5	43.0	42.8				
01-SP-07	12.7		1.6	43.8	43.6				
01-SP-07	12.6		4.1	5.5	5.0				
02-SP-07	30.7		1.4	2.4	2.3				
02-SP-07	34.3		1.0	1.5	1.4				
02-SP-07	26.8		1.0	1.2	1.0				
02-SP-07	17.5		1.0	1.1	0.9				
03-SP-07	35.6		1.6	6.6	6.4				
03-SP-07	45.2		1.2	8.1	7.9				
03-SP-07	45.2		1.2	2.1	1.9				
03-SP-07	17.6		1.2	1.2	1.1				
04-SP-07	15.1		1.2	3.5	3.3				
04-SP-07	14.2		0.8	1.5	1.4				
04-SP-07	12.0		0.7	0.6	0.5				
04-SP-07	14.3		1.1	0.4	0.2				
05-SP-07	14.3		0.8	0.7	0.6				
05-SP-07	15.3		1.2	0.2	<0.1				
05-SP-07	9.09		0.7	0.2	0.1				
06-SP-07	12.5		2.4	3.7	3.5				
06-SP-07	1.60	<0.02	5.4	22.7	22.2	0.31	9.67	47.4	37.7
06-SP-07	15.7		0.7	1.3	1.2				
07-SP-07	14.6		1.1	2.5	2.4				
07-SP-07	14.6		1.2	1.1	1.0				
07-SP-07	10.7		0.8	0.7	0.6				
07-SP-07	5.62		0.6	0.2	0.2				
08-SP-07	15.7		1.3	14.6	14.4				
08-SP-07	14.2		1.0	2.3	2.2				
08-SP-07	11.8		0.5	0.4	0.3				
08-SP-07	11.0		0.9	0.2	0.1				
09-SP-07	18.6		0.9	1.4	1.3				
09-SP-07	9.72		0.4	0.4	0.4				
09-SP-07	10.7		1.0	0.3	0.2				
09-SP-07	15.9		0.7	0.2	0.1				
10-SP-07	12.9		1.2	17.6	17.5				
10-SP-07	14.9		1.0	1.0	0.9				
10-SP-07	11.0		0.6	0.4	0.3				
10-SP-07	11.8		3.0	0.4	<0.1				
11-SP-07	18.6		0.8	2.0	1.9				
11-SP-07	16.6		1.1	0.6	0.5				
11-SP-07	15.6		1.1	0.4	0.3				
11-SP-07	14.7		0.8	0.2	0.1				
11-SP-07	11.1		1.1	0.1	<0.1				
12-SP-07	18.9		0.9	1.0	0.9				

Sample ID	Phosphorus ppm	Selenium ppm	CO3 %	Total Carbon %	TOC %	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t
12-SP-07	16.7		1.3	4.1	3.9				
~~12-SP-07~~	15.9		0.6	1.1	1.0				
12-SP-07	16.6		1.2	1.0	0.8				
12-SP-07	17.8		0.7	0.9	0.8				
12-SP-07	18.8		0.9	0.6	0.5				
13-SP-07	17.3		1.2	11.8	11.6				
13-SP-07	1.44	<0.02	1.5	62.9	62.7	0.36	11.4	14.1	2.72
13-SP-07	16.7		1.0	2.7	2.5				
13-SP-07	12.7		0.7	0.7	0.6				

Appendix 3. Field Soil Pedon Descriptions

For 36 SOIL PROFILES

[illegible]	9-14-06	60°	Soil:	Depth:	Longitude:	° ' " W	10-14-06	Sec.	T. R.

e:	mE:	mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:
[illegible]	[illegible]	4397806		UTAH CARBON	KINNEY		

:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
[illegible]	VALLEY				290°	6	SIMPLE	PLANAR [illegible]

rofile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
[illegible]		CONCAVE					

	Flooding:	Ponding:	Soil Moisture Status:	Permeability: MOD. RAP Ksat:	Land Cover / Use:
[illegible]	[illegible]	—	[illegible] 12"		RABBITBR[illegible]

erial:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
[illegible] MIXED	MIXED COLLUVIAL + ALLUVIUM	

Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:
[illegible]	[illegible]	20 25 5	—

Section: Ave. Clay %:	Ave. Rock Frag %:	
ge: 22-26	<15%	D-1 COLUMBINE PORTAL WEST.

VEGETATION :

COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

D-1 COLUMBINE PORTAL

SAMPLED 0-6" } RE-CLAIMED/GRADED
6-15 }
[illegible] A BIR 16-25
25-40
40-65
65-95+
1½ FEET OF RE-CLAIMED SOIL OVER A.C.C
STREAM [illegible] DEPOSITS
VERY LITTLE COAL FINES PRESENT BELOW 2"

PHOTO #15 (P)

D-1
P-2

Method	(in) (cm)			Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont Col Mst Shp Loc
Pit	0-6	Bur				GRV SL	35gr 10cB	SG → 1F GR	SO	FR	SO	PO	None
"	6-16	Bur				GRV SL	35gr 10cB	1M SBK → SG	SO	FR	SO/PO		
B	16-25	A/B				Loam	15g 3cB	1M-F SBK	SH	FR	SS/PO		NATURE B [illegible]
E	25-110	C1				[illegible] Loam	15g 5cB	1M-F SBK	[illegible]		[illegible]		
P	110-65	C2				GR. [illegible]	20gr 5cB	Loose	SO	VFR	SO/PO		
	65-95+	C3				[illegible]	15gr 10cB	SG	LO	LO	[illegible]		

Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
			2vf, 1F,	1M					[illegible] SEDIMENTARY [illegible] SUBSOIL
			1VF, F						[illegible]
			1VF, F						[illegible]
			1VF, F						[illegible]
			1VF						[illegible]

D-2

[illegible]	10-14-06	[illegible]	Soil: Depth:	Longitude: ° ' " W	Datum: 10-14-06	Location: Sec. T. R	
Zone: mE: mN: [illegible] 806 4397782	Topo Quad.:	Site ID: YR: State: County: Pedon #: UT CARBON	Soil Survey Area: [illegible]	MLRA / LRU:	Transect: ID. Stop #: Interval:		
scape: [illegible]	Landform: TOESLOPE	Microfeature:	Anthro:	Elevation:	Aspect: 310°	Slope (%): 4	Slope Complexity: SINGLE
Slope Shape: (Up & Dn / Across) COMPLEX							
ope Profile Position: [illegible]	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
age: WET	Flooding: None	Ponding:	Soil Moisture Status: MOIST TO 12"	Permeability: MODERATE Ksat:	Land Cover / Use: LOW [illegible]		
t Material: [illegible]	Bedrock: Kind: Fract.: Hard.: Depth: COLUMBIA LANDSLIDE DEBRIS	Lithostrat. Units: Group: Formation: Member:					
on: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: 25 15 5 5	Diagnostic Horz. / Prop.: Kind: Depth: [illegible]				
Control Section: Ave. Clay %: Ave. Rock Frag %: th Range: <20 50-60%	D-2 (EAST) RE-GRADED PORTAL AREA OF COLUMBINE MINE, SE EDGE [illegible]						

VEGETATION :

BOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

D-2 COLUMBINE PORTAL

SAMPLED 2 0-6

6-24

[illegible] BELOW [illegible]

TO BE USEFUL TOPSOIL

PHOTO (P) 16

USTORTHENT, LOAMY

D-2
P-2

Map Unit Symbol: Date:

Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
A	0 - 6	BUR				SBV LMM	25g 30cB 10st	SG	LO	FR	SO	PO	
	6-24	BUR				STU LOAM	20g 35cB 15st	SG	LO	FR	SO	PO	
	24-45	C				STU SL	15g 25g 35st	SG	LO	FR	SO	PO	[illegible]

Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
			1VF-F						[illegible]
			1VF-F						COLLUVIUM MIXED 7Y
			VIVF						NO SAMPLED: ROCKS

D-2

Describer(s):	Date:	Weather: Temp.: Air: 46° Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum:	Location: D-3 Sec. T. R.
BL	10-16-06	PARTLY CLOUDY			

UTM: Zone:	mE:	mN:	Topo Quad.:	Site ID: YR:	State:	County:	Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:
0	0486586	4398188			UT	CARBON	D-3	KWD		

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
MTN	SIDESLOPE			2359 m	320°	16		CONVEX

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
LOWER							

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
WELL			MOIST WITHIN 16"	MOD Ksat:	RABBITBRUSH - GRASSES

Parent Material:	Bedrock: Kind:	Fract.:	Hard.:	Depth:	Lithostrat. Units: Group:	Formation:	Member:
[illegible]							

Erosion: Kind:	Degree:	Runoff:	Surface Frag %:	GR:	CB:	ST:	BD:	CN:	SL:	Diagnostic Horz. / Prop.:	Kind:	Depth:
SHEET			Kind:	5	3	2	2	4	TR	—		

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %:
Depth Range: <35 26%

D-3 [illegible] SURFACE MED
WITH [illegible] CAL IN [illegible] 2 [illegible]

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

5 SAMPLES 0-10"
[illegible] 1 [illegible] - 15"
10 to 22" [illegible]
[illegible]
20-40"
40-70"
60-75" LOWER
30% of 10 FEET [illegible] EXCAVATION WAS [illegible] FOR 4 CHANNEL
THOUGH I SAMPLED BELOW TABLE LEVEL
[illegible]
TOPSOIL TO 20" [illegible]
ON SOIL TRENCH TALE [illegible]

TRAY LOWER 40

D-3
P 2

Map Unit Symbol: | Date:

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Co Mst Shp
1		0 - 10	A dist					10gr 5cb 5st	1m-f SBK-MGR	SH	FR	SS	PO	
2		10 - 20	Bt dist				GR LMPN	15gr 5st 10cb	2m-f SBK	DR	SH	SS	PS	
3		20 - 40	Bt 2 dist				CB CL	10gr 3st 15cb	2m-c ABK	VH	VFI	S	P	
4		40 - 60	C1				CBV CL	20cb 15gr 10st	3m-c ABK	VH	VFI	S	P	
5		60 - 75+	C2				CBN CL	15gr 20cb 10st	MASSIVE	EH	EF	S	P	
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				2vf 1f						25% [illegible]
2				2vf 1f						15% [illegible]
3				1vf						[illegible]
4				1vf						[illegible]
5										[illegible]
6										
7										
8										
9										

D-3

Describer(s):	Date:	Weather: Temp.: Air: 47	Latitude: ° ' " N	Datum:	Location: D-4
BC	10-15-06	Sun Soil: Depth:	Longitude: ° ' " W		Sec. T. R.

UTM: Zone:	mE.	mN:	Topo Quad.:	Site ID: YR: State:	County:	Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID:
W 20	0486845	4398189		UTM4	(Carbon)	D-4			Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
Toeslope				2358 m	270°	22		

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
Wem - SPD			Moist to 16"	Mod Slow Ksat:	Pasture Rangeland

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
Lacustrine Material	None	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BO: CN: FC: Cob	Diagnostic Horz. / Prop.: Kind: Depth:
Slight-Mod	Rain on Slopes > 40%	Kind: 15 15 5 5 3 6	None

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %:	
Depth Range: >35%	D-4 50 FEET FROM SP-92 AT LEAST 12 FEET BURIED COAL AT THIS SITE

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

0-8" Sandy subsoils (Recently Dry top layer Dry)
8-16" 2 " (Sat)

D-4
F-2

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles Coal % Sz Cont. Col Mst Shp
1		8 8-16	DIST SUBSOIL				CB CL	15 GR 5CB SST	MASSIVE 1F SBK	SH	FI	S	P	15% COAL 12% COAL
2		12-47	COAL WASTE					10 GR 10CB						75%
3		47-85	COAL WASTE					15 GR 15CB						90%
4		85-104	COAL WASTE (MOIST)					10 GR 2CB						95%
5														
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9	4-D									
10										

Describer(s):	Date:	Weather:	Temp.:	Air: CLEAR	Latitude: ° ' " N	Datum:	Location:
[illegible]	[illegible] 06	51		Soil: Depth:	Longitude: ° ' " W		Sec. T. R. D-5

UTM: Zone:	mE:	mN:	Topo Quad.:	Site ID: YR:	State:	County:	Pedon #:	Soil Survey Area	MLRA / LRU:	Transect ID:
04	436345	4398123			UTAH	[illegible]	D-5	[illegible]		Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
MTN.	[illegible]			2370m	[illegible]	[illegible]	[illegible]	

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physic. Section:	State Physic. Area:	Local Physio. Area:
LOWER							

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
MOD WELL				Ksat:	

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
COLLUVIUM	NONE TO [illegible]	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL:	Diagnostic Horz / Prop.: Kind: Depth:
NONE		Kind: 10 5 5 3 2	

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %:	
Depth Range: [illegible]	D-5 [illegible]

VEGETATION :

SYMBOL	COMMON NAME	%OD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

[illegible]

Map Unit Symbol: | Date: | P.2

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp
1	Backhoe Pit	0 - 6	Dist Pisco		1		GRV CL	3Sg 5Sb 5gt	2 [illegible]	[illegible]	FI	[illegible]	[illegible]	None
2		6 - 20	D2				GRV CL	3Sg 15GR 10gt	[illegible]	VH	VFI	[illegible]	P	
3		20 - 40	D3				GRV CL	25gt 25gr 10gt	[illegible]	VH	VF	VS	[illegible]	
4		40 - 68 +	D4				GRV CL	15g 30GR 10gt	[illegible]	VH	EFI	VS	VD	
5														
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				2VF 1F						[illegible] Fill material
2				2VF 1F						[illegible]
3				1VF						[illegible]
4				—						[illegible]
5										
6										
7										
8										
9	S-D									
10										

Observer(s):	Date:	Weather: Temp.: Air:	Latitude: ° ' " N	Datum:	Location: D-6
[illegible]	10-14-05	[illegible] 52 Soil: Depth:	Longitude: ° ' " W		Sec. T. R.

Zone:	mE:	mN:	Topo Quad.:	Site ID: YR:	State:	County:	Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:
	0486825	4398031			UT	[illegible]		[illegible]		

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
[illegible]	[illegible]				20	[illegible]	[illegible]	[illegible]

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
LOWER							

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
[illegible]			None	Moderate Ksat:	[illegible]

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
Colluvium / [illegible]		

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL:	Diagnostic Horz. / Prop.: Kind: Depth:
Slight / Sheet		Kind: 10 12 3 4 2	Mollic

Control Section: Ave. Clay %: Ave. Rock Frag %:	D-6 CRUSHING / SCREENING
Depth Range:	

VEGETATION:

SYMBOL	COMMON NAME	% GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH:

SAMPLED BELOW COAL AND 6" [illegible]

COAL-AFFECTED LAYER [illegible]

AND VARIES FROM 1.0-2.5 [illegible]

SAMPLE [illegible]

PHOTO #17 [illegible] NOT

PRESENT

[illegible]

4.5-7.5" [illegible]

[illegible] STUDY [illegible]

FROM [illegible]

D-6

P2

Map Unit Symbol: | Date:

Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1	0-6	A				cl CL	10g [illegible]	2m [illegible]	-	[illegible]	[illegible]	[illegible]	
2	6-24	C [illegible]		coal		stv	15g 20 [illegible]	[illegible]	-				
3	24-[illegible]	C2				stv CL	20g 20 [illegible]	2m [illegible]	[illegible]	[illegible]	S	P	
4	[illegible]-12	C[illegible]				stv CL	25g 20 [illegible]	2F [illegible]	[illegible]	[illegible]	S	P	
5													
6													
7													
8													
9													
10													

Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
			1 VF, 1F						SUMP [illegible], [illegible]
			1 VF						75 [illegible]
			1 VF						<15% [illegible]
			1F 1M						<[illegible]
9-0									

Zone:	mE:	mN:	Topo Quad.:	Site ID:	YR:	State:	County:	Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect:	ID:	Stop #:	Interval:
0486843	4398018					UTAH	CARBON					D-7		

ape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
[illegible]	[illegible]			2375M	280°	28	[illegible]	[illegible]

pe Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
[illegible]							

ge:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
Well	[illegible]		Moist to 14"	Kast: [illegible]	[illegible]

Material:	Bedrock:	Kind:	Fract.:	Hard.:	Depth:	Lithostrat. Units:	Group:	Formation:	Member:
[illegible]	—								

:	Kind:	Degree:	Runoff:	Surface Frag %:	GR:	CB:	ST:	BD:	CN:	FL:	Diagnostic Horz. / Prop.:	Kind:	Depth:
	Shear			Kind:	16	5	5		[illegible]		—		

ntrol Section:	Ave. Clay %:	Ave. Rock Frag %:	
Range:	> [illegible]	45%	D-7 [illegible]

VEGETATION :

OL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

SAMPLE DEPTHS 0-6"

6-24"

[illegible]

24-42

42-58"

BURIED SOIL ↓ 58-75"

[illegible]

[illegible]

[illegible]

PHOTO F19 (2)

D-7
P-2

Map Unit Symbol: | Date:

Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
	0-6	D1				CB CLAY	10gr [illegible]	2M-F SBK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	6-20	D2				CB CL	15 [illegible] 3ST	[illegible]	SH	[illegible]	[illegible]	[illegible]	
	20-[illegible]	D3				CBV CL	25gr 20cB 5ST	2FM SBK	[illegible]	[illegible]		[illegible]	
	42-58	D4				CBX CL	2M-F [illegible]	[illegible] 5ST 25cB	VH	[illegible]	[illegible]	[illegible]	
	58-75+	B6				CB LOM	[illegible]	15cB 3gr [illegible]	VH	[illegible]	[illegible]	[illegible]	

Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
			WF IF					[illegible]	[illegible]
			WF IF						[illegible]
			WF						[illegible]
			WF-F						[illegible]
			WF						[illegible]
D-7									

D-8

USDA-NRCS PEDON DESCRIPTION

Pedon ID # : | Draft | Mar-02

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s):	Date:	Weather: Temp. Air:	Latitude: ° ' " N Datum:	Location:
		Soil: Depth:	Longitude: ° ' " W	Sec. T. R

UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State:	County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID:	Stop #: Interval:
			D-8				

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding: Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
			Ksat:	

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL:	Diagnostic Horz. / Prop.: Kind: Depth:	
		Kind:		

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %:	D-8
Depth Range:	

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

SAMPLED 0-6

6-13

13-26"

26-45

[illegible]

[illegible]

[illegible]

D-8
p-2

Component Name: | Map Unit Symbol: | Date:

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp
1		0 - 6	A				Loam	5gr 3cB 3st	1F GR	SL	[illegible]	[illegible]	[illegible]	None
2		6 - 13	BA				CB Loam	5gr 2cB 5st	1F-M GR	SL	VFR	[illegible]	[illegible]	
3		13 - 26	Bt				CB CL	10gr 10cB 5st	1F-M SBK	HA	FI	[illegible]	SP	
4		26 - 48	Bt2				Stv CL	15cB 1st 5gr	2M SBK	HA	[illegible]	[illegible]	SP	
5		48 - 78	C				Stx Loam	25st 15cB 15BY	MASSIVE	VH	[illegible]	[illegible]	PS	
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				2VF 1F 2M						
2				2VF, 1F 1M						
3				1VF-F 1M						
4				1F						
5				1VF						Not [illegible] WINEST
6										
7										
8										
9										
10	D-8									

D-9A

USDA-NRCS | **PEDON DESCRIPTION** | Pedon ID #: | Draft | Mar-0

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s):	Date:	Weather: Temp.: Air: CLEAR Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum:	Location: Sec. T. R.
BC	10-15-06	56			

UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:
0456907 4398243		Ut [illegible] D-9A			

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
Mtn	Lower			2307m	270	19	SINGLE	[illegible]

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability: Mod Ksat:	Land Cover / Use:
Moderate			[illegible]		

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
Waste Dump	None	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:
			Disturbed [illegible]

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range:	
15-30% [illegible]	D-9A Disturbed Dump Site [illegible] By 15" Waste Rock-Soil Mix

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

Coal Dump 0-16 overburden
6-15
15-80 coal not sampled
[illegible]
[illegible] L Bigh [illegible]
Sampled 0-6 [illegible]
— coal —
80-95
95-115
115-140
Photos 23-24 + end of [illegible]

Component Names

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp
1	[illegible]	0-6	DISTURBED				GR CL	15gr 5[illegible]	[illegible]					
2	BACKHOE	0-15	Dist 2				CL	25GR 10GS	2M SBK					
3		15-80	[illegible]				COAL	FINE+	[illegible] MAS. E					
4	AUGER	80-95	AB				Loam	15GR [illegible]	1M-F GR					
5	AUGER	95-115	BTb				Lt	[illegible]	2M-F [illegible]					
6	AUGER	115-140	BTcb				Loam	15gr 5GS	[illegible]					
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				2F 1F						[illegible]
2				1vF 1F						
3				—						[illegible]
4				—						
5				—						[illegible]
6										
7										
8										
9										
10	76-0									

D-9B

USDA-NRCS PEDON DESCRIPTION

Pedon ID # : | Draft | Mar-02

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Reg me (Tax):

Describer(s): BC	Date: 10-15-06	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum: Location: Sec. T R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #: D-9B	Soil Survey Area: MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape: MTN	Landform: SIDESLOPE	Microfeature:	Anthro:	Elevation:	Aspect: 300	Slope (%): 22°	Slope Complexity:	Slope Shape: (Up & Dn / Across) COMPLEX

Hillslope Profile Position: LOWER	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage: MOD. WELL	Flooding:	Ponding:	Soil Moisture Status:	Permeability: Kest:	Land Cover / Use: RANGELAND

Parent Material: COLLUVIUM / WASTE ROCK	Bedrock: Kind: Fract.: Hard.: Depth:		Lithostrat. Units: Group: Formation: Member:

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range:	D9-B

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

DISTURBED DUMP AREA

SAMPLED 3 0-6 } SUBSOIL REPLACED
6-11 } DISTURBED
52-80" } BURIED NATIVE SOIL
80-102"

Component Name: | **Map Unit Symbol:** | **Date:**

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont Col Mst Shp
1	A	0-11	MIXED SUBSOIL OVER WASTE MATERIAL				GRV CL	ROCK 10CB 3SA						
2		11-29	COAL 50-75% W SUBSOIL					1SGr 10CB						
3		29-52	COAL 95% W SUBSOIL					M GR						
4		52-80	Bb				LOAM	—						
5	AUGER	80-95	EL				GR L	1SG 10CB						
6	AUGER													
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				2vF 1F						
2				2vF 1F						
3				3vF						NOT SAMPLED
4				—						
5				—						AUGER REJECTED
6					3F					
7										
8										
9										
10	Eb-G									

USDA-NRCS

PEDON DESCRIPTION

Pedon ID #: | Draft | Mar-02

Series or Component Name:	Map Unit Symbol: D-10	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s): BC	Date: 10-15-06	Weather: 60° Temp.: Air: Sunny Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.

UTM: Zone: 0486935 mE: mN: 4395846	Topo Quad.:	Site ID: YR: State: UT County: CARBON	Pedon #: D-10	Soil Survey Area: MLRA / LRU: KINNEY	Transect: ID: Stop #: Interval:	

Landscape: Fan	Landform: Side slope	Microfeature:	Anthro:	Elevation: 2370 m	Aspect: 300°	Slope (%): 4	Slope Complexity:	Slope Shape: (Up & Dn / Across)

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding: Ponding:	Soil Moisture Status:	Permeability: Ksat:	Land Cover / Use: Sagebrush

Parent Material: Colluvium from mixed sedimentary	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:

Erosion: Kind: None Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %:
Depth Range: >35"

D-10 Slope cut [illegible]

VEGETATION :

SYMBOL	COMMON NAME	%GC COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

Sample 05

5-11"

Air dried

Compacted 11-23

Dry [illegible]

Subsoil 23-35

35-60 Not sampled Too stony

Component Name: **Map Unit Symbol:** **Date:** [illegible] p.2

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp
1		0 - 5	A				Loam	[illegible] 3 [illegible]	2 [illegible]	[illegible]	FR	[illegible]	[illegible]	
2		5 - 11	[illegible]				CL		2 M-F [illegible]	[illegible]	FI	[illegible]	[illegible]	
3	[illegible]	11-23	[illegible]				CL		2 M-F [illegible]	[illegible]	[illegible]	S	[illegible]	
4	[illegible]	23 [illegible]	[illegible]				CLAY		[illegible]	[illegible]	[illegible]	VS	[illegible]	
5		42-65+	C				Loam		MASSIVE	[illegible]	[illegible]	VS	[illegible]	
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				1 F [illegible] 1 M 1 C						[illegible]
2				1 F 1 F 1 M [illegible]						[illegible]
3				1 [illegible] 1 M						[illegible]
4				1 F						
5										
6										
7										
8										
9										
10	01-[illegible]									

nber(s): BS	Date: 10-16-06	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N / Longitude: ° ' " W	Datum:	Location: Sec. T. R. D-11		
Zone: 2N	UTM: E: 0486625 N: 4395837	Topo Quad.:	Site ID: YR: State: Utah	County: Carbon	Pedon #: D-11	Soil Survey Area: Kanab	MLRA / LRU:
Transect: ID: Stop #: Interval:							

scape: Top	Landform: Mtn	Microfeature:	Anthro:	Elevation: 2349 m	Aspect: 290	Slope (%): 11%	Slope Complexity:	Slope Shape: (Up & Dn / Across) Convex
ope Profile Position: Lower	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	

age: 580	Flooding:	Ponding: YES	Soil Moisture Status: Wet	Permeability: Moderate / Ksat:	Land Cover / Use: Rangeland

t Material: Colluvium / Weak Sandstone / Clay	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:	
on: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

Control Section: Ave. Clay %: >35% Ave. Rock Frag %: 24% Bd and 60"
th Range:

D-11 MAY BE OUTSIDE LOWER LIMIT OF WEST SERIES
WET AT BASE OF SLOPE 70" TO WATER TABLE

VEGETATION :

IBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

SAMPLED 0-12"

CLAY 12-62 MOST SAMPLED

62-80 SAMPLED THROUGH KNEE OF SLOPE >35%

80+ NOT SAMPLED PROBED 70" TO TOP OF ROCK

70" [illegible]

ZONE FROM [illegible] TRANSECT, THE WETTER
LOW: [illegible] LEASE [illegible]

I-1
P-2

Component Name: **Map Unit Symbol:** **Date:**

Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont Col Mst Shp Loc
1	[illegible]	SUBSOIL RECLAIMED				GRV CL	15GR 3st 10CB						8%
2	[illegible] 62	COAL w/ SOME SUBSOIL MIXED					15gr						90%
3	62-80	C NATIVE SOIL				GRV CLAY	3 GR 15CB 10st	NA					25% COAL
4	80 90+					GRV CLAY	4 GR 25	MASSIVE					
5													
6													
7													
8													
9													
10													

Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
			ZVF 1F						
			NF 1F						
									[illegible]
11-D									

D-12

SDA-NRCS PEDON DESCRIPTION

Pedon ID #: | Draft | Mar-02

...s or Component Name:	Map Unit Symbol:	Photo #:	Classification: Pachic Argiudolls, Fine-loamy	Soil Moist. Regime (Tax.): Ustic
...ribe(s): BC	Date: 12-15-86	Weather: Temp.: Air: 50° Rain, Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
...: Zone: mE: mN: Topo Quad.:		Site ID: YR: State: Utah County: Carbon Pedon #: D-12	Soil Survey Area: Kenilworth MLRA / LRU:	Transect: ID. Stop #: Interval:

...lscape: Mountain	Landform: Sideslope	Microfeature:	Anthro:	Elevation: 8070 ft	Aspect: 330°	Slope (%): 22	Slope Complexity: Simple	Slope Shape: (Up & Dn / Across) Concave
...lope Profile Position: Toeslope	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	

...nage: Well	Flooding:	Ponding:	Soil Moisture Status: Moist to 16"	Permeability: Moderate Kast:	Land Cover / Use: Rangeland Aspen w/ Sagebrush
...nt Material: Mixed Sedi. Colluvium Mixed	Bedrock: Kind: Fract.: Hard.: Depth: Paxton			Lithostrat. Units: Group: Formation: Member:	
...ion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:		Diagnostic Horz. / Prop.: Pachic Mollic	Kind: Depth:
Control Section: Ave. Clay %: <35% ...pth Range:	Ave. Rock Frag %: <35%	Cross-section (photo gallery)			

VEGETATION :

MBCL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

Deep Roots [illegible] to 7½ ft

0-6 Cum not affecting the subsoil [illegible]

6-14

14-28

28-48

48-66

Component Name:							Map Unit Symbol:							Date: 8-2
	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp
1		0 - 6	A1				GR SL	[illegible]	2M-F [illegible]	SO	VFR	SO	PO	
2		6 - 14	A2				GR [illegible]	8GR	2 MGR 2M-F SBK	SO	FR	SO	PO	
3		14 - 28	BAT				GR CL	14GR 5 [illegible]	3FM [illegible]	VH	VF	[illegible]	PS	
4		28 - 48	B12				STK CL	25GR 15GR 15GT	3CM [illegible]	[illegible]	[illegible]	VS	VP	
5		48 - 64	B13/C				CBK CL	35GR 20 CB 10GT	[illegible]	[illegible]	[illegible]	[illegible]	VP	
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				3 VF 1F 2F 2M						[illegible]
2				3 VF 2F 1M [illegible]						
3				2 VF 1F						
4				1 VF						[illegible]
5				1 VF						[illegible]
6										
7										
8										
9										
10	D-12									

1A-2

SDA-NRCS PEDON DESCRIPTION

Pedon ID # : | Draft | Mar-02

s or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

ribe(s): R.L.	Date: 10-15-06	Weather: Temp.: Air: 52° Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum: Location: Sec. T. R.

Zone:	mE: 0486932	mN: 4398464	Topo Quad.:	Site ID: YR: State: County: Pedon #: 1A-2 KINNEY	Soil Survey Area: MLRA / LRU	Transect: ID. Stop #: Interval:

scape: MTN	Landform: SHOULDER	Microfeature:	Anthro:	Elevation: 2380M	Aspect: 320°	Slope (%): 30%	Slope Complexity: CONVEX	Slope Shape: (Up & Dn / Across) CONVEX

ope Profile Position: LOWER	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

age: WELL	Flooding:	Ponding:	Soil Moisture Status: MOIST >20"	Permeability: MODERATE Kest:	Land Cover / Use: Desert Shrub

rt Material: Colluvium	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:		
ion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BO: CN: FL: Kind: 5 2 2	Diagnostic Horz. / Prop.: MELAN	Kind: Depth:

Control Section: Ave. Clay %: <35% Ave. Rock Frag %: >35%
nth Range:

1A-2 LOWER TOESLOPE WITH 12-15" [illegible] 1/2" LEAF LITTER

VEGETATION :

BOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

COAL FROM 0-15 [illegible]

15-25 BWk1 A

25-40"

40-60

60-[illegible]

[illegible] 10"

Component Name: | Map Unit Symbol: | Page: A-2 P 2

Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1	0-15	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]					
2	15-25	Ab				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
3	25-40	Bt				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
4	40-60	BC				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
5	60-75"	C1				[illegible]	[illegible]	MASSIVE	[illegible]	[illegible]	[illegible]	[illegible]	
6	75-90"	C2				[illegible]	[illegible]	MASSIVE	[illegible]	[illegible]	[illegible]	[illegible]	
7													
8													
9													
0													

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				[illegible]						[illegible]
2				3F 2M 2C 2VF						[illegible] Mottles
3				1F, 1M						[illegible]
4				1F, M						
5				1VF 1F	1F					
6										
7										
8										
9										
0	C-A1									

ZA-1

USDA-NRCS | **PEDON DESCRIPTION** | Pedon ID #: | Draft | Mar-02

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):
	ZA-1		1 ARGIUSTOLL, FINE-LOAMY	USTIC

Describer(s):	Date:	Weather: Temp.: Air: CLOUDY Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum:	Location: Sec. T. R.
BC	10-14-06	60° 6½			

UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:
0486811 4397900		UTAH CARBON			

Landscape	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
MTN.	TOESLOPE			2372 m	270°	27	SIMPLE	CONCAVE

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
LOWER							

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability: Ksat:	Land Cover / Use:
WELL			MOIST TO 15'		GRASS + SAGEBRUSH

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
COLLUVIUM	BACKHAWK FM	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:
NONE	MODERATE	12 2 3 2 10	MOLLIC ARGILLIC

P.S. Control Section: Ave. Clay %: Depth Range:	Ave. Rock Frag %:	
	25-30%	ZA-1 TRANSFER

VEGETATION:

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH:

SAMPLED 5 INCREMENTS 0-10"
10-24"
24-44"
44-65"
65-90 INCHES

BACKHOE PIT!
6½ FEET PHOTO (P) #15

SOIL MIXING FROM LANDSLIDE MOVEMENT -
MASS WASTING BELOW 44"
HORIZONS INDISTINCT BELOW THIS ↑ DEPTH

IN STRU
WEATHERING OF SS + SHALE IN LOWER 2 HORIZONS

Component Name: | Map Unit Symbol: | Site: P-2

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Msl	Consistence Stk	Consistence Pls	Mottles % Sz Cont Col Msl Shp
1	PIT	0	10	A					10 GR 5 CB	1M-F GR					
2	"	10	24	AB					15 GR 5 CB	2M-F SBK					
3	"	24	44	BT					15 GR 15 CB 5 S	3M-F SBK					
4	"	44	65	BT/C					20 GR 15 CB 10 S 5 BY	MA					
5	"	65	80+	C					20 GR 10 CB 15 S 5 BY	MASSIVE					
6															
7															
8															
9															
10															

	Redoximorphic Features % Sz Cr Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				3 VF 1F						
2				2 VF 1F						
3				1 VF 1F						
4				1 VF						
5				1F						
6										
7										
8										
9										
10	1-F/C									

Describer(s):	Date:	Weather: Temp.: Air: 55° Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum:	Location: Sec. T. R
BC	10-14-06	[illegible]			2A-2

UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:
0486335 4347839	[illegible]	UTAH 2A-2	KINNEY		

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
MOUNTAIN	SIDESLOPE					24	SINGLE	PLANAR → SL CONCAVE

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
MIDDLE → LOWER							

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability: Kast:	Land Cover / Use:
1 MODERATE			MOIST TO 15"	MOD	GRASS + SAGEBRUSH

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
[illegible] RIM SANDSTONE		

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz / Prop.: Kind: Depth:
		15 5 3 4	MOLLIC

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range: 25-30%

2A-2 TRANSFER

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

BACKHOE P + TRANSMISSION LINE RT
5 1/2 FT DEEP

SAMPLED 0-5 [illegible]
6-14 [illegible]
14-25
25-38
38+ NO SAMPLE

PHOTO # 17 (UP)

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp
1		0-5	A1				Lam	5 gr 5 cB	2 [illegible]	So	VFR	[illegible]	Po	
2		5-14	A2				GrL	10 gr 5 cB	2 M-F Gr	So	[illegible]	So	Po	
3		14-25	Bw				Gr Lam	[illegible] 10 cB 5 st	2 M [illegible]	Ho	[illegible]	[illegible]	[illegible]	
4		25-38	B/C				Grv Lam	20 gr 10 cB 5 st 5 cH	2 F [illegible] ABK	Ho	VF	S	PS	[illegible]
5		38-[illegible]	C2				Stk Gr	20 gr 10 cB 2 st [illegible]	MASSIVE	VH	VF	[illegible]	PS	
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				3 VF, 2 F, 1 M						
2				2 VF [illegible]						
3				1 VF						[illegible]
4				/						[illegible]
5				1 VF						
6										
7										
8										
9	t-ve									

Zone:	mE:	mN:	Topo Quad.:	Site ID: YR:	State:	County:	Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID:
0486976	4398624		10-15-06				2A-3	KINNEY		2A-3 Stop #: Interval:

scape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
MTN	SIDESLOPE			2384M	300°	27%	[illegible]	[illegible]

ope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
MIDDLE							

age:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use
WELL			MOIST TO 13"	MODERATE Ksat:	

nt Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
COLLUVIUM FROM SANDSTONE + SILTSTONE		

on: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL:	Diagnostic Horz. / Prop.: Kind: Depth:
MAFF WASTING / SLUMPING		Kind: 10 5 2 2 2	[illegible]

Control Section: Ave. Clay %: Ave. Rock Frag %: 2A-3 NATIVE SOIL DEEPER A HORIZON UNDER SAGEBRUSH HUMMOCKS UP TO 10-16" DEPTH

th Range:

VEGETATION :

BOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

SAMPLED 0-9"

9-19

19-36

36-52

52 TO [illegible] NOT SAMPLED [illegible]

MIXED [illegible]

	Method	(inf) (cm)			Dry	Moist		Knd % Rnd Sz	Grade Sz Type	Consistence Dry	Mst	Stk	Pls	Mottles % Sz Cont Col Mst Shp Loc
1	Ø	0 - 9	A				GR SLOAM	10g 5Ø	2M GR	SO	FR	SO	PO	NONE
2	—	9 - 19	Bt				GR LOAM+	15gr 3CB	2F-M SBK	SH	FI	SS	PO	
3	[illegible]	19 - 36	Bt2				CBV CL	10g 15CB 10CH	2M-C ABK	VH	FI	S	P	
4	[illegible]	36 - 52	C1				STV CL	15g 15C 20ST	3F-M SBK	EH	EF	S	P	
5	[illegible]	52 - 75"	C2				BTV CL	20ST 15DH	MASSIVE	EH	EF	V S	VP	
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				3VF 2F 1M						
2				1VF, 1F						
3				1VF, 1F						
4				1VF						[illegible] COLLUVIUM
5				1VF						WEATHERED SILTSTONE AND SANDSTONE COLLUVIUM
6										
7										
8	2A-3									

2A-5

2A-5
P-2

LOAD-OUT SITE

BELOW RR TRACK 100 M SE OF SUPHER SPRING
SAGEBRUSH/RABBITBRUSH COMPLEX HUMMOCKY TOESLOPE

28% 280° ASPECT

[illegible]

BELOW ROAD TO TOWN

Component Name: 2A-5 Silt Fine Sand **Map Unit Symbol:** **Date:** 10-16-06

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Wet	Consistence Stk	Consistence Pls	Mottles % Sz Con L Col Mst Shp Loc
1	[illegible]	0	6	A				Sil Loam	10 gr 15 sr 15 Bl	2M-F GR	SO	[illegible]	SO	SO	
2	[illegible]	6	12	D				Sil Loam	15 gr 15 sr 15 Bl	2 [illegible]	SO	FR	PO	PO	
3	[illegible]	12	24	Bt				Sil C	10 cb 10 gr 15 sr	[illegible]	HA	[illegible]		[illegible]	
4	[illegible]	24	48	Bt				CR Clay	25 gr 15 cb	[illegible]	FH	FR	[illegible]	[illegible]	[illegible]
5		48	65+	BC				CR Clay	25 gr 10 cb	[illegible]	FH	FR		[illegible]	
6															
7															
8															
9															
10															

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Sho	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				3vf 3f						
2				2vf 1f 1m						
3				1vf						
4				1f						
5										
6										
7										
8										
9										
10										

2A-5

Zone	Easting	Northing	Topo Quad:	Site ID: YR:	State:	County:	Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID:	Stop #:	Interval:
WGS	0456828	4397820			UT	CARBON	2A6	KIMBER		2A6		

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
MTN.	SLOPE/LANDSLIDE DEBRIS			2379m	310°	23	COMPLEX	COMPLEX HOMOGENOUS

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:
LOWER							

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
WELL			MOIST TO 15"	MODERATE Ksat:	ARTIMA - GRASSES

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
COLLUVIUM	MIXED SEDIMENTARY	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL:	Diagnostic Horz. / Prop.: Kind: Depth:
SLIGHT		Kind: 5 2 2 2 TR	PACHIC PARGIC

P.S. Control Section: Ave. Clay %: Ave. Rock Frag %:	
Depth Range: 71 <35	NEWER TWO CUT INTO COLUMBINE MINE DEEP ROCK-FREE LANDSLIDE DEPOSIT 15' NE OF FEATURE

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

SAMPLE 0-6"

6-12"

12-24

24-40

40-66

66-95'

SAME AS THE BEST-DEVELOPED TOPSOIL ON PROJECT AREA

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont Col Mst Shp Loc
1	↑	0 6	A1				L	Tr GR-CB	2m [illegible]	SD	[illegible]	SO	PO	
2	SLOPE,	6 - 12	A2				L	3 gr 2 cb	1m SBL → MGR	[illegible]	[illegible]	SO	PO	
3	ROAD CUT	12 - 21	Bw1				Lt	5 gr 3 cb	2m [illegible]	[illegible]	FI	SS	PO	
4	LOCATION	21 - 40	Bw2				LOAM	5 gr 3 cb	2m SBL	SH	FI	S	[illegible]	
5	↓	40 - 66	C				GR LOAM	10 gr + cb	2m [illegible]	SH	FI	[illegible]	PO	
6	↓	66 - 85+	C				LOAM	20 GR + CH	MASSIVE	[illegible]	FI	SH	PO	
7								5 st + BT						
8														
9														
0														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1				3 [illegible]						
2				2 [illegible]						
3				WF VF						
4				WF						[illegible]
5				WF						[illegible]
6										
7										
8										
9										
0										

2A-6

GPS UTOPIA 72 1 0 2B & 2B-1

DA-NRCS PEDON DESCRIPTION

Pedon ID #: | Draft | Mar-02

s or Component Name:	Map Unit Symbol: 2B-1	Photo #:	Classification:	Soil Moist. Regime (Tax.)

ribers): 2B	Date: 10-14-06	Weather: Temp.: Air: COOL Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum: Location: Sec. T. R.

Zone: mE: mN: 0486 439700	Topo Quad.:	Site ID: YR: State: UT	County: Carbon	Pedon #:	Soil Survey Area: Emery Area	MLRA / LRU:	Transect: ID: Stop #: Interval:

scape:	Landform: Mtn Slope	Microfeature:	Anthro:	Elevation: 2404 m	Aspect: 280	Slope (%): 46	Slope Complexity: Planar	Slope Shape: (Up & Dn / Across) Straight	

ope Profile Position: Upper Third	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Phys o. Area:

age: None	Flooding: Ponding:	Soil Moisture Status: Dry	Permeability: Ksat: Moderate	Land Cover / Use: Shrub / Forest

t Material: Colluvium	Bedrock: Kind: Fract.: Hard.: Depth: Brush Creek Fm.	Lithostrat. Units: Group: Formation: Member:

on: Kind: Degree: Slight	Runoff: Rapid	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth: None	

Control Section: Ave. Clay %: Ave. Rock Frag %: 25 th Range:	2B-1 TRANSPORT ROUTE, SWITCHBACK

VEGETATION :

BOL	COMMON NAME	%GD COVER
	Sagebrush	
	Mountain Mahogany	
	Rabbitbrush	
	Grasses	

MISCELLANEOUS FIELD NOTES / SKETCH :

Sampled increments

Photo Pedon Camera (P)

Soils Below 19 inches Indurated

Evaluation Needed for Carbonate

B-1
P-2

Component Name: **Map Unit Symbol:** **Site:**

	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1		0 - 9	A				Lcm	3gr 10cb 5st						[illegible]
2		9 - 19	Bt				CL	20gr 10cb 5st						
3		19 - 33	Bt				CL	20gr 15cb 10st						
4		33 - 51	BC				CL	15gr 15cb 15st						
5		51 - 80	Cr		SANDSTONE [illegible] MIXED WITH [illegible] SEDS [illegible]									
6		8[illegible]	R		HARD SANDSTONE SEDS [illegible]									
7														
8														
9														
0														

	Redoximorphic Features % Sz Cn Hd Sp Kd Loc Bd Col	Concentrations % Sz Cn Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CCE	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9										
0	1-8 C									

USDA - [illegible] Service

SOIL DESCRIPTION

(Reference FSH 2569.18)

01-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
3A	COMMULEC ENODAQUALL, CO-LAMY	9-5-07	BL				Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY MINE			UT	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
WITH COAL RUN-OUT ALLUVIUM	MIXED		a. Kind NONE b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
FLOODPLAIN	a. % 3 b. Shape CONCAVE c. Length 100' d. Aspect 10°	SPD	a. GR 5 b. CB 0 c. ST 0 d. BY 0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
WEEDY WITH THISTLE			

HORIZON DESIGNATION (a)	DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
D1	0-6	10YR 2/1	10YR 5/2	/	SL 10 [illegible]	2F SBK	SH	FI	SO PO	/	GR - 10 CB - 0 ST - 0	3VF 1F	2VF IN 1F TU	NE	7.3	C.W
D2	6-14	10YR 2/2	10YR 4/2	/	SL 11	2F SBK	SH	FI	SO PO	/	GR - 5 CB - 0 ST - 0	2VF 1F	1VF IN 1F TU	NE	7.4	A.W
Ab	14-24	10YR 3/2	10YR 5/2	2 FANT 15%	LOAM SILT 22 LOAM [illegible]	MASS NE	VH	VFI	SS PO	/	GR - 0 CB - 0 ST - 0	1VF 1F	2VF IN	NE	7.7	
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					

26. Partial Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-24	16	4	>60 FT.

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	COMMULEC	—	10-40"

Previous edition [illegible] date.

FS 2500-1 (2/86)

USDA - F[illegible]rvice

SOIL D[illegible]RIPTION

HAPLOCRYOLL (Reference FSH 2509.16) 02-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
3A	FINE-LOAMY COMOLLIC HAPLOSTOLL	9-5-07	BL				Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY #2				CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
ALLUVIUM	MIXED		a. Kind ___ b. Class ___

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
FLOODPLAIN TERRACE	a. % 7 b. Shape ___ c. Length ___ d. Aspect ___		a. GR 0 b. CB 0 c. ST — d. BY 0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
BIG SAGEBRUSH			45" +

HORIZON DESIGNATION (a)	INCH DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
A1	0-6	10YR 3/2	10YR 5/2	/	LOAM 16 20	2M-F SBK	SH	FR	SS/PS	/	GR - 0 CB - 0 ST - 0	3VF 1F 1M		NE	6.6	A, W
A2	6-17	10YR 3/3	10YR 5/3	/	L 18 22	2M SBK	SH	FR	SS/PS	/	GR - 0 CB - 0 ST - 0	2VF 1F		NE	6.8	A, S
A3	17-32	10YR 3/3	10YR 5/2	/	~~SIL~~ LOAM 17 23	2M-C SBK	HA	FI	S/PS	/	GR - 3 CB - 0 ST - 0	1VF		NE	7.2	A, S
BW	32-44	10YR 3/3	10YR 5/3	/	~~SIL~~ LOAM 22 25	2C-M SBK	SH	FI	S/PS	/	GR - 0 CB - 0 ST - 0	1VF		NE	7.4	
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
28. Diagnostic Horizons	a. Surface:	b. Subsurface:		29. Moist Control Section Depth:

Previous edition [illegible] etc.

FS 2500-1 (2/86)

USDA - Forest Service

SOIL DESCRIPTION

(Reference FSH 2509.18)

03-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
3A	FLOAMY CUMMULIC HAPLOCRYOLL	9-5-07	BC				Sec. ___ T. ___ R ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY #2			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
Alluvium	—		a. Kind ___ b. Class ___

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
FLOODPLAIN	a. % 3 b. Shape Concave c. Length 200 d. Aspect 350	SPD	a. GR ___ b. CB ___ c. ST ___ d. BY ___

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
SHOBS + GRASS			

HORIZON DESIGNATION (a)	Inches DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	%	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
	0-6	10YR 2/1	10YR 3/2	/	Loam	19	2m-F GR	SO	VFR	SO PO	/	GR - TR CB - 0 ST - 0	3VF 1F 1M	2VF IN 1FTU	NE	6.5	C, W
	6-11	10YR 4/1	10YR 3/2	/	Loam	18	2m-C GR	SO	FR	SS PO	/	GR - 0 CB - 0 ST - 0	2VF 2F	3VF IN 1FT	NE	6.9	C, W
	11-20	10YR 4/3	10YR 3/2	1m pores	Loam	21	2m-F SBK	SO	FI	SS PS	/	GR - / CB - / ST - /	1VF 1F	1VF IN 1FTU	NE	7.0	C, S
	20-40	10YR 5/3	10YR 4/2	2m pores	Loam	21	3m-C SBK	SH	FI	SS PO	/	GR - / CB - / ST - /	1VF	1VF to 1F IN	NE	7.6	
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-40	20	0	>60" EST

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	MOLLIC	CAMBIC	10-40"

Previous edition Note.

FS-2500-1 (12/86)

NOT DISTURBED

USDA - [illegible] Service

SOIL DESCRIPTION

(Reference FSH 2509.18)

-04-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
2A	LOAMY-SKEL TYPIC HAPLUSTOLL	9/5/07	BC				See ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY MINE			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
COLLUVIUM	SANDSTONE		a. Kind NONE b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
FANSLOPE	a. % 16 b. Shape CONCAVE c. Length 170 d. Aspect 260	WD	a. GR 1 b. CB 3 c. ST 1 d. BY 0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
GRASSES BIG SAGEBRUSH W/SNOWBERRY			

HORIZON DESIGNATION (a)	DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
A1	0-6	10YR 3/2	10YR 5/3	/	S LOAM 17 19	2M-F SBK	SO	VFR	SO PO	/	GR - 2 CB - 2 ST - 0	1VF 2F 1M	2VF IN	NE	6.6	C, S
A2	6-11	10YR 3/3	10YR 5/2	/	STV LOAM 17 20	3F-M ABK	VFI	VFI	SS PS	/	GR - 5 CB - 20 ST - 20	1VF 1F	2VF IN 1F TU	NE	6.6	G, W
BW	11-20	7.5YR 5/4	7.5YR 6/4	/	STX LOAM 18 17	3M-F ABK	VFI	VFI	SS PS	/	GR - 10 CB - 20 ST - 25	1VF	1VF TU	NE	6.7	G, W
C	20-60	7.5YR 5/4	7.5YR 6/2	/	SCL 21 15	MASSIVE	SH	FI	SO PO	/	GR - 0 CB - 0 ST - 0	/	1VF IN 1VF TU	NE	6.9	
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-40"	19%	39%	>60 EST

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	MOLLIC	CAMBIC	10-40"

Previous edition [illegible] date.

FS-2500-1 (2/86)

USDA F[illegible] Service

SOIL D[illegible]RIPTION

(Reference FSH 2509.18)

MISSING A HORIZON

05-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location: Sec. ___ T. ___ R. ___
DA 05	DISTURBED	9/5/07	BC				

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY MINE			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion: a. Kind	b. Class
COLLUVIUM	SANDSTONE		NONE	

18. Landform	19. Slope: a. %	b. Shape	c. Length	d. Aspect	20. Drainage Class	21. Surface Stone and Rock: a. GR	b. CB	c. ST	d. BY
TOESLOPE	4	PLANK	50'		WD	10	5	2	TR

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
GRASS + SAGEBRUSH SOIL SURFACE SCRAPED			NONE

HORIZON DESIGNATION (a)	Lower DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB ~~FIELD~~ pH (i)	BOUNDARY (j)
B	0-8	7.5YR 4/4	7.5YR 6/4	/	LOAM 22 27	2cPL 1FSBM	HA	VFI	S PS	/	GR - 5 CB - 5 ST - 3	2VF 1F	2VF IN 2FTU	NE	6.5	CS
C1	8-28	7.5YR 5/4	7.5YR 6/4	/	CBL SANDY 21 24	2M-F SBM	HA	VFI	S PS	/	GR - 10 CB - 15 ST - 10	1VF 1F	1VF-F TU	NE	6.7	C, W
C2	28-60	7.5YR 6/4	7.5YR 7/4	/	STGL 20 22	2M-F SBM	HA	FI	SS PO	/	GR - 15 CB - 20 ST - 20	1VF	1VF-F TU	NE	7.1	
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
28. Diagnostic Horizons	a. Surface:	b. Subsurface:		29. Moist Control Section Depth:

Previous edition [illegible]

FS 2500-1 (2/86)

USDA - [redacted]ervice

06-SP-07

SOIL D[redacted]RIPTION

(Reference FSH 2509.18)

06-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No	6. Step No.	7. USGS Quad	8. Location: Sec. ___ T. ___ R. ___
DA	DISTURBED	9/5/07	BC				

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY MINE			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion: a. Kind	b. Class
COLLUVIUM	SANDSTONE		SHEET	

18. Landform	19. Slope: a. %	b. Shape	c. Length	d. Aspect	20. Drainage Class	21. Surface Stone and Rock: a. GR	b. CB	c. ST	d. BY
TOESLOPE / FANSLOPE	12	CONVEX			WD	5	15	5	

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
SAGE RABBITBRUSH, AMPLER, PUTC			NONE

HORIZON DESIGNATION (a)	pH or DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
REC X1	0-6	10YR 3/1	10YR 4/2	/	LOAM 20	2 m GR	SO	FR	SO PO	/	GR 5 CB 3 ST 3	2vf vf	2vf m	NE	7.3	C W
COAL	6-55	COAL	FINES	& SAMPLES	LOAM 25	DOUBLE, m	SELINIT AND	ACID	BASE	POT	GR 10 CB 5 ST 15	vf		NE	7.4	C S
2B	55-80	10YR 3/2	10YR 5/2	/	LOAM ~~SILT~~ LOAM 20	3 c m SBK	HA	FI	SO PO	/	GR 5 CB 5 ST 5	/	1vf tu	NE	6.2	
											GR CB ST					
											GR CB ST					
											GR CB ST					
											GR CB ST					
											GR CB ST					
											GR CB ST					

26. Partial Site Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:

Previous edition [illegible] Sept.

FS 2509.1 (12/96)

USDA - [illegible] Service

SOIL [illegible]CRIPTION

(Refer[illegible] SH 2509.18)

07-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location
ZA	LO-SH TYPIC ~~ARGIUSTOLL~~ HAPLISTOLL / GR	9/5/07	BC				Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY MINE			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
COLLUVIUM	SANDSTONE		a. Kind NONE b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
TOPSLOPE	a. % 8 b. Shape PLANAR c. Length 150' d. Aspect 270'	WD	a. GR 5 b. CB 5 c. ST TR d. BY 0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
SAGEBRUSH GRASSES W/ LOPINE & PRINCEBROOK			

HORIZON DESIGNATION (a)	DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	TEXTURE (d)	%C	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
A1	0-6	10YR 3/1	10YR 4/2	/	SL	15 16	2M GR	SO	VFR	SO PO	/	GR-5 CB-5 ST-0	3VF 2F 1C	3VF IN	NE	6.6	C, S
A2	6-11	10YR 3/3	10YR 5/3	/	SPLOAM	16 19	2F SPL → FGR	SO	VFR	SO PO	/	GR-15 CB-15 ST-5	2VF 2F 1C	2VF IN 1F tr	NE	6.5	C, W
BW	11-28	10YR 4/3	10YR 6/3	/	STV SL	16 16	MASS INE	HA	VFI	SO PO	/	GR-15 CB-20 ST-20+ BY	1M 1VF 1F	3VF IN	NE	6.6	G, W
BT	28-40	7.5YR 5/4	7.5YR 6/4	/	STK SL	18 29	MASS INE	VH	VFI	SO PO	/	GR-20 CB-25 ST-25+ BY	/	2VF tr 2VF IN	NE	7.1	
												GR- CB- ST-					
												GR- CB- ST-					
												GR- CB- ST-					
												GR- CB- ST-					
												GR- CB- ST-					

26. Partical Site Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-40"	17	>50%	>60' EST.

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	MOLLIC	CAMBIC	10-40'

Previous edition [illegible] Note.

FS-2500-1 (2/85)

USDA - Forest Service

SOIL DESCRIPTION

(Reference FSH 2569.18)

98-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No	6. Stop No.	7. USGS Quad	8. Location:
2A	Fi-Loamy Typic ~~Argiustoll~~ Haplustoll	9-5-07	B				Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
Kinney Mine			Utah	Carbon

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
Colluvium	Sandstone		a. Kind None b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
Fanslope	a. % 10 b. Shape Concave c. Length 200' d. Aspect 290	WD	a. GR 2 b. CB 2 c. ST 3 d. BY 0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
Artr w/ Rabbitbrush Grasses			None

HORIZON DESIGNATION (a)	INCHES DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	L/B TEXTURE (4)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB ~~FIELD~~ pH (i)	BOUNDARY (j)
A	0-9	10YR 3/3	10YR 5/3	—	S Loam 17 14	2 M-F GR	SO	VFR	SO PO	—	GR - Tr CB - 2 ST - 0	3VF 2F	3VF-N	NE	6.5	[illegible]
BW	9-17	10YR 4/4	10YR 6/3	—	S Loam 19 16	7 M SBK → M GR	HA	FI	SO PO	—	GR - 3 CB - 2 ST - 0	2VF 1F	1VF-N 2F TU	NE	6.6	[illegible]
Bt1	17-36	7.5YR 5/4	7.5YR 6/4	GR	~~GR~~ Loam 17 21	2 M SBK	SH	FR	SO PO	—	GR - 10 CB - 5 ST - 0	1VF	1VF-F TU	NE	6.6	[illegible]
Bt2	36-60	7.5YR 4/4	7.5YR 6/4	—	Stv SL 15	3 M C SBK	SH	FR	SO PO	—	GR - 15 CB - 10 ST - 10	1VF	1VF-F TU	NE	6.7	
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-40"	18%	15%	>60"

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	Mollic	Cambic	10-40"

Previous edition Note.

FS 2500 [illegible]

USDA Forest Service

SOIL DESCRIPTION

(Reference FSH 2509.10)

09-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
ZA	Fine loamy Typic Argiustolls	9-6-07	BC				Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
Lincoln				Curry

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion: a. Kind	b. Class
Colluvium			None	

18. Landform	19. Slope: a. %	b. Shape	c. Length	d. Aspect	20. Drainage Class	21. Surface Stone and Rock: a. GR	b. CB	c. ST	d. BY
Toeslope	7	Concave	200	315	Wp	1	3	5	0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
Artva / Grasses			None

HORIZON DESIGNATION (a)	DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (5)	LAB FIELD pH (6)	BOUNDARY (7)
A	0-6	10YR 3/2	10YR 5/3	/	SL 14	1F-M GR	LO	LO	SO PO	/	GR-10 CB-0 ST-10	3VF 2F	3F-M	NE	6.5	C,S
Bw	6-12	10YR 4/4	10YR 6/3	/	SLOM 19 16	2M-C SBK	SH	FR	SO PO	/	GR-0 CB-0 ST-10	2VF 1C	1VF-M 2F-M	NE	6.5	C,W
Bt1	12-30	7.5YR 4/4	7.5YR 6/4	/	CSLOM 21 22	3M SBK	SH	FI	SS PO	/	GR-10 CB-10 ST-/	1VF	1F,VF T	NE	6.5	G,W
Bt2	30-60	7.5YR 5/4	7.5YR 6/4	/	LOAM 14 25	3M NBK	VH	VFI	SS PS		GR-5 CB-0 ST-0	1VF	1VF-F T	NE	6.9	
											GR- CB- ST-					
											GR- CB- ST-					
											GR- CB- ST-					
											GR- CB- ST-					
											GR- CB- ST-					

26. Partical Size Control Section	a. Depth	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	6-26"	20	< 5%	>60"

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	Ochric → Mollic	Argillic	10-40"

Previous edition Note: INTERGRADE

FS 2509.3 (2/06)

Map Unit [redacted] was later determined to be D-A

DISTURBANCE [illegible] ONLY

SOIL [redacted]RIPTION

(Reference FSH 2509.18)

ARGICRYOLL

10-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
1A	LA-SK, MIXED TYPIC ARGICRYOLL	9-5-07	BC				Sec. ___ T ___ R ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY #2			UT	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
COLLUVIUM	SANDSTONE		a. Kind SLIGHT b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
SIDESLOPE	a. % 32 b. Shape CONVEX c. Length 25' d. Aspect 316	WD	a. GR 5 b. CB 5 c. ST 3 d. BY 0

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
ASPEN - SNOWBERRY			NONE

HORIZON DESIGNATION (a)	INCHES DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	%C	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
A	0-7	10YR 3/2	10YR 5/2	/	ST SL	11 15	1M-F SBK	SH	FR	SW PO	/	GR - 10 CB - 5 ST - 10	1VF-F 2M2C	3VF IN	NE	6.9	C, W
Bt1	7-17	7.5YR 6/4	7.5YR 6/4	/	LB GL LOAM	19 28	2M-F SBK	VH	VFI	S/P	1MPF 1MPO	GR - 5 CB - 15 ST - 5	1VF-F 2M2C	3VF IN 2FTU	NE	6.6	C S
Bt2	17-40	7.5YR 5/4	7.5YR 6/2		ST V LOAM ~~SCL~~	24	3M-C ABK	HA	VFI	S/P	2MKPF 1MPO	GR - 0 CB - 10 ST - 15	1M 1C	1VFTU 1FIN	NE	6.7	G, W
Bt3	40-70	7.5YR 5/4	10YR 6/4	/	ST X LOAM	18 26	3M-C SBK	VH	VFI	SS/PS	2MPPO	GR - 10 CB - 15 ST - 30	1VF	2VF IN 1FTU	NE	7.3	
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	7-27'	20%	30%	>60"

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	MOLLIC	ARGILLIC	10-40"

Previous edition [illegible]

FS 2500-1 (2/85)

SOIL DESCRIPTION

ARGIUSTOLL (Reference FSH 2509.18) 11-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Snap No.	7. USGS Quad	8. Location:
2B	LO-SKELETAL TYPIC ~~HAPLO~~STOLL	9-6-07	BC				Sec. ___ T ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY MUE			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
COLLUVIUM	SANDSTONE		a. Kind NONE b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
TOESLOPE LANDSLIDE DEPOSIT	a. % 32 b. Shape CONVEX c. Length 50' d. Aspect 290	VD	a. GR ___ b. CB ___ c. ST ___ d. BY ___

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
BIG SAGEBRUSH, GRASSES, RABBITBRUSH			NONE

HORIZON DESIGNATION (a)	INCHES DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LOB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (5)	LAB ~~FIELD~~ pH (6)	BOUNDARY (7)
A	0-5	10YR 3/2	10YR 5/3	/	CB SL 16	2M-F GR	SD	VFR	SO PO	/	GR - 10 CB - 10 ST - 0	2VF 1F 1M	3VF-M	NE	6.8	C,S
AB	5-13	10YR 4/3	10YR 6/3	/	ST BLOAM 20 17	2F SBK	SH	FI	SS PO	/	GR - 15 CB - 5 ST - 15	1VF 1F 1M	2VF-M 1F-TU	NE	6.4	C,S
BW	13-33	10YR 5/4	10YR 6/2	/	GRV SL 17 14	SG	LO	LO	SO PO	/	GR - 15 CB - 10 ST - 10	1VF 1F	2VF-M	NE	6.6	C,W
Bt	33-55	7.5YR 5/4	7.5YR 6/4	/	GRV LOAM 24 21	2F-M SBK	SH	FR	SO PO	/	GR - 25 CB - 10 ST - 5	1VF 1F	2F-TU	NE	6.8	G,W
C2	55-80	7.5YR 5/4	7.5YR 6/4	/	GR BLOAM 26	3M-F SBK	HA	FI	SS PS	/	GR - 10 CB - 5 ST - 0	/	1F-VF TU	NE	7.1	
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					
											GR - CB - ST -					

26. Partial Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-40"	22	37%	>80

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	MOLLIC	ARGILLIC ?	10-40

Previous edition Note.

FS 2500-1 (2/86)

USDA - [illegible] Service

Inclusion

SOIL DESCRIPTION

(Reference FSH 2509.18)

DISTURBED [illegible]

12-SP-07

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
DA 2A	Co-Loamy Typic Haplustoll	9-6-07	BC		07-12		Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
Kinney Mine			UT	Carbon

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
Colluvium	Sandstone		a. Kind None b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
Sideslope	a. % 23 b. Shape Convex c. Length 30' d. Aspect 290°	WD	a. GR 5 b. CB 3 c. ST 2 d. BY

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
Rabbitbrush			None

HORIZON DESIGNATION (a)	WEIR DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	LAB TEXTURE (d)	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER CLASS (h)	LAB ~~FIELD~~ pH (i)	BOUNDARY (j)
A1	0-6	10YR 3/3	10YR 5/3	/	S Loam 16 21	2M GR	SO	VFR	SS/PO	/	GR-3 CB-2 ST-0	3VF 2F	3VF IN	NE	7.1	C, S
A2	6-12	10YR 4/3	10YR 5/2	/	S Loam 16 23	3M-C SBK	HA	FI	SS/PS	/	GR-3 CB-2 ST-0	1VF 1F	1VF IN 2F TU	NE	7.2	G, W
BW1	12-24	10YR 4/3	10YR 5/2	/	S Loam 15 25	3M-C SBK	HA	FI	SS/PS	/	GR-4 CB-2 ST-0	1VF	1VF IN 2F TU	NE	7.2	G, W
BW2	24-36	10YR 4/4	10YR 5/2	/	CBSL 15 24	MASS INE	VH	VFI	SS/PS	/	GR-10 CB-15 ST-0	1VF	1F TU	NE	7.4	C, S
C1	36-52	10YR 4/4	10YR 5/2	/	S Loam 14 26	MASS INE	EH	VFI	SO/PO	/	GR-3 CB-2 ST-0	/	1VF-F TU	NE	7.4	C, S
C2	52-75	10YR 5/4	10YR 6/3	/	S Loam 15 23	MASS INE	EH	VFI	SO/PS	/	GR-2 CB-2 ST-0	/	1VF-F TU		7.8	
											GR- CB- ST-					
											GR- CB- ST-					
											GR- CB- ST-					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
	10-40'	14	<10%	>80"

28. Diagnostic Horizons	a. Surface:	b. Subsurface:	29. Moist Control Section Depth:
	Mollic	Cambic	10-40"

Previous edition [illegible] Date.

FS 2500-1 (2/06)

USDA - [illegible] Service 10 MDS-3

SOIL DESCRIPTION

(Reference FSH 2509.18) 13-SP-OT

1. Map Unit Symbol	2. Family or Series	3. Date	4. By	5. Photo. No.	6. Stop No.	7. USGS Quad	8. Location:
DE	DISTURBED	9-7-07	RC				Sec. ___ T. ___ R. ___

9. Area	10. Forest	11. Ranger District	12. State	13. County
KINNEY #2			UTAH	CARBON

14. Parent Material	15. Bedrock Name	16. Elevation	17. Erosion:
COLLUVIUM	SS		a. Kind NONE b. Class

18. Landform	19. Slope:	20. Drainage Class	21. Surface Stone and Rock
FANSLOPE	a. % 12 b. Shape ___ c. Length ___ d. Aspect ___	WD	a. GR 2 b. CB 3 c. ST 3 d. BY ___

22. Potential Natural Vegetation	23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)
CHNA - SAGEBRUSH			

HORIZON DESIGNATION (a)	DEPTH (b)	COLOR (c) Moist (1)	Dry (2)	Mottling (3)	TEXTURE (d)	%	STRUCTURE (e)	CONSISTENCE (f) Dry (1)	Moist (2)	Wet (3)	SPECIAL FEATURES (g) Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)	EFFER. CLASS (h)	LAB FIELD pH (i)	BOUNDARY (j)
D	0-8	10YR 4/3	10YR 5/4	/	SL	16 / 14	2M-F GR	SO	FR	SO PO	/	GR - 0 CB - 0 ST - 0	3VF 1F	3VF IN	NE	7.0	C, S
COAL	8-25	COAL REFUSE			SAND	6	SG	LO	LO	SO PO	/	GR - 0 CB - 0 ST - 0	1VF	2F IN	NE	6.2	C, S
BL	25-42	10YR 4/3	10YR 5/3	/	SANDY LOAM	13 / 21	2C SBK	HA	FI	SO PO	/	GR - 0 CB - 0 ST - 0	1VF		NE	6.8	C, W
BC	42-70	7.5YR 5/4	7.5YR 6/4	/	GRX SL	13 / 6	2F-M SBK	LO	LO	SO PO	/	GR - 60 CB - 5 ST - 0			NE	6.6	
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					
												GR - CB - ST -					

26. Partical Size Control Section	a. Depth:	b. Average Clay %:	c. Average Rock Fragment Content:	27. Depth to Lithic or Paralithic Contact:
28. Diagnostic Horizons	a. Surface:	b. Subsurface:		29. Moist Control Section Depth:

Previous edition [illegible] date.

FS 2509.1 (2/86)

Appendix 4. Soil Profile Photographs For 36 Laboratory Tested Sample Sites

KINNEY 06, Soil Pit 1A-1

6" 2VF 2+1M

17" 2M2C 1VF

28" NF1FLY

60" 1VF

KINNEY 06, Soil Pit 1A-2

15-20

25-40

40-60

60-75

75-90

KINNEY 06, Soil Pit 1B-1

0-7 3VF

7-15 2FM1C

15-28 1VR1F

28-60 1F1M

60+ 1VF

KINNEY 06, Soil Pit 2A-1

0-10 A

10-24 AB

24-44 B+

44-65 B+/C

65-80+ C

KINNEY 06, Soil Pit 2A-2

0-5 A1

5-14 A2

14-25 BN

25-38 B/C

38-60+ C2

KINNEY 06, Soil Pit **2A-3**

0-9 A

9-19 B+

19-36 B+2

36-52 C1

52-75 C2

KINNEY 06, Soil Pit 2A-5

0-6 A

6-12 D

12-24 B+

24-48 B+

48-65+ BC

KINNEY 06, Soil Pit 2A-6

0-6 A1

6-12 A2

12-21 BW1

21-40 BW2

40-66 C

66-85+ C

KINNEY 06, Soil Pit 2A-7

0-7 A

7-20 B+

20-38 C

KINNEY 06, Soil Pit 2B-1

0-9 A

9-19 B+

19-33 B+

33-51 BC

51-80 Cr

80+ R

KINNEY 06, Soil Pit D-1

0-6 BUR

6-16 BUR

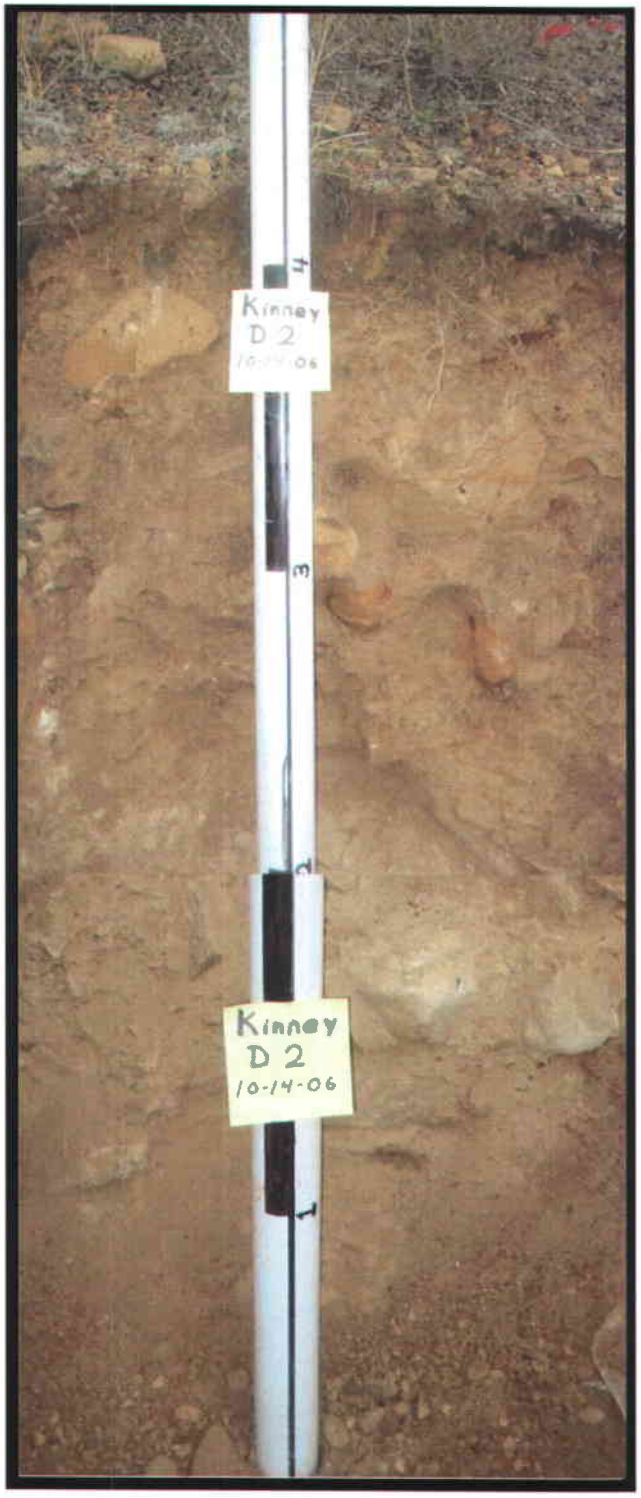
16-25 A/B

25-40 C1

40-65 C2

65-95+ C3

KINNEY 06, Soil Pit D-2



0-6 BUR

6-24 BUR

24-45+ C

KINNEY 06, Soil Pit D-3

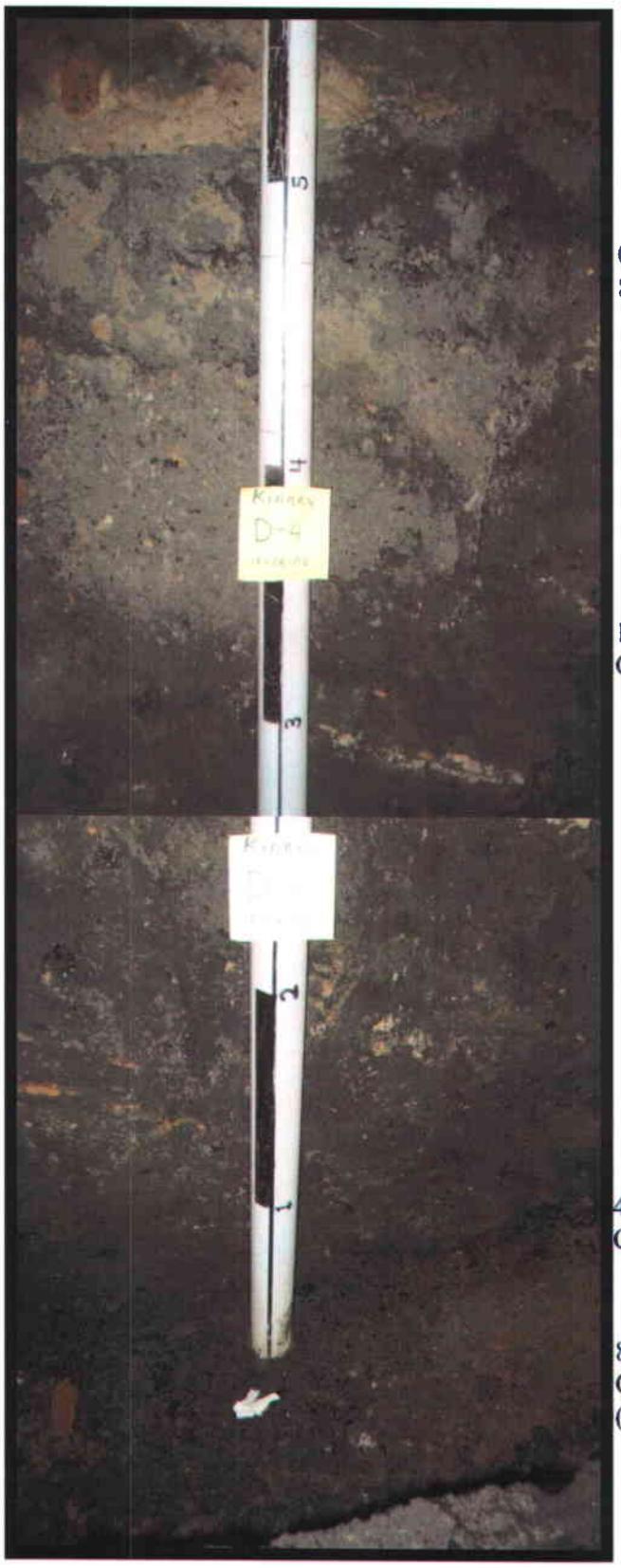
0-10 A out

10-20
B+ Dist

40-60 C1

60-75+ C2

KINNEY 06, Soil Pit D-4



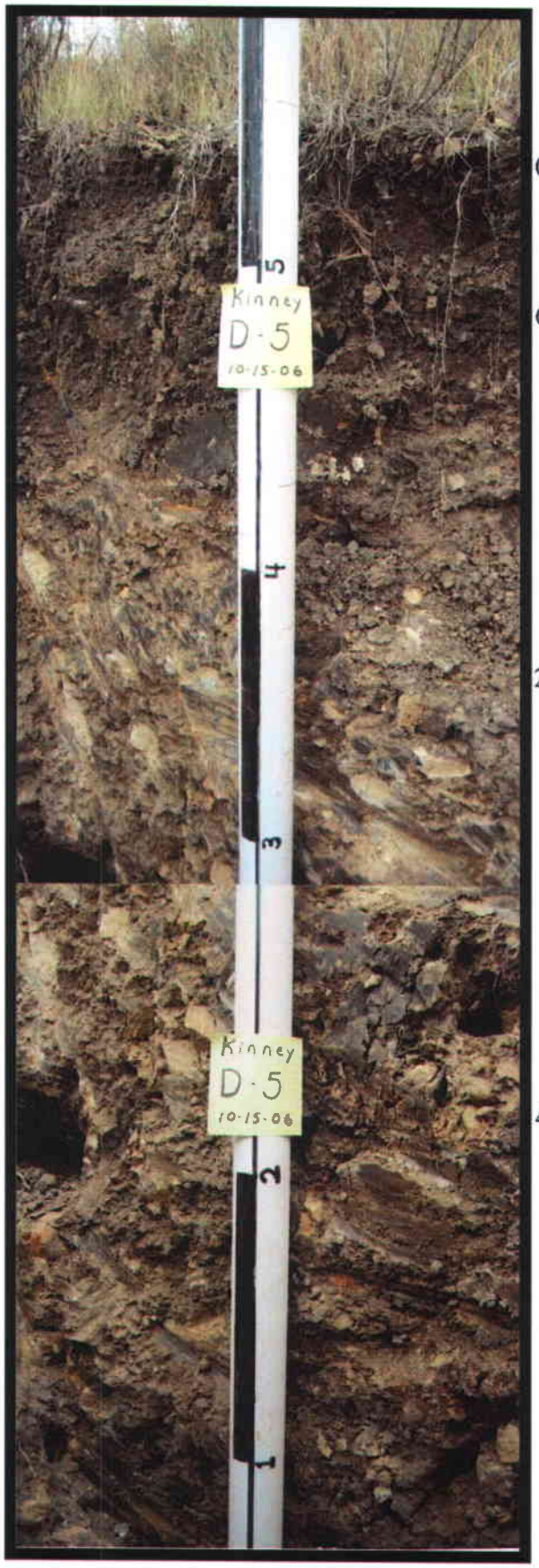
0-8 Disturbed
8-16 Subsoil

12-47
Coal waste

47-85
Coal waste

85-144
Coal waste
(moist)

KINNEY 06, Soil Pit D-5



0-6 D1

6-20 D2

20-40 D3

40-68+ D4

KINNEY 06, Soil Pit D-6

0-6 A

6-24 2C clumped coal

24-48 2C 2

48-72 2C 3

KINNEY 06, Soil Pit D-7

0-6 D1

6-20 D2

20-42 D3

42-58 D4

58-75+ B6

KINNEY 06, Soil Pit D-8

0-6 A

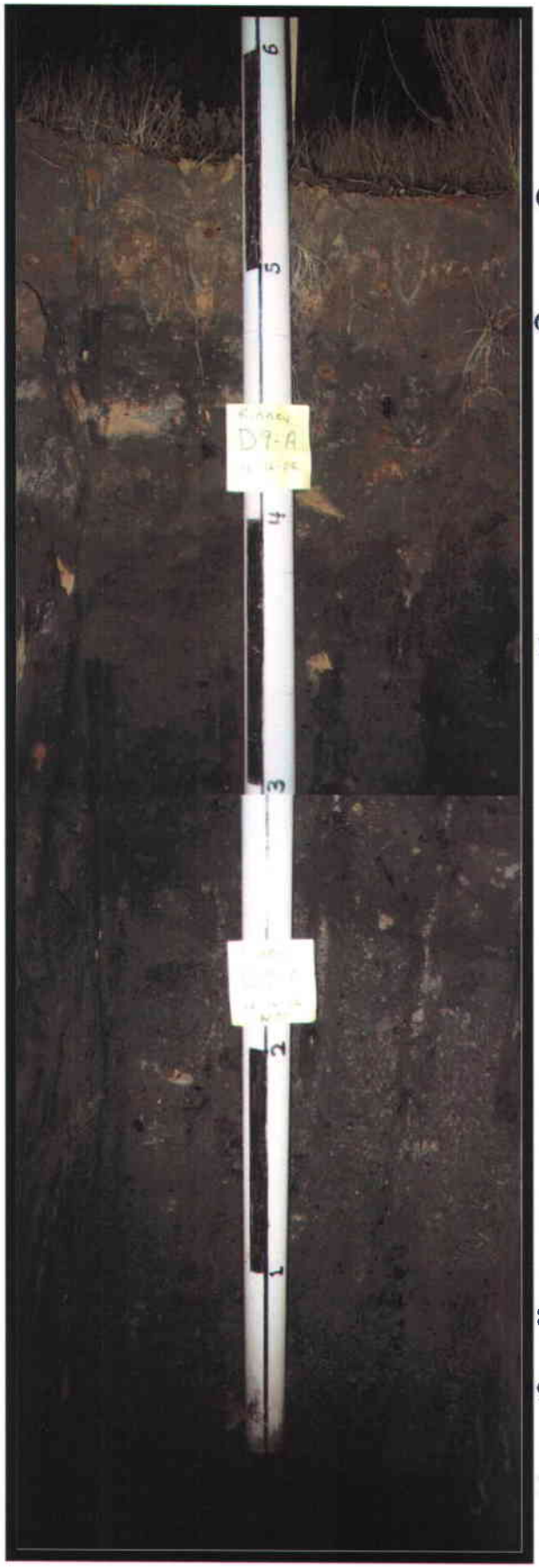
6-13 BA

13-26 B+

26-48 B+2

48-78+ C

KINNEY 06, Soil Pit D9-A



0-6 Disturbed

6-15 Dist. 2

15-80 Coal

80-95 Ab

95-115+ B+b

115-140 B+Cb

KINNEY 06, Soil Pit D9-B

0-11 Mixed Subsoil over waste material

11-29 Coal 50- 70% fines w/ Subsoil

29-52 Coal 95% NA w/ Subsoil

52-80 Bb

80-95 Bb

KINNEY 06, Soil Pit D-10

0-5 A

5-11 B+1

11-23 B+2

23-45 B+3

45-65 C

KINNEY 06, Soil Pit D-11

0-12 Subsoil reclaimed

12-62 w/ some
Subsoil mixed

62-80 C
Native soil

80-90+

KINNEY 06, Soil Pit D-12

0-6

9-19 B+

19-33 B+

33-51 BC

51-80 Cr

80+ R

2-07
Kinney Soil Pit

Hand Auger Hole. See Pedon discription for horizons.

3-07
Kinney Soil Pit

Auger Hole in bottom of visable pit. See Pedon discription for horizons.

4-07
Kinney Soil Pit

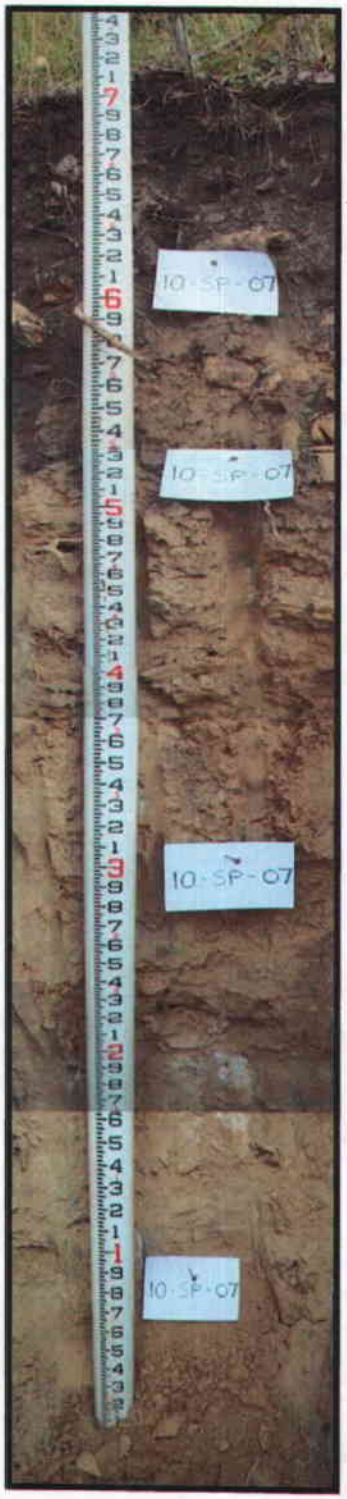
5-07
Kinney Soil Pit

6-07
Kinney Soil Pit

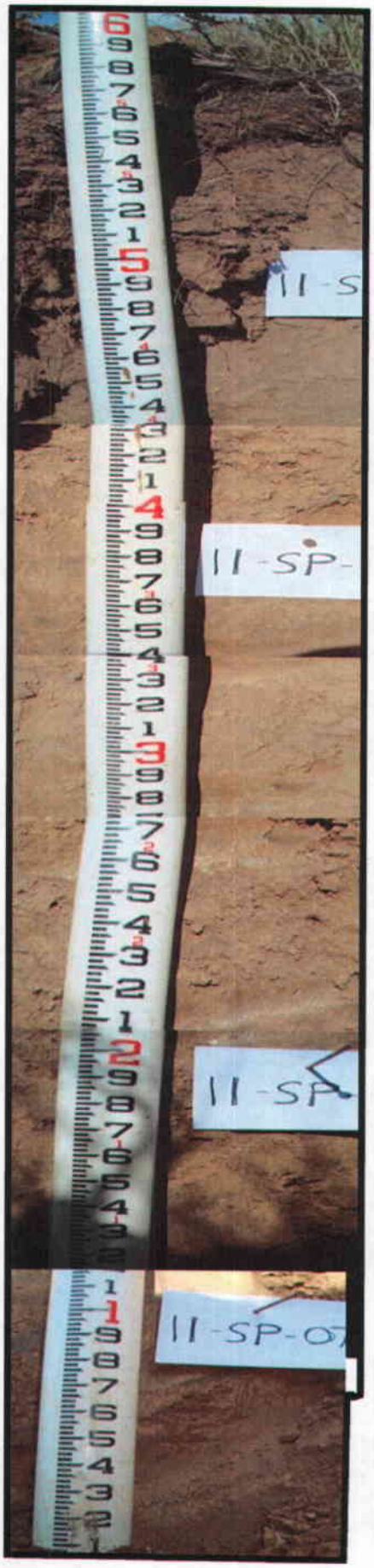
7-07
Kinney Soil Pit

8-07
Kinney Soil Pit

9-07
Kinney Soil Pit



10-07
Kinney Soil Pit



11-07
Kinney Soil Pit

12-07
Kinney Soil Pit

13-07
Kinney Soil Pit
Also (10-MDS-3)

0-8 inches Overburden mix with est. 15% coal chunks

8-15 inches coal layer with some overburden

25-40 inches Buried B horizon

40-60 inches Buried B and C horizons

No potential topsoil at this site (map Unit DA)

Trackhoe trench site 10-MDS-3, Map unit DA

14-07
Kinney Soil Pit

C 30-60 inches sandier, lacks structure and chem. for topsoil material

Bw2 18-30 inches subsoil, same as Bw somewhat coarser

Bw 8-18 inches subsoil, good material

A 0-8 inches, potentially decent topsoil, pending lab results

14-SP-07 (Trackhoe trench 12-MDF-1) located approx. 50 ft. from canal on lowerfanslope, Map unit 2A.

15-CP-07
Trackhoe Pit

15-CP-07, measured on 9/7 had 4'11 inches of coal at "pinch out" beginning at 19 inch depth, followed by buried B or C soil horizons. Not sampled. Staked by lathe photographed by BC. Will send this one. Located in trackhoe parking area.

15-07
Kinney Soil Pit

11 inches potential topsoil, pending lab result

C 26-40 inches very boulder subsoil

Bw 11-26 inches very stony subsoil

A2 5-11 inches topsoil, granular structure

A1 0-5 inches dark-colored topsoil

Oe I inch duff and organic matter layer

15-SP-07 Located near Kinney #1 mine portal Trackhoe scrapped in aspen grove roadcut on 9/7/07, not sapled Map Unit 1A

16-07
Kinney Soil Pit

No topsoil available at this site

13-60 inches Buried B horizon very stony

13-34 inches coal refuse

0-13 inches Overburden and 20% coal chunks in reclaimed materials (AMP cover

16-SP-07 (trackhoe site 13 WSF-2) located in DA map unit north end Hansen property, nearby 2006 soil pit.

18-07
Kinney Soil Pit

14 inches of potetial topsoil at this site Map unit 1A

C 36-60 inches

B 14-36 inches

A2 5-14 inches

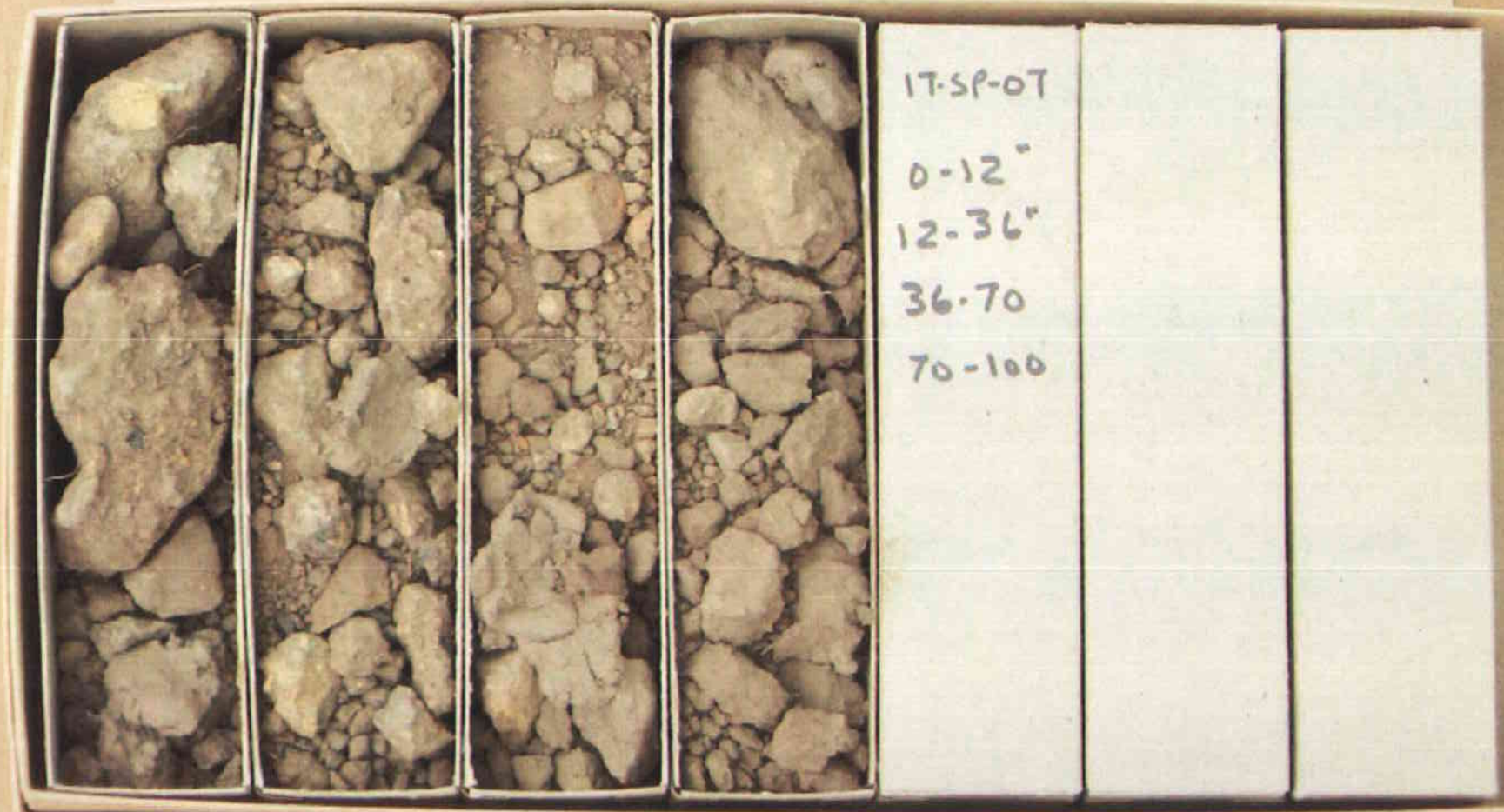
A1 0-5 inches

18-SP-07 (trackhoe scrapped nearby Grimes Corner survey flagging, roadcut near Kinney 1 aspen grove). Sampled 9/7/07.

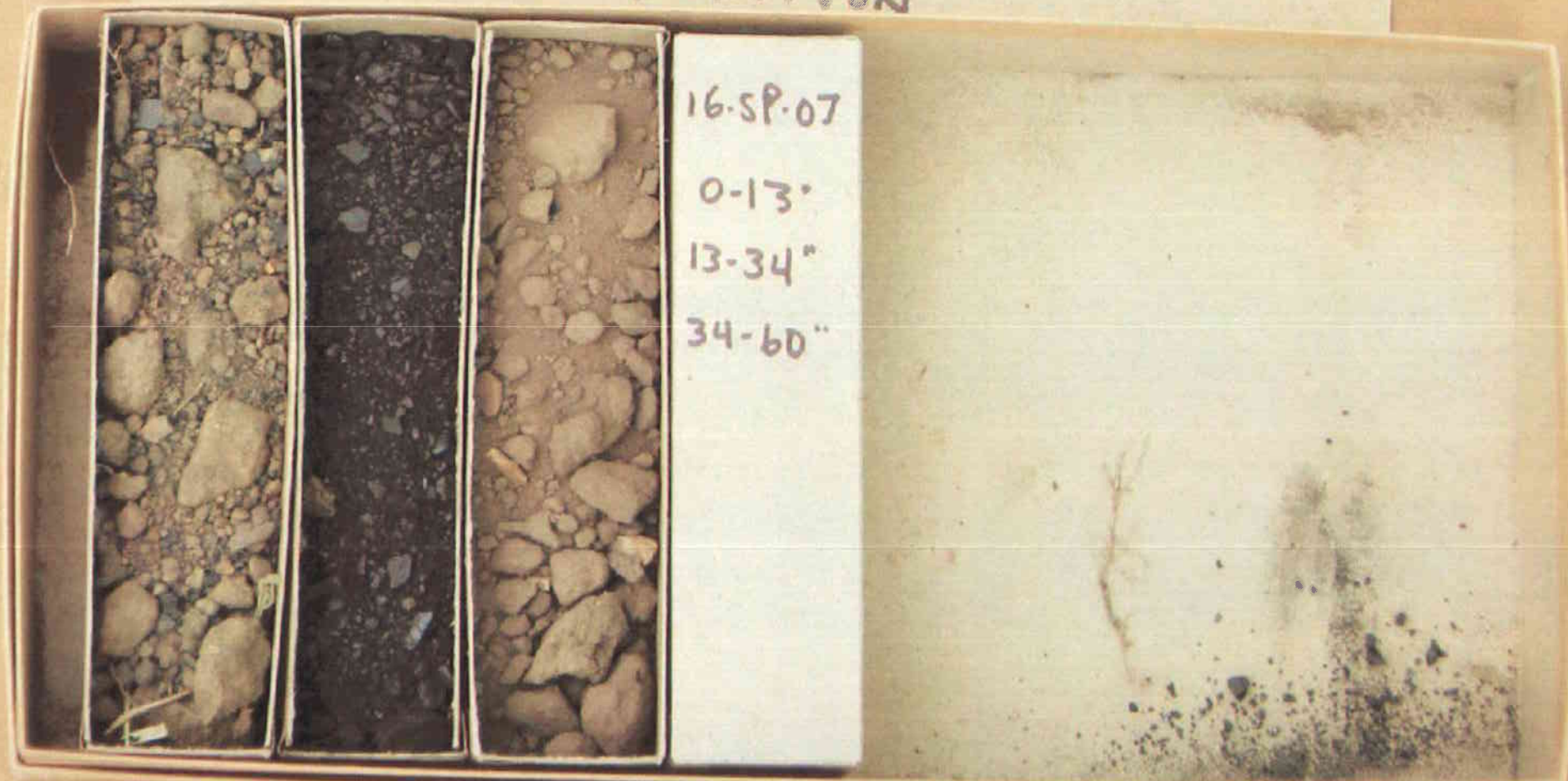
Appendix 5. Photographs of Soil Micromonolith Box Samples

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION



KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION



KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

13-SP-07
0-8"
8-25"
25-42"
42-70"

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
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SEPT 2007
HANSEN PROPERTY
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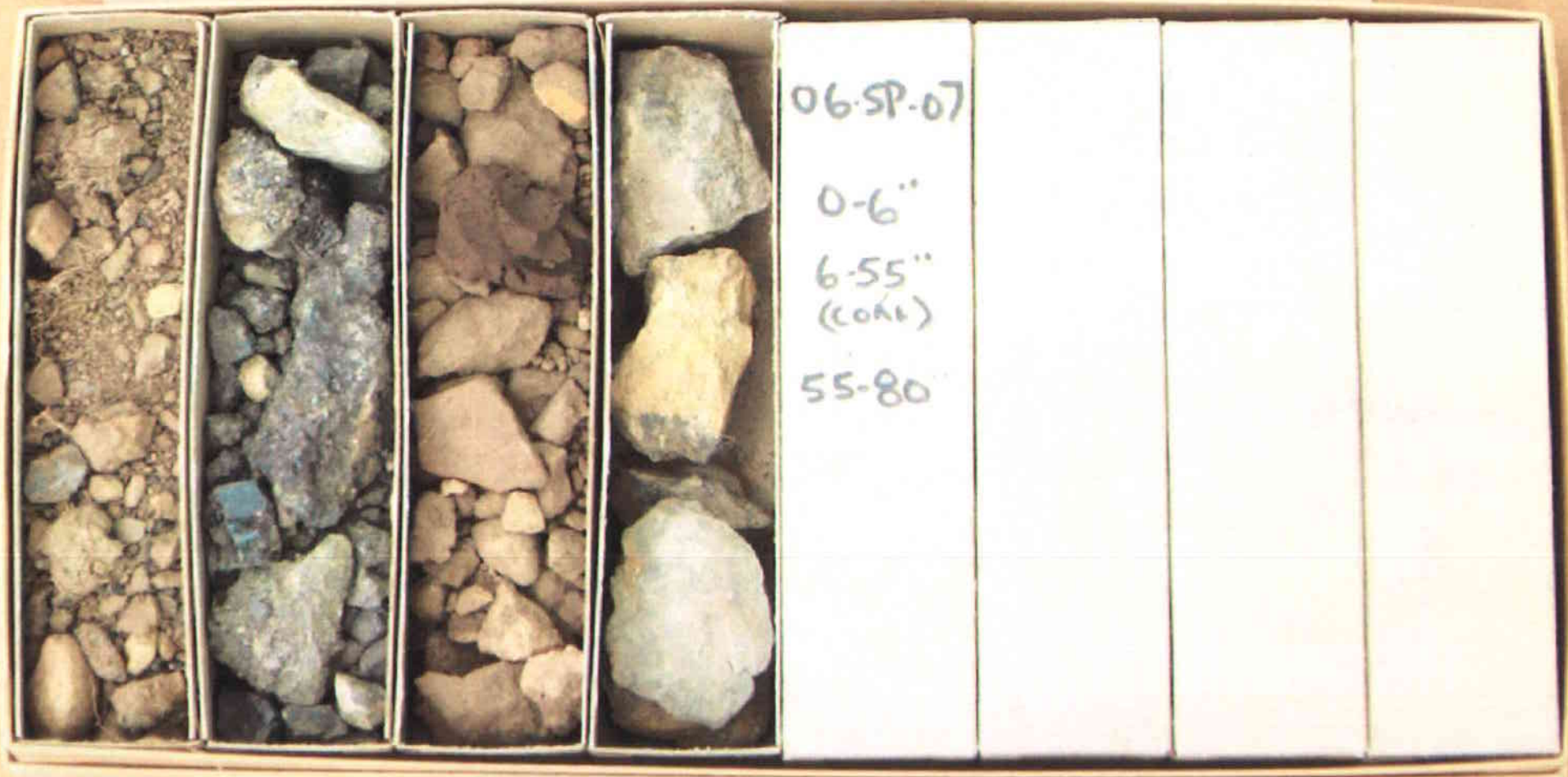
KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION



KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
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KINNEY MINE
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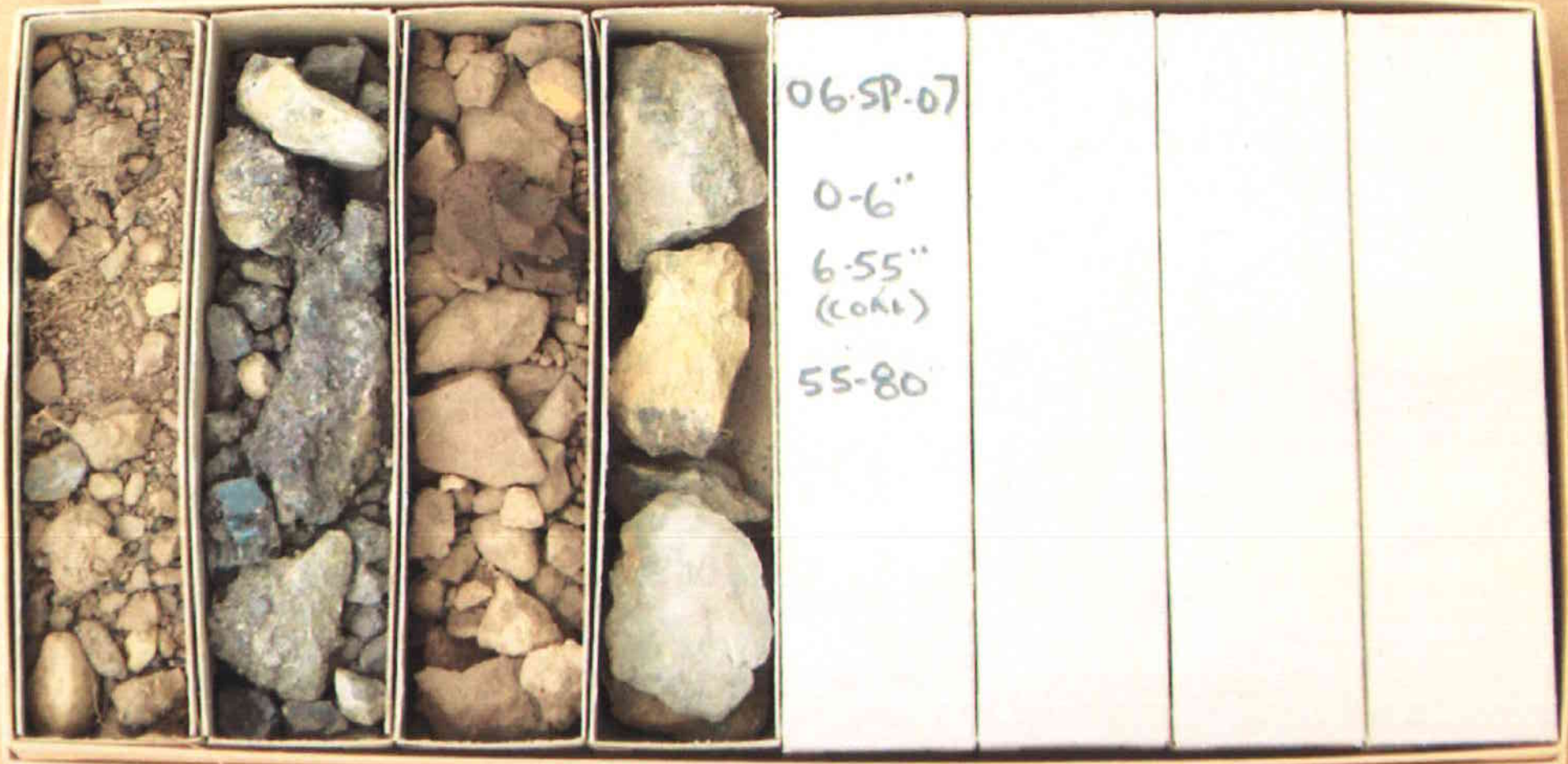
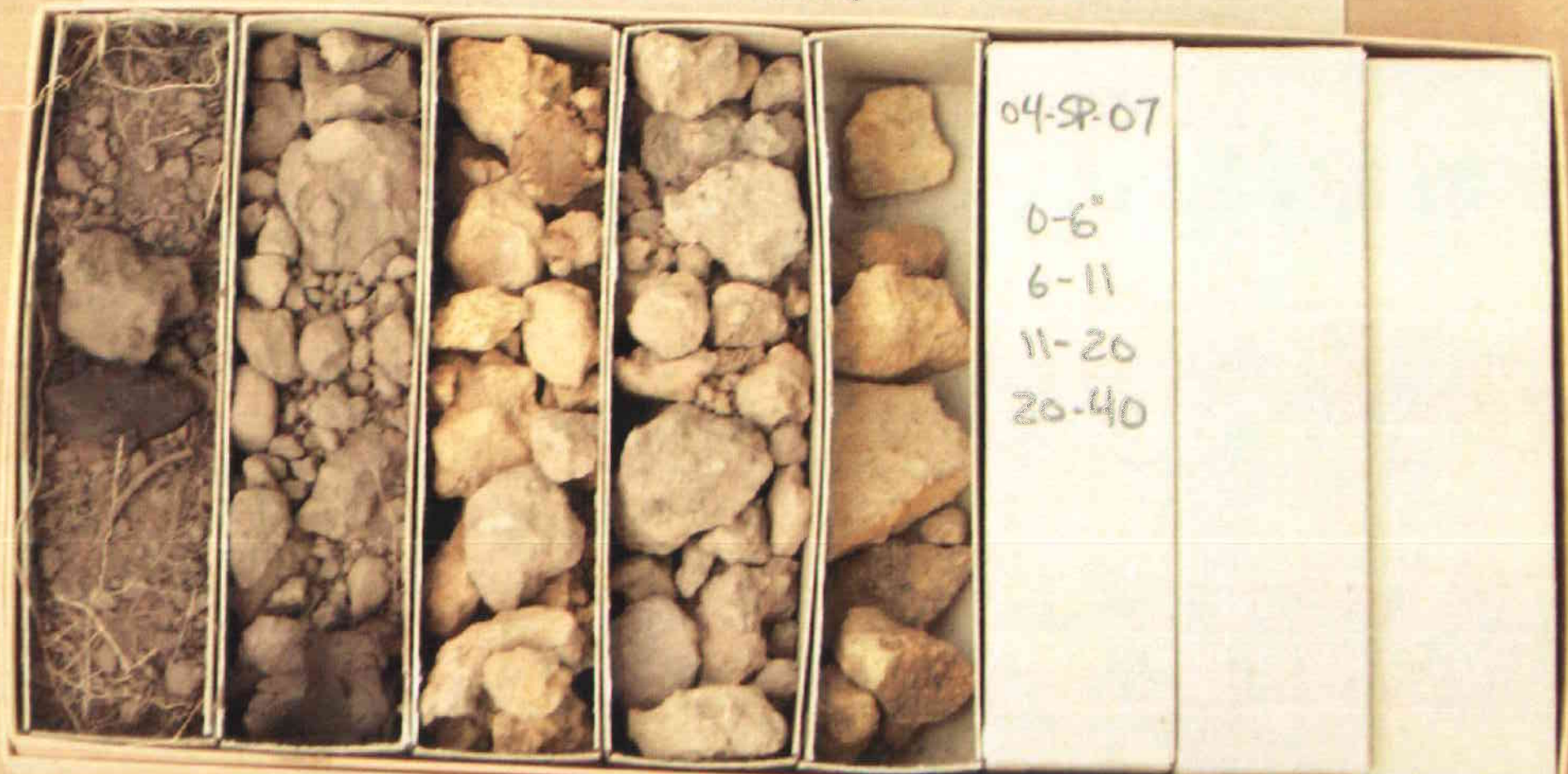
SEPT 2007
HANSEN PROPERTY
ADDITION



KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION



KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

KINNEY MINE
SOIL SURVEY
SEPT 2007
HANSEN PROPERTY
ADDITION

APPENDIX 6. OFFICIAL SOIL SERIES DESCRIPTIONS

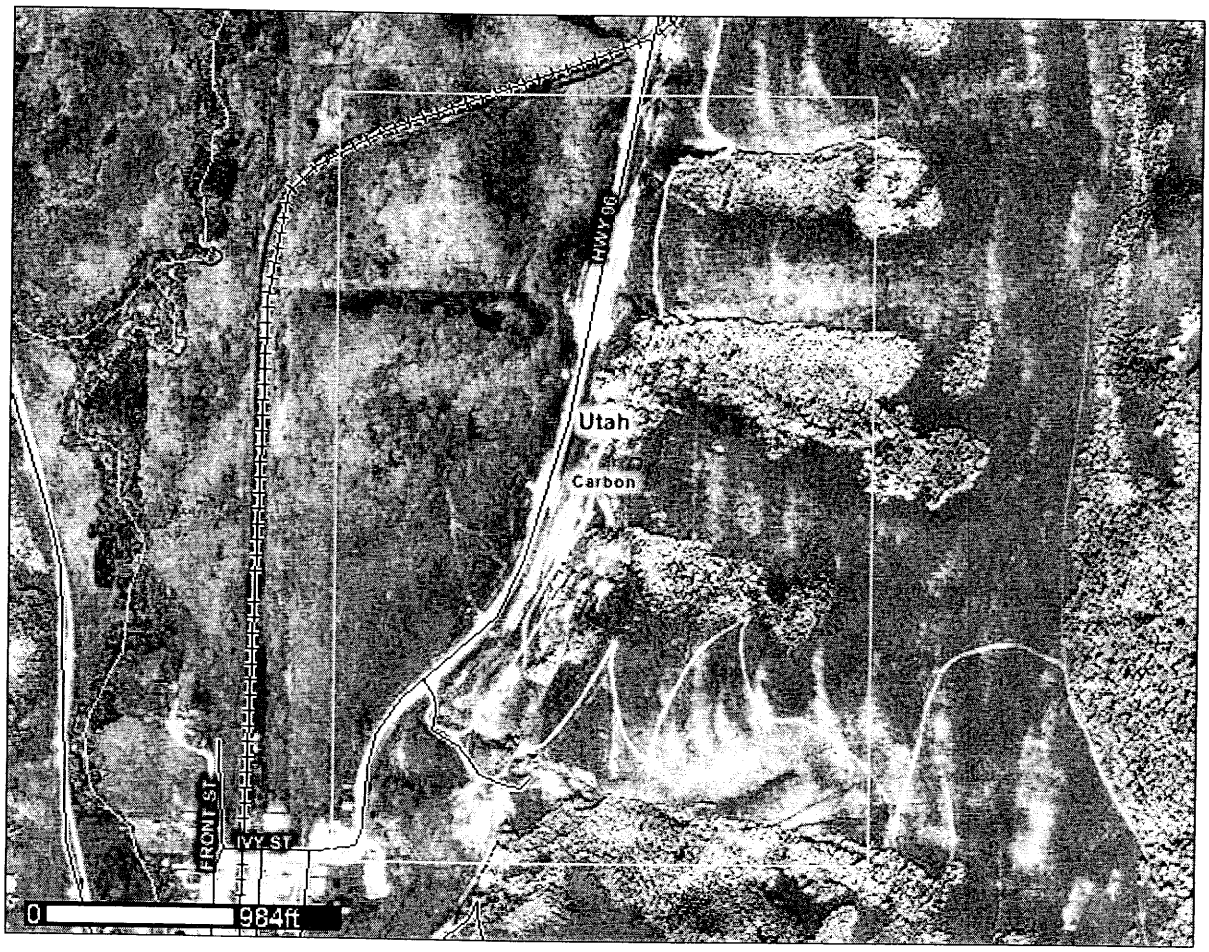
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Gully

Short Steep Slope

Other

Political Features

Municipalities

Cities

Urban Areas

Water Features

Oceans

Streams and Canals

Transportation

Rails

Roads

Interstate Highways

US Routes

State Highways

Local Roads

Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Carbon Area, Utah, Parts of Carbon and Emery Counties
Survey Area Data: Version 3, Dec 14, 2006

Date(s) aerial images were photographed: 9/30/1997; 10/5/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Carbon Area, Utah, Parts of Carbon and Emery Counties (UT616)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
29	Dumps,mine	23.0	9.2%
108	Silas loam	70.8	28.2%
109	Silas-Brycan loams	16.2	6.4%
117	Trag-Beje-Senchert complex	6.1	2.4%
118	Trag-Croydon complex	135.2	53.8%
Totals for Area of Interest (AOI)		251.3	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that

have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Carbon Area, Utah, Parts of Carbon and Emery Counties
Version date:12/14/2006 5:20:04 PM

29—Dumps,mine

Map Unit Composition
Dumps: 100 percent

Description of Dumps

Properties and qualities
Slope: 3 to 65 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups
Land capability (nonirrigated): 8s

Typical profile
0 to 60 inches: Fragmental material

108—Silas loam

Map Unit Setting
Elevation: 7,180 to 7,680 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 38 to 45 degrees F
Frost-free period: 60 to 80 days

Map Unit Composition
Silas and similar soils: 80 percent
Minor components: 5 percent

Description of Silas

Setting
Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from sandstone and shale

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability (nonirrigated): 6w
Ecological site: Wet Fresh Meadow (Willow-Sedge) (R048AY008UT)

Typical profile

0 to 2 inches: Loam
2 to 17 inches: Loam
17 to 28 inches: Loam
28 to 43 inches: Loam
43 to 60 inches: Sandy clay loam

Minor Components

Silas, poorly drained

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Wet Fresh Meadow (Willow-Sedge) (R048AY008UT)

109—Silas-Brycan loams

Map Unit Setting

Elevation: 7,680 to 8,580 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 38 to 45 degrees F
Frost-free period: 60 to 80 days

Map Unit Composition

Silas and similar soils: 65 percent
Brycan and similar soils: 20 percent
Minor components: 7 percent

Description of Silas

Setting

Landform: Valleys
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from sandstone and shale

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: High (about 9.6 inches)

Interpretive groups

Land capability (nonirrigated): 6w

Ecological site: Wet Fresh Meadow (Willow-Sedge) (R048AY008UT)

Typical profile

0 to 2 inches: Loam
2 to 17 inches: Loam
17 to 28 inches: Loam
28 to 43 inches: Loam
43 to 60 inches: Sandy clay loam

Description of Brycan

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and shale

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability (nonirrigated): 6c
Ecological site: MOUNTAIN LOAM (SALINA WILDRYE) (R048AY409UT)

Typical profile

0 to 12 inches: Loam
12 to 32 inches: Loam
32 to 60 inches: Silt loam

Minor Components

Silas, poorly drained

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Wet Fresh Meadow (Willow-Sedge) (R048AY008UT)

Flooded soils

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave

117—Trag-Beje-Senchert complex

Map Unit Setting

Elevation: 7,180 to 8,480 feet
Mean annual precipitation: 16 to 22 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 50 to 100 days

Map Unit Composition

Trag and similar soils: 45 percent
Senchert and similar soils: 15 percent
Beje and similar soils: 15 percent

Description of Trag

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Alluvium and/or colluvium derived from sandstone and shale

Properties and qualities

Slope: 3 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water capacity: High (about 10.8 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: MOUNTAIN LOAM (SALINA WILDRYE) (R048AY409UT)

Typical profile

0 to 5 inches: Clay loam
5 to 39 inches: Clay loam
39 to 60 inches: Clay loam

Description of Beje

Setting

Landform: Drainageways
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Slope alluvium and/or colluvium over residuum weathered from sandstone and shale

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability (nonirrigated): 6s
Ecological site: Mountain Shallow Loam (Mountain Big Sagebrush) (R047XA446UT)

Typical profile

0 to 6 inches: Loam
6 to 14 inches: Clay loam
14 to 18 inches: Unweathered bedrock

Description of Senchert

Setting

Landform: Drainageways, draws
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Colluvium and/or slope alluvium over residuum weathered from sandstone and shale

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups

Land capability (nonirrigated): 6e
Ecological site: High Mountain Loam (Aspen) (R047XA508UT)

Typical profile

0 to 4 inches: Loam
4 to 16 inches: Loam
16 to 35 inches: Clay loam
35 to 39 inches: Unweathered bedrock

118—Trag-Croydon complex

Map Unit Setting

Elevation: 7,580 to 9,470 feet
Mean annual precipitation: 16 to 25 inches
Mean annual air temperature: 34 to 40 degrees F
Frost-free period: 40 to 80 days

Map Unit Composition

Trag and similar soils: 50 percent
Croydon and similar soils: 30 percent

Description of Trag

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Alluvium and/or colluvium derived from sandstone and shale

Properties and qualities

Slope: 30 to 60 percent
Surface area covered with cobbles, stones or boulders: 13.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability (nonirrigated): 7e
Ecological site: MOUNTAIN LOAM (SALINA WILDRYE) (R048AY409UT)

Typical profile

0 to 10 inches: Stony loam
10 to 36 inches: Clay loam
36 to 60 inches: Clay loam

Description of Croydon

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and/or slope alluvium over residuum weathered from sandstone and shale

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.1 inches)

Interpretive groups

Land capability (nonirrigated): 7e
Ecological site: High Mountain Loam (Aspen) (R047XA508UT)

Typical profile

0 to 16 inches: Loam
16 to 23 inches: Loam
23 to 48 inches: Clay loam
48 to 52 inches: Weathered bedrock

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Exhibit 3.2

Vegetation Information

VEGETATION OF THE KINNEY NO. 2 MINE SITE

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INTRODUCTION

The old Kinney No. 2 mine area, an historical coal mining site, has been proposed to be the location for new mining activities. The site is located in Carbon County, Utah just northeast of the town of Scofield. Elevation of the permit area ranges from approximately 7,700 to 8,600 ft above sea level, with most of the surface facilities proposed in the lower elevations of that range.

Most of the vegetation proposed to be disturbed by the new mining activities have already been disturbed by the previous mining operations mentioned above. However, a sagebrush/grass community that has not been disturbed previously could also be impacted by the new mine.

The purpose of this document is to report the findings from quantitative sampling the plant communities that could be impacted by the proposed new mining activities. The communities that may be affected are: 1) the previously disturbed (presently rabbitbrush/grass) community, and 2) a native sagebrush/grass community. Additionally, a reference area to be used for future revegetation success standards has also been chosen and sampled for this study. A vegetation map showing the plant communities within and adjacent to the permit area has been prepared and included in the Mining & Reclamation Plan (MRP) for the new Kinney No. 2 Mine site (Map 5, Regional Vegetation). This map also shows the sample areas where the quantitative data were collected to compile this report.

METHODS

Methodologies used for this study were performed in accordance with the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM). Quantitative and qualitative data were taken in the plant communities that have been proposed for disturbance area along with a reference area chosen to represent them at the time of final reclamation and revegetation. These datasets were recorded August 8-9, 2007.

Sample Areas

GPS coordinates within the sample areas are provided below.

GPS COORDINATES FOR THE VEGETATION SAMPLE AREAS OF THE KINNEY NO. 2 MINE (August 2007; UTM NAD 27)

Community Name	Zone	Easting	Northing	Notes
Rabbitbrush/Grass	12	0486865 0486783	4397843 4397713	a) Area was previously disturbed by mining, b) was a sagebrush/grass community prior to disturbance, c) coordinates represent centers of transect lines.
Sagebrush/Grass	12	0486953 0486920	4397681 4397737	a) Proposed disturbed native undisturbed community, b) coordinates represent centers of transect lines.
Reference Area	12	0487053	4397766	a) Native, undisturbed community sagebrush/grass community, b) coordinates represent center of transect line.

Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling were placed randomly within the boundaries of the proposed disturbed and reference areas. The transect placement technique was employed with the goal to adequately sample a representative subset of the entire site as a whole. Once the 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 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 recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 2003).

Woody Species Density

Density of woody plant species for the proposed disturbed and reference areas was estimated using the point-quarter method. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root

of the mean area per individual. The number of individuals per acre was the end results of the calculations.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density of the proposed disturbed sites with the reference area.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been

included in this report.

Threatened & Endangered Plant Species

Prior to the field work, a list of those plant species that could be in the area and have been identified by agencies as rare, sensitive, threatened or endangered was prepared. Habitats were surveyed for these species at the mine site prior to and during the sample period.

Raw Data

The raw data have been summarized on spreadsheets and are available upon request.

RESULTS

Previously Disturbed Areas

Most of the plant communities in the permit area that have been proposed for disturbance by the new mining operations were impacted previously by other activities, most of which were a result of the historical mining mentioned above. A very small proportion of these disturbances were within aspen communities, but most were within sagebrush/grass communities.

The "previously disturbed area", one area that has been proposed for new disturbance by the

proposed mine, was quantitatively sampled by placing sample quadrats over the entire area [see *Map 5, Regional Vegetation (included in the MRP) and Color Photographs of the Sample Areas (included in this report*]. The dominant plant species in the previously disturbed area were those one would expect in a plant community that has been impacted and not reclaimed, including the shrub, rubber rabbitbrush (*Chrysothamnus nauseosus*), and grasses such as Western wheatgrass (*Elymus smithii*) and Kentucky bluegrass (*Poa pratensis*). Prior to disturbance, the community was once primarily a sagebrush/grass community. There were also several forb species present in the sample quadrats, each of which comprised less than 2 percent of the living cover. Examples of these forbs were native species such as hoary aster (*Machaeranthera canescens*), silky lupine (*Lupinus sericeus*), Engelmann's daisy *(Erigeron engelmannii*) and other "weedy", exotic species such as houndstongue (*Cynoglossum officinale*), and dandelion (*Taraxacum officinale*). A list of all plant species present in the sample quadrats placed in the previously disturbed area is shown on Table 1.

The total living cover of the community was estimated at 39.50% (Table 2-A). Composition of the cover was comprised of 44.73% shrubs, 34.09% grasses and 21.18% forbs (Table 2-B). Woody species density measurements were also recorded. The total number per acre was only 210 individuals, most of which were rubber rabbitbrush (Table 3).

Proposed Disturbed Sagebrush/Grass

The major plant community that has *not* been previously disturbed, but may also be impacted by

the proposed new mining activities, is a sagebrush/grass community [see *Map 5, Regional Vegetation (included in the MRP) and Color Photographs of the Sample Areas (included in this report*]. The two dominant plant species in the community by a wide margin were: the shrub, Vasey sagebrush (*Artemisia tridentata* var. *vaseyana*) and the grass, bluestem wheatgrass (*Elymus spicatus*). The next most common shrub was viscid rabbitbrush (*Chrysothamnus viscidiflorus*), and the next most common grass was Kentucky bluegrass. There were also several native forb species present in the sample quadrats, the most common of which was Watson's penstemon (*Penstemon watsonii*). For a complete listing of the plants present in the quadrats including all cover and frequency values, refer to Table 4.

The total living cover of the sagebrush/grass community was estimated 63.83% (Table 5-A). In the living cover, 55.42% of it was comprised of shrubs, 34.98% grasses and 9.60% forbs (Table 5-B). Woody species density was estimated 7,573 plants per acre (Table 6) with the three most common shrubs as Vasey sagebrush, viscid rabbitbrush and snowberry (*Symphoricarpos oreophilus*).

Sagebrush/Grass Reference Area

Another native sagebrush/grass community that will remain undisturbed was chosen in the immediate area to represent future standards for revegetation success [see *Map 5, Regional Vegetation (included in the MRP) and Color Photographs of the Sample Areas (included in this report*]. This community was sampled so that it could be compared statistically at this time with

the sagebrush/grass community proposed for disturbance to make sure it would be an appropriate area to be used for future revegetation success standards.

Very much like the proposed disturbed sagebrush/grass community it was chosen to represent and be compared with, the most common shrubs here were Vasey sagebrush and viscid rabbitbrush; the most common grasses were bluebunch wheatgrass and Kentucky bluegrass. Forbs species were also similar to the community proposed for disturbance (Table 7).

The total living cover for the reference area was 60.83% (Table 8-A). The composition of the cover by lifeform was represented by 61.42% shrubs, 28.15% grasses and 10.43% forbs (Table 8-B). The total woody species density for the community was 7,595 plants per acre with the same species for dominants as the area proposed for disturbance (Table 9).

Threatened & Endangered Plant Species Survey

No rare, threatened, endangered, endemic or otherwise sensitive plant species were found in the areas proposed for new disturbance.

Table 1: Kinney No. 2 Mine. Living Cover and Frequency by Plant Species (2007).

Community: Rabbitbrush/Grass (Previously Disturbed)	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Populus tremuloides	1.50	7.76	4.00
UNDERSTORY			
SHRUBS			
Amelanchier utahensis	0.10	0.70	2.00
Artemisia tridentata	4.30	6.40	38.00
Chrysothamnus nauseosus	11.46	15.95	60.00
Mahonia repens	0.10	0.70	2.00
Purshia tridentata	0.50	2.50	4.00
Rosa woodsii	0.10	0.70	2.00
Symphoricarpos oreophilus	2.20	6.57	14.00
FORBS			
Cynoglossum officinale	0.10	0.70	2.00
Erigeron engelmannii	1.10	3.36	10.00
Geranium richardsonii	0.10	0.70	2.00
Grindelia squarrosa	0.60	2.15	8.00
Ipomopsis aggregata	0.20	1.40	2.00
Lupinus sericeus	1.30	3.85	12.00
Machaeranthera canescens	1.50	3.20	20.00
Melilotus officinalis	0.40	1.36	8.00
Polygonum aviculare	0.40	2.80	2.00
Taraxacum officinale	0.60	2.15	8.00
GRASSES			
Agropyron cristatum	0.40	2.20	4.00
Bromus tectorum	0.80	3.79	6.00
Elymus smithii	7.34	10.01	50.00
Elymus spicatus	0.20	1.40	2.00
Hordeum jubatum	0.10	0.70	2.00
Poa pratensis	4.10	8.58	24.00

Table 2: Kinney No. 2 Mine. Total Cover and Composition (2007).

Community: Rabbitbrush/Grass (Previously Disturbed)		
A. TOTAL COVER	Mean Percent	Standard Deviation
Overstory (O)	1.50	7.76
Understory (U)	38.00	18.17
Litter	14.20	13.01
Bareground	25.40	19.69
Rock	22.40	16.77
O+ U	39.50	20.16
B. % COMPOSITION		
% COMPOSITION		
Shrubs	44.73	34.28
Forbs	21.18	29.68
Grasses	34.09	28.51

Table 3: Kinney No. 2 Mine. Total Cover and Composition (2007).

Community: Rabbitbrush/Grass (Previously Disturbed)	
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	
Artemisia tridentata	63.92
Cercocarpus oreophilus	1.05
Chrysothamnus nauseosus	116.31
Chrysothamnus viscidiflorus	1.05
Populus tremuloides	4.19
Purshia tridentata	5.24
Rosa woodsii	1.05
Symphoricarpos oreophilus	16.76
TOTAL	**209.56**

Table 4: Kinney No. 2 Mine. Living Cover and Frequency by Plant Species (2007).

Community: Sagebrush/Grass (Proposed Disturbed)	Mean Percent	Standard Deviation	Percent Frequency
SHRUBS			
Amelanchier utahensis	1.33	4.07	10.00
Artemisia tridentata var. vaseyana	18.50	12.59	93.33
Chrysothamnus viscidiflorus	7.50	8.24	56.67
Mahonia repens	0.17	0.90	3.33
Purshia tridentata	2.33	5.28	23.33
Symphoricarpos oreophilus	5.83	6.59	56.67
FORBS			
Astragalus sp.	0.33	1.80	3.33
Cirsium sp.	0.33	1.25	6.67
Eriogonum sp.	1.17	2.79	16.67
Hedysarum boreale	1.17	2.48	20.00
Lupinus sericeus	0.83	4.49	3.33
Machaeranthera canescens	0.17	0.90	3.33
Penstemon watsonii	2.00	3.56	26.67
GRASSES			
Elymus spicatus	13.17	13.63	70.00
Poa pratensis	0.50	2.69	3.33
Poa secunda	8.17	8.90	60.00
Stipa comata	0.33	1.80	3.33

Table 5: Kinney No. 2 Mine. Total Cover and Composition (2007).

Community: Sagebrush/Grass (Proposed Disturbed)	Mean Percent	Standard Deviation
A. TOTAL COVER		
Total Living Cover	63.83	6.41
Litter	15.73	9.82
Bareground	10.07	7.37
Rock	10.37	10.63
B. % COMPOSITION		
Shrubs	55.42	18.54
Forbs	9.60	11.07
Grasses	34.98	18.45

Table 6: Kinney No. 2 Mine. Total Cover and Composition (2007).

Community: Sagebrush/Grass (Proposed Disturbed)	
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	63.11
Artemisia tridentata var. vaseyana	3912.62
Chrysothamnus nauseosus	63.11
Chrysothamnus viscidiflorus	1640.78
Purshia tridentata	378.64
Symphoricarpos oreophilus	1514.56
TOTAL	**7572.81**

Table 7: Kinney No. 2 Mine. Living Cover and Frequency by Plant Species (2007).

Community: Sagebrush/Grass (Reference Area)			
TREES & SHRUBS	Mean Percent	Standard Deviation	Percent Frequency
Artemisia tridentata var. vaseyana	26.33	10.72	100.00
Chrysothamnus nauseosus	1.17	4.78	6.67
Chrysothamnus viscidiflorus	6.50	6.21	60.00
Purshia tridentata	0.83	3.67	6.67
Symphoricarpos oreophilus	3.00	6.14	26.67
FORBS			
Castilleja sp.	0.17	0.90	3.33
Eriogonum sp.	1.67	3.50	23.33
Hedysarum boreale	1.50	2.93	23.33
Lupinus sericeus	1.00	3.27	10.00
Penstemon watsonii	2.00	2.45	40.00
GRASSES			
Elymus salinus	0.33	1.25	6.67
Elymus spicatus	9.33	7.04	73.33
Poa pratensis	0.33	1.25	6.67
Pos secunda	6.67	7.89	56.67

Table 8: Kinney No. 2 Mine. Total Cover and Composition (2007).

Community: Sagebrush/Grass (Reference Area)		
A. TOTAL COVER	Mean Percent	Standard Deviation
Total Living Cover	60.83	7.75
Litter	11.50	6.08
Bareground	16.80	9.11
Rock	10.87	7.82
B. % COMPOSITION		
Shrubs	61.42	14.19
Forbs	10.43	9.79
Grasses	28.15	12.56

Table 9: Kinney No. 2 Mine. Total Cover and Composition (2007).

Community: Sagebrush/Grass (Reference Area)	
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	126.58
Artemisia tridentata var. vaseyana	4999.96
Chrysothamnus nauseosus	126.58
Chrysothamnus viscidiflorus	1455.68
Juniperus scopulorum	63.29
Purshia tridentata	63.29
Symphoricarpos oreophilus	759.49
TOTAL	**7594.88**

SUMMARY & DISCUSSION

Statistical comparisons of the total living cover and woody species density values were made between the areas proposed for disturbance by mining activities and the reference area chosen to represent future revegetation success standards. When the total living cover of the previously disturbed rabbitbrush/grass community (also proposed for new disturbance) was compared to the sagebrush/grass reference area, results suggested the reference area had significantly more cover (Figure 1-A). Similarly, when woody species density of these two areas were compared, results again suggested there was a significant difference with a greater density value for the reference area (Figure 2-A).

FIGURE 1. A statistical comparison (Student's t-tests) of the **total living cover** between the proposed disturbed (previously disturbed and undisturbed) and reference areas.

	$\bar{x}$	s	n	t	df	SL
A. Rabbitbrush/Grass						
Previously Disturbed:	39.50	20.16	50			
Reference Area:	60.83	7.75	30			
t-test				-5.543	78	p<0.001
B. Sagebrush/Grass						
Proposed Disturbed:	63.83	6.41	30			
Reference Area:	60.83	7.75	30			
t-test				1.634	58	N.S.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
p = probability
SL= Significance Level

Next, the total living cover value of the proposed disturbed (currently undisturbed) sagebrush/grass community was compared with the reference area – the differences were non-significant (Figure 1-B). The woody species densities of these two communities were also non-significant (Figure 2-B).

As described above, much of the area has been previously disturbed by earlier mining and other activities. Although the quantitative data of the previously disturbed rabbitbrush/grass community was compared to the reference area at this time, future success standards may be different. State regulations (R645-301-356.250) indicates that "*areas previously disturbed by mining that were not reclaimed to the requirements of R645-200 through R645-203 and R645-301 through R645-302 and that are*

FIGURE 2. A statistical comparison (Student's t-tests) of the **woody species density** between the proposed disturbed (previously disturbed and undisturbed) reference areas.

	$\bar{x}$	s	n	t	df	SL
A. Rabbitbrush/Grass						
Previously Disturbed:	209.56	1138.85	50			
Reference Area:	7594.88	2309.39	30			
t-test				-19.119	78	p<0.001
B. Sagebrush/Grass						
Proposed Disturbed:	7572.81	2575.81	30			
Reference Area:	7594.88	2309.39	30			
t-test				-0.035	58	N.S.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level

remined or otherwise redisturbed by coal mining and reclamation operations, at a minimum, the vegetative ground cover will be not less than the ground cover existing before redisturbance and will be adequate to control erosion". To address this issue, a discussion about reclamation and revegetation standards should be provided in the Mining & Reclamation Plan for the Kinney No. 2 Mine.

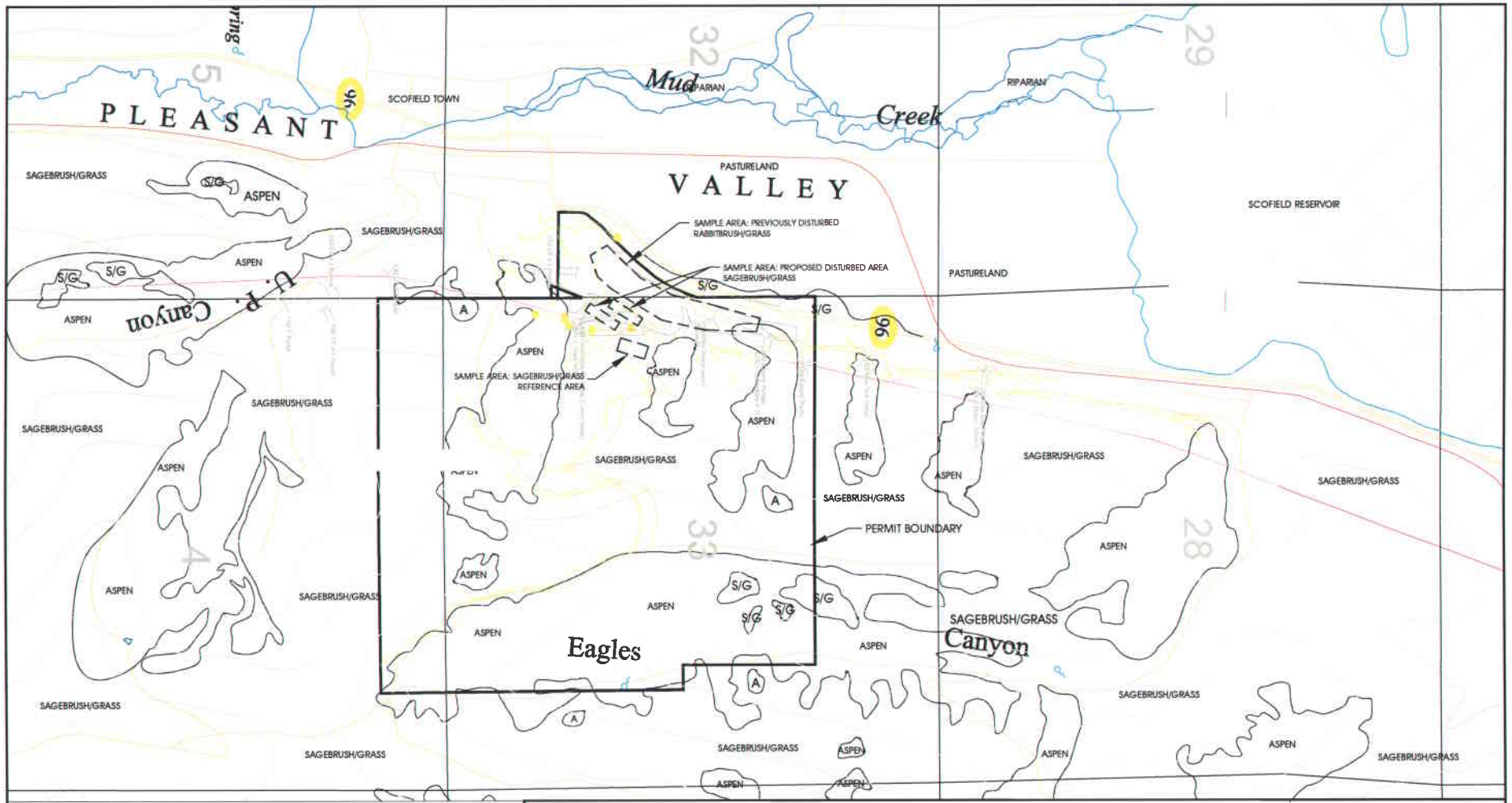
For those areas that will be disturbed by the proposed new mining activities that have *not* been previously impacted such as the sagebrush/grass community described in this report, the state regulations (R645-301.353) require that the final established plant communities: 1) *be diverse, effective, and permanent,* 2) *be comprised of species native to the area, or of introduced species where desirable and necessary to achieve the approved postmining land use and approved by the Division,* 3) *be at least equal in extent of cover to the natural vegetation of the area,* 4) *be capable of stabilizing the soil surface from erosion,* 5) *be compatible with the approved postmining land use,* 6) *have the same seasonal characteristics of growth as the original vegetation,* 7) *be capable of self-regeneration and plant succession, and* 8) *be compatible with the plant and animal species of the area.*

Small and comparatively inconsequential stands of aspen trees presently exist in the previously disturbed areas. Sample quadrats were also placed in these stands of trees. Because of the relative small area that these stands comprise, and because they too were disturbed previously and will be subject to the rules described above for areas previously impacted and not reclaimed, data for these aspen stands have been included with the other previously disturbed community

dataset. Accordingly, this dataset will represent the previously disturbed area as a whole, rather than attempting to separate or subdivide it.

The reference area chosen and compared statistically to the proposed disturbed (currently undisturbed) sagebrush/grass community should provide a community with adequate standards to achieve the required characteristics described above for the reclaimed areas at time of final reclamation and revegetation of the Kinney No. 2 Mine.

COLOR PHOTOGRAPHS OF THE SAMPLE AREAS



LEGEND

PRE - MINING DISTURBED AREA

PRE - MINING ROADS

KINNEY NO. 2 MINE DISTURBANCE FOOTPRINT

N

0 500 1000 1500 ft

SCALE

Contour Interval 20 ft

Carbon Resources LLC

KINNEY NO. 2 MINE

FIGURE 1

REGIONAL & SITE

VEGETATION MAP

DRAWN BY: P.C., B.G. DATE: 11/07

APPROVED BY: G.H. DATE:

DWG. NAME:

Photo 1: Sagebrush/Grass (Proposed Disturbed)

Photo 2: Sagebrush/Grass (Proposed Disturbed)

Photo 3: Sagebrush/Grass (Reference Area)

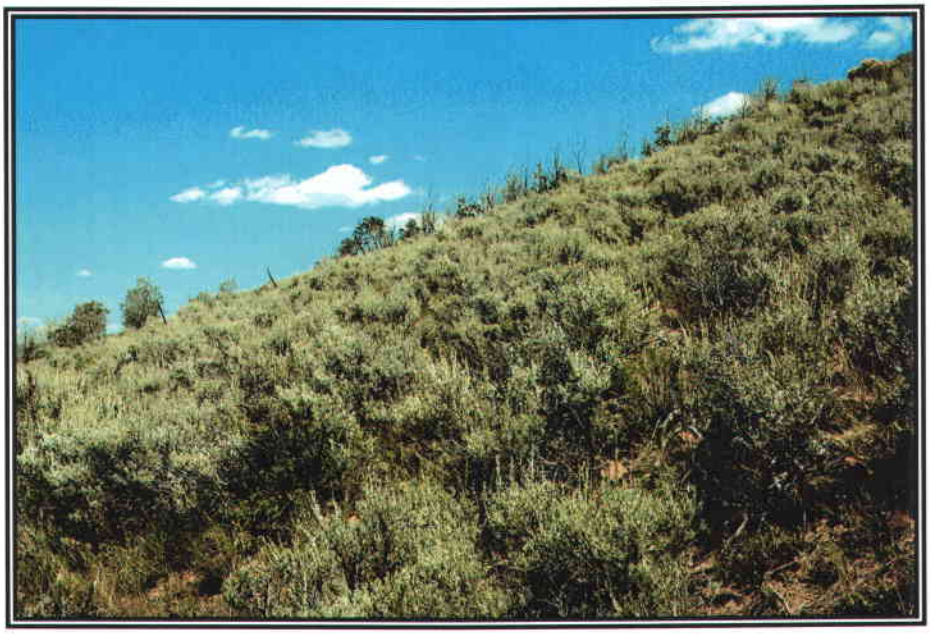


Photo 4: Sagebrush/Grass (Reference Area)

Photo 5: Rabbitbrush/Grass (Previously Disturbed)

Photo 6: Rabbitbrush/Grass (Previously Disturbed)

Photo 7: Rabbitbrush/Grass (Previously Disturbed)

Photo 8: Rabbitbrush/Grass (Previously Disturbed)

Exhibit 3.3

Fish and Wildlife Information

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

State of Utah

DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Division of Wildlife Resources

JAMES F. KARPOWITZ
Division Director

August 13, 2007

Ben Grimes
Hansen, Allen & Luce Engineers
23 S. Carbon Avenue, Suite 21
Price, Utah 84501

Subject: Species of Concern Near the Proposed Coal Mine in Carbon County

Dear Ben Grimes:

I am writing in response to your email dated August 9, 2007 regarding information on species of special concern proximal to the proposed coal mine in Carbon County, Utah (Sections 26-35 of Township 12 South, Range 7 East, and Sections 2-6 of Township 13 South, Range 7 East, SLB&M).

The Utah Division of Wildlife Resources (UDWR) has records of occurrence for sandhill crane and bald eagle within the project area noted above. In addition, in the vicinity there are records of occurrence for northern flying squirrel and northern river otter.

The information provided in this letter is based on data existing in the Utah Division of Wildlife Resources' central database at the time of the request. It should not be regarded as a final statement on the occurrence of any species on or near the designated site, nor should it be considered a substitute for on-the-ground biological surveys. Moreover, because the Utah Division of Wildlife Resources' central database is continually updated, and because data requests are evaluated for the specific type of proposed action, any given response is only appropriate for its respective request.

In addition to the information you requested, other significant wildlife values might also be present on the designated site. Please contact UDWR's habitat manager for the southeastern region, Chris Wood, at (435) 636-0279 if you have any questions.

Please contact our office at (801) 538-4759 if you require further assistance.

Sincerely,

Sarah Lindsey

Sarah Lindsey
Information Manager
Utah Natural Heritage Program

cc: Chris Wood, SERO

1594 W. North Temple, Suite 2110, PO Box 146301, Salt Lake City, UT 84114-6301
telephone (801) 538-4700 • facsimile (801) 538-4709 • TTY (801) 538-7458 • www.wildlife.utah.gov

UTAH DNR WILDLIFE RESOURCES

inside the biggest black box.

If you have any questions please call me at (435) 650-7075.

Thank you,
Ben Grimes, Office Manager
HANSEN, ALLEN & LUCE ENGINEERS
PRICE, UAH

No virus found in this incoming message.
Checked by AVG Free Edition.
Version: 7.5.476 / Virus Database: 269.11.17/951 - Release Date: 8/13/2007
10:15 AM

Ben Grimes

From: "Lenora Sullivan" <lenorasullivan@utah.gov>
To: <halengpr@emerytelcom.net>
Cc: "Chris Colt" <CHRISCOLT@utah.gov>
Sent: Monday, March 20, 2006 10:12 AM
Subject: Re: T&E Species Request

Dear Mr.Grimes:

I am writing in response to your email dated March 9, 2006 for information regarding species of special concern proximal to a coal mine project located in Carbon County, Utah [T012S 007E S27-29, 32-34; T013S 007E S3-5 SLB&M].

The Utah Division of Wildlife Resources (UDWR) does not have records of occurrence for any threatened, endangered, or sensitive species within the project boundaries. However, in the vicinity of the project, there are recent records of occurrence for winter roosting habitat for bald eagle, a federally-listed threatened bird, which is included on the Utah Sensitive Species List.

The information provided in this letter is based on data existing in the Utah Division of Wildlife Resources' central database at the time of the request. It should not be regarded as a final statement on the occurrence of any species on or near the designated site, nor should it be considered a substitute for on-the-ground biological surveys. Moreover, because the Utah Division of Wildlife Resources' central database is continually updated, and because data requests are evaluated for the specific type of proposed action, any given response is only appropriate for its respective request.

In addition to the information you requested, other significant wildlife values might also be present on the designated site. Please contact UDWR's habitat manager for the southeastern region, Chris Colt, at (435) 636-0279 if you have any questions.

Please contact our office at (801) 538-4759 if you require further assistance.

Sincerely,

Lenora B. Sullivan
Information Manager
Utah Natural Heritage Program

cc: Chris Colt, SERO

>>> <halengpr@emerytelcom.net> 03/09/2006 1:36 PM >>>
We are working on a coal mine permit application with the Utah Div of Oil, Gas and Mining and need consultation on T&E species for the proposed Kinney No 2 Mine area. The area is in Carbon County. The attached PDF map shows the area of interest.

Would you please review your records and indicate if there have been any T&E species identified within the area marked on the map.

Please reply to my email address, and by hard copy.

If you have any questions please call Ben Grimes at (435) 650-7075.

Thank
you.

This message was sent using Endymion MailMan.
http://www.endymion.com/products/mailman/

Ben Grimes

From: "Ben Grimes" <halengpr@emerytelcom.net>
To: "Sarah Lindsey" <sarahlindsey@utah.gov>
Sent: Monday, August 13, 2007 12:21 PM
Subject: Re: Information Request

Thank you for the letter.

As I indicated in my first email, I need a (complete) list of mammals, birds, amphibians, snakes and fish that occur in the area, not just species of special interest. I have to provide these lists in the permit application to the Utah Division of Oil, Gas and Mining. Chris Wood told me you would be to provide me with this information.

If you have any questions please call me at (435) 650-7075.

Thank You,
Ben Grimes

----- Original Message -----
From: "Sarah Lindsey" <sarahlindsey@utah.gov>
To: "Ben Grimes" <halengpr@emerytelcom.net>
Cc: "Chris Wood" <CHRISWOOD@utah.gov>
Sent: Monday, August 13, 2007 10:29 AM
Subject: Re: Information Request

Mr. Grimes,

Attached is a letter in response to your request. Please contact me if you have any questions.

Sincerely,
Sarah Lindsey

Utah Natural Heritage Program
Division of Wildlife Resources
1594 West North Temple
Salt Lake City, UT 84114-6301
(801) 538-4759

>>> "Ben Grimes" <halengpr@emerytelcom.net> 8/9/2007 4:12 PM >>>
I am working on a permit application for a new coal mine in Carbon County and I need to include the following:

1. Species lists for mammals, birds, amphibians, snakes, and fish
2. Threatened and Endangered species

The attached PDF shows the area I need information for --- the large area

Ben Grimes

From: "Ben Grimes" <halengpr@emerytelcom.net>
To: <sarahlindsey@utah.gov>
Sent: Thursday, August 09, 2007 4:12 PM
Attach: List MapRequest_0001.pdf
Subject: Information Request

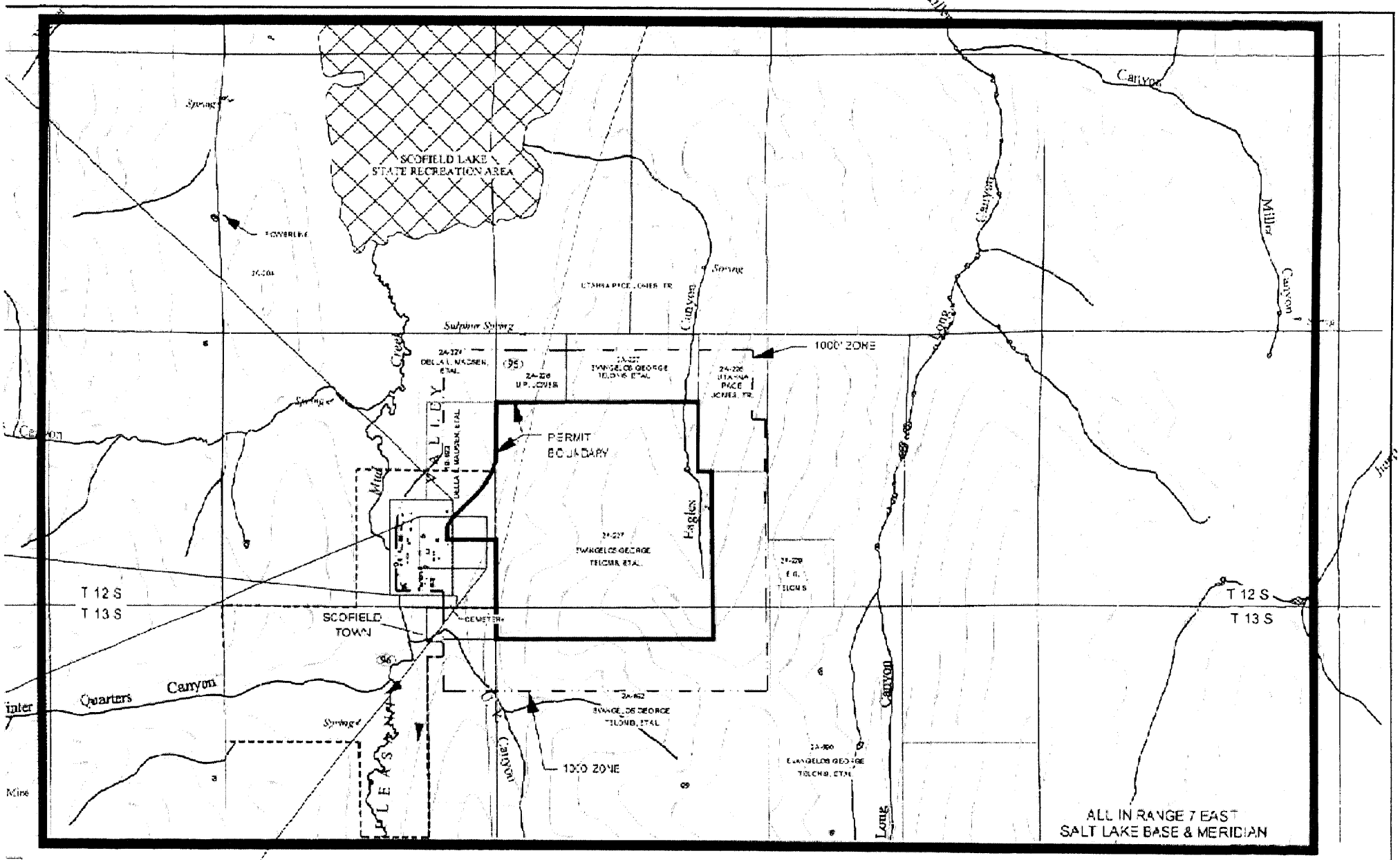
I am working on a permit application for a new coal mine in Carbon County and I need to include the following:

1. Species lists for mammals, birds, amphibians, snakes, and fish
2. Threatened and Endangered species

The attached PDF shows the area I need information for --- the large area inside the biggest black box.

If you have any questions please call me at (435) 650-7075.

Thank you,
Ben Grimes, Office Manager
HANSEN, ALLEN & LUCE ENGINEERS
PRICE, UAH



NEED SPECIES LISTS -MAMMALS, BIRDS, AMPHIBIANS, SNAKES ETC
AND T & E SPECIES FOR THIS AREA

Mining and Reclamation Permit Application
Kinney No. 2 Mine

Volume 3

Prepared By:

HANSEN ALLEN & LUCE inc
ENGINEERS

Carbon Resources LLC

P.O. Box 11789
Albuquerque, NM 87192
505-286-1253

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No. 8002 Date 02/19/2008
In C/007004/7, 2008, Incoming
For additional information + Confidential

Exhibit 3.7.2.2-1

Seep and Spring Survey

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No 0002 Date 02192008
In C/ 0070047 2008, Incoming
For additional information & Confidential

Rock Logic Consulting LLC

Rock Logic Consulting
PO Box 544 • Cedaredge, CO 81413
Phone: (435) 851-9044 • rocklogicconsulting@gmail.com
Brad Lindsay • Consulting Geologist

Memorandum

Date: 20 December 2006
To: Greg Hunt – Carbon Resources
From: Brad Lindsay
Subject: Spring and Seep Survey - June 2006

Summary

A spring and seep survey was conducted for Carbon Resources June 5th through June 9th 2006. Brad Lindsay conducted an extensive field survey within the area of interest outlined by Greg Hunt. Springs were observed and recorded in the field by traversing the property. Springs were identified in UP Canyon, Eagle Canyon, Long Canyon, Merrill Canyon, and Jump Creek. A 1/8-mile radius was traversed around drill hole locations listed in Carbon Resources Minor Coal Exploration Plan December 22, 2005. CR-06-04 was the only drill hole location with a spring within the 1/8-mile radius.

Methods

Area of interest survey - Greg Hunt outlined a large area of interest. The area was traversed by 4-wheeler and by hiking. Large dry slopes were observed from a distance. Areas that are more likely to have springs (such as down-dip slopes, heavily wooded areas, and canyon bottoms) were covered with a tighter traverse. Indications of existing or previously existing water were watched for. Indications include changes in vegetation, soil erosion, and desiccation cracks. When springs were located they were described, photographed, and coordinates taken. Flows were estimated for each spring.

Drill hole survey - A 1/8-mile radius was walked around each drill hole. Areas within the circle that could not be observed while walking the radius were traversed. Distances were measured using a handheld GPS unit. Evidence of springs was recorded as described above. Eagle Seep 3 was the only spring or seep found within a 1/8-mile radius of a drill hole location.

Observations

Springs were identified in five main locations: UP Canyon, Eagle Canyon, Long Canyon, Merrill Canyon, and Jump Creek. Findings at each of these locations are discussed below. Please refer to the attached map for exact locations. A track identifying the traverse path is also included on the map. Photographs of the springs are attached.

UP Canyon and near highway 96

Sulfur Spring – is located just east of highway 96 approximately 1 mile north of Scofield. The spring runs year round at an average rate of approximately 80 gpm. The spring flows through a culvert under the highway and west into a field.

Miller Spring – is approximately 1 ¼ mile north of sulfur spring east of highway 96. It is slightly north of the area of interest. A wooden fence surrounds the springhead. The spring only flows in the springtime. Estimated flow at the time of the survey is approximately 1 gpm.

UP Spring – is located east of the dirt road up the south fork of UP Canyon. The spring was not flowing, but water was ponded in a low area.

Two dry ponds and one full pond were identified near the end of the road up the south fork of UP Canyon. One dry pond was located near the end of the road up the east fork of UP Canyon.

Eagle Canyon

Angle Spring – is located at the north end of Eagle Canyon where it bends to the west. The spring is piped out of the ground into several metal stock tanks. The spring flows year round at an average rate of approximately ½ gpm.

Eagle Seep 1 & Eagle Seep 1A – these seeps are located near the valley bottom. They appear to flow into a stock pond immediately down hill and north. There is some old piping around the seeps and the stock pond. The flow from the seeps is estimated to be less than ½ gpm.

Eagle Spring 2 – is located north of Seep 1 and 1A in the valley bottom. A springhead was not located. A large stock pond was observed to be full all summer long. It is assumed that the spring feeds the pond from its bottom somewhere. The flow was not estimated.

Eagle Seep 3 – is located approximately 400 feet northeast downhill of proposed drill hole CR-06-04. The seep has an estimated flow of less than ½ gpm.

There is a dry trough and some piping directly north of an old corral in the bottom of the valley east of proposed drill hole CR-06-04. It appears that there may have been a spring at that location at one time.

Long Canyon

An effluent stream flows down Long Canyon fed by visible springs and seeps. The springs and seeps along with current beaver ponds have been mapped.

LC Seep 1 & 2 – are located at the north (downstream) end of Long Canyon. These seeps are north of the area of interest.

LC Seep 3 – is located approximately 1 mile south of LC Seep 1 &2.

LC Spring 1 – is near LC Seep 3. It is located on the west side of the stream. The estimated flow is approximately 10 gpm.

LC Spring 2 – is near LC Spring 1. It is located on the east side of the stream. The estimated flow is approximately 1/2 gpm.

LC Spring 3 – is south of LC Spring 1 & 2. It is located on the west side of the stream. The estimated flow is approximately 3 gpm.

LC Spring 4 – is part way up a small drainage along the west side of the canyon. The estimated flow is less than ½ gpm.

LC Spring 5 & 5A – are located in the canyon bottom at the east-west fence line that runs along the township 12 and township 13 boundary. Each spring has an estimated flow of approximately 5 gpm.

LC Spring 6 – is located in the west split of Long Canyon. The estimated flow is approximately 10 gpm.

LC Spring 7 – is located in a drainage along the west side of the west split of Long Canyon. It feeds a small stock pond. The estimated flow is approximately 7 gpm.

LC Spring 8 – is located in the east split of Long Canyon. It flows out of a steep cut bank west of the stream. The estimated flow is approximately 20 gpm.

Merrill Canyon

Merrill Canyon branches off approximately 1 mile south of the mouth of Long Canyon. It runs southeast toward Jump Creek. A small stream flows from Merrill Canyon into the stream in Long Canyon. At the time of this field survey, the majority of the water flowing from Merrill Canyon appeared to originate from springs in the canyon.

Merrill Spring 1 – is located at the canyon bottom up near the southeast end of the canyon. The estimated flow is approximately 10 gpm.

Luis Spring – is located on the south edge of the stream. The estimated flow is approximately 10-15 gpm.

Guzman Spring – is immediately west. The estimated flow is approximately 1/2 gpm.

Merrill Spring 2 – is north down the canyon. It is also located on the south side of the canyon. The estimated flow is approximately 10 gpm.

Merrill Spring 4, 5 & 5A, & 6 – are located in a small canyon that extends south from Merrill Canyon. Merrill Spring 4 is at the south (upstream) end of the canyon. It has an estimated flow of approximately 5 gpm. Merrill springs 5 and 5A are near the middle of the offshoot canyon. There is some 1" pvc piping protruding from the ground here. The springs have an estimated combined flow of approximately 10 gpm. Merrill spring 6 is located near the mouth of the offshoot canyon. It feeds a small pond. The estimated flow is less than 1 gpm.

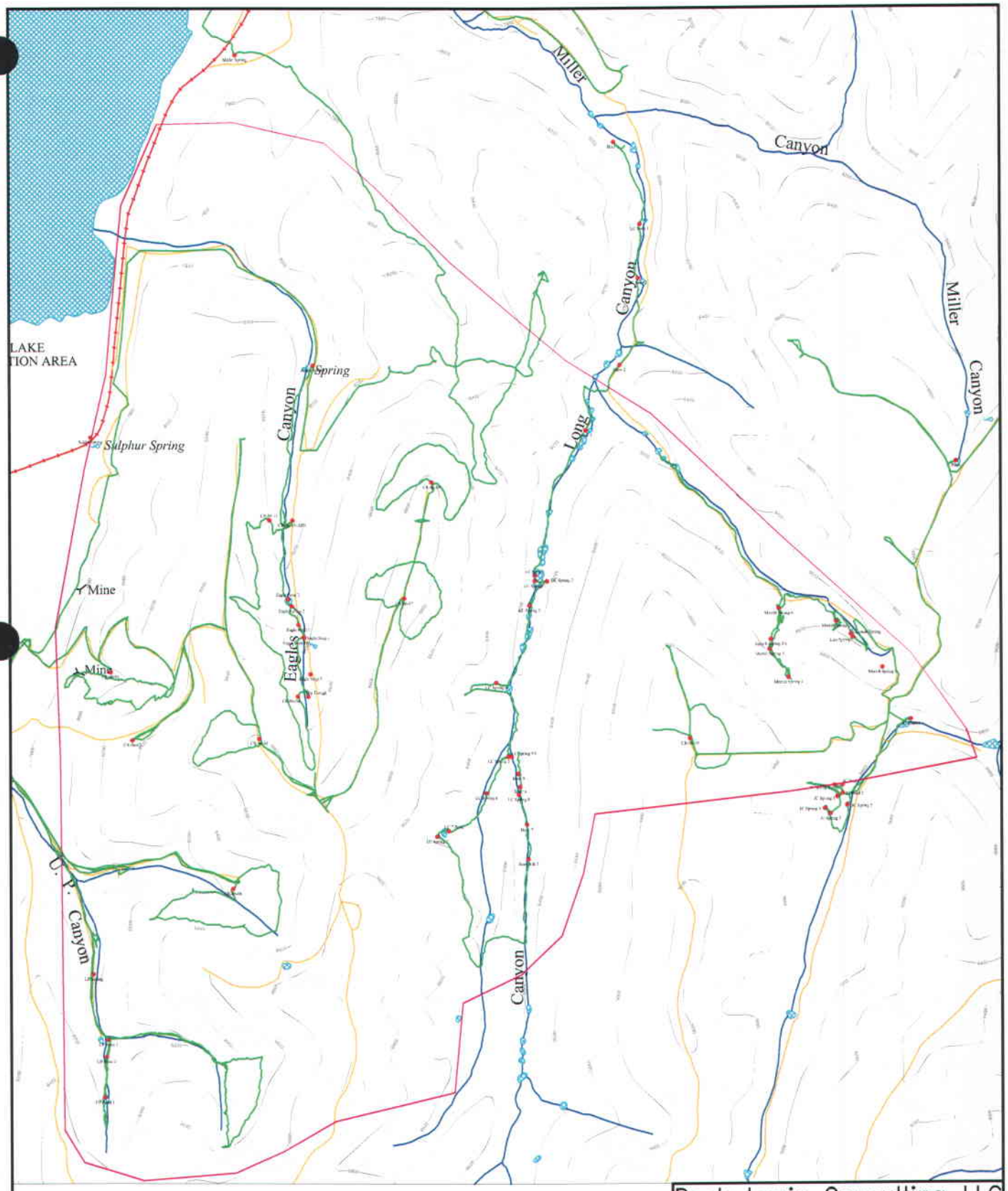
Jump Creek

Several springs were identified just south of the area of interest near Jump Creek. There is a spring fed stock pond in the area. There is also a second pond down the canyon that is fed by Jump Creek.

JC Spring 1 – is south of the pond and flows into Jump Creek. It has an estimated flow of approximately 10 gpm.

JC Spring 2 – is located northwest and feeds into the stock pond. It has an estimated flow of approximately 5 gpm.

JC Springs 3, 4, & 5 – are all located south of the stock pond and flow into Jump Creek. They each have estimated flows of less than 1 gpm.



KEY

Angle Spring	Spring, Seep, or Pond Location
	Area of Interest Boundary
	Survey Traverse Track

Drawing Loc: Spring and Seep Survey\GPS Data in KCS.dwg

Scale 1 = 2,200

Rock Logic Consulting LLC

Carbon Resources LLC
Spring and Seep Survey
June 2006

DWG	BWL & ER
CKD	
APD	

DATE: 6/28/06

Miller Spring

UP Spring

UP Pond 1

Angle Spring

Eagle Seep 1

Eagle Spring 2 and Pond

Eagle Seep 3

LC Spring 1

LC Spring 2

LC Spring 3

LC Spring 4

LC Spring 5A

LC Spring 5A

LC Spring 5

LC Spring 6

LC Spring 7

LC Spring 8

Merrill Spring 1

Luis Spring

Guzman Spring

Merrill Spring 4

Merrill Spring 5

JC Pond 1

JC Spring 1

JC Spring 2

JC Pond 2

JC Spring 3

JC Spring 4

JC Spring 5

Exhibit 3.7.2.2-2

Surface and Ground Water Field Measurements

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Miller Outlet

Elevation: **~7,632**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	59	8.09	6.9	474	330	42	10.4
9/6/2005	18	8.04	4.6	433		22	13.1
10/31/2005	134	6.89	7.2	440	300	29	4.8
11/28/2005	frozen	5.65	8.0	556	300	30	1.7
12/22/2005	frozen	6.06	6.8	435	370	27	4.2
1/22/2006	frozen	6.04	7.1	440	310	26	1.2
2/26/2006	frozen		4.6	320	240	24	14.0
3/27/2006	frozen	**8.1**		**550**	270	26	~1
4/26/2006	545	8.01	3.6	369	360	48	19.2
5/25/2006	266	8.53	4.0	408	240	19	30.2
6/29/2006	171	8.57	4.2	415	200	20	28.6
7/31/2006	103	8.41	4.4	326	620	20	27.6
8/20/2006	89	8.6	4.6	110	200	20	27.7
9/7/2006	122	lab	7.4	375			13.0
10/30/2006	182	8.33	8.5	285	310	25	13.0
11/27/2006	frozen	8	5.1	327	280	24	10.0
12/26/2006	frozen	8.06	7.2	428	300	20	8.4
1/31/2007	frozen	8.01	5.3	387	310	21	8.6
2/19/2007	frozen	8.12	7.0	354	260	23	8.0
3/29/2007	212	8.7	9.9	440	300	34	13.3
4/25/2007	156	8.54	6.7	436	290	30	23.4
5/29/2007	142	8.42	7.9	417	270	23	22.9
6/25/2006	35	8.06	4.7	508	280	27	31.0
7/30/2007	36	8.45	4.9	362	280	19	27.7

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*Miller Outlet was initiallly misnamed "Eagle Outlet" and was once misnamed "Eagle Outlook". Samples collected from may 2005 to may 2006 were mislabled "Eagle Outlet" or "Eagle Outlook" and analyltic data are labled accordingly. From June 2006 to present the data are labled as Miller Outlet. Data labled Miller Outlet, Eagle Outlet, & Eagle Outlook represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Eagle Spring

Elevation: **~7,700**

Date	Estimated Flow (1) (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	10	7.35	6	98.9			18.0
9/6/2005	dried up						
10/31/2005	dried up						
11/28/2005	dried up						
12/22/2005	dried up						
1/22/2006	dried up						
2/26/2006	dried up						
3/27/2006	dried up						
4/26/2006	10	7.2	4.7	41.8			21.0
5/25/2006		8.18	5.9	83.7			28.9
6/29/2006	dried up						
7/31/2006	dried up						
8/20/2006	dried up						
9/7/2006	dried up						
10/30/2006	dried up						
11/27/2006	dried up						
12/26/2006	dried up						
1/31/2007	dried up						
2/19/2007	dried up						
3/29/2007	dried up						
4/25/2007	dried up						
5/29/2007	dried up						
6/25/2006	dried up						
7/30/2007	dried up						

1 - Flow <10

Lab Data

*The sample collected at Eagle Spring in May 2005 was mislabled "Eagle Springs" and analyltic data are labled accordingly. Data labled Eagle Spring & Eagle Springs represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Sulfur Spring

Elevation: **~7,670**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	73	6.76	0.7	603	390	43	13.6
9/6/2005	32	7.2	2.4	559		45	15.9
10/31/2005	90	5.69	2.6	541	390	46	13.2
11/28/2005	76	5.85	3.9	561	330	45	11.9
12/22/2005	69	5.64	3.5	490	420	46	17.4
1/22/2006	69	7.64	1.3	410	380	44	14.7
2/26/2006	69	8.08	4.3	383	300	43	23.9
3/27/2006	90	**7.38**		**710**	230	44	~14
4/26/2006	64	7.03	1.2	413	360	29	23.4
5/25/2006	79	7.46	2.4	503	350	41	28.2
6/29/2006	69	7.45	2.9	550	310	44	25.1
7/31/2006	74	7.27	2.0	446	330	47	24.1
8/20/2006	72	7.29	2.3	169	320	47	24.1
9/7/2006	86	lab	2.2	473			22.0
10/30/2006	80	7.27	4.0	384	360	46	22.2
11/27/2006	90	7.02	1.8	389	350	43	20.0
12/26/2006	90	7.00	3.0	538	370	42	20.0
1/31/2007	90	7.01	5.1	682	390	41	17.4
2/19/2007	88	7.03	4.1	473	340	42	21.5
3/29/2007	72	7.39	4.4	544	340	44	21.7
4/25/2007	90	7.33	7.0	557	380	45	23.4
5/29/2007	91	7.41	5.5	523	380	46	22.8
6/25/2006	86	7.25	2.4	615	360	46	27.5
7/30/2007	136	7.33	4.0	507	390	47	22.7

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*Samples collected at Sulfur Spring have occasionaly been mislabled "Sulfur Springs", "Sulfer Spring", & "Sulfer Springs". From May 2005 to Nov 2006 sample names varied. From Dec 06 to present, samples have been labled Sulfur Spring. Analyltic data are Labled accordingly. Data labled Sulfur Spring, Sulfur Springs, Sulfer Spring, & Sulfer Springs represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Angle Spring

Elevation: **~7,940**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
9/6/2005	0.25	7.35	3.7	358		15	22.0
10/31/2005	0.33	6.01	4.7	519	350	0	10.6
11/28/2005	0.35	6.46	4.7	428	290	16	22.2
12/22/2005	0.35	5.23	3.9	512	400	15	11.6
1/22/2006	0.31	4.36	8.4	469	350	16	8.9
2/26/2006		8.28	4.7	385	240	14	14.7
3/27/2006	0.35	**7.04**		**670**	190	15	~10
4/26/2006	0.75	7.28	5.1	361	310	19	18.0
5/25/2006	1.00	5.96	3.8	492	330	14	20.5
6/29/2006		7.5	6.3	522	280	18	20.9
7/31/2006	1.25	7.24	3.7	410	290	18	29.9
8/20/2006	1.03	7.26	3.5	156	270	18	22.3
9/7/2006	0.86	lab	4	387			18.5
10/30/2006	not measured						
11/27/2006	not measured						
12/26/2006	not measured						
1/31/2007	not measured						
2/19/2007	not measured						
3/29/2007	not measured						
4/25/2007	not measured						
5/29/2007	not measured						
6/25/2006	not measured						
7/30/2007	not measured						

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Mud Creek

Elevation: **~7,685**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	13,015	8.31	7.4	694	500	120	10.0
9/6/2005	4,937	8.51	5.4	655		250	17.7
10/31/2005	6,732	6.68	6.4	759	720	250	10.7
11/29/2005	6,283	6.94	7.2	758	700	260	5.6
12/22/2005	5,386	6.67	6.2	520	600	190	13.6
1/22/2006	8,527	8.63	4.1	568	720	290	7.6
2/26/2006	5,834	9.0	3.6	501	570	250	19.3
3/27/2006	5,386	**8.18**		**1000**	**510**	**250**	~2
4/26/2006	17,952	8.3	5	394	410	88	18.5
5/25/2006		8.45	4.4	324	230	42	26.5
6/29/2006	11,670		6.2	581	380	160	28.5
7/31/2006	6,732	8.4	4.8	471	380	160	26.9
8/20/2006	6,284	8.38	5.1	188	420	130	27.7
9/7/2006	5,386	lab	6.1	564			14.3
10/30/2006	7,181	7.94	6.9	424	460	160	17.3
11/27/2006	7,181	7.76	6	463	490	160	12.0
12/26/2006	6,284	8.08	7.3	571	490	150	13.1
1/31/2007	7,181	7.4	5.5	834	420	120	12.4
2/19/2007	6,732	8.3	6.8	476	440	150	12.4
3/29/2007	8,528	8.33	7.9	555	380	120	13.4
4/25/2007	9,425	8.29	7.8	546	360	120	25.0
5/29/2007	12,567	8.51	7.9	481	360	87	20.7
6/25/2006	6,733	8.65	5.7	742	440	140	27.7
7/30/2007	6,284	8.58	5.3	532	440	140	25.5

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*The sample collected at Mud Creek in May 2005 was mislabled "Muddy Creek" and analyltic data are labled accordingly. Data labled Mud Creek & Muddy Creek represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Res-1 (Scofield Reservoir)

Elevation: **~7,620**

Date	Water Level (feet)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/30/2006	13.5	8.09	5.6	424	230	34	20.6
6/29/2006	11.5	9.03	10	287	96	34	31.9
7/31/2006	9.4	10.16	9.1	257	170	24	29.8
8/20/2006	7.7	9.82	9	108	200	24	35.7
9/7/2006	6.0	lab	5.2	365		74	15.5
10/30/2006	4.5	8.13	6.7	351	400		18.2
11/27/2006	4.8	frozen					
12/26/2006	5.5	frozen					
1/31/2007	6.3	frozen					
2/19/2007	7.1	frozen					
3/29/2007	7.8	8.43	9.7	408	290	97	14.9
4/25/2007	7.8	8.39	7.8	390	210	60	23.4
5/29/2007	8.1	8.48	8	350	250	56	24.9
6/25/2006	5.6	10.52	7.3	360	190	25	36.1
7/30/2007	0.1	8.02	5.9	616	590	48	28
	Estimated				Lab Data		

*The samples collected at Res-1 in June, July, & Aug 2006 were mislabled "Scofield Res. 1" and analyltic data are labled accordingly. Data labled Res-1 & Scofield Res. 1 represent samples collected at the same location.

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-01

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		7951.2	
Screened Interval Depth:		79	86
Screened Interval Elevation:		7872.2	7865.2
Hiawatha Seam Interval Depth:		76.9	85
Hiawatha Seam Interval Elevation:		7874.3	7866.2

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	Dry					
4/26/2006	Dry					
5/25/2006	Dry					
6/29/2006	Dry					
7/25/2006	Dry					
8/20/2006	Dry					
9/7/2006	Dry					
10/30/2006	Dry					
11/27/2006	Dry					
12/26/2006	97.4	7853.8				
1/31/2007	97.5	7853.7				
2/19/2007	97.4	7853.8				
3/29/2007	Dry					
4/25/2007	97.6	7853.6				
5/29/2007	97.4	7853.8				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements

CR-06-01-BLW

DATUM :	Top of Fiberglass completion string	
DATUM ELEVATION:	7951.1	
Screened Interval Depth:	240	250
Screened Interval Elevation:	7711.1	7701.1
Hiawatha Seam Interval Depth:	76.9	85
Hiawatha Seam Interval Elevation:	7874.2	7866.1

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water was observed with a camera in the open hole at 210 feet and 215 feet.					
3/8/2006	Dry					
4/26/2006	Dry					
5/25/2006	Dry					
6/29/2006	242.0	7709.1				
7/19/2006	Dry					
8/20/2006	242.1	7709.0				
9/7/2006	242.0	7709.1				
10/30/2006	242.2	7708.9				
11/27/2006	237.3	7713.8				
12/26/2006	242.1	7709.0				
1/31/2007	242.3	7708.8				
2/19/2007	242.2	7708.9				
3/29/2007	Dry					
4/25/2007	242.4	7708.7				
5/29/2007	242.3	7708.8				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-02-ABV

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8337.7	
Screened Interval Depth:		288	298
Screened Interval Elevation:		8049.8	8039.8
Hiawatha Seam Interval Depth:		428	437
Hiawatha Seam Interval Elevation:		7909.8	7900.8

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	302.8	8034.9				
4/26/2006	309.0	8028.7				
5/25/2006	Dry					
6/29/2006	307.2	8030.5				
7/19/2006	303.6	8034.1				
8/20/2006	301.7	8036.0				
9/7/2006	301.6	8036.1				
10/30/2006	301.7	8036.0				
11/27/2006	301.6	8036.1				
12/26/2006	301.6	8036.1				
1/31/2007	301.2	8036.5				
2/19/2007	301.8	8035.9				
3/29/2007	301.7	8036.0				
4/25/2007	301.8	8035.9				
5/29/2007	301.7	8036.0				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements

CR-06-02

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8338.6	
Screened Interval Depth:		429	437
Screened Interval Elevation:		7909.6	7901.6
Hiawatha Seam Interval Depth:		428	437
Hiawatha Seam Interval Elevation:		7910.6	7901.6

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	437.0	7901.6				
4/26/2006	437.1	7901.5				
5/25/2006	441.4	7897.2				
6/29/2006	438.3	7900.3				
7/19/2006	438.1	7900.5				
8/20/2006	438.4	7900.2				
9/7/2006	439.0	7899.6				
10/30/2006	437.6	7901.0				
11/27/2006	438.6	7900.0				
12/26/2006	439.3	7899.3				
1/31/2007	439.7	7898.9				
2/19/2007	439.9	7898.7				
3/29/2007	439.3	7899.3				
4/25/2007	439.9	7898.7				
5/29/2007	440.1	7898.5				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-03-ABV

DATUM :	Top of Fiberglass completion string	
DATUM ELEVATION:	8,135.97	
Screened Interval Depth:	480	490
Screened Interval Elevation:	7656	7646
Hiawatha Seam Interval Depth:	647	654
Hiawatha Seam Interval Elevation:	7009	7002

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006	Purged approximatly 600 gal of water.					
3/7/2006	Purged an additional 300 gal of water.					
4/26/2006	337.1	7798.9	6.92	5.7	425	26.6
5/25/2006	337.8	7798.2	7.28	1.3	599	28.3
6/29/2006	338.2	7797.8	7.23	2.2	689	21.8
7/31/2006	337.5	7798.5	6.87	1.1	549	23.9
8/20/2006	337.7	7798.3	6.99	1.1	245	25
9/7/2006	337.8	7798.2	>12	1.7	522	20.7
10/30/2006	not measured					
11/27/2006	not measured					
12/26/2006	not measured					
1/31/2007	not measured					
2/19/2007	not measured					
3/29/2007	not measured					
4/25/2007	not measured					
5/29/2007	not measured					

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-05A

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8798.9	
Screened Interval Depth:		1036	1051
Screened Interval Elevation:		7762.9	7747.9
Hiawatha Seam Interval Depth:		1037	1043
Hiawatha Seam Interval Elevation:		7761.9	7755.9

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	1051.7	7747.2				
10/30/2006	1057.6	7741.3				
11/27/2006	not measured					
12/26/2006	1058.0	7740.9				
1/31/2007	1057.8	7741.1				
2/19/2007	1057.9	7741.0				
3/29/2007	1057.5	7741.4				
4/25/2007	1058.1	7740.8				
5/29/2007	1057.8	7741.1				

Carbon Resources LLC

Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09-BLW

DATUM :	Top of PVC completion string	
DATUM ELEVATION:	8842.9	
Screened Interval Depth:	1020	1040
Screened Interval Elevation:	7822.9	7802.9
Hiawatha Seam Interval Depth:	990	1001.5
Hiawatha Seam Interval Elevation:	7852.9	7841.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water appeared durring drilling at ~760 feet.					
	After drilling deeper, appearant wl was ~800 feet.					
	Durring geophysical logging wl was 935 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/18/2006	989.5	7853.4	-	-	-	-
9/7/2006	990.5	7852.4				
10/30/2006	990.8	7852.1				
11/27/2006	not measured					
12/26/2006	991.0	7851.9				
1/31/2007	991.0	7851.9				
2/19/2007	990.3	7852.6				
3/29/2007	991.2	7851.7				
4/25/2007	990.8	7852.1				
5/29/2007	991.0	7851.9				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements

CR-06-09

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8,843.30	
Screened Interval Depth:		989.5	1001.5
Screened Interval Elevation:		7853.8	7841.8
Hiawatha Seam Interval Depth:		992.2	>1002
Hiawatha Seam Interval Elevation:		7851.1	<7840.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	982.0	7861.3				
10/30/2006	984.1	7859.2				
11/27/2006	not measured					
12/26/2006	982.4	7860.9				
1/31/2007	983.1	7860.2				
2/19/2007	983.3	7860.0				
3/29/2007	982.8	7860.5				
4/25/2007	982.9	7860.4				
5/29/2007	982.6	7860.7				

Carbon Resources LLC

Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09-ABV

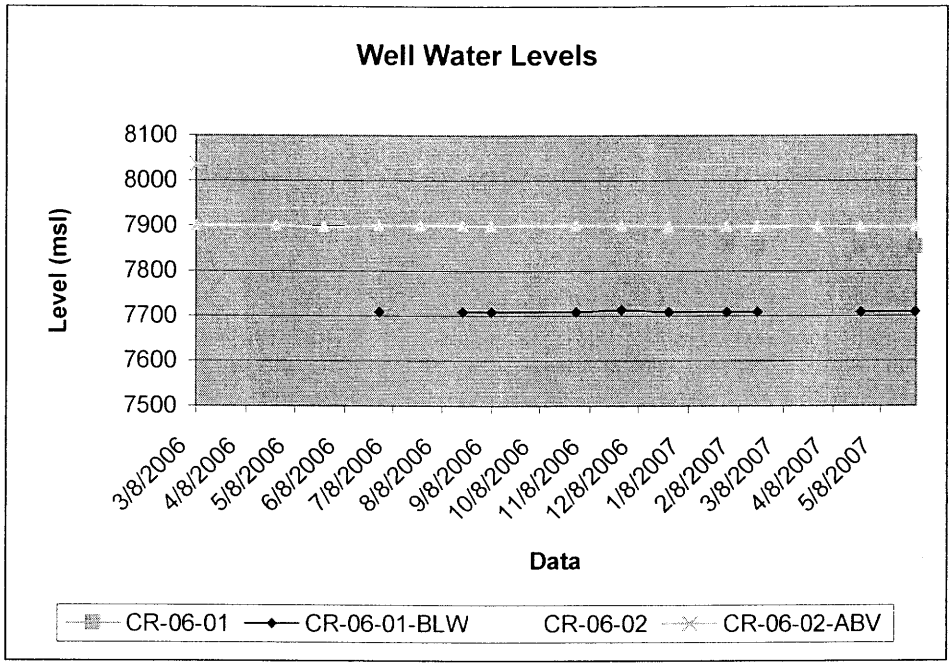
DATUM :	Top PVC of completion string		
DATUM ELEVATION:		8843.3	
Screened Interval Depth:		888	898
Screened Interval Elevation:		7955.3	7945.3
Hiawatha Seam Interval Depth:		992.2	>1002
Hiawatha Seam Interval Elevation:		7851.1	<7840.4

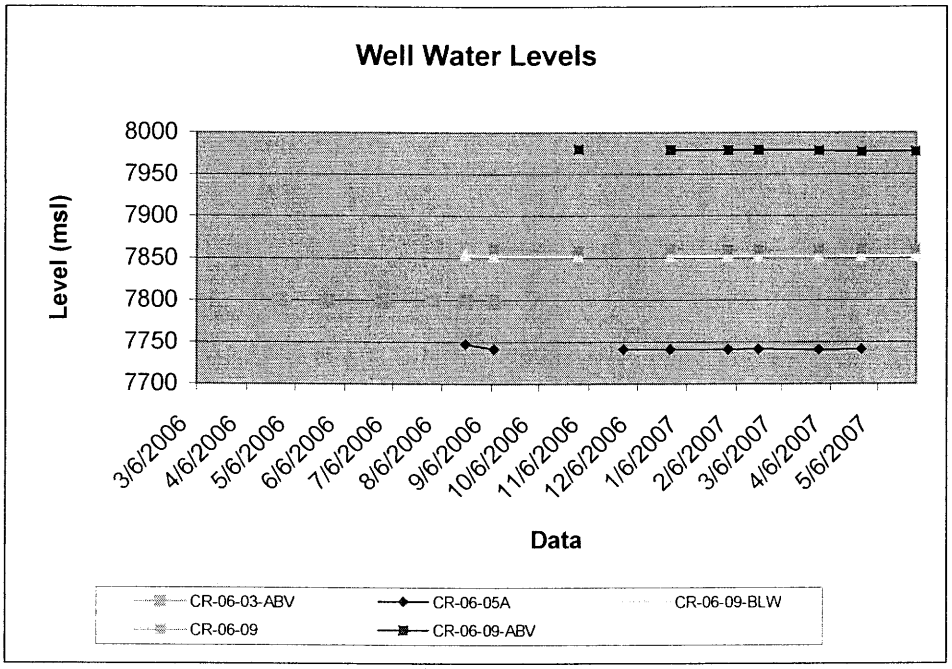
Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	Not developed - WL 3 days after instalation = 861.3					
10/30/2006	863.1	7980.2				
11/27/2006	not measured					
12/26/2006	863.9	7979.4				
1/31/2007	864.5	7978.8				
2/19/2007	864.1	7979.2				
3/29/2007	864.7	7978.6				
4/25/2007	866.1	7977.2				
5/29/2007	866.1	7977.2				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements





Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Miller Outlet

Elevation: **~7,632**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	59	8.09	6.9	474	330	42	10.4
9/6/2005	18	8.04	4.6	433		22	13.1
10/31/2005	134	6.89	7.2	440	300	29	4.8
11/28/2005	frozen	5.65	8.0	556	300	30	1.7
12/22/2005	frozen	6.06	6.8	435	370	27	4.2
1/22/2006	frozen	6.04	7.1	440	310	26	1.2
2/26/2006	frozen		4.6	320	240	24	14.0
3/27/2006	frozen	**8.1**		**550**	270	26	~1
4/26/2006	545	8.01	3.6	369	360	48	19.2
5/25/2006	266	8.53	4.0	408	240	19	30.2
6/29/2006	171	8.57	4.2	415	200	20	28.6
7/31/2006	103	8.41	4.4	326	620	20	27.6
8/20/2006	89	8.6	4.6	110	200	20	27.7
9/7/2006	122	lab	7.4	375			13.0
10/30/2006	182	8.33	8.5	285	310	25	13.0
11/27/2006	frozen	8	5.1	327	280	24	10.0
12/26/2006	frozen	8.06	7.2	428	300	20	8.4
1/31/2007	frozen	8.01	5.3	387	310	21	8.6
2/19/2007	frozen	8.12	7.0	354	260	23	8.0
3/29/2007	212	8.7	9.9	440	300	34	13.3
4/25/2007	156	8.54	6.7	436	290	30	23.4
5/29/2007	142	8.42	7.9	417	270	23	22.9
6/25/2006	35	8.06	4.7	508	280	27	31.0
7/30/2007	36	8.45	4.9	362	280	19	27.7
					Lab Data		

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*Miller Outlet was initiallly misnamed "Eagle Outlet" and was once misnamed "Eagle Outlook". Samples collected from may 2005 to may 2006 were mislabled "Eagle Outlet" or "Eagle Outlook" and analyltic data are labled accordingly. From June 2006 to present the data are labled as Miller Outlet. Data labled Miller Outlet, Eagle Outlet, & Eagle Outlook represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Eagle Spring

Elevation: **~7,700**

Date	Estimated Flow (1) (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	10	7.35	6	98.9			18.0
9/6/2005	dried up						
10/31/2005	dried up						
11/28/2005	dried up						
12/22/2005	dried up						
1/22/2006	dried up						
2/26/2006	dried up						
3/27/2006	dried up						
4/26/2006	10	7.2	4.7	41.8			21.0
5/25/2006		8.18	5.9	83.7			28.9
6/29/2006	dried up						
7/31/2006	dried up						
8/20/2006	dried up						
9/7/2006	dried up						
10/30/2006	dried up						
11/27/2006	dried up						
12/26/2006	dried up						
1/31/2007	dried up						
2/19/2007	dried up						
3/29/2007	dried up						
4/25/2007	dried up						
5/29/2007	dried up						
6/25/2006	dried up						
7/30/2007	dried up						

1 - Flow <10

Lab Data

*The sample collected at Eagle Spring in May 2005 was mislabled "Eagle Springs" and analyltic data are labled accordingly. Data labled Eagle Spring & Eagle Springs represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Sulfur Spring

Elevation: **~7,670**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	73	6.76	0.7	603	390	43	13.6
9/6/2005	32	7.2	2.4	559		45	15.9
10/31/2005	90	5.69	2.6	541	390	46	13.2
11/28/2005	76	5.85	3.9	561	330	45	11.9
12/22/2005	69	5.64	3.5	490	420	46	17.4
1/22/2006	69	7.64	1.3	410	380	44	14.7
2/26/2006	69	8.08	4.3	383	300	43	23.9
3/27/2006	90	**7.38**		**710**	230	44	~14
4/26/2006	64	7.03	1.2	413	360	29	23.4
5/25/2006	79	7.46	2.4	503	350	41	28.2
6/29/2006	69	7.45	2.9	550	310	44	25.1
7/31/2006	74	7.27	2.0	446	330	47	24.1
8/20/2006	72	7.29	2.3	169	320	47	24.1
9/7/2006	86	lab	2.2	473			22.0
10/30/2006	80	7.27	4.0	384	360	46	22.2
11/27/2006	90	7.02	1.8	389	350	43	20.0
12/26/2006	90	7.00	3.0	538	370	42	20.0
1/31/2007	90	7.01	5.1	682	390	41	17.4
2/19/2007	88	7.03	4.1	473	340	42	21.5
3/29/2007	72	7.39	4.4	544	340	44	21.7
4/25/2007	90	7.33	7.0	557	380	45	23.4
5/29/2007	91	7.41	5.5	523	380	46	22.8
6/25/2006	86	7.25	2.4	615	360	46	27.5
7/30/2007	136	7.33	4.0	507	390	47	22.7

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*Samples collected at Sulfur Spring have occasionaly been mislabled "Sulfur Springs", "Sulfer Spring", & "Sulfer Springs". From May 2005 to Nov 2006 sample names varied. From Dec 06 to present, samples have been labled Sulfur Spring. Analyltic data are Labled accordingly. Data labled Sulfur Spring, Sulfur Springs, Sulfer Spring, & Sulfer Springs represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Angle Spring

Elevation: **~7,940**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
9/6/2005	0.25	7.35	3.7	358		15	22.0
10/31/2005	0.33	6.01	4.7	519	350	0	10.6
11/28/2005	0.35	6.46	4.7	428	290	16	22.2
12/22/2005	0.35	5.23	3.9	512	400	15	11.6
1/22/2006	0.31	4.36	8.4	469	350	16	8.9
2/26/2006		8.28	4.7	385	240	14	14.7
3/27/2006	0.35	**7.04**		**670**	190	15	~10
4/26/2006	0.75	7.28	5.1	361	310	19	18.0
5/25/2006	1.00	5.96	3.8	492	330	14	20.5
6/29/2006		7.5	6.3	522	280	18	20.9
7/31/2006	1.25	7.24	3.7	410	290	18	29.9
8/20/2006	1.03	7.26	3.5	156	270	18	22.3
9/7/2006	0.86	lab	4	387			18.5
10/30/2006	not measured						
11/27/2006	not measured						
12/26/2006	not measured						
1/31/2007	not measured						
2/19/2007	not measured						
3/29/2007	not measured						
4/25/2007	not measured						
5/29/2007	not measured						
6/25/2006	not measured						
7/30/2007	not measured						

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Mud Creek

Elevation: **~7,685**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	13,015	8.31	7.4	694	500	120	10.0
9/6/2005	4,937	8.51	5.4	655		250	17.7
10/31/2005	6,732	6.68	6.4	759	720	250	10.7
11/29/2005	6,283	6.94	7.2	758	700	260	5.6
12/22/2005	5,386	6.67	6.2	520	600	190	13.6
1/22/2006	8,527	8.63	4.1	568	720	290	7.6
2/26/2006	5,834	9.0	3.6	501	570	250	19.3
3/27/2006	5,386	**8.18**		**1000**	**510**	**250**	~2
4/26/2006	17,952	8.3	5	394	410	88	18.5
5/25/2006		8.45	4.4	324	230	42	26.5
6/29/2006	11,670		6.2	581	380	160	28.5
7/31/2006	6,732	8.4	4.8	471	380	160	26.9
8/20/2006	6,284	8.38	5.1	188	420	130	27.7
9/7/2006	5,386	lab	6.1	564			14.3
10/30/2006	7,181	7.94	6.9	424	460	160	17.3
11/27/2006	7,181	7.76	6	463	490	160	12.0
12/26/2006	6,284	8.08	7.3	571	490	150	13.1
1/31/2007	7,181	7.4	5.5	834	420	120	12.4
2/19/2007	6,732	8.3	6.8	476	440	150	12.4
3/29/2007	8,528	8.33	7.9	555	380	120	13.4
4/25/2007	9,425	8.29	7.8	546	360	120	25.0
5/29/2007	12,567	8.51	7.9	481	360	87	20.7
6/25/2006	6,733	8.65	5.7	742	440	140	27.7
7/30/2007	6,284	8.58	5.3	532	440	140	25.5
					Lab Data		

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*The sample collected at Mud Creek in May 2005 was mislabled "Muddy Creek" and analyltic data are labled accordingly. Data labled Mud Creek & Muddy Creek represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Res-1 (Scofield Reservoir)

Elevation: **~7,620**

Date	Water Level (feet)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/30/2006	13.5	8.09	5.6	424	230	34	20.6
6/29/2006	11.5	9.03	10	287	96	34	31.9
7/31/2006	9.4	10.16	9.1	257	170	24	29.8
8/20/2006	7.7	9.82	9	108	200	24	35.7
9/7/2006	6.0	lab	5.2	365		74	15.5
10/30/2006	4.5	8.13	6.7	351	400		18.2
11/27/2006	4.8	frozen					
12/26/2006	5.5	frozen					
1/31/2007	6.3	frozen					
2/19/2007	7.1	frozen					
3/29/2007	7.8	8.43	9.7	408	290	97	14.9
4/25/2007	7.8	8.39	7.8	390	210	60	23.4
5/29/2007	8.1	8.48	8	350	250	56	24.9
6/25/2006	5.6	10.52	7.3	360	190	25	36.1
7/30/2007	0.1	8.02	5.9	616	590	48	28
	Estimated				Lab Data		

*The samples collected at Res-1 in June, July, & Aug 2006 were mislabled "Scofield Res. 1" and analyltic data are labled accordingly. Data labled Res-1 & Scofield Res. 1 represent samples collected at the same location.

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-01

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		7951.2	
Screened Interval Depth:		79	86
Screened Interval Elevation:		7872.2	7865.2
Hiawatha Seam Interval Depth:		76.9	85
Hiawatha Seam Interval Elevation:		7874.3	7866.2

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	Dry					
4/26/2006	Dry					
5/25/2006	Dry					
6/29/2006	Dry					
7/25/2006	Dry					
8/20/2006	Dry					
9/7/2006	Dry					
10/30/2006	Dry					
11/27/2006	Dry					
12/26/2006	97.4	7853.8				
1/31/2007	97.5	7853.7				
2/19/2007	97.4	7853.8				
3/29/2007	Dry					
4/25/2007	97.6	7853.6				
5/29/2007	97.4	7853.8				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements

CR-06-01-BLW

DATUM :	Top of Fiberglass completion string		
DATUM ELEVATION:		7951.1	
Screened Interval Depth:		240	250
Screened Interval Elevation:		7711.1	7701.1
Hiawatha Seam Interval Depth:		76.9	85
Hiawatha Seam Interval Elevation:		7874.2	7866.1

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water was observed with a camera in the open hole at 210 feet and 215 feet.					
3/8/2006	Dry					
4/26/2006	Dry					
5/25/2006	Dry					
6/29/2006	242.0	7709.1				
7/19/2006	Dry					
8/20/2006	242.1	7709.0				
9/7/2006	242.0	7709.1				
10/30/2006	242.2	7708.9				
11/27/2006	237.3	7713.8				
12/26/2006	242.1	7709.0				
1/31/2007	242.3	7708.8				
2/19/2007	242.2	7708.9				
3/29/2007	Dry					
4/25/2007	242.4	7708.7				
5/29/2007	242.3	7708.8				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements

CR-06-02

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8338.6	
Screened Interval Depth:		429	437
Screened Interval Elevation:		7909.6	7901.6
Hiawatha Seam Interval Depth:		428	437
Hiawatha Seam Interval Elevation:		7910.6	7901.6

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	437.0	7901.6				
4/26/2006	437.1	7901.5				
5/25/2006	441.4	7897.2				
6/29/2006	438.3	7900.3				
7/19/2006	438.1	7900.5				
8/20/2006	438.4	7900.2				
9/7/2006	439.0	7899.6				
10/30/2006	437.6	7901.0				
11/27/2006	438.6	7900.0				
12/26/2006	439.3	7899.3				
1/31/2007	439.7	7898.9				
2/19/2007	439.9	7898.7				
3/29/2007	439.3	7899.3				
4/25/2007	439.9	7898.7				
5/29/2007	440.1	7898.5				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-02-ABV

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8337.7	
Screened Interval Depth:		288	298
Screened Interval Elevation:		8049.8	8039.8
Hiawatha Seam Interval Depth:		428	437
Hiawatha Seam Interval Elevation:		7909.8	7900.8

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	302.8	8034.9				
4/26/2006	309.0	8028.7				
5/25/2006	Dry					
6/29/2006	307.2	8030.5				
7/19/2006	303.6	8034.1				
8/20/2006	301.7	8036.0				
9/7/2006	301.6	8036.1				
10/30/2006	301.7	8036.0				
11/27/2006	301.6	8036.1				
12/26/2006	301.6	8036.1				
1/31/2007	301.2	8036.5				
2/19/2007	301.8	8035.9				
3/29/2007	301.7	8036.0				
4/25/2007	301.8	8035.9				
5/29/2007	301.7	8036.0				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-03-ABV

DATUM :	Top of Fiberglass completion string		
DATUM ELEVATION:		8,135.97	
Screened Interval Depth:		480	490
Screened Interval Elevation:		7656	7646
Hiawatha Seam Interval Depth:		647	654
Hiawatha Seam Interval Elevation:		7009	7002

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006	Purged approximatly 600 gal of water.					
3/7/2006	Purged an additional 300 gal of water.					
4/26/2006	337.1	7798.9	6.92	5.7	425	26.6
5/25/2006	337.8	7798.2	7.28	1.3	599	28.3
6/29/2006	338.2	7797.8	7.23	2.2	689	21.8
7/31/2006	337.5	7798.5	6.87	1.1	549	23.9
8/20/2006	337.7	7798.3	6.99	1.1	245	25
9/7/2006	337.8	7798.2	>12	1.7	522	20.7
10/30/2006	not measured					
11/27/2006	not measured					
12/26/2006	not measured					
1/31/2007	not measured					
2/19/2007	not measured					
3/29/2007	not measured					
4/25/2007	not measured					
5/29/2007	not measured					

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-05A

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8798.9	
Screened Interval Depth:		1036	1051
Screened Interval Elevation:		7762.9	7747.9
Hiawatha Seam Interval Depth:		1037	1043
Hiawatha Seam Interval Elevation:		7761.9	7755.9

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	1051.7	7747.2				
10/30/2006	1057.6	7741.3				
11/27/2006	not measured					
12/26/2006	1058.0	7740.9				
1/31/2007	1057.8	7741.1				
2/19/2007	1057.9	7741.0				
3/29/2007	1057.5	7741.4				
4/25/2007	1058.1	7740.8				
5/29/2007	1057.8	7741.1				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09-BLW

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8842.9	
Screened Interval Depth:		1020	1040
Screened Interval Elevation:		7822.9	7802.9
Hiawatha Seam Interval Depth:		990	1001.5
Hiawatha Seam Interval Elevation:		7852.9	7841.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water appeared durring drilling at ~760 feet.					
	After drilling deeper, appearant wl was ~800 feet.					
	Durring geophysical logging wl was 935 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/18/2006	989.5	7853.4	-	-	-	-
9/7/2006	990.5	7852.4				
10/30/2006	990.8	7852.1				
11/27/2006	not measured					
12/26/2006	991.0	7851.9				
1/31/2007	991.0	7851.9				
2/19/2007	990.3	7852.6				
3/29/2007	991.2	7851.7				
4/25/2007	990.8	7852.1				
5/29/2007	991.0	7851.9				

Carbon Resources LLC

Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8,843.30	
Screened Interval Depth:		989.5	1001.5
Screened Interval Elevation:		7853.8	7841.8
Hiawatha Seam Interval Depth:		992.2	>1002
Hiawatha Seam Interval Elevation:		7851.1	<7840.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet. Higher flow of water durring drilling at ~450 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	982.0	7861.3				
10/30/2006	984.1	7859.2				
11/27/2006	not measured					
12/26/2006	982.4	7860.9				
1/31/2007	983.1	7860.2				
2/19/2007	983.3	7860.0				
3/29/2007	982.8	7860.5				
4/25/2007	982.9	7860.4				
5/29/2007	982.6	7860.7				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09-ABV

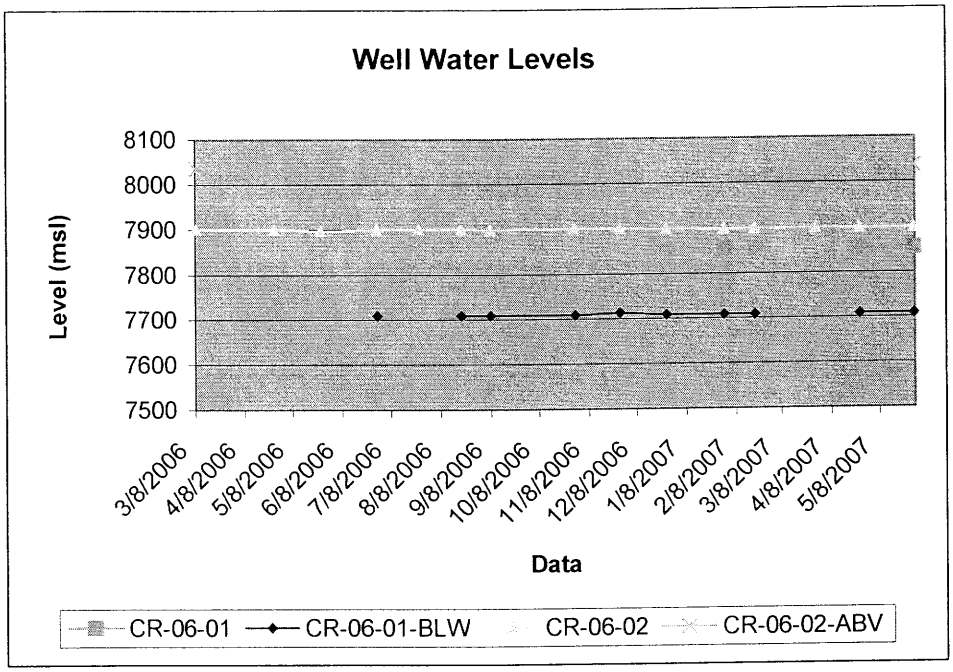
DATUM :	Top PVC of completion string		
DATUM ELEVATION:		8843.3	
Screened Interval Depth:		888	898
Screened Interval Elevation:		7955.3	7945.3
Hiawatha Seam Interval Depth:		992.2	>1002
Hiawatha Seam Interval Elevation:		7851.1	<7840.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet. Higher flow of water durring drilling at ~450 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	Not developed - WL 3 days after instalation = 861.3					
10/30/2006	863.1	7980.2				
11/27/2006	not measured					
12/26/2006	863.9	7979.4				
1/31/2007	864.5	7978.8				
2/19/2007	864.1	7979.2				
3/29/2007	864.7	7978.6				
4/25/2007	866.1	7977.2				
5/29/2007	866.1	7977.2				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements



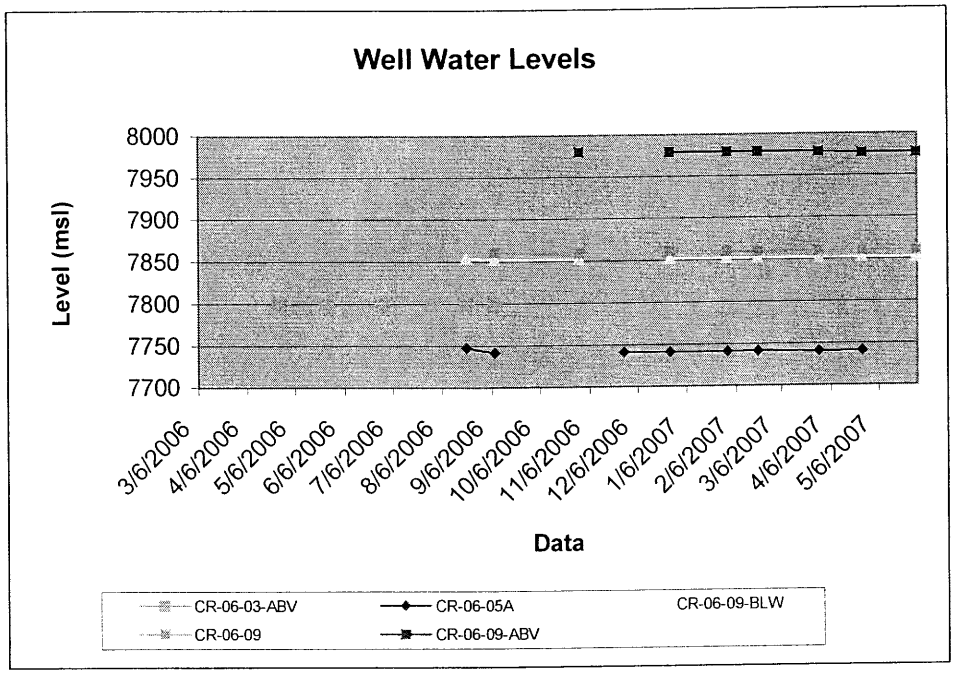
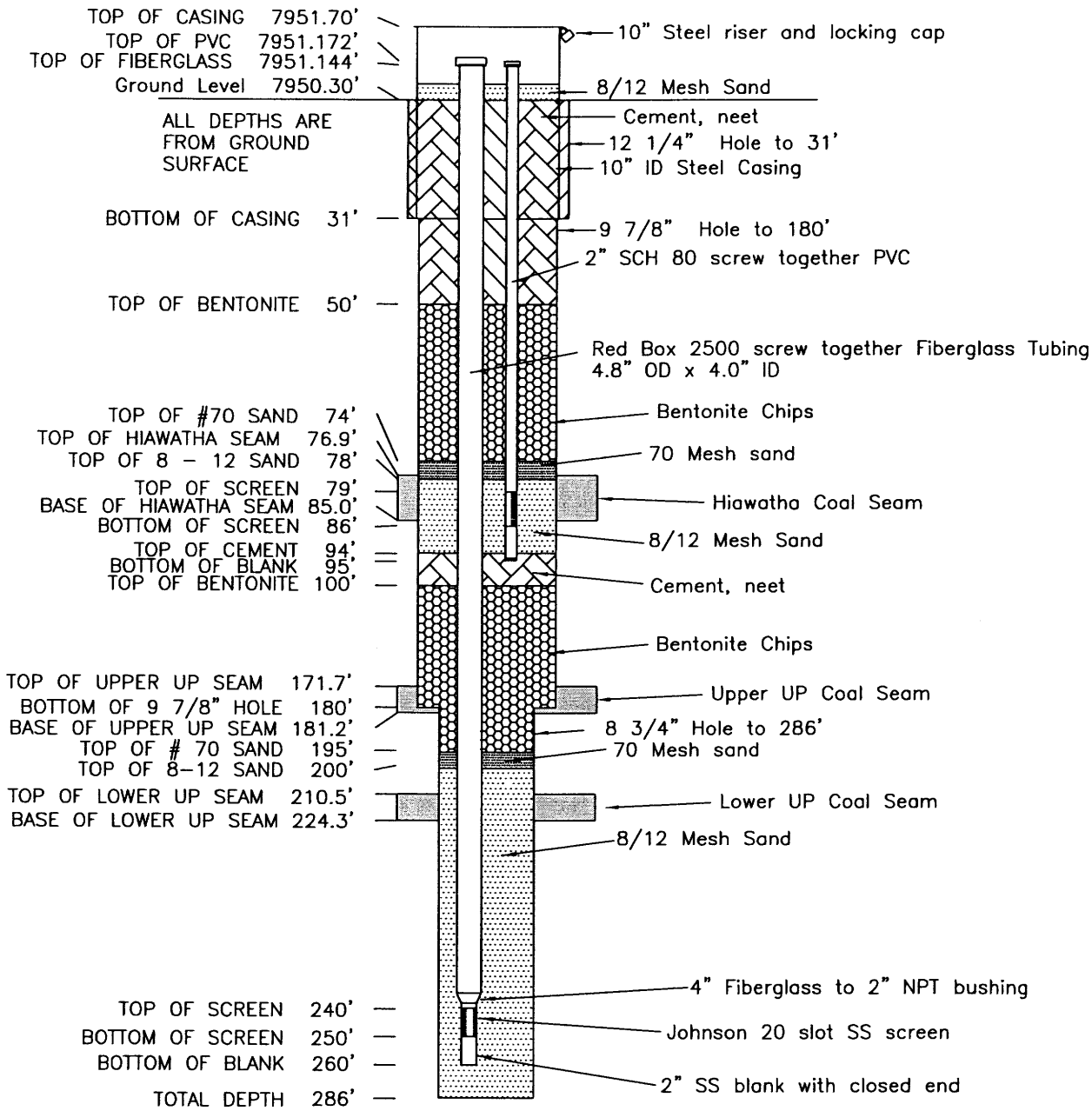


Exhibit 3.7.2.2-3

Monitor Well Completion

Monitor Well Completion Diagram
CR-06-01 AND CR-06-01-BLW

NOT TO SCALE



8000 ft Elevation Datum
E. 1739299.757
N. 7073837.862
Gounnd Surface, ELEV. 7950'

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-01 AND CR-06-01-BLW

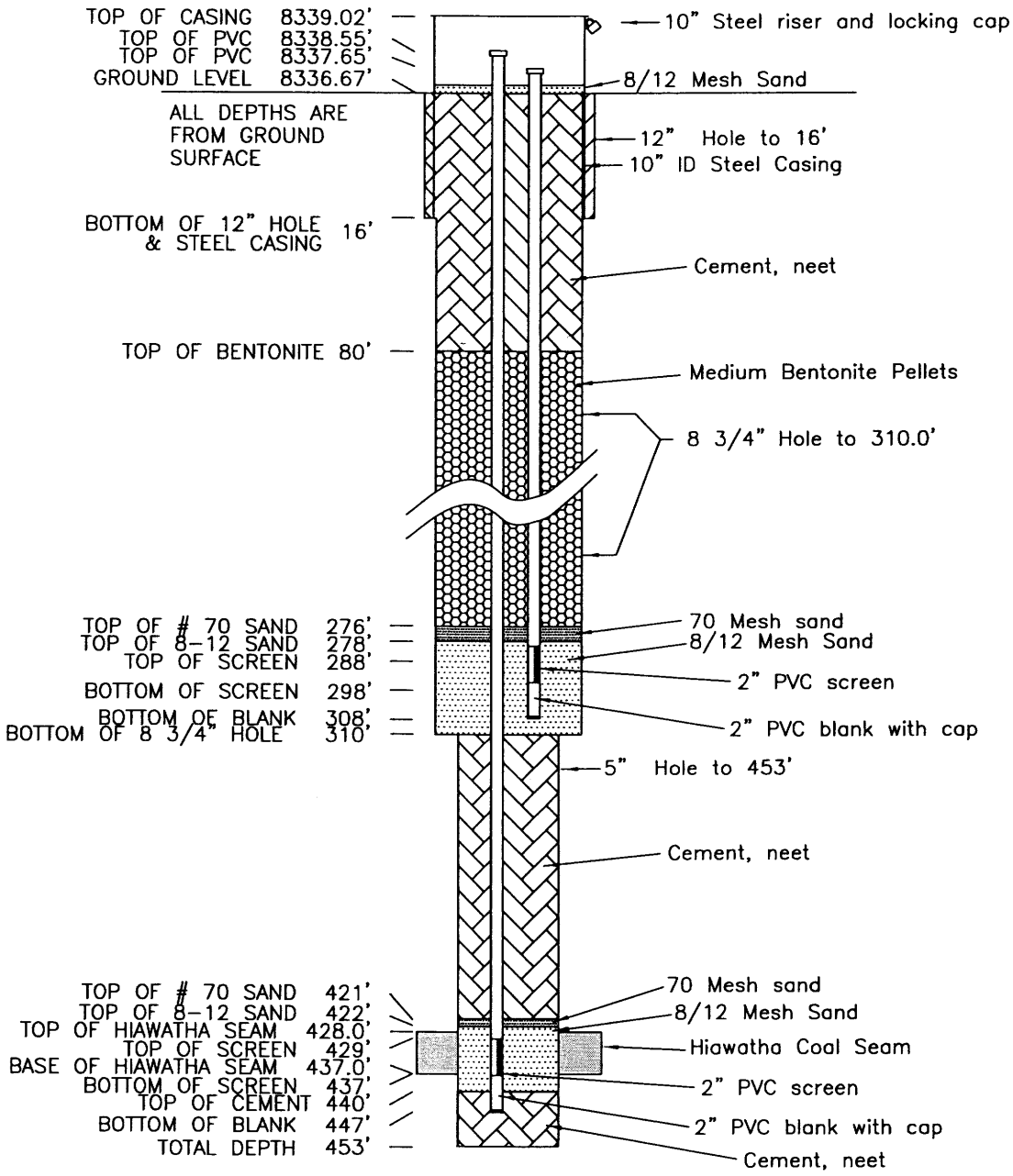
DWG	BWL
CKD	
APD	

DATE: 3/25/06

Drawing Loc: Drilling Phase 1\Completion Diagrams\CR-06-01 AS BUILT.dwg

Monitor Well Completion Diagram
CR-06-02 AND CR-06-02-ABV

NOT TO SCALE



8000 ft Elevation Datum
E. 1739673.995
N. 7072672.439
Gounnd Surface, ELEV. 8337'

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-02 AND CR-06-02-ABV

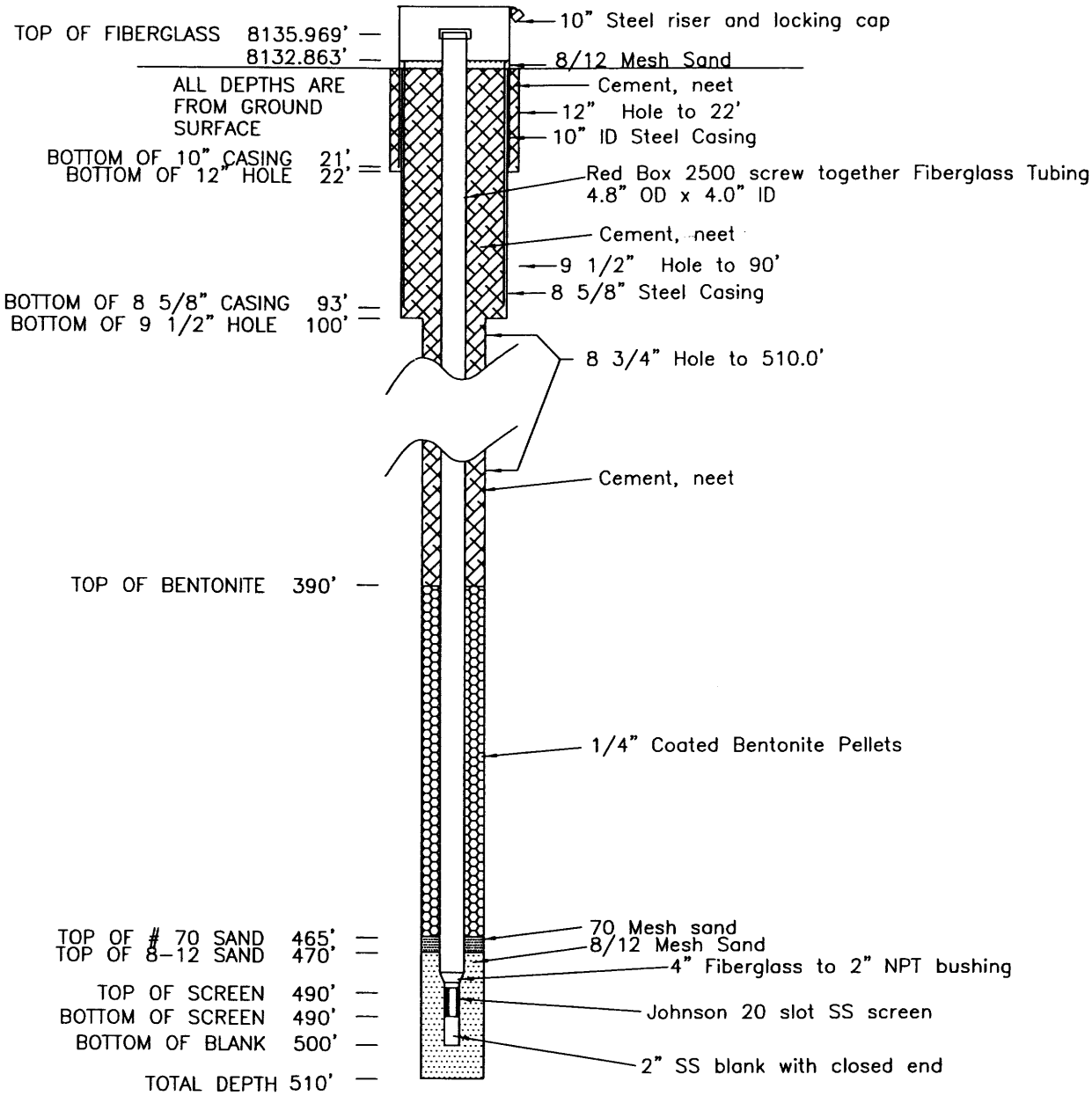
DWG	BWL
CKD	
APD	

DATE: 3/25/06

Drawing Loc: Drilling Phase 1\Completion Diagrams\CR-06-02 AS BUILT.dwg

Monitor Well Completion Diagram
CR-06-03-ABV

NOT TO SCALE



8000 ft Elevation Datum
E. 1742345.531
N. 7076325.902
Gounnd Surface, ELEV. 8132

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-03-ABV

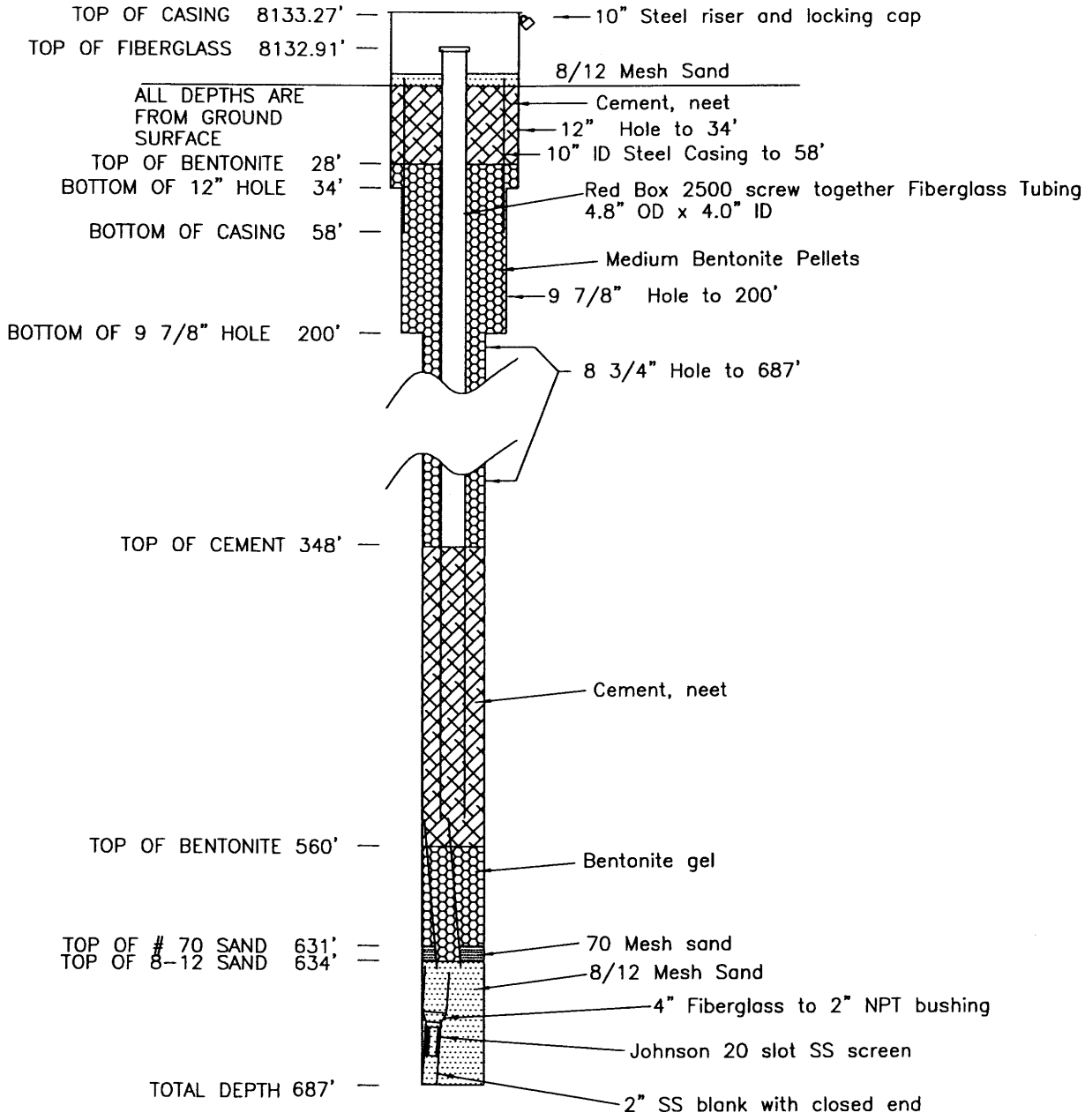
DWG	BWL	
CKD		
APD		

DATE: 3/25/06

Drawing Loc: Drilling Phase 1\Completion Diagrams\CR-06-03-ABV AS BUILT.dwg

Monitor Well Completion Diagram
CR-06-03

NOT TO SCALE



8000 ft Elevation Datum
E. 1742245.129
N. 7076291.102
Gounnd Surface, ELEV. 8132

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-03

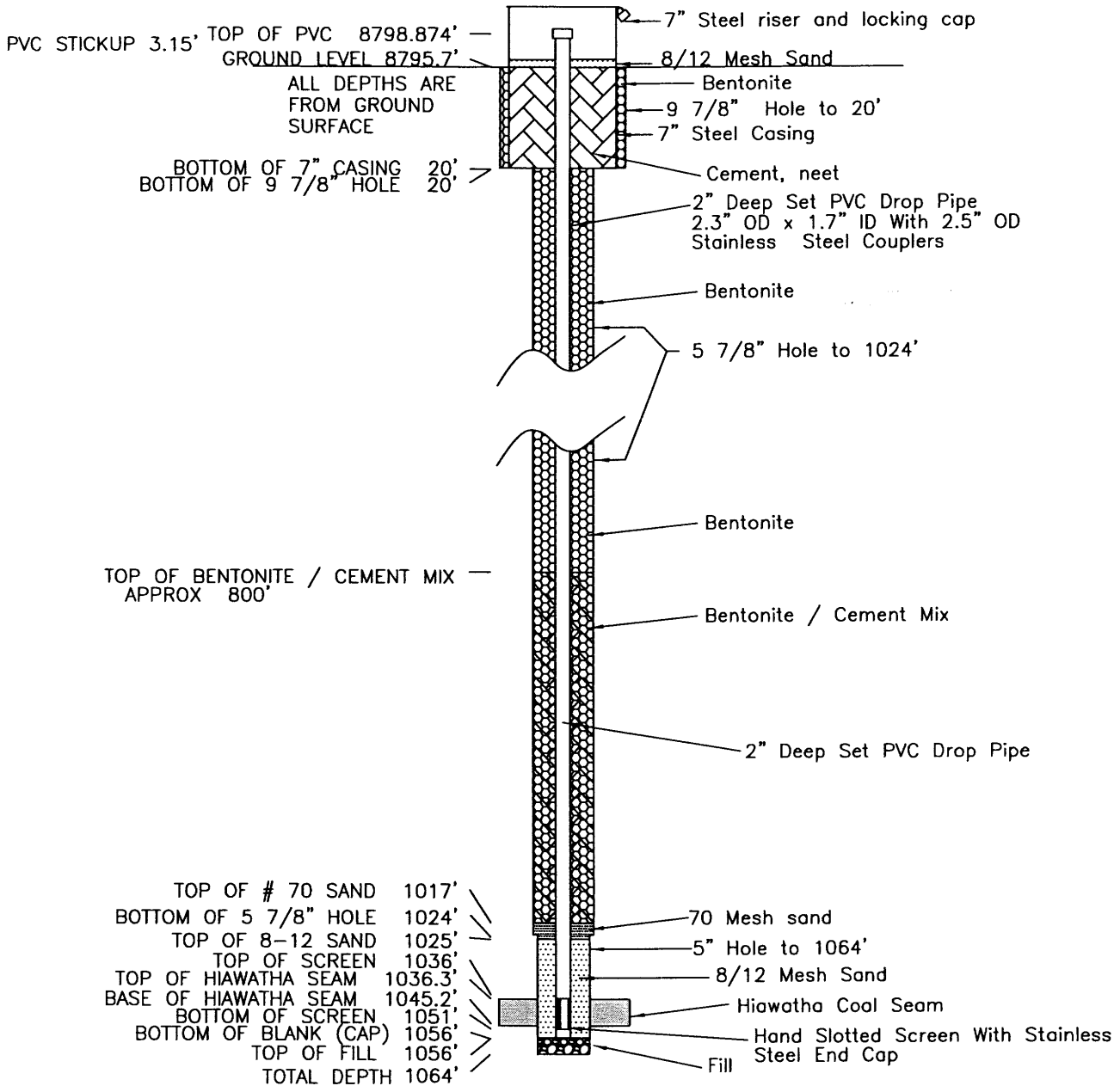
DWG	BWL	
CKD		
APD		

DATE: 3/25/06

Drawing Loc: Drilling Phase 1\Completion Diagrams\CR-06-03 AS BUILT.dwg

Monitor Well Completion Diagram
CR-06-05-A

NOT TO SCALE



8000 ft Elevation Datum
E. 1740939.20397
N. 7069330.51296
Gounnd Surface, ELEV. 8795.7'

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-05-A

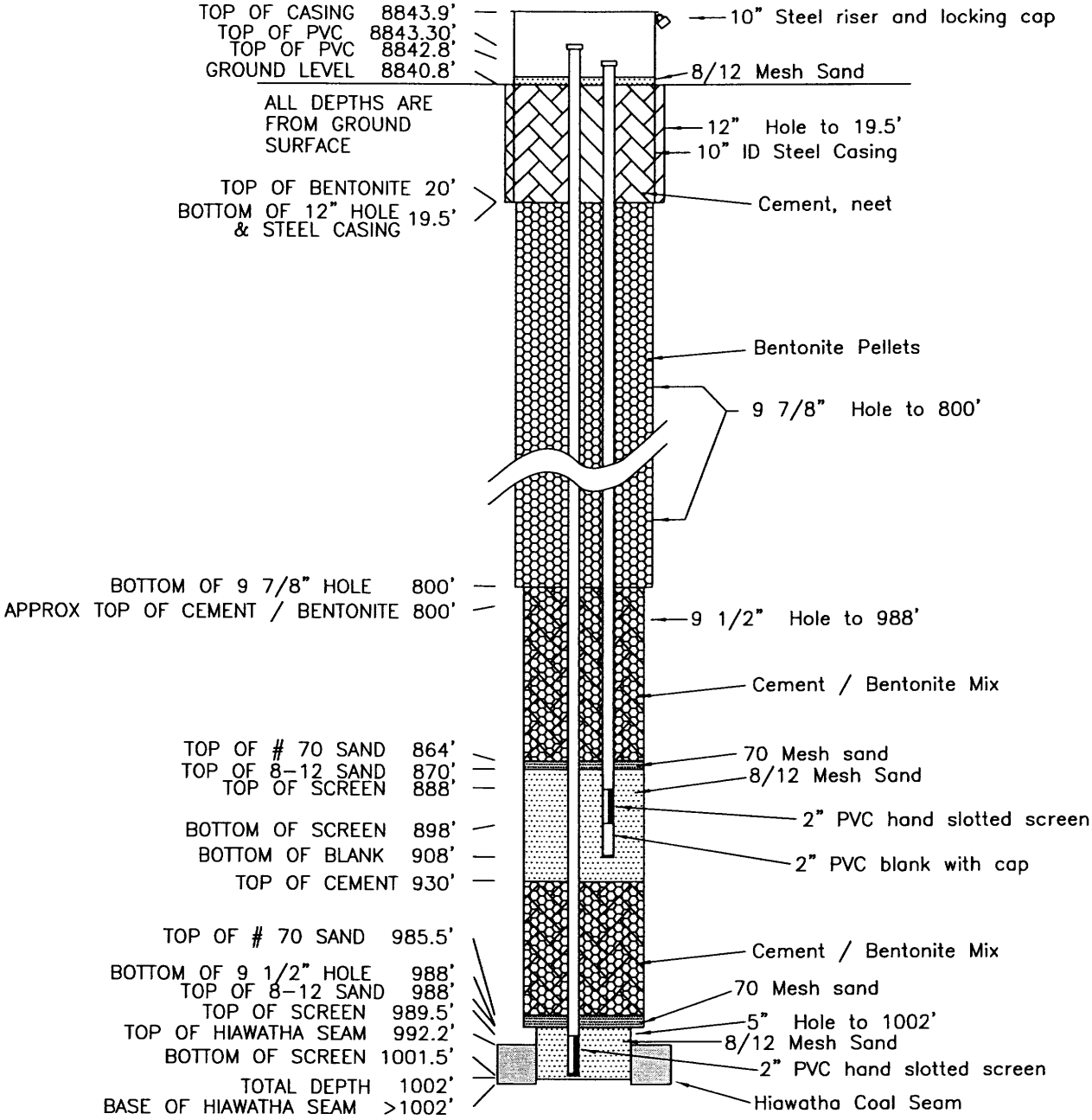
DWG	BWL	
CKD		
APD		

DATE: 12/18/06

\Completion Diagrams\CR-06-05-A AS BUILT.dwg

Monitor Well Completion Diagram
CR-06-09 AND CR-06-09-ABV

NOT TO SCALE



E. 1743857.5
N. 7073380.8
Gounnd Surface, ELEV. 8841'

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-09 AND CR-06-09-ABV

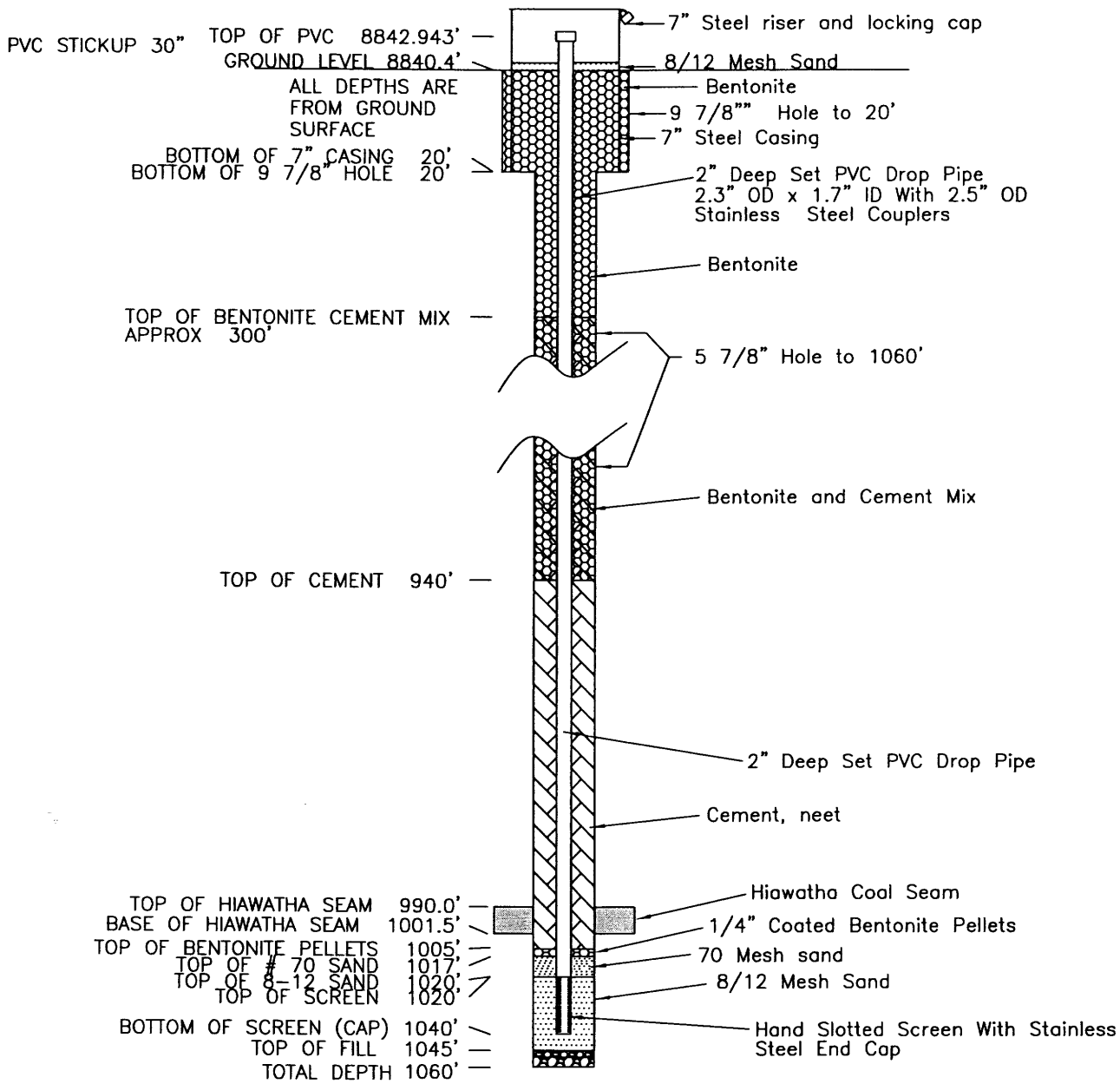
DWG	BWJ
CKD	
APD	

DATE: 12/18/06

Drawing Loc: Drilling Phase 1\Completion Diagrams\CR-06-09 AS BUILT.dwg

Monitor Well Completion Diagram
CR-06-09-BLW

NOT TO SCALE



8000 ft Elevation Datum
E. 1743808.008
N. 7073416.824
Gounnd Surface, ELEV. 8840.4

Carbon Resources LLC
Monitor Well Completion Diagram
CR-06-09-BLW

DWG	BWL
CKD	
APD	

DATE: 9/8/06

\Completion Diagrams\CR-06-09-BLW AS BUILT.dwg

Exhibit 3.7.2.4-1

Surface and Ground Water Quality Data

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Miller Outlet

Elevation: **~7,632**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	59	8.09	6.9	474	330	42	10.4
9/6/2005	18	8.04	4.6	433		22	13.1
10/31/2005	134	6.89	7.2	440	300	29	4.8
11/28/2005	frozen	5.65	8.0	556	300	30	1.7
12/22/2005	frozen	6.06	6.8	435	370	27	4.2
1/22/2006	frozen	6.04	7.1	440	310	26	1.2
2/26/2006	frozen		4.6	320	240	24	14.0
3/27/2006	frozen	**8.1**		**550**	270	26	~1
4/26/2006	545	8.01	3.6	369	360	48	19.2
5/25/2006	266	8.53	4.0	408	240	19	30.2
6/29/2006	171	8.57	4.2	415	200	20	28.6
7/31/2006	103	8.41	4.4	326	620	20	27.6
8/20/2006	89	8.6	4.6	110	200	20	27.7
9/7/2006	122	lab	7.4	375			13.0
10/30/2006	182	8.33	8.5	285	310	25	13.0
11/27/2006	frozen	8	5.1	327	280	24	10.0
12/26/2006	frozen	8.06	7.2	428	300	20	8.4
1/31/2007	frozen	8.01	5.3	387	310	21	8.6
2/19/2007	frozen	8.12	7.0	354	260	23	8.0
3/29/2007	212	8.7	9.9	440	300	34	13.3
4/25/2007	156	8.54	6.7	436	290	30	23.4
5/29/2007	142	8.42	7.9	417	270	23	22.9
6/25/2006	35	8.06	4.7	508	280	27	31.0
7/30/2007	36	8.45	4.9	362	280	19	27.7
					Lab Data		

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*Miller Outlet was initiallly misnamed "Eagle Outlet" and was once misnamed "Eagle Outlook". Samples collected from may 2005 to may 2006 were mislabled "Eagle Outlet" or "Eagle Outlook" and analyltic data are labled accordingly. From June 2006 to present the data are labled as Miller Outlet. Data labled Miller Outlet, Eagle Outlet, & Eagle Outlook represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Eagle Spring

Elevation: **~7,700**

Date	Estimated Flow (1) (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	10	7.35	6	98.9			18.0
9/6/2005	dried up						
10/31/2005	dried up						
11/28/2005	dried up						
12/22/2005	dried up						
1/22/2006	dried up						
2/26/2006	dried up						
3/27/2006	dried up						
4/26/2006	10	7.2	4.7	41.8			21.0
5/25/2006		8.18	5.9	83.7			28.9
6/29/2006	dried up						
7/31/2006	dried up						
8/20/2006	dried up						
9/7/2006	dried up						
10/30/2006	dried up						
11/27/2006	dried up						
12/26/2006	dried up						
1/31/2007	dried up						
2/19/2007	dried up						
3/29/2007	dried up						
4/25/2007	dried up						
5/29/2007	dried up						
6/25/2006	dried up						
7/30/2007	dried up						

1 - Flow <10

Lab Data

*The sample collected at Eagle Spring in May 2005 was mislabled "Eagle Springs" and analyltic data are labled accordingly. Data labled Eagle Spring & Eagle Springs represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Sulfur Spring

Elevation: **~7,670**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	73	6.76	0.7	603	390	43	13.6
9/6/2005	32	7.2	2.4	559		45	15.9
10/31/2005	90	5.69	2.6	541	390	46	13.2
11/28/2005	76	5.85	3.9	561	330	45	11.9
12/22/2005	69	5.64	3.5	490	420	46	17.4
1/22/2006	69	7.64	1.3	410	380	44	14.7
2/26/2006	69	8.08	4.3	383	300	43	23.9
3/27/2006	90	**7.38**		**710**	230	44	~14
4/26/2006	64	7.03	1.2	413	360	29	23.4
5/25/2006	79	7.46	2.4	503	350	41	28.2
6/29/2006	69	7.45	2.9	550	310	44	25.1
7/31/2006	74	7.27	2.0	446	330	47	24.1
8/20/2006	72	7.29	2.3	169	320	47	24.1
9/7/2006	86	lab	2.2	473			22.0
10/30/2006	80	7.27	4.0	384	360	46	22.2
11/27/2006	90	7.02	1.8	389	350	43	20.0
12/26/2006	90	7.00	3.0	538	370	42	20.0
1/31/2007	90	7.01	5.1	682	390	41	17.4
2/19/2007	88	7.03	4.1	473	340	42	21.5
3/29/2007	72	7.39	4.4	544	340	44	21.7
4/25/2007	90	7.33	7.0	557	380	45	23.4
5/29/2007	91	7.41	5.5	523	380	46	22.8
6/25/2006	86	7.25	2.4	615	360	46	27.5
7/30/2007	136	7.33	4.0	507	390	47	22.7

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*Samples collected at Sulfur Spring have occasionaly been mislabled "Sulfur Springs", "Sulfer Spring", & "Sulfer Springs". From May 2005 to Nov 2006 sample names varied. From Dec 06 to present, samples have been labled Sulfur Spring. Analyltic data are Labled accordingly. Data labled Sulfur Spring, Sulfur Springs, Sulfer Spring, & Sulfer Springs represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Angle Spring

Elevation: **~7,940**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
9/6/2005	0.25	7.35	3.7	358		15	22.0
10/31/2005	0.33	6.01	4.7	519	350	0	10.6
11/28/2005	0.35	6.46	4.7	428	290	16	22.2
12/22/2005	0.35	5.23	3.9	512	400	15	11.6
1/22/2006	0.31	4.36	8.4	469	350	16	8.9
2/26/2006		8.28	4.7	385	240	14	14.7
3/27/2006	0.35	**7.04**		**670**	190	15	~10
4/26/2006	0.75	7.28	5.1	361	310	19	18.0
5/25/2006	1.00	5.96	3.8	492	330	14	20.5
6/29/2006		7.5	6.3	522	280	18	20.9
7/31/2006	1.25	7.24	3.7	410	290	18	29.9
8/20/2006	1.03	7.26	3.5	156	270	18	22.3
9/7/2006	0.86	lab	4	387			18.5
10/30/2006	not measured						
11/27/2006	not measured						
12/26/2006	not measured						
1/31/2007	not measured						
2/19/2007	not measured						
3/29/2007	not measured						
4/25/2007	not measured						
5/29/2007	not measured						
6/25/2006	not measured						
7/30/2007	not measured						

Lab Data

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Mud Creek

Elevation: **~7,685**

Date	Estimated Flow (gpm)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/11/2005	13,015	8.31	7.4	694	500	120	10.0
9/6/2005	4,937	8.51	5.4	655		250	17.7
10/31/2005	6,732	6.68	6.4	759	720	250	10.7
11/29/2005	6,283	6.94	7.2	758	700	260	5.6
12/22/2005	5,386	6.67	6.2	520	600	190	13.6
1/22/2006	8,527	8.63	4.1	568	720	290	7.6
2/26/2006	5,834	9.0	3.6	501	570	250	19.3
3/27/2006	5,386	**8.18**		**1000**	**510**	**250**	~2
4/26/2006	17,952	8.3	5	394	410	88	18.5
5/25/2006		8.45	4.4	324	230	42	26.5
6/29/2006	11,670		6.2	581	380	160	28.5
7/31/2006	6,732	8.4	4.8	471	380	160	26.9
8/20/2006	6,284	8.38	5.1	188	420	130	27.7
9/7/2006	5,386	lab	6.1	564			14.3
10/30/2006	7,181	7.94	6.9	424	460	160	17.3
11/27/2006	7,181	7.76	6	463	490	160	12.0
12/26/2006	6,284	8.08	7.3	571	490	150	13.1
1/31/2007	7,181	7.4	5.5	834	420	120	12.4
2/19/2007	6,732	8.3	6.8	476	440	150	12.4
3/29/2007	8,528	8.33	7.9	555	380	120	13.4
4/25/2007	9,425	8.29	7.8	546	360	120	25.0
5/29/2007	12,567	8.51	7.9	481	360	87	20.7
6/25/2006	6,733	8.65	5.7	742	440	140	27.7
7/30/2007	6,284	8.58	5.3	532	440	140	25.5
					Lab Data		

NOTE: Bolded values measured in March 2006 were analyzed at the laboratory. Specific conductivity values were actually measured as conductivity.

*The sample collected at Mud Creek in May 2005 was mislabled "Muddy Creek" and analyltic data are labled accordingly. Data labled Mud Creek & Muddy Creek represent samples collected at the same location.

Carbon Resources LLC

Kinney II Baseline Water Sampling

Surface Water Field Measurements

Res-1 (Scofield Reservoir)

Elevation: **~7,620**

Date	Water Level (feet)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Lab TDS	Sulfate	Temp (C)
5/30/2006	13.5	8.09	5.6	424	230	34	20.6
6/29/2006	11.5	9.03	10	287	96	34	31.9
7/31/2006	9.4	10.16	9.1	257	170	24	29.8
8/20/2006	7.7	9.82	9	108	200	24	35.7
9/7/2006	6.0	lab	5.2	365		74	15.5
10/30/2006	4.5	8.13	6.7	351	400		18.2
11/27/2006	4.8	frozen					
12/26/2006	5.5	frozen					
1/31/2007	6.3	frozen					
2/19/2007	7.1	frozen					
3/29/2007	7.8	8.43	9.7	408	290	97	14.9
4/25/2007	7.8	8.39	7.8	390	210	60	23.4
5/29/2007	8.1	8.48	8	350	250	56	24.9
6/25/2006	5.6	10.52	7.3	360	190	25	36.1
7/30/2007	0.1	8.02	5.9	616	590	48	28
	Estimated				Lab Data		

*The samples collected at Res-1 in June, July, & Aug 2006 were mislabled "Scofield Res. 1" and analyltic data are labled accordingly. Data labled Res-1 & Scofield Res. 1 represent samples collected at the same location.

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-01

DATUM :	Top of PVC completion string	
DATUM ELEVATION:	7951.2	
Screened Interval Depth:	79	86
Screened Interval Elevation:	7872.2	7865.2
Hiawatha Seam Interval Depth:	76.9	85
Hiawatha Seam Interval Elevation:	7874.3	7866.2

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	Dry					
4/26/2006	Dry					
5/25/2006	Dry					
6/29/2006	Dry					
7/25/2006	Dry					
8/20/2006	Dry					
9/7/2006	Dry					
10/30/2006	Dry					
11/27/2006	Dry					
12/26/2006	97.4	7853.8				
1/31/2007	97.5	7853.7				
2/19/2007	97.4	7853.8				
3/29/2007	Dry					
4/25/2007	97.6	7853.6				
5/29/2007	97.4	7853.8				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-01-BLW

DATUM :	Top of Fiberglass completion string	
DATUM ELEVATION:	7951.1	
Screened Interval Depth:	240	250
Screened Interval Elevation:	7711.1	7701.1
Hiawatha Seam Interval Depth:	76.9	85
Hiawatha Seam Interval Elevation:	7874.2	7866.1

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water was observed with a camera in the open hole at 210 feet and 215 feet.					
3/8/2006	Dry					
4/26/2006	Dry					
5/25/2006	Dry					
6/29/2006	242.0	7709.1				
7/19/2006	Dry					
8/20/2006	242.1	7709.0				
9/7/2006	242.0	7709.1				
10/30/2006	242.2	7708.9				
11/27/2006	237.3	7713.8				
12/26/2006	242.1	7709.0				
1/31/2007	242.3	7708.8				
2/19/2007	242.2	7708.9				
3/29/2007	Dry					
4/25/2007	242.4	7708.7				
5/29/2007	242.3	7708.8				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-02

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8338.6	
Screened Interval Depth:		429	437
Screened Interval Elevation:		7909.6	7901.6
Hiawatha Seam Interval Depth:		428	437
Hiawatha Seam Interval Elevation:		7910.6	7901.6

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	437.0	7901.6				
4/26/2006	437.1	7901.5				
5/25/2006	441.4	7897.2				
6/29/2006	438.3	7900.3				
7/19/2006	438.1	7900.5				
8/20/2006	438.4	7900.2				
9/7/2006	439.0	7899.6				
10/30/2006	437.6	7901.0				
11/27/2006	438.6	7900.0				
12/26/2006	439.3	7899.3				
1/31/2007	439.7	7898.9				
2/19/2007	439.9	7898.7				
3/29/2007	439.3	7899.3				
4/25/2007	439.9	7898.7				
5/29/2007	440.1	7898.5				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-02-ABV

DATUM :	Top of PVC completion string	
DATUM ELEVATION:	8337.7	
Screened Interval Depth:	288	298
Screened Interval Elevation:	8049.8	8039.8
Hiawatha Seam Interval Depth:	428	437
Hiawatha Seam Interval Elevation:	7909.8	7900.8

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	No water encountered durring drilling.					
3/8/2006	302.8	8034.9				
4/26/2006	309.0	8028.7				
5/25/2006	Dry					
6/29/2006	307.2	8030.5				
7/19/2006	303.6	8034.1				
8/20/2006	301.7	8036.0				
9/7/2006	301.6	8036.1				
10/30/2006	301.7	8036.0				
11/27/2006	301.6	8036.1				
12/26/2006	301.6	8036.1				
1/31/2007	301.2	8036.5				
2/19/2007	301.8	8035.9				
3/29/2007	301.7	8036.0				
4/25/2007	301.8	8035.9				
5/29/2007	301.7	8036.0				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-03-ABV

DATUM :	Top of Fiberglass completion string	
DATUM ELEVATION:	8,135.97	
Screened Interval Depth:	480	490
Screened Interval Elevation:	7656	7646
Hiawatha Seam Interval Depth:	647	654
Hiawatha Seam Interval Elevation:	7009	7002

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006	Purged approximatly 600 gal of water.					
3/7/2006	Purged an additional 300 gal of water.					
4/26/2006	337.1	7798.9	6.92	5.7	425	26.6
5/25/2006	337.8	7798.2	7.28	1.3	599	28.3
6/29/2006	338.2	7797.8	7.23	2.2	689	21.8
7/31/2006	337.5	7798.5	6.87	1.1	549	23.9
8/20/2006	337.7	7798.3	6.99	1.1	245	25
9/7/2006	337.8	7798.2	>12	1.7	522	20.7
10/30/2006	not measured					
11/27/2006	not measured					
12/26/2006	not measured					
1/31/2007	not measured					
2/19/2007	not measured					
3/29/2007	not measured					
4/25/2007	not measured					
5/29/2007	not measured					

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-05A

DATUM :	Top of PVC completion string		
DATUM ELEVATION:		8798.9	
Screened Interval Depth:		1036	1051
Screened Interval Elevation:		7762.9	7747.9
Hiawatha Seam Interval Depth:		1037	1043
Hiawatha Seam Interval Elevation:		7761.9	7755.9

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	1051.7	7747.2				
10/30/2006	1057.6	7741.3				
11/27/2006	not measured					
12/26/2006	1058.0	7740.9				
1/31/2007	1057.8	7741.1				
2/19/2007	1057.9	7741.0				
3/29/2007	1057.5	7741.4				
4/25/2007	1058.1	7740.8				
5/29/2007	1057.8	7741.1				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09-BLW

DATUM :	Top of PVC completion string	
DATUM ELEVATION:	8842.9	
Screened Interval Depth:	1020	1040
Screened Interval Elevation:	7822.9	7802.9
Hiawatha Seam Interval Depth:	990	1001.5
Hiawatha Seam Interval Elevation:	7852.9	7841.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water appeared durring drilling at ~760 feet.					
	After drilling deeper, appearant wl was ~800 feet.					
	Durring geophysical logging wl was 935 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/18/2006	989.5	7853.4	-	-	-	-
9/7/2006	990.5	7852.4				
10/30/2006	990.8	7852.1				
11/27/2006	not measured					
12/26/2006	991.0	7851.9				
1/31/2007	991.0	7851.9				
2/19/2007	990.3	7852.6				
3/29/2007	991.2	7851.7				
4/25/2007	990.8	7852.1				
5/29/2007	991.0	7851.9				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09

DATUM :	Top of PVC completion string	
DATUM ELEVATION:	8,843.30	
Screened Interval Depth:	989.5	1001.5
Screened Interval Elevation:	7853.8	7841.8
Hiawatha Seam Interval Depth:	992.2	>1002
Hiawatha Seam Interval Elevation:	7851.1	<7840.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	982.0	7861.3				
10/30/2006	984.1	7859.2				
11/27/2006	not measured					
12/26/2006	982.4	7860.9				
1/31/2007	983.1	7860.2				
2/19/2007	983.3	7860.0				
3/29/2007	982.8	7860.5				
4/25/2007	982.9	7860.4				
5/29/2007	982.6	7860.7				

Carbon Resources LLC
Kinney II Baseline Water Sampling
Ground Water Field Measurements

CR-06-09-ABV

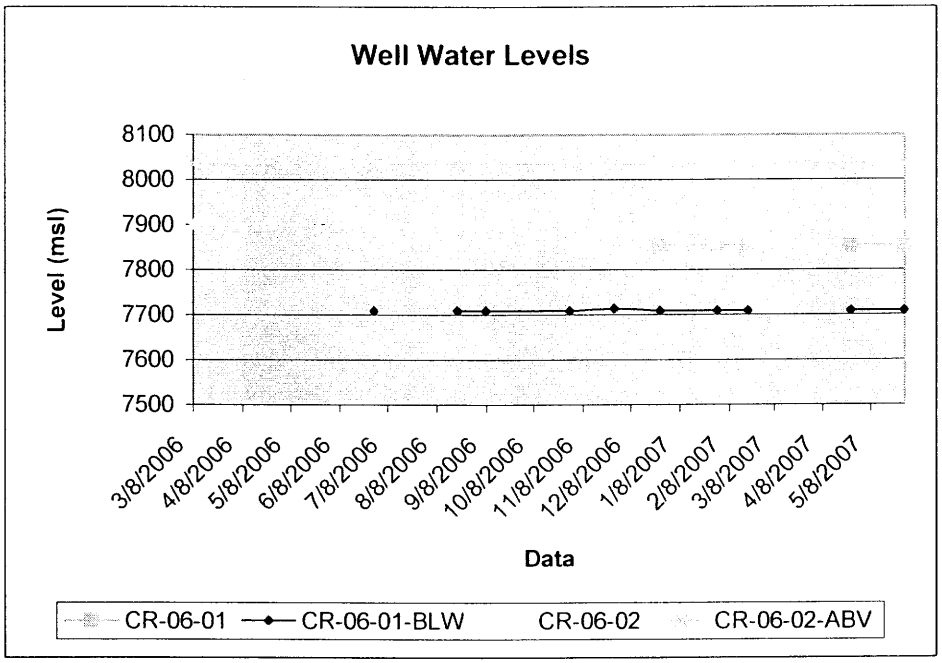
DATUM :	Top PVC of completion string		
DATUM ELEVATION:		8843.3	
Screened Interval Depth:		888	898
Screened Interval Elevation:		7955.3	7945.3
Hiawatha Seam Interval Depth:		992.2	>1002
Hiawatha Seam Interval Elevation:		7851.1	<7840.4

Date	Static Water Level Depth from DATUM (ft)	Static Water Level Elevation (ft)	pH	Dissolved Oxygen (ppm)	Specific Conductivity (Us)	Temp (C)
	Water encountered durring drilling at ~ 380 feet.					
	Higher flow of water durring drilling at ~450 feet.					
3/6/2006						
3/7/2006						
4/26/2006						
5/25/2006						
6/29/2006						
7/31/2006						
8/20/2006						
9/7/2006	Not developed - WL 3 days after instalation = 861.3					
10/30/2006	863.1	7980.2				
11/27/2006	not measured					
12/26/2006	863.9	7979.4				
1/31/2007	864.5	7978.8				
2/19/2007	864.1	7979.2				
3/29/2007	864.7	7978.6				
4/25/2007	866.1	7977.2				
5/29/2007	866.1	7977.2				

Carbon Resources LLC

Kinney II Baseline Water Sampling

Ground Water Field Measurements



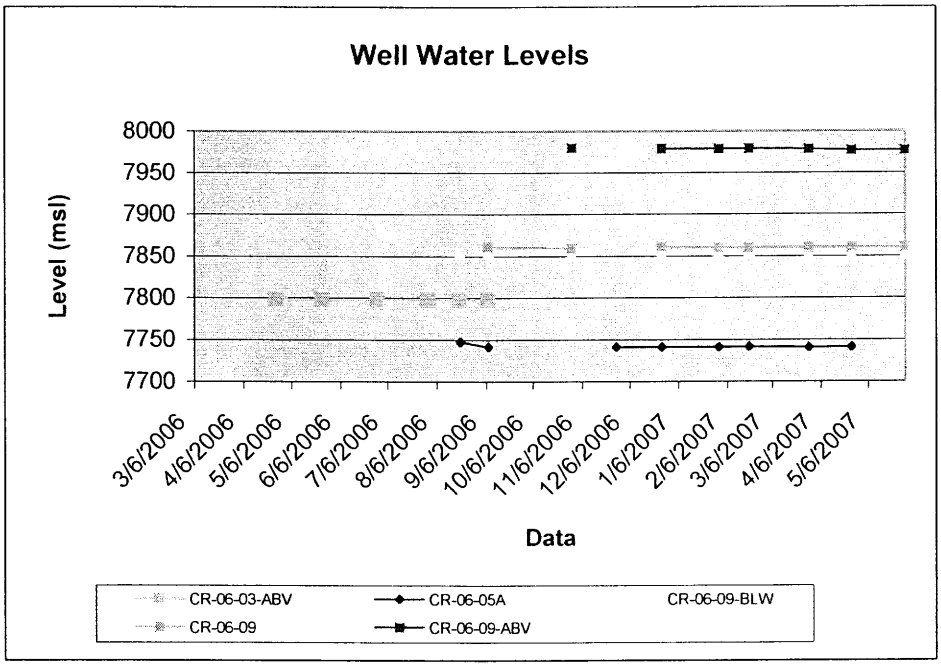


Exhibit 3.7.2.5-1

Water Rights

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 91-4029

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007

WATER RIGHT: 91-4029 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: George Telonis C/O Luke Pappas
ADDR: Price UT 84501

DATES, ETC.

LAND OWNED BY APPLICANT? Yes

FILED:	|PRIORITY: / /1869	|PUB BEGAN:	|PUB ENDED:	|NEWSPAPER:
ProtestEnd:	|PROTESTED: [No	]|HEARNG HLD:	|SE ACTION: [	]|ActionDate:
EXTENSION:	|ELEC/PROOF:[	]|ELEC/PROOF:	|CERT/WUC: 01/22/1973	|LAP, ETC:
RUSH LETTR:	|RENOVATE:	|RECON REQ:	|TYPE: [	]

\|PROOF DUE:
\|LAPS LETTER:

PD Book No. Map: 39

Type of Right: Diligence Claim Source of Info: Water User's Claim Status: Water User's Claim

LOCATION OF WATER RIGHT

FLOW: 0.011 cfs SOURCE: Unnamed Spring

COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located at N 660 ft. W 660 ft. from SE corner, Sec 10, T13S, R7E, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 615009. Water Rights Appurtenant to the following use(s):
91-3640,4025,4026,4027,4028,4029,4031,4032,4033

###STOCKWATER: Group Total: 510.0000 Stock Div Limit: 10.76 acft. PERIOD OF USE: 03/01 TO 11/30
Sole Supply for Stockwatering for 91-4029 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 615057. Water Rights Appurtenant to the following use(s):
91-3640,4025,4026,4027,4028,4029,4030,4031,4032,4033,4143

###STOCKWATER: Group Total: 510.0000 Stock Div Limit: PERIOD OF USE: 05/01 TO 11/30
Sole Supply for Stockwatering for 91-4029 in this Group has NOT YET been evaluated

PLACE OF USE for STOCKWATERING

	NORTH-WEST¼	NORTH-EAST¼	SOUTH-WEST¼	SOUTH-EAST¼
	NW NE SW SE	NW NE SW SE	NW NE SW SE	NW NE SW SE
Sec 10 T 13S R 7E SLBM	* : : : *	* : : : *	* : : : *	* : : : X*

END OF DATA

==========

Storage from 01/01 to 12/31, inclusive, in Upper Miller Canyon Res. with a maximum capacity of 2.000 acre-feet, located in:

	NORTH-WEST¼	NORTH-EAST¼	SOUTH-WEST¼	SOUTH-EAST¼
Height of Dam:				
Area Inundated:	NW NE SW SE	NW NE SW SE	NW NE SW SE	NW NE SW SE
Sec 34 T 12S R 7E SLBM	* : : : *	* : : : *	* : : : X*	* : : : *

Small Dam Required?: No

****

**********E N D O F D A T A**********

****

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 91-1396

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007

WATER RIGHT: 91-1396 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Clarence Anderson Estate
ADDR: Price UT 84501

DATES, ETC.

LAND OWNED BY APPLICANT? Yes

FILED:	|PRIORITY: 00/00/1902	|PUB BEGAN:	|PUB ENDED:	|NEWSPAPER:
ProtestEnd:	|PROTESTED: [No]	|HEARNG HLD:	|SE ACTION: [ ]	|ActionDate: |PROOF DUE:
EXTENSION:	|ELEC/PROOF: [ ]	|ELEC/PROOF:	|CERT/WUC: 07/22/1965	|LAP, ETC: |LAPS LETTER:
RUSH LETTR:	|RENOVATE:	|RECON REQ:	|TYPE: [ ]	

PD Book No. 1 Map: 29c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: SOURCE: Hopkins Creek

COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on reservoir located at N 660 ft. W 660 ft. from S4 corner, Sec 34, T12S, R7E, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 614017. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-1396 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614068. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402,1403,1475,3279

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-1396 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614071. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402,1403

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-1396 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614088. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402,1475

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-1396 in this Group has NOT YET been evaluated

PLACE OF USE for STOCKWATERING

	NORTH-WEST¼	NORTH-EAST¼	SOUTH-WEST¼	SOUTH-EAST¼
	NW NE SW SE	NW NE SW SE	NW NE SW SE	NW NE SW SE
Sec 34 T 12S R 7E SLBM	* : : : *	* : : : *	* : : : X*	* : : : *

SUPPLEMENTAL GROUP NO. 614820.
91-352

###DOMESTIC: 1.0000 Family — Div Limit: 0.37 acft. — PERIOD OF USE: 01/01 TO 12/31

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section Totals
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	
Sec 27 T 12S R 7E SLBM								X									0.0000
Sec 03 T 13S R 7E SLBM				X													0.0000

PLACE OF USE for STOCKWATERING

	NORTH-WEST¼				NORTH-EAST¼				SOUTH-WEST¼				SOUTH-EAST¼			
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE
Sec 27 T 12S R 7E SLBM	:	:	:	:	:	:	:	X	:	:	:	:	:	:	:	:
Sec 03 T 13S R 7E SLBM	:	:	:	X	:	:	:	:	:	:	:	:	:	:	:	:

END OF DATA

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 91-352

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007

WATER RIGHT: 91-352 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Clarence Anderson Estate
ADDR: Price UT

DATES, ETC.

LAND OWNED BY APPLICANT?

FILED:	|PRIORITY: 00/00/1860	|PUB BEGAN:	|PUB ENDED:	|NEWSPAPER:	
ProtestEnd:	|PROTESTED: [No]	|HEARNG HLD:	|SE ACTION: [ ]	|ActionDate:	|PROOF DUE:
EXTENSION:	|ELEC/PROOF: [ ]	|ELEC/PROOF:	|CERT/WUC: 07/22/1965	|LAP, ETC:	|LAPS LETTER:
RUSH LETTR:	|RENOVATE:	|RECON REQ:	|TYPE: [ ]		

PD Book No. 2 Map: 29c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: SOURCE: Hopkins Creek

COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
(1)Stockwatering directly on stream from a point at N 660 ft. E 1980 ft. from W4 corner, Sec 03, T13S, R7E, SLBM,
to a point at N 660 ft. W 660 ft. from E4 corner, Sec 27, T12S, R7E, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 614017. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-352 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614068. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402,1403,1475,3279

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-352 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614071. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402,1403

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-352 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614088. Water Rights Appurtenant to the following use(s):
91-352,640,740,1221,1396,1397,1398,1399,1400,1401,1402,1475

###STOCKWATER: Group Total: 556.0000 Stock Div Limit: 8.18 acft. PERIOD OF USE: 05/01 TO 11/01
Sole Supply for Stockwatering for 91-352 in this Group has NOT YET been evaluated

POINT OF RELEASE:

FLOW: 20.0 acre-feet PERIOD OF USE: 01/01 TO 12/31

***Location of Release Point(s) is the SAME as Point(s) of Diversion in CURRENT RIGHT above.

NATURE OF USE:
SUPPLEMENTAL GROUP NO. 615764.

SEGREGATION HISTORY for: **********RUN DATE:

This Exchange as originally filed:

FLOW IN CFS	QUANTITY IN ACRE-FEET	*----------W A T E R U S E S----------* IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER (*----------ACRE-FEET----------*)
	20.0							

****
**********E N D O F D A T A**********
****

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for E1934(91-4891)

EXCHANGE: E1934 (91-4891) BASE WATER RIGHT: - STOCK/CONTRACT NUMBER:

RIGHT EVIDENCED BY: Price River Water Users Association Stock Certific
ate # 4035

OWNERSHIP

NAME: UCO Incorporated
ADDR: 1580 Lincoln Suite 530
Denver UT 80203

DATES, ETC.

FILED: 06/29/1981 | PRIORITY: 06/29/1981 | ADV BEGAN: | ADV ENDED: | NEWSPAPER:
ProtestEnd: | PROTESTED: [No] | HEARNG HLD: | SE ACTION: [ ] | ActionDate:01/21/1983 | PROOF DUE:
EXTENSION: | ProofFiled: | CertIssued: | LAP, ETC: | LAPS LETTR: | RUSH LETTER:
RENOVATE: | RECON REQ: | TYPE: [ ]

Date Verified: Initials: Status: Approved
Related Distribution System: Not part of any Distribution System

C U R R E N T R I G H T

FLOW: 20.0 acre-feet
SOURCE: Scofield Reservoir
COUNTY: Carbon

POINT OF DIVERSION -- SURFACE:
(1) N 810 ft W 1000 ft from SE cor, Sec 10, T 12S, R 7E, SLBM
Diverting Works: Source: Scofield Reservoir

NATURE OF USE:

###OTHER Irrigation under Wellington Canal System. PERIOD OF USE: 01/01 TO 12/31

P R O P O S E D E X C H A N G E

FLOW: 20.0 acre-feet PERIOD OF USE: 01/01 TO 12/31
SOURCE: Underground Water Well
COUNTY: Carbon COMMON DESCRIPTION: 1.5 - 2.5 mi. W. Scofield Town

POINTS OF EXCHANGE -- UNDERGROUND:
(1) N 1320 ft 0 ft from S4 cor, Sec 21, T 12S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(2) N 1771 ft E 210 ft from S4 cor, Sec 21, T 12S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(3) N 2220 ft E 420 ft from S4 cor, Sec 21, T 12S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(4) N 2640 ft E 630 ft from S4 cor, Sec 21, T 12S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(5) S 2200 ft W 700 ft from NE cor, Sec 01, T 13S, R 6E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(6) S 2000 ft W 2300 ft from NE cor, Sec 01, T 13S, R 6E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(7) S 1300 ft W 2200 ft from NE cor, Sec 12, T 13S, R 6E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(8) S 2100 ft E 2500 ft from NW cor, Sec 06, T 13S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:
(9) S 2100 ft E 1000 ft from NW cor, Sec 06, T 13S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? WELL ID#:

```
| Source:      Coal Washing Plant                                  ||
|(21) S 1925 ft W  811 ft from NE cor, Sec 16, T 15S, R 11E, SLBM||
| Dvrting Wks:                                                     ||
| Source:      Coal Washing Plant                                  ||
|(22) S  470 ft W  310 ft from E4 cor, Sec 16, T 15S, R 11E, SLBM||
| Dvrting Wks:                                                     ||
| Source:      Farnham Ditch                                       ||
|(23) N 2261 ft W  218 ft from SE cor, Sec 16, T 15S, R 11E, SLBM||
| Dvrting Wks:                                                     ||
| Source:      Coal Washing Plant                                  ||
|------------------------------------------------------------------||
```

```
|PLACE OF USE ------>                                              ||CHANGED as follows:
|------------------------------------------------------------------||------------------------------------------------------------
|                          --NW¼--  --NE¼--  --SW¼--  --SE¼--      ||                          --NW¼--  --NE¼--  --SW¼--  --SE¼--
|                         |N N S S||N N S S||N N S S||N N S S|     ||                         |N N S S||N N S S||N N S S||N N S S|
|                         |W E W E||W E W E||W E W E||W E W E|     ||                         |W E W E||W E W E||W E W E||W E W E|
|                                                                  ||Sec 21 T 12S R  7E SLBM    * : : : ** : : : ** : : :X** : : : *|
```

```
|NATURE OF USE ------>                                             ||CHANGED as follows:
|------------------------------------------------------------------||------------------------------------------------------------
|SUPPLEMENTAL to Other Water Rights: No                            ||SUPPLEMENTAL to Other Water Rights: No
|------------------------------------------------------------------||------------------------------------------------------------
|IRR:  18904.8200 acs Sol/Sup:    199.0300 acs USED 04/01 - 10/31||IRR:      0.5000 acs Sol/Sup:            acs USED 04/01 - 10/31|
|..................................................................||............................................................|
|                                                                  ||DOM: 2.0000 Equivalent Domestic Units        USED 01/01 - 12/31|
```

```
|RESERVOIR STORAGE -->                                             ||CHANGED as follows:
|------------------------------------------------------------------||------------------------------------------------------------
|Storage 01/01 to 12/31, in Scofield Reservoir                     ||
| with a maximum capacity of 73600.000 acre-feet, located in:      ||
|                          --NW¼--  --NE¼--  --SW¼--  --SE¼--      ||
|  Height of Dam:     125 ft |N N S S||N N S S||N N S S||N N S S|  ||
|  Area Inundat  2000.000 acs|W E W E||W E W E||W E W E||W E W E|  ||
|Sec 33 T 11S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 03 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 04 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 08 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 09 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 10 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 15 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 16 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 17 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 18 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 20 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 21 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 28 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|Sec 29 T 12S R  7E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|------------------------------------------------------------------||------------------------------------------------------------
|------------------------------------------------------------------||------------------------------------------------------------
```

**********E N D O F D A T A**********

POINT(S) OF DIVERSION ------>

Point Surface:
(1) N 810 ft W 990 ft from SE cor, Sec 10, T 12S, R 7E, SLBM
Dvrting Wks:
Source:

Point Underground:

Point Rediversion:
(1) N 900 ft E 100 ft from SW cor, Sec 03, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.430, Theresa A. Phelps-well
(2) N 1420 ft W 480 ft from SE cor, Sec 04, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.175, Rudy Scartezina-well
(3) N 1285 ft W 345 ft from SE cor, Sec 04, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.336, Frank Marrelli-well
(4) S 1400 ft W 20 ft from E4 cor, Sec 04, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.397,Robt.or Francis Mallard-Well
(5) N 1338 ft E 655 ft from SW cor, Sec 17, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.178, Catherine Rudman-spring
(6) N 860 ft E 430 ft from S4 cor, Sec 19, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.375, G. Pete Frandsen-spring
(7) N 30 ft E 465 ft from S4 cor, Sec 32, T 12S, R 7E, SLBM
Dvrting Wks:
Source: Ex.164, Louis Gorishek-well
(8) N 430 ft W 410 ft from S4 cor, Sec 26, T 12S, R 9E, SLBM
Dvrting Wks:
Source: Price City Filtering Plant
(9) S 90 ft E 730 ft from N4 cor, Sec 35, T 12S, R 9E, SLBM
Dvrting Wks:
Source: Power Plant & Coal Company
(10) S 970 ft E 60 ft from W4 cor, Sec 05, T 13S, R 7E, SLBM
Dvrting Wks:
Source: Ex.452, Robert Radokovich-well
(11) N 900 ft E 980 ft from SW cor, Sec 12, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Bryner-Hansen Ditch
(12) S 480 ft E 1440 ft from W4 cor, Sec 12, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Bryner-Ploutz Ditch
(13) S 560 ft W 840 ft from N4 cor, Sec 13, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Spring Glen Canal
(14) S 0 ft W 730 ft from NE cor, Sec 24, T 13S, R 9E, SLBM
Dvrting Wks:
Source: O`Berto Ditch
(15) S 1190 ft W 1490 ft from E4 cor, Sec 24, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Stowell Ditch
(16) N 1310 ft E 1000 ft from S4 cor, Sec 24, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Gay Ditch
(17) N 580 ft W 240 ft from S4 cor, Sec 36, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Country Club-Cook Ditch
(18) N 560 ft W 240 ft from S4 cor, Sec 36, T 13S, R 9E, SLBM
Dvrting Wks:
Source: Price-Wellington Canal
(19) S 560 ft E 680 ft from N4 cor, Sec 01, T 14S, R 9E, SLBM
Dvrting Wks:
Source: Carbon Canal
(20) N 1410 ft W 535 ft from S4 cor, Sec 08, T 15S, R 11E, SLBM
Dvrting Wks:

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Underground:
(1) N 1050 ft W 360 ft from S4 cor, Sec 21, T 12S, R 7E, SLBM
Diameter: 6 ins. Depth: 0 to 300 ft. WELL ID#: 034697
COMMENT:

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for a28898(91-5083)

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007

CHANGE: a28898 WATER RIGHT: 91-5083 CERT. NO.: AMENDATORY? No

BASE WATER RIGHTS: 91-5083

RIGHT EVIDENCED BY: 91-5083(A1035)
91-2 Price River Water User's Association Stock Certificates #8171 and #8172

CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [X].

NAME: Tom F. & Kim Kreek
ADDR: 233 East 3000 South
Price UT 84501
REMARKS:

NAME: Price River Water User's Association
ADDR: 375 South Carbon Avenue A-10
Price, Utah 84501
REMARKS:

FILED: 04/09/2004 | PRIORITY: 04/09/2004 | ADV BEGAN: 05/13/2004 | ADV ENDED: 05/20/2004 | NEWSPAPER: Sun Advocate
ProtestEnd:06/09/2004 | PROTESTED: [No] | HEARNG HLD: | SE ACTION: [Approved] | ActionDate:08/06/2004 | PROOF DUE: 08/31/2009
EXTENSION: | ELEC/PROOF:[ ] | ELEC/PROOF: | CERT/WUC: | LAP, ETC: | LAPS LETTER:
RUSH LETTR: | RENOVATE: | RECON REQ: | TYPE: [ ]

Status: Approved

**********H E R E T O F O R E**********

FLOW: 2.0 acre-feet

SOURCE: Gooseberry Creek

COUNTY: Carbon

HERETOFORE PLACE OF USE: Delivery through Carbon Canal

**********H E R E A F T E R**********

FLOW: 2.0 acre-feet

SOURCE: Underground Water Well

COUNTY: Carbon COM DESC: 2 miles North of Scofield Town

HEREAFTER PLACE OF USE: Lots #1 and #2 in Scofield Lakeside Subdivision.

HERETOFORE:

Diversion: 0.40 acs x 5 af/ac/yr = 2 af/year
Depletion: 2.52 af/ac/yr x 0.40 = 1.008 af/year

HEREAFTER:

Diversion: 2 families x 0.25 af/family/yr = 0.50 af/year
Depletion: 0.50 af/yr x 0.20 = 0.1 af/year
Diversion: 0.50 ac x 3 af/ac = 1.5 af/year
Depletion: 1.29 af/ac/yr x 0.50 ac = 0.645 af/year
Total Depletion: 0.745 af/year

Consumptive use data was taken from Research Report #145 Consumptive Use of Irrigated Crops in Utah. Heretofore from Castle Dale Station page 158. Hereafter from the Scofield Station page 324.

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section Totals
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	
Sec 05 T 13S R 7E SLBM					X												0.0000

SEGREGATION HISTORY for: **********RUN DATE:

This Exchange as originally filed:

FLOW IN CFS	QUANTITY IN ACRE-FEET	WATER USES: IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
					ACRE-FEET			
	1.0			1.0000				

**********END OF DATA**********

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for E1912(91-4889)

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007 Page 1

EXCHANGE: E1912 (91-4889) BASE WATER RIGHT: - STOCK/CONTRACT NUMBER:

RIGHT EVIDENCED BY: Stock Cert. 4018, Price River Water Users Assoc.

OWNERSHIP

NAME: Jim Nicolodemos
ADDR: 1221 South 2820 West
South Jordan UT 84065

DATES, ETC.

FILED: 06/11/1981 |PRIORITY: 06/11/1981 |ADV BEGAN: |ADV ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No] |HEARNG HLD: |SE ACTION: [ ] |ActionDate:04/30/1982 |PROOF DUE:
EXTENSION: |ProofFiled: |CertIssued: |LAP, ETC: |LAPS LETTR: |RUSH LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

Date Verified: Initials: Status: Approved
Related Distribution System: Not part of any Distribution System

CURRENT RIGHT

FLOW: 1.0 acre-feet
SOURCE: Scofield Reservoir
COUNTY: Carbon

POINT OF DIVERSION -- SURFACE:
(1) N 850 ft W 1080 ft from SE cor, Sec 10, T 12S, R 7E, SLBM

NATURE OF USE:
###IRRIGATION: Total: acres Sole Supply: acres PERIOD OF USE: 04/01 TO 10/31

PROPOSED EXCHANGE

FLOW: 1.0 acre-feet PERIOD OF USE: 01/01 TO 12/31
SOURCE: Underground Water Well
COUNTY: Carbon COMMON DESCRIPTION: 12 1/2 Mi. NW of Scofield Dam

POINT OF EXCHANGE -- UNDERGROUND:
(1) N 2145 ft W 1350 ft from E4 cor, Sec 05, T 13S, R 7E, SLBM
DIAMETER OF WELL: 6 ins. DEPTH: 100 to 500 ft. YEAR DRILLED: WELL LOG? WELL ID#:

POINT OF RELEASE:

FLOW: 1.0 acre-feet PERIOD OF USE: 01/01 TO 12/31

***Location of Release Point(s) is the SAME as Point(s) of Diversion in CURRENT RIGHT above.

NATURE OF USE:
SUPPLEMENTAL GROUP NO. 615761.
###DOMESTIC: 1.0000 EDU Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

SEGREGATION HISTORY for: **********RUN DATE:

This Exchange as originally filed:

FLOW IN CFS	QUANTITY IN ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAMILIES)	MUNICIPAL	MINING	POWER	OTHER
		----------W A T E R U S E S----------						
					(*----------ACRE-FEET----------*)			
	1.0			1.0000				

****
**********E N D O F D A T A**********
****

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for E164(91-4945)

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007 Page 1

EXCHANGE: E164 (91-4945) BASE WATER RIGHT: - STOCK/CONTRACT NUMBER:

RIGHT EVIDENCED BY: Price River Water Users Certificate Number:

OWNERSHIP**********

NAME: Louis Gorishek
ADDR: Scofield UT

DATES, ETC.**********

FILED: 02/18/1965|PRIORITY: 02/18/1965|ADV BEGAN: |ADV ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate:09/10/1965|PROOF DUE:
EXTENSION: |ProofFiled: |CertIssued: |LAP, ETC: |LAPS LETTR: |RUSH LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

Date Verified: 08/03/1993 Initials: MJK Status: Approved
Related Distribution System: Not part of any Distribution System

**********C U R R E N T R I G H T**********

FLOW: 1.0 acre-feet
SOURCE: Scofield Reservoir
COUNTY: Carbon

POINT OF DIVERSION -- SURFACE:
(1) N 850 ft W 1080 ft from SE cor, Sec 10, T 12S, R 7E, SLBM

NATURE OF USE:

.....

###MISCELLANEOUS Irrigation on the Price River PERIOD OF USE: 03/15 TO 11/30

**********P R O P O S E D E X C H A N G E**********

FLOW: 1.0 acre-feet PERIOD OF USE: 01/01 TO 12/31
SOURCE: Underground Water Well
COUNTY: Carbon COMMON DESCRIPTION:

POINT OF EXCHANGE -- UNDERGROUND:
(1) N 30 ft E 465 ft from S4 cor, Sec 32, T 12S, R 7E, SLBM
DIAMETER OF WELL: 7 ins. DEPTH: 65 to ft. YEAR DRILLED: WELL LOG? WELL ID#:

POINT OF RELEASE:

FLOW: 1.0 acre-feet PERIOD OF USE: 01/01 TO 12/31

***Location of Release Point(s) is the SAME as Point(s) of Diversion in CURRENT RIGHT above.

NATURE OF USE:
SUPPLEMENTAL GROUP NO. 615819.

.....

###DOMESTIC: 1.0000 EDU Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 91-3401

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 08/30/2007

WATER RIGHT: 91-3401 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Waino E. Burton
ADDR: Scofield UT

DATES, ETC.

LAND OWNED BY APPLICANT? Yes

FILED:	|PRIORITY: 00/00/1895	|PUB BEGAN:	|PUB ENDED:	|NEWSPAPER:
ProtestEnd:	|PROTESTED: [No]	|HEARNG HLD:	|SE ACTION: [ ]	|ActionDate: |PROOF DUE:
EXTENSION:	|ELEC/PROOF:[ ]	|ELEC/PROOF:	|CERT/WUC: 08/02/1967	|LAP, ETC: |LAPS LETTER:
RUSH LETTR:	|RENOVATE:	|RECON REQ:	|TYPE: [ ]	

PD Book No. 1 Map: 28d

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: 0.011 cfs SOURCE: Underground Water Well

COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION -- UNDERGROUND:
(1) N 625 ft E 710 ft from S4 cor, Sec 32, T 12S, R 7E, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? No WELL ID#:
Comment:

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 614798. Water Rights Appurtenant to the following use(s):
91-3401,3402

###STOCKWATER: Group Total: 4.0000 Stock Un Div Limit: 0.11 acft. PERIOD OF USE: 01/01 TO 12/31
Sole Supply for Stockwatering for 91-3401 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 614799.
91-3401

###DOMESTIC: 1.0000 Family Div Limit: 0.73 acft. PERIOD OF USE: 01/01 TO 12/31

**********E N D O F D A T A**********

Exhibit 4.5.2.1-1

Geotechnical Investigations

GEOTECHNICAL INVESTIGATION

KINNEY MINE

Scofield, Utah

Prepared for:
Carbon Resources LLC,
a New Mexico Limited Liability Company

November 2007

RB&G
ENGINEERING, INC.

200701-045

RB&G
ENGINEERING, INC.

November 26, 2007

Carbon Resources LLC,
a New Mexico Limited Liability Company
c/o Greg Hunt
Geo-Hunt Consulting, Inc.
16577 Columbine Lane
Cedarredge, CO 81413

Subject: Kinney Mine, Scofield, Utah
Geotechnical Investigation

Gentlemen:

A Geotechnical Investigation has been completed for the proposed Kinney Mine in Scofield, Utah. The results of the study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER
NO.162291
BRADFORD E.
PRICE
12/17/07
STATE OF UTAH

Bradford E. Price, P.E.

bep/jal

1435 WEST 820 NORTH, PROVO, UTAH 84601-1343
PROVO 801-374-5771 SALT LAKE CITY 801-521-5771 FAX 801-374-5773

Geotechnical Investigation

Kinney Mine

Scofield, Utah

Prepared for:
Carbon Resources LLC,
a New Mexico Limited Liability Company

November 2007

RB&G ENGINEERING, INC.

RB&G ENGINEERING, INC.

KINNEY MINE
Scofield, Utah

Geotechnical Investigation

INTRODUCTION

This report outlines the results of a geotechnical investigation performed for the proposed Kinney Mine surface facilities to be located north-northeast of Scofield, Utah at the approximate location shown in Figure 1. The purpose of this investigation was to determine the characteristics of the subsurface material throughout the site so that satisfactory substructures and slopes can be designed to support the proposed facilities. The results of the investigation, along with pertinent recommendations for design, are outlined in the following sections of this report.

The information contained in the report is discussed under the following headings: (1) Geologic Setting and Existing Site Conditions, (2) Field and Laboratory Testing Procedures, (3) Subsurface Soil and Water Conditions, (4) Site Preparation and Compacted Fill Requirements, (5) Foundation Considerations and Recommendations, and (6) Slope Stability Analyses.

I. GEOLOGIC SETTING AND EXISTING SITE CONDITIONS

The regional and site geology is being prepared by others and will be submitted under separate cover. The area is located in Seismic Zone 2B according to the 1997 edition of the Uniform Building Code. The site is located on the east side of Highway 96, rising to the east with the elevation ranging from about 7700 to 7900 feet. Adjacent to Highway 96, the southerly half of the site is relatively flat for a few hundred feet before rising to the east. This area has been used for mining activities in the past and has been reclaimed with topsoil overlying approximately 2 to 6 feet of coal and soil fill. The vegetative cover across the site consists of native grass and sagebrush with some aspen trees.

Scofield Reservoir is located 0.5 to 1 mile northwest of the site at about elevation 7620 feet. No major water conveyance facilities or other water bodies exist in the immediate vicinity, which would influence the groundwater level at this site. Other than the information provided above, no conditions appear to exist at this site which would adversely affect foundation performance.

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II. FIELD AND LABORATORY TESTING PROCEDURES

The subsurface investigation was performed with borings and test pits. The borings were drilled using a Simco 2800 drill rig and continuous flight auger to advance the boring, and a Longyear 44 with H.Q. core to advance the boring. Where coring was performed in overburden, split spoon samples were obtained at select intervals. Sampling was generally performed in the overburden at five-foot intervals throughout the depth investigated. Disturbed samples were obtained by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value, corrected for overburden and hammer energy, provides a good indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of the cohesive material, since the penetration resistance of materials of this type is a function of the moisture content. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of the granular particle exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with a reasonable core recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material.

It will be noted that it was not possible to drive the sampling spoon through the full 18 inches at some sampling locations. Where the sampling tube could not be driven through the full 18 inches, the number of blows to drive the spoon through a given depth of penetration is shown on the boring logs.

Miniature vane shear tests, which provide an indication of the undrained shearing strength of cohesive materials, were performed on samples of the clay soil during the field investigations. The results of these tests are shown on the boring logs as the torvane value in tsf.

The test pits were excavated using a John Deere 160 trackhoe. During the subsurface investigation, the test pits were logged and sampling was performed at about three-foot intervals throughout the depth investigated. Both disturbed and undisturbed samples were obtained during the field investigations. The in-place dry unit weight and the natural moisture content was determined in the field using a Troxler nuclear density gauge at select sample locations with the samples delivered to the laboratory to verify moisture content. Undisturbed samples were obtained by trimming block samples of the cohesive material encountered in the soil profile.

Each sample obtained in the field was classified in the laboratory according to the Modified Unified Soil Classification System. The symbol designating the soil type according to this system, is presented on the logs. A description of the Modified Unified Soil Classification System is presented in the appendix, and the meaning of the various symbols, shown on the logs, can be obtained from this figure.

Laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed site included in-place dry unit weight, natural moisture content, Atterberg Limits, mechanical analyses, unconfined compressive strength, pH, resistivity, sulfate, direct shear, triaxial shear, and consolidation tests. Testing was performed following procedures outlined in the American Society for Testing and Materials (ASTM) standards.

III. SUBSURFACE SOIL AND WATER CONDITIONS

The characteristics of the subsurface material throughout the site were evaluated by drilling 6 borings to depths of between 25 and 76.5 feet and excavating 14 test pits to depths of between 8 and 19.5 feet at the approximate locations shown in Figure 2. The logs for the borings and test pits are presented in the appendix and the subsurface profile at each test hole location is included on the logs. Also included in the appendix are photos of the cores obtained in the borings.

No groundwater was encountered within the depth investigated at the time the field investigation was performed (August/September 2007).

The results of classification, density and moisture tests are presented on the test hole logs, and the results of all laboratory tests, with exception of the consolidation tests, are summarized in Tables 1 and 2 in the appendix. It will be noted from Table 1 that the in-place dry unit weight of the subsurface material varies from 86.6 to 118.5 pcf and that the natural moisture content of the cohesive soil ranges from 4.5 to 17.5%. The cohesive soil has 15 to 34% gravel, 19 to 42% sand, and 27 to 66% clay. The liquid limit of the lean clay and silt ranges from 19 to 42 and the plasticity index varies from 4 to 26. The non-plastic silty sand has 15 to 38% gravel size particles, 38 to 61% sand, and 9 to 28% silt. The gravelly material has 55 to 64% gravel, 23% sand, and 13 to 22% silt size particles. The unconfined compressive strength of the lean clay ranges from 2080 to 8280 psf.

One direct shear test was performed on a sample of the sandy lean clay obtained from Test Pit CV-5-1 at a depth of 12 feet. The results of this test are included in the appendix and summarized on Table 2. It will be noted that this sample has a friction angle of 20 degrees and a cohesion of 15 psi.

Two triaxial shear tests were performed on samples of the lean clay obtained from Boring CV-4-1 at a depth of 20 to 21.5 feet and from Boring SC-2 at 23 to 24 feet. The results of this test are also included in the appendix and summarized on Table 2. It will be observed that a friction angle of 29.6 and 32.5 degrees with 2 psi cohesion was obtained for the total stress envelopes.

In order to obtain an indication of the corrosive nature of the subsurface material at this site, four resistivity, pH, and sulfate tests were performed on samples obtained throughout the site. The results of these tests are presented on Table 2. It will be noted that the soils tested have relatively low corrosive characteristics. It is recommended that Type II cement be used for concrete in contact with soil.

The compressibility characteristics of the subsurface material were evaluated by performing eleven consolidation tests, and the results of these tests are also presented in the appendix. During the performance of the consolidation tests, each sample was loaded at the natural moisture content until a load intensity of 0.58 tsf had been reached. At this point in the loading cycle, each sample was permitted to absorb water without any increase in the load intensity. Soils having collapsible characteristics always settle without any increase in the load when they become wet or saturated, and expansive soils experience an increase in void ratio on absorbing water. It will be observed from these tests that five of the samples tested exhibited collapsible characteristics and that three of the samples showed expansive characteristics.

IV. SITE PREPARATION AND COMPACTED FILL REQUIREMENTS

Included on Figure 2 are the location of preliminary cut and fill sections. These sections are presented in Figures 3 through 8. In areas where structures will be located, it is recommended that clearing and grubbing be performed to remove excess organic matter. It is anticipated that this will require stripping of the upper 6 inches and grubbing of tree and sagebrush roots. This action should also be performed in parking areas and borrow areas. Where cut and fill operations will take place, it is recommended that the excavated material be moisture conditioned to within 2% of optimum moisture content, placed in 8 inch (maximum) lifts and compacted to an in-place unit weight equal to at least 92% of the maximum laboratory density as determined by ASTM D 1557 for fills outside of building areas and 95% for fills where structures will be located. A sheeps-foot or tamping-type roller should be used for compacting the clay soils.

V. FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS

It is recommended that exterior structural foundations be located at a depth below finished grade sufficient to provide frost protection, which is about 4.5 feet in this area. If the foundations for

the proposed facilities are designed in accordance with the recommendations outlined below, the maximum settlement of any footing should not exceed one inch and differential settlement throughout the structure should not exceed 0.5 inch. It is generally recognized that the tolerable differential settlement for steel and concrete structures is about 0.002 times the column spacing. This criterion is tantamount to a differential settlement of about 0.5 inch for column spacings of 20 feet and 0.7 inch for column spacings of 30 feet. Since it is not anticipated that the column spacing for this structure will be less than 20 feet, a differential settlement of 0.5 inch should be satisfactory for the proposed facility. Additional potential settlement associated with collapsible type soil layers is discussed where applicable.

A. MINE DRY / OFFICE – (Test Pits MDF-1, MDF-2, & MDF-3)

Test Pits MDF-1, 2 and 3 define the characteristics of the subsurface profile in the vicinity of the Mine Dry / Office facility. It will be noted from the test pit logs that the soil profile for Test Pit MDF-1 consists of stiff lean clay throughout the depth investigated (15 feet). Test Pit MDF-2 encountered clayey sand with gravel and silty sand with gravel, cobbles and boulders to a depth of 9 feet, followed by stiff lean clay to a depth of 18 feet. Test Pit MDF-3 encountered 3 feet of coal fill, followed by silty sand and gravel with cobbles and boulders to a depth of 15 feet. Lean clay with sand was encountered from 15 feet to the bottom of the test pit at 20 feet.

It is our understanding that the floor level for this structure will be at about elevation 7727 feet. Tabulated below is the ground elevation at the three test pit locations:

MDF-1	7720.4 feet
MDF-2	7729.6 feet
MDF-3	7744.0 feet

It is apparent that about 7 feet of fill will be required to meet final grade on the westerly side of the building site (MDF-1), and that 17 feet of cut will be required on the easterly side of the building site (MDF-3). The native lean clay has relatively high dry strength; however, this material has collapsible characteristics and will experience significant settlement if it becomes wet.

Options for foundation support include (1) supporting the structure on spread footings and providing partial mitigation against settlement associated with collapsible soils, and (2) supporting the structure on deep foundations extending below the collapsible lean clay layers.

(1) Spread Footings

As indicated above, the native lean clay has relatively high dry strength. If these soils become wet, the soil matrix will collapse and settlement will occur. Up to 20 inches of settlement is possible under saturated conditions. If precautions are taken to prevent the native lean clay from becoming wet, the structure can be supported on spread footings. These precautions should include providing positive drainage away from the building and installing an impervious membrane extending at least 6 feet beyond the outside footings. While this action will reduce the risk of moisture entering the subgrade clay, the owner should be made aware that significant settlement will occur if these soils become wet.

An allowable soil bearing capacity of 2500 psf can be used for spread footings supported on the native lean clay and fill compacted to the recommendations outlined in Section IV. Shallow foundation support will be satisfactory provided that the native lean clay does not become wet during the design life of the structure.

(2) Deep Foundations

It is our opinion that drilled shafts represent the most efficient deep foundation option for this structure. To minimize downdrag forces if the collapsible soils become wet, it is recommended that 2 foot diameter drilled shafts be used with the ends belled for increased capacity. It is recommended that the shafts extend to elevation 7700 feet. Shown in the following table are allowable capacities for end bearing drilled shafts terminating in the stiff lean clay at a depth of about 27 feet below the finished pad level.

Procedures outlined in FHWA-H1-88-042, "*Drilled Shafts: Construction Procedures and Design Methods*" have been used to determine size and load capacities. It has been assumed that high quality construction, good specifications and excellent inspection will exist for the structure. The capacities are based upon end bearing only, and it is, therefore, essential that the base of the shafts be cleaned to remove all loose debris.

Based upon these assumptions, a factor of safety of 2.5 has been selected. The shafts can be belled to achieve the required base diameter.

Tabulated below are capacities for compression loading for various diameters of shafts.

Shaft Diameter (ft)	Total Compressive Capacity (kips)	Allowable Compressive Capacity (kips) – f.s. = 2.5
2	40	16
3	89	35
4	158	63
5	247	99

The design of rebar and concrete should follow established guidelines. If this option is used, it is recommended that inspection of the shaft excavations be made by the soils engineer prior to placement of concrete.

B. SHOP / WAREHOUSE – (Test Pits WSF-1, WSF-2, & WSF-3)

Test Pits WSF-1, 2 and 3 define the characteristics of the subsurface profile in the vicinity of the proposed Shop / Warehouse structure. It will be noted from the test pit logs that the soil profile includes a 1 foot sandy lean clay layer underlain by 3 to 5 feet of coal fill. In Test Pit WSF-1 a 2 foot layer of sandy clay was encountered below the coal fill, followed by highly weathered sandstone to the bottom of the test hole at 13 feet. Test Pit WSF-2 encountered loose silty sand with gravel below the coal fill from 3.5 to 8.5 feet. The silty sand was followed by layers of sandy clay and clayey sand from 8.5 to 12 feet, then gravel with cobbles and boulders to the bottom of the test pit at 16 feet. The profile in Test Pit WSF-3 consists of loose silty sand with gravel below the coal fill from 3 to 9 feet, followed by a 2.5 foot layer of sandy clay to 11.5 feet, then medium dense silty sand from 11.5 to 15 feet.

It is our understanding that the floor level for this structure will be at about elevation 7728 feet. Tabulated below is the ground elevation at the three test pit locations:

MSF-1	7719.5 feet
MSF-2	7721.6 feet
MSF-3	7718.7 feet

It is apparent that 6 to 9.5 feet of fill will be required to meet final grade throughout the building site. It is recommended that the loose coal fill be removed from beneath the building area prior to placement of fill. Assuming that the native soils (including lean clay, sand, and gravel) are used to establish final grade, and that compaction requirements outlined in Section IV are complied with, footings can be designed using an allowable soil bearing capacity of 3500 psf, except that in no case should the width of any footing be less than 2 feet.

Up to 3 feet of collapsible soils were encountered in Test Pits WSF-2 and 3. The sample from 9 feet in Test Pit WSF-3 experienced about 3% settlement upon wetting. It is estimated that 1 inch of additional settlement may occur if these soils become saturated.

C. COVERED STORAGE AND FUEL STRUCTURE – (Test Pits CS-1 and F-1)

Test Pits CS-1 and F-1 define the characteristics of the subsurface profile in the vicinity of the proposed Covered Storage and Fuel Structure sites. It will be noted from the test pit logs that the soil profile includes a 0.5 to 1 foot sandy lean clay layer underlain by 7 to 8.5 feet of loose fill consisting of coal, and layers of coal and clayey sand with gravel. In Test Pit CS-1, sandy lean clay was encountered below the coal fill, extending from 8.5 to 16 feet, followed by a 2 foot layer of sandy gravel. The lean clay exhibits collapse characteristics. Test Pit F-1 encountered 4 feet of sandy clay and clayey sand layers below the 7 feet of loose fill, followed by sand and gravel from 11 to 16 feet.

It is our understanding that the floor level for these structures will be at about elevation 7728 feet. Tabulated below is the ground elevation at the two test pit locations:

CS-1	7716.6 feet
F-1	7724.0 feet

It is apparent that 4 to 11 feet of fill will be required to meet final grade throughout the building sites. It is recommended that the loose coal fill be removed from beneath the building areas prior to placement of fill. Assuming that the native soils (including lean clay, sand, and gravel) are used to establish final grade, and that compaction requirements outlined in Section IV are complied with, footings can be designed using an allowable soil bearing capacity of 3500 psf, except that in no case should the width of any footing be less than 2 feet.

Up to 5 feet of collapsible soils were encountered in Test Pit CS-1 between 10 and 16 feet below the existing ground surface. It is estimated that up to 2 inches of additional settlement may occur if these soils become saturated. Since the moisture sensitive soils will be about 20 feet below final grade, it is our opinion that the risk of saturation and collapse of this layer once the structures are in place is relatively low.

D. CONVEYOR SECTION–1 (Boring Portal 1 and Test Pit TT-1-2)

Boring Portal-1 and Test Pit TT-1-2 were placed along the alignment for Conveyor Section-1. It will be noted from the boring log that the subsurface profile in the portal area consists of interbedded siltstone and sandstone gravels and cobbles in a sandy silt matrix with occasional clay layers to a depth of about 18 feet (elev. 7873'). A 4 foot coal layer was encountered between elevation 7873 and 7869 feet, followed by 6 inches of highly weathered mudstone; then relatively competent sandstone to the bottom of the boring at 25 feet (elev. 7865').

The ground elevation at Test Pit TT-1-2 was 7873.1 feet, and the profile consists predominantly of silty clay with gravel to a depth of 4 feet (elev. 7869'), followed by clayey gravel with cobbles to the bottom of the test pit at a depth of 8 feet (elev. 7865').

It is our understanding that the portal pad elevation will be at 7869 feet. Structures contemplated along this section include the portal entrance, conveyor supports and the transfer tower. At elevation 7869 feet, the portal excavation will extend into bedrock. It is recommended that supports not be founded on the coal or the highly weathered mudstone. We recommend that foundation support areas extend through these materials and into the underlying sandstone. It is recommended that the sandstone be treated as a very dense sand to evaluate allowable bearing capacity for footings. For footings located on the sandstone or granular fill overlying the sandstone and compacted to an in-place density equal to at least 95% of the maximum laboratory density as determined by ASTM D 1557, we recommend that footings be designed using the allowable bearing capacities shown in the following table:

FOOTING WIDTH (ft)	ALLOWABLE BEARING CAPACITY (psf) (assumes factor of safety = 2.5)
2	5800
3	6900
4	7950
5	9050
6	10,100
7	9,800
8	9,500
12	8,800
16	8,500

The above capacities assume a minimum embedment depth of 2 feet and a maximum total settlement of 1 inch with differential settlement less than 0.5 inch.

The clay encountered in Test Pit TT-1-2 to elevation 7869 feet has collapsible characteristics and we recommend that no foundations be supported on this material. It appears that foundations for the conveyor section will extend into the gravelly clay and clayey gravel with cobbles and boulders below an elevation of 7869 feet. If the conveyor is supported using spread footings, it is recommended that an allowable bearing capacity of 2500 psf be used for the clay soils.

For this conveyor section, capacities for drilled shafts extending 8 to 10 feet into the gravelly clay and clayey gravel are shown in the following table:

Shaft Diameter (ft)	Total Compressive Capacity (kips)	Allowable Compressive Capacity (kips) – f.s. = 2.5
2	42	17
3	84	34
4	141	56
5	211	84

It is recommended that lateral bearing be determined using procedures outlined in Section 1804 and 1805 of the 2006 edition of the International Building Code (IBC). It is recommended that Material Class 5 (CL) be used with a lateral bearing of 100 psf per foot. L-Pile Parameters can be provided upon request for specific locations.

It is apparent from Figures 2 and 8 that the transfer tower will be located on compacted fill. It is anticipated that the collapsible clay layer, which extended to a depth of about 4 feet, will also exist in the area where the transfer tower is planned. If the transfer tower is supported on spread footings, it is recommended that the collapsible clay layer be excavated prior to placement of fill. Under this scenario, the footings placed on compacted fill can be designed using an allowable bearing capacity of 3500 psf, following recommendations outlined in Section V.B.

E. CONVEYOR SECTION–2 (Test Pit CV-2-1, Boring CV-2-2, & Test Pit CV-2-3)

Test Pit CV-2-1, Boring CV-2-2, and Test Pit CV-2-3 were placed along the alignment for Conveyor Section-2. The soil profile for each of these test holes is discussed separately below:

Test Pit CV-2-1

This test pit encountered stiff lean clay with gravel and cobbles to a depth of 3.5 feet, followed by 6 inches of coal. Below the coal, the profile consists of cobbles and boulders in a silty sand matrix to a depth of 14 feet, followed by competent sandstone to the bottom of the boring at 19 feet.

Boring CV-2-2

The boring encountered sandy clay to a depth of 3 feet, followed by medium dense to dense silty sand with gravel to 24 feet. A layer of lean clay was encountered between 24 and 30 feet. The clay was underlain by dense silty sand with gravel to the bottom of the boring at 32 feet.

Test Pit CV-2-3

This test pit encountered stiff sandy lean clay with gravel fill to a depth of 6.5 feet, underlain by 6 inches of coal. Native very stiff sandy clay with gravel was encountered between a depth of 6 and 11 feet, followed by sandstone to the bottom of the test pit at 15 feet.

Foundations for this conveyor section can be designed using the recommendations provided for Conveyor Section 1 in Section V., except that no footings should be located on the existing clay fill. Where fill is encountered, it is recommended that the foundations either extend below the fill, or that the fill be excavated and replaced as compacted fill under controlled conditions.

F. CONVEYOR SECTION–3 (Borings NS-1 and S-1)

Borings NS-1 and S-1 were placed along the alignment for Conveyor Section-3. It will be noted from the boring logs that the subsurface profile at each of these locations consists predominantly of very stiff sandy lean clay with some gravel and occasional cobbles and boulders lower in the profile. The borings extended to a depth of about 50 feet, terminating at elevation 7735 feet.

It will be noted from Figure 4 that a significant excavation will be required on the westerly side of the stockpile area and that some filling will be required on the easterly side to provide the pad elevation at 7780 feet. The ground elevation at the boring locations is at about 7785 feet. Some samples of the clay in the upper 5 feet have a pinhole type structure characteristic of collapsible soils. Samples deeper in the profile between elevation 7730 and 7715 feet exhibited expansive characteristics for load intensities less than about 2 tsf. The allowable bearing capacity for spread footings located between elevation 7775 and 7755 feet will be controlled by the stiff lean clay.

It is recommended that spread footings be designed using an allowable bearing capacity of 2500 psf. The magnitude of large area loads associated with the coal stockpiles are not known as of the preparation of this report. If the area loads exceed 500 psf, it is recommended that an analysis be performed to evaluate the settlement associated with large area loads.

G. CONVEYOR SECTION–4 (Borings CV-4-1 and SC-2)

Borings CV-4-1 and SC-2 were placed along the alignment for Conveyor Section-4, with SC-2 located at the location of the proposed screening and crushing facility. Boring CV-4-1 was

located at elevation 7776 feet and encountered lean clay with gravel and occasional cobbles and boulders throughout the depth investigated, terminating at a depth of 71 feet (elev. 7705'). Boring SC-2 was located at ground elevation 7741 feet and extended to a depth of about 31 feet (elev. 7710'). It will be noted from the boring log that no sampling was performed in the upper 19 feet. At the time drilling was performed, it was assumed that this material would be removed.

It will be noted from Figure 2 that the pad elevation for the Screening and Crushing facility is at 7742 feet. It is recommended that this structure be supported on drilled shafts extending to a depth of at least 25 feet. Recommendations provided in Section V.A. Mine Dry / Office *(2) Deep Foundations* are applicable to this site.

It is recommended that foundations for the conveyor along this section also be supported on drilled shafts extending to a depth of 8 to 10 feet in the vicinity of Boring CV-4-1 and 25 feet in Boring SC-2. Foundations for this conveyor section can be designed using the recommendations provided for Conveyor Section 1 in Section V., except that no footings should be located on the existing clay fill.

H. CONVEYOR SECTION–5 (Test Pits CV-5-1 and CV-5-2)

Test Pits CV-5-1 and CV-5-2 were placed along the alignment for Conveyor Section-5. Each of the test pits encountered fill consisting of lean clay with layers of coal and silt to a depth of 5 feet in Test Pit CV-5-1 and 11.5 feet in Test Pit CV-5-2. The fill was underlain by sandy lean clay which exhibited a pinhole structure characteristic of collapsible-type soils. The sample obtained at a depth of 9 feet in Test Pit CV-5-1 settled approximately 8% when saturated. The sample obtained at a depth of 12 feet in Test Pit CV-5-2 exhibited a 2% swell when saturated.

The proposed pad elevation for this area is at 7232 feet. The elevation of the two test pits are as follows:

CV-5-1	7737.7 feet
CV-5-2	7749.8 feet

It will be noted that Test Pit CV-5-2 located near the Truck Loadout only extended to elevation 7730 feet, 2 feet below the pad level. It is recommended that foundations for the Truck Loadout facility bypass the moisture sensitive clay in the upper portion of the soil profile. Based upon the two test pits, it appears that these clays extend to at least elevation 7715 feet. We recommend that the structure be supported on drilled shafts extending to an estimated depth of 30 feet below the pad level, to about elevation 7702 feet. We recommend

that an additional boring be located at the Truck Loadout site to evaluate the characteristics of the subsurface soil. We recommend that the conveyor system also be supported on drilled shafts extending to a depth of 8 to 10 feet below the pad level.

Recommendations provided in Section V.A. Mine Dry / Office (2) Deep Foundations are applicable to this area.

I. DETENTION POND

It is our understanding that a below ground detention pond is planned at the north side of the property at the approximate location shown in Figure 2. We understand that the pond will be sized to hold between 2.5 and 2.7 acre feet with the bottom 12 to 15 feet below the existing ground surface. No test holes were located in the detention pond area; however, test pits CV-5-1 and CV-5-2 located a few hundred feet south of the area both encountered fill to depths varying from 5 to 12 feet. The fill has interbedded layers of coal, sandy gravel and lean clay. It is recommended that the excavation side slopes be cut at 3 horizontal to 1 vertical. If fill is encountered, it is recommended that the cut be over-excavated a distance of at least 10 feet into the side slope, and that this zone be replaced with engineered fill. On site material can be used as engineered fill provided that it is placed in lifts not exceeding 8 inches, moisture conditioned and compacted in accordance with the recommendations provided in Section IV of this report. It is also recommended that the detention pond be lined with 18 inches of compacted lean clay obtained from on-site excavations and that a 6 inch layer of sandy gravel be placed over the liner to protect the clay from cracking.

J. ROADWAYS

The project will require cuts and fills for roadway construction throughout the development. For shallow cuts less than 20 feet in the native clayey soils, we recommend that slopes of 1.25H:1V or flatter be used. Fill slopes less than 20 feet high and constructed of clayey soils may slope as steeply at 1.5H:1V. Fill slopes constructed of sandy soils should be sloped at 1.8H:1V or flatter. Slopes for roadway fills and cuts with heights or depths greater than 20 feet should be designed in conformance with the slope stability recommendations in Section VI of this report.

K. SEISMIC CONSIDERATIONS

As indicated earlier in this report, the site is located in Seismic Zone 2B according to the 1997 edition of the Uniform Building Code. Soil profile type S_D should be used for structural

seismic design, with the Uniform Building Code. The site is classified as Site Class D, as per Section 1613 of the 2006 International Building Code.

The site is located at latitude 39.7330° North and longitude 111.1535° West. Probabilistic peak ground acceleration (PGA) values are tabulated below:

Probabilistic ground motion values in %g.

	10%PE in 50 yr	2%PE in 50 yr
PGA	12.19	27.94
0.2 sec SA	28.21	64.33
1.0 sec SA	9.46	21.94

The allowable soil bearing pressure indicated above may be increased by one-third where seismic forces are involved in the structural loads. If the passive pressures associated with footings and walls are used to resist seismic forces, and if backfilling is performed using granular material, we recommend that the passive pressures be calculated from the lateral earth pressure equation using an earth pressure coefficient of 2.0. If the frictional resistance of the footings and floor slabs are used to resist seismic forces, we recommend a coefficient of friction of 0.40 be used to calculate these forces.

Since the groundwater level is at a substantial depth below the ground surface and since the subsurface soil profile consists predominantly of lean clay and gravel, problems associated with liquefaction during a seismic event are unlikely at this location, and no special mitigation of the foundation soils is required.

VI. SLOPE STABILITY

The proposed development will require earthwork to establish roadways, level structure areas, and a detention basin on the hillside. Figures 3 through 8 show sections cut at locations as shown in Figure 2. The purpose of these sections is to evaluate the stability of the proposed cut and fill slopes.

It will be noted from the section drawings that the proposed fill slopes range from about 1.5H:1V to 2H:1V. The proposed cut slopes are steeper, varying from about 0.8H:1V to 1.4H:1V. The section drawings also show the locations of test holes performed in the vicinity of the section lines. The holes applicable to each section are summarized on the table below, along with the predominant soil types and brief descriptions of the proposed earthwork in the area.

Section	Earthwork Description (as shown on sections)	Test Hole No.	Depth (ft)	Soil / Rock Description
A-A	Cut Slopes 0.8H:1V to 1.4H1V Fill Slope 1.5H:1V	CV-5-1 TH	19.5	Stiff Sandy Lean Clay
		CV-4-1 DRL	71.5	Stiff Sandy and Gravelly Lean Clay
		SC-2 DRL	30.5	Stiff Sandy Lean Clay (not sampled above 19')
B-B	Cut Slope 0.8H:1V File Slope 1.5H:1V	NS-1 DRL	50	Stiff Lean Clay, with some dense Sand and Gravel layers
		S-1 DRL	76.5	Stiff Sandy Lean Clay
C-C	Cut Slope 0.8H:1V Fill Slope 1.8H:1V	CV-2-2 DRL	31.5	Silty Clay to 3', Silty Sand from 3' to 24' Stiff Lean Clay from 24' to 30.5', then Sand
D-D	Cut Slope 1.25H:1V Fill Slope 2H:1V	WSF-3 TH	19.5	Silty Sand and Lean Clay layers, some coal in upper 3'
		WSF-2 TH	16	Silty Sand and Lean Clay layers, some coal in upper 3', gravel below 12'
E-E	Cut Slope 1H:1V Fill Slopes 2H:1V	MDF-1 TH	19.5	Stiff Sandy Lean Clay
		MDF-2 TH	19.5	Stiff Sandy Lean Clay with Silty Sand layer
		MDF-3 TH	19.5	Silty Sand, Gravel and Lean Clay layers, some coal in upper 2'
F-F	Cut Slope 0.8H:1V Fill Slope 1.8H:1V	TT-1-2 TH	8	Silty Clay to 4', then Gravel with Clay
		Portal-1 DRL	25	Silty Gravel with some Clay layers to 14' Sandstone, Mudstone, Coal from 14' to 25'

Stability analyses were performed using the computer program Slope/W. Spencer's method, which satisfies both force and moment equilibrium requirements, was used to compute factors of safety. Potential circular failure surfaces were evaluated using a grid and radius approach.

Stability analyses were performed primarily for Sections A-A, B-B and F-F. At Sections A-A and B-B, the predominant soil type was assumed to be stiff lean clay. Based on the results of field and laboratory testing, this material was assigned an internal friction angle of 30 degrees with cohesion of 250 psf. At Section F-F, the portal drill hole encountered gravelly material in a silty matrix in the upper 10 to 15 feet, underlain by lean clay and rock. This gravelly material was modeled using a friction angle of 35 degrees and 100 psf cohesion.

At Sections A-A, B-B and F-F, the cut slopes were initially modeled as shown on the section drawings, with slopes as steep as 0.8H:1V. For these slopes, the computed factors of safety were in the range of 1.0 to 1.2. Following the initial stability analyses, additional calculations were performed to estimate factors of safety for flatter cut slopes. A summary of computed factors of safety is shown below, and the critical failure surfaces are shown in the appendix.

Section	Cut Slope	Approximate Depth of Cut (ft)	Factor of Safety
A-A	0.8H:1V	35	1.17
	1H:1V	39	1.24
	1.25H:1V	44	1.35
	1.5H:1V	56	1.41
	1.75H:1V	67	1.50
B-B	0.8H:1V	69	0.91
	1H:1V	75	1.00
	1.25H:1V	88	1.10
	1.5H:1V	113	1.19
	1.75H:1V	153	1.29
F-F	0.8H:1V	23	1.07
	1H:1V	30	1.19
	1.25H:1V	35	1.32
	1.5H:1V	40	1.45
	1.75H:1V	45	1.57

The acceptable factor of safety for a given slope depends upon several factors, including the level of certainty and conservatism of model parameters, as well as the nature of the slope and potential consequences of failure. For static, long-term conditions, required minimum factors of safety typically range from about 1.3 to 1.5, with the 1.5 factor used for more critical facilities. For Sections A-A and F-F, an estimated factor of safety of 1.3 or better is achieved for slopes of 1.25H:1V. To achieve an estimated factor of safety of 1.5, the slopes would have to be flattened to about 1.75H:1V. It will be noted that the deep cut on Section B-B has a factor of safety of almost 1.3 only if flattened to 1.75H:1V.

We recommend that permanent cut slopes greater than 10 feet deep in the native silty gravel and lean clay materials be no steeper than 1.25H:1V, in order to provide an estimated factor of safety of 1.3. A greater factor of safety may be required by regulatory agencies, policies, or the facility owner, and can be achieved by further flattening the cut slopes.

It is likely that cut slopes for the pads on the easterly side of the development will be located on the upthrown side of the fault which runs through the site. It appears that the borings throughout this area were located on the downthrown side of the fault. The geology report for the project (prepared by others) references sandstone outcrops and prior boring logs which show a dominance of sandstone to be the norm in the area. Near-vertical sandstone outcrops were observed east of the borings on the north end of the site by RB&G's geologist during field exploration work.

Where the proposed cuts encounter bedrock, they can be performed at near vertical angles in sandstone, and at relatively steep overall angles in interbedded sandstone/mudstone without jeopardizing overall slope stability. Problems associated with the interbedded degradable clay/mudstone layers limit the steepness of the cut, however. It is recommended that the overall

cut slope at these locations be no steeper than 0.8H:1V. It is also recommended that horizontal benches be constructed at the top of degradable clay and mudstone layers, such that a resultant slope in these layers of 1.5H:1V can be achieved without undercutting the overlying ledge rock. If the horizontal benches are not feasible, long term maintenance associated with ledge rock fall should be planned as the mudstone weathers and degrades, resulting in undercutting of the ledges.

It is anticipated that fill slopes will be created with on-site material. If this material is placed and compacted in accordance with recommendations provided in Section IV, fill slopes as steep as 1.5H:1V will have a factor of safety of at least 1.3 if constructed of the native clayey soils. Fill slopes shown on Sections A-A, B-B, and FF will likely be constructed of this clayey on-site fill. Test pits in the vicinity of the fill areas shown on Sections C-C, D-D, and E-E encountered significant amounts of medium-dense silty sand. Fill slopes as steep as 1.8H:1V constructed of this silty sand material have a computed factor of safety of at least 1.3. Plots of stability analyses for typical fill slopes are included in the appendix.

Cut and fill slopes will be susceptible to erosion and shallow surficial failures – particularly for slopes steeper than 2H:1V. We recommend that soil slopes be seeded and erosion control blankets provided where necessary to minimize such problems on bare slopes.

VII. LIMITATIONS

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which could not be defined during this investigation. Since the bearing capacity for foundation design and slope stability are dependent upon adequate compaction of fill, it is requested that testing of the fill be performed under the direct supervision of the soils engineer.

It is recommended that a soils engineer observe the foundation excavations prior to placement of footings. If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken.

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Figures

RB&G ENGINEERING INC.
Provo, Utah

Figure 1 VICINITY MAP

Kinney Mine

Scofield, Utah

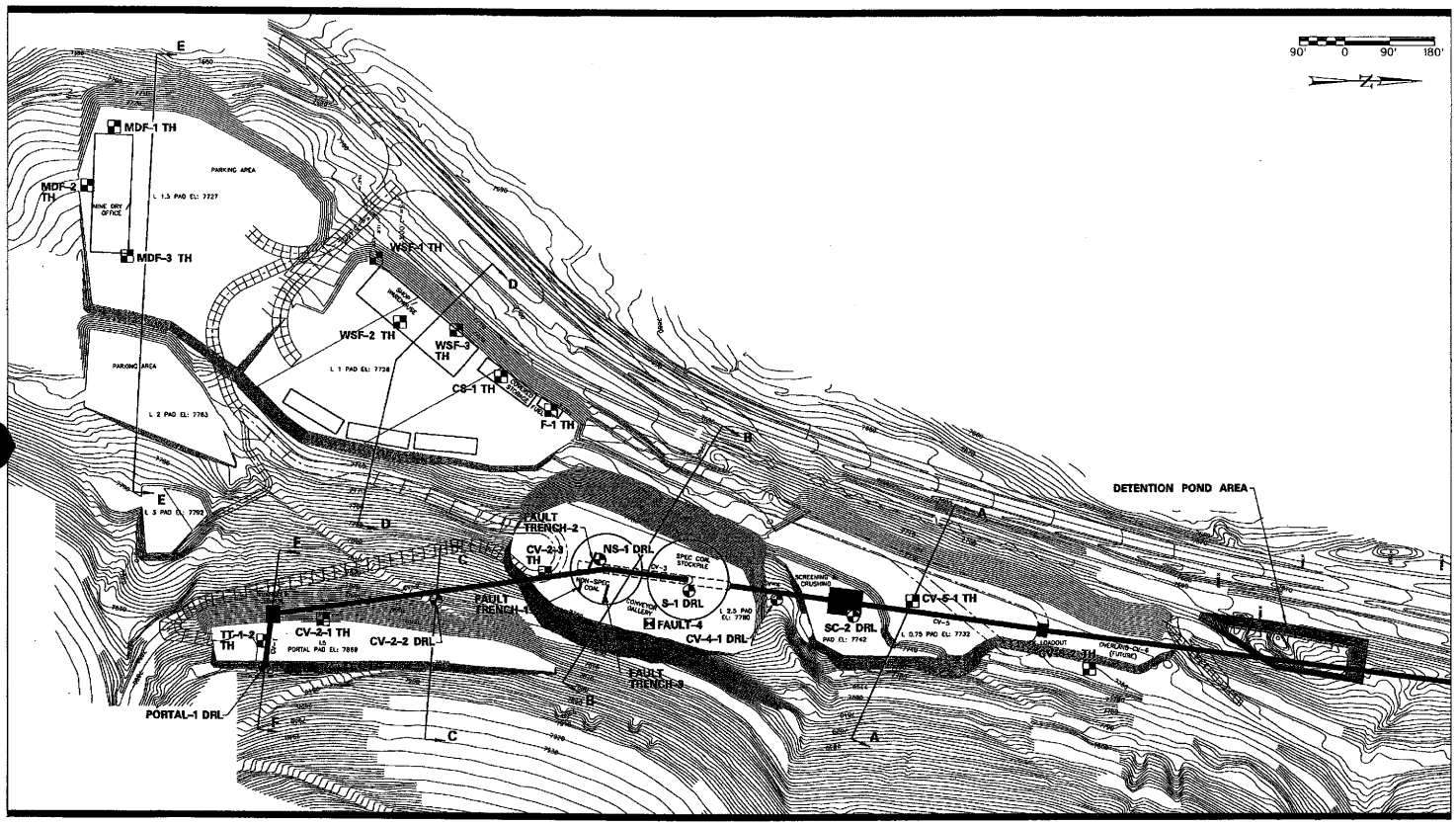

Figure 2

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KINNEY MINE
Scofield, Utah

Site Plan Wth Test Hole & Section Locations

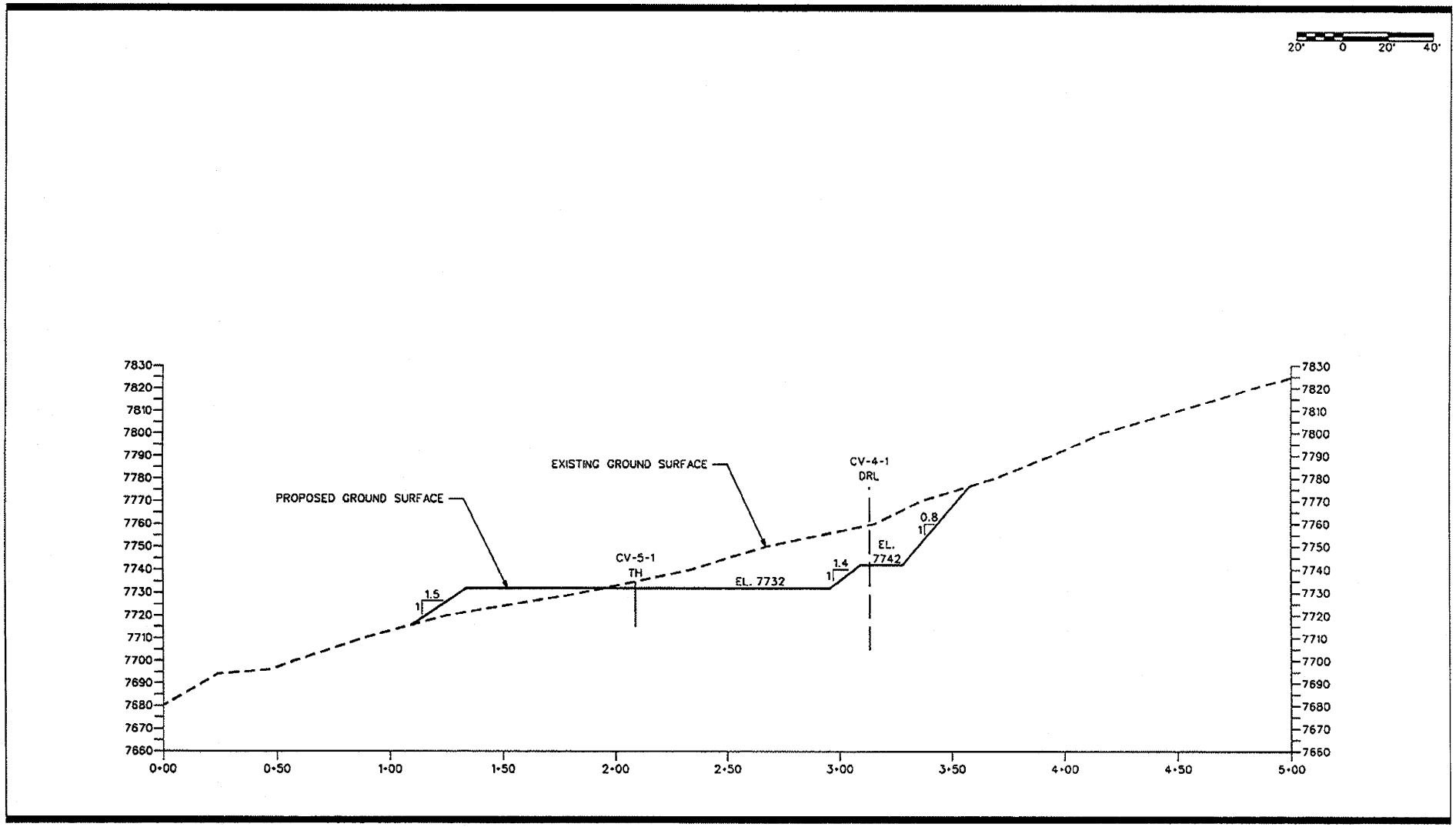

Figure 3

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Kinney Mine
Scofield, Utah

Section A–A

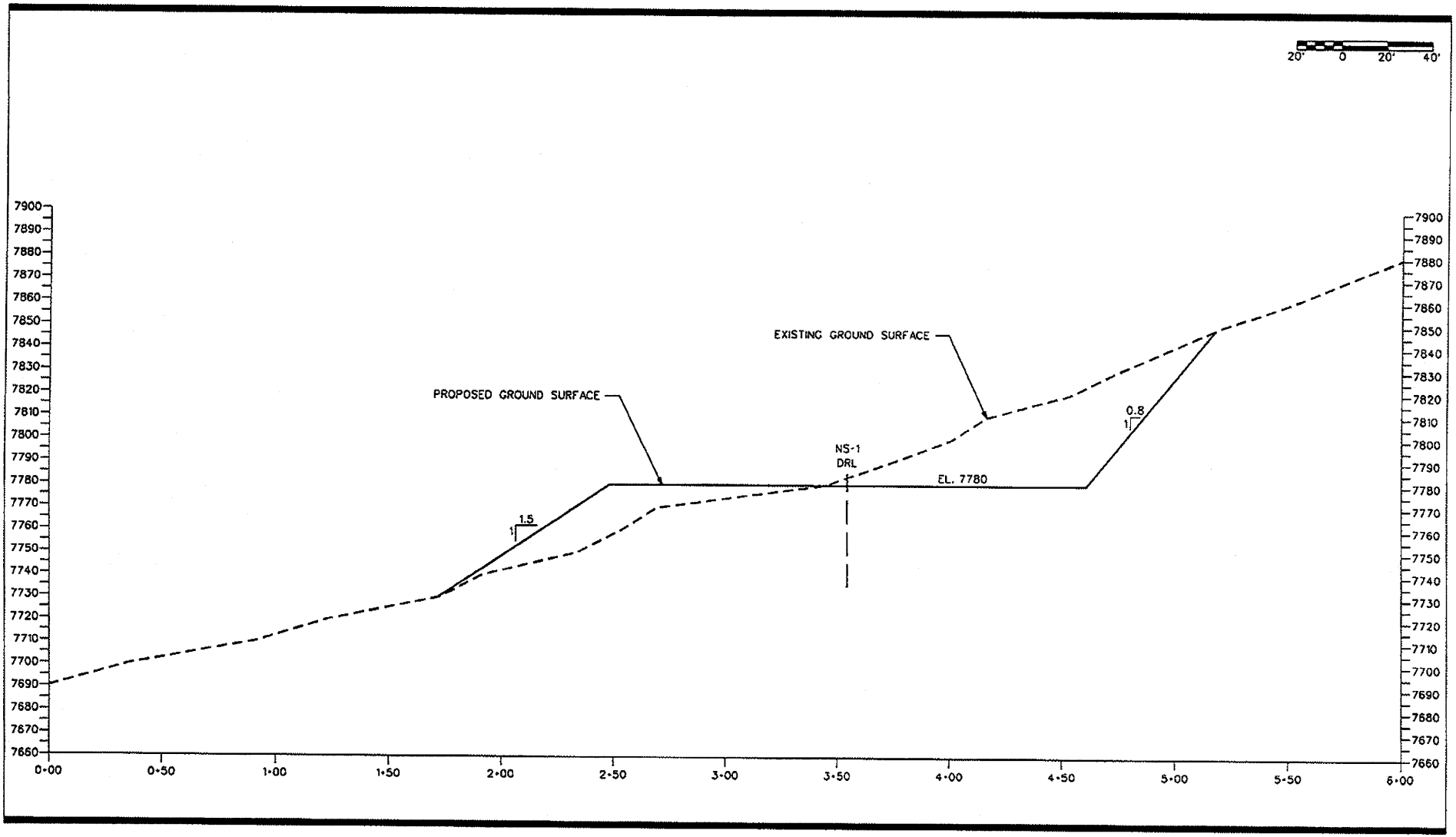

Figure 4

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Kinney Mine
Scofield, Utah

Section B–B

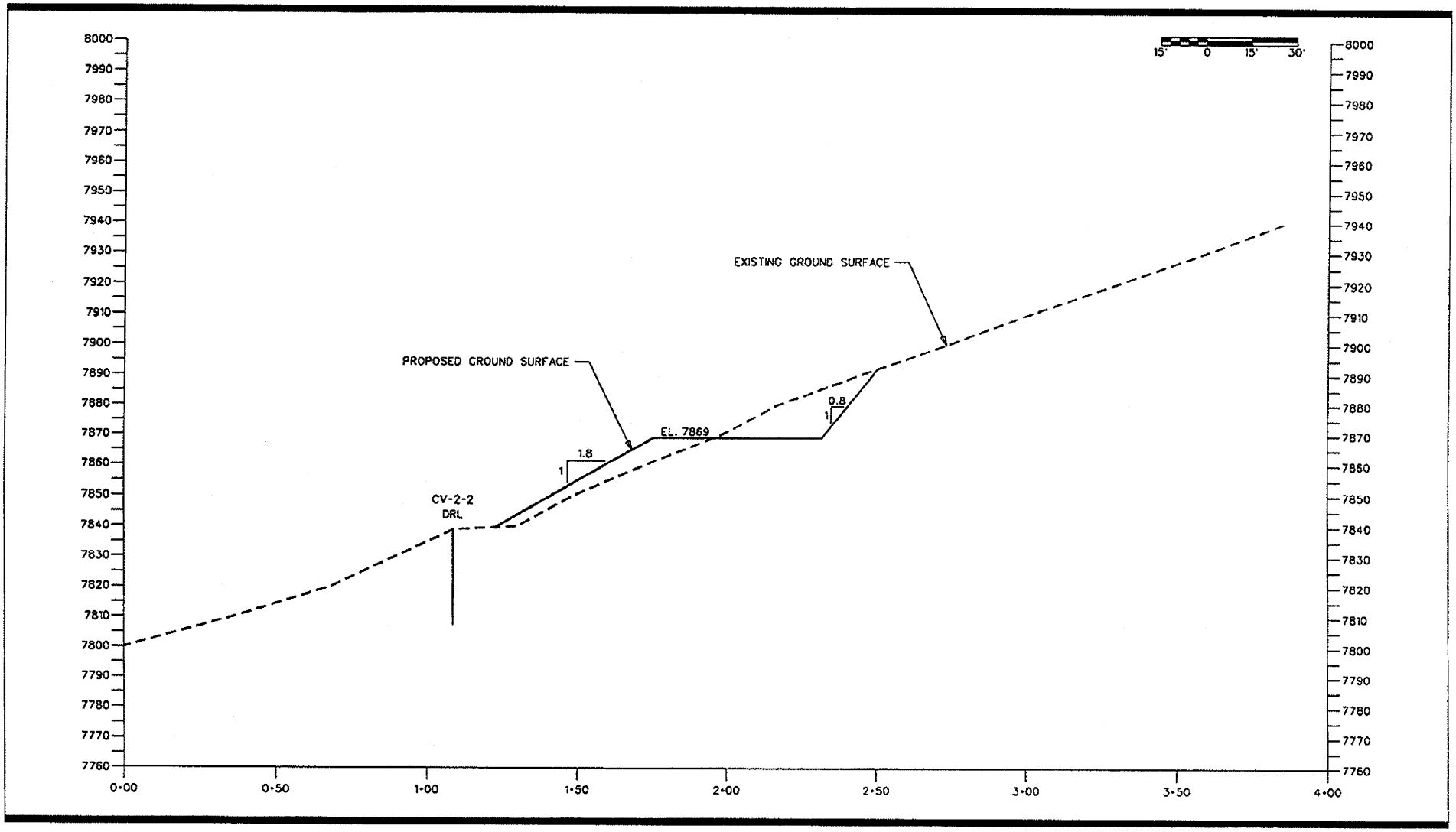

Figure 5

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Kinney Mine
Scofield, Utah

Section C–C

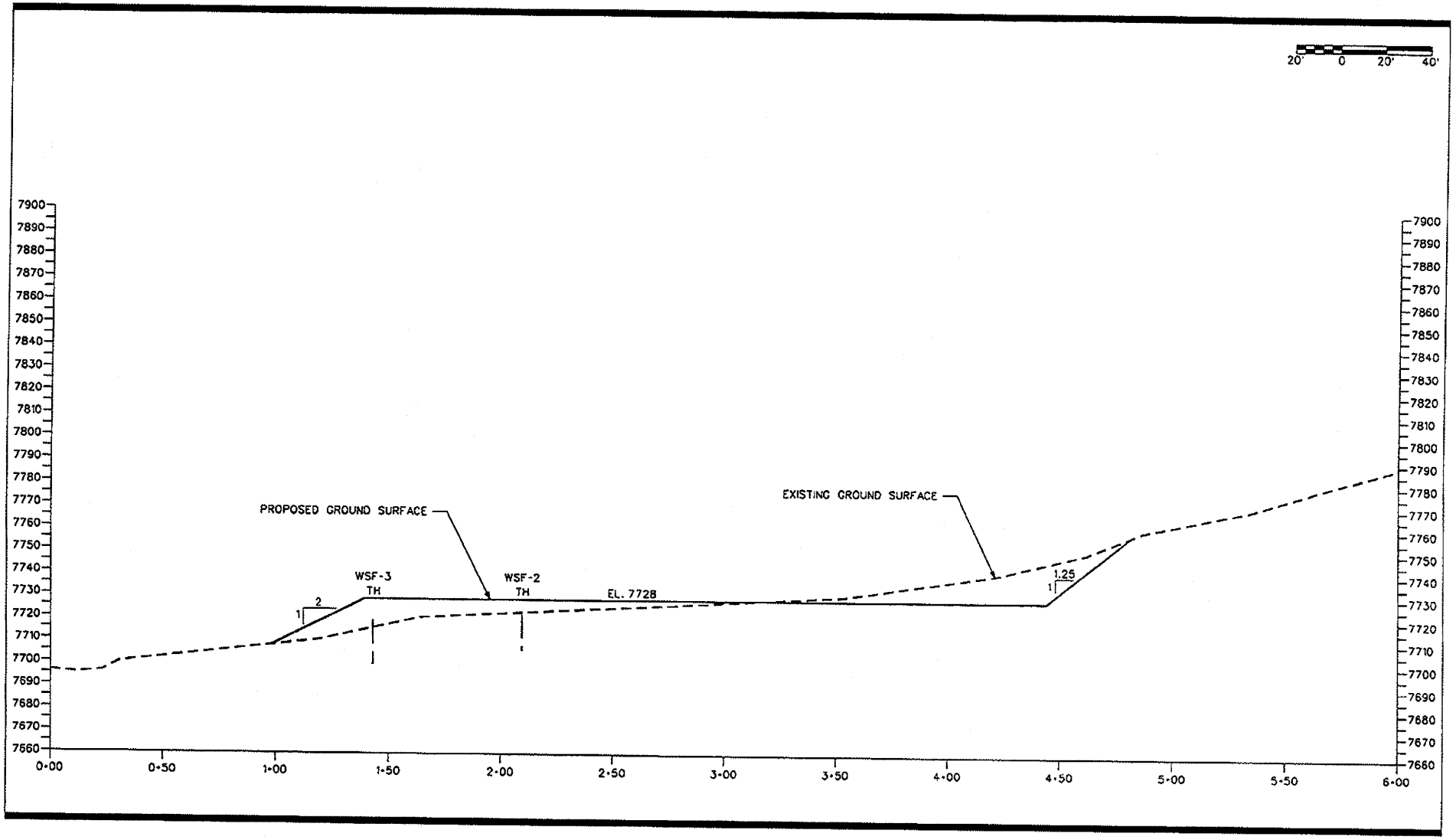

Figure 6

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Kinney Mine
Scofield, Utah

Section D–D

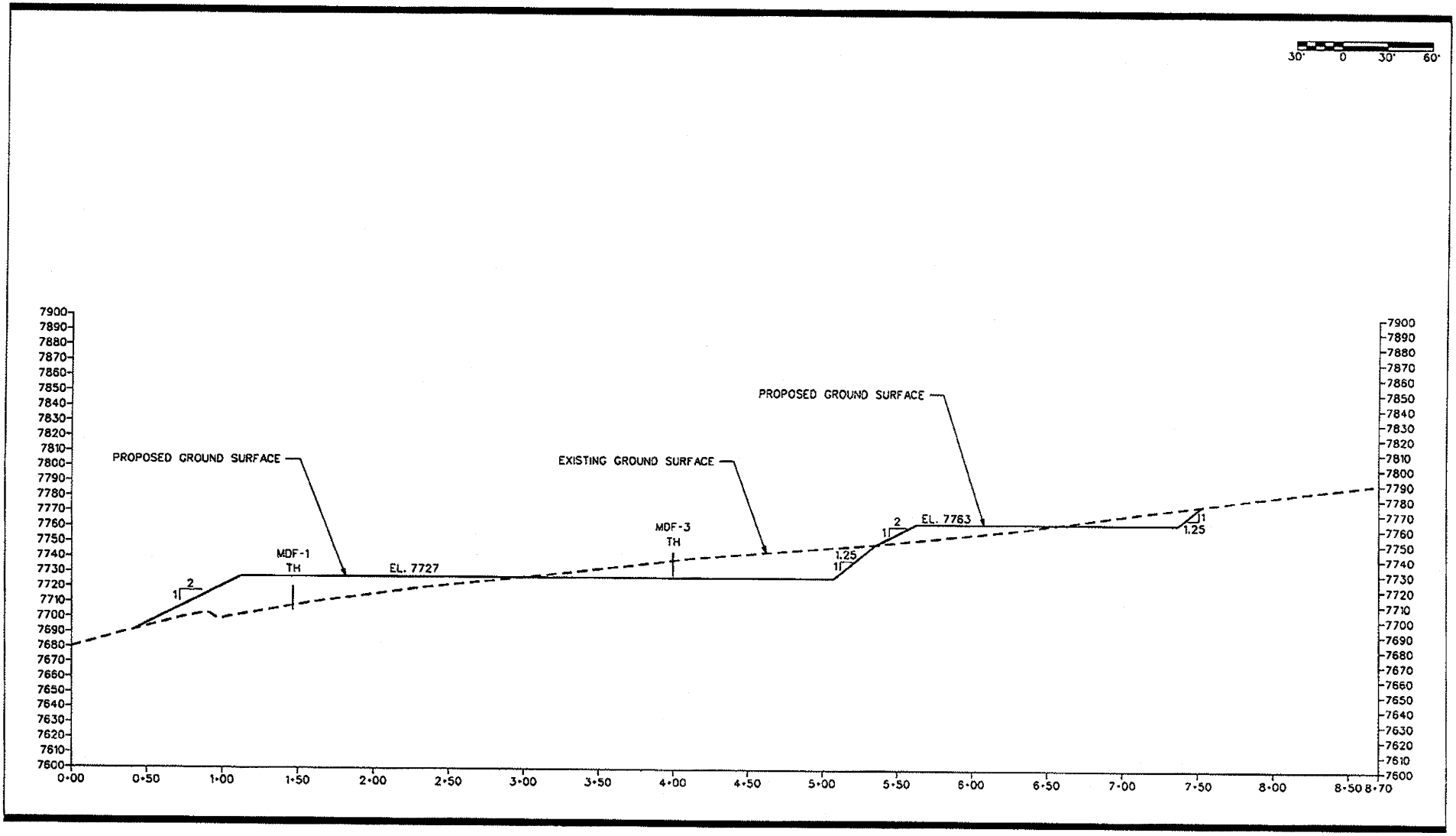

Figure 7

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Kinney Mine
Scofield, Utah

Section E–E

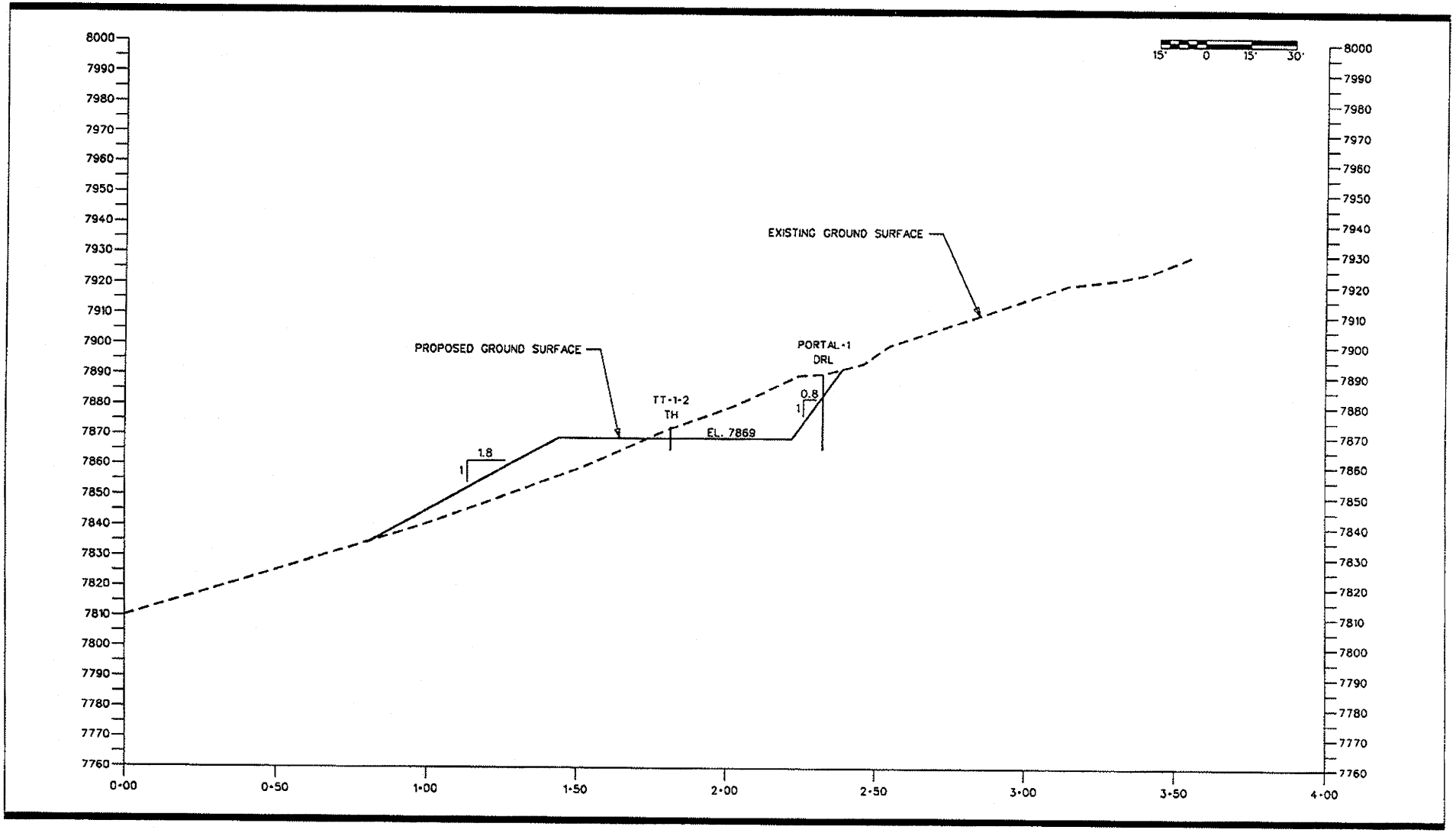

Figure 8

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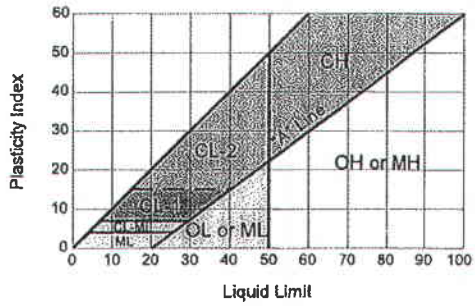
Kinney Mine
Scofield, Utah

Section F–F

Appendix

Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
COARSE-GRAINED SOILS *more than half of material is larger than No. 200 sieve*	Gravels *more than half of coarse fraction is larger than No. 4 sieve size*	Clean Gravels *little or no fines*	GW	Well graded gravels, gravel-sand mixtures, little or no fines	*For laboratory classification of coarse-grained soils*	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Determine percentage of gravel and sand from grain-size curve.	Not meeting all gradation requirements for GW	
		Gravels With Fines *appreciable amount of fines*	GM* d	Silty gravels, poorly graded gravel-sand-silt mixtures	Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			GM* u			Atterberg limits above "A" line, or PI greater	
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures			
	Sands *more than half of coarse fraction is smaller than No. 4 sieve size*	Clean Sands *little or no fines*	SW	Well graded sands, gravelly sands, little or no fines	Less than 5% GW, GP, SW, SP	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	More than 12% GM, GC, SM, SC	Not meeting all gradation requirements for SW	
		Sands with Fines *appreciable amount of fines*	SM* d	Silty sands, poorly graded sand-silt mixtures	5% to 12% Borderline cases requiring use of dual symbols**	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			SM* u				
			SC	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
FINE-GRAINED SOILS *more than half of material is smaller than No. 200 sieve*	Silts and Clays *liquid limit is less than 50*		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	*For laboratory classification of fine-grained soils*		
			CL 1	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			CL 2				
			OL	Organic silts and organic silt-clays of low plasticity			
	Silts and Clays *liquid limit is greater than 50*		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils			



Plasticity Chart

NOTE: USCS Modified to include CL-type subcategories

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing charnceteristics of two groups are designated by combinations of group symbols. (For example GW-GC, well graded gravel-sand mixture with clay biner.)

MINE DRY / OFFICE

TEST PITS MDF-1, MDF-2 & MDF-3

TEST PIT LOG

TEST PIT NO. MDF-1 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: MINE DRY FACILITY / N:73,774 E:37,860
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/6/07
DATE COMPLETED: 9/6/07
GROUND ELEVATION: 7720.4'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
7720						CL	brown, dry	SANDY LEAN CLAY								
						CL-ML	brown, slightly moist	GRAVELLY SILTY CLAY W/SAND	102.7	4.9	20	4				CT
	5															
7715					0.70	CL	brown, slightly moist, stiff		94.8	9.9						
					0.81	CL-1	brown, slightly moist, stiff		86.6	8.4	25	11				CT
	10															
7710								LEAN CLAY W/SAND pinhole structure, ~10% cobbles								
					0.95	CL	brown, moist, stiff									
	15															
7705					0.87	CL	brown, moist, stiff									
					0.69	CL-1	brown, moist, stiff	SANDY LEAN CLAY pinhole structure	108.7	10.8	23	10				CT

TP_LOGV1 KINNEYMINE TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:
DISTURBED SAMPLE — Bucket ← Type of Sample
0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. MDF-2 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: MINE DRY FACILITY / N:73,721 E:37,976
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/6/07
DATE COMPLETED: 9/6/07
GROUND ELEVATION: 7729.6'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL	brown, dry — SANDY LEAN CLAY W/GRAVEL								
			■			SC-SM	brown, slightly moist — SILTY CLAYEY SAND W/GRAVEL >20% cobbles	108.6	4.6	20	5	34	38	28	
7725	5														
			■			SM	brown, slightly moist, med. dense — SILTY SAND W/GRAVEL >30% cobbles & boulders	118.5	3.8		NP	38	47	15	
7720	10														
			⊠		0.95	CL	lt. brown, slightly moist, stiff								
7715	15						SANDY LEAN CLAY gravel seams, pinhole structure								
			⊠		0.88	CL-1	lt. brown, moist, stiff	94.8	9.3	23	9	6	38	56	CT
			⊠		0.85	CL	lt. brown, slightly moist, stiff								
7710															

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:
DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. MDF-3 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: MINE DRY FACILITY / N:73,800 E:38,115
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/6/07
DATE COMPLETED: 9/6/07
GROUND ELEVATION: 7744.0'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL	brown, dry	GRAVELLY LEAN CLAY W/SAND								
						-		COAL (fill)								
						CL	brown, dry, very stiff	LEAN CLAY W/SAND								
						SM	brown, slightly moist		106.5	6.1						
7740																
	5							SILTY SAND W/GRAVEL >30% cobbles & boulders								
						SM	brown, slightly moist		102.9	5.8		NP	34	39	27	
7735																
	10					GP-GM	brown, dry									
								GRAVEL W/SILT & SAND >50% cobbles & boulders								
						GP-GM	brown, dry									
7730																
	15															
					0.99+	CL-1	lt. brown, slightly moist, stiff			7.5	22	10				
								LEAN CLAY W/SAND slight pinhole structure								
7725					0.99+	CL-1	lt. brown, slightly moist to dry, stiff			5.3	21	8				

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:
DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
CV-2-1 TH	3	Grab	95.0	9.0		32	15	17				CL-2
	6	Grab		3.1				NP	64	23	13	GM
CV-2-3 TH	3	Grab	106.1	7.6	4000+*	25	13	12				CL-1
	6	Grab	88.6	6.5	4000+*	23	17	6				CL-ML
	9	Grab	97.1	4.8	4000+*	19	15	4				CL-ML / SC-SM
CV-5-1 TH	3	Grab	89.8	5.8	4000+*	22	15	7				CL-1
	9	Grab	90.7	7.1	4000+*	21	17	4				CL-ML
	12	Grab	95.8	9.7	4000+*	22	12	10				CL-1
	19	Grab		9.6	4000+*	23	13	10				CL-1
CL-5-2 TH	12	Grab	112.7	13.8	4000+*	42	16	26				CL-2
	15	Grab		14.1	4000+*	33	15	18				CL-2
WSF-1 TH	6	Grab	97.9	4.5	2827	21	16	5				CL-ML
WSF-2 TH	3	Grab	91.0	4.6				NP	29	45	26	SM
	9	Grab		4.7		19	15	4				CL-ML / SC-SM
WSF-3 TH	6	Grab	89.6	4.6				NP	34	38	28	SM
	9	Grab	96.3	10.1	3000*	22	14	8				CL-1
	12	Grab		6.1	3320*			NP	34	38	28	SM
MDF-1 TH	3	Grab	102.7	4.9		20	16	4				CL-ML / SC-SM
	9	Grab	86.6	8.4	3240*	25	14	11				CL-1
	18.5	Grab	108.7	10.8	2760*	23	13	10				CL-1
MDF-2 TH	3	Grab	108.6	4.6		20	15	5	34	38	28	SC-SM
	6	Grab	118.5	3.8				NP	38	47	15	SM
	15	Grab	94.8	9.3	3520*	23	14	9				CL-1
MDF-3 TH	6	Grab	102.9	5.8				NP	34	39	27	SM
	15	Grab		7.5	4000+*	22	12	10				CL-1
	18	Grab		5.3	4000+*	21	13	8				CL-1
CS-1 TH	6	Grab										Coal
	9	Grab		8.8	2080*	23	14	9				CL-1
	12	Grab		15.5	2240*	24	16	8				CL-1
F-1 TH	6	Grab	91.3	5.6		22	18	4	18	42	40	SC-SM
	9	Grab		6.1		21	16	5				CL-ML / SC-SM

NP=Nonplastic
*pravne value used to estimate unconfined compressive Strength.

Table 2

OTHER LABORATORY TESTING

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE

CHEMICAL TESTS					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	pH	RESISTIVITY (ohm-cm)	SULFATE (%)	USCS (MODIFIED) / AASHTO CLASSIFICATION
3-NS-1	6-7.5	8.0	6761	0.0031	CL-1
11-MDF-2	3	8.2	7202	0.0064	SC-SM
9-WSF-1	6	7.3	3322	0.0195	CL-ML
13-WSF-2	3	7.8	6502	0.0315	SM

DIRECT SHEAR TESTS CONSOLIDATED DRAINED					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	DRY DENSITY (pcf)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	USCS (MODIFIED) / AASHTO CLASSIFICATION
07-CV-5-1 TH	12	95.8	20	15	CL-1

TRIAXIAL SHEAR TESTS MULTI-STAGE CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENTS						
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	TOTAL STRESS		EFFECTIVE STRESS		USCS (MODIFIED) / AASHTO CLASSIFICATION
		FRICTION ANGLE $\Phi_{(cu)}$ (degrees)	COHESION $c_{(cu)}$ (psi)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	
CV-4-1 DRL	20-21.5	29.6	2	36.0	2	CL
SC-2 DRL	23-24	32.5	2	36.7	2	CL-1

* Visual Classification
**Bulk Sample

RB&G ENGINEERING INC.
1435 West 820 North, Provo, Utah 84601
801 374-5771 Provo
801 521-5771 Salt Lake City

PROJECT NO.	200701.045
REPORT NO.	-

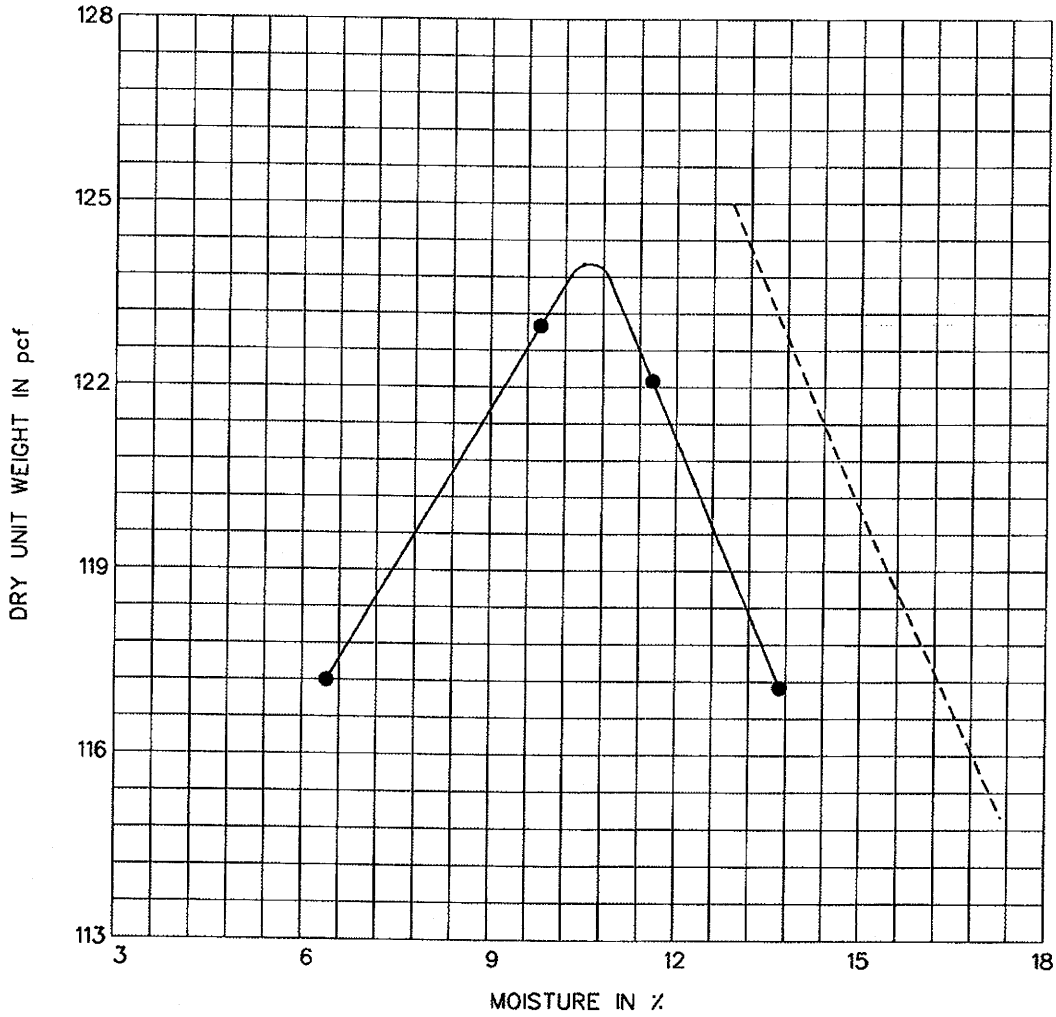
MOISTURE-DENSITY RELATION (PROCTOR)

Project	KINNEY MINE			Date	9/6/07
Location / No.	SCOFIELD, UTAH / MDF-1 TH AT 3'-10'			Technician	G. PEASLEE
Material Description	BROWN SANDY LEAN CLAY	USCS	CL	Method	ASTM D 1557

Procedure Used[1]	B
Classification Procedure[2]	Visual

[1] A-No. 4 Sieve, B-3/8" Sieve, C-3/4" Sieve
[2] Visual as per ASTM D 2488, Test as per ASTM D 2487

Preparation Method	Moist
Rammer Used	Manual
As-Received Moisture Content (%)	6.0



Maximum Dry Density (pcf)	124.0
Optimum Moisture Content (%)	10.5
Corrected Maximum Density (pcf)	**124.0**
Corrected Optimum Moisture Content (%)	**10.5**

- - - - - 100% Saturation Curve

Specific Gravity of Soil	2.70	Est.

OVERSIZE CORRECTION-ASTM D 4718

Specific Gravity of Soil +3/4	2.70	Est.
Percent Oversize	0.0	

Type of Specific Gravity is BULK Unless Otherwise Indicated

RB&G ENGINEERING INC.
1435 West 820 North, Provo, Utah 84601
801 374-5771 Provo
801 521-5771 Salt Lake City

PROJECT NO.	200701.045
REPORT NO.	-

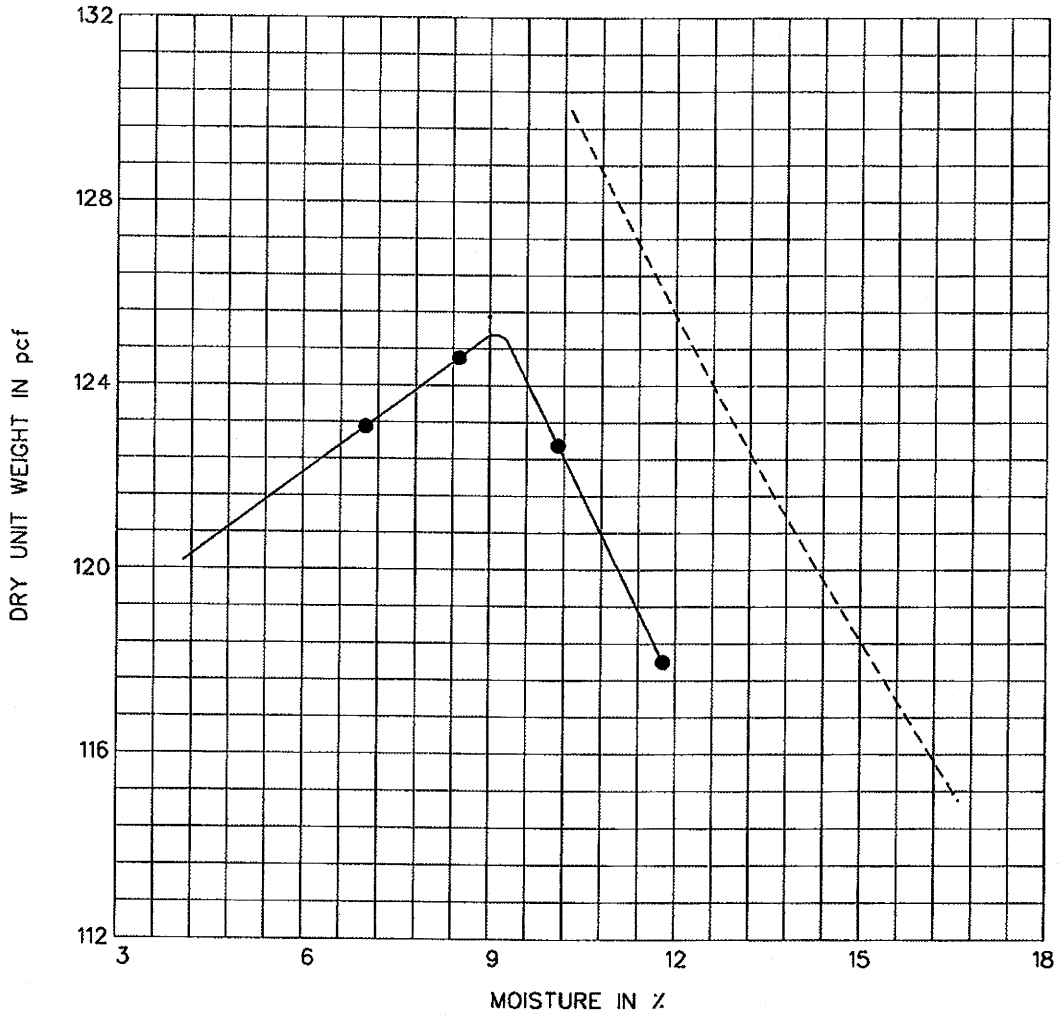
MOISTURE-DENSITY RELATION (PROCTOR)

Project	KINNEY MINE			Date	9/6/07
Location / No.	SCOFIELD, UTAH / WSF-2 TH AT 3'-8'			Technician	G. PEASLEE
Material Description	LT. BROWN SILTY SAND W/GRAVEL	USCS	SM	Method	ASTM D 1557

Procedure Used[1]	C
Classification Procedure[2]	Visual

[1] A-No. 4 Sieve, B-3/8" Sieve, C-3/4" Sieve
[2] Visual as per ASTM D 2488, Test as per ASTM D 2487

Preparation Method	Moist
Rammer Used	Manual
As-Received Moisture Content (%)	5.0



Maximum Dry Density (pcf)	125.5
Optimum Moisture Content (%)	9.0
Corrected Maximum Density (pcf)	128.0
Corrected Optimum Moisture Content (%)	8.5

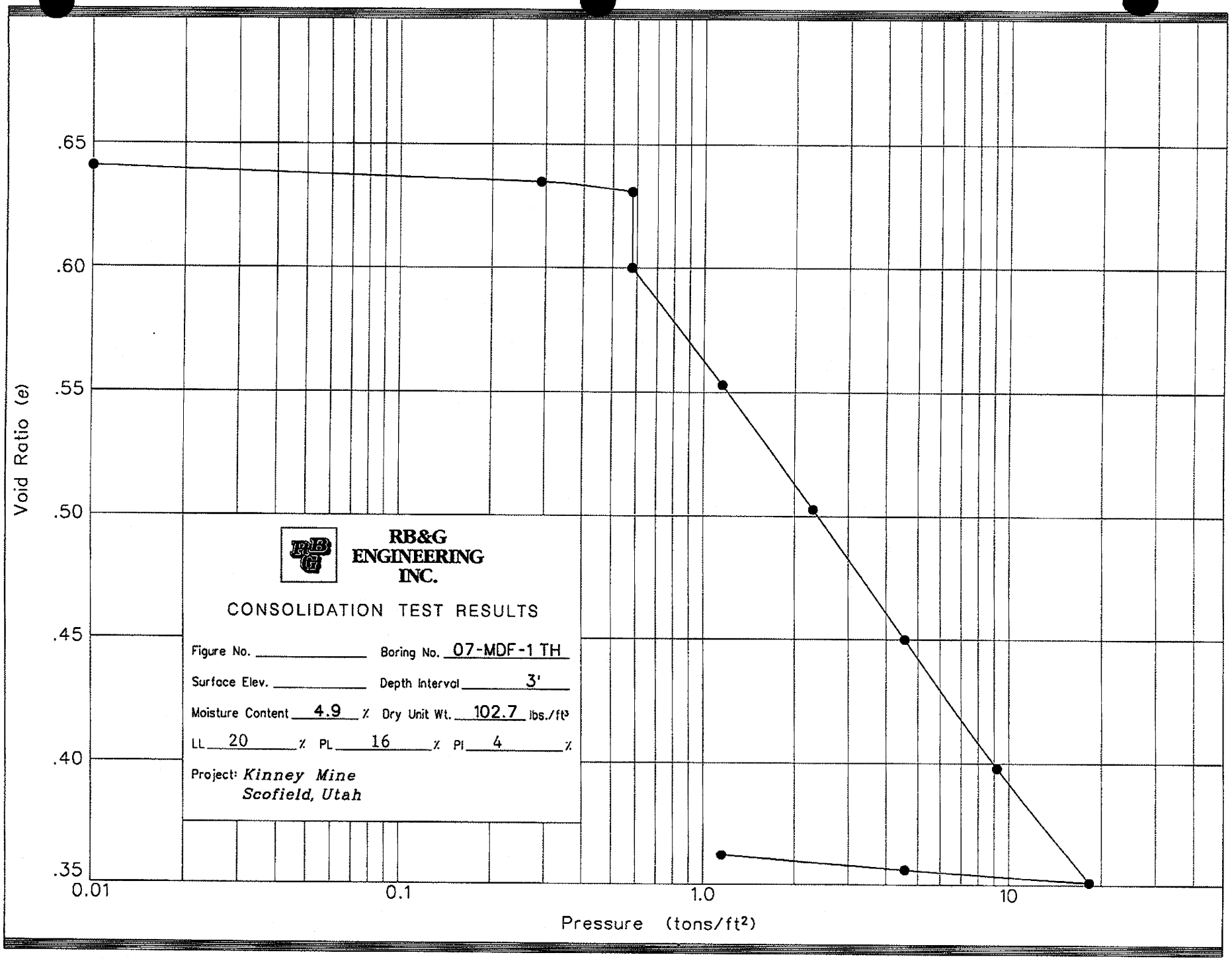
----- 100% Saturation Curve

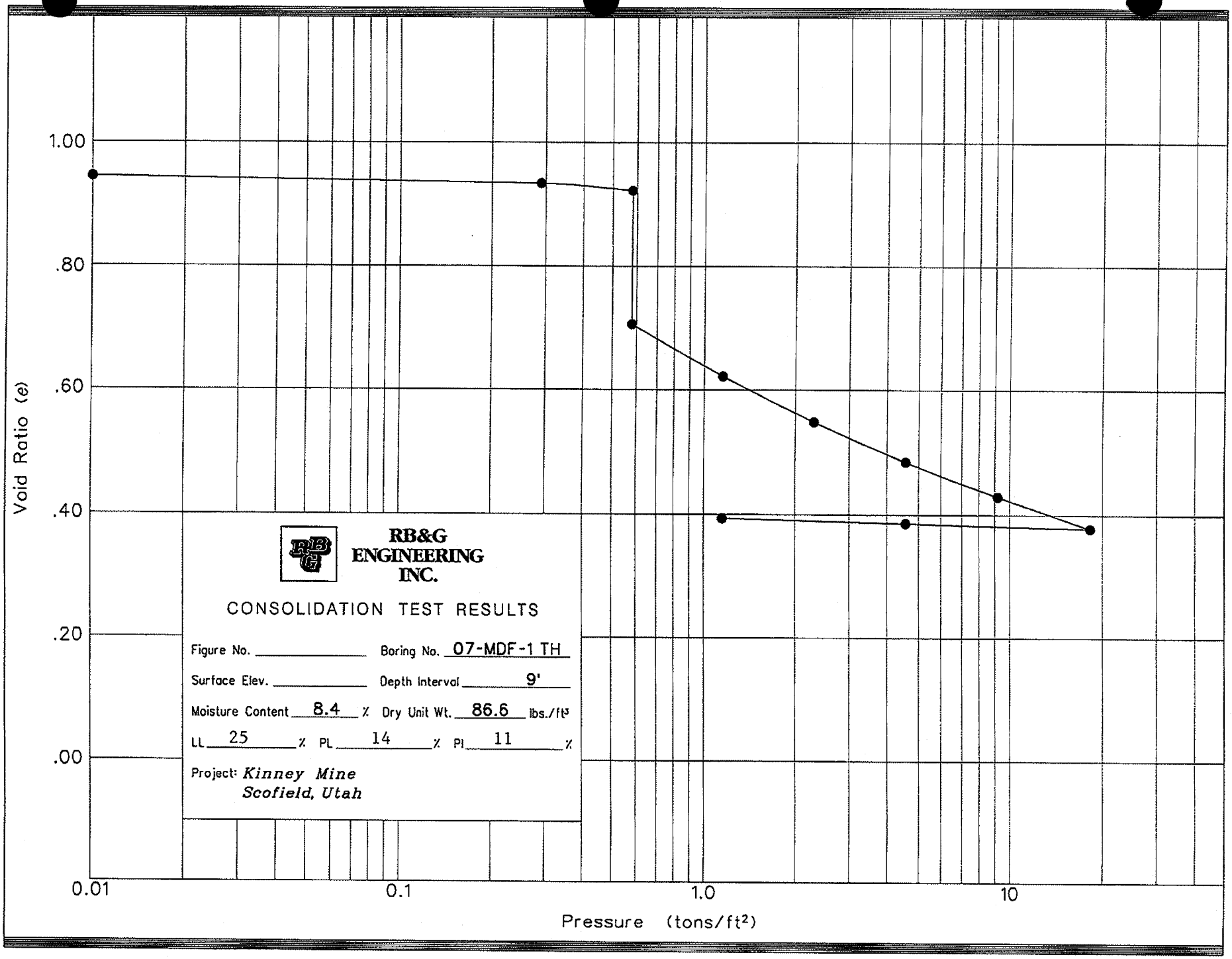
Specific Gravity of Soil	2.65	Est.

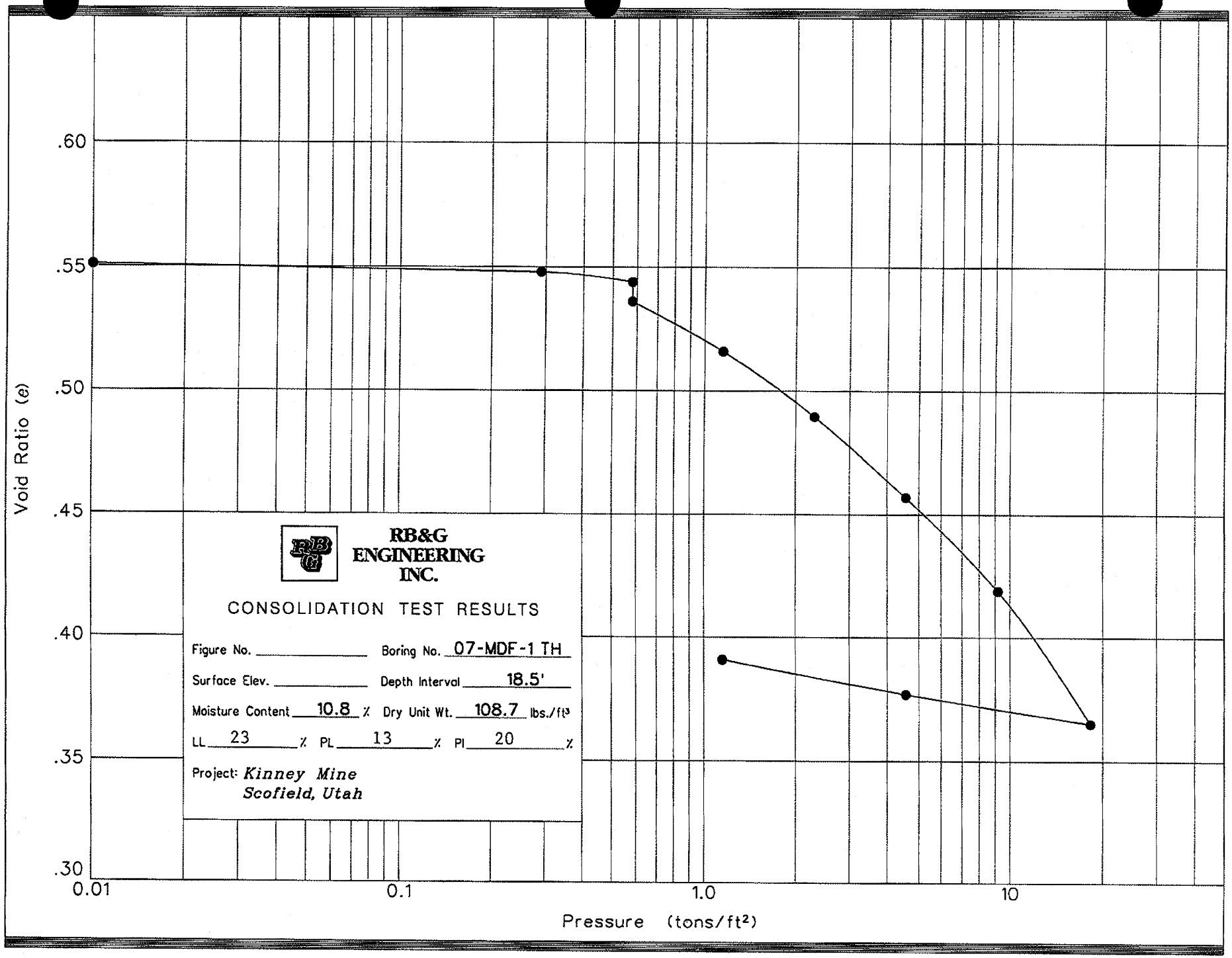
OVERSIZE CORRECTION-ASTM D 4718

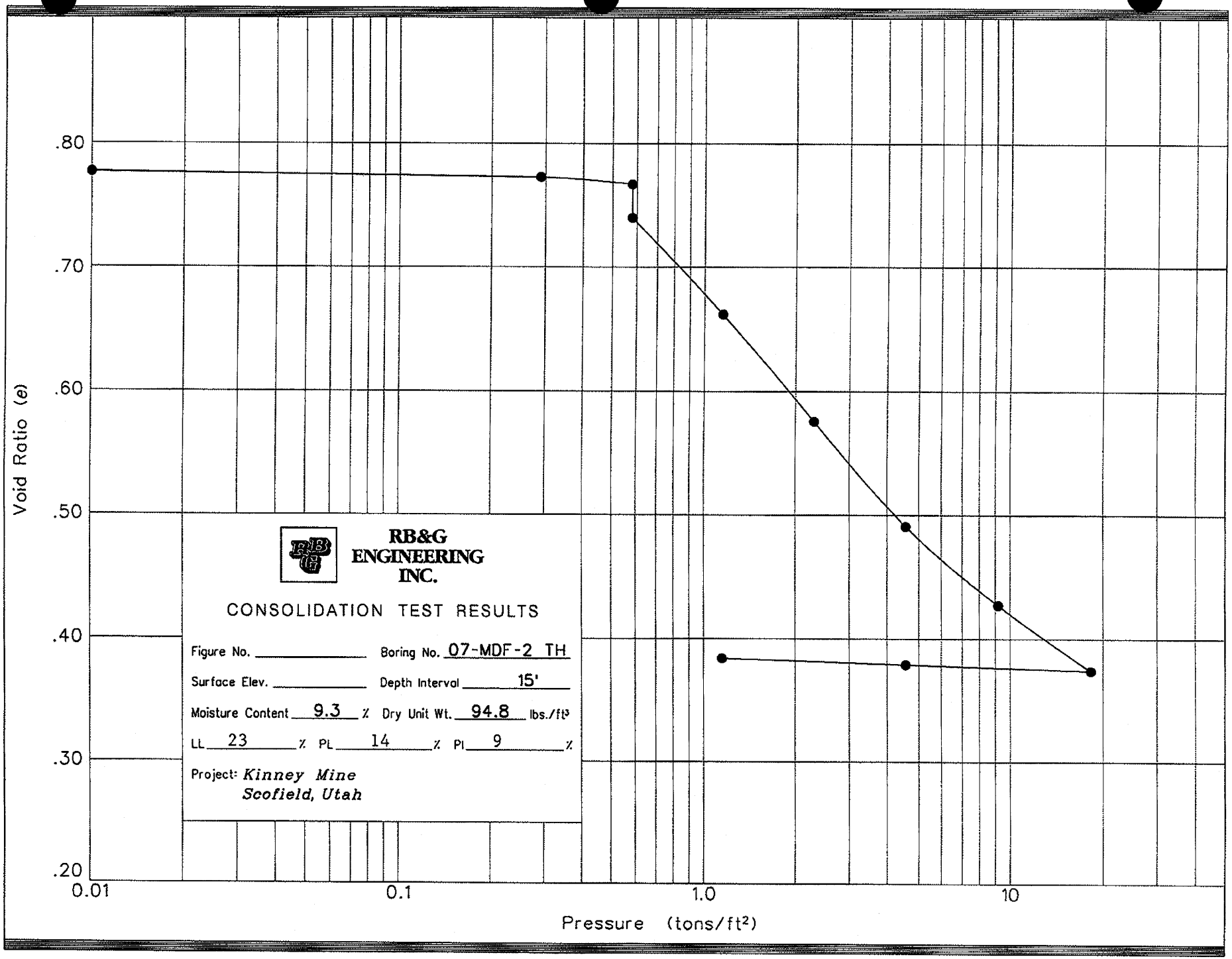
Specific Gravity of Soil +3/4	2.65	Est.
Percent Oversize	10.0	

Type of Specific Gravity is BULK Unless Otherwise Indicated


.65
.60
.55
.50
.45
.40
.35
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING
INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-MDF-1 TH
Surface Elev.
Depth Interval 3'
Moisture Content 4.9 %
Dry Unit Wt. 102.7 lbs./ft³
LL 20 %
PL 16 %
PI 4 %
Project: Kinney Mine
Scofield, Utah


1.00
.80
.60
.40
.20
.00
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING
INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-MDF-1 TH
Surface Elev.
Depth Interval 9'
Moisture Content 8.4 %
Dry Unit Wt. 86.6 lbs./ft³
LL 25 %
PL 14 %
PI 11 %
Project: Kinney Mine
Scofield, Utah


.60
.55
.50
.45
.40
.35
.30
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-MDF-1 TH
Surface Elev.
Depth Interval 18.5'
Moisture Content 10.8 %
Dry Unit Wt. 108.7 lbs./ft³
LL 23 %
PL 13 %
PI 20 %
Project: Kinney Mine
Scofield, Utah


.80
.70
.60
.50
.40
.30
.20
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING
INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-MDF-2 TH
Surface Elev.
Depth Interval 15'
Moisture Content 9.3 %
Dry Unit Wt. 94.8 lbs./ft³
LL 23 %
PL 14 %
PI 9 %
Project: Kinney Mine
Scofield, Utah

SHOP / WAREHOUSE

TEST PITS WSF-1, WSF-2 & WSF-3

TEST PIT LOG

TEST PIT NO. WSF-1 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: WARWEHOUSE & SHOP FACILITY / N:74,287 E:38,116
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/6/07
DATE COMPLETED: 9/6/07
GROUND ELEVATION: 7719.5'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL-ML	brown, dry — SILTY SANDY CLAY (fill)								
						-	COAL (fill)								
7715	5				+1.00	CL-ML	brown, dry, hard — SANDY SILTY CLAY	97.9	4.5	21	5				UC
7710	10					-	lt. brown, dry, dense — SANDSTONE very weathered, more competent w/depth								
7705	15						Trackhoe unable to excavate deeper								
7700															

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. WSF-2 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: WARWEHOUSE & SHOP FACILITY / N:74,287 E:38,116
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/7/07
DATE COMPLETED: 9/7/07
GROUND ELEVATION: 7721.6'
LOGGED BY: J. LINDO

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL	dk. brown, dry	SANDY LEAN CLAY								
7720						-	black, dry	COAL (fill)								
						SM	dk. brown, slightly moist, loose		91	4.6		NP	29	45	26	
	5							SILTY SAND W/GRAVEL occasional cobbles								
7715						SM	dk. brown, slightly moist, loose		89.4	6.5						
	10					CL-ML/ SC-SM	brown, slightly moist	SANDY SILTY CLAY TO SILTY CLAYEY SAND slight pinhole structure		4.7	19	4				
7710						GM	lt. brown, dry	SILTY GRAVEL W/SAND cobbles & boulders increasing w/depth								
	15					GM	lt. brown, dry									
7705								Bottom of excavation very rocky, trackhoe unable to excavate deeper								

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:
DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. WSF-3 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: WARWEHOUSE & SHOP FACILITY / N:74,287 E:38,116
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/7/07
DATE COMPLETED: 9/7/07
GROUND ELEVATION: 7718.7'
LOGGED BY: J. LINDO

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL	dk. brown, dry	SANDY LEAN CLAY								
						-	black, dry	COAL (fill)								
7715						SM	dk. brown, very moist, loose	SILTY SAND W/GRAVEL	84.7	18						
	5					SM	dk. brown, slightly moist, loose		89.6	4.6		NP	34	38	28	
7710					0.75	CL-1	lt. brown, slightly moist, stiff	SANDY LEAN CLAY W/GRAVEL slight pinhole structure	96.3	10.1	22	8				CT
	10				0.83	SM	lt. brown, moist, med. dense	SILTY SAND clay layers to 4" thick		6.1		NP	34	38	28	
7705	15				0.70	CL	lt. brown, moist, stiff	SANDY LEAN CLAY W/GRAVEL >20% cobbles & boulders								
7700					+1.00	CL	lt. brown, moist, very stiff									

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
CV-2-1 TH	3	Grab	95.0	9.0		32	15	17				CL-2
	6	Grab		3.1				NP	64	23	13	GM
CV-2-3 TH	3	Grab	106.1	7.6	4000+*	25	13	12				CL-1
	6	Grab	88.6	6.5	4000+*	23	17	6				CL-ML
	9	Grab	97.1	4.8	4000+*	19	15	4				CL-ML / SC-SM
CV-5-1 TH	3	Grab	89.8	5.8	4000+*	22	15	7				CL-1
	9	Grab	90.7	7.1	4000+*	21	17	4				CL-ML
	12	Grab	95.8	9.7	4000+*	22	12	10				CL-1
	19	Grab		9.6	4000+*	23	13	10				CL-1
CL-5-2 TH	12	Grab	112.7	13.8	4000+*	42	16	26				CL-2
	15	Grab		14.1	4000+*	33	15	18				CL-2
WSF-1 TH	6	Grab	97.9	4.5	2827	21	16	5				CL-ML
WSF-2 TH	3	Grab	91.0	4.6				NP	29	45	26	SM
	9	Grab		4.7		19	15	4				CL-ML / SC-SM
WSF-3 TH	6	Grab	89.6	4.6				NP	34	38	28	SM
	9	Grab	96.3	10.1	3000*	22	14	8				CL-1
	12	Grab		6.1	3320*			NP	34	38	28	SM
MDF-1 TH	3	Grab	102.7	4.9		20	16	4				CL-ML / SC-SM
	9	Grab	86.6	8.4	3240*	25	14	11				CL-1
	18.5	Grab	108.7	10.8	2760*	23	13	10				CL-1
MDF-2 TH	3	Grab	108.6	4.6		20	15	5	34	38	28	SC-SM
	6	Grab	118.5	3.8				NP	38	47	15	SM
	15	Grab	94.8	9.3	3520*	23	14	9				CL-1
MDF-3 TH	6	Grab	102.9	5.8				NP	34	39	27	SM
	15	Grab		7.5	4000+*	22	12	10				CL-1
	18	Grab		5.3	4000+*	21	13	8				CL-1
CS-1 TH	6	Grab										Coal
	9	Grab		8.8	2080*	23	14	9				CL-1
	12	Grab		15.5	2240*	24	16	8				CL-1
F-1 TH	6	Grab	91.3	5.6		22	18	4	18	42	40	SC-SM
	9	Grab		6.1		21	16	5				CL-ML / SC-SM

NP=Nonplastic
*pravne value used to estimate unconfined compressive Strength.

OTHER LABORATORY TESTING

PROJECT Kinney Mine
LOCATION Scofield, Utah

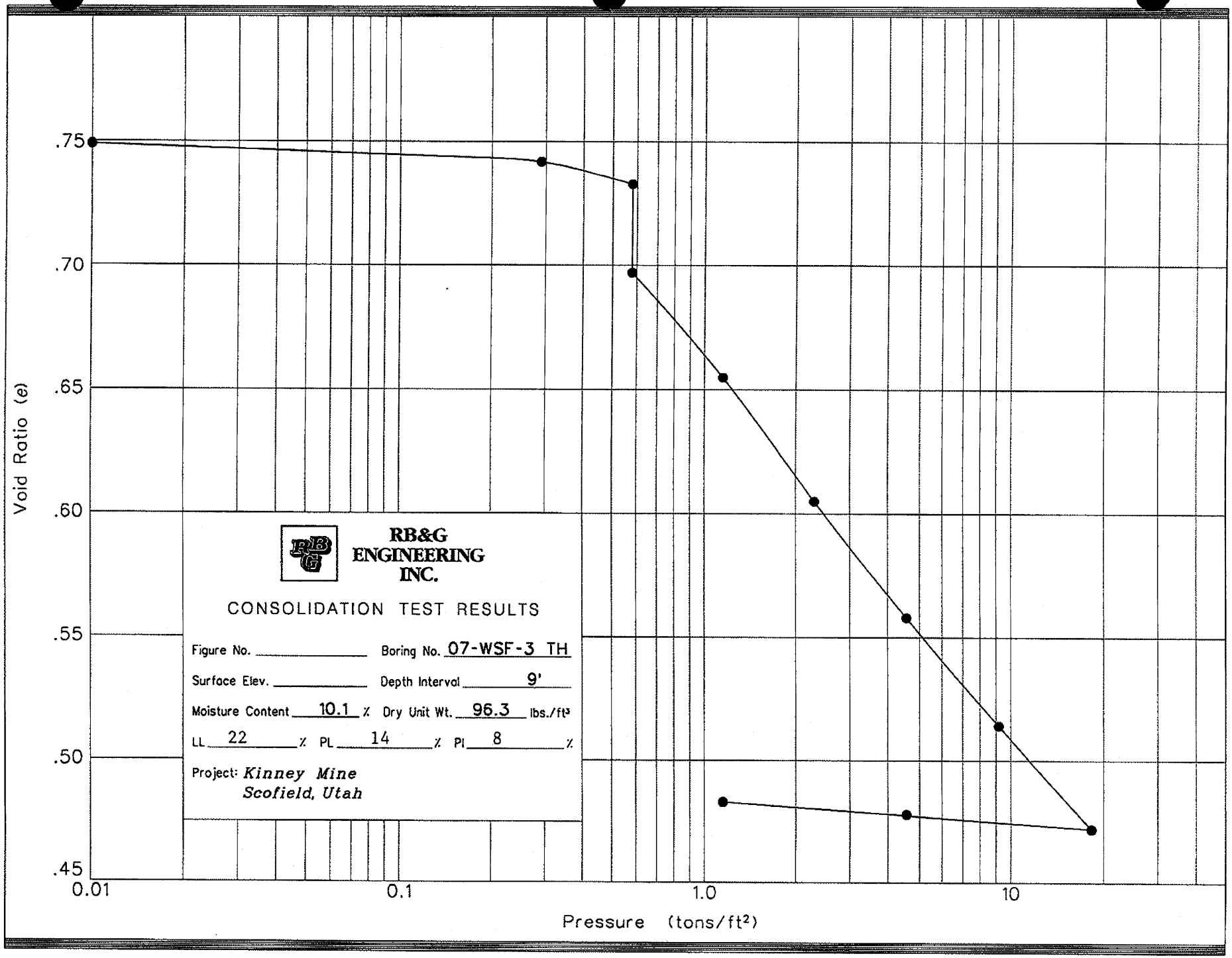
PROJECT NO. 200701-045
FEATURE

CHEMICAL TESTS					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	pH	RESISTIVITY (ohm-cm)	SULFATE (%)	USCS (MODIFIED) / AASHTO CLASSIFICATION
3-NS-1	6-7.5	8.0	6761	0.0031	CL-1
11-MDF-2	3	8.2	7202	0.0064	SC-SM
9-WSF-1	6	7.3	3322	0.0195	CL-ML
13-WSF-2	3	7.8	6502	0.0315	SM

DIRECT SHEAR TESTS CONSOLIDATED DRAINED					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	DRY DENSITY (pcf)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	USCS (MODIFIED) / AASHTO CLASSIFICATION
07-CV-5-1 TH	12	95.8	20	15	CL-1

TRIAXIAL SHEAR TESTS MULTI-STAGE CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENTS						
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	TOTAL STRESS		EFFECTIVE STRESS		USCS (MODIFIED) / AASHTO CLASSIFICATION
		FRICTION ANGLE $\Phi_{(cu)}$ (degrees)	COHESION $c_{(cu)}$ (psi)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	
CV-4-1 DRL	20-21.5	29.6	2	36.0	2	CL
SC-2 DRL	23-24	32.5	2	36.7	2	CL-1

* Visual Classification
**Bulk Sample


.75
.70
.65
.60
.55
.50
.45
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-WSF-3 TH
Surface Elev.
Depth Interval 9'
Moisture Content 10.1 %
Dry Unit Wt. 96.3 lbs./ft³
LL 22 %
PL 14 %
PI 8 %
Project: Kinney Mine
Scofield, Utah

COVERED STORAGE & FUEL STRUCTURE

TEST PITS CS-1 & F-1

TEST PIT LOG

TEST PIT NO. CS-1 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: COVERED STORAGE / N:74,530 E:38,348
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/6/07
DATE COMPLETED: 9/6/07
GROUND ELEVATION: 7716.6'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL	dk. brown, dry	SANDY LEAN CLAY W/GRAVEL								
7715																
						-	black, dry									
	5							COAL fine grained, occasional gravel layer (fill)								
7710						-	black, dry									
					0.52	CL-1	dk. brown, slightly moist, stiff	SANDY LEAN CLAY (fill?)		8.8	23	9				
	10															
7705					0.56	CL-1	orange-brown, moist, stiff	SANDY LEAN CLAY W/GRAVEL pinhole structure		15.5	24	8				
	15				0.55	CL	orange-brown, moist, stiff									
7700						GM	orange-brown, moist	SILTY GRAVEL W/SAND								
					0.85	CL	lt. brown, moist, stiff	LEAN CLAY W/SAND								

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. F-1 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: FUEL / N:74,629 E:38,415
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/7/07
DATE COMPLETED: 9/7/07
GROUND ELEVATION: 7724.0'
LOGGED BY: J. LINDO

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						CL	dk. brown, dry	SANDY LEAN CLAY								
7720	5		■			SC-SM	brown, slightly moist, loose	SILTY CLAYEY SAND W/GRAVEL coal layers (fill)	89.3	6.2						
			■			SC-SM	brown, slightly moist, loose		91.3	5.6	22	4	18	42	40	
7715	10		■			CL-ML/ SC-SM	dk. brown, slightly moist	SANDY SILTY CLAY TO SILTY CLAYEY SAND		6.1	21	5				
			■			SM	lt. brown, slightly moist	SILTY SAND W/GRAVEL more gravel w/depth								
7710	15		■			GM	lt. brown, slightly moist, dense	SILTY GRAVEL W/SAND								
7705																

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE ■ Bucket ← Type of Sample
0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE ☒

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
CV-2-1 TH	3	Grab	95.0	9.0		32	15	17				CL-2
	6	Grab		3.1				NP	64	23	13	GM
CV-2-3 TH	3	Grab	106.1	7.6	4000+*	25	13	12				CL-1
	6	Grab	88.6	6.5	4000+*	23	17	6				CL-ML
	9	Grab	97.1	4.8	4000+*	19	15	4				CL-ML / SC-SM
CV-5-1 TH	3	Grab	89.8	5.8	4000+*	22	15	7				CL-1
	9	Grab	90.7	7.1	4000+*	21	17	4				CL-ML
	12	Grab	95.8	9.7	4000+*	22	12	10				CL-1
	19	Grab		9.6	4000+*	23	13	10				CL-1
CL-5-2 TH	12	Grab	112.7	13.8	4000+*	42	16	26				CL-2
	15	Grab		14.1	4000+*	33	15	18				CL-2
WSF-1 TH	6	Grab	97.9	4.5	2827	21	16	5				CL-ML
WSF-2 TH	3	Grab	91.0	4.6				NP	29	45	26	SM
	9	Grab		4.7		19	15	4				CL-ML / SC-SM
WSF-3 TH	6	Grab	89.6	4.6				NP	34	38	28	SM
	9	Grab	96.3	10.1	3000*	22	14	8				CL-1
	12	Grab		6.1	3320*			NP	34	38	28	SM
MDF-1 TH	3	Grab	102.7	4.9		20	16	4				CL-ML / SC-SM
	9	Grab	86.6	8.4	3240*	25	14	11				CL-1
	18.5	Grab	108.7	10.8	2760*	23	13	10				CL-1
MDF-2 TH	3	Grab	108.6	4.6		20	15	5	34	38	28	SC-SM
	6	Grab	118.5	3.8				NP	38	47	15	SM
	15	Grab	94.8	9.3	3520*	23	14	9				CL-1
MDF-3 TH	6	Grab	102.9	5.8				NP	34	39	27	SM
	15	Grab		7.5	4000+*	22	12	10				CL-1
	18	Grab		5.3	4000+*	21	13	8				CL-1
CS-1 TH	6	Grab										Coal
	9	Grab		8.8	2080*	23	14	9				CL-1
	12	Grab		15.5	2240*	24	16	8				CL-1
F-1 TH	6	Grab	91.3	5.6		22	18	4	18	42	40	SC-SM
	9	Grab		6.1		21	16	5				CL-ML / SC-SM

NP=Nonplastic
*pravne value used to estimate unconfined compressive Strength.

CONVEYOR SECTION-1

BORING PORTAL-1 & TEST PIT TT-1-2

DRILL HOLE LOG

BORING NO. PORTAL-1 DRL

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: TRANSFER TOWER / N:74,072 E:38,924
DRILLING METHOD: SIMCO 2800 / C.F. AUGER & H.Q. CORE W/AIR
DRILLER: S. MCCRAKEN
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 8/31/07
DATE COMPLETED: 8/31/07
GROUND ELEVATION: 7890.6'
LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
7890				10	6,10	CL-ML	lt. brown, dry	SANDY SILTY CLAY								
						GM	lt. brown, dry									
	5			13	Core 55,0	GM	yellow & lt. brown, dry									
7885								INTERBEDDED SILTSTONE & SANDSTONE GRAVELS & COBBLES IN A SANDY SILT MATRIX occasional clay layers to 1" thick								
				13	Core 28,0	GM	yellow & lt. brown, dry									
	10															
7880				10	5,10,7	GM	yellow & lt. brown, dry, loose			5		NP	55	23	22	
				0	Core 0,0	-										
				9	9,5,2 0.39	CL	gray-brown, slightly moist, firm	LEAN CLAY W/SAND								
	15			0	Core 0,0	-										
7875								SILTY SANDSTONE VERY HIGHLY WEATHERED								
				2	14,11,10	GM	yellow, dry									
					1.88	CL	dk. brown, very stiff	LEAN CLAY								
				18	Core 100,0	OH	black, dry									
	20			11	4,6,10	OH	black, dry, med. dense	COAL very highly weathered		72	78	4	0	41	59	
7870				0	Core 0,0	-										
								CLAYEY MUDSTONE very highly weathered								
				42	Core 117,50	GM	lt. brown, dry	SANDSTONE more competent w/depth								

OH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 11/1/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2 ← Blow Count per 6"; 0.45 ← Torvane (tsf)
CORE — CORE 95,60 ← Rock Quality Designation (% RQD); ← Percent Sample Recovery
UNDISTURBED SAMPLE — PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. TT-1-2 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: TRANSFER TOWER / N:74,070 E:38,873
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/5/07
DATE COMPLETED: 9/5/07
GROUND ELEVATION: 7873.1'
LOGGED BY: M.N.H.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						ML	lt. brown w/some green, dry	SANDY SILT W/ORGANICS								
7870						CL-ML	lt. brown, dry	SILTY CLAY W/GRAVEL some pinhole structure, flagstone cobbles of sandstone								
						GC	dry	COBBLES & GRAVEL W/CLAY								
	5					CL/GC	lt. brown, dry	GRAVELLY CLAY TO CLAYEY GRAVEL								
						CL-ML	dk. brown, dry	SILTY CLAY W/GRAVEL								
						GC	lt. brown, dry	GRAVEL W/CLAY cobbles & boulders								
7865																

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

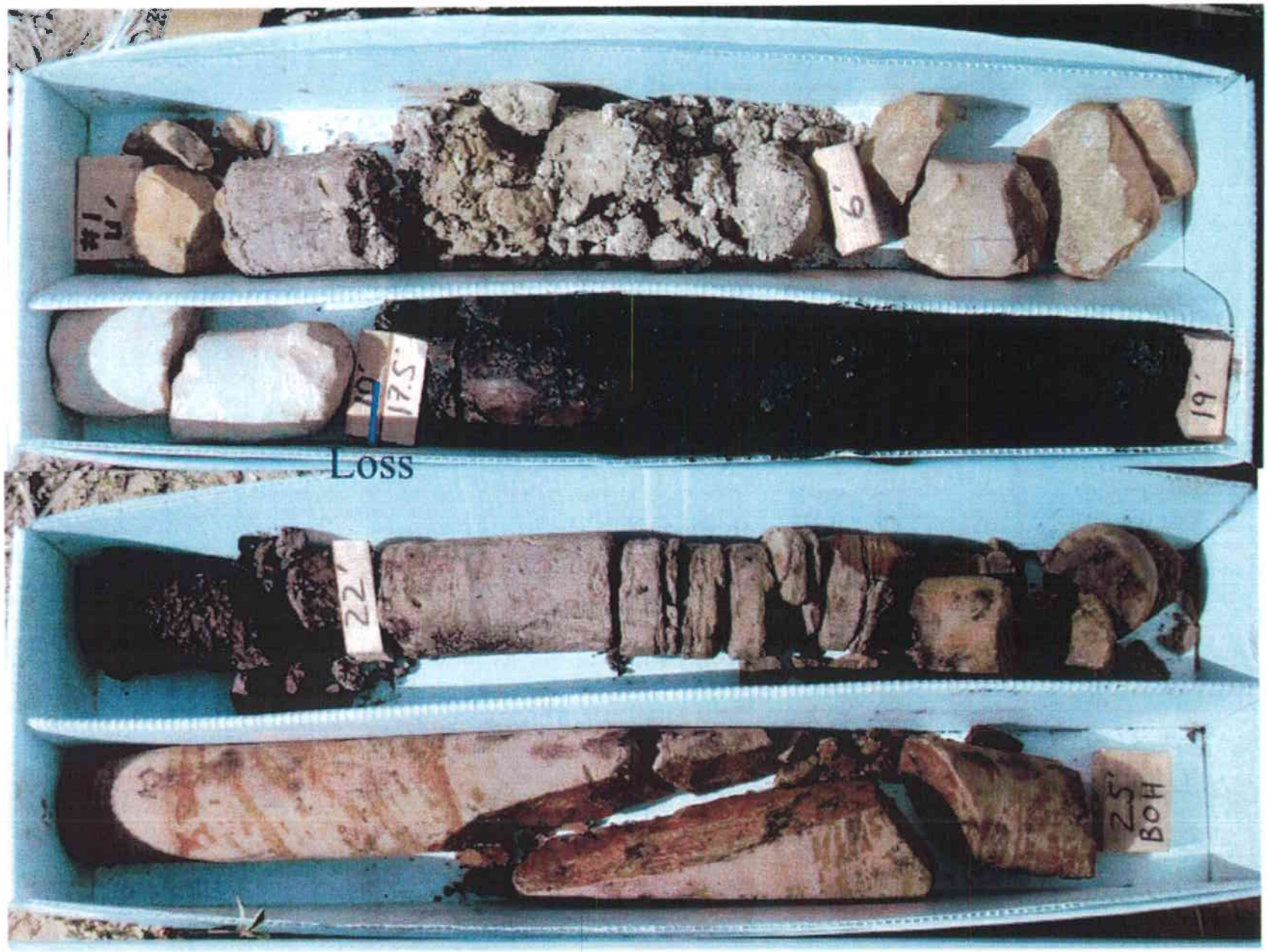
RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio



TT-1-DH

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
Portal 1-DRL	10-11.5	17		5.0				NP	55	23	22	GM
	19-20.5	16		72.0		78	74	4	0	41	59	OH
CV-2-2 DRL	3-4.5	52		3.6				NP	15	59	26	SM
	9-10.5	11		4.9				NP	17	61	22	SM
	15-16.5	19		4.4				NP	42	49	9	SP-SM
	25-26.5	19		10.7		31	15	16				CL-2
NS-1 DRL	6-7.5	28		5.3		22	13	9				CL-1
	9-10.5	52		6.1		26	13	13				CL-1
	15-16.5	46		5.3				NP	6	25	69	ML
	22.5-24	23		11.8		26	13	13				CL-1
	31.5-31.9		109.6	18.8								CL
S-1 DRL	10-11.5	23		7.8		28	14	14				CL-1
	20-21.5	19		12.9		24	14	10				CL-1
	30-31.5	27		12.8		26	14	12				CL-1
	40-41.5	25		17.5	6280*	28	15	13				CL-1
	50-51.5	29		16.2	5840*	34	15	19				CL-2
	57		113.9	16.3								
	66		103.4	18.1								CL
	70-71.5	35		17.2	8280*	35	14	21				CL-2
CV-4-1 DRL	5-6.5	21		10.0		25	18	7				CL-1
	10.5-15	Core		9.2		20	13	7	24	24	52	CL-1
	15-16.5	55		10.2		21	11	10				CL-1
	21.5-25	Core		11.9	3600*	22	12	10				CL-1
	25-26.5	22		13.8	2240*	26	10	16				CL-2
	31.5-35	Core		10.5	2220*	21	10	11				CL-1
	35-36.5	9		17.1	3200*	21	11	10				CL-1
	41.5-45	Core		17.1		29	13	16				CL-2
	45-46.5	74		14.6	3320*	30	14	16				CL-2
	55-60	Core		12.6	4000*	21	14	7				CL-1
	66.5-70	Core		12.6	4000*	29	11	18	15	19	66	CL-2
SC-2 DRL	23-24					24	12	12				CL-1

NP=Nonplastic
*Torvane value used to estimate unconfined compressive strength.

CONVEYOR SECTION-2

TEST PIT CV-2-1, BORING CV-2-2, & TEST PIT CV-2-3

TEST PIT LOG

TEST PIT NO. CV-2-1 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:74,184 E:38,833
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/5/07
DATE COMPLETED: 9/5/07
GROUND ELEVATION: 7862.7'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
							SANDY LEAN CLAY W/GRAVEL ~30% cobbles & boulders								
7860						CL-2	brown, slightly moist, stiff	95	9	32	17				
							COAL								
	5					GM	lt. brown, dry, dense		3.1		NP	64	23	13	
7855							COBBLES & BOULDERS IN SILTY SAND MATRIX >80% gravel, cobbles & boulders; fractured & weathered sandstone								
	10					GM	lt. brown, dry, dense								
7850															
	15					-	lt. brown, dry								
7845							SANDSTONE competent, trackhoe able to excavate w/difficulty								

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:
DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

DRILL HOLE LOG

BORING NO. CV-2-2 DRL

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:74,404 E:38,793
DRILLING METHOD: SIMCO 2800 / C.F. AUGER
DRILLER: S. MCCRAKEN
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/1/07
DATE COMPLETED: 9/1/07
GROUND ELEVATION: 7841.2'
LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
7840				18	4,5,5	CL-ML	gray-brown, dry, firm	SANDY SILTY CLAY								
						CL-ML	lt. brown, dry									
				16	9,27,25	SM	yellow-brown, dry, very dense			3.6		NP	15	59	26	
	5															
7835				12	30,21,12	SM	yellow-brown, dry, dense									
								SILTY SAND W/GRAVEL very highly weathered sandstone								
	10			18	4,5,6	SM	yellow-brown, dry, med. dense			4.9		NP	17	61	22	
7830																
				11	3,6,7	SM	yellow-brown, dry, med. dense									
	15															
7825				12	11,9,10	SP-SM	lt. brown, dry, med. dense			4.4		NP	42	49	9	
								SAND W/SILT & GRAVEL very highly weathered sandstone								
	20															
7820				11	4,5,7	SP-SM	lt. brown, dry, med. dense									
	25															
7815				15	4,7,12	CL-2	gray-brown, slightly moist, stiff			10.7	31	16				
								LEAN CLAY W/SAND very highly weathered mudstone								
	30					CL	yellow-brown, slightly moist, stiff									
7810				12	7,11,36	SM	yellow-brown	SILTY SAND W/GRAVEL very highly weathered sandstone								

DH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 11/1/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE: 2,3,2 ← Blow Count per 6"; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. CV-2-3 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:74,617 E:38,738
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/5/07
DATE COMPLETED: 9/5/07
GROUND ELEVATION: 7805.2'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
7805																
					+1.00	CL-1	dk. brown, dry to slightly moist, very stiff	SANDY LEAN CLAY W/GRAVEL (fill)	106.1	7.6	25	12				
7800	5															
								COAL & ORGANIC LAYER								
					+1.00	CL-ML	lt. brown, dry, very stiff	SANDY SILTY CLAY W/GRAVEL very blocky	88.6	6.5	23	6				
					+1.00	CL-ML/ SC-SM	lt. brown, dry, very stiff	SANDY SILTY CLAY TO SILTY CLAYEY SAND pinhole structure	97.1	4.8	19	4				
7795	10															
						-	lt. brown, dry, dense	SANDSTONE weathered, becomes more competent w/depth								
7790	15															

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

SIUFF
25.0
25.5
DH-2
Soils
26.0
26.5

SIUFF
29.5
Kinney
DH. 2
Soils
31.0
31.5

CV-2

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
Portal 1-DRL	10-11.5	17		5.0				NP	55	23	22	GM
	19-20.5	16		72.0		78	74	4	0	41	59	OH
CV-2-2 DRL	3-4.5	52		3.6				NP	15	59	26	SM
	9-10.5	11		4.9				NP	17	61	22	SM
	15-16.5	19		4.4				NP	42	49	9	SP-SM
	25-26.5	19		10.7		31	15	16				CL-2
NS-1 DRL	6-7.5	28		5.3		22	13	9				CL-1
	9-10.5	52		6.1		26	13	13				CL-1
	15-16.5	46		5.3				NP	6	25	69	ML
	22.5-24	23		11.8		26	13	13				CL-1
	31.5-31.9		109.6	18.8								CL
S-1 RL	10-11.5	23		7.8		28	14	14				CL-1
	20-21.5	19		12.9		24	14	10				CL-1
	30-31.5	27		12.8		26	14	12				CL-1
	40-41.5	25		17.5	6280*	28	15	13				CL-1
	50-51.5	29		16.2	5840*	34	15	19				CL-2
	57		113.9	16.3								
	66		103.4	18.1								CL
	70-71.5	35		17.2	8280*	35	14	21				CL-2
CV-4-1 DRL	5-6.5	21		10.0		25	18	7				CL-1
	10.5-15	Core		9.2		20	13	7	24	24	52	CL-1
	15-16.5	55		10.2		21	11	10				CL-1
	21.5-25	Core		11.9	3600*	22	12	10				CL-1
	25-26.5	22		13.8	2240*	26	10	16				CL-2
	31.5-35	Core		10.5	2220*	21	10	11				CL-1
	35-36.5	9		17.1	3200*	21	11	10				CL-1
	41.5-45	Core		17.1		29	13	16				CL-2
	45-46.5	74		14.6	3320*	30	14	16				CL-2
	55-60	Core		12.6	4000*	21	14	7				CL-1
	66.5-70	Core		12.6	4000*	29	11	18	15	19	66	CL-2
SC-2 DRL	23-24					24	12	12				CL-1

NP=Nonplastic
*vane value used to estimate unconfined compressive strength.

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
CV-2-1 TH	3	Grab	95.0	9.0		32	15	17				CL-2
	6	Grab		3.1				NP	64	23	13	GM
CV-2-3 TH	3	Grab	106.1	7.6	4000+*	25	13	12				CL-1
	6	Grab	88.6	6.5	4000+*	23	17	6				CL-ML
	9	Grab	97.1	4.8	4000+*	19	15	4				CL-ML / SC-SM
CV-5-1 TH	3	Grab	89.8	5.8	4000+*	22	15	7				CL-1
	9	Grab	90.7	7.1	4000+*	21	17	4				CL-ML
	12	Grab	95.8	9.7	4000+*	22	12	10				CL-1
	19	Grab		9.6	4000+*	23	13	10				CL-1
CL-5-2 TH	12	Grab	112.7	13.8	4000+*	42	16	26				CL-2
	15	Grab		14.1	4000+*	33	15	18				CL-2
WSF-1 TH	6	Grab	97.9	4.5	2827	21	16	5				CL-ML
WSF-2 TH	3	Grab	91.0	4.6				NP	29	45	26	SM
	9	Grab		4.7		19	15	4				CL-ML / SC-SM
WSF-3 TH	6	Grab	89.6	4.6				NP	34	38	28	SM
	9	Grab	96.3	10.1	3000*	22	14	8				CL-1
	12	Grab		6.1	3320*			NP	34	38	28	SM
MDF-1 TH	3	Grab	102.7	4.9		20	16	4				CL-ML / SC-SM
	9	Grab	86.6	8.4	3240*	25	14	11				CL-1
	18.5	Grab	108.7	10.8	2760*	23	13	10				CL-1
MDF-2 TH	3	Grab	108.6	4.6		20	15	5	34	38	28	SC-SM
	6	Grab	118.5	3.8				NP	38	47	15	SM
	15	Grab	94.8	9.3	3520*	23	14	9				CL-1
MDF-3 TH	6	Grab	102.9	5.8				NP	34	39	27	SM
	15	Grab		7.5	4000+*	22	12	10				CL-1
	18	Grab		5.3	4000+*	21	13	8				CL-1
CS-1 TH	6	Grab										Coal
	9	Grab		8.8	2080*	23	14	9				CL-1
	12	Grab		15.5	2240*	24	16	8				CL-1
F-1 TH	6	Grab	91.3	5.6		22	18	4	18	42	40	SC-SM
	9	Grab		6.1		21	16	5				CL-ML / SC-SM

NP=Nonplastic
*Toravne value used to estimate unconfined compressive Strength.

CONVEYOR SECTION-3

BORINGS NS-1 & S-1

DRILL HOLE LOG

BORING NO. NS-1 DRL

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: NON-SPEC COAL STOCKPILE / N:74,729 E:74,72938,707
DRILLING METHOD: SIMCO 2800 / C.F. AUGER & H.Q. CORE
DRILLER: S. MCCRAKEN
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 8/30/07
DATE COMPLETED: 9/1/07
GROUND ELEVATION: 7785.2'
LOGGED BY: M.N.H., G.L.H.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				11	13,16,16	CL-ML	gray-brown, dry, very stiff	SANDY SILTY CLAY occasional cobbles								
				13	7,7,10	CL-ML	dk. brown, dry, stiff, slight pinhole structure									
7780	5			11	11,13,15	CL-1	mottled rust & brown, dry, very stiff	SANDY LEAN CLAY		5.3	22	9				
7775	10			15	9,24,28	CL-1	mottled gray-brown, dry, hard			6.1	26	13				
				9	32,50/3"	GC-GM	gray-brown, dry, dense	SILTY CLAYEY GRAVEL W/SAND possible cobbles								
7770	15			13	11,19,27	OH ML	black, dry lt. brown, dry, dense	COAL very highly weathered SANDY SILT very highly weathered siltstone		5.3		NP	6	25	69	
				5	19,50/3"	SM	lt. brown, dry, dense	SILTY SAND W/GRAVEL very highly weathered sandstone, more competent w/depth								
7765	20			6	Core 50,30	SM	lt. brown, dry									
				0	Core 0,0	-										
				0	Core 0,0	-										
				15	7,10,13 0.80	CL-1	brown, slightly moist, stiff			11.8	26	13				
7760	25			2	10,10,14	CL	brown, slightly moist, stiff	SANDY LEAN CLAY W/GRAVEL								
7755	30			18	5,10,12 0.90+	CL	lt. brown, yellow-brown & gray, moist, very stiff		109.6	18.8						CT
				0	Core 0,0	-										
7750	35			30	Core 1.78 50,0	CL	lt. brown & yellow-brown, moist, very stiff									
				42	Core 100,0	CL,GM	tan, dk. gray & yellow-brown, slightly moist, very stiff									
7745	40			35	Core 100,0	CL,GM	lt. brown & yellow-brown, slightly moist	SANDY LEAN CLAY W/GRAVEL sandstone cobbles and/or boulders								
				25	Core 72,0	CL,GM	lt. brown, gray & yellow-brown, slightly moist									
7740	45			19	Core 76,0	CL,GM	lt. brown, rust & gray, slightly moist									
				36	Core 97,0	CL,GM	lt. brown, gray & yellow-brown, slightly moist									

DH_LOGV3_KINNEYMINE_DH.GPJ US EVAL.GDT 12/13/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE: 2,3,2 ← Blow Count per 6"; 0.45 ← Torvane (tsf)
CORE: CORE 95,60 ← Rock Quality Designation (% RQD); ← Percent Sample Recovery
UNDISTURBED SAMPLE: PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

DRILL HOLE LOG

BORING NO. S-1 DRL

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: SPEC COAL STOCKPILE / N:74,730 E:38,707
DRILLING METHOD: LONGYEAR 44 & CME-2800 / C.F. AUGER & H.Q. CORE
DRILLER: S. MCCRAKEN
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/2/07
DATE COMPLETED: 9/12/07
GROUND ELEVATION: 7784.6'
LOGGED BY: G.L.H., M.N.H

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				12	12,16,21	CL-ML	dk. brown to black, dry, very stiff	SANDY SILTY CLAY coal & sandstone gravels, occasional cobbles								
				18	10,11,15	CL-ML	brown, dry, very stiff, slight pinhole structure									
7780	5															
7775	10			18	10,13,26	CL-1	dk. gray to brown, dry to slightly moist, hard			7.8	28	14				
7770	15			13	10,16,20	CL	dk. gray to lt. gray-brown, dry to slightly moist, hard									
7765	20			18	7,10,9	CL-1	lt. brown to gray, slightly moist, very stiff			12.9	24	10				
7760	25			18	13,10,10	CL	dk. gray to brown, slightly moist, very stiff	SANDY LEAN CLAY W/GRAVEL sandstone cobbles & boulders, sand layers to 3" thick								
7755	30			18	7,10,17	CL-1	lt. brown, slightly moist, very stiff			12.8	26	12				
				34	Core 2.20 100,0	CL	lt. orange-brown, slightly moist, very stiff									
7750	35			0	Core	-										
				2	0,0 14,10,11	CL	rust-brown, very moist, very stiff									
				22	Core 1.45 51,29	CL	gray-brown, moist, very stiff									
7745	40			8	7,13,12 1.57	CL-1	orange-brown, moist, very stiff			17.5	28	13				
				41	Core 1.63 97,86	CL	gray-brown, moist, very stiff									
7740	45			2	4,6,7 0.91	CL	gray, moist, stiff									
7735				24	Core 0.85 57,57	CL	gray to lt. brown, moist, stiff to very stiff									

DH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 12/13/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE: 2,3,2 ← Blow Count per 6"; 0.45 ← Torvane (tsf)
CORE: CORE 95,60 ← Rock Quality Designation (% RQD); ← Percent Sample Recovery
UNDISTURBED SAMPLE: PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

DRILL HOLE LOG

BORING NO. S-1 DRL

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: SPEC COAL STOCKPILE / N:74,730 E:38,707
DRILLING METHOD: LONGYEAR 44 & CME-2800 / C.F. AUGER & H.Q. CORE
DRILLER: S. MCCRAKEN
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/2/07
DATE COMPLETED: 9/12/07
GROUND ELEVATION: 7784.6'
LOGGED BY: G.L.H., M.N.H

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				18	8,13,16 *1.46*	CL-2	lt. gray-brown, moist, very stiff	SANDY LEAN CLAY W/GRAVEL sandstone cobbles & boulders, sand layers to 3" thick		16.2	34	19				
				42	Core *100,0*	CL	lt. orange-brown, moist, very stiff									
7730	55			18	8,19,24 *0.90+*	CL	lt. brown, moist, very stiff to hard									
				42	Core *1.37* *100,63*	CL	gray to rusty-brown & lt. brown, moist, hard		113.9	16.3						CT
7725	60			22	Core *0.90* *36,0*	CL	yellow-brown to brown, moist, stiff									
7720	65			62	Core *2.37* *104,100*	CL	gray-brown & yellow-brown, moist, hard	SANDY LEAN CLAY W/GRAVEL sandstone & mudstone cobbles & boulders	103.4	18.1						CT
7715	70			18	10,17,18 *2.07*	CL-2	brown, moist, hard			17.2	35	21				
				42	Core *2.14* *100,100*	CL	brown, moist, hard									
7710	75			18	10,19,20 *0.90+*	CL	brown to lt. brown, moist, hard									
7705	80															
7700	85															
7695	90															
7690	95															
7685																

DH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 12/13/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2 ← Blow Count per 6"; *0.45* ← Torvane (tsf)
CORE — CORE *95,60* ← Rock Quality Designation (% RQD); Percent Sample Recovery
UNDISTURBED SAMPLE — PUSHED *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

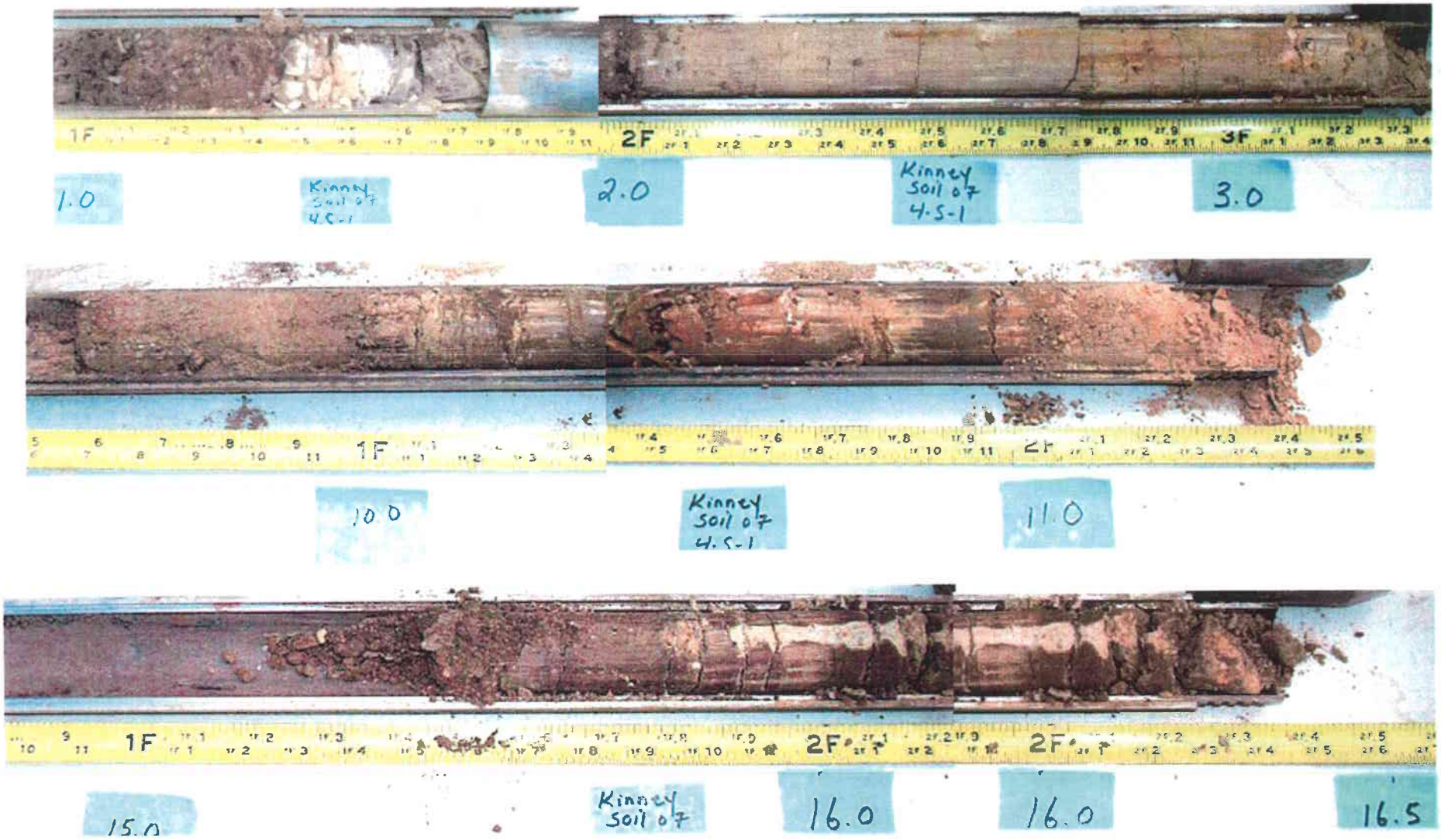
Photo Loss

1F
Kinney Soil
3-NS-1

2F
3F
47.0
Kinney Soil 07
3-NS-1
48.0

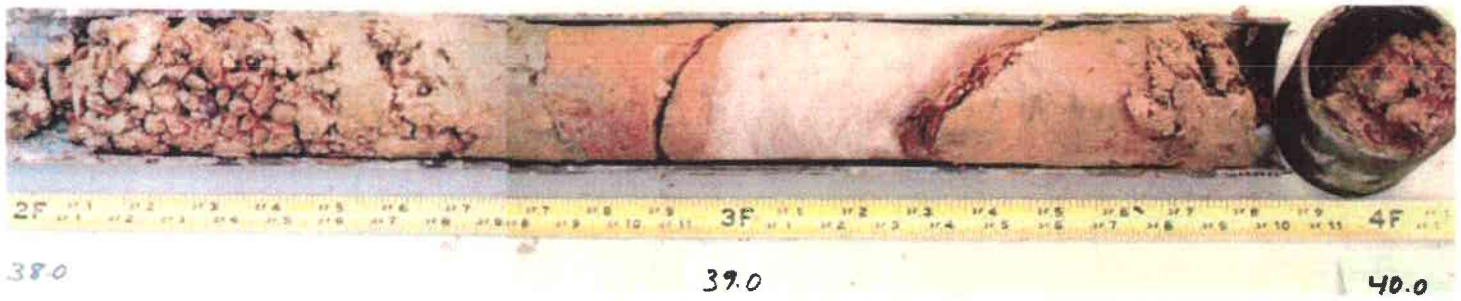
3F
4F
48.0
Kinney Soil 07
3-NS-1
49.0

4F
5F
9.0
Kinney Soil 07
3-NS-1
50.0


1.0
Kinney Soil 07 4.S-1
2.0
Kinney Soil 07 4.S-1
3.0
10.0
Kinney Soil 07 4.S-1
11.0
15.0
Kinney Soil 07
16.0
16.0
16.5

S-1 Page 1

1F
2F
20.0
Kinney
soil 07
4-S-1
21.0
21.5
1F
2F
25.0
Kinney
soil 07
4-S-1
26.0
26.5
1F
2F
30.0
Kinney
Soil 07
4-S-1
31.0
31.5



40.0 - 41.5 Core Loss

Core Loss

Core Loss

51.0
1F
2F
3F
52.0
53.0

3F
4F
5F
53.0
4-S-1
54.0
55.0

Core
Loss

1F
1F
2F
56.5
57.0
57.0
4-S-1
58.0

2F
3F
58.0
4-S-1
59.0

3F
4F
59.0
4-S-1
60.0

1F
60.0
61.0

1F
2F
61.0
4-S-1
61.8
Missing

1F
65.0

1F
2F
66.0
67.0

2F
3F
67.0
4-S-1

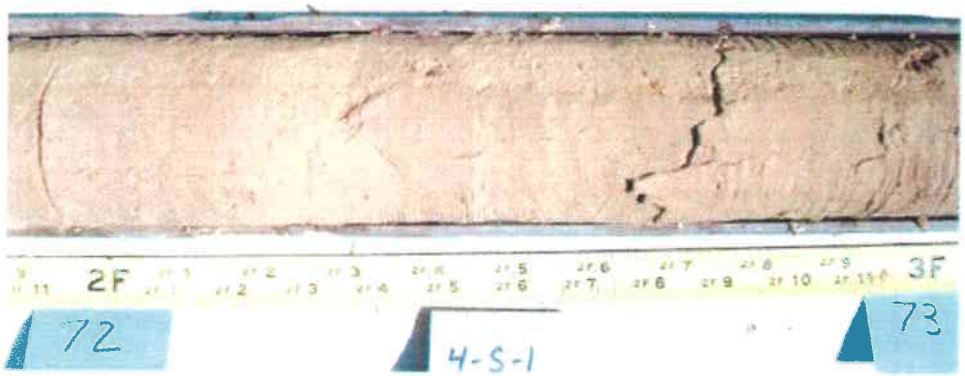
3F
4F
68.0
69.0

4F
5F
69.0
70.0

1F
70.0
4-S-1
71.0

1F
71.0
4-S-1
71.5

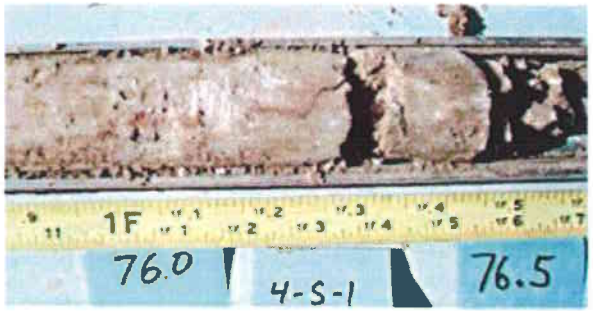
2F
71.5
72


2F
3F
72
73
4-S-1

3F
4F
73
74
4-S-1

4F
5F
74
75.0
4-S-1

1F
75.0
4-S-1
76.0


1F
76.0
4-S-1
76.5

TD

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
Portal 1-DRL	10-11.5	17		5.0				NP	55	23	22	GM
	19-20.5	16		72.0		78	74	4	0	41	59	OH
CV-2-2 DRL	3-4.5	52		3.6				NP	15	59	26	SM
	9-10.5	11		4.9				NP	17	61	22	SM
	15-16.5	19		4.4				NP	42	49	9	SP-SM
	25-26.5	19		10.7		31	15	16				CL-2
NS-1 DRL	6-7.5	28		5.3		22	13	9				CL-1
	9-10.5	52		6.1		26	13	13				CL-1
	15-16.5	46		5.3				NP	6	25	69	ML
	22.5-24	23		11.8		26	13	13				CL-1
	31.5-31.9		109.6	18.8								CL
S-1 DRL	10-11.5	23		7.8		28	14	14				CL-1
	20-21.5	19		12.9		24	14	10				CL-1
	30-31.5	27		12.8		26	14	12				CL-1
	40-41.5	25		17.5	6280*	28	15	13				CL-1
	50-51.5	29		16.2	5840*	34	15	19				CL-2
	57		113.9	16.3								
	66		103.4	18.1								CL
	70-71.5	35		17.2	8280*	35	14	21				CL-2
CV-4-1 DRL	5-6.5	21		10.0		25	18	7				CL-1
	10.5-15	Core		9.2		20	13	7	24	24	52	CL-1
	15-16.5	55		10.2		21	11	10				CL-1
	21.5-25	Core		11.9	3600*	22	12	10				CL-1
	25-26.5	22		13.8	2240*	26	10	16				CL-2
	31.5-35	Core		10.5	2220*	21	10	11				CL-1
	35-36.5	9		17.1	3200*	21	11	10				CL-1
	41.5-45	Core		17.1		29	13	16				CL-2
	45-46.5	74		14.6	3320*	30	14	16				CL-2
	55-60	Core		12.6	4000*	21	14	7				CL-1
	66.5-70	Core		12.6	4000*	29	11	18	15	19	66	CL-2
SC-2 DRL	23-24					24	12	12				CL-1

NP=Nonplastic
*Torvane value used to estimate unconfined compressive strength.

OTHER LABORATORY TESTING

PROJECT Kinney Mine
LOCATION Scofield, Utah

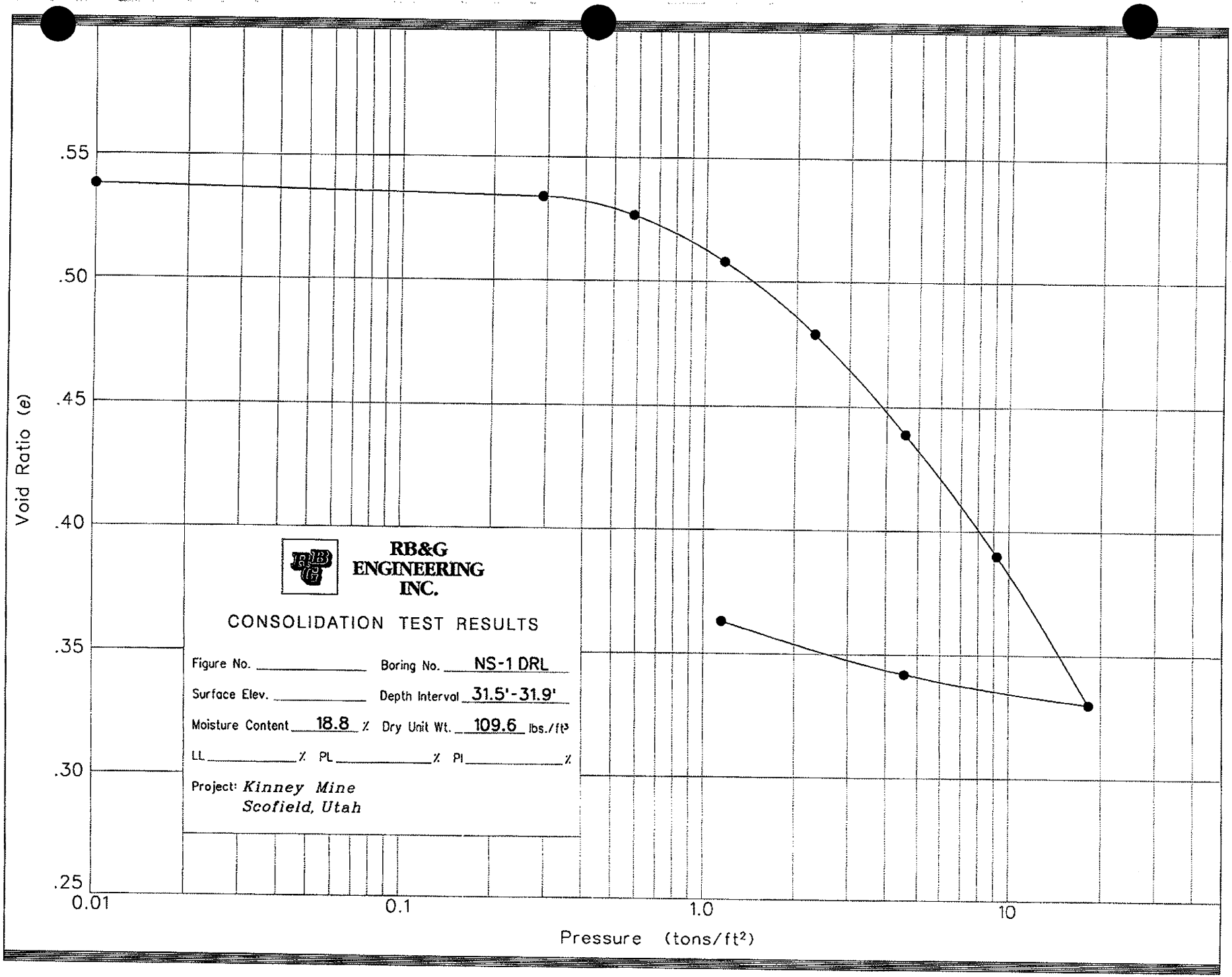
PROJECT NO. 200701-045
FEATURE

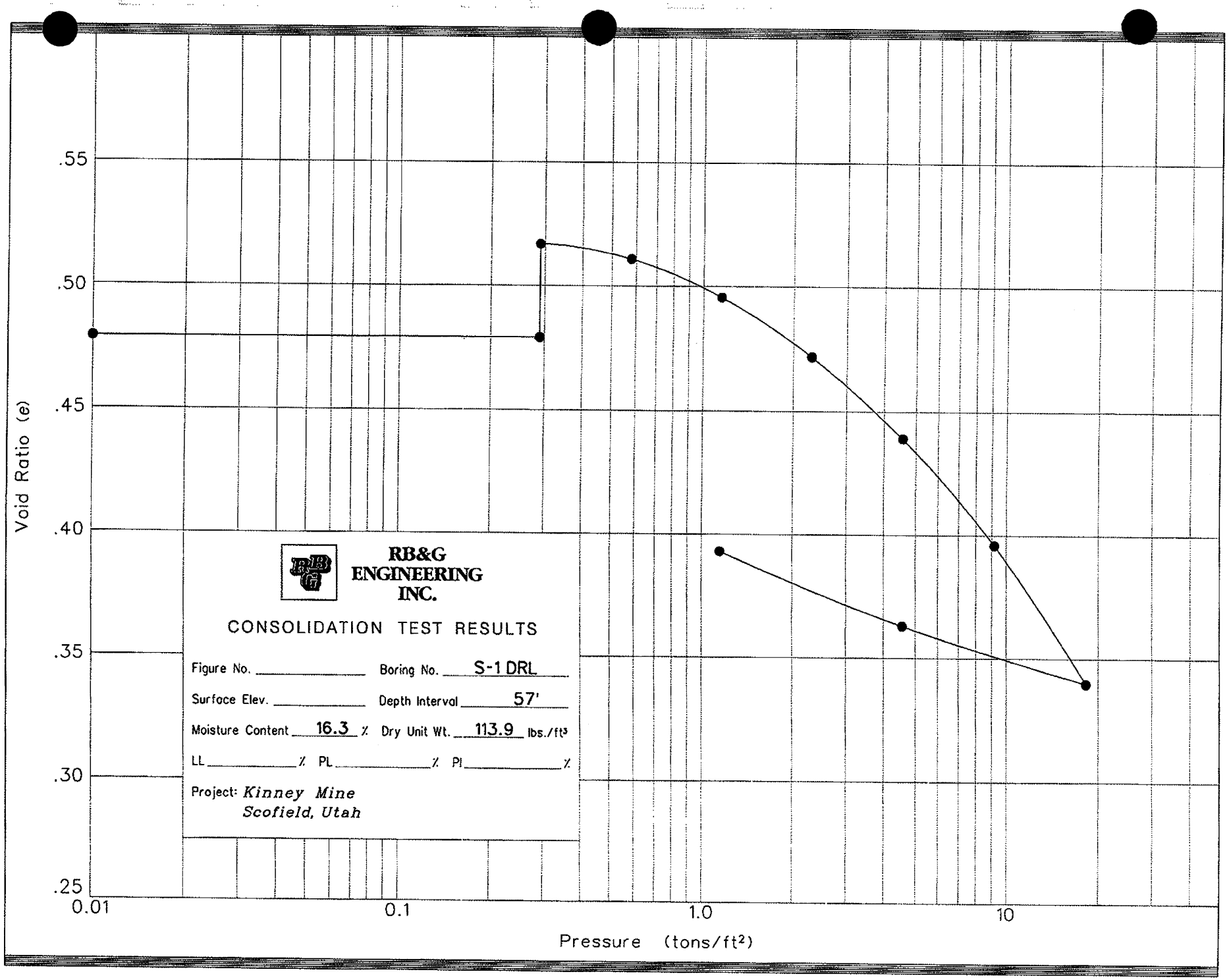
CHEMICAL TESTS					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	pH	RESISTIVITY (ohm-cm)	SULFATE (%)	USCS (MODIFIED) / AASHTO CLASSIFICATION
3-NS-1	6-7.5	8.0	6761	0.0031	CL-1
11-MDF-2	3	8.2	7202	0.0064	SC-SM
9-WSF-1	6	7.3	3322	0.0195	CL-ML
13-WSF-2	3	7.8	6502	0.0315	SM

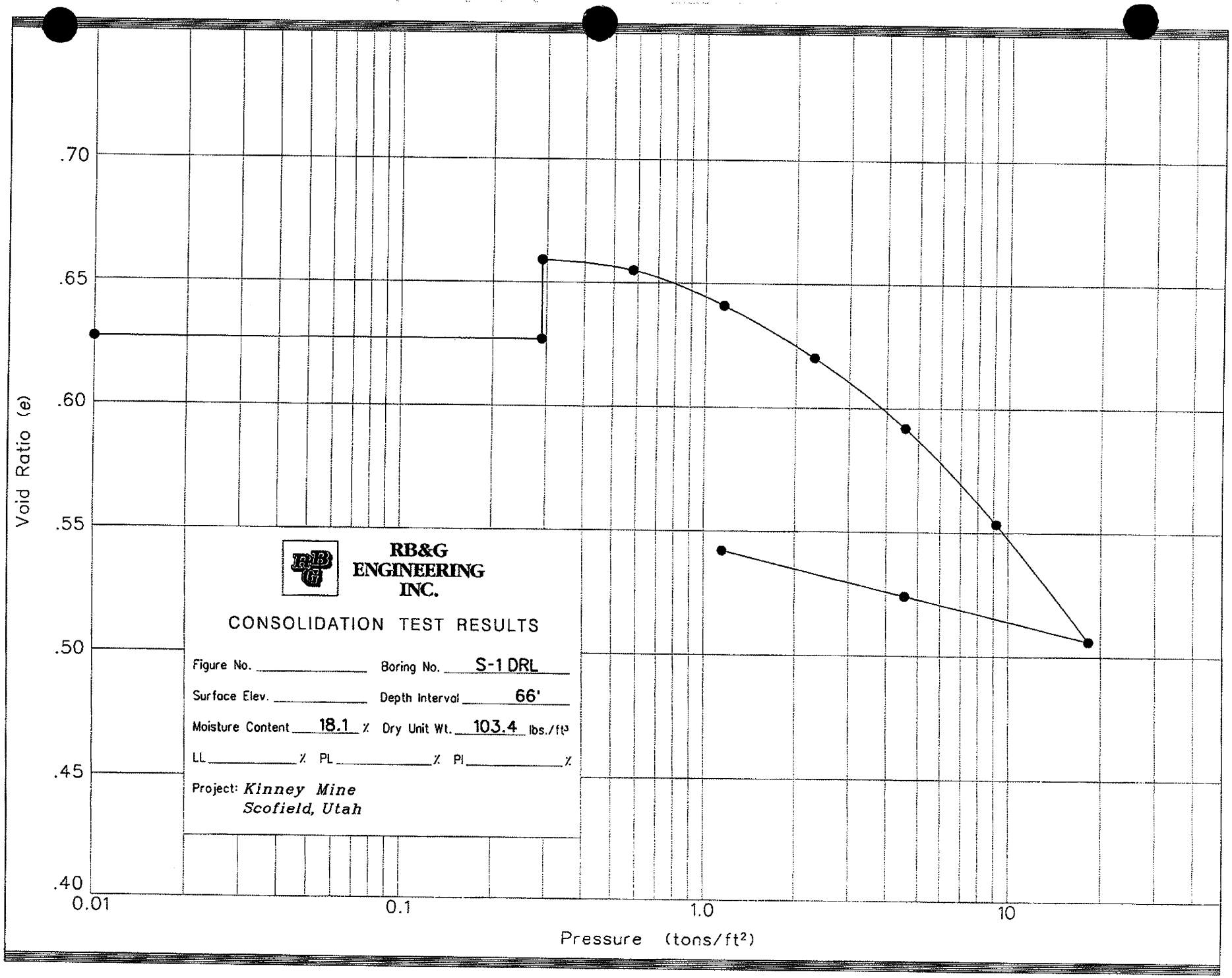
DIRECT SHEAR TESTS CONSOLIDATED DRAINED					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	DRY DENSITY (pcf)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	USCS (MODIFIED) / AASHTO CLASSIFICATION
07-CV-5-1 TH	12	95.8	20	15	CL-1

TRIAXIAL SHEAR TESTS MULTI-STAGE CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENTS						
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	TOTAL STRESS		EFFECTIVE STRESS		USCS (MODIFIED) / AASHTO CLASSIFICATION
		FRICTION ANGLE $\Phi_{(cu)}$ (degrees)	COHESION $c_{(cu)}$ (psi)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	
CV-4-1 DRL	20-21.5	29.6	2	36.0	2	CL
SC-2 DRL	23-24	32.5	2	36.7	2	CL-1

* Visual Classification
**Bulk Sample


.55
.50
.45
.40
.35
.30
.25
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. NS-1 DRL
Surface Elev.
Depth Interval 31.5'-31.9'
Moisture Content 18.8 %
Dry Unit Wt. 109.6 lbs./ft³
LL % PL % PI %
Project: Kinney Mine
Scofield, Utah


.55
.50
.45
.40
.35
.30
.25
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING
INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. S-1 DRL
Surface Elev.
Depth Interval 57'
Moisture Content 16.3 %
Dry Unit Wt. 113.9 lbs./ft³
LL %
PL %
PI %
Project: Kinney Mine
Scofield, Utah


.70
.65
.60
.55
.50
.45
.40
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING
INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. S-1 DRL
Surface Elev.
Depth Interval 66'
Moisture Content 18.1 %
Dry Unit Wt. 103.4 lbs./ft³
LL % PL % PI %
Project: Kinney Mine
Scofield, Utah

CONVEYOR SECTION-4

BORINGS CV-4-1 & SC-2

DRILL HOLE LOG

BORING NO. CV-4-1 DRL

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:75,077 E:38,786
DRILLING METHOD: LONGYEAR 44 / H.Q. CORE W/SPLIT SPOON
DRILLER: S. KISSNER
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/13/07
DATE COMPLETED: 9/14/07
GROUND ELEVATION: 7776.3'
LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
7775				11	Core 18,0	CL	brown, dry, very stiff									
	5			18	9,9,12	CL-1	brown, slightly moist, very stiff			10	25	7				
7770				35	Core 83,0	CL	very dk. brown to black, slightly moist, very stiff									
	10			6	55/6"	CL	dk. gray, slightly moist, hard									
7765				42	Core 0.99+ 78,44	CL-1	brown & yellow-brown, slightly moist, very stiff			9.2	20	7	24	24	52	
	15			18	18,25,30	CL-1	brown, slightly moist, hard			10.2	21	10				
7760				42	Core 100,57	CL	brown, slightly moist, hard									
	20			18	17,27,41 0.90+	CL	brown, slightly moist, hard, weathered coal in sample	SANDY LEAN CLAY W/GRAVEL sandstone cobbles & boulders								TS
7755				38	Core 91,69	CL-1	brown & dk. gray, moist, hard			11.9	22	10				
	25			14	7,11,11 0.56	CL-2	brown, moist, stiff to very stiff			13.8	26	16				
7750				38	Core 0.79 91,0	CL	brown, moist, stiff to very stiff									
	30			18	5,5,8 0.55 0.58	CL	brown, moist, stiff									
7745				22	Core 0.69 51,0	CL-1	brown, moist, stiff			10.5	21	11				
	35			18	3,4,5 0.80	CL-1	brown, moist, stiff			17.1	21	10				
7740				19	Core 0.42 0.77 46,0	CL	brown & yellow-brown, moist, stiff									
	40			10	9,12,15	CL	brown, moist, stiff									
7735				42	Core 0.90+ 100,0	CL-2	green-gray, yellow-brown & gray to black, moist, very stiff			17.1	29	16				
	45			13	20,18,56 0.83	CL-2	lt. gray to brown, moist, stiff to very stiff	GRAVELLY LEAN CLAY W/SAND sandstone cobbles & boulders		14.6	30	16				
7730				42	Core 0.90+ 100,29	CL	dk. gray & brown, moist, very stiff									

DH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 10/30/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2 ← Blow Count per 6"; 0.45 ← Torvane (tsf)
CORE — CORE 95,60 ← Rock Quality Designation (% RQD); Percent Sample Recovery
UNDISTURBED SAMPLE — PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

DRILL HOLE LOG

BORING NO. CV-4-1 DRL

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:75,077 E:38,786
DRILLING METHOD: LONGYEAR 44 / H.Q. CORE W/SPLIT SPOON
DRILLER: S. KISSNER
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/13/07
DATE COMPLETED: 9/14/07
GROUND ELEVATION: 7776.3'
LOGGED BY: M. HANSEN

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				4	50/4"	CL	brown, very moist, hard								
7725				37	Core 0.99+ 67,18	CL	brown & yellow-brown, moist to very moist, very stiff								
	55			0	30/0"	-	GRAVELLY LEAN CLAY W/SAND sandstone cobbles & boulders								
7720				60	Core 0.99+ 100,0	CL-1	brown & yellow-brown, very moist, hard		12.6	21	7				
	60			18	8,20,41 0.90+	CL	brown, moist, very stiff								
7715				42	Core 100,0	CL	brown to dk. gray-brown, moist, very stiff								
	65			9	13,40,54 0.90+	CL	brown to rusty-brown, moist, hard								
7710				42	Core 0.99+ 100,0	CL-2	GRAVELLY LEAN CLAY W/SAND TO SANDY LEAN CLAY W/GRAVEL sandstone cobbles & boulders; brown, moist, hard		12.6	29	18				
	70			16	12,33,52 0.90+	CL	brown, moist, hard								
7705															
	75														
7700															
	80														
7695															
	85														
7690															
	90														
7685															
	95														
7680															

DH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 10/30/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — 2,3,2 ← Blow Count per 6"; 0.45 ← Torvane (tsf)
CORE — CORE 95,60 ← Rock Quality Designation (% RQD); Percent Sample Recovery
UNDISTURBED SAMPLE — PUSHED 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

DRILL HOLE LOG

BORING NO. SC-2 DRL

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: SCREENING & CRUSHING / N:75,227 E:38,820
DRILLING METHOD: LONGYEAR 44 & CME-2800 / C.F. AUGER & H.Q. CORE
DRILLER: S. MCCRAKEN
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/14/07
DATE COMPLETED: 9/14/07
GROUND ELEVATION: 7741.2'
LOGGED BY: M.N.H., G.L.H.

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	Sample USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
7740							NOT SAMPLED									
	5															
7735																
	10															
7730																
	15															
7725																
	20			16	11,12,13 *0.66*	CL	brown, slightly moist, stiff									
7720				14	Core *34,0*	CL-1	brown, slightly moist, stiff	SANDY LEAN CLAY W/GRAVEL sandstone cobbles	115.6	15.3	24	12				TS
	25			18	5,6,10 *0.52*	CL	brown, slightly moist, stiff									
7715				19	Core *46,0*	CL-ML	brown, slightly moist, stiff	SANDY SILTY CLAY W/GRAVEL sandstone cobbles	123.8	11.3	18	5				CT
	30			18	9,9,15 *0.25* *0.57*	CL	brown, slightly moist, firm to stiff	SANDY LEAN CLAY W/GRAVEL sandstone cobbles								
7710																

DH_LOGV3 KINNEYMINE_DH.GPJ US EVAL.GDT 11/16/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE: 2,3,2 ← Blow Count per 6"; *0.45* ← Torvane (tsf)
CORE: CORE *95,60* ← Rock Quality Designation (% RQD); Percent Sample Recovery
UNDISTURBED SAMPLE: PUSHED *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

1F
5
5-CV-4
6

2F
3F
5-CV-4
8

3F
4F
8
5-CV-4
9

4F
5F
9
10

10
5-CV-4
10.5

2F
10.5
11
5-CV-4
12

2F
3F
12
13

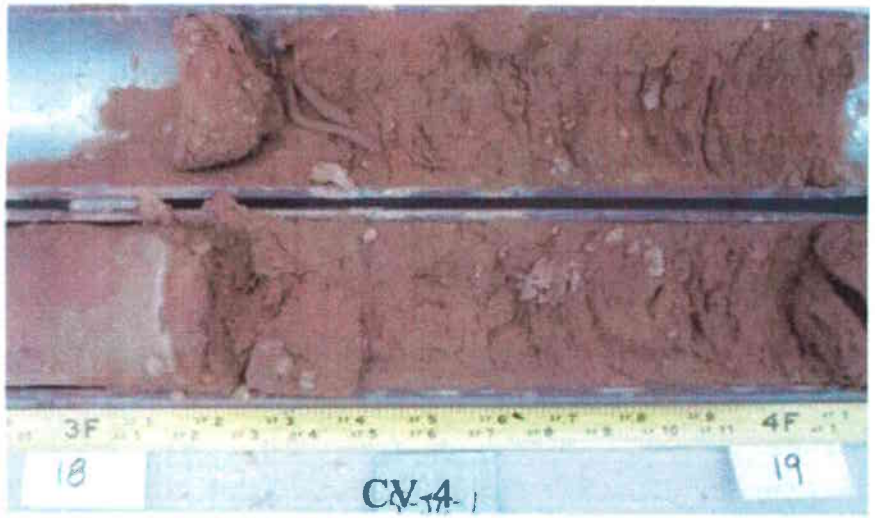
3F
4F
13
14

4F
14
15

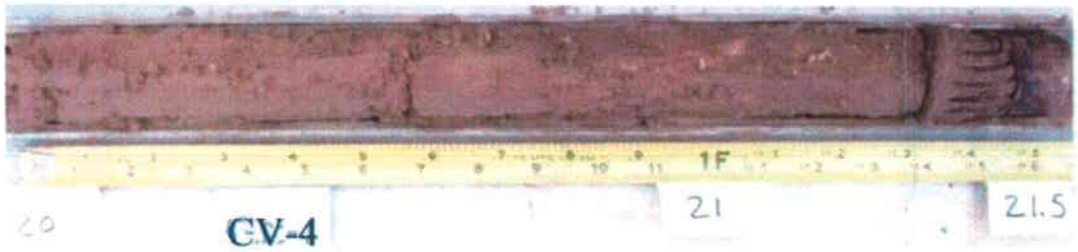
3F
4F
15
5-CV-4
16
16.5

2F
17
16.5
CV-4

2F
3F
17
18
CV-4


3F
4F
18
19
CV-4

4F
5F
19
20


1F
20
21
21.5
CV-4

2F
22

2F
3F
22
23

3F
4F
23
24

4F
5F
24
25

1F
25
5-CV4
26
26.5

2F
5-CV4
27

2F
3F
27
5-CV4
28

3F
4F
28
29

4F
5F
29
5-CV4
30

1F
30'
31.5'

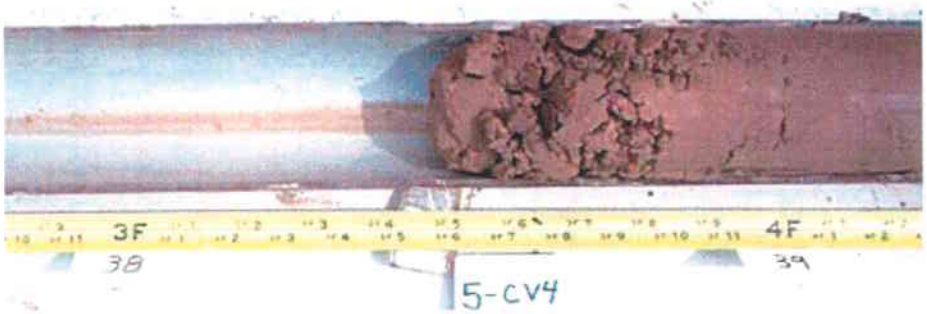
2F
3F
31.5'
32
5-CV4
33

4F
34
5-CV4

4F
5F
34
35'

1F
5-CV4
36.5

2F
3F
36.5'
37
5-CV4


3F
4F
38
39
5-CV4

4F
5F
39
5-CV4
40

1F
5-CV4
41.5

2F
41.5
5-CV4
42

2F
3F
42
5-CV4
43

3F
4F
43
5-CV4
44

4F
5F
44
5-CV4
45'

1F
46
5-CV4
46.5

TD

SCF-1

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
Portal 1-DRL	10-11.5	17		5.0				NP	55	23	22	GM
	19-20.5	16		72.0		78	74	4	0	41	59	OH
CV-2-2 DRL	3-4.5	52		3.6				NP	15	59	26	SM
	9-10.5	11		4.9				NP	17	61	22	SM
	15-16.5	19		4.4				NP	42	49	9	SP-SM
	25-26.5	19		10.7		31	15	16				CL-2
NS-1 DRL	6-7.5	28		5.3		22	13	9				CL-1
	9-10.5	52		6.1		26	13	13				CL-1
	15-16.5	46		5.3				NP	6	25	69	ML
	22.5-24	23		11.8		26	13	13				CL-1
	31.5-31.9		109.6	18.8								CL
S-1 RL	10-11.5	23		7.8		28	14	14				CL-1
	20-21.5	19		12.9		24	14	10				CL-1
	30-31.5	27		12.8		26	14	12				CL-1
	40-41.5	25		17.5	6280*	28	15	13				CL-1
	50-51.5	29		16.2	5840*	34	15	19				CL-2
	57		113.9	16.3								
	66		103.4	18.1								CL
	70-71.5	35		17.2	8280*	35	14	21				CL-2
CV-4-1 DRL	5-6.5	21		10.0		25	18	7				CL-1
	10.5-15	Core		9.2		20	13	7	24	24	52	CL-1
	15-16.5	55		10.2		21	11	10				CL-1
	21.5-25	Core		11.9	3600*	22	12	10				CL-1
	25-26.5	22		13.8	2240*	26	10	16				CL-2
	31.5-35	Core		10.5	2220*	21	10	11				CL-1
	35-36.5	9		17.1	3200*	21	11	10				CL-1
	41.5-45	Core		17.1		29	13	16				CL-2
	45-46.5	74		14.6	3320*	30	14	16				CL-2
	55-60	Core		12.6	4000*	21	14	7				CL-1
	66.5-70	Core		12.6	4000*	29	11	18	15	19	66	CL-2
SC-2 DRL	23-24					24	12	12				CL-1

NP=Nonplastic
*rvane value used to estimate unconfined compressive strength.

OTHER LABORATORY TESTING

PROJECT Kinney Mine
LOCATION Scofield, Utah

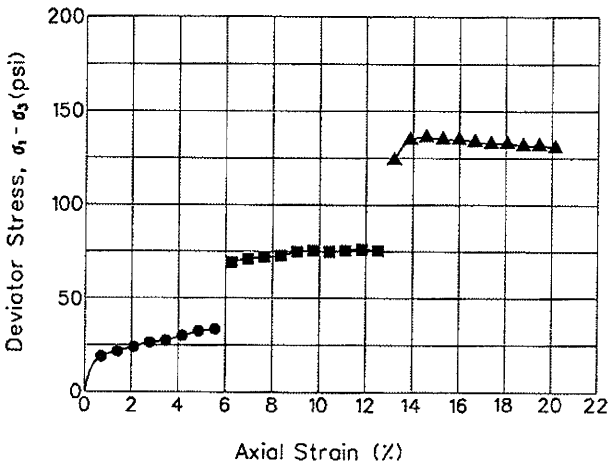
PROJECT NO. 200701-045
FEATURE

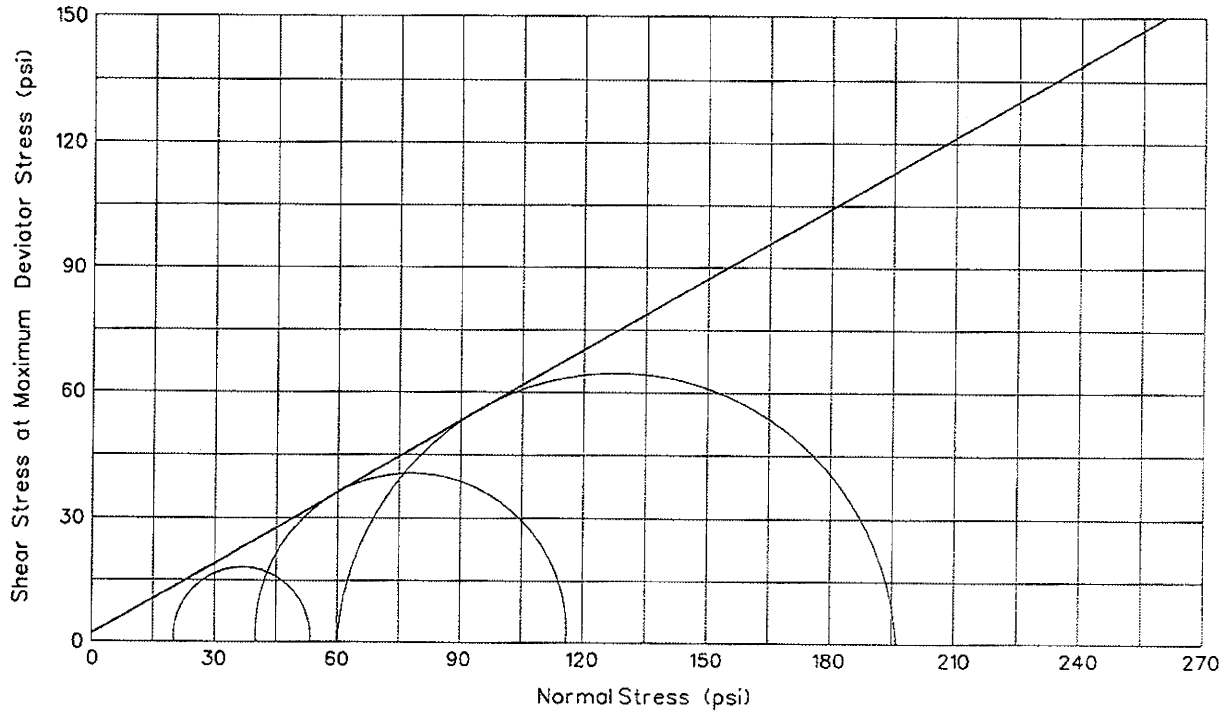
CHEMICAL TESTS					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	pH	RESISTIVITY (ohm-cm)	SULFATE (%)	USCS (MODIFIED) / AASHTO CLASSIFICATION
3-NS-1	6-7.5	8.0	6761	0.0031	CL-1
11-MDF-2	3	8.2	7202	0.0064	SC-SM
9-WSF-1	6	7.3	3322	0.0195	CL-ML
13-WSF-2	3	7.8	6502	0.0315	SM

DIRECT SHEAR TESTS CONSOLIDATED DRAINED					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	DRY DENSITY (pcf)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	USCS (MODIFIED) / AASHTO CLASSIFICATION
07-CV-5-1 TH	12	95.8	20	15	CL-1

TRIAXIAL SHEAR TESTS MULTI-STAGE CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENTS						
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	TOTAL STRESS		EFFECTIVE STRESS		USCS (MODIFIED) / AASHTO CLASSIFICATION
		FRICTION ANGLE $\Phi_{(cu)}$ (degrees)	COHESION $c_{(cu)}$ (psi)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	
CV-4-1 DRL	20-21.5	29.6	2	36.0	2	CL
SC-2 DRL	23-24	32.5	2	36.7	2	CL-1

* Visual Classification
**Bulk Sample





MULTI-STAGE CONSOLIDATED UNDRAINED W/PORE PRESSURE MEASUREMENTS:

TOTAL STRESS FAILURE ENVELOPE

Test No. or Symbol	Sample Data		Degree of Saturation (%)	Confining Pressure (psi)	Maximum Deviator Stress (psi)	Strength Values at Failure		Sample Size, L/D (inches)	Strain Rate (inches/minute)
	Dry Density (pcf)	Moisture Content (%)				Friction Angle ϕ (degrees)	Cohesion (c/psi)		
●	115.0	7.8	~100	20	53.4	29.6	2	2.88/1.38	0.001
■	115.0	7.8	~100	40	116.1				
▲	115.0	7.8	~100	60	196.1				

MATERIAL: SANDY LEAN CLAY (CL)

RB&G ENGINEERING INC.
Provo, Utah

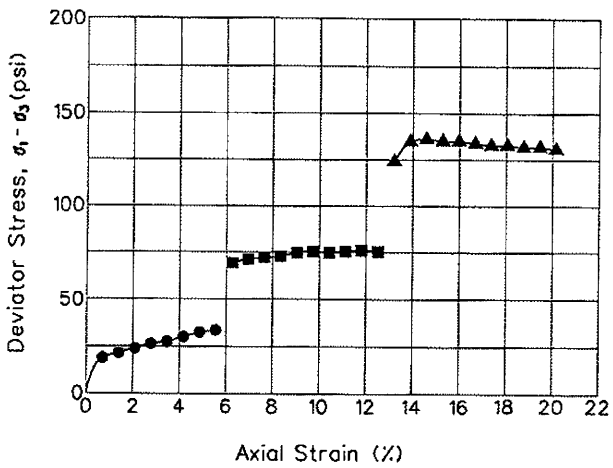
TRIAXIAL SHEAR TEST

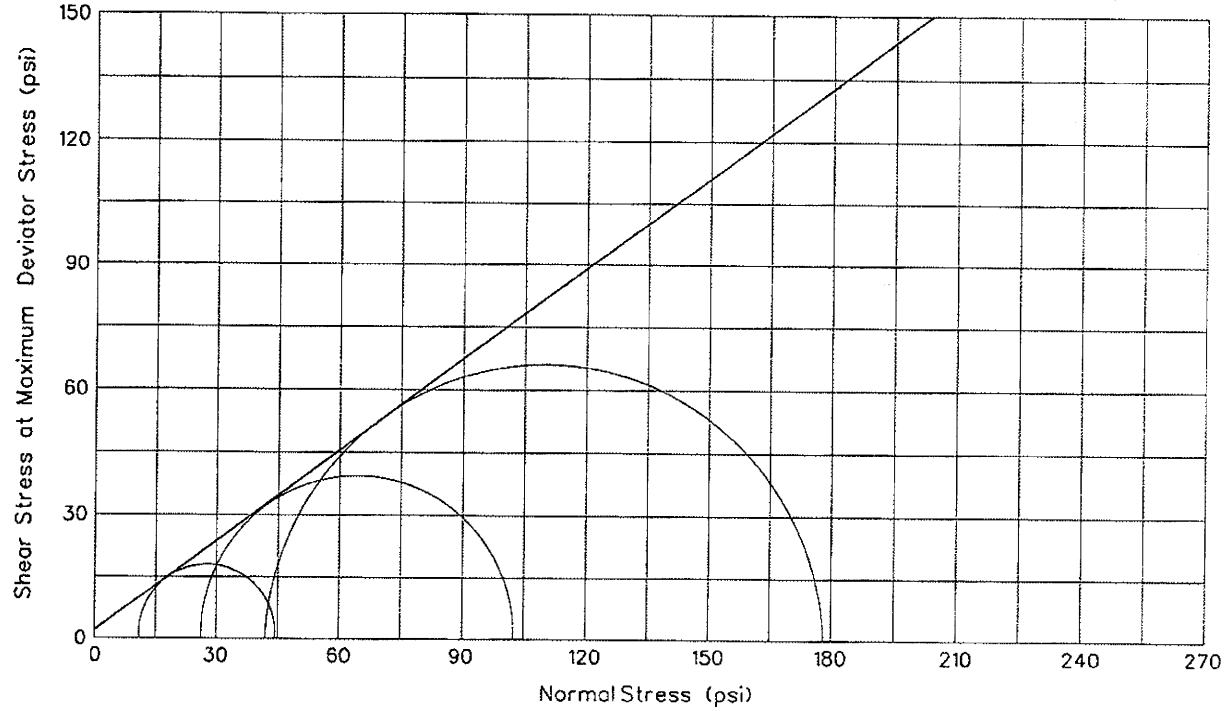
Project: *Kinney Mine*
Scofield, Utah

HOLE NO.: CV-4-1 DRL

DEPTH: 20'-21.5'

Figure





MULTI-STAGE CONSOLIDATED UNDRAINED W/PORE PRESSURE MEASUREMENTS:

EFFECTIVE STRESS FAILURE ENVELOPE

Test No. or Symbol	Sample Data		Degree of Saturation (%)	Confining Pressure (psi)	Maximum Deviator Stress (psi)	Strength Values at Failure		Sample Size, L/D (inches)	Strain Rate (inches/minute)
	Dry Density (pcf)	Moisture Content (%)				Friction Angle ϕ (degrees)	Cohesion (c/psi)		
●	115.0	7.8	~100	11.0	44.4	36.0	2	2.88/1.38	0.001
■	115.0	7.8	~100	26.3	102.4				
▲	115.0	7.8	~100	42.0	178.1				

MATERIAL: SANDY LEAN CLAY (CL)

RB&G ENGINEERING INC.
Provo, Utah

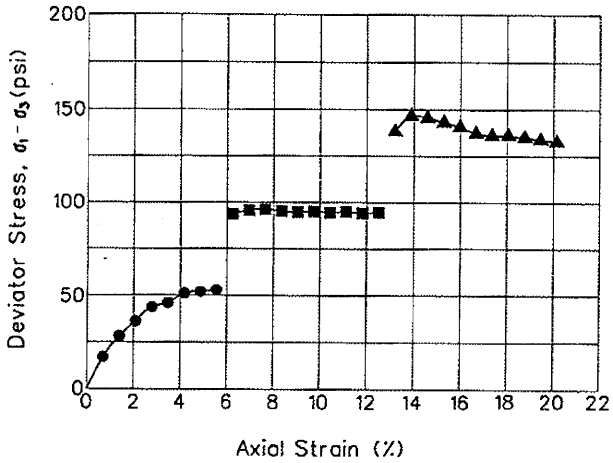
TRIAXIAL SHEAR TEST

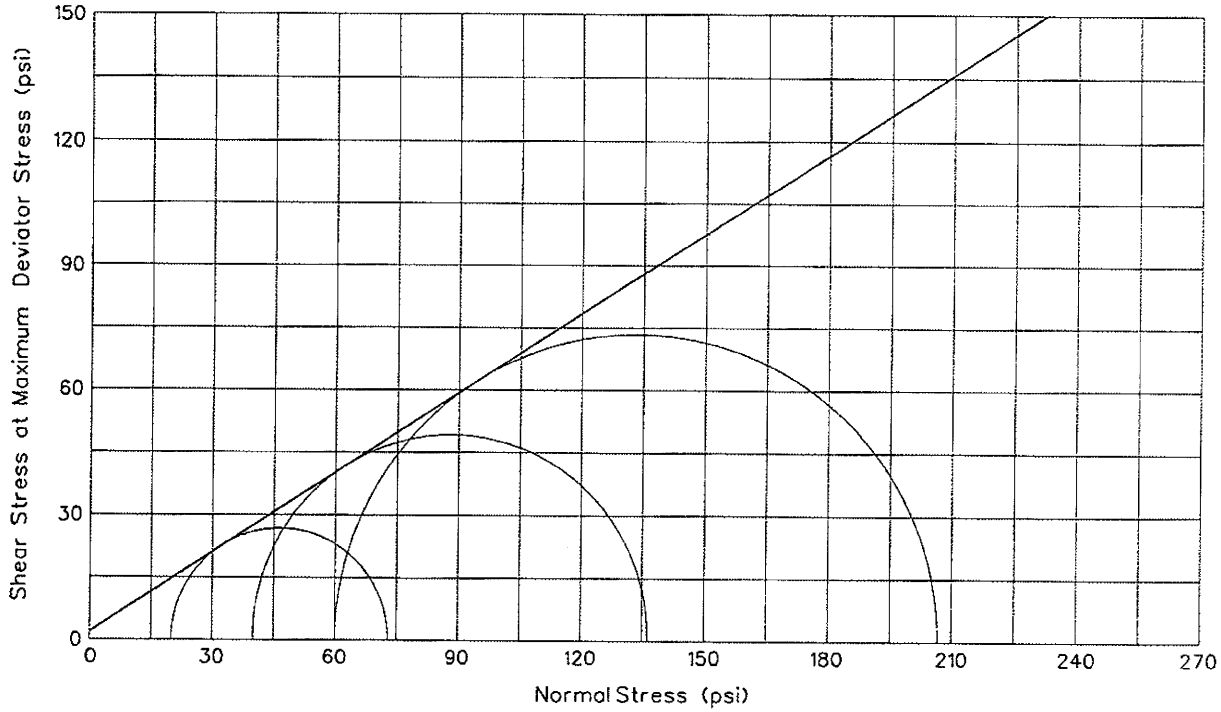
Project: *Kinney Mine*
Scofield, Utah

HOLE NO.: CV-4-1 DRL

DEPTH: 20'-21.5'

Figure





MULTI-STAGE CONSOLIDATED UNDRAINED W/PORE PRESSURE MEASUREMENTS:

TOTAL STRESS FAILURE ENVELOPE

Test No. or Symbol	Sample Data		Degree of Saturation (%)	Confining Pressure (psi)	Maximum Deviator Stress (psi)	Strength Values at Failure		Sample Size, L/D (inches)	Strain Rate (inches/minute)
	Dry Density (pcf)	Moisture Content (%)				Friction Angle ϕ (degrees)	Cohesion (c/psi)		
●	115.6	15.3	~100	20	72.9	32.5	2	2.88/1.38	0.001
■	115.6	15.3	~100	40	136.3				
▲	115.6	15.3	~100	60	206.7				

MATERIAL: SANDY LEAN CLAY (CL)

RB&G ENGINEERING INC.
Provo, Utah

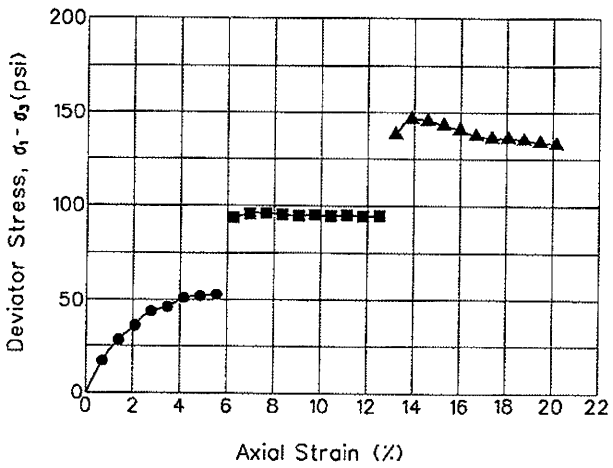
TRIAXIAL SHEAR TEST

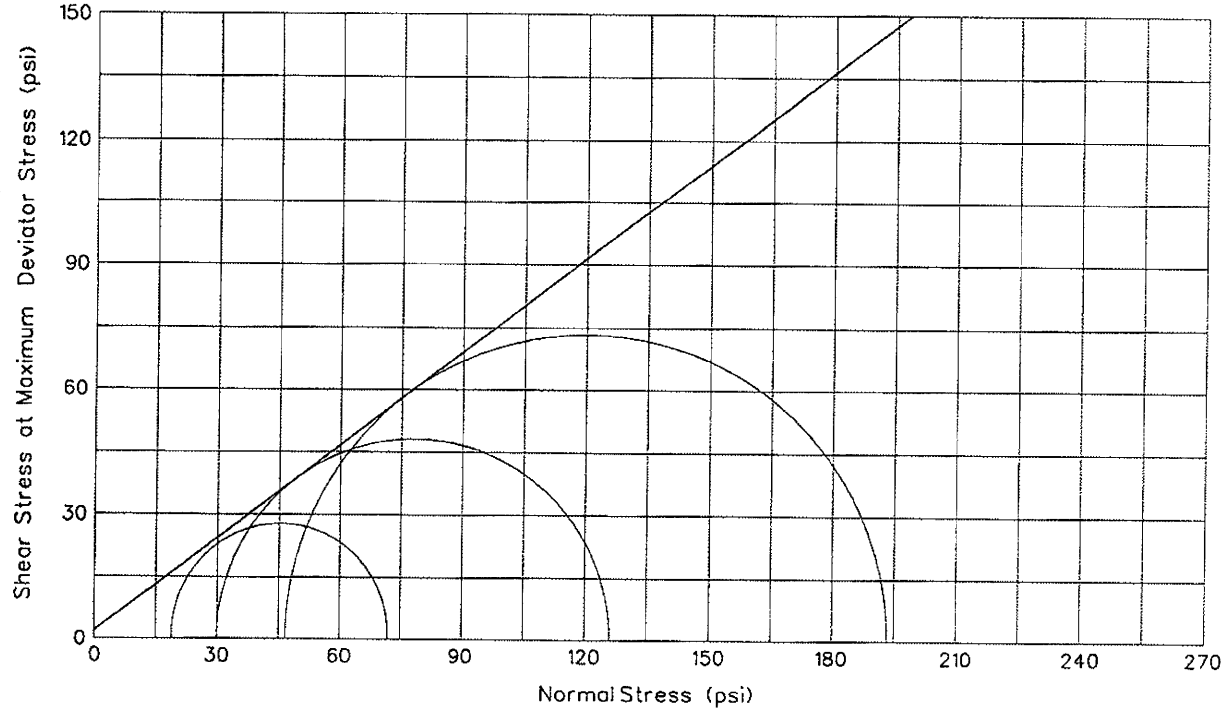
Project: *Kinney Mine*
Scofield, Utah

HOLE NO.: SC-2 DRL

DEPTH: 23'-24'

Figure





MULTI-STAGE CONSOLIDATED UNDRAINED W/PORE PRESSURE MEASUREMENTS:
EFFECTIVE STRESS FAILURE ENVELOPE

Test No. or Symbol	Sample Data		Degree of Saturation (%)	Confining Pressure (psi)	Maximum Deviator Stress (psi)	Strength Values at Failure		Sample Size, L/D (inches)	Strain Rate (inches/minute)
	Dry Density (pcf)	Moisture Content (%)				Friction Angle ϕ (degrees)	Cohesion (c/psi)		
●	115.6	15.3	~100	18.9	71.8	36.7	2	2.88/1.38	0.001
■	115.6	15.3	~100	29.8	126.1				
▲	115.6	15.3	~100	46.6	193.3				

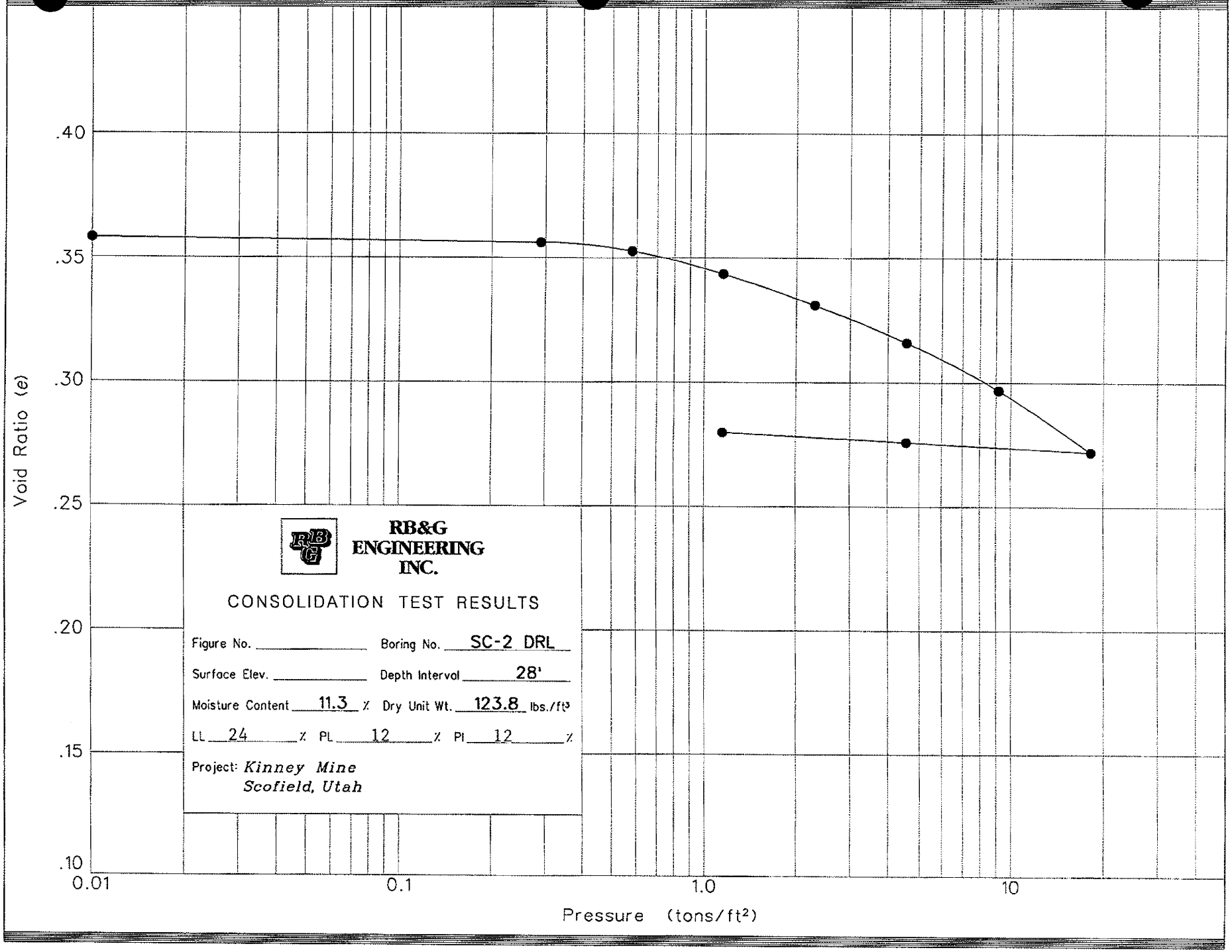
MATERIAL: SANDY LEAN CLAY (CL)

RB&G ENGINEERING INC.
Provo, Utah

TRIAXIAL SHEAR TEST
Project: *Kinney Mine*
Scofield, Utah

HOLE NO.: SC-2 DRL
DEPTH: 23'-24'

Figure



RB&G ENGINEERING INC.

CONSOLIDATION TEST RESULTS

Figure No. _____ Boring No. SC-2 DRL

Surface Elev. _____ Depth Interval 28'

Moisture Content 11.3 % Dry Unit Wt. 123.8 lbs./ft³

LL 24 % PL 12 % PI 12 %

Project: *Kinney Mine*
Scofield, Utah

CONVEYOR SECTION-5

TEST PITS CV-5-1 & CV-5-2

TEST PIT LOG

TEST PIT NO. CV-5-1 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:75,340 E:38,792
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/5/07
DATE COMPLETED: 9/5/07
GROUND ELEVATION: 7737.7'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
							SANDY LEAN CLAY sandy silt layers & pockets (fill)								
7735			X			CL-1	brown, dry, stiff	89.8	5.8	22	7				
	5														
			X		+1.00	CL-ML	lt. brown, dry, very stiff	95.6	4.9						
7730							SANDY SILTY CLAY pinhole structure, occasional cobble and/or boulder								
			X		+1.00	CL-ML	lt. brown, dry to slightly moist, very stiff	90.7	7.1	21	4				CT
	10														
			X		+1.00	CL-1	lt. brown, dry, very stiff		9.7	22	10				DS
7725															
	15		X		+1.00	CL	lt. brown, slightly moist, hard								
							SANDY LEAN CLAY pinhole structure, occasional cobble and/or boulder								
7720															
			X		+1.00	CL-1	lt. brown, slightly moist, hard		9.6	23	10				

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

TEST PIT LOG

TEST PIT NO. CV-5-2 TH

SHEET 1 OF 1

PROJECT: KINNEY MINE
CLIENT: GEO-HUNT CONSULTING, LLC
LOCATION: CONVEYOR BENT / N:75,688 E:38,928
DIGGING METHOD: JOHN DEERE 160 TRACKHOE
OPERATOR:
DEPTH TO WATER - INITIAL: ▽ DRY' AFTER 24 HOURS: ▼ N.M.

PROJECT NUMBER: 200701.045
DATE STARTED: 9/5/07
DATE COMPLETED: 9/5/07
GROUND ELEVATION: 7749.8'
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS	Material Description		Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
						COAL, CL,GM	brown, slightly moist, very stiff		101.8	7.9						
7745	5					COAL, CL,GM	brown, dry, very stiff	INTERBEDDED LAYERS OF COAL, SANDY LEAN CLAY & SILTY GRAVEL W/SAND (fill)	107.3	4.2						
7740	10					COAL, CL,GM	brown, dry, very stiff		100.4	6.9						
					+1.00	CL-2	brown, slightly moist, very stiff		112.7	13.8	42	26				CT
7735	15				+1.00	CL-2	brown, slightly moist, hard	SANDY LEAN CLAY slight pinhole structure		14.1	33	18				
7730					+1.00	CL	brown, slightly moist, hard									

TP_LOGV1 KINNEYMINE_TP.GPJ US EVAL.GDT 10/29/07

RB&G ENGINEERING INC.
PROVO, UTAH

LEGEND:

DISTURBED SAMPLE — Bucket ← Type of Sample; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
TS = Triaxial Shear
CBR = California Bearing Ratio

Table 1

SUMMARY OF TEST DATA

PROJECT Kinney Mine
LOCATION Scofield, Utah

PROJECT NO. 200701-045
FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
CV-2-1 TH	3	Grab	95.0	9.0		32	15	17				CL-2
	6	Grab		3.1				NP	64	23	13	GM
CV-2-3 TH	3	Grab	106.1	7.6	4000+*	25	13	12				CL-1
	6	Grab	88.6	6.5	4000+*	23	17	6				CL-ML
	9	Grab	97.1	4.8	4000+*	19	15	4				CL-ML / SC-SM
CV-5-1 TH	3	Grab	89.8	5.8	4000+*	22	15	7				CL-1
	9	Grab	90.7	7.1	4000+*	21	17	4				CL-ML
	12	Grab	95.8	9.7	4000+*	22	12	10				CL-1
	19	Grab		9.6	4000+*	23	13	10				CL-1
CL-5-2 TH	12	Grab	112.7	13.8	4000+*	42	16	26				CL-2
	15	Grab		14.1	4000+*	33	15	18				CL-2
WSF-1 TH	6	Grab	97.9	4.5	2827	21	16	5				CL-ML
WSF-2 TH	3	Grab	91.0	4.6				NP	29	45	26	SM
	9	Grab		4.7		19	15	4				CL-ML / SC-SM
WSF-3 TH	6	Grab	89.6	4.6				NP	34	38	28	SM
	9	Grab	96.3	10.1	3000*	22	14	8				CL-1
	12	Grab		6.1	3320*			NP	34	38	28	SM
MDF-1 TH	3	Grab	102.7	4.9		20	16	4				CL-ML / SC-SM
	9	Grab	86.6	8.4	3240*	25	14	11				CL-1
	18.5	Grab	108.7	10.8	2760*	23	13	10				CL-1
MDF-2 TH	3	Grab	108.6	4.6		20	15	5	34	38	28	SC-SM
	6	Grab	118.5	3.8				NP	38	47	15	SM
	15	Grab	94.8	9.3	3520*	23	14	9				CL-1
MDF-3 TH	6	Grab	102.9	5.8				NP	34	39	27	SM
	15	Grab		7.5	4000+*	22	12	10				CL-1
	18	Grab		5.3	4000+*	21	13	8				CL-1
CS-1 TH	6	Grab										Coal
	9	Grab		8.8	2080*	23	14	9				CL-1
	12	Grab		15.5	2240*	24	16	8				CL-1
F-1 TH	6	Grab	91.3	5.6		22	18	4	18	42	40	SC-SM
	9	Grab		6.1		21	16	5				CL-ML / SC-SM

NP=Nonplastic
*Toravne value used to estimate unconfined compressive Strength.

Table 2
Page 1 of 1
OTHER LABORATORY TESTING

PROJECT Kinney Mine
LOCATION Scofield, Utah

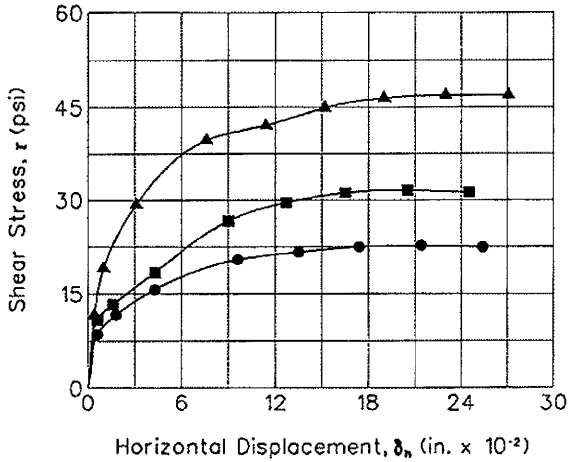
PROJECT NO. 200701-045
FEATURE

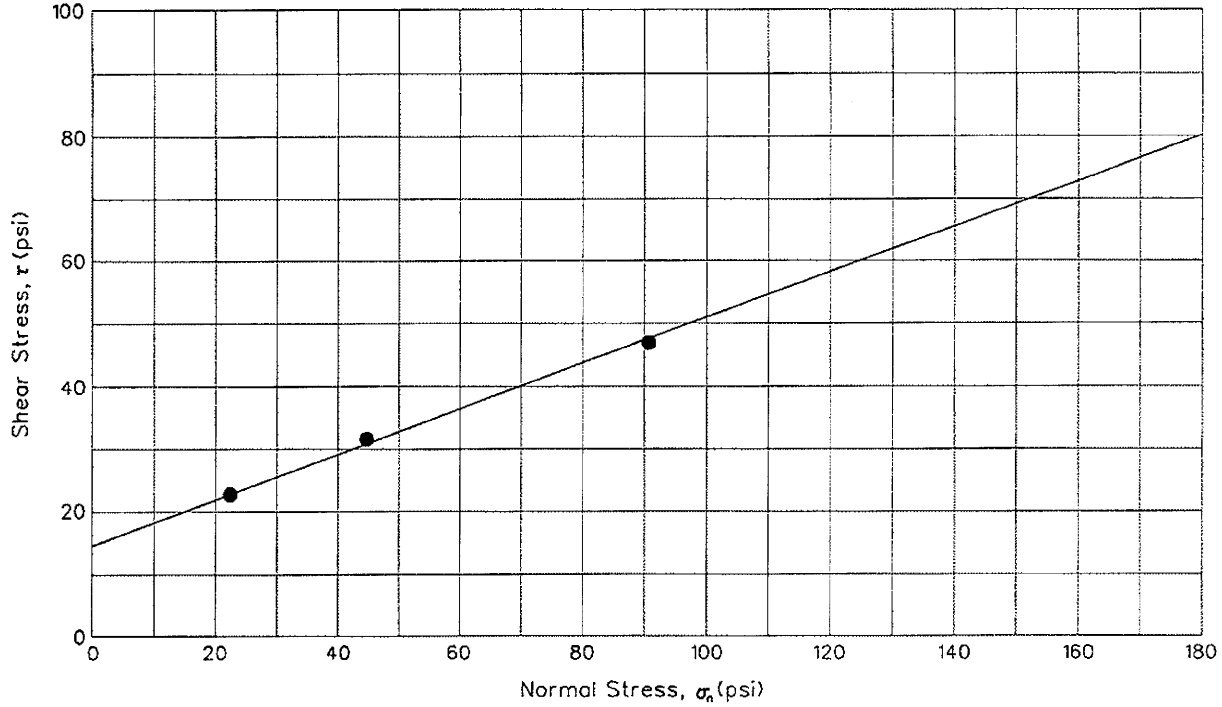
CHEMICAL TESTS					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	pH	RESISTIVITY (ohm-cm)	SULFATE (%)	USCS (MODIFIED) / AASHTO CLASSIFICATION
3-NS-1	6-7.5	8.0	6761	0.0031	CL-1
11-MDF-2	3	8.2	7202	0.0064	SC-SM
9-WSF-1	6	7.3	3322	0.0195	CL-ML
13-WSF-2	3	7.8	6502	0.0315	SM

DIRECT SHEAR TESTS CONSOLIDATED DRAINED					
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	DRY DENSITY (pcf)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	USCS (MODIFIED) / AASHTO CLASSIFICATION
07-CV-5-1 TH	12	95.8	20	15	CL-1

TRIAXIAL SHEAR TESTS MULTI-STAGE CONSOLIDATED UNDRAINED WITH PORE PRESSURE MEASUREMENTS						
SAMPLE LOCATION	DEPTH BELOW GROUND SURFACE (ft)	TOTAL STRESS		EFFECTIVE STRESS		USCS (MODIFIED) / AASHTO CLASSIFICATION
		FRICTION ANGLE $\Phi_{(cu)}$ (degrees)	COHESION $c_{(cu)}$ (psi)	FRICTION ANGLE Φ (degrees)	COHESION c (psi)	
CV-4-1 DRL	20-21.5	29.6	2	36.0	2	CL
SC-2 DRL	23-24	32.5	2	36.7	2	CL-1

* Visual Classification
**Bulk Sample





Test No. or Symbol	Sample Size (inches)	Sample Data		Degree of Saturation (%)	Normal Stress δ_n (psi)	Maximum Shear Stress τ (psi)	Strain Rate (inches/minute)	Shear Strength Parameters	
		Dry Density (pcf)	Moisture Content (%)					Friction Angle φ (degrees)	Cohesion (c/psi)
●	2.375	95.7	9.8	~100	22.4	22.7	0.0005	20.0	15
■	2.375	95.9	9.7	~100	44.7	31.6	0.0005		
▲	2.375	95.8	9.8	~100	90.7	46.9	0.0005		

MATERIAL: SANDY LEAN CLAY (CL-1)

RB&G ENGINEERING INC.
Provo, Utah

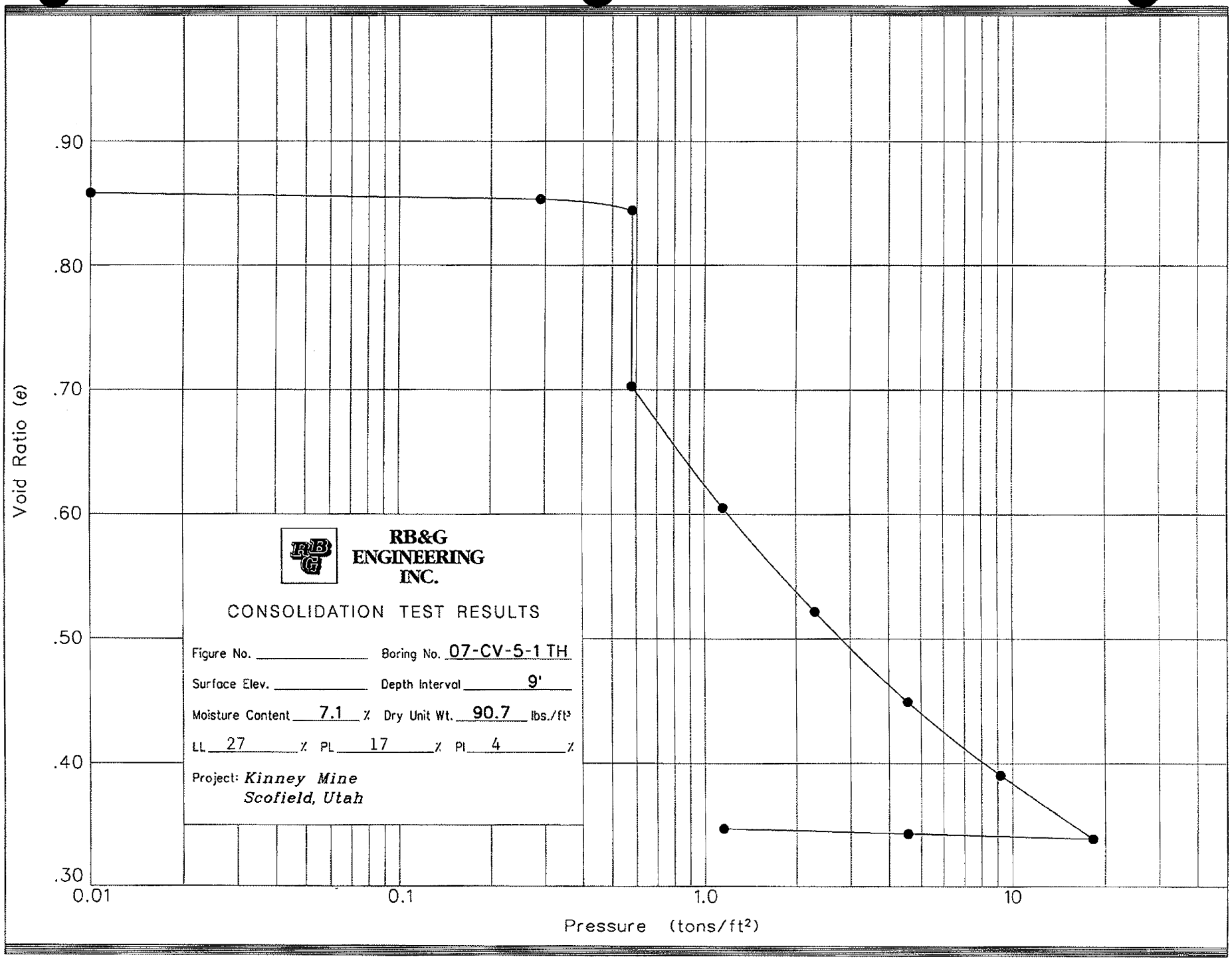
DIRECT SHEAR TEST

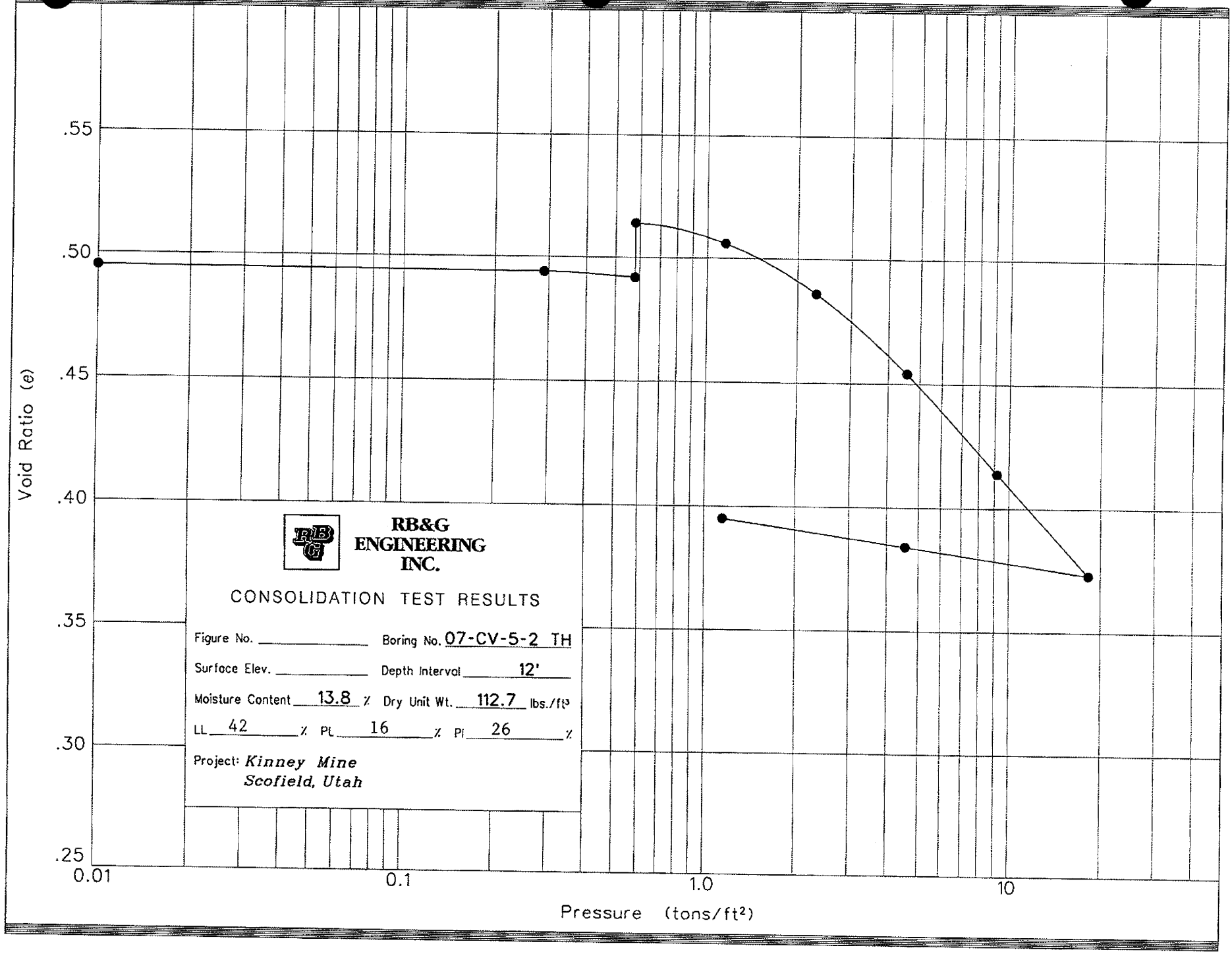
Project: *Kinney Mine*
Scofield, Utah

HOLE NO.: 07-CV-5-1 TH

DEPTH: 12'

Figure


.90
.80
.70
.60
.50
.40
.30
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-CV-5-1 TH
Surface Elev.
Depth Interval 9'
Moisture Content 7.1 %
Dry Unit Wt. 90.7 lbs./ft³
LL 27 %
PL 17 %
PI 4 %
Project: Kinney Mine
Scofield, Utah

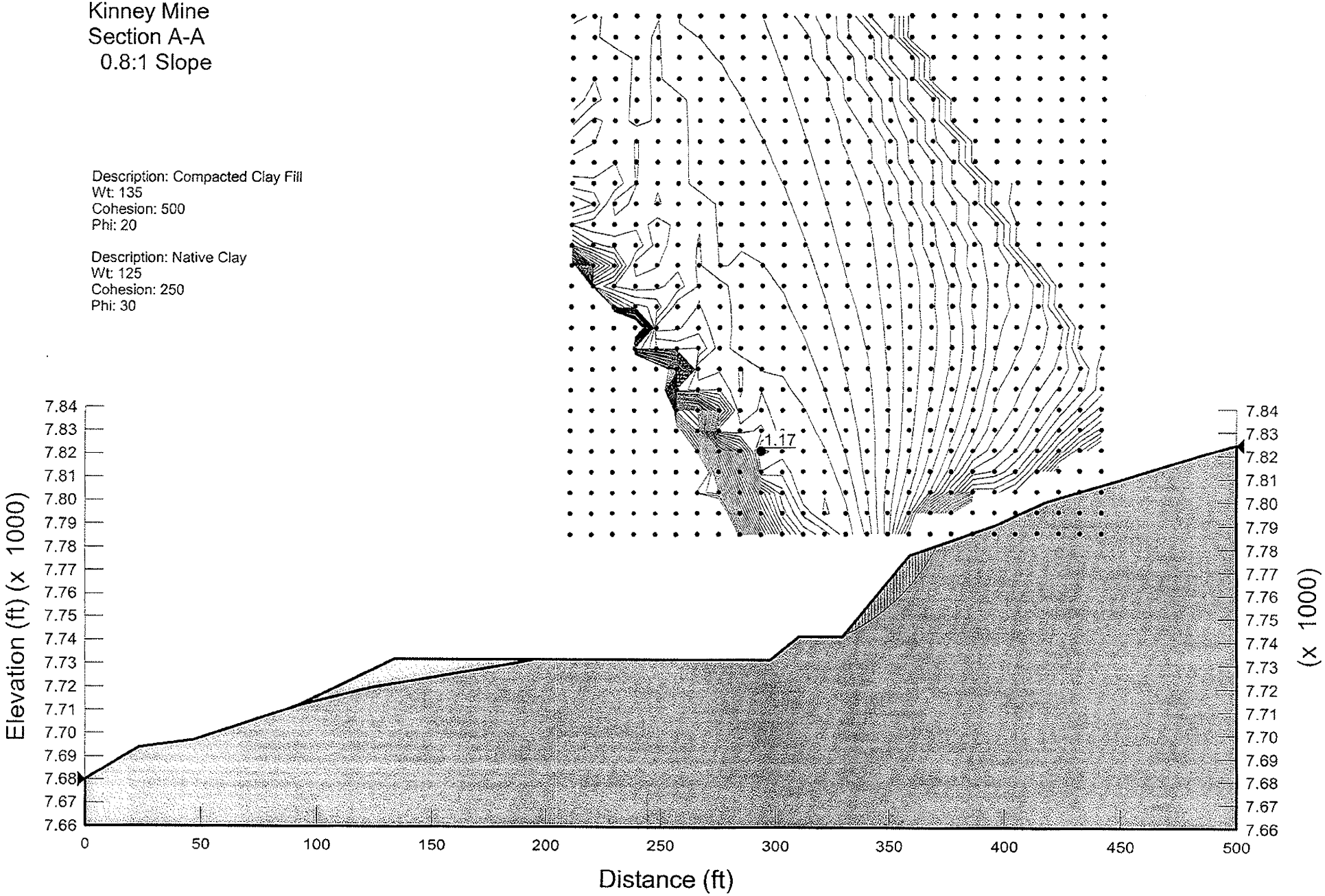

.55
.50
.45
.40
.35
.30
.25
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G ENGINEERING INC.
CONSOLIDATION TEST RESULTS
Figure No.
Boring No. 07-CV-5-2 TH
Surface Elev.
Depth Interval 12'
Moisture Content 13.8 %
Dry Unit Wt. 112.7 lbs./ft³
LL 42 %
PL 16 %
PI 26 %
Project: Kinney Mine
Scofield, Utah

SLOPE STABILITY ANALYSES

Kinney Mine
Section A-A
0.8:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

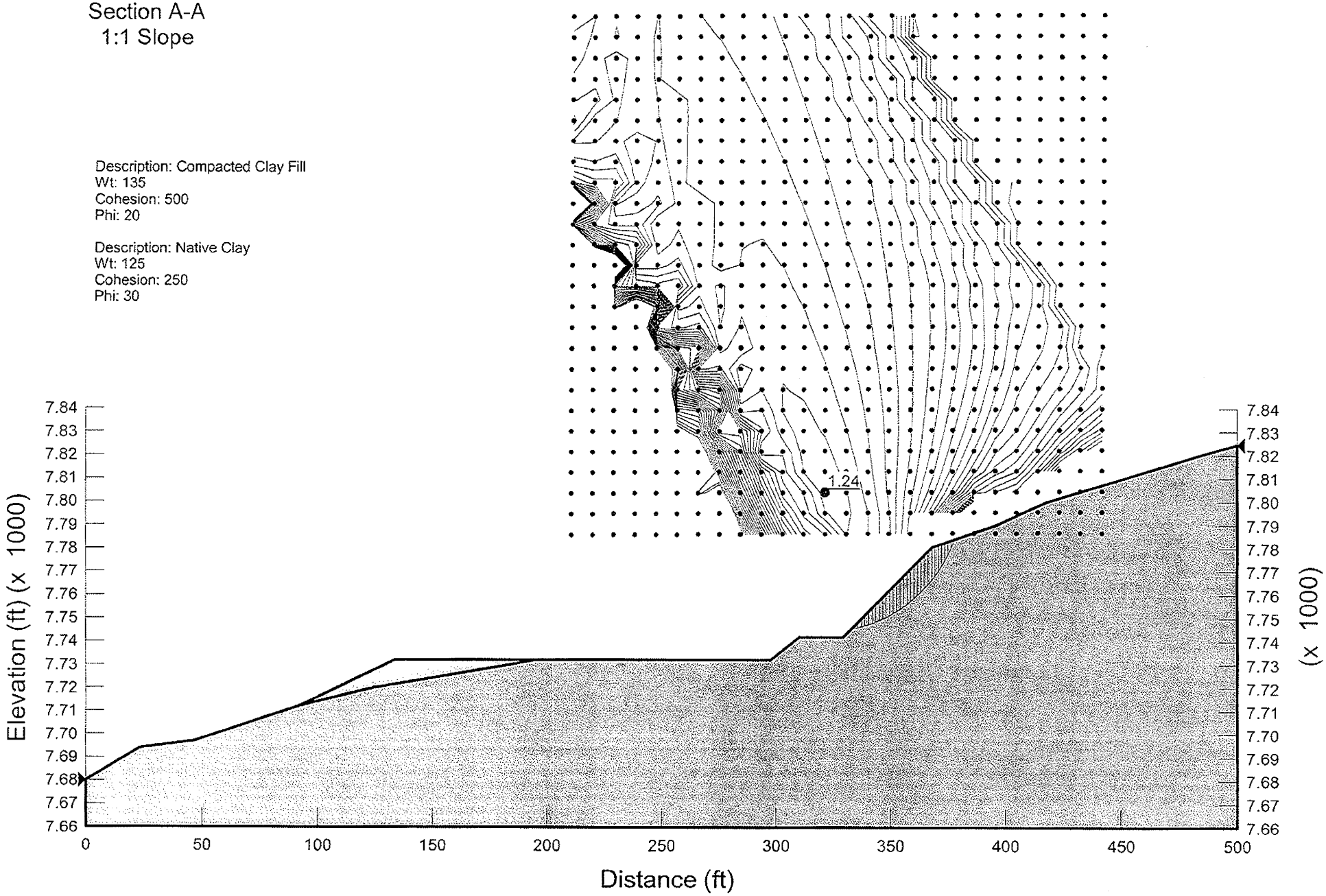
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section A-A
1:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

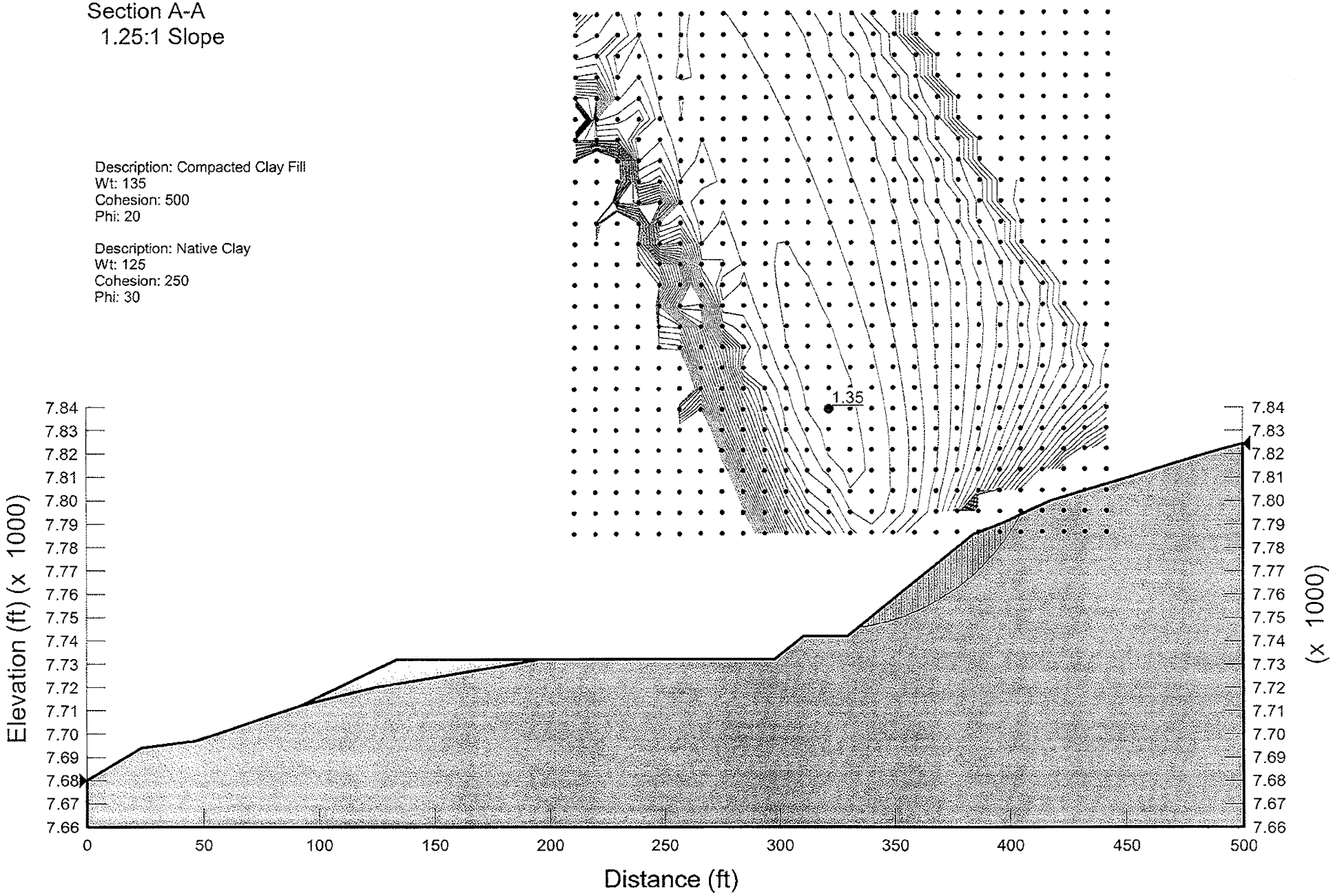
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section A-A
1.25:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

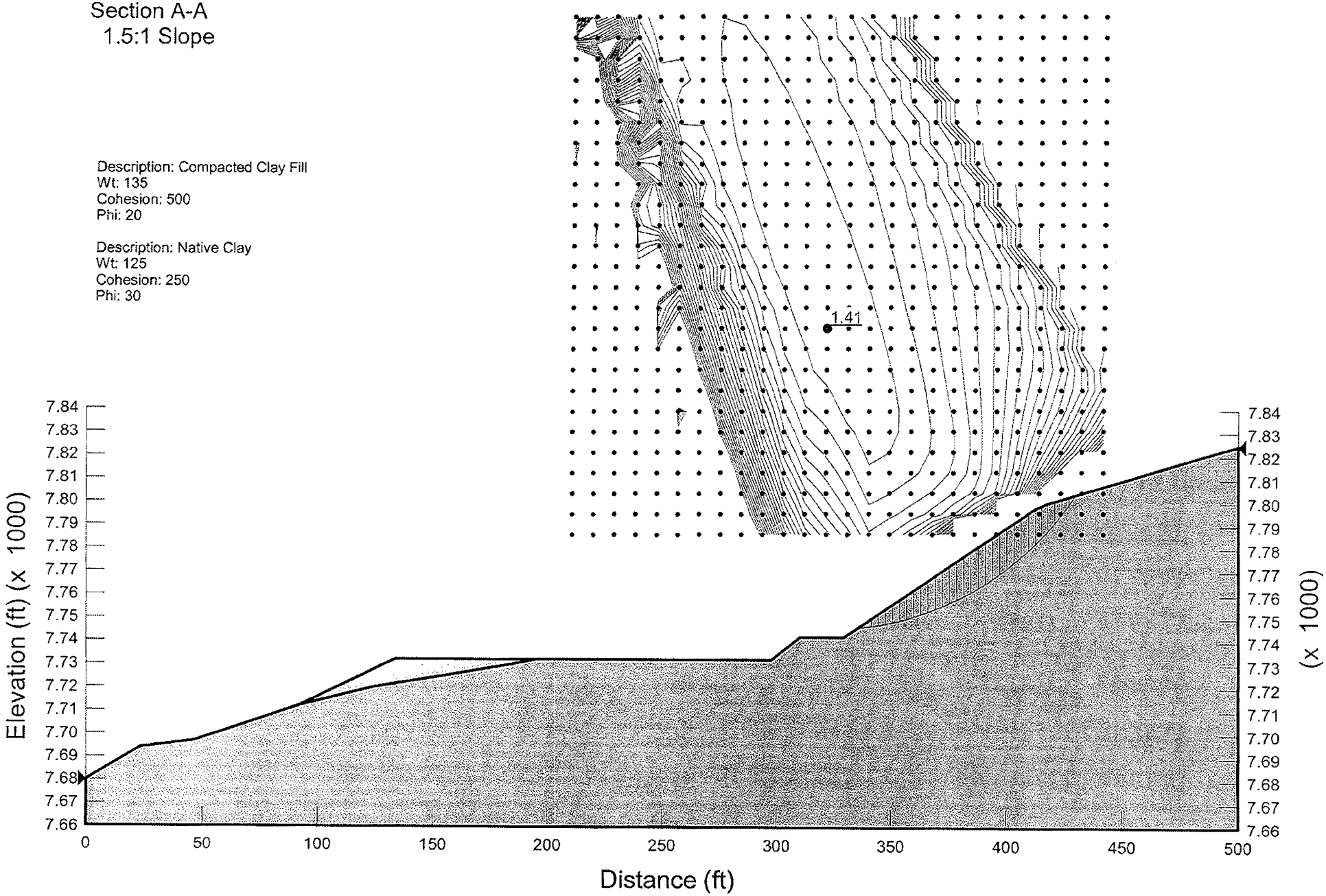
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section A-A
1.5:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

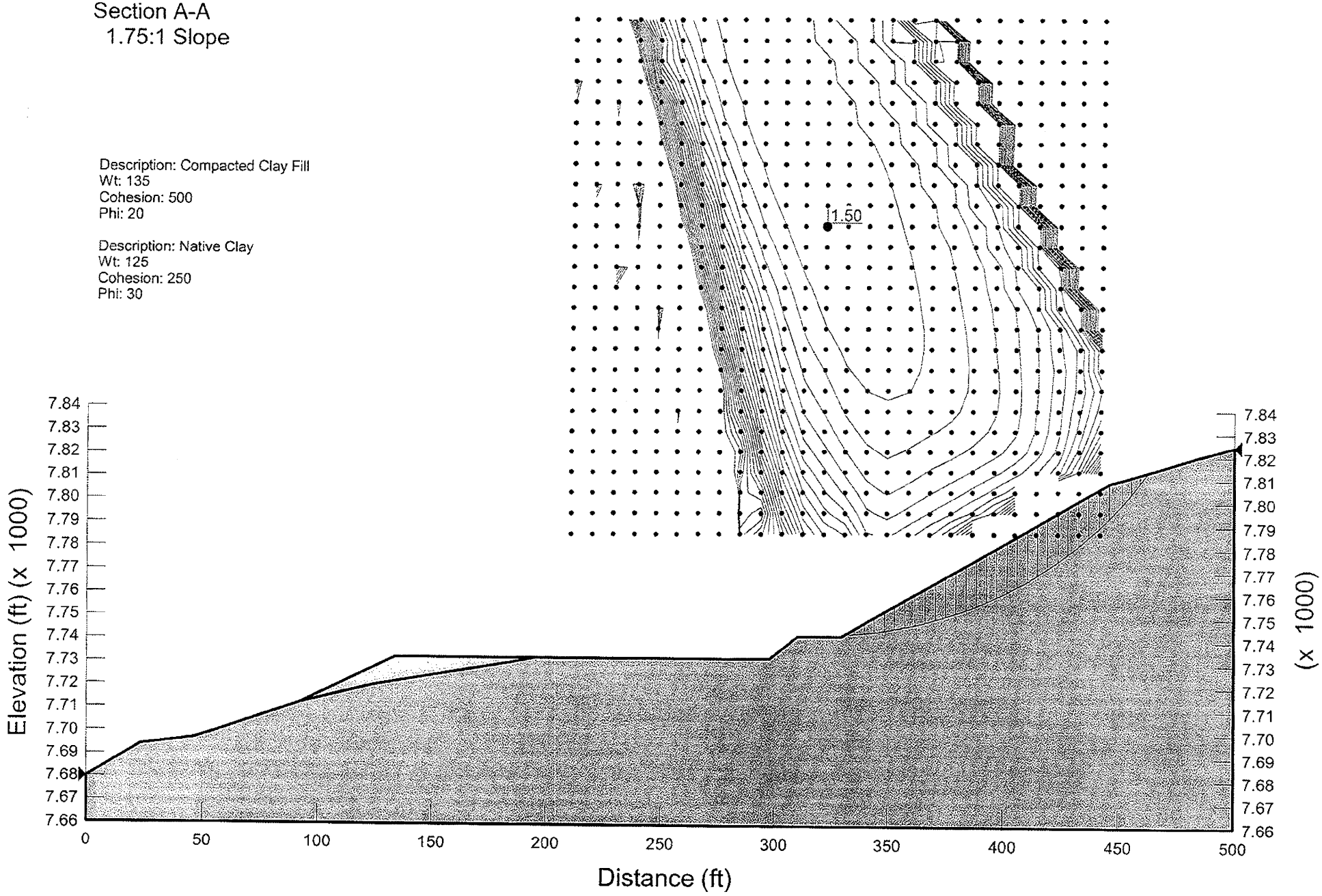
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section A-A
1.75:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

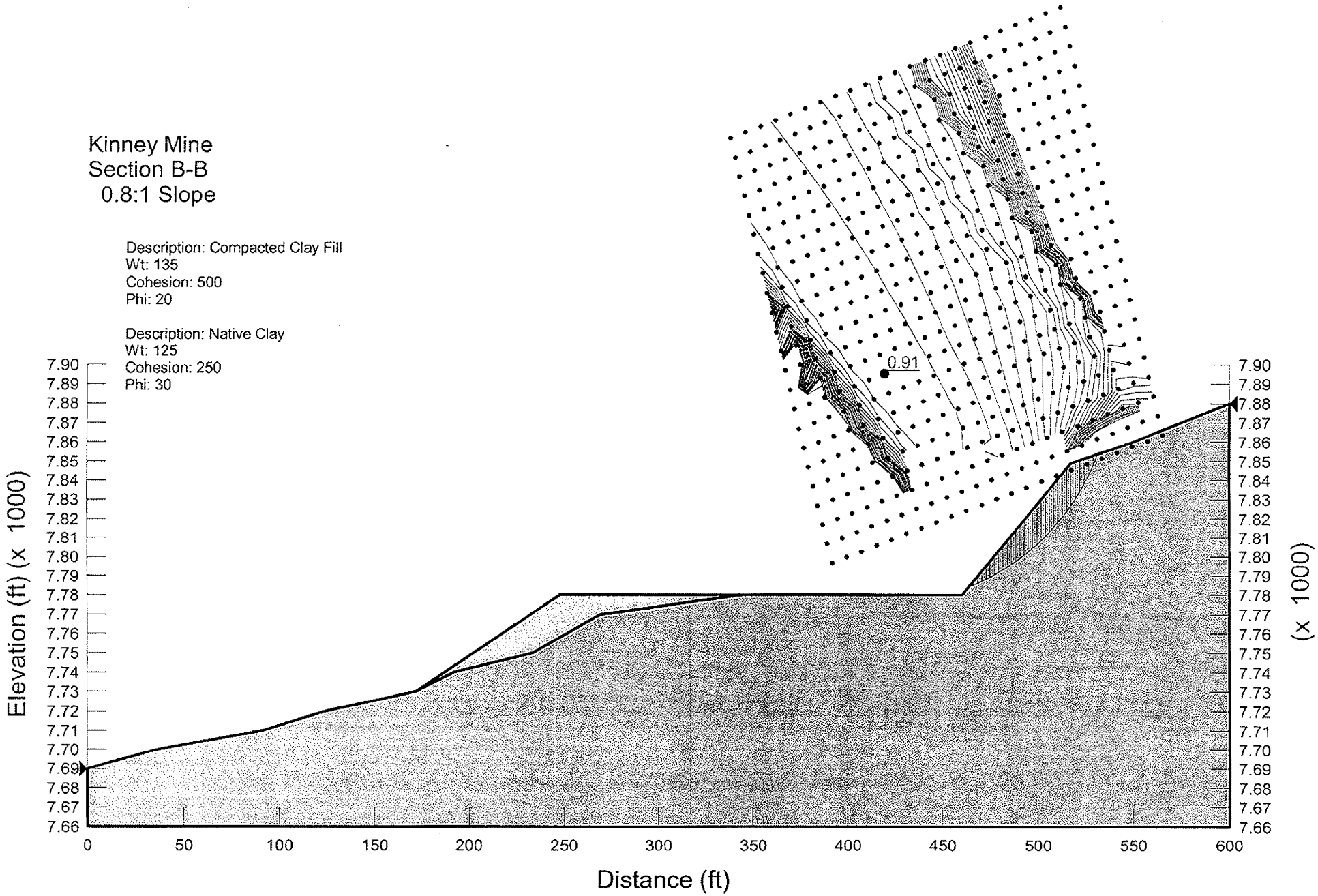
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section B-B
0.8:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

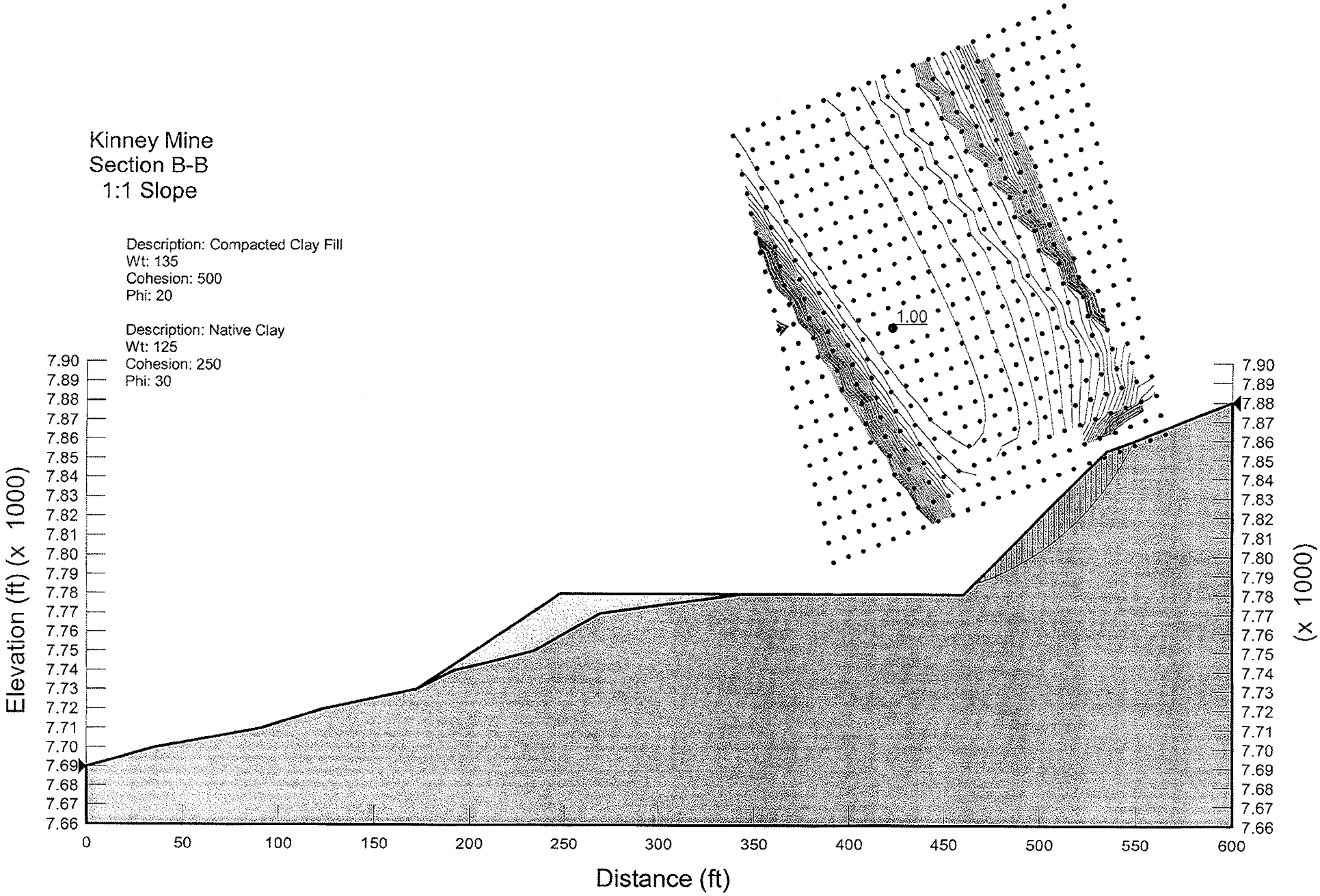
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section B-B
1:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

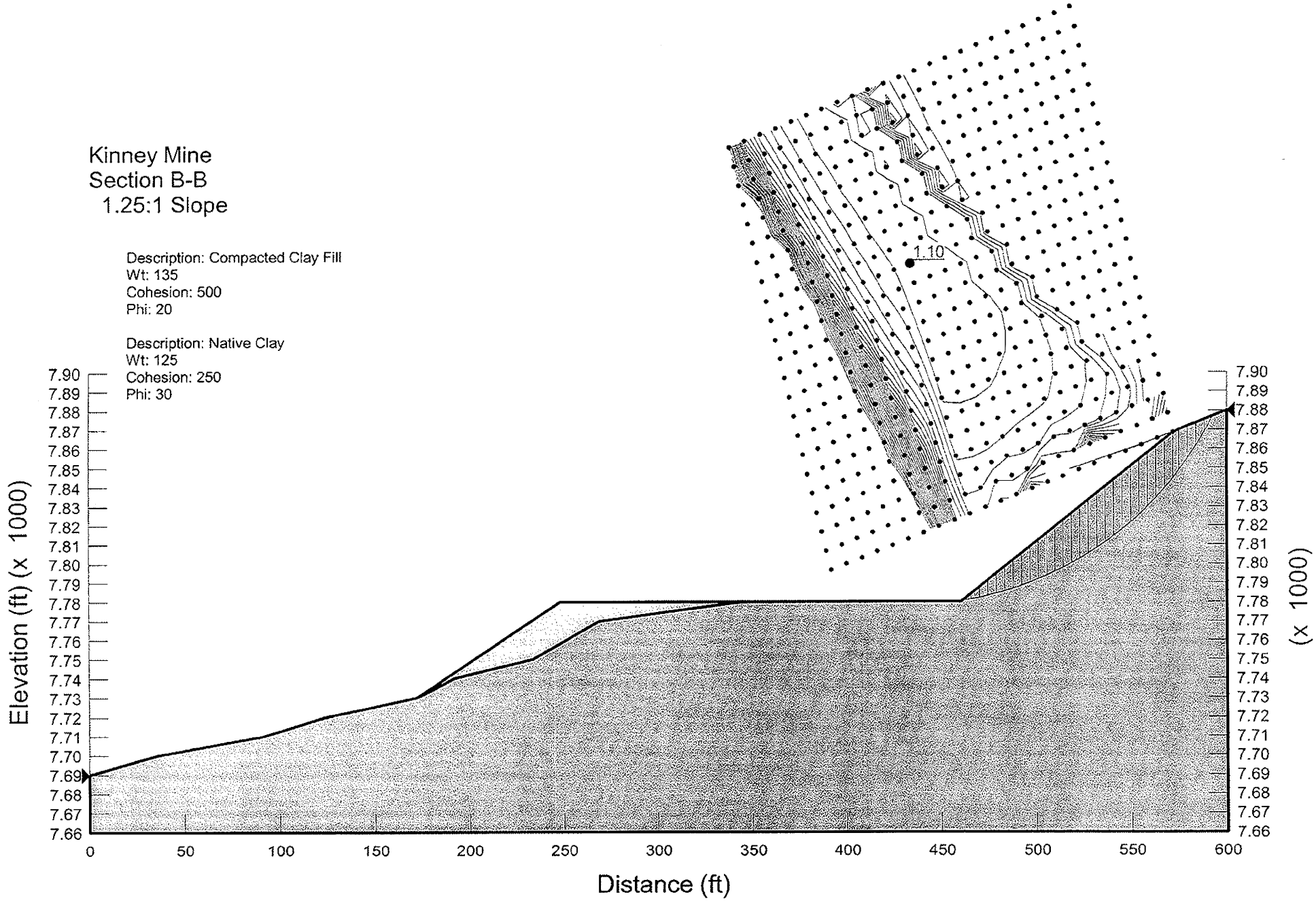
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section B-B
1.25:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

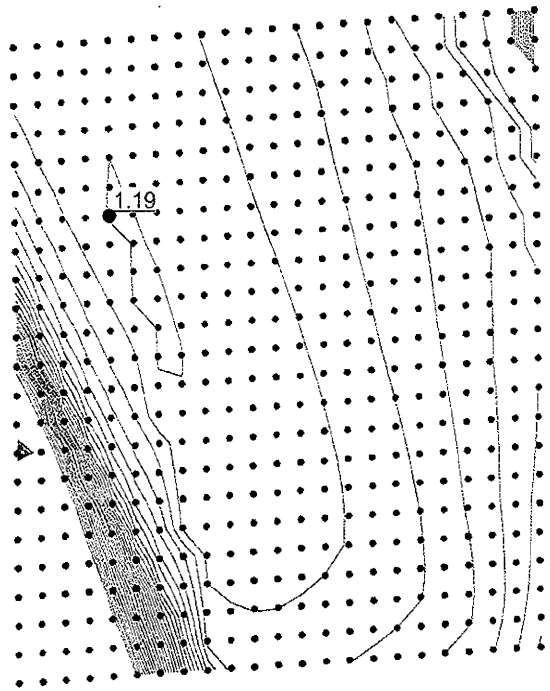
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30

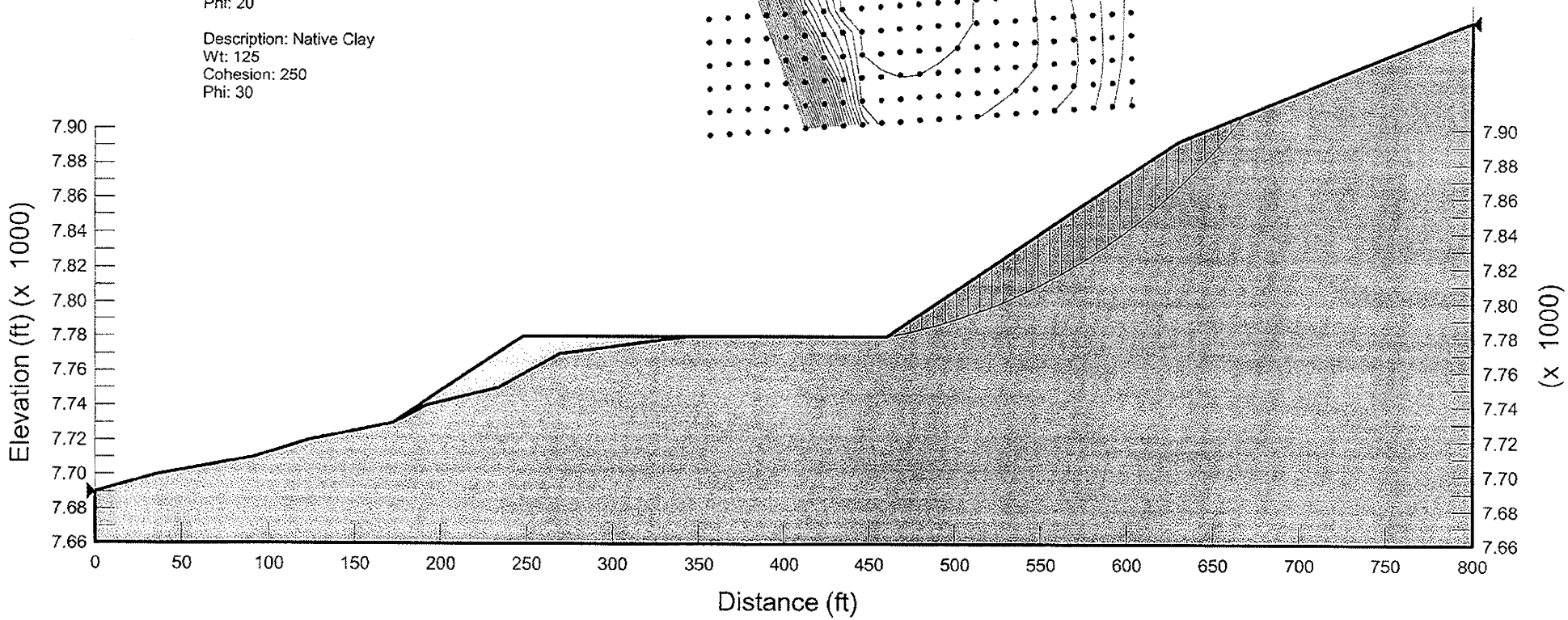


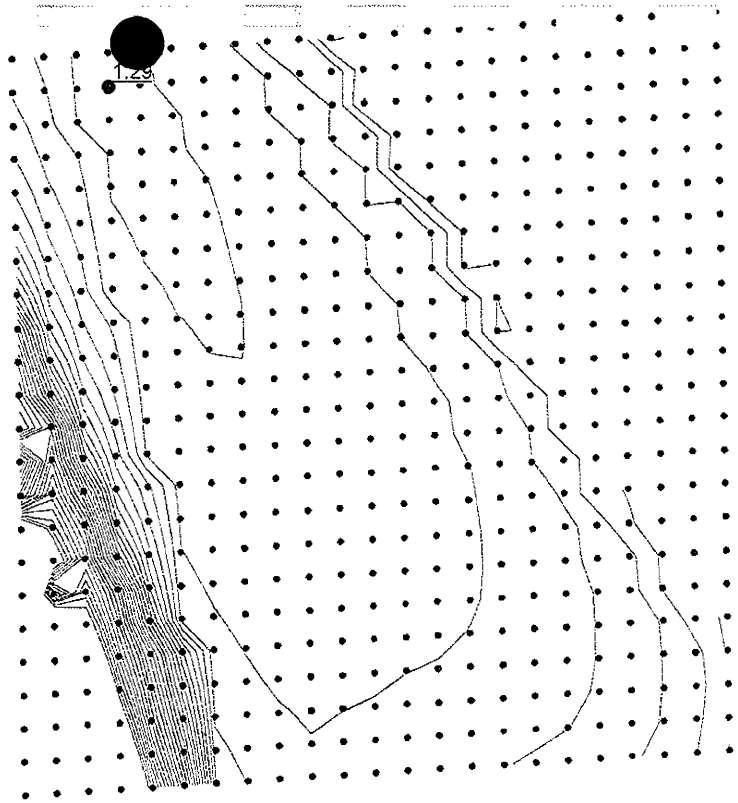
Kinney Mine
Section B-B
1.5:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



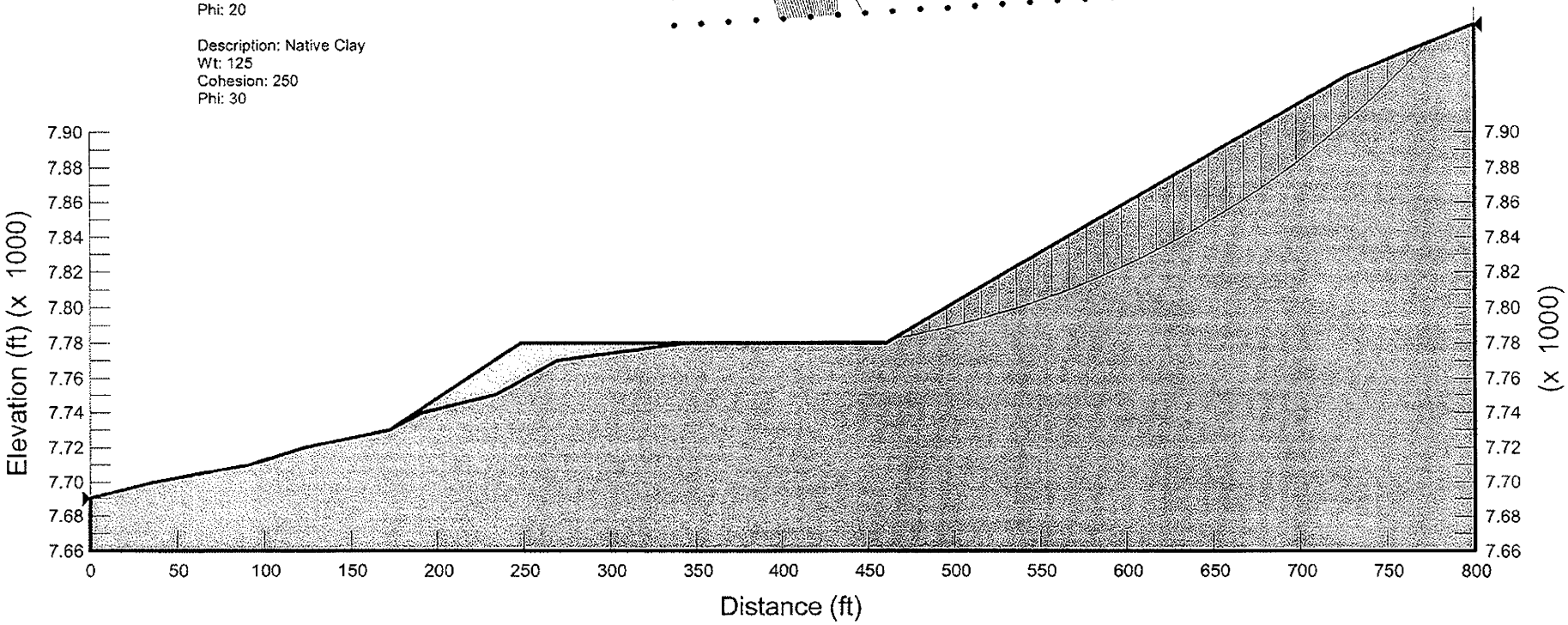




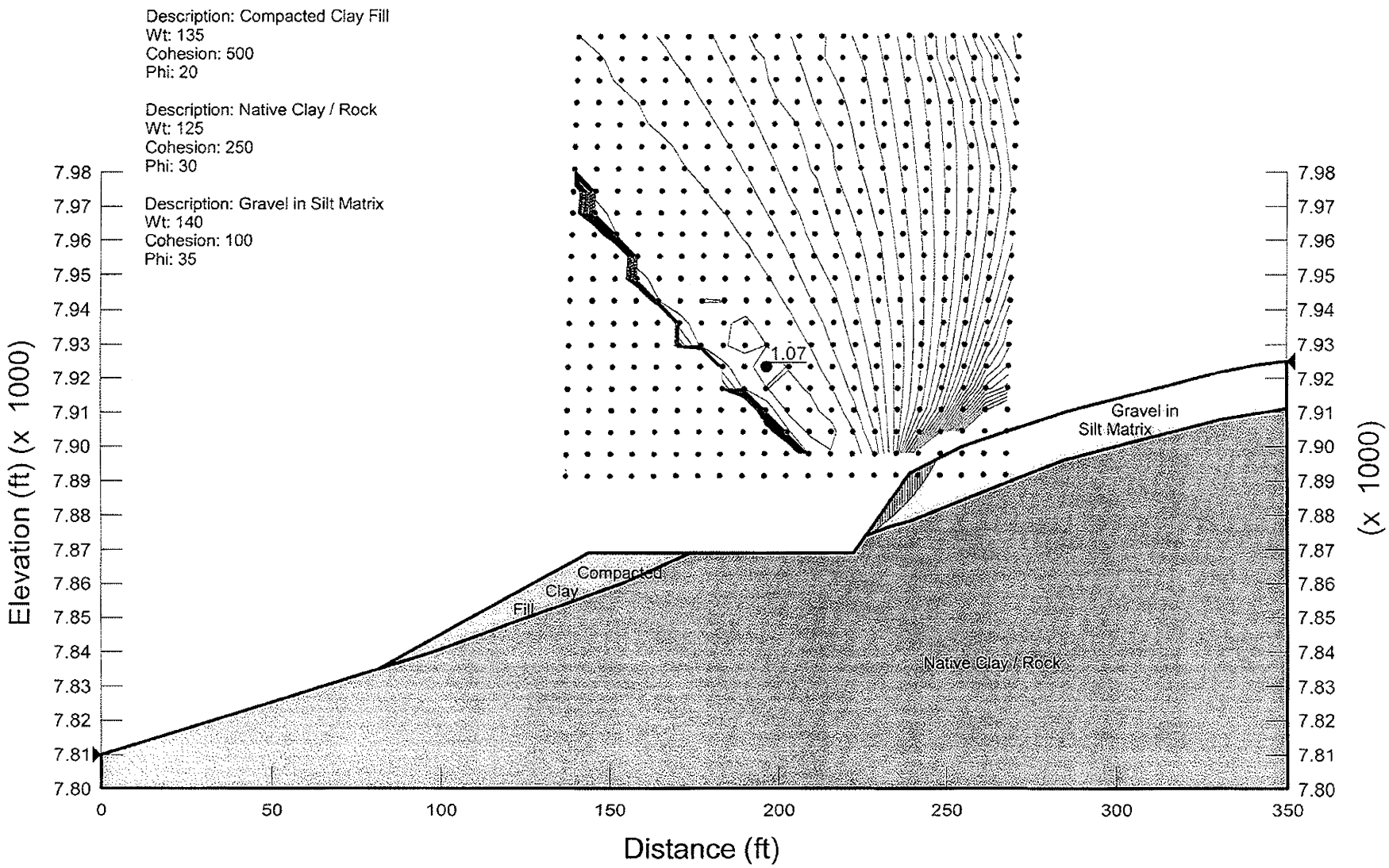
Kinney Mine
Section B-B
1.75:1 Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 500
Phi: 20

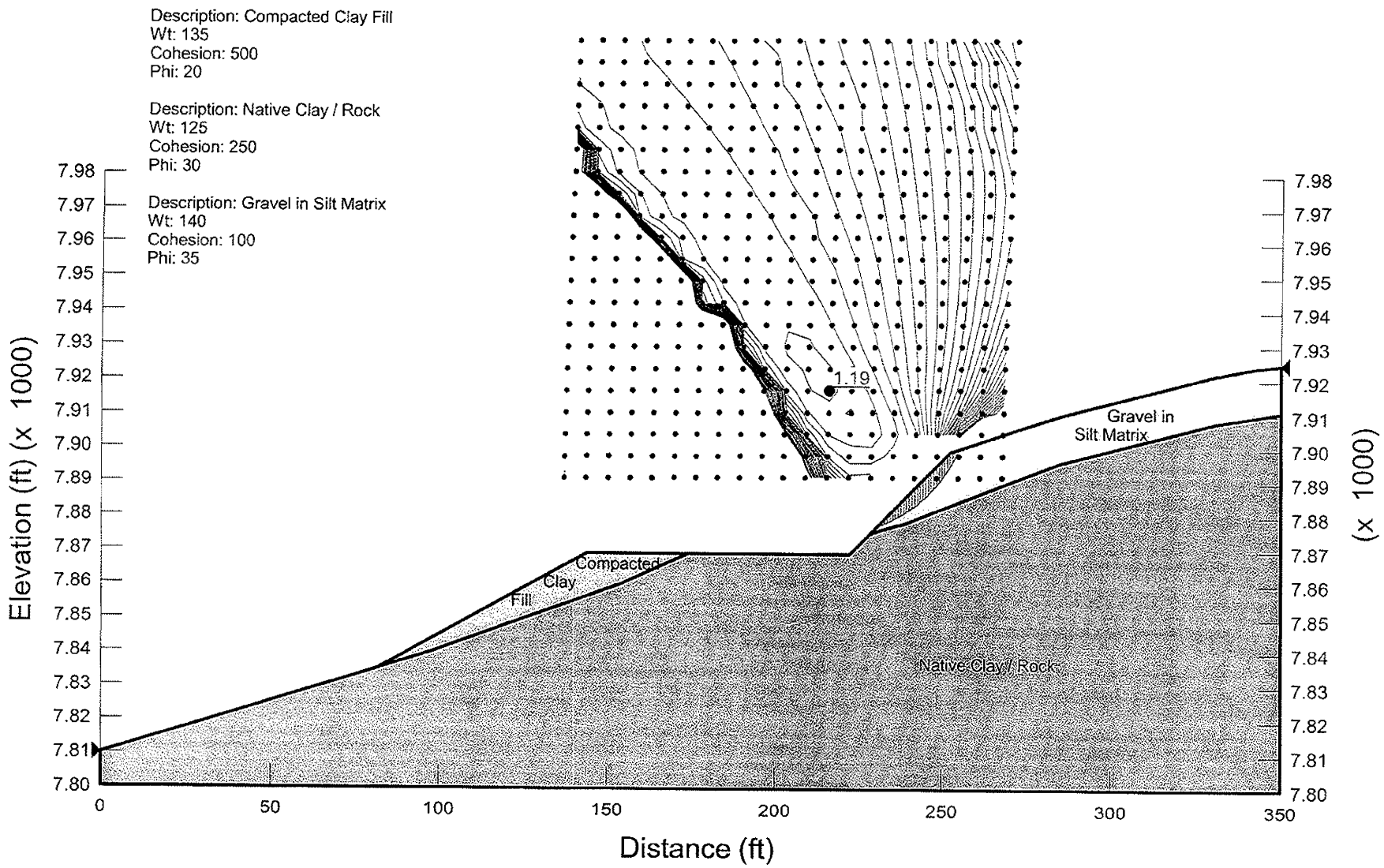
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



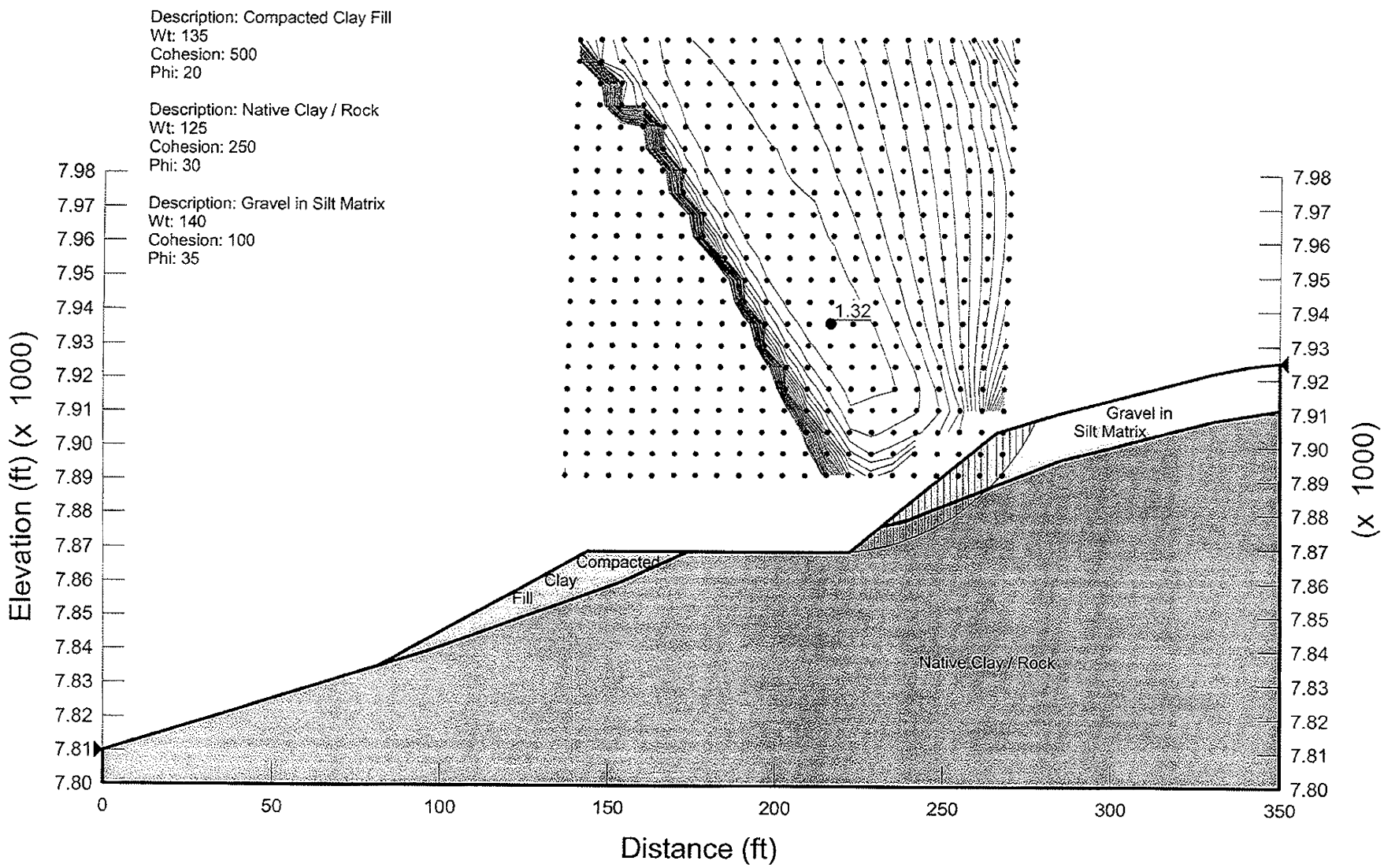
Kinney Mine
Section F-F
0.8:1 Slope



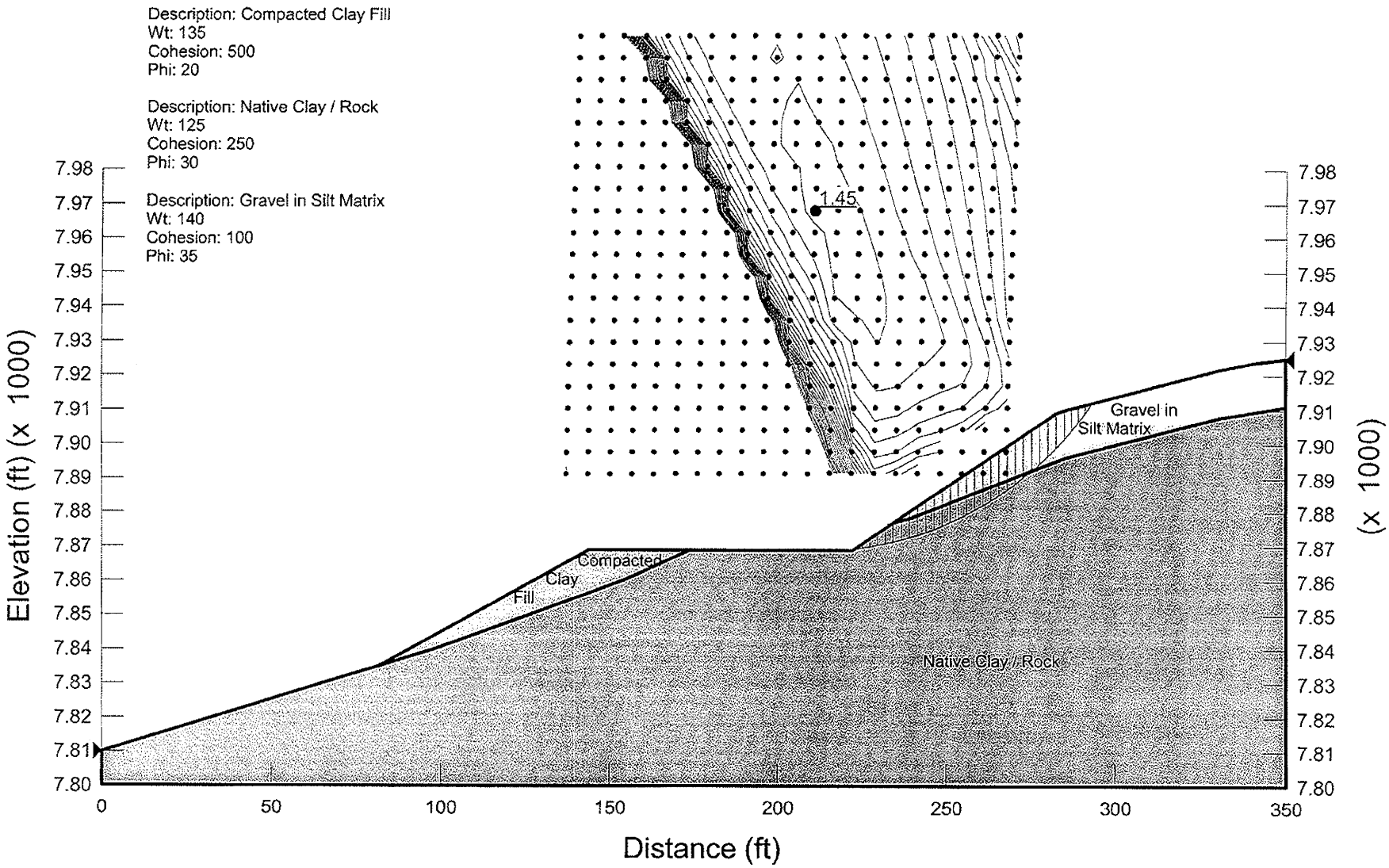
Kinney Mine
Section F-F
1:1 Slope



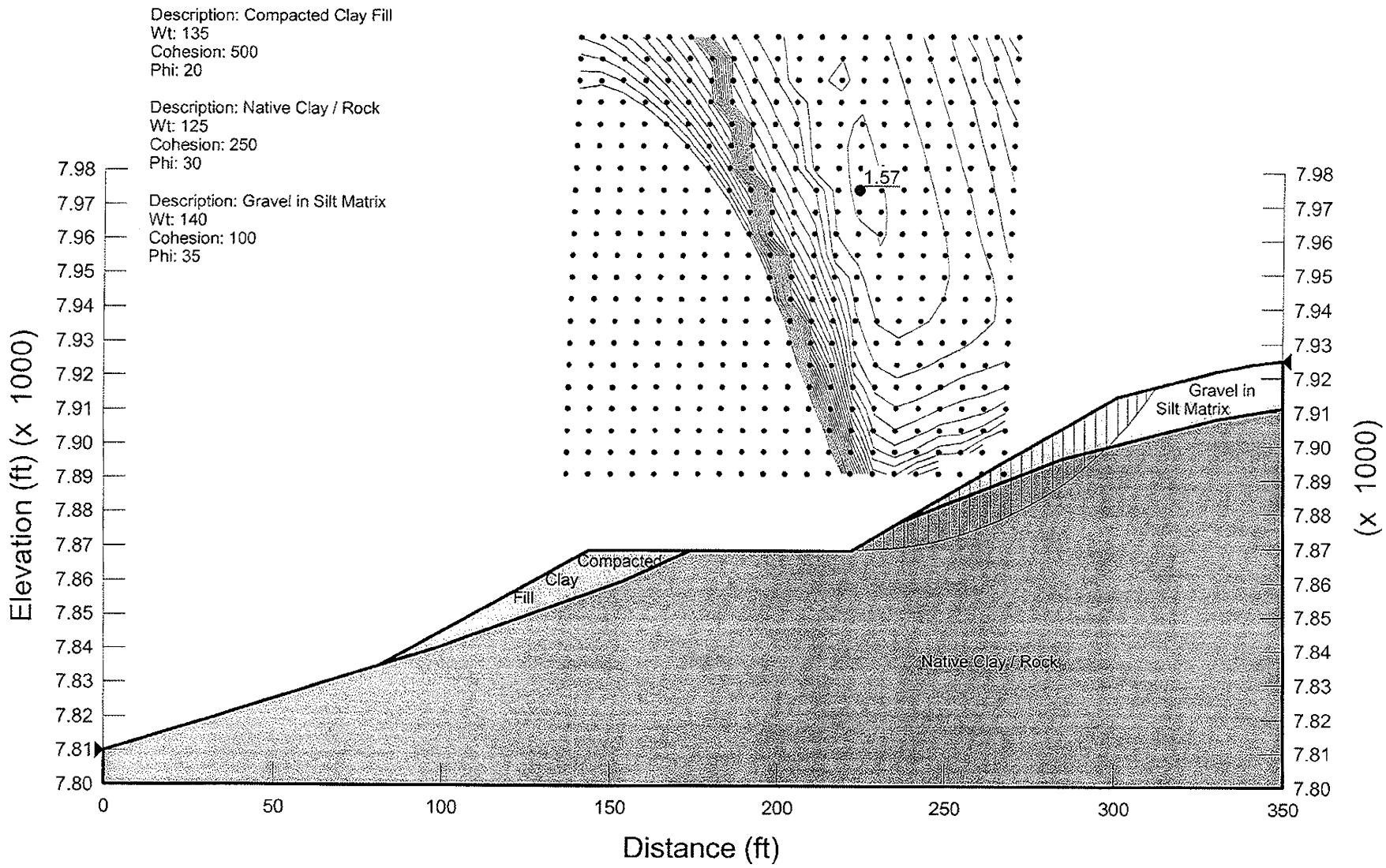
Kinney Mine
Section F-F
1.25:1 Slope



Kinney Mine
Section F-F
1.5:1 Slope



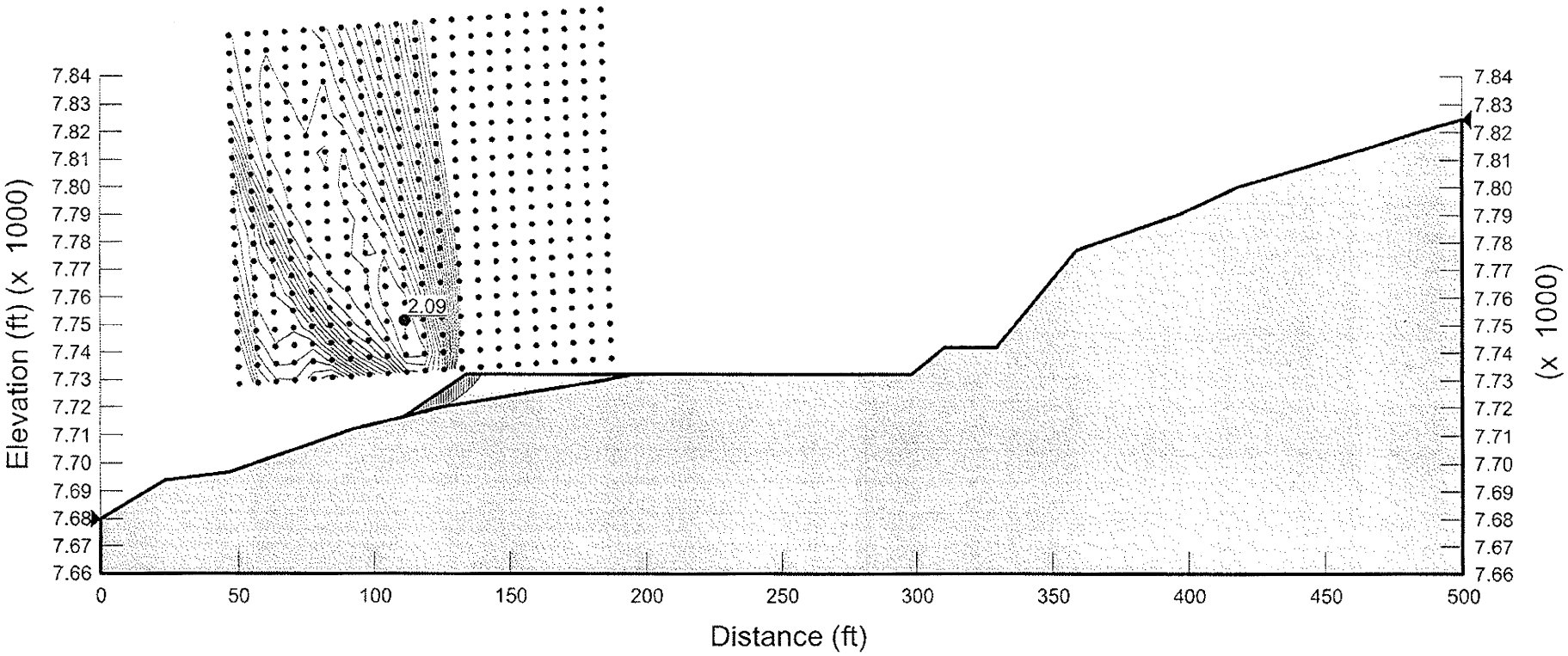
Kinney Mine
Section F-F
1.75:1 Slope



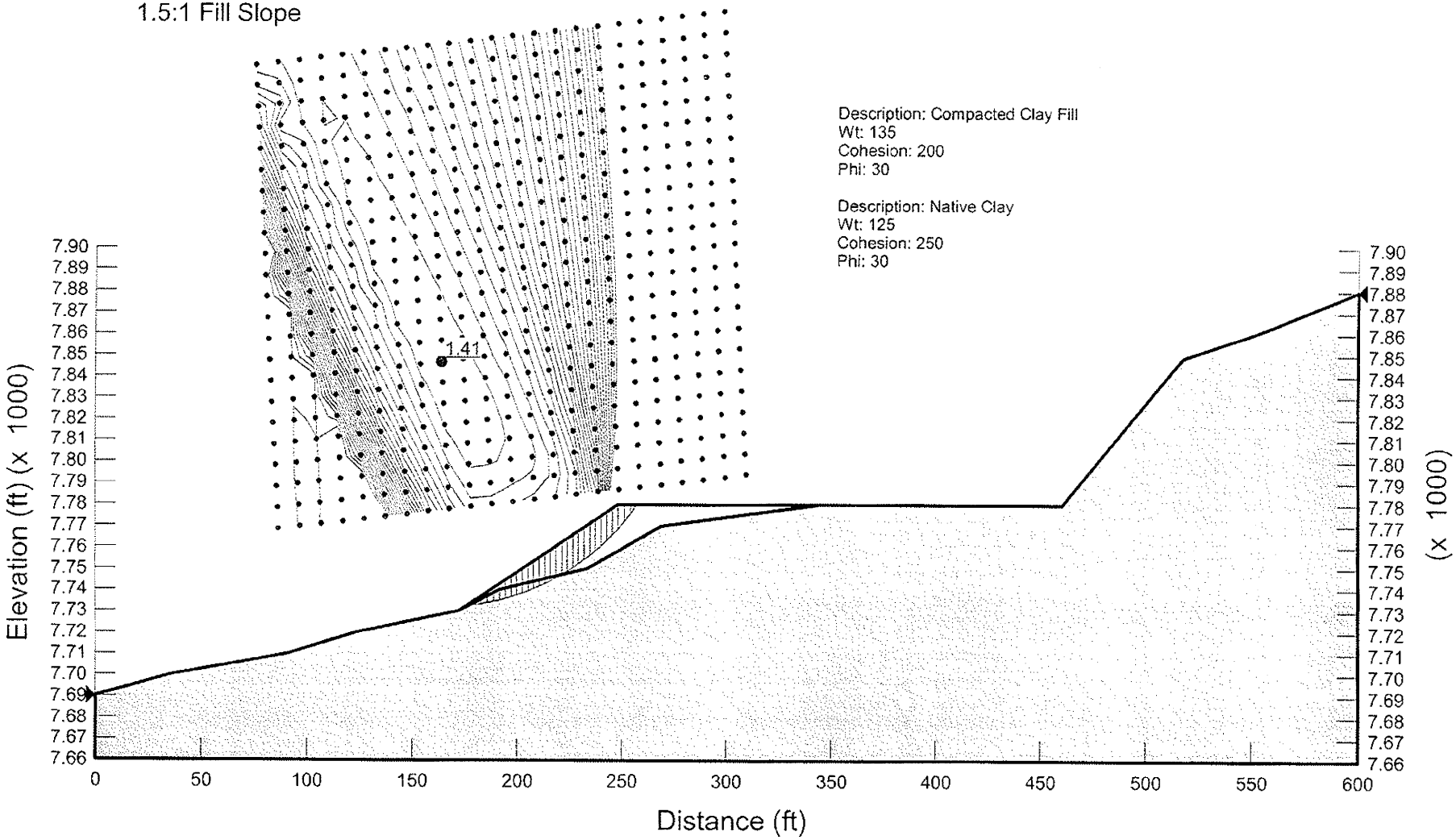
Kinney Mine
Section A-A
1.5:1 Fill Slope

Description: Compacted Clay Fill
Wt: 135
Cohesion: 200
Phi: 30

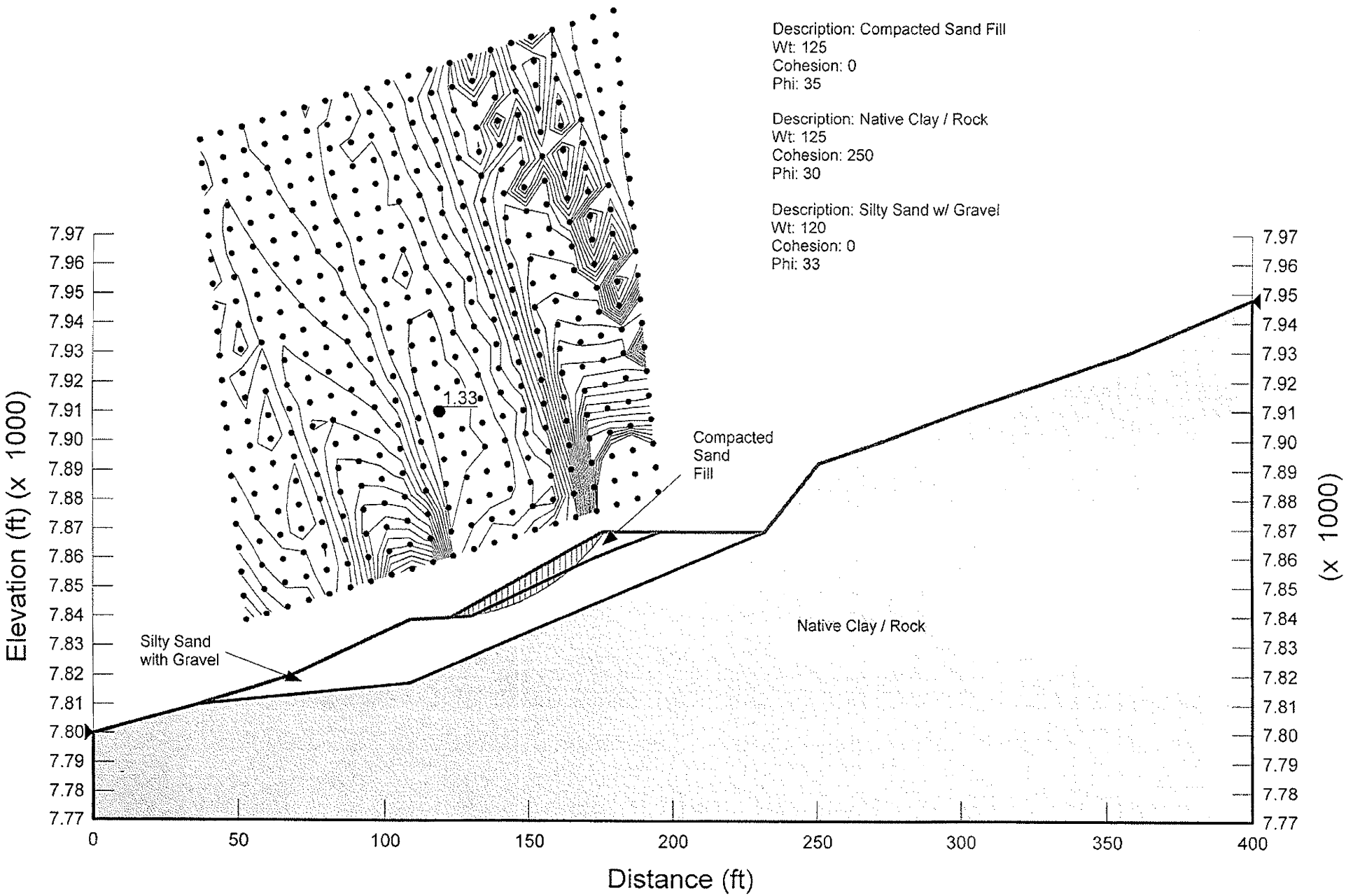
Description: Native Clay
Wt: 125
Cohesion: 250
Phi: 30



Kinney Mine
Section B-B
1.5:1 Fill Slope



Kinney Mine
Section C-C
1.8:1 Fill Slope



Kinney Mine
Section F-F
1.8:1 Fill Slope

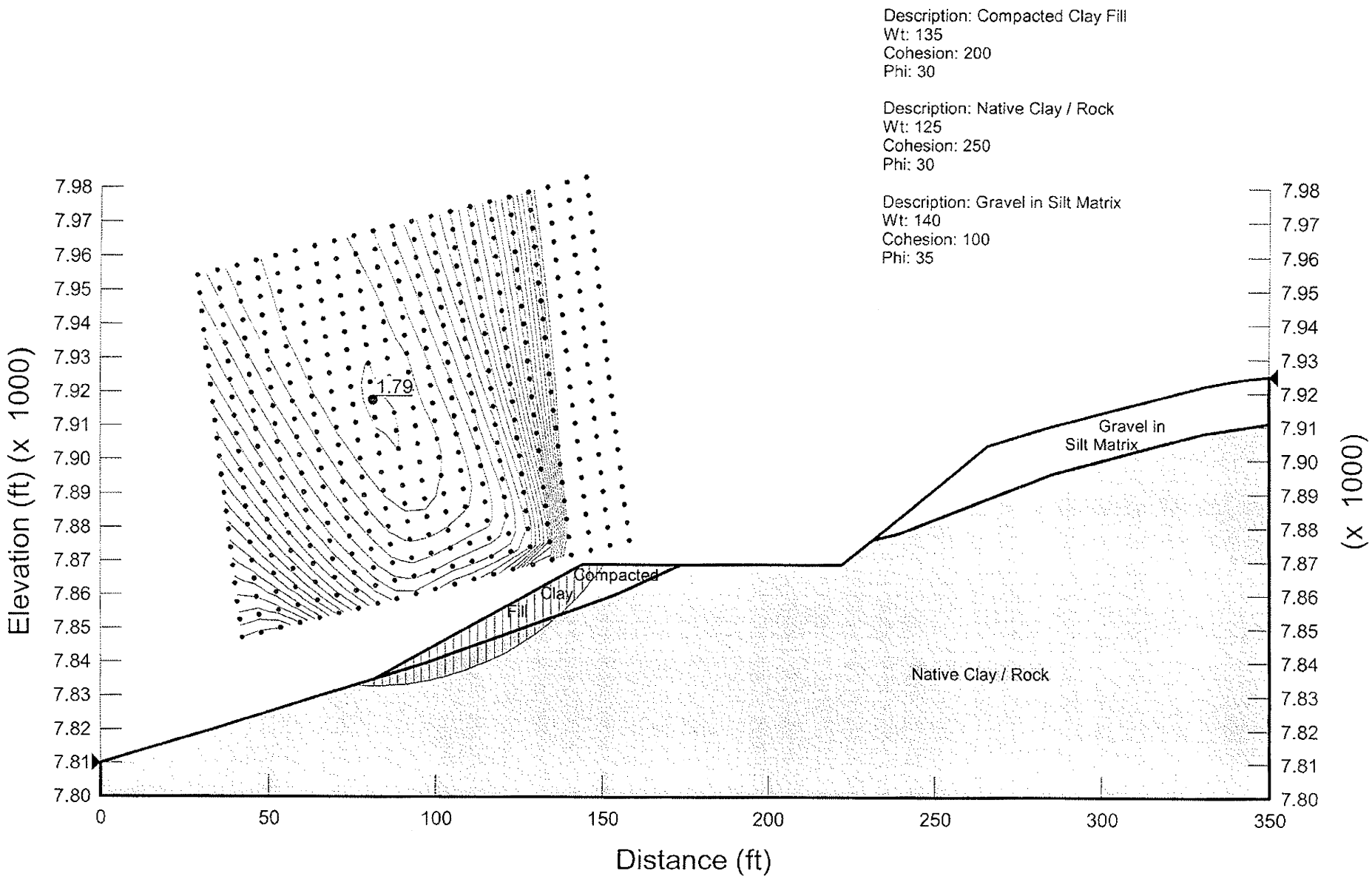


Exhibit 4.5.2.1-2

Blasting Plan

EXHIBIT 15
KINNEY NO. 2 MINE BLASTING PLAN

This blasting plan conforms to the Utah Coal Mining Rules R645-301-524 et. seq. The plan generally follows the format of the regulations, each regulation will be addressed as follows:

524.100 & 524.110

All surface blasting will be conducted under the direction of a certified blaster. Blasters will be qualified through the Division's blaster certification program.

524.120

Certificates of blaster certification will be carried by blasters or will be on file at a location within the permit area during blasting operations.

524.130

A blaster and at least one other person will be present for blasts.

524-140

The certified blaster responsible for blasting operations at the site will be familiar with the blasting plan and site-specific performance standards and give on-the-job training to persons who are not certified and who are assigned to the blasting crew or assist in the use of explosives.

524.210 – 524.240

Blasting may be required at the surface facilities of the Kinney No. 2 Mine located in the east half of the southeast quarter of Section 32, the west half of the west half of Section 33, Township 12 South, Range 7 East, Salt Lake Base & Meridian. Said areas can be seen on Map 3.4.1.4-1, Regional Land Use Map. A portion of this area is within 1,000 feet of occupied buildings, and within 500 feet of abandoned coal mines in the area. In addition, portions of the area are adjacent to Highway 96.

Blast Design

The blast design, as illustrated by Table 15-1, is intended to show the general layout and present general blasting information. Any significant deviation from this plan will be presented to the Division prior to the blast.

Structures To Be Protected

Structures to be protected will include all structures within 1,000 feet of the area described above, including the convenience store on the corner of Highway 96 south of the permit area, and all dwellings and public building located within 1,000 feet of the blasting area described above. The locations of buildings and structures within a 1,000 foot zone of the potential blasting area can be seen on Map 4.5.1.2-1 , Regional Surface Ownership Map.

Blaster Signature

This plan has been signed by a certified blaster on the last page of the plan. In the event the blaster that signed the plan no longer works for Carbon Resources (CR), or is no longer certified, a new certified blaster will be secured to execute the plan, his signature will be placed in the space below the original blaster, and a copy of the signed plan will be filed in the blasting records file.

524.300

A preblasting survey will be performed when 5 or more pounds of explosive are used as follows:

524.310 – At least 30 days before initiation of blasting, CR or its agent will notify, in writing, all residents or owners of dwellings, utilities or other structures located within on-half mile of the permit area, how to request a preblasting survey. Attachment A to this plan is a copy of a notification to be sent to the residents or owners of dwellings, utilities or other structures located within on-half mile of the permit area regarding their rights under the R645 rules to request a preblasting survey per R645-301-524.320.

524.320 – A resident or owner of a dwelling, structure, or utility within one-half mile of any part of the permit area may request a preblasting survey. The request will be made in writing directly to CR or UDOGM, who will promptly notify CR. CR will promptly conduct a preblasting survey of the dwelling, structure or utility and promptly prepare a report of the survey. An updated survey of any additions, modifications, or renovatins ill be performed by CR if requested by a resident or owner.

524.330 – CR will determine the condition of the dwelling, structure, or utility and will document any preblasting damage and other physical factors that could reasonably be affected by the blasting. Structures such as pipelines, cables, powerlines, and water systems will receive special attention, however, the assessment of these structures may be limited to surface conditions and other readily available data.

524.340 – The written report of the survey will be signed by the person that conducted the survey. Copies of the report will be promptly provided to UDOGM and to the person requesting the survey. If the person requesting the survey disagrees with the contents and/or recommendations contained therein, he or she may submit to both CR and UDOGM a detailed description of the specific areas of disagreement.

524.350 – Any surveys requested more than ten days before the planned initiation of blasting will be completed by CR before the initiation of blasting.

524.400

Blasting schedule: Blasting during construction of the Kinney No. 2 Mine surface facilities will begin any time after start of construction, which is scheduled to begin as soon after all appropriate permit approvals as possible. After construction is completed, blasting will be conducted as needed.

Blasting during initial site construction and during full mine operation will be done during daylight hours.

524.410 – Unscheduled blasts may occur for the following reasons:

- Where public safety requires
- Emergency blasting, such as boulders falling onto roadways, and etc.
- Destruction of damaged or deteriorated explosives or detonators in a safe manner
- Disposal of misfires and undetonated explosives
- Firing of charged holes as soon as practical after cessation of static electricity or stray current conditions when electrical detonators are used
- Firing of charged holes when weather conditions indicate the existence of a safety hazard is imminent

Residents of buildings or structures within one-half mile will be notified of unscheduled blasts using audible signals. CR will document the reason for the unscheduled blasts on the blasting records in accordance with R645-301-524.760.

524.430 – Written notice of blasting that is conducted within one-half mile of residents, structures, local governments, or utilities including Scofield Town, PacificCorp Power, and the Utah Department of Transportation will be given. A notice for blasting conducted during construction will be sent to the above entities weekly but in no case less than 24 hours before blasting will occur. The notices will contain the following:

- General location of the blasting
- Genera schedule
- General times of blasts
- Warning signals to be used before and after blasting

Notification to UDOT will be given that Highway 96 may be closed temporarily during blasting if a public safety hazard exists. A general notice of blasting will be placed in the Sun Advocate Newspaper before construction begins. Daily notices will be given each morning to the town of Scofield, and weekly notices will be given to UDOT if blasting during the following week has the potential to interfere with traffic on Highway 96.

524.500 & 524.510 – Blasting signs will be posted at the entrances to the Kinney No. 2 Mine site warning all who enter thereon of blasting. There are three possible entrances to the site, at the main entrance from Highway 96, at the private property road east of the site and the private property road at the north end of the permit area. The signs will be in accordance with R645-301-521.200 as follows:

- Signs will be posted, maintained, and removed by CR or its agent
- Signs will be of uniform design that can be easily seen and read
- Signs will be of durable materials and conform to local laws and regulations
- Signs will be maintained during all activities which they pertain

524.511 - Signs reading "BLASTING AREA" will be placed at conspicuous places along the edge of Highway 96 adjacent to the permit boundary where blasting may occur.

524.512 – Signs reading "WARNING! EXPLOSIVES IN USE" will be placed in conspicuous locations at all entrances to the permit area. The signs will also clearly list and describe the meaning of the audible blast warning and all-clear signals, and explain the marking of blasting areas and charged holes awaiting firing within the permit area.

524.520 – CR or its agent will give warning and all-clear signals of different character that are audible within a range of one-half mile from the point of the blast. A single long tone will be sounded approximately three (3) minutes before all blasts as the warning signal and two (2) short tones from the siren will signal all clear after each blast. Persons within the permit area and persons who reside or work within on-half mile of the permit area will be notified of the meaning of the signals through appropriate written notification as addressed above.

524.530 – Access within the blasting areas will be controlled to prevent the presence of livestock or unauthorized persons during blasting and until CR or its agent has determined that there are no unusual hazards and access to the travel within the blasting area can be safely resumed.

524.621 – Airblast will not exceed the limits below at the location of occupied dwellings or structures outside the permit area:

Lower Frequency Limit of Measuring System, HZ(+3dB)	Maximum Level dB
0.1 Hz or lower – flat response(1)	134 peak
2 Hz or lower – flat response	133 peak
6 Hz of lower – flat response	129 peak
C-weighted – slow response(1)	105 peak bBC
Note: (1) Only when approved by the Division	

524.631 – Periodic monitoring will be conducted to ensure compliance with airblast standards.

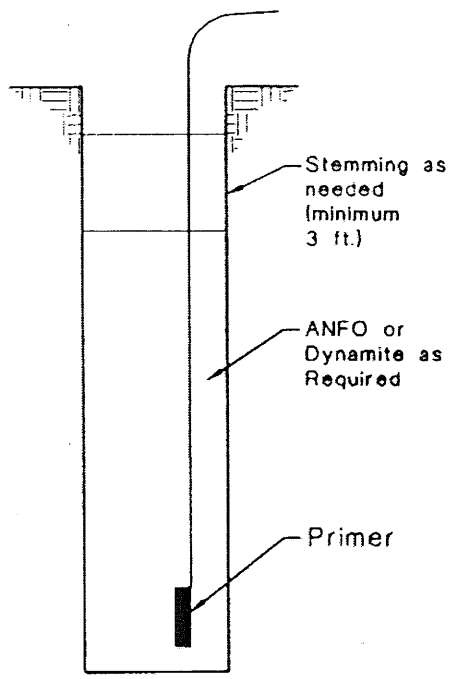
524.632 – The measuring system used will have an upper-end flat frequency response of at least 200 Hz.

524.633 – Flyrock traveling in the air or along the ground will not be cast from the blasting site more than one-half the distance to the nearest dwelling or other structure; beyond the area of control required under R645-301-524.530; or beyond the permit boundary.

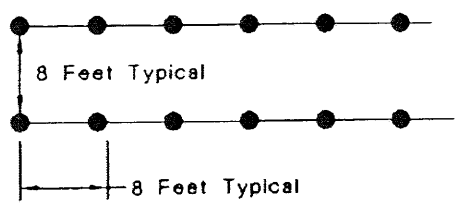
Table 15-1

BLASTING PARAMETERS

Explosive Material	ANFO or Dynamite
Hole Depth	As needed
Hole Diameter	2.5 inches
Hole Stemming	3 ft.
Powder Column	As needed
Pounds of Powder Per Hole (ANFO Density @ 0.85 gm/cc)	1.8 lbs/ft. ANFO, dynamite as needed
Powder Factor	0.61 lb/BCY
Bank Cubic Yards Per Hole	depends on hole depth
Drilling Pattern	8 ft. x 0 ft.
Primer	1.5" x 8" stick dynamite for ANFO or cap for dynamite



TYPICAL POWDER COLUMN



TYPICAL HOLE PATTERN

Exhibit 15-5

TABLE 15-2 BLASTING RECORD (Page 1 of 2)	
Kinney No. 2 Mine Carbon Resources Kinney No. 2 Mine Carbon Resources, LLC P.O. Box 11789 Albuquerqui, New Mexico 87192	Blaster in Charge:_____ License No.:_____

Shot Number:		Number in Blasting Crew:
Date:	Time:	Explosives used:
Location:		Weight of explosives used:
		*Max. number of explosives detonated:
Distance to nearest structure:		*Max. number of holes detonated:
Direction to nearest structure:		Method of firing:
Weather conditions: Temp:_____ Wind Direction:_____ Wind speed:_____ Other:_____		Type & length of stemming:
		Protection Used:
Material blasted:		Type of delay detonator used:
Number of holes:		Reason for unscheduled blast:
Diameter of holes:		
Burden distance:		
Spacing distance:		
Depth of holes:		
*Detonator within any 8 millisecond period.		

Signature:_____
Blaster In Charge

TABE 15-2 BLASTING RECORD (Page 2 of 2)
DELAY PATTERN SKETCH

524.640 – CR or its agent will use the explosive equation for blasting set forth in R645301.524.651 to comply with the peak particle velocity limits as set forth in the Explosives Table given in R645-301-524.642. When deviations from the number of holes per delay, as calculated by the referenced equation occurs, a seismograph will be utilized to assure compliance.

524.700 – Records of blasting will be maintained at the mine site for three years and will be available for inspection by the UDOGM or the public at reasonable times. The record of blasting will be on a form as shown as Table 15-2.

524.750 – If required, a record of seismographic and airblast information will be recorded and attached to the blasting record. The contents of this record will be in accordance with R645-301-524.751 through R645-301-524.755.

524.760 – The reason for unscheduled blasts will be recorded on the blasting record for the individual blast.

524.800 – CR will comply with all appropriate Utah and Federal laws and regulations in the use of explosives.

Signature:_____

Certified Blaster No. _____

Date:_____

Signature:_____

Certified Blaster No. _____

Date:_____

ATTACHMENT A

[Owner]
[Address]

Date:

To Whom It May Concern,

Re: Blasting By Kinney No. 2 Mine – Preblasting Survey

As per Utah Coal Mining Rules R645-301-524.310 et. seq., you have the right to request a preblasting survey of your structures that lie within on-half mile of the Kinney No. 2 Mine permit area shown on the attached map. This notice is required to be mailed to you at least 30 days before initiation of blasting when more than 5 pounds of blasting agent are used. Since blasting may be necessary during the construction phase of the project as well as during operation of the mine, this notice is being mailed to you before starting construction. We will notify you weekly of blasting that is planned during that week. You should evaluate your needs for a preblasting survey before the construction starts. You may request a preblasting survey any time during the life of the mine. Blasting will be done in compliance with the Utah Coal Mining Rules at R645-301-524.

According to R645-301-524.320, your request must be made in writing to either:

Carbon Resources
Kinney No. 2 Mine
Carbon Resources, LLC
P.O. Box 11789
Albuquerqui, New Mexico 87192

Or

Utah Coal Regulatory Program
Division of Oil. Gas and Mining
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Carbon Resources will promptly conduct a preblasting survey of the structure and promptly prepare a written report of the survey. An updated survey of any additions, modifications, or renovations will be performed if requested. The report will contain:

1. The condition of the structure and will document any preblasting damage and other physical factors that could reasonably be affected by the blasting. The assessment of the structures may be limited to surface conditions and other readily available data and information.
2. The written report will be signed by the person who conducted the survey. Copies of the report will be provided to The Division of Oil, Gas and Mining and to you.

If you disagree with the contents of and/or the recommendations in the report, you may submit to us or the Division of Oil, Gas and Mining a detailed description of the specific areas of disagreement.

Any surveys requested more than ten days before the planned blasting will be conducted and completed before the initiation of blasting.

Sincerely,

Carbon Resources

SUMMARY STATISTICS Angle Spring thru 9/27/2006				
Analyte	Count	Max	Min	Avg
Acidity	13	0.00	0.00	0.00
Alkalinity,(As CaCO3)	13	320.00	290.00	300.77
Aluminum	13	0.00	0.00	0.00
Ammonia (as N)	13	0.17	0.00	0.01
Arsenic	13	0.01	0.00	0.00
Bicarbonate (As CaCO3)	14	320.00	290.00	300.71
Boron	14	0.00	0.00	0.00
Cadmium	14	0.09	0.00	0.01
Calcium	14	100.00	90.00	97.07
Carbonate (As CaCO3)	14	0.00	0.00	0.00
Chloride	14	67.00	20.00	25.79
Copper	14	0.02	0.00	0.00
Conductivity	1	670.00	670.00	670.00
Hardness (as CaCO3)	14	340.00	220.00	317.86
Iron - Total	14	0.00	0.00	0.00
Iron - Diss	14	0.00	0.00	0.00
Lead	14	0.00	0.00	0.00
Magnesium	14	20.00	17.00	18.50
Manganese - Total	14	0.00	0.00	0.00
Manganese - Diss	14	0.01	0.00	0.00
Molybdenum	14	0.00	0.00	0.00
Nitrate (as N)	13	1.10	0.92	0.99
Nitrite (as N)	13	0.10	0.00	0.01
Oil & Grease	14	5.50	0.00	3.01
pH @ 25° C	2	7.71	7.04	7.38
Phosphate, ortho (as P)	14	0.04	0.00	0.00
Potassium	14	1.90	0.00	1.33
Selenium	14	0.05	0.00	0.00
Settleable Solids	14	0.00	0.00	0.00
Sodium	14	21.00	8.70	10.49
Sulfate	14	19.00	0.00	13.86
TDS	13	400.00	190.00	303.85
TSS	14	0.00	0.00	0.00
Zinc	14	0.11	0.00	0.04

Exhibit 4.7.2.2-1

Hydrology and Hydraulics
Ditches and Culverts
Sedimentation Pond 1
Energy Dissipation Structures

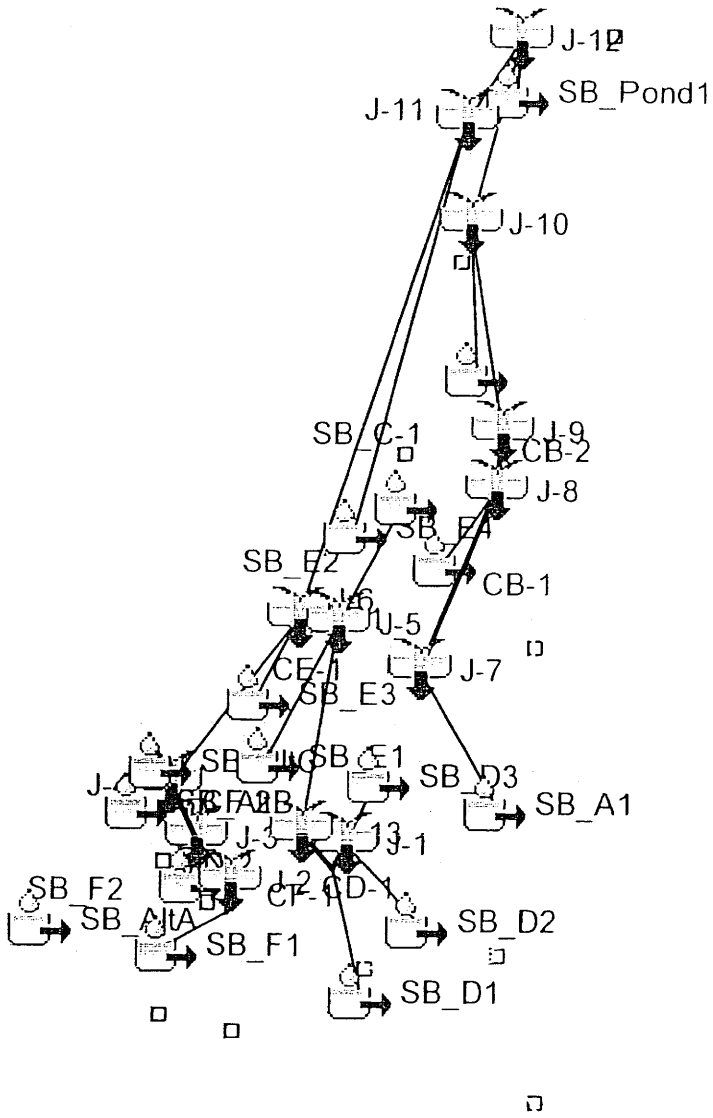
Hydrology & Hydraulics

HEC-HMS

Project : Kinney Mine Hydrology

Basin Model : Kinney Mine

Jan 03 10:28:03 MST 2008



Hydrologic Element	Drainage Area (mi2)	10yr 6hr Peak Discharge (cfs)	Time of Peak	Volume (in)
CB-1	0.0064	0.9	01Jul2007, 03:32	0.26
CB-2	0.01188	2	01Jul2007, 03:32	0.3
CD-1	0.00517	0.3	01Jul2007, 03:33	0.17
CD-2	0.00952	0.6	01Jul2007, 03:36	0.19
CE-1	0.0190796	2.4	01Jul2007, 03:33	0.28
CF-1	0.00581	1.3	01Jul2007, 03:31	0.39
CF-2	0.00779	1.7	01Jul2007, 03:31	0.37
J-1	0.00517	0.3	01Jul2007, 03:33	0.17
J-10	0.0184117	2.9	01Jul2007, 03:32	0.3
J-11	0.0300896	4.2	01Jul2007, 03:32	0.29
J-12	0.0518713	7.6	01Jul2007, 03:32	0.29
J-13	0.00952	0.6	01Jul2007, 03:36	0.19
J-2	0.00581	1.3	01Jul2007, 03:31	0.39
J-3	0.00779	1.7	01Jul2007, 03:31	0.37
J-4	0.00779	1.7	01Jul2007, 03:31	0.37
J-5	0.0190796	2.4	01Jul2007, 03:33	0.28
J-6	0.0276996	4.1	01Jul2007, 03:32	0.3
J-7	0.0064	0.9	01Jul2007, 03:31	0.26
J-8	0.01188	2	01Jul2007, 03:32	0.3
J-9	0.01188	2	01Jul2007, 03:32	0.3
SB_A1	0.0064	0.9	01Jul2007, 03:31	0.26
SB_AltA	0.00401	0.4	01Jul2007, 03:34	0.23
SB_AltB	0.00092	0.2	01Jul2007, 03:30	0.32
SB_AltC	0.0007	0.1	01Jul2007, 03:30	0.32
SB_B1	0.00548	1.1	01Jul2007, 03:32	0.35
SB_C-1	0.0065317	1	01Jul2007, 03:33	0.29
SB_D1	0.00435	0.3	01Jul2007, 03:37	0.21
SB_D2	0.00308	0.2	01Jul2007, 03:34	0.16
SB_D3	0.00209	0.2	01Jul2007, 03:33	0.18
SB_E1	0.00693	1.6	01Jul2007, 03:32	0.43
SB_E2	0.0026296	0.2	01Jul2007, 03:36	0.23
SB_E3	0.00083	0.1	01Jul2007, 03:31	0.23
SB_E4	0.00239	0.1	01Jul2007, 03:35	0.13
SB_F1	0.00581	1.3	01Jul2007, 03:31	0.39
SB_F2	0.00198	0.4	01Jul2007, 03:31	0.32
SB_G1	0.00712	0.3	01Jul2007, 03:35	0.14
SB_Pond1	0.00337	0.6	01Jul2007, 03:30	0.29
UDC-1	0.15526	2.7	01Jul2007, 05:45	0.09
UDD-1	0.101508	1.8	01Jul2007, 05:45	0.09

Hydrologic Element	Drainage Area (mi2)	100yr 6hr Peak Discharge (cfs)	Time of Peak	Volume (in)
CB-1	0.0064	2.9	01Jul2007, 03:31	0.75
CB-2	0.01188	5.8	01Jul2007, 03:31	0.82
CD-1	0.00517	1.6	01Jul2007, 03:32	0.59
CD-2	0.00952	2.9	01Jul2007, 03:34	0.62
CE-1	0.0190796	7.8	01Jul2007, 03:32	0.78
CF-1	0.00581	3.3	01Jul2007, 03:31	0.97
CF-2	0.00779	4.4	01Jul2007, 03:31	0.94
J-1	0.00517	1.6	01Jul2007, 03:32	0.59
J-10	0.0184117	8.7	01Jul2007, 03:31	0.81
J-11	0.0300896	12.9	01Jul2007, 03:31	0.79
J-12	0.0518713	23.2	01Jul2007, 03:31	0.8
J-13	0.00952	2.9	01Jul2007, 03:34	0.62
J-2	0.00581	3.3	01Jul2007, 03:31	0.97
J-3	0.00779	4.4	01Jul2007, 03:30	0.94
J-4	0.00779	4.4	01Jul2007, 03:31	0.94
J-5	0.0190796	7.8	01Jul2007, 03:32	0.78
J-6	0.0276996	12.4	01Jul2007, 03:31	0.82
J-7	0.0064	2.9	01Jul2007, 03:30	0.75
J-8	0.01188	5.8	01Jul2007, 03:31	0.82
J-9	0.01188	5.8	01Jul2007, 03:31	0.82
SB_A1	0.0064	2.9	01Jul2007, 03:30	0.75
SB_AltA	0.00401	1.5	01Jul2007, 03:33	0.7
SB_AltB	0.00092	0.5	01Jul2007, 03:30	0.85
SB_AltC	0.0007	0.4	01Jul2007, 03:30	0.85
SB_B1	0.00548	2.9	01Jul2007, 03:31	0.91
SB_C-1	0.0065317	2.9	01Jul2007, 03:32	0.8
SB_D1	0.00435	1.4	01Jul2007, 03:35	0.65
SB_D2	0.00308	0.9	01Jul2007, 03:33	0.57
SB_D3	0.00209	0.7	01Jul2007, 03:32	0.61
SB_E1	0.00693	4.1	01Jul2007, 03:31	1.03
SB_E2	0.0026296	0.9	01Jul2007, 03:35	0.7
SB_E3	0.00083	0.3	01Jul2007, 03:31	0.7
SB_E4	0.00239	0.6	01Jul2007, 03:33	0.49
SB_F1	0.00581	3.3	01Jul2007, 03:31	0.97
SB_F2	0.00198	1	01Jul2007, 03:30	0.85
SB_G1	0.00712	1.9	01Jul2007, 03:33	0.53
SB_Pond1	0.00337	1.6	01Jul2007, 03:30	0.8
UDC-1	0.15526	14.3	01Jul2007, 04:16	0.42
UDD-1	0.101508	9.4	01Jul2007, 04:14	0.42

Hydrologic Element	Drainage Area (mi2)	100yr 6hr Peak Discharge (cfs)	Time of Peak	Volume (in)
Reclaimed Watershed	0.112	11.5	01Jul2007, 04:14	0.45

Hydrologic Element	Drainage Area (mi2)	100yr 24hr Peak Discharge (cfs)	Time of Peak	Volume (in)
UDC-1	0.15526	38.5	01Jul2007, 13:34	0.79
UDD-1	0.101508	25.7	01Jul2007, 13:33	0.79

Hydrologic Element	Drainage Area (mi2)	100yr 6hr Peak Discharge (cfs)	Time of Peak	Volume (in)
Combined	0.05887	18.7	01Jul2007, 03:43	0.8

Kinney Mine Hydrology
Time of Concentration/Lag Time Esitimates

Method: SCS TR 55

Tc = Sheet flow time + shallow concentrated flow time + channel flow time

Tt = 0.007*(n*L) ^ 0.8/((P2) ^ .5*S ^ .4)
P2 = 2-yr 24-hr precip = 1.39 inches
S = Slope (ft/ft)

SUBBASIN	SHEET FLOW TIME				SHALLOW CONCENTRATED TIME				Channel Time				TOTAL Tc	LAG TIME	LAG TIME
	L (ft)	S	n	Tt (hrs)	L	S	v (fps)	T (hrs)	L	S	v (fps)	T (hrs)	(hrs)	(hrs)	(mins)
SB_A1	24	0.583	0.13	0.02	0	0.000	0	0.00	1515	0.064	6.5	0.07	0.08	0.05	3.0
SB_B1	157	0.682	0.13	0.08	0	0.000	0	0.00	644	0.010	2.6	0.07	0.15	0.09	5.3
SB_C1	224	0.393	0.13	0.13	0	0.000	0	0.00	599	0.023	3.9	0.04	0.17	0.10	6.1
SB_D1	300	0.313	0.13	0.18	1303	0.058	3.8	0.10	240	0.021	3.7	0.02	0.29	0.17	10.5
SB_D2	300	0.333	0.13	0.17	176	0.244	8	0.01	350	0.082	7.3	0.01	0.19	0.12	6.9
SB_D3	47	0.021	0.13	0.12	0	0.000	0	0.00	467	0.029	4.4	0.03	0.15	0.09	5.3
SB_E1	300	0.008	0.011	0.10	51	0.011	1.6	0.01	490	0.010	2.6	0.05	0.17	0.10	6.0
SB_E2	413	0.240	0.13	0.25	0	0.000	0	0.00	424	0.021	3.7	0.03	0.29	0.17	10.3
SB_E3	63	0.333	0.13	0.05	0	0.000	0	0.00	525	0.010	2.6	0.06	0.11	0.06	3.8
SB_E4	73	0.260	0.13	0.06	0	0.000	0	0.00	1238	0.010	2.6	0.13	0.20	0.12	7.1
SB_F1	240	0.013	0.011	0.07	154	0.013	1.8	0.02	244	0.033	4.6	0.01	0.11	0.07	4.0
SB_F2	56	0.125	0.13	0.07	0	0.000	0	0.00	503	0.090	7.7	0.02	0.08	0.05	3.1
SB_G1	30	0.020	0.013	0.01	0	0.000	0	0.00	1809	0.010	2.6	0.20	0.21	0.13	7.6
SB_Pond1	64	0.313	0.13	0.05	0	0.000	0	0.00	544	0.065	6.5	0.02	0.07	0.04	2.7
SB_AltA	300	0.200	0.13	0.21	0	0.000	0	0.00	133	0.010	2.6	0.01	0.23	0.14	8.1
SB_AltB	63	0.270	0.13	0.05	0	0.000	0	0.00	145	0.083	7.4	0.01	0.06	0.04	2.1
SB_AltC	29	0.720	0.13	0.02	0	0.000	0	0.00	227	0.044	5.4	0.01	0.03	0.02	1.1
Combined	190	0.005	0.03	0.20	500	0.005	1.2	0.12	2080	0.01	2.6	0.23	0.54	0.32	19.5

Chapter 3 Time of Concentration and Travel Time

Travel time (T_t) is the time it takes water to travel from one location to another in a watershed. T_t is a component of time of concentration (T_c), which is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. T_c is computed by summing all the travel times for consecutive components of the drainage conveyance system.

T_c influences the shape and peak of the runoff hydrograph. Urbanization usually decreases T_c, thereby increasing the peak discharge. But T_c can be increased as a result of (a) ponding behind small or inadequate drainage systems, including storm drain inlets and road culverts, or (b) reduction of land slope through grading.

Factors affecting time of concentration and travel time

Surface roughness

One of the most significant effects of urban development on flow velocity is less retardance to flow. That is, undeveloped areas with very slow and shallow overland flow through vegetation become modified by urban development: the flow is then delivered to streets, gutters, and storm sewers that transport runoff downstream more rapidly. Travel time through the watershed is generally decreased.

Channel shape and flow patterns

In small non-urban watersheds, much of the travel time results from overland flow in upstream areas. Typically, urbanization reduces overland flow lengths by conveying storm runoff into a channel as soon as possible. Since channel designs have efficient hydraulic characteristics, runoff flow velocity increases and travel time decreases.

Slope

Slopes may be increased or decreased by urbanization, depending on the extent of site grading or the extent to which storm sewers and street ditches are used in the design of the water management system. Slope will tend to increase when channels are straightened and decrease when overland flow is directed through storm sewers, street gutters, and diversions.

Computation of travel time and time of concentration

Water moves through a watershed as sheet flow, shallow concentrated flow, open channel flow, or some combination of these. The type that occurs is a function of the conveyance system and is best determined by field inspection.

Travel time (T_t) is the ratio of flow length to flow velocity:

$$T_t = \frac{L}{3600V} \qquad \text{[eq. 3-1]}$$

where:

T_t = travel time (hr)
L = flow length (ft)
V = average velocity (ft/s)
3600 = conversion factor from seconds to hours.

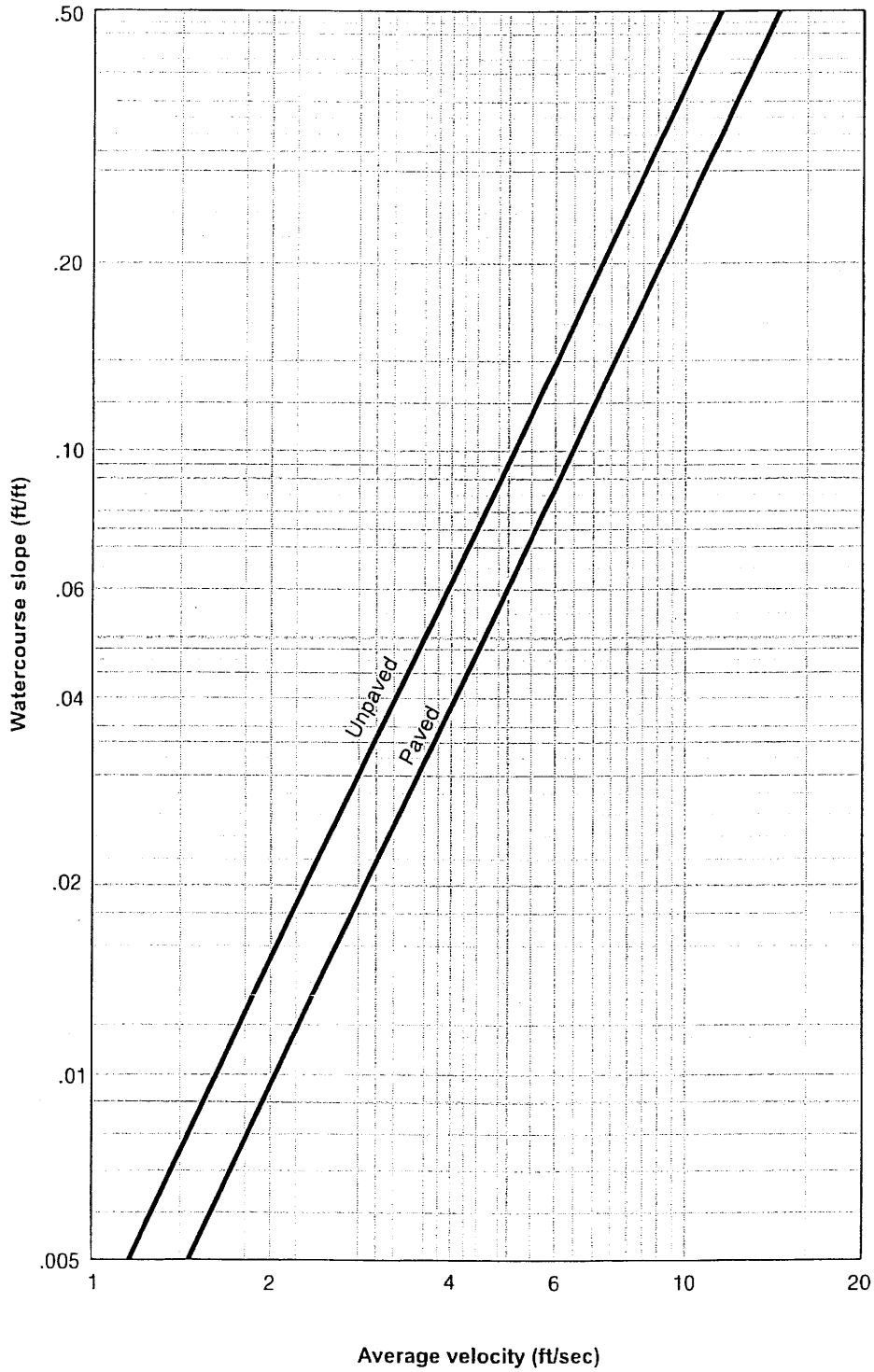
Time of concentration (T_c) is the sum of T_t values for the various consecutive flow segments:

$$T_c = T_{t_1} + T_{t_2} + \ldots T_{t_m} \qquad \text{[eq. 3-2]}$$

where:

T_c = time of concentration (hr)
m = number of flow segments

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1] The n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

Manning's equation is:

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad \text{[eq. 3-4]}$$

where:

V = average velocity (ft/s)
r = hydraulic radius (ft) and is equal to a/p_w
a = cross sectional flow area (ft^2)
p_w = wetted perimeter (ft)
s = slope of the hydraulic grade line (channel slope, ft/ft)
n = Manning's roughness coefficient for open channel flow.

Manning's n values for open channel flow can be obtained from standard textbooks such as Chow (1959) or Linsley et al. (1982). After average velocity is computed using equation 3-4, T_t for the channel segment can be estimated using equation 3-1.

Reservoirs or lakes

Sometimes it is necessary to estimate the velocity of flow through a reservoir or lake at the outlet of a watershed. This travel time is normally very small and can be assumed as zero.

Limitations

- Manning's kinematic solution should not be used for sheet flow longer than 300 feet. Equation 3-3 was developed for use with the four standard rainfall intensity-duration relationships.

- In watersheds with storm sewers, carefully identify the appropriate hydraulic flow path to estimate T_c. Storm sewers generally handle only a small portion of a large event. The rest of the peak flow travels by streets, lawns, and so on, to the outlet. Consult a standard hydraulics textbook to determine average velocity in pipes for either pressure or nonpressure flow.

- The minimum T_c used in TR-55 is 0.1 hour.

- A culvert or bridge can act as a reservoir outlet if there is significant storage behind it. The procedures in TR-55 can be used to determine the peak flow upstream of the culvert. Detailed storage routing procedures should be used to determine the outflow through the culvert.

Example 3-1

The sketch below shows a watershed in Dyer County, northwestern Tennessee. The problem is to compute T_c at the outlet of the watershed (point D). The 2-year 24-hour rainfall depth is 3.6 inches. All three types of flow occur from the hydraulically most distant point (A) to the point of interest (D). To compute T_c, first determine T_t for each segment from the following information:

Segment AB: Sheet flow; dense grass; slope (s) = 0.01 ft/ft; and length (L) = 100 ft. Segment BC: Shallow concentrated flow; unpaved; s = 0.01 ft/ft; and L = 1,400 ft. Segment CD: Channel flow; Manning's n = .05; flow area (a) = 27 ft^2; wetted perimeter (p_w) = 28.2 ft; s = 0.005 ft/ft; and L = 7,300 ft.

See figure 3-2 for the computations made on worksheet 3.

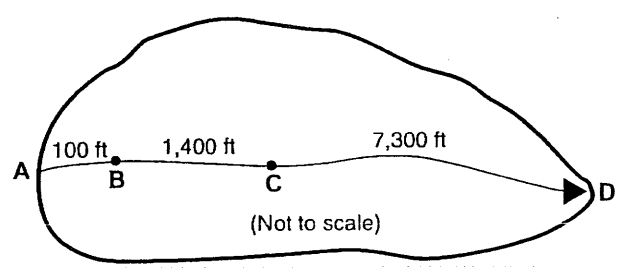


Figure 3-2 Worksheet 3 for example 3-1

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	Heavenly Acres	By DW	Date 10/6/85
Location	Dyer County, Tennessee	Checked NM	Date 10/8/85

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

	Segment ID	AB		
1. Surface description (table 3-1)		Dense Grass		
2. Manning's roughness coefficient, n (table 3-1)		0.24		
3. Flow length, L (total L ≤ 300 ft) ft		100		
4. Two-year 24-hour rainfall, P_2 in		3.6		
5. Land slope, s ft/ft		0.01		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr		0.30	+	= 0.30

Shallow concentrated flow

	Segment ID	BC		
7. Surface description (paved or unpaved)		Unpaved		
8. Flow length, L ft		1400		
9. Watercourse slope, s ft/ft		0.01		
10. Average velocity, V (figure 3-1) ft/s		1.6		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		0.24	+	= 0.24

Channel flow

	Segement ID	CD		
12. Cross sectional flow area, a ft^2		27		
13. Wetted perimeter, p_w ft		28.2		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft		0.957		
15 Channel slope, s ft/ft		0.005		
16. Manning's roughness coefficient, n		0.05		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s		2.05		
18. Flow length, L ft		7300		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		0.99	+	= 0.99
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr				1.53

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Mountain Watershed Lag Time
PROJECT NO 308.01.400

SHEET ____ OF ____
COMPUTED TDS
CHECKED ____
DATE 6-4-07

Lag Time for Mountain Watersheds

Watershed Calcs

$$t_{lag} = 0.0051 \times width^{0.594} \times slope^{-0.150} \times S_{nat}^{0.313}$$

$$width = \frac{\text{watershed area}}{\text{watershed length}}$$

$$slope = \frac{\text{max elevation difference}}{\text{longest flow path}}$$

$$S_{nat} = \frac{1000}{CN} - 10$$

① UDC-1

$$width = \frac{3{,}936{,}738\ ft^2}{3{,}030\ ft} = 1299\ ft$$

$$slope = \frac{8810 - 7850}{3{,}080\ ft} = 0.314$$

$$S_{nat} = \frac{1000}{CN} - 10 = \frac{1000}{75} - 10 = 3.33$$

$$t_{lag} = 0.0051 \times (1299)^{0.594} \times (0.314)^{-0.15} \times (3.33)^{0.313}$$

$$= 0.63\ hrs = \underline{\underline{37.8\ min}}$$

HANSEN ALLEN & LUCE INC
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Mountain Watershed Lag Time
PROJECT NO 308.01.400

SHEET ____ OF ____
COMPUTED TDS
CHECKED ____
DATE 8-3-07

(2) UDD-1

$$\text{width} = \frac{2{,}829{,}870\ ft^2}{2{,}320\ ft} = 1{,}220\ ft$$

$$\text{slope} = \frac{8{,}610\ ft - 7{,}840\ ft}{2{,}670\ ft} = 0.288$$

$$S_{nat} = \frac{1000}{CN} - 10 = \frac{1000}{75} - 10 = 3.33$$

$$t_{lag} = 0.0051 \times (1{,}220\ ft)^{0.594} \times (0.288)^{-0.15} \times (3.33)^{0.313}$$

$$= 0.61\ hrs = \underline{\underline{36.6\ min}}$$

Lag time characteristics for small watersheds in the U.S.

M.J. Simas[1], R.H. Hawkins[2]

Abstract

Lag time, defined as the time from the centroid of rainfall excess to the centroid of direct runoff, was evaluated for over 50,000 rainfall-runoff events in 168 small watersheds in the United States ranging from 0.243 to 3490 acres. In most watersheds a stable value of lag time was observed for the larger storms, with peak flow the variable that best showed this tendency. The watersheds were divided into groups to explain the variation of lag time between watersheds. The groups that had a significant effect in the regression equation were geographical regions, watershed management practices, and the stability of the lag time value for the bigger storms. Separation of watersheds by land use and hydrologic behavior did not significantly improve the regression analyses. When only watersheds with stable behavior were used (N=78), no group significantly improved the regression equation, $t_{lag} = 0.0051 \times width^{0.594} \times slope^{-0.150} \times S_{nat}^{0.313}$, which exhibited R^2=58%.

Introduction

Public investment in surface drainage improvements in developing urban areas involves an annual capital investment on the order of a few billion of dollars (Pilgrim and Cordery, 1993). The average annual expenditure for works in small rural drainage basins amounts to 46 percent of the total expenditure on structures and works, making

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flood estimation for these small drainage basins of great importance in terms of national expenditure.

In design flood estimation, characteristic response times are required for the determination of hydrograph parameters and critical duration of flood producing rainfall (Ward et al., 1980). A given volume of water may or may not represent a flood hazard, as the hazard will depend on the time distribution of the flood runoff. Almost all hydrologic analysis of rainfall and runoff usually require the value of at least one time parameter as input (McCuen, 1989).

Most hydrologic models require a watershed characteristic that reflects the timing of runoff. One of the most widely used methods for estimating floods on small drainage basins is the U.S. Soil Conservation Service (SCS) method. The SCS method uses lag time, defined as the time difference between the centroid of the effective rainfall and the peak of direct runoff.

There is some inconsistency in the definition of lag time, and this leads to difficulty in analyzing the results from the different models that use it. Singh (1988) gathered nine different definitions for lag time. Still another constraint in the applicability of the time parameters is the lack of diversity of data (McCuen et al., 1984), since most empirical equations were developed for urbanized areas, rather than for rural areas (Miller et al., 1995).

The accuracy of the design flood estimate is directly related to the accuracy with which an estimate of the watershed response time is made (Singh, 1988). Errors on the order of 75% in the estimation of the peak discharge can be attributed to errors in the estimated value of the time parameter (McCuen, 1989; Singh, 1988). Little is known about the accuracy of estimates of response times on ungaged watersheds. For a specified recurrence interval, a first approximation of the design flood estimate is inversely proportional to the response time (Singh, 1988). In performing hydrologic computations of runoff, a particular synthetic unit hydrograph is often selected, and as such, a particular time parameter consistent with the unit hydrograph theory adopted. However, if a unit hydrograph method is chosen and the selected time parameter is inconsistent with it, unknowingly significant errors may be introduced in runoff computations (Miller et al., 1995).

Lag time is affected by watershed and rainstorm parameters. The physiographic parameters that affect lag time are areal extent, form, slope, surface topographic characteristics, vegetation, and land use. The rainfall characteristics are intensity in time and space, rainfall duration, and direction of runoff. There are still other factors that affect lag time, like the antecedent moisture conditions, infiltration characteristics, wind velocity, and weather condition (Singh, 1988).

Lag time used in this study was defined as the time from the centroid of rainfall excess to the centroid of direct runoff. This definition has been accepted as being the most stable measure of lag time (Schultz and Lopez, 1974).

Methodology

Lag time values were evaluated from rainfall-runoff data in over 50,000 events from 168 small watersheds in the United States. The watersheds ranged from 0.243 to 3490 acres, with periods of rainfall-runoff records from 3 to 58 years.

The data used in this study was obtained entirely from the Water Data Center maintained by the US Department of Agriculture, the Agricultural Research Service (ARS) in Beltsville, Maryland. This national archive of variable time-series readings for precipitation and runoff contains sufficient detail to reconstruct storm hydrographs and hyetographs. Textual files containing watershed descriptive information, land use and soils are published in the Hydrologic Data for Experimental Agricultural Watersheds in the United States book series.

Rainfall and runoff events were separated using GETPQ, a software developed at the University of Arizona which uses breakpoint rainfall-runoff data, and separates hydrographs using a constant baseflow separation slope. It then matches the rainfall to this hydrograph by comparing the times of occurrence of both the hydrograph and the hyetograph.

The lag time definition used in this study is the difference from the centroid of effective rainfall and the centroid of direct runoff.

Effective rainfall was defined and computed by an initial loss followed by a continuing loss rate (phi index). The phi was determined iteratively by adjusting its value until the effective rainfall hyetograph matched observed direct runoff depth. This done, the centroid of effective rainfall is computed.

Direct runoff was defined and computed as the runoff that has occurred once the baseflow has been deducted. The baseflow separation was done by using a constant baseflow separation slope (0.0002 in/hr^2).

The rainfall-runoff events were selected based on some pre-defined criteria. This filtering followed the approaches of Gray (1961) and Eagleson (1962) to select only those hydrographs with a single peak followed by an uninterrupted recession. All rainfall-runoff events were visually inspected. The rainfall-runoff events were discarded if the hydrographs were multi-peaked; if the hydrographs started before the hyetographs, suggesting inconsistency in the timing of rainfall and runoff data; if the hydrographs started after the hyetograph ended, because effective rainfall contributing to that runoff event cannot be computed; or if the events presented a negative lag time (the centroid of effective rainfall occurring after the centroid of runoff) suggesting that there is some inconsistency in the timing of rainfall and runoff data.

A total of 31,030 events were selected (out of 55,645) for further analysis of the 168 watersheds under study. Most of the factors described above that affect lag time were evaluated in this study. The study was separated in two parts. The first one evaluated the rainfall characteristics and how they affect lag time, and the second part evaluated how the watershed characteristics affected it.

Lag time should be a constant for all storms of a given watershed if the excess rainfall-direct runoff process was truly linear. However, some differences were observed when computing lag time from observed data (Barnes, 1959; Minshall, 1960; Gray, 1961; Eagleson, 1962; Diskin, 1964; Rastogi and Jones, 1969; Laureson, 1964; Askew, 1970).

In the present study, four rainfall-runoff characteristics were used to evaluate the variation of lag time within a watershed. These factors were degree of saturation of a watershed (Ramser, 1927) - represented by the previous 48 hour rainfall; effective

rainfall intensity (Ramser, 1927; Ragan and Duru, 1972; Singh and Agiralioglu, 1982) - defined as the average effective rainfall intensity, effective rainfall being defined as the rainfall that occurred after the hydrograph started; mean total discharge (Ramser, 1927; Barnes, 1959; Laureson, 1964; Askew, 1970) - ratio between total runoff depth and its duration; peak flow - introduced in this study as another hydrologic variable to explain the variation of lag time values within a watershed. Peak flow is represented by the maximum flow rate in a hydrograph.

Several watershed parameters were thought to be related to lag time, like for example length and slope of the catchment (Bell and Karr, 1969; Ragan and Duru, 1972). Vegetation cover seemed to be the most influential factor in the computation of lag time (Ragan and Duru; 1972). Imperviousness of a watershed was another factor that seemed to be important on lag time computation (Rao and Delleur, 1974).

The watershed variables observed in this study were watershed area (ac); watershed length (ft) - longest flow-path from the highest elevation to the watershed outlet; watershed slope - ratio between the maximum difference in elevation and the longest flow-path length; S_{nat} - storage coefficient (in) used in the Curve Number (CN) method. Width (ft) is the watershed area divided by the watershed length. CN was computed using the asymptotic determination of runoff Curve Numbers from rainfall and runoff data technique (Hawkins, 1992).

Multiple linear regression analysis was performed on the data. The desired form of the fitted equation was $Lag = a_0 * width^{a_1} * slope^{a_2} * S_{nat}^{a_3}$.

The watersheds were separated into four diverse groups to clarify possible grouping relationships and give more reliable fittings. The groups represented qualitative characteristics of a watershed and were: regions (East, Midwest, Central, Southwest); land use (pasture, mixed, agriculture, forest); management (high, medium and low disturbance); behavior (Complacent, Standard, Violent) (Hawkins, 1992).

Results and Discussion

Variations of lag time within a watershed

Lag time was not a constant for a watershed but varied considerably. Some watersheds showed a tendency towards a constant value of lag time for the bigger storms. Unlike what is described in the literature, the degree of saturation of a watershed, represented by the prior 48-hour rainfall, showed no significant or consistent relationship to lag time. As for the effective rainfall intensity, previous studies had found that time of concentration (directly related to lag time) should decrease for the higher rainfall intensity storms (Ramser, 1927; Ragan and Duru, 1972; Agiraloglu and Singh, 1981; Singh, 1982). Such relationship was not observed in this study. A non-linear relation between lag time and mean total discharge was suggested by Askew (1970). In this study, only 5 of the 168 watersheds had a coefficient of determination (r^2) above 0.50 upon for such relationships.

However, some watersheds showed a tendency to a constant value of lag time at the higher values of previous 48-hour rainfall, suggesting that the scatter observed under 'drier' conditions is perhaps because of partial area contribution to runoff. The same is true for the higher intensity storms, suggesting that the watershed might not be

at equilibrium for the small storms, when the hydrology of the watershed is still not well developed. The same tendency towards a constant value of lag time at the high mean runoff rate values was found, suggesting that the hydrology of the watershed is better defined for bigger storms. Also, for bigger storms the watershed may reach steady-state conditions. The variable introduced in this study was peak flow, and similarly to the previous evaluations, lag time showed a stable value for larger peak flow values. The higher peak flow suggests bigger storms, that might be better distributed both in time and space. This might represent steady-state conditions, and the value of lag time should not be affected by the size of the storm, once these conditions are met. The best estimate of lag time was computed for each watershed.

Variations of lag time between watersheds

All variables (width, slope, S_{nat}) were significant in explaining the variation of lag time in regression analysis. Two sets of watersheds were evaluated, the first being all watersheds, and the second being composed of the watersheds that showed a stable value for the larger storms. For the first set, the groups that had a significant effect were geographical regions, watershed management practices, and the tendency towards a constant value of lag time for the bigger storms. Separation of watersheds by land use and hydrologic behavior did not significantly improve the regression analyses. When the second set of watersheds was used, no group significantly improved the regression equation. The final regression equation (second set) was

$$t_{lag} = 0.0051 \times width^{0.594} \times slope^{-0.150} \times S_{nat}^{0.313} \ .$$

This equation had R^2= 58, and N= 78. It bears repeating that t_{lag} is in hours, *width* is in feet, *slope* is a decimal fraction, and S_{nat} is in inches.

Conclusions

There was a tendency towards a stable value of lag time for the larger storms. Peak flow was the hydrologic variable that best showed this tendency. Hydrologic relationships previously described in the literature were not verified in this study.

In order to compute lag time rainfall-runoff data should be used, especially for the larger storms. If there is not enough data available, grouping the watersheds into regions and management practices will improve the regression equation. Width, slope and S_{nat} are good variables for prediction of lag time. The model developed in this study had a higher coefficient of determination compared to other models presented in the literature.

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Table 9.1.--Runoff curve numbers for hydrologic soil-cover complexes

(Antecedent moisture condition II, and $I_a = 0.2\ S$)

Land use	Cover: Treatment or practice	Cover: Hydrologic condition	Hydrologic soil group A	B	C	D
Fallow	Straight row	----	77	86	91	94
Row crops	"	Poor	72	81	88	91
	"	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	"	Good	65	75	82	86
	"and terraced	Poor	66	74	80	82
	" " "	Good	62	71	78	81
Small grain	Straight row	Poor	65	76	84	88
		Good	63	75	83	87
	Contoured	Poor	63	74	82	85
		Good	61	73	81	84
	"and terraced	Poor	61	72	79	82
		Good	59	70	78	81
Close-seeded legumes 1/ or rotation meadow	Straight row	Poor	66	77	85	89
	" "	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	"	Good	55	69	78	83
	"and terraced	Poor	63	73	80	83
	"and terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	"	Fair	25	59	75	83
	"	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads (dirt) 2/		----	72	82	87	89
(hard surface) 2/		---	74	84	90	92

1/ Close-drilled or broadcast.
2/ Including right-of-way.

Pad

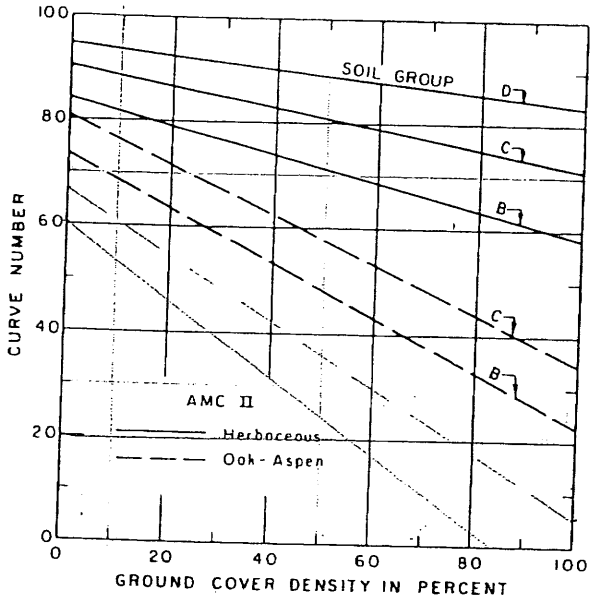


Figure 9.5.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: herbaceous and oak-aspen complexes.

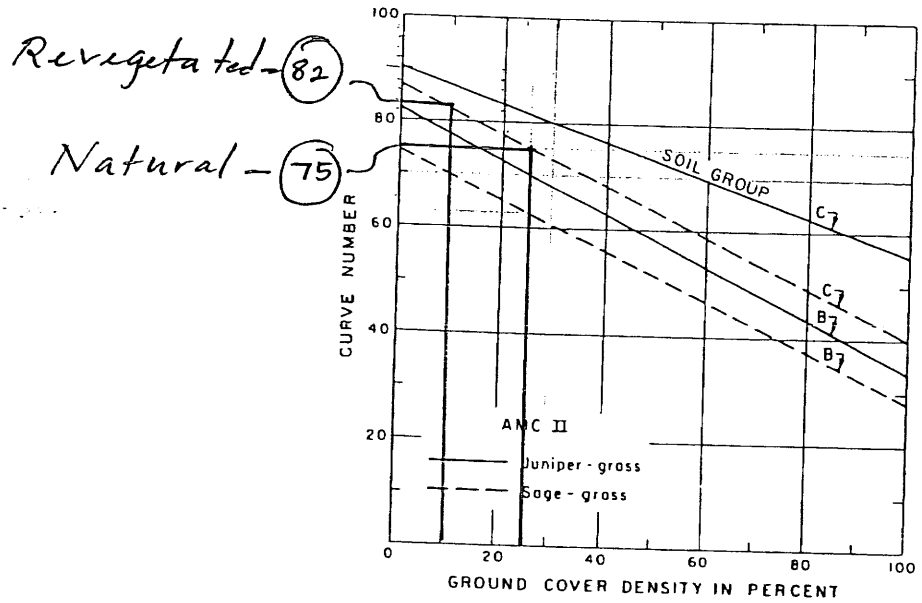
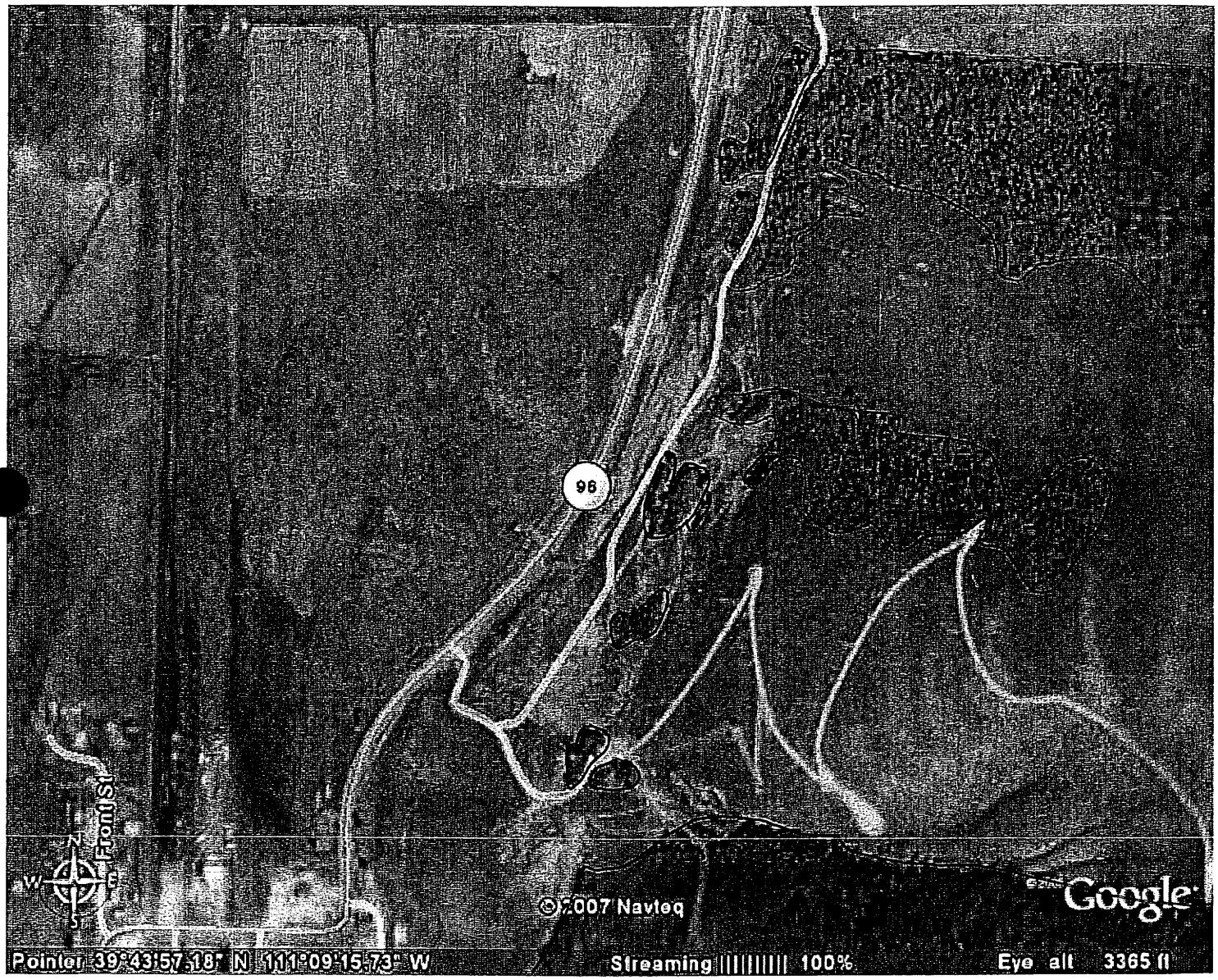


Figure 9.6.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: juniper-grass and sage-grass complexes.


96
Front St
N
W
E
S
©2007 Navteq
Google
Pointer 39°43'57.18" N 111°09'15.73" W
Streaming |||||||||| 100%
Eye alt 3365 ft

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Utah 39.730247 N 111.1550194 W 7998 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Wed May 30 2007

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | Docs | U.S. Map

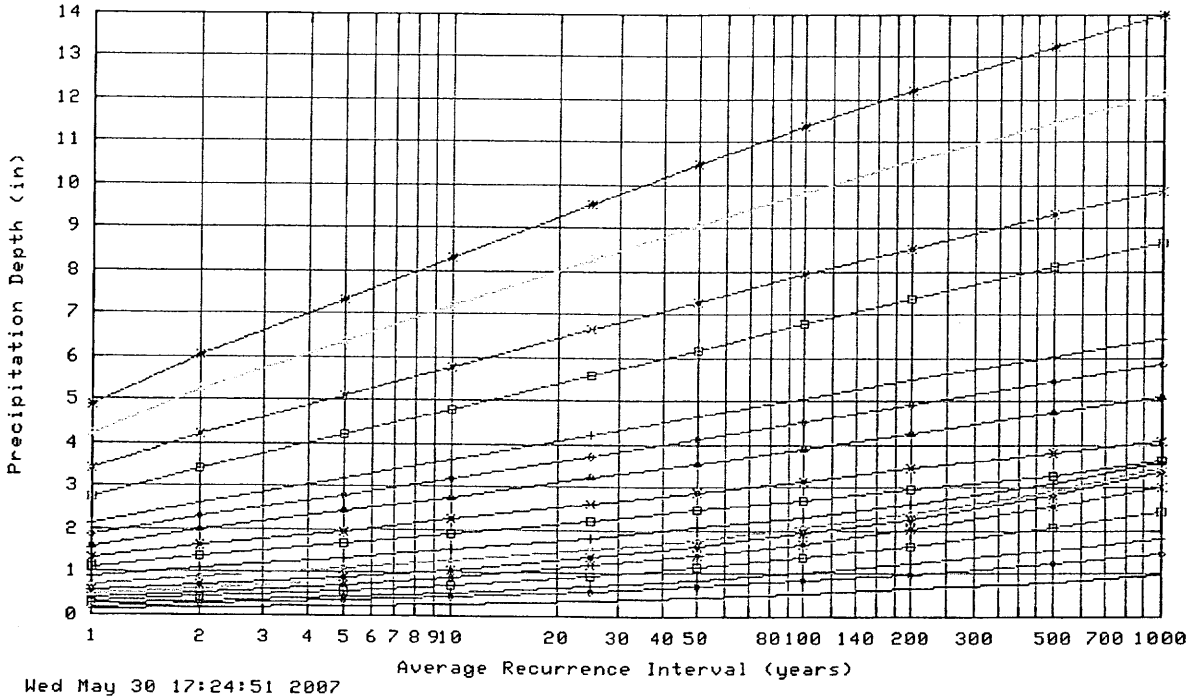
Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.13	0.20	0.24	0.33	0.41	0.50	0.56	0.71	0.90	1.12	1.31	1.62	1.88	2.13	2.77	3.40	4.22	4.89
2	0.17	0.25	0.32	0.42	0.53	0.63	0.70	0.89	1.11	1.39	1.62	2.00	2.32	2.64	3.44	4.21	5.23	6.06
5	0.23	0.35	0.44	0.59	0.73	0.84	0.90	1.10	1.35	1.69	1.97	2.42	2.82	3.20	4.21	5.10	6.34	7.35
10	0.29	0.44	0.54	0.73	0.90	1.03	1.08	1.28	1.56	1.92	2.25	2.77	3.21	3.64	4.81	5.78	7.18	8.32
25	0.38	0.57	0.71	0.95	1.18	1.33	1.38	1.54	1.84	2.24	2.61	3.22	3.74	4.22	5.60	6.66	8.27	9.57
50	0.45	0.69	0.86	1.15	1.43	1.59	1.63	1.78	2.07	2.48	2.89	3.58	4.14	4.65	6.19	7.30	9.05	10.48
100	0.54	0.83	1.03	1.38	1.71	1.90	1.94	2.08	2.31	2.73	3.17	3.93	4.55	5.08	6.78	7.94	9.82	11.36
200	0.65	0.99	1.22	1.65	2.04	2.26	2.29	2.40	2.61	2.97	3.45	4.28	4.95	5.51	7.36	8.55	10.56	12.20
500	0.81	1.24	1.53	2.07	2.56	2.82	2.85	2.95	3.13	3.29	3.81	4.75	5.47	6.05	8.12	9.32	11.47	13.25
1000	0.96	1.46	1.81	2.44	3.02	3.34	3.37	3.46	3.62	3.65	4.09	5.11	5.87	6.46	8.68	9.88	12.13	13.99

Text version of table

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

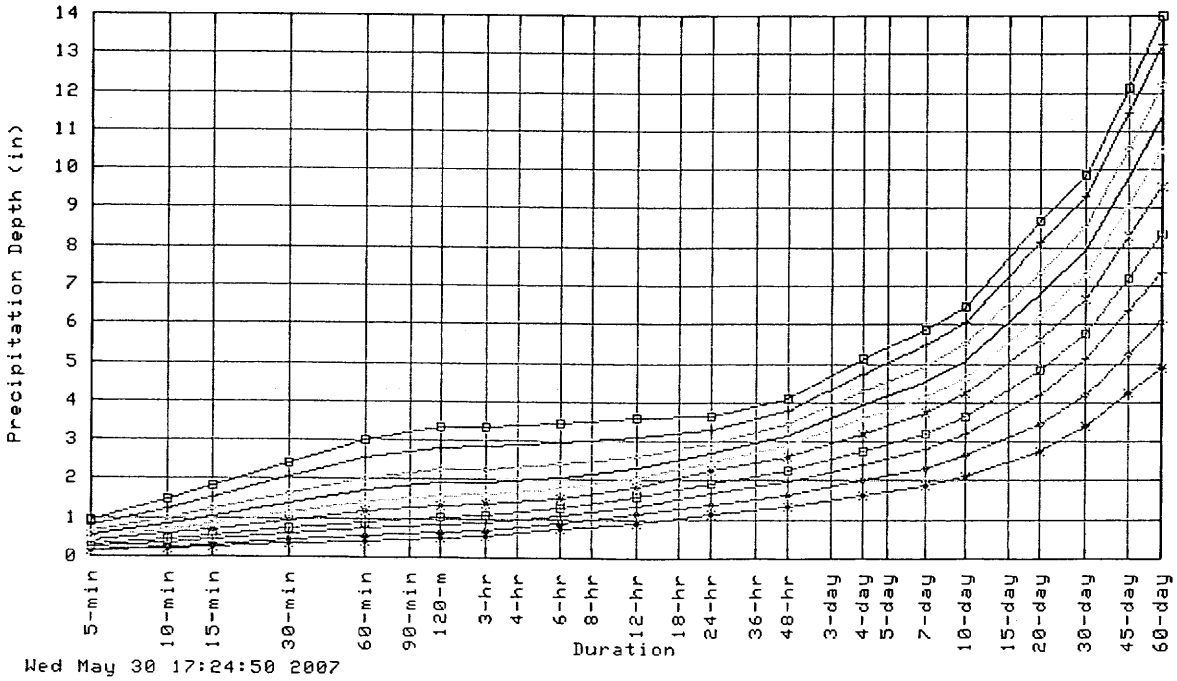
Partial duration based Point Precipitation Frequency Estimates Version: 4
39.730247 N 111.1550194 W 7998 ft



Wed May 30 17:24:51 2007

Duration			
5-min	120-m	48-hr	30-day
10-min	3-hr	4-day	45-day
15-min	6-hr	7-day	60-day
30-min	12-hr	10-day	
60-min	24-hr	20-day	

Partial duration based Point Precipitation Frequency Estimates Version: 4
39.730247 N 111.1550194 W 7998 ft



Wed May 30 17:24:50 2007

Average Recurrence Interval (years)	
1	50
2	100
5	200
10	500
25	1000

Confidence Limits -

*** Upper bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.16	0.24	0.29	0.40	0.49	0.60	0.66	0.82	1.01	1.27	1.48	1.86	2.18	2.46	3.31	4.02	5.03	5.74
2	0.20	0.31	0.38	0.51	0.63	0.75	0.82	1.01	1.24	1.57	1.83	2.30	2.69	3.05	4.11	4.99	6.25	7.13
5	0.28	0.42	0.52	0.71	0.87	1.00	1.07	1.26	1.51	1.91	2.22	2.79	3.26	3.71	5.05	6.07	7.60	8.65
10	0.35	0.53	0.65	0.88	1.09	1.23	1.28	1.47	1.74	2.18	2.53	3.18	3.72	4.22	5.79	6.88	8.61	9.79
25	0.45	0.69	0.86	1.15	1.43	1.59	1.63	1.78	2.07	2.54	2.95	3.70	4.34	4.90	6.76	7.94	9.92	11.29
50	0.55	0.84	1.04	1.40	1.73	1.92	1.94	2.07	2.34	2.82	3.26	4.12	4.82	5.41	7.50	8.71	10.89	12.41
100	0.66	1.01	1.25	1.68	2.08	2.31	2.32	2.43	2.62	3.10	3.59	4.53	5.30	5.93	8.23	9.48	11.84	13.48
200	0.79	1.21	1.50	2.02	2.50	2.76	2.77	2.83	3.00	3.38	3.92	4.94	5.79	6.45	8.97	10.26	12.78	14.52
500	1.01	1.54	1.91	2.57	3.18	3.50	3.52	3.54	3.65	3.77	4.37	5.52	6.46	7.13	9.97	11.24	13.96	15.87
1000	1.21	1.85	2.29	3.08	3.81	4.22	4.27	4.31	4.35	4.40	4.70	5.97	6.97	7.65	10.72	11.98	14.86	16.86

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.

** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

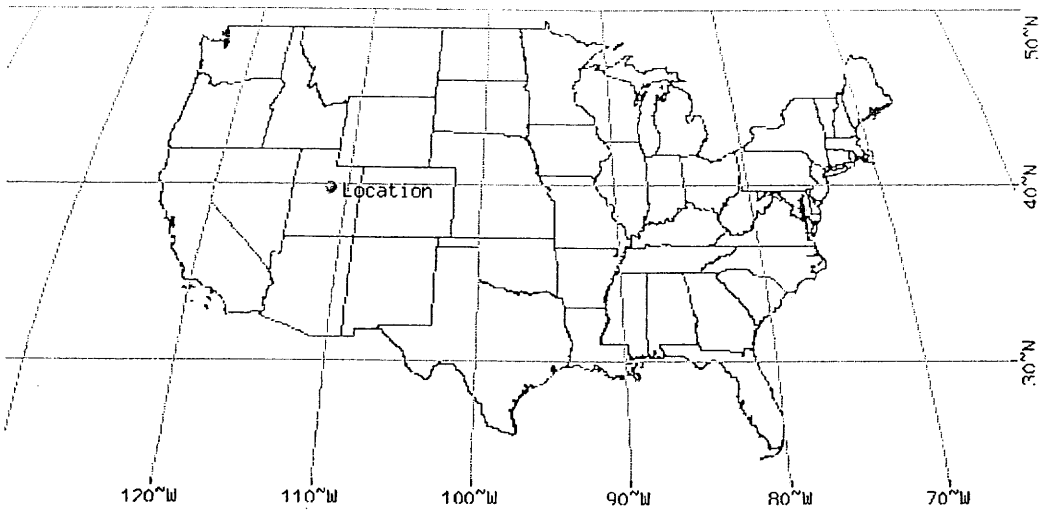
*** Lower bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

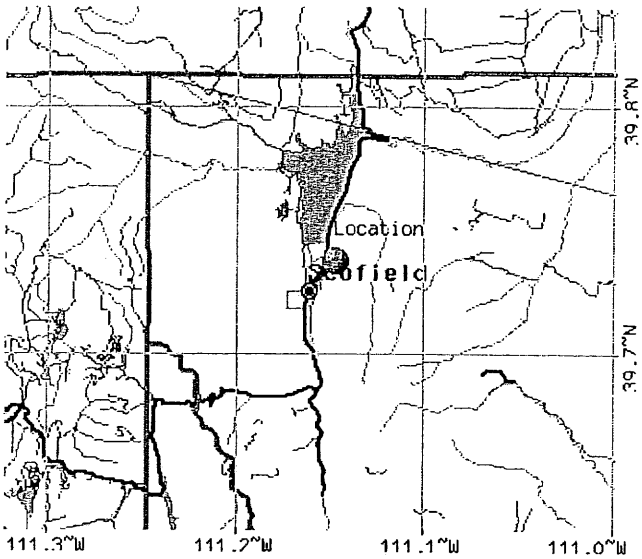
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.11	0.17	0.21	0.28	0.35	0.43	0.49	0.64	0.81	1.00	1.17	1.42	1.66	1.86	2.39	2.92	3.63	4.22
2	0.14	0.22	0.27	0.36	0.45	0.54	0.61	0.79	1.00	1.24	1.44	1.75	2.04	2.30	2.97	3.62	4.50	5.24
5	0.20	0.30	0.37	0.50	0.61	0.72	0.78	0.97	1.22	1.50	1.74	2.12	2.48	2.78	3.61	4.37	5.42	6.34
10	0.24	0.37	0.45	0.61	0.76	0.87	0.94	1.13	1.39	1.71	1.98	2.41	2.82	3.15	4.11	4.93	6.13	7.17
25	0.31	0.47	0.58	0.78	0.96	1.10	1.17	1.34	1.63	1.98	2.29	2.79	3.26	3.63	4.75	5.64	7.01	8.19
50	0.36	0.55	0.69	0.92	1.14	1.29	1.35	1.53	1.81	2.18	2.52	3.07	3.58	3.98	5.21	6.15	7.64	8.91
100	0.43	0.65	0.80	1.08	1.34	1.50	1.57	1.75	2.00	2.38	2.74	3.35	3.90	4.32	5.67	6.63	8.27	9.60
200	0.49	0.75	0.93	1.25	1.55	1.73	1.82	1.99	2.23	2.57	2.97	3.61	4.22	4.65	6.11	7.09	8.82	10.23
500	0.59	0.90	1.12	1.50	1.86	2.07	2.18	2.38	2.62	2.81	3.25	3.96	4.62	5.05	6.63	7.63	9.49	10.99
1000	0.67	1.02	1.27	1.71	2.12	2.36	2.49	2.72	2.97	2.99	3.45	4.20	4.90	5.34	7.02	8.03	9.97	11.53

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

State
County
Indian Resv
Lake/Pond/Ocean
Street
Expressway
Highway
Connector
Stream
Military Area
National Park
Other Park
City
County

Scale 1:228583 0 2 4 6 8 mi 0 2 4 6 8 10 km
*average--true scale depends on monitor resolution

Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available
from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information
about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study,
please refer to our documentation.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (39.730247/-111.1550194). Digital ASCII data can be obtained directly from **NCDC**.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the **Western Regional Climate Center's state-specific SNOTEL station maps**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910
(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

SCS CURVE NUMBER
Kinney Mine Hydrology

SB_F1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	2288.29	0.05	0.00008	1.4	98	0.20	1.1	202.9	1.7	323.2	1.9	353.5
Pad	122526.6	2.81	0.00440	75.7	90	1.11	0.5	5267.5	1.0	10478.0	1.2	11869.8
Natural	21443.42	0.49	0.00077	13.2	75	3.33	0.1	170.3	0.3	612.0	0.4	752.0
Revegetated	15641.47	0.36	0.00056	9.7	82	2.20	0.2	303.6	0.6	777.7	0.7	915.0
TOTALS	161899.8	3.72	0.00581	100	87			5944.3		12190.9		13890.2
										0.28 ac-ft		0.32 ac-ft

SB_D1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	2165.29	0.05	0.00008	2.5	98	0.20	1.1	192.0	1.7	305.9	1.9	334.5
Pad	40914.9	0.94	0.00147	33.7	90	1.11	0.5	1758.9	1.0	3498.9	1.2	3963.6
Natural	67374.28	1.55	0.00242	55.5	75	3.33	0.1	535.2	0.3	1922.9	0.4	2362.7
Revegetated	10895.72	0.25	0.00039	9.0	82	2.20	0.2	211.5	0.6	541.7	0.7	637.4
TOTALS	121350.2	2.79	0.00435	101	81			2697.6		6269.3		7298.2
										0.14 ac-ft		0.17 ac-ft

SB_D2

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	2442.07	0.06	0.00009	2.8	98	0.20	1.1	216.5	1.7	345.0	1.9	377.2
Pad	12679.13	0.29	0.00045	14.8	90	1.11	0.5	545.1	1.0	1084.3	1.2	1228.3
Natural	59411.24	1.36	0.00213	69.1	75	3.33	0.1	471.9	0.3	1695.6	0.4	2083.5
Revegetated	11426.79	0.26	0.00041	13.3	82	2.20	0.2	221.8	0.6	568.1	0.7	668.4
TOTALS	85959.23	1.97	0.00308	100	79			1455.3		3693.0		4357.4
										0.08 ac-ft		0.10 ac-ft

SB_F2

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	10732.04	0.25	0.00038	19.4	98	0.20	1.1	951.5	1.7	1516.0	1.9	1657.8
Natural	0	0.00	0.00000	0.0	75	3.33	0.1	0.0	0.3	0.0	0.4	0.0
Revegetated	44561.29	1.02	0.00160	80.6	82	2.20	0.2	865.0	0.6	2215.6	0.7	2606.7
TOTALS	55293.33	1.27	0.00198	100	85			1816.6		3731.6		4264.5
										0.09 ac-ft		0.10 ac-ft

SB_E1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Pad	143106.9	3.29	0.00513	74.1	90	1.11	0.5	6152.2	1.0	12237.9	1.2	13863.5
Natural	9446.91	0.22	0.00034	4.9	75	3.33	0.1	75.0	0.3	269.6	0.4	331.3
Revegetated	40693.85	0.93	0.00146	21.1	82	2.20	0.2	789.9	0.6	2023.3	0.7	2380.5
TOTALS	193247.7	4.44	0.00693	100	88			7017.2		14530.8		16575.3
										0.33 ac-ft		0.38 ac-ft

SB_D3

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	11513.94	0.26	0.00041	19.7	98	0.20	1.1	1020.9	1.7	1626.4	1.9	1778.6
Natural	39630.22	0.91	0.00142	20.5	75	3.33	0.1	314.8	0.3	1131.0	0.4	1389.8
Revegetated	7211.62	0.17	0.00026	12.4	82	2.20	0.2	140.0	0.6	358.6	0.7	421.9
TOTALS	58355.78	1.34	0.00209	53	80			1475.6		3116.0		3590.2
										0.07 ac-ft		0.08 ac-ft

SB_A1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	19147.5	0.44	0.00069	32.8	98	0.20	1.1	1697.7	1.7	2704.7	1.9	2957.8
Natural	63174.77	1.45	0.00227	32.7	75	3.33	0.1	501.8	0.3	1803.0	0.4	2215.5
Pad	42016.47	0.96	0.00151	21.7	90	1.11	0.5	1806.3	1.0	3593.1	1.2	4070.4
Revegetated	54006.16	1.24	0.00194	30.3	82	2.20	0.2	1048.4	0.6	2685.2	0.7	3159.2
TOTALS	178344.9	4.09	0.00640	118	83			5054.1		10786.0		12402.8
										0.25 ac-ft		0.28 ac-ft

SB_B1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Pad	91371.01	2.10	0.00328	47.3	90	1.11	0.5	3928.1	1.0	7813.7	1.2	8851.6
Natural	26384.94	0.61	0.00095	13.7	75	3.33	0.1	209.6	0.3	753.0	0.4	925.3
Revegetated	34907.15	0.80	0.00125	22.9	82	2.20	0.2	677.6	0.6	1735.6	0.7	2042.0
TOTALS	152663.1	3.50	0.00548	84	86			677.6		1735.6		2042.0
										0.04 ac-ft		0.05 ac-ft

SB_C1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	0	0.00	0.00000	0.0	98	0.20	1.1	0.0	1.7	0.0	1.9	0.0
Pad	91265.3	2.10	0.00327	136.8	90	1.11	0.5	3923.5	1.0	7804.6	1.2	8841.3
Natural	52325.33	1.20	0.00188	27.1	75	3.33	0.1	415.6	0.3	1493.4	0.4	1835.0
Revegetated	38502.3	0.88	0.00138	21.1	82	2.20	0.2	747.4	0.6	1914.3	0.7	2252.3
TOTALS	182092.9	4.18	0.00653	185	84			5086.5		11212.3		12928.6
										0.26 ac-ft		0.30 ac-ft

SB_E2

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	13703.95	0.31	0.00049	7.5	98	0.20	1.1	1215.0	1.7	1935.8	1.9	2116.9
Pad	0	0.00	0.00000	0.0	90	1.11	0.5	0.0	1.0	0.0	1.2	0.0
Natural	26904.93	0.62	0.00097	13.9	75	3.33	0.1	213.7	0.3	767.9	0.4	943.5
Revegetated	32464.12	0.75	0.00116	17.8	82	2.20	0.2	630.2	0.6	1614.1	0.7	1899.1
TOTALS	73073	1.68	0.00262	39	82			2058.9		4317.8		4959.5
										0.10 ac-ft		0.11 ac-ft

SB_E4

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Natural	50993.98	1.17	0.00183	76.5	75	3.33	0.1	405.0	0.3	1455.4	0.4	1788.3
Revegetated	15708.03	0.36	0.00056	23.5	82	2.20	0.2	304.9	0.6	781.0	0.7	918.9
TOTALS	66702.01	1.53	0.00239	100	77			710.0		2236.4		2707.2
										0.05 ac-ft		0.06 ac-ft

SB_E3

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Revegetated	23139.08	0.53	0.00083	34.7	82	2.20	0.2	449.2	0.6	1150.5	0.7	1353.6
TOTALS	23139.08	0.53	0.00083	35	82			449.2		1150.5		1353.6
										0.03 ac-ft		0.03 ac-ft

SB_Pond1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Detention Pond	19356.6	0.44	0.00069	20.6	100	0.00	1.3	2064.7	1.9	3097.1	2.1	3355.1
Revegetated	46571.36	1.07	0.00167	69.8	82	2.20	0.2	904.0	0.6	2315.5	0.7	2724.3
Natural	28145.53	0.65	0.00101	29.9	75	3.33	0.1	223.6	0.3	803.3	0.4	987.0
TOTALS	94073.49	2.16	0.00337	120	84			3192.3		6215.8		7066.5
										0.14 ac-ft		0.16 ac-ft

SB_AIIA

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Revegetated	111806.6	2.57	0.00401	167.6	82	2.20	0.2	2170.4	0.6	5559.0	0.7	6540.3
TOTALS	111806.6	2.57	0.00401	168	82			2170.4		5559.0		6540.3
										0.13 ac-ft		0.15 ac-ft

SB_AIIB

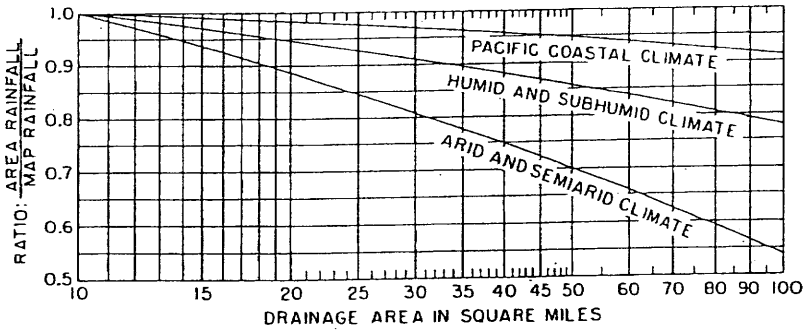
Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	4030.63	0.09	0.00014	2.2	98	0.20	1.1	357.4	1.7	569.4	1.9	622.6
Revegetated	21513.94	0.49	0.00077	32.3	82	2.20	0.2	417.6	0.6	1069.7	0.7	1258.5
TOTALS	25544.57	0.59	0.00092	34	85			775.0		1639.0		1881.1
										0.04 ac-ft		0.04 ac-ft

SB_AIIC

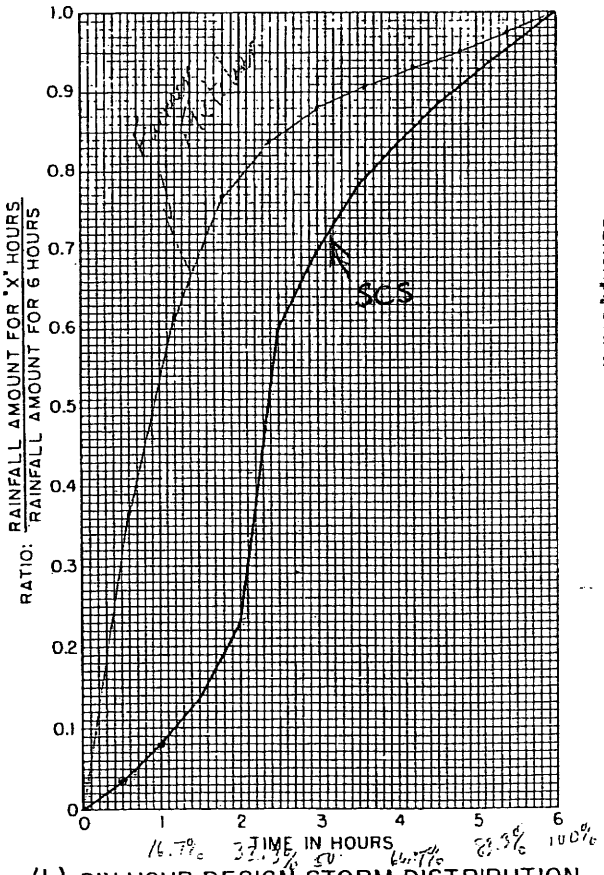
Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	3773.2	0.09	0.00014	2.1	98	0.20	1.1	334.5	1.7	533.0	1.9	582.9
Revegetated	15615.05	0.36	0.00056	23.4	82	2.20	0.2	303.1	0.6	776.4	0.7	913.4
TOTALS	19388.25	0.45	0.00070	25	85			637.7		1309.4		1496.3
										0.03 ac-ft		0.03 ac-ft
Overall Totals	1602934	36.80	0.0575		84							

Total Approximate Storage Volumes = 2.06 ac-ft 2.37 ac-ft

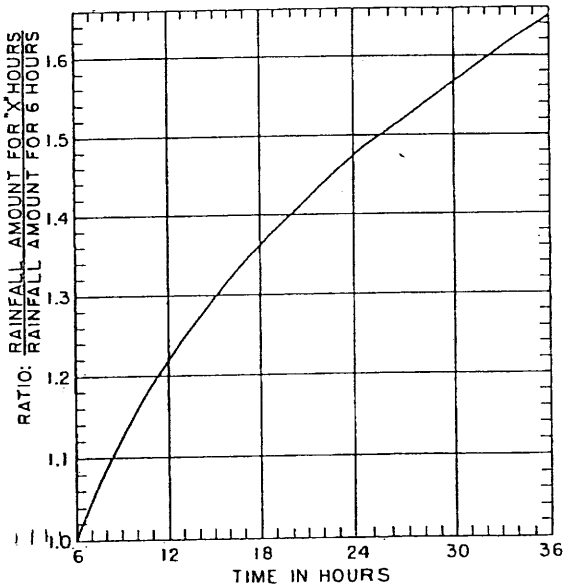
HYDROLOGY: CRITERIA FOR DESIGN STORMS USED IN DEVELOPING EMERGENCY SPILLWAY DESIGN AND FREEBOARD HYDROGRAPHS



(a) RAINFALL RATIOS FOR DRAINAGE AREAS OF 10 TO 100 SQUARE MILES



(b) SIX HOUR DESIGN STORM DISTRIBUTION



(c) RELATIVE INCREASE IN RAINFALL AMOUNT FOR STORM DURATIONS OVER SIX HOURS

FIGURE 21.2

REFERENCE	U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING DIVISION - CENTRAL TECHNICAL UNIT	STANDARD DWG. NO. ES-1003 SHEET 1 OF 1 DATE 7-2-56 REVISED 9-10-63

Ref: NEH-4

```
      PROGRAM HYDRO
C.    This is the new version of hydro. Updated Nov 17, 1987.
C..   This version allows time and flow to be saved on disk.
C...  It also has been modified for output page formating.
C....  This version has been modified to ease input for subsequent
C.....  runs by screen editing of input data.
$DEBUG
$LARGE
      DIMENSION GAMMA(2),DRAN(100),RANFF(11),RANSCS(13),RNSC24(49)
     1,DIMRAN(50),SDIMRN(1701),STMACC(1701),RAINEX(1701),Q(1701)
     1,QT(1701),DIMO(1701),QH(1701),GS(1701),UPL1(21),UPL2(21),UPL3(21)
     1,XX(220),YY(220),RANF2(21)
      CHARACTER ASED*1,ADIST*1,ATITLE*62,ADISTR*20,AGR*1,AFILE*3,AF*12,
     1AGAIN*3,ANEW*1,IOUT*1
      DATA RANFF/0.0,.365,.615,.769,.839,.88,.908,.932,.952,.977,1./
      DATA RANF2/0.0,.002,.009,.015,.026,.05,.10,.19,.30,.44,.586
     1,.73,.82,.87,.91,.935,.96,.97,.98,.99,1.00/
      DATA RANSCS/0.,.035,.08,.135,.23,.6,.7,.78,.835,.885,.925,.965
     1,1./
      DATA RNSC24/0.,.008,.011,.017,.022,.029,.034,.042,.048,.057
     1,.062,.072,.08,.09,.1,.111,.12,.132,.147,.163,.181,.204,.236
     1,.283,.663,.735,.772,.799,.82,.84,.854,.868,.88,.891,.901,.912
     1,.921,.930,.938,.946,.952,.96,.968,.974,.979,.985,.99,.995,1./
      DATA UPL1/0.0,.18,.36,.54,.61,.675,.74,.79,.835,.87,.895,.905,
     1.91,.91,.91,.915,.925,.94,.955,.975,1.0/
      DATA UPL2/0.0,.02,.04,.07,.105,.15,.2,.285,.485,.64,.705,.74,
     1.775,.805,.84,.875,.91,.935,.965,.985,1.0/
      DATA UPL3/0.0,.005,.015,.03,.04,.06,.07,.1,.12,.155,.215,.38,
     1.52,.70,.775,.83,.87,.91,.95,.975,1.0/
      DATA XX/0.,1.,2.,3.,4.,5.,6.,7.,8.,9.,10.,11.,12.,13.,14.,15.,16.,
     117.,18.,19.,20.,21.,22.,23.,24.,25.,26.,27.,28.,29.,30.,31.,32.,33
     1.,34.,35.,36.,37.,38.,39.,40.,41.,42.,43.,44.,45.,46.,47.,48.,49.,
     150.,51.,52.,53.,54.,55.,56.,57.,58.,59.,60.,61.,62.,63.,64.,65.,
     166.,67.,68.,69.,70.,71.,72.,73.,74.,75.,76.,77.,78.,79.,80.,81.,
     182.,83.,84.,85.,86.,87.,88.,89.,90.,91.,92.,93.,94.,95.,96.,97.,
     198.,99.,100.,101.,102.,103.,104.,105.,106.,107.,108.,109.,110.,
     1111.,112.,113.,114.,115.,116.,117.,118.,119.,120.,121.,122.,123.,
     1124.,125.,126.,127.,128.,129.,130.,131.,132.,133.,134.,135.,136.,
     1137.,138.,139.,140.,141.,142.,143.,144.,145.,146.,147.,148.,149.,
     1150.,151.,152.,153.,154.,155.,156.,157.,158.,159.,160.,161.,162.,
     1163.,164.,165.,166.,167.,168.,169.,
     1170.,180.,190.,200.,210.,220.,230.,240.,250.,260.,
     1270.,280.,290.,300.,310.,320.,330.,340.,350.,360.,370.,380.,390.,
     1400.,410.,420.,430.,440.,450.,460.,470.,480.,490.,500.,510.,520.,
     1530.,540.,550.,560.,570.,580.,590.,600.,610.,620.,630.,640.,650.,
     1660./
      DATA YY/0.,.06,.12,.18,.24,.3,.37,.47,.58,.72,.9,1.09,1.31,1.58,
     11.91,2.3,2.54,2.81,3.11,3.44,3.8,4.09,4.41,4.74,5.11,5.5,5.74,5.99
```

SCS 6 hr distributi
(30 min intervals)

72 min [illegible]

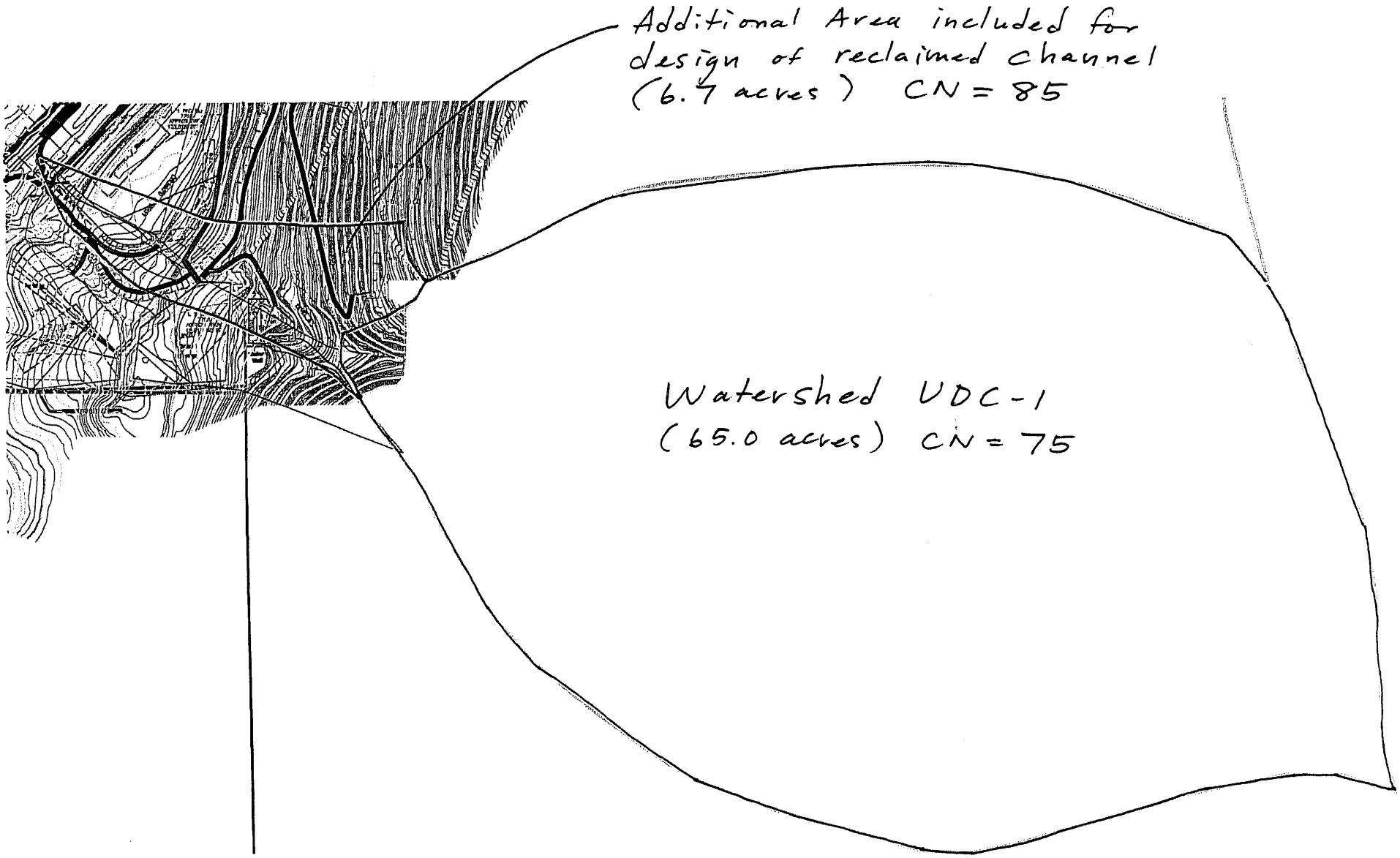
Reclaimed Channel designed for the 100yr 6hr event.

HEC-HMS analysis was performed to determine 100 yr 6hr discharge for design of the reclaimed channel.

Area weighted CN for area =

$$CN_{weighted} = \frac{(6.7\text{ acres})(85) + (65.0\text{ acres})(75)}{(6.7\text{ acres} + 65.0\text{ acres})}$$

$$= \underline{\underline{76}}$$


Additional Area included for design of reclaimed channel (6.7 acres) CN = 85
Watershed UDC-1 (65.0 acres) CN = 75

↑ N

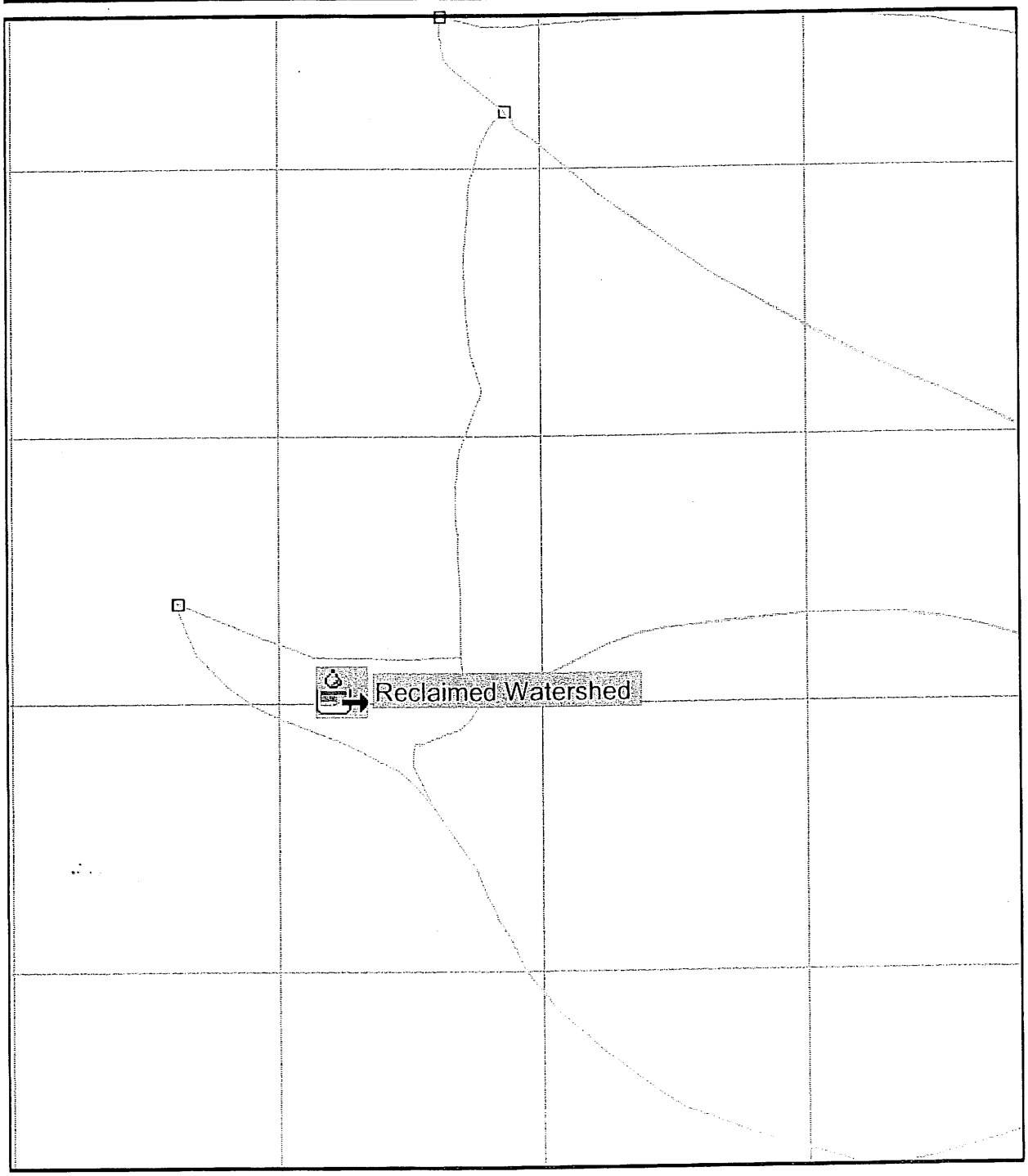
Scale: 1" = 500'

HEC-HMS

Project : Reclaimed Watershed-A

Basin Model : Kinney Mine

Aug 03 16:52:28 MDT 2007



Hydrologic Element	Drainage Area (mi2)	100yr 6hr Peak Discharge (cfs)	Time of Peak	Volume (in)
Reclaimed Watershed	0.112	11.5	01Jul2007, 04:14	0.45

Reclamation Channel Design (UDC-1)

Design Procedure:

Estimated a D50 size of 1 feet diameter from the Chart 27 from "Design of Stable Channels with Flexible Linings" - October 1975. The D50 size was based on a slope of approximately 13% and a calculated maximum flow depth of 0.5 ft (see spreadsheet calcs).

HANSEN ALLEN & LUCE inc ENGINEERS	Client: Carbon Resources	Sheet:	
	Project: Kinney Mine Hydrology	Comp.: TDS	
	Feature: Ditch Design (UDC-1)	Chck'd:	
	Project #: 308.01.400	Date: 06-Jul-07	

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	11.50	cfs
Bottom Width:	3.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.0	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.040	
Min. Bottom Slope:	0.13	ft/ft
Max. Bottom Slope:	0.13	ft/ft
Freeboard:	0.5	feet

Depth Check

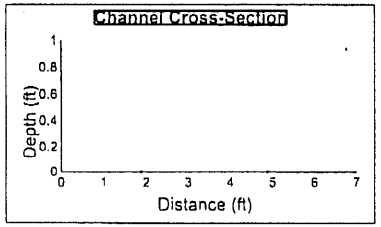
Depth (Min. Slope):	0.44	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.94	feet
Area:	1.72	ft2
Perimeter:	4.98	feet
Hydraulic Radius:	0.35	feet
Velocity:	6.69	ft/sec
Froude Number:	1.96	

Velocity Check

Depth (Max. Slope):	0.44	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.94	feet
Area:	1.72	ft2
Perimeter:	4.98	feet
Hydraulic Radius:	0.35	feet
Velocity:	6.69	ft/sec
Froude Number:	1.96	

Channel Design Summary:

Bottom Width:	3.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.13	ft/ft
Max. Bottom Slope:	0.13	ft/ft
Min. Channel Depth:	0.94	feet
Channel Top Width:	6.77	feet



HANSEN ALLEN & LUCE inc ENGINEERS	Client: Carbon Resources	Sheet: of	
	Project: Kinney Mine Hydrology	Comp.: TDS	
	Feature: Ditch Design (UDC-1)	Chck'd:	
	Project #: 308.01.400	Date: 06-Aug-07	

DESIGN CRITERIA:

Design Flow:	11.50		cfs
Bottom Width:	3.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.04		
Min. Bottom Slope:	13.0	%	
Max. Bottom Slope:	13.0	%	
Flow Depth (Min. S):	0.44		feet
Flow Depth (Max. S):	0.44		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	1.20
Reynolds # for Smin	85,860
U=(gRS)^0.5 for Smax	1.20
Reynolds # for Smax	85,860

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.064
K for S max (See K vs. R Chart)	0.064
F for S min	14.9
F for S max	14.9

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks:	0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

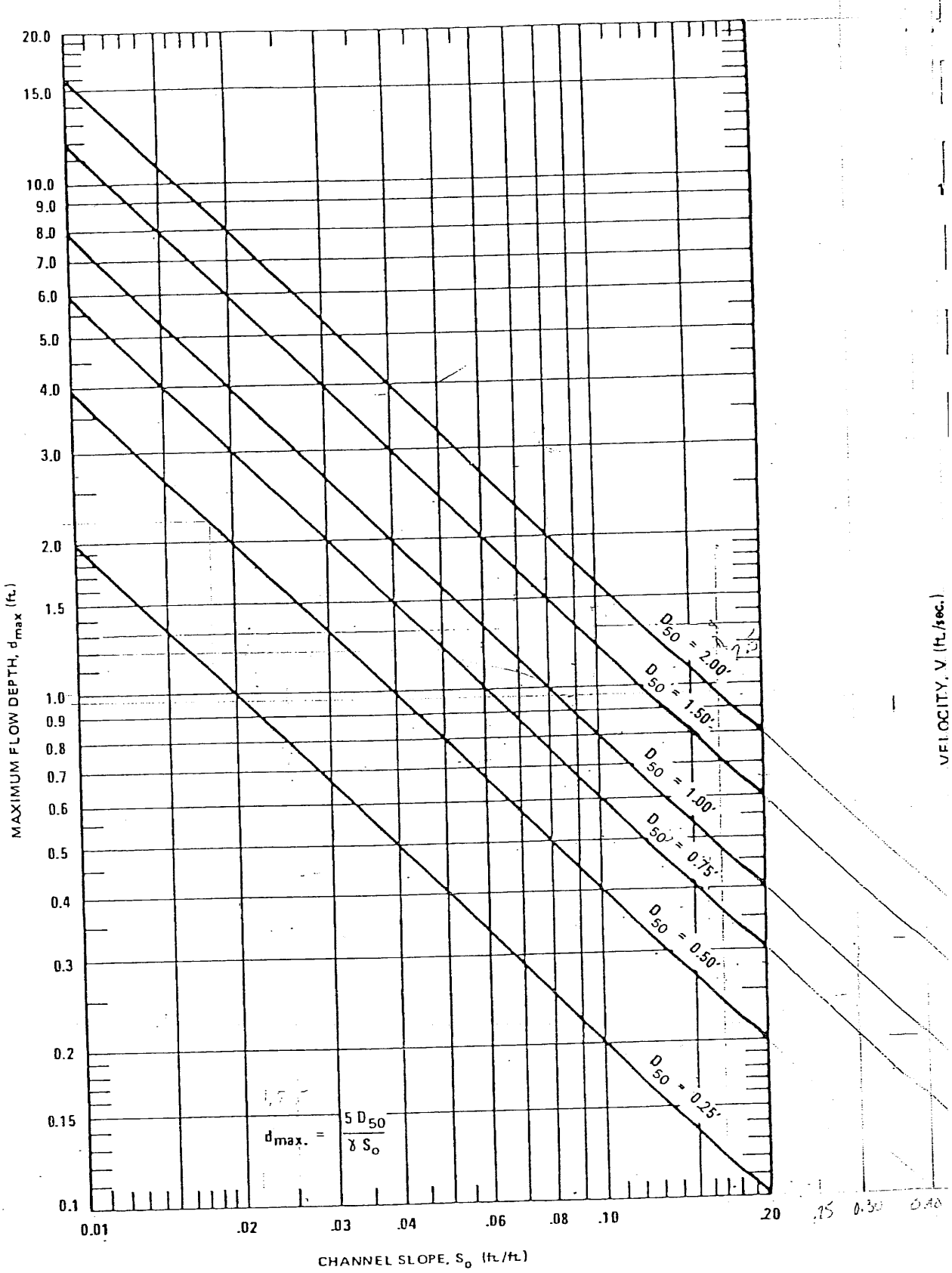
Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.00	1.00	feet
T	3.59	3.59	lb/ft2
Nb	0.52	0.52	
Tmax	2.73	2.73	lb/ft2
Ns	0.39	0.39	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	20.53	20.53	degrees
Nsp	0.29	0.29	
SFb	1.50	1.50	
SFs	1.18	1.18	

Chart 27



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max})
FOR CHANNELS LINED WITH ROCK RIPRAP

$n = .0395 D_{50}^{1/6}$

Ref: "Design of Stable Channels with Flexible Linings"

Ditch & Culverts

CULVERT/DITCH DESIGN FLOWS

	System Element	10yr 6hr Peak Discharge (cfs)	100yr 6hr Peak Discharge (cfs)	Model Element
Culverts	CB-1	0.9	2.9	CB-1
	CB-2	2.0	5.8	CB-2
	CC-1	2.9	8.7	J-10
	CD-1	0.3	1.6	CD-1
	CD-2	0.6	2.9	CD-2
	CE-1	2.4	7.8	CE-1
	CF-1	1.7	4.4	J-3
Ditches	DA-1	0.6	1.6	SB-A1
	DC-1	1.0	2.9	SB_C1
	DC-2	2.9	8.7	J-10
	DC-3	2.9	8.7	J-10
	DC-4	1.0	2.9	SB_C1
	DC-5	2.9	8.7	J-10
	DC-6	3.5	10.3	J-10 + SB_Pond1
	DD-1	0.2	0.7	SB_D3
	DD-2	0.2	0.9	SB_D2
	DD-3	0.3	1.6	CD-1
	DE-1	0.6	2.9	J-13
	DE-2	0.2	0.9	SB_E2
	DE-3	4.1	12.4	J-6
	DE-4	4.2	12.9	J-11
	DF-1	0.4	1.0	SB_F2
	DF-2	0.4	1.0	SB_F2
	DF-3	1.3	3.3	SB_F1
	DF-4	1.7	4.4	J-4
	DF-5	1.7	4.4	CF-2

TABLE 4.7.2.2-2
CULVERT DESIGN DETAILS

Culvert	Tributary Sub-Basins[1]	Area (acre)	Weighted CN	Peak Flow (cfs)	Total Design Flow (cfs)	Diameter (in)
CB-1	A1	4.09	83	0.9	2.0	18
	B1	3.50	86	1.1		
CB-2	A1	4.09	83	0.9	2.0	18
	B1	3.50	86	1.1		
CC-1	A1	4.09	83	0.9	2.9	18
	B1	3.50	86	1.1		
	C1	4.18	84	1.0		
CD-1	D2	1.97	79	0.2	0.4	18
	D3	1.34	80	0.2		
CD-2	D1	2.79	81	0.3	0.6	18
	D2	1.97	79	0.2		
	D3	1.34	80	0.2		
CE-1	D1	2.79	81	0.3	2.4	18
	D2	1.97	79	0.2		
	D3	1.34	80	0.2		
	E1	4.44	88	1.6		
	E2	1.68	82	0.2		
CF-1	F1	3.72	87	1.3	1.7	18
	F2	1.27	85	0.4		
UDC-1	UDC-1	99.37	75	14.3	14.3	30
UDC-2	UDD-1, UDD-2	64.96	75	9.4	9.4	24
CP-1	Pond 1 100 Yr, 6 Hr Discharge			22.5	22.5	24
CP-2	UDD-1, UDD-2	64.96	75	9.4	33.8	42
	Pond 1 100 Yr, 6 Hr Discharge			22.5		
	G1	4.56	78	1.9		

1 - See Map 4.7.2.1-2, Drainage and Sediment Control Plan – Undisturbed Drainage Areas, and Map 4.7.2.1-5, Drainage and Sediment Control Plan – Disturbed Drainage Sub Basins.

HANSEN ALLEN & LUCE INC
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Culvert Sizing
PROJECT NO 308.01.400

SHEET ___ OF ___
COMPUTED TDS
CHECKED ___
DATE 6-7-07

Determined the size of culverts based of Chart 5 in the "Hydraulic Charts for the Selection of Highway Culverts" assuming HW/D = 1.0 with a projecting entrance type. Design discharge for culverts were estimated from HEC-HMS results. A minimum size culvert was assumed to be 18 in.

Culvert	10 yr 24 hr Q (cfs)	Required Diameter Based on Chart 5 (in)	Actual Diameter (in)
CF-1	1.7	12	18
CE-1	2.4	15	18
CB-1	2.0	15	18
CB-2	2.0	15	18
CD-2	0.6	10	18
CD-1	0.4	10	18
CF-2	1.7	12	18
CC-1	2.9	15	18

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE UDC-1 Culvert
PROJECT NO 308.01.400

SHEET ____ OF ____
COMPUTED GLO
CHECKED ____
DATE 12/20/07

UDC-1

Design Flow = 14.3 cfs

(Based on the 100 yr - 6 hr event)

Based on Chart 5 in the "Hydraulic Charts for the selection of Highway Culverts," assuming $H_w/D = 1.0$ with a projecting entrance type, $D = 27.5$ in, so use

$D = \underline{\underline{30 \text{ in}}}$

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CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Culvert Design
PROJECT NO

SHEET ___ OF ___
COMPUTED GWJ
CHECKED
DATE 12/21/07

Culvert #1 (UDC-2)

Design Flow (Q_1) = 9.4 cfs
(Comes from UDD1 for 100yr 6hr event)

Based on Chart 5 in the "Hydraulic Charts for the Selection of Highway Culverts," assuming $H_w/D = 1.0$ with a projecting entrance type, $D_1 = 23$ in

So use $D_1 = 24$ in

Culvert #2 (CP-1)

$D_2 = 24$ in (Design based on overflow discharge from detention basin - see detention basin calculations)

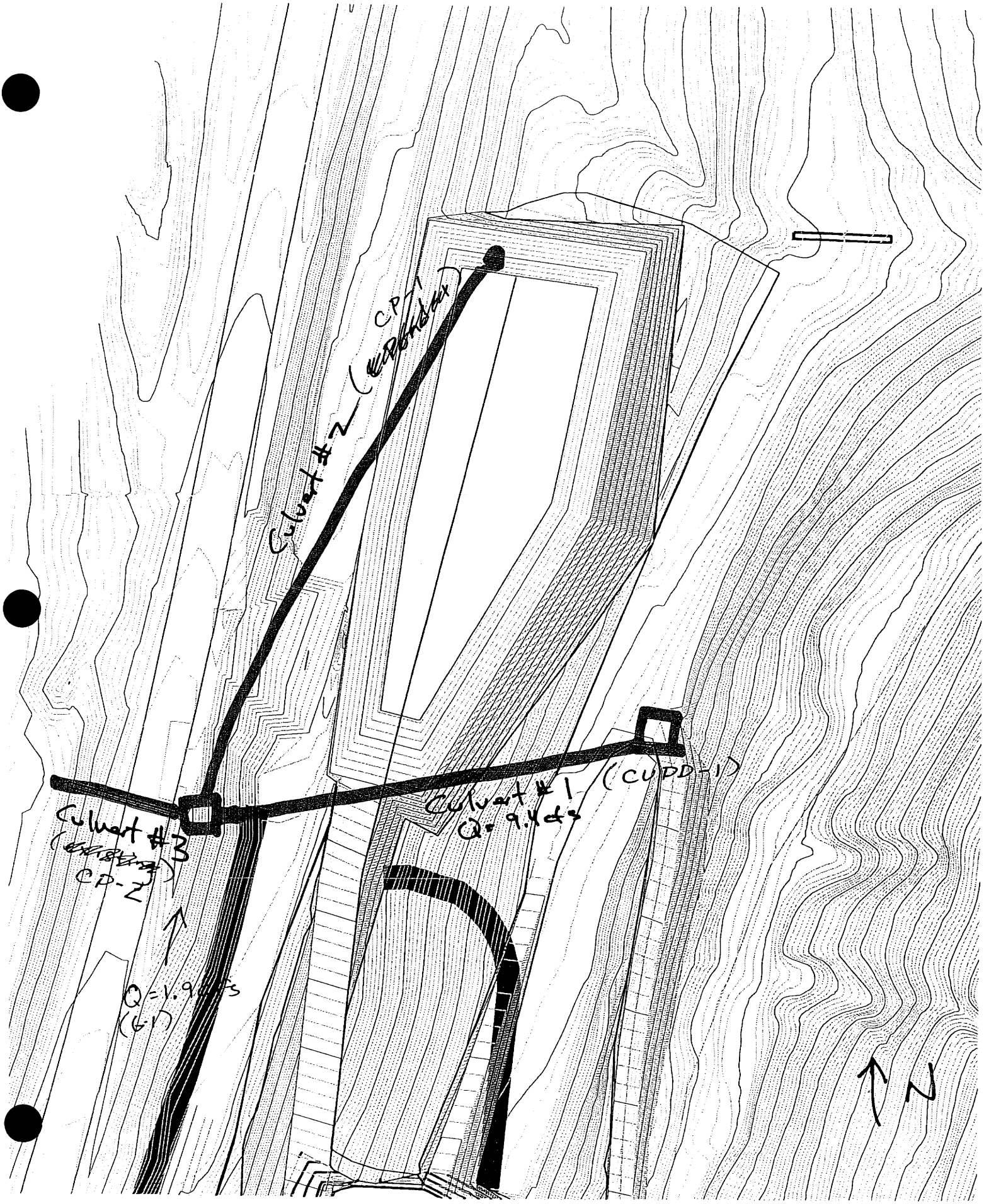
Culvert #3 (CP-2)

Design Flow (Q_3) = 33.8 cfs

(Combination of flows from culvert #1 & #2, a subbasin 6-1 of 22.5 cfs, 9.4 cfs and 1.9 cfs respectively)

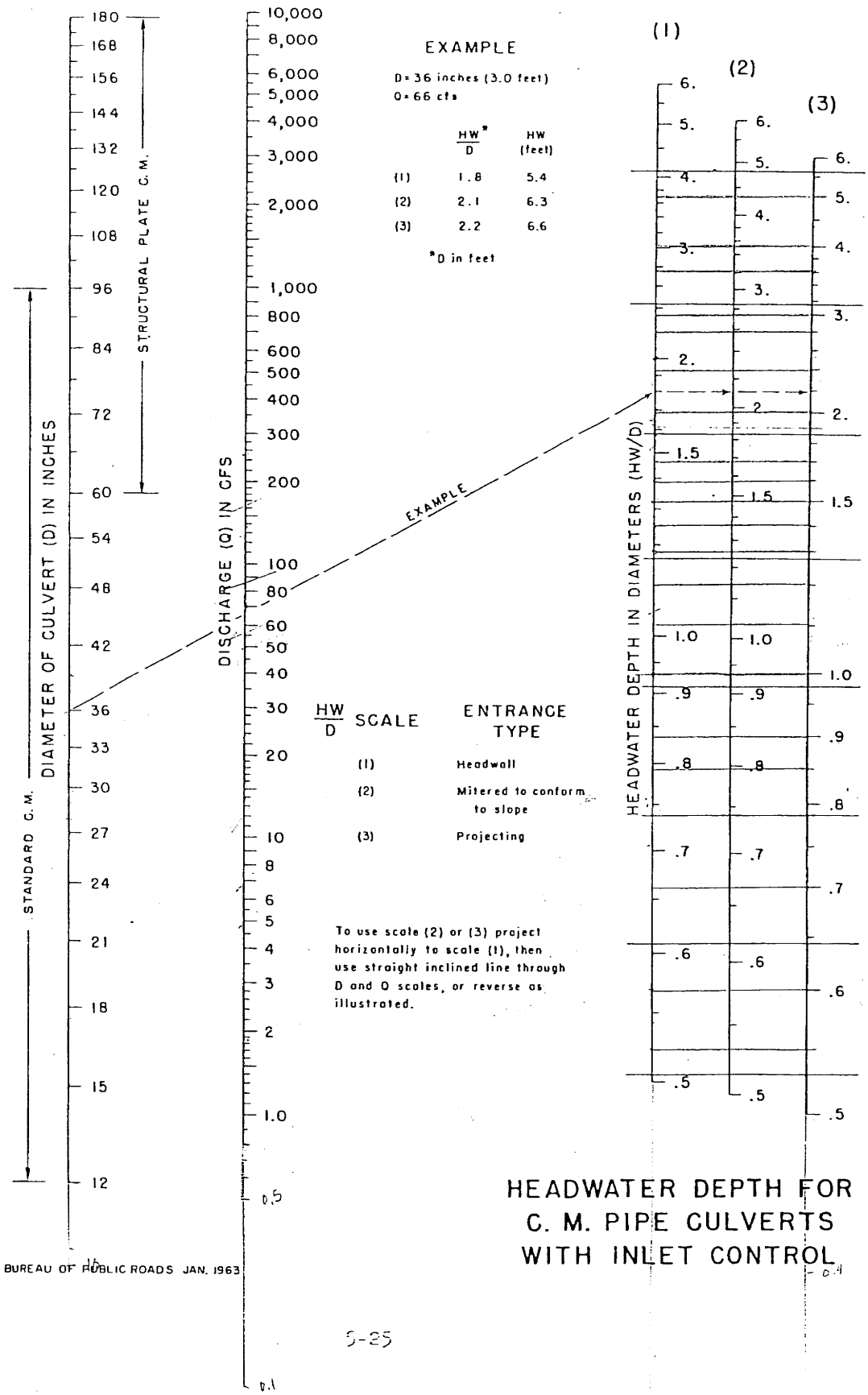
Based on Chart 5 in the "Hydraulic Charts for the Selection of Highway Culverts," assuming $H_w/D = 1.0$ with a projecting entrance type, $D_3 = 42''$

There is an existing 36" diameter pipe at this location



Culvert #2 (CP-1)
Culvert #1 (CUDD-1)
Q= 9.4cfs
Culvert #3
CP-2
Q=1.9cfs
(6-1)
N

CHART 5



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Ref: Hydraulic Charts for the Selection of Highway Culverts

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Typical Ditch Cross Section
PROJECT NO 308.01.400

SHEET ____ OF ____
COMPUTED TDS
CHECKED ____
DATE 7-3-07

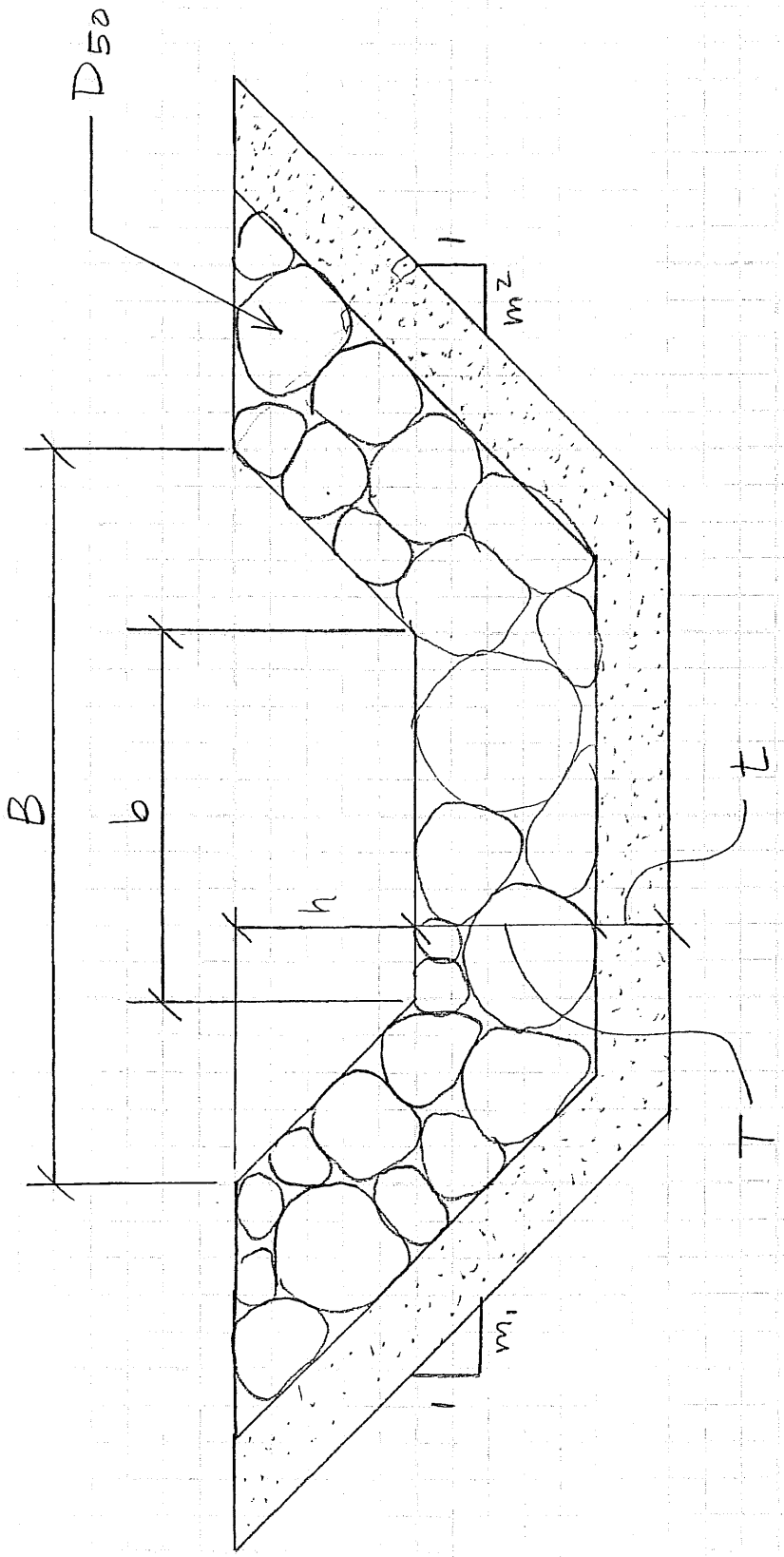


TABLE 4.7.2.2-1
DITCH DESIGN DETAILS

Drainage Ditch	10yr-6hr Design Flow (cfs)	Side Slope m1 (H:1)	Side Slope m2 (H:1)	Ditch Slope Max (%)	Ditch Slope Min (%)	Manning's n	Max Velocity (fps)	Flow Depth (ft)	Freeboard (ft)	Minimum Ditch Depth[1] (ft)	Bottom Width (ft)	Top Width (ft)	Riprap D_{50}[2] (inches)	Grout (yes/no)
DA-1	0.6	2	2	14.0	5.0	0.02	6.64	0.32	0.48	0.8	0.0	3.2	0.25	Yes
DC-1	1.0	2	2	0.5	0.5	0.02	1.90	0.32	0.48	0.8	1.0	4.2	n/a	n/a
DC-2	2.9	2	2	15.0	0.6	0.02	8.68	0.52	0.48	1.0	1.0	5.0	0.25	Yes
DC-3	2.9	2	2	0.8	0.8	0.02	3.05	0.48	0.52	1.0	1.0	5.0	n/a	n/a
DC-4	1.0	2	2	9.3	9.3	0.02	5.86	0.29	0.51	0.8	0.0	3.2	0.25	Yes
DC-5	2.9	2	2	0.8	0.8	0.02	3.01	0.49	0.51	1.0	1.0	5.0	0.25	Yes
DC-6	3.5	2	2	12.3	12.3	0.02	8.88	0.44	0.46	0.9	0.0	3.6	0.25	Yes
DD-1	0.2	2	2	3.8	3.8	0.02	2.8	0.19	0.51	0.7	0.0	2.8	n/a	n/a
DD-2	0.2	2	2	13.0	13.0	0.02	4.44	0.15	0.55	0.7	0.0	2.8	0.25	Yes
DD-3	0.3	2	2	3.8	3.8	0.02	3.10	0.22	0.48	0.7	0.0	2.8	n/a	n/a
DE-1	0.6	2	2	0.9	0.9	0.02	2.15	0.37	0.53	0.9	0.0	3.6	n/a	n/a
DE-2	0.2	2	2	2.0	2.0	0.02	2.18	0.21	0.49	0.7	0.0	2.8	n/a	n/a
DE-3	4.1	2	2	1.0	1.0	0.02	2.55	0.53	0.47	1.0	2.0	6.0	n/a	n/a
DE-4	4.2	2	2	1.0	1.0	0.02	2.57	0.53	0.47	1.0	2.0	6.0	n/a	n/a
DF-1	0.4	2	2	14.3	3.3	0.02	5.47	0.25	0.55	0.8	0.0	3.2	0.25	Yes
DF-2	0.4	2	2	6.1	6.1	0.02	3.97	0.22	0.48	0.7	0.0	2.8	n/a	n/a
DF-3	1.3	2	2	10.0	10.0	0.02	6.42	0.32	0.48	0.8	0.0	3.2	0.25	Yes
DF-4	1.7	2	2	5.7	5.7	0.02	5.56	0.39	0.51	0.9	0.0	3.6	0.25	Yes
DF-5	1.7	2	2	5.7	5.7	0.02	5.56	0.39	0.51	0.9	0.0	3.6	0.25	Yes
UDD-1	9.4[3]	50	4	7.0	7.0	0.02	5.18	0.26	0.00	0.26	0.0	15.0	n/a	n/a
UDD-2	9.4[3]	50	4	7.0	7.0	0.02	5.18	0.26	0.00	0.26	0.0	15.0	n/a	n/a

1 - Includes 0.5 foot freeboard.
2 - Maximum riprap size is 1.5 times D_{50}. All Riprap to be installed over 1.0 foot Type II Granular Filter.
3 - 100 Year, 6 Hour runoff.

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Ditch Design
PROJECT NO 308.01.400

SHEET ____ OF ____
COMPUTED TDS
CHECKED ____
DATE 1-2-07

Ditch Design Procedure:

1. Determined velocities in ditch based on minimum and maximum slopes.

2. Ditches with velocities less than 4 ft/s will not require any rip-rap.

3. Ditches with velocities greater than or equal to 4 ft/s will require rip-rap.

   a. Estimated D50 size in order to achieve a minimum safety factor of 1.5.

   b. If D50 size was an unreasonable size for the associated ditch, the D50 size was determined to be 0.25 ft (diameter) and the ditch will need to be grouted. (This was the case for all ditches with velocities greater than 4 ft/s)

* Sizing details for each ditch are shown in "Ditch Design Details" spreadsheet.

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DA-1))	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.90	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.50	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.05	ft/ft
Max. Bottom Slope:	0.14	ft/ft
Freeboard:	0.5	feet

Depth Check

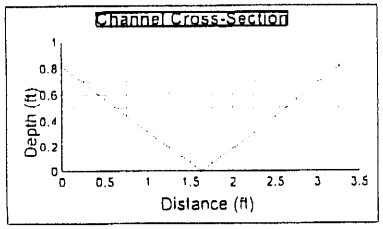
Depth (Min. Slope):	0.32	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.82	feet
Area:	0.20	ft2
Perimeter:	1.41	feet
Hydraulic Radius:	0.14	feet
Velocity:	4.52	ft/sec
Froude Number:	2.00	

Velocity Check

Depth (Max. Slope):	0.26	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.76	feet
Area:	0.14	ft2
Perimeter:	1.16	feet
Hydraulic Radius:	0.12	feet
Velocity:	6.64	ft/sec
Froude Number:	3.25	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.05	ft/ft
Max. Bottom Slope:	0.14	ft/ft
Min. Channel Depth:	0.82	feet
Channel Top Width:	3.26	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DA-1))	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	0.90		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	5.0	%	
Max. Bottom Slope:	14.0	%	
Flow Depth (Min. S):	0.32		feet
Flow Depth (Max. S):	0.26		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.48
Reynolds # for Smin	51,075
U=(gRS)^0.5 for Smax	0.72
Reynolds # for Smax	77,606

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.065
K for S max (See K vs. R Chart)	0.068
F for S min	15.8
F for S max	15.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.50	1.50	feet
T	0.98	2.27	lb/ft2
Nb	0.10	0.22	
Tmax	0.75	1.73	lb/ft2
Ns	0.08	0.17	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	4.39	9.35	degrees
Nsp	0.04	0.11	
SFb	6.39	2.62	
SFs	1.66	1.49	

HANSEN ALLEN & LUCE inc
ENGINEERS

Client: Carbon Resources
Project: Kinney Mine Hydrology
Feature: Ditch Design (DC-1)
Project #: 308.01.400

Sheet:
Comp.: TDS
Chck'd:
Date: 02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	1.00	cfs
Bottom Width:	1.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.20	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.005	ft/ft
Max. Bottom Slope:	0.005	ft/ft
Freeboard:	0.5	feet

Depth Check

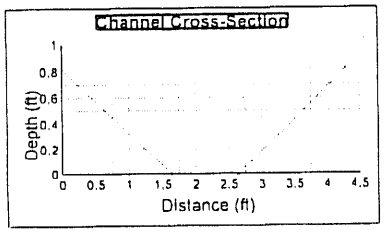
Depth (Min. Slope):	0.32	feet
Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
Required Depth:	0.82	feet
Area:	0.53	ft2
Perimeter:	2.43	feet
Hydraulic Radius:	0.22	feet
Velocity:	1.90	ft/sec
Froude Number:	0.70	

Velocity Check

Depth (Max. Slope):	0.32	feet
Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
Required Depth:	0.82	feet
Area:	0.53	ft2
Perimeter:	2.43	feet
Hydraulic Radius:	0.22	feet
Velocity:	1.90	ft/sec
Froude Number:	0.70	

Channel Design Summary:

Bottom Width:	1.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.005	ft/ft
Max. Bottom Slope:	0.005	ft/ft
Min. Channel Depth:	0.82	feet
Channel Top Width:	4.28	feet



HANSEN ALLEN & LUCE inc
ENGINEERS

Client: Carbon Resources
Project: Kinney Mine Hydrology
Feature: Ditch Design (DC-1)
Project #: 308.01.400

Sheet: of
Comp.: TDS
Chck'd:
Date: 03-Jan-08

DESIGN CRITERIA:

Design Flow:	1.00		cfs
Bottom Width:	1.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	0.5	%	
Max. Bottom Slope:	0.5	%	
Flow Depth (Min. S):	0.32		feet
Flow Depth (Max. S):	0.32		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.19
Reynolds # for Smin	2,666
U=(gRS)^0.5 for Smax	0.19
Reynolds # for Smax	2,666

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.20	0.20	feet
T	0.10	0.10	lb/ft2
Nb	0.08	0.08	
Tmax	0.08	0.08	lb/ft2
Ns	0.06	0.06	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	3.43	3.43	degrees
Nsp	0.03	0.03	
SFb	11.91	11.91	
SFs	1.70	1.70	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-2)	Chck'd	
Project #	308.01.400	Date	02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	2.90	cfs
Bottom Width:	1.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.50	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.006	ft/ft
Max. Bottom Slope:	0.150	ft/ft
Freeboard:	0.5	feet

Depth Check

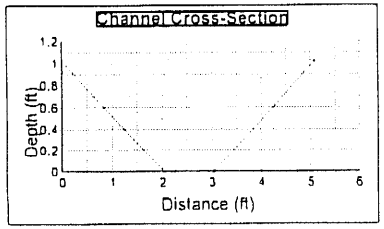
Depth (Min. Slope):	0.52	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	1.02	feet
Area:	1.06	ft2
Perimeter:	3.32	feet
Hydraulic Radius:	0.32	feet
Velocity:	2.75	ft/sec
Froude Number:	0.83	

Velocity Check

Depth (Max. Slope):	0.23	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.73	feet
Area:	0.33	ft2
Perimeter:	2.02	feet
Hydraulic Radius:	0.17	feet
Velocity:	8.68	ft/sec
Froude Number:	3.66	

Channel Design Summary:

Bottom Width:	1.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.00625	ft/ft
Max. Bottom Slope:	0.15	ft/ft
Min. Channel Depth:	1.02	feet
Channel Top Width:	5.07	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-2)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	2.90		cfs
Bottom Width:	1.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	0.6	%	
Max. Bottom Slope:	15.0	%	
Flow Depth (Min. S):	0.52		feet
Flow Depth (Max. S):	0.23		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.25
Reynolds # for Smin	27,116
U=(gRS)^0.5 for Smax	0.89
Reynolds # for Smax	95,652

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.070
F for S min	16.1
F for S max	14.6

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.50	1.50	feet
T	0.20	2.14	lb/ft2
Nb	0.02	0.20	
Tmax	0.15	1.63	lb/ft2
Ns	0.02	0.15	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	0.93	8.55	degrees
Nsp	0.01	0.10	
SFb	35.63	2.68	
SFs	1.77	1.51	

HANSEN ALLEN & LUCE inc ENGINEERS

Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-3)	Chck'd	
Project #	308.01.400	Date	02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

	Design Flow:	2.90	cfs
	Bottom Width:	1.0	feet
	Side Slope1:	2.0	m1
	Side Slope2:	2.0	m2
	Friction Factor:		
	Assumed D50:	0.20	
Anderson et al. (1970)	If X=1, n=0.0395(D50)^1/6		
Abt. et al. (1987, 1988)	If X=2, n=0.0456(D50*S)^0.0159		
	If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}		
	Generally Applicable for R/D50 > 0.5		
Jarrell (1984)	If X=4, n=0.39*(S^0.38)*(R^0.16)		
	If X=5, n=input n value		
	X:	1	
	Input n Value when X=5:		
	Calc (used) n Value:	0.020	
	Min. Bottom Slope:	0.008	ft/ft
	Max. Bottom Slope:	0.008	ft/ft
	Freeboard:	0.5	feet

Depth Check

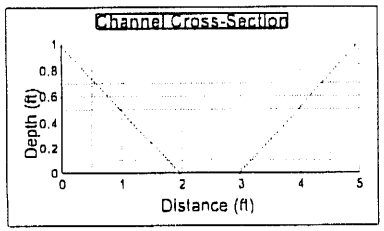
Depth (Min. Slope):	0.48	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.98	feet
Area:	0.95	ft2
Perimeter:	3.16	feet
Hydraulic Radius:	0.30	feet
Velocity:	3.05	ft/sec
Froude Number:	0.94	

Velocity Check

Depth (Max. Slope):	0.48	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.98	feet
Area:	0.95	ft2
Perimeter:	3.16	feet
Hydraulic Radius:	0.30	feet
Velocity:	3.05	ft/sec
Froude Number:	0.94	

Channel Design Summary:

Bottom Width:	1.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.0083	ft/ft
Max. Bottom Slope:	0.0083	ft/ft
Min. Channel Depth:	0.98	feet
Channel Top Width:	4.93	feet



HANSEN ALLEN & LUCE inc ENGINEERS

Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-3)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	2.90		cfs
Bottom Width:	1.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	0.8	%	
Max. Bottom Slope:	0.8	%	
Flow Depth (Min. S):	0.48		feet
Flow Depth (Max. S):	0.48		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.28
Reynolds # for Smin	4,051
U=(gRS)^0.5 for Smax	0.28
Reynolds # for Smax	4,051

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.20	0.20	feet
T	0.25	0.25	lb/ft2
Nb	0.20	0.20	
Tmax	0.19	0.19	lb/ft2
Ns	0.15	0.15	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.53	8.53	degrees
Nsp	0.09	0.09	
SFb	4.87	4.87	
SFs	1.55	1.55	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-4)	Chck'd	
Project #	308.01.400	Date	02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	1.00	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.25	

Anderson et al. (1970) If X = 1, n = 0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X = 2, n = 0.0456(D50*S)^0.0159

If X = 3, n = {D50^1/6*(R/D50)^1/6}/{3.82*[2.25 + 5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X = 4, n = 0.39*(S^0.38)*(R^0.16)

If X = 5, n = input n value

X:	1	
Input n Value when X = 5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.093	ft/ft
Max. Bottom Slope:	0.093	ft/ft
Freeboard:	0.5	feet

Depth Check

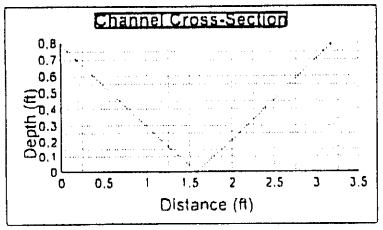
Depth (Min. Slope):	0.29	feet
Q-1.49AR(2/3)S(1/2)/n =	0.000	Accuracy
Required Depth:	0.79	feet
Area:	0.17	ft2
Perimeter:	1.31	feet
Hydraulic Radius:	0.13	feet
Velocity:	5.86	ft/sec
Froude Number:	2.70	

Velocity Check

Depth (Max. Slope):	0.29	feet
Q-1.49AR(2/3)S(1/2)/n =	0.000	Accuracy
Required Depth:	0.79	feet
Area:	0.17	ft2
Perimeter:	1.31	feet
Hydraulic Radius:	0.13	feet
Velocity:	5.86	ft/sec
Froude Number:	2.70	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.0932	ft/ft
Max. Bottom Slope:	0.0932	ft/ft
Min. Channel Depth:	0.79	feet
Channel Top Width:	3.17	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-4)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	1.00		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	9.3	%	
Max. Bottom Slope:	9.3	%	
Flow Depth (Min. S):	0.29		feet
Flow Depth (Max. S):	0.29		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U = Shear Velocity, v = viscosity

U = (gRS)^0.5 for Smin	0.63
Reynolds # for Smin	55,912
U = (gRS)^0.5 for Smax	0.63
Reynolds # for Smax	55,912

T = G*d*S where G = Unit weight of Water

Nb = F*T/(G(SG-1)D50)

F = (1/0.047) = 21.3 for flat slopes with Reynolds No. < 500

F = (1/0.062) = 16.1 for 500 < Reynolds No. < 40,000

F = varies from (1/0.062) = 16.1 for Reynolds No. = 40,000 to (1/0.25) = 4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	15.7
F for S max	15.7

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks = 0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar)) + Sin(Ar))

Nsp = Ns(1 + Sin(Ar + B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar) + Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.25	1.25	feet
T	1.70	1.70	lb/ft2
Nb	0.21	0.21	
Tmax	1.29	1.29	lb/ft2
Ns	0.16	0.16	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.83	8.83	degrees
Nsp	0.10	0.10	
SFb	3.21	3.21	
SFs	1.52	1.52	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-5)	Chck'd	
Project #	308.01.400	Date	02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	2.90	cfs
Bottom Width:	1.0	feet
Side Slope1:	2:0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.20	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.008	ft/ft
Max. Bottom Slope:	0.008	ft/ft
Freeboard:	0.5	feet

Depth Check

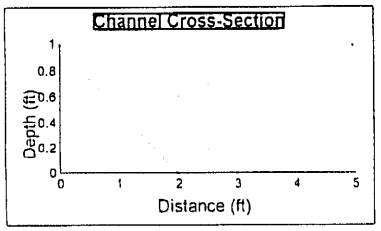
Depth (Min. Slope):	0.49	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.99	feet
Area:	0.96	ft2
Perimeter:	3.18	feet
Hydraulic Radius:	0.30	feet
Velocity:	3.01	ft/sec
Froude Number:	0.93	

Velocity Check

Depth (Max. Slope):	0.49	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.99	feet
Area:	0.96	ft2
Perimeter:	3.18	feet
Hydraulic Radius:	0.30	feet
Velocity:	3.01	ft/sec
Froude Number:	0.93	

Channel Design Summary:

Bottom Width:	1.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.008	ft/ft
Max. Bottom Slope:	0.008	ft/ft
Min. Channel Depth:	0.99	feet
Channel Top Width:	4.95	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DC-5)	Chck'd	
Project #	308.01.400	Date	08-Jan-08

DESIGN CRITERIA:

Design Flow:	2.90		cfs
Bottom Width:	1.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	0.8	%	
Max. Bottom Slope:	0.8	%	
Flow Depth (Min. S):	0.49		feet
Flow Depth (Max. S):	0.49		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.28
Reynolds # for Smin	3,992
U=(gRS)^0.5 for Smax	0.28
Reynolds # for Smax	3,992

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.20	0.20	feet
T	0.24	0.24	lb/ft2
Nb	0.19	0.19	
Tmax	0.19	0.19	lb/ft2
Ns	0.15	0.15	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.30	8.30	degrees
Nsp	0.08	0.08	
SFb	5.01	5.01	
SFs	1.56	1.56	

HANSEN ALLEN & LUCE inc ENGINEERS

Client: Carbon Resources
Project: Kinney Mine Hydrology
Feature: Ditch Design (DC-6)
Project #: 308.01.400

Sheet:
Comp.: TDS
Chck'd:
Date: 02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	3.50	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	2.25	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.123	ft/ft
Max. Bottom Slope:	0.123	ft/ft
Freeboard:	0.5	feet

Depth Check

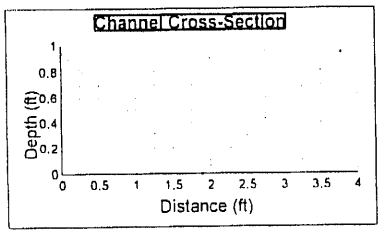
Depth (Min. Slope):	0.44	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.94	feet
Area:	0.39	ft2
Perimeter:	1.99	feet
Hydraulic Radius:	0.20	feet
Velocity:	8.88	ft/sec
Froude Number:	3.32	

Velocity Check

Depth (Max. Slope):	0.44	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.94	feet
Area:	0.39	ft2
Perimeter:	1.99	feet
Hydraulic Radius:	0.20	feet
Velocity:	8.88	ft/sec
Froude Number:	3.32	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.1225	ft/ft
Max. Bottom Slope:	0.1225	ft/ft
Min. Channel Depth:	0.94	feet
Channel Top Width:	3.78	feet



HANSEN ALLEN & LUCE inc ENGINEERS

Client: Carbon Resources
Project: Kinney Mine Hydrology
Feature: Ditch Design (DC-6)
Project #: 308.01.400

Sheet: of
Comp.: TDS
Chck'd:
Date: 08-Jan-08

DESIGN CRITERIA:

Design Flow:	3.50		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	12.3	%	
Max. Bottom Slope:	12.3	%	
Flow Depth (Min. S):	0.44		feet
Flow Depth (Max. S):	0.44		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.89
Reynolds # for Smin	142,240
U=(gRS)^0.5 for Smax	0.89
Reynolds # for Smax	142,240

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	13.4
F for S max	13.4

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	2.25	2.25	feet
T	3.39	3.39	lb/ft2
Nb	0.20	0.20	
Tmax	2.58	2.58	lb/ft2
Ns	0.15	0.15	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.34	8.34	degrees
Nsp	0.09	0.09	
SFb	2.99	2.99	
SFs	1.53	1.53	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DD-1)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.20	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.50	

Anderson et al. (1970) If X = 1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X = 2, n=0.0456(D50*S)^0.0159

If X = 3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X = 4, n=0.39*(S^0.38)*(R^0.16)

If X = 5, n=input n value

X:	1	
Input n Value when X = 5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.038	ft/ft
Max. Bottom Slope:	0.038	ft/ft
Freeboard:	0.5	feet

Depth Check

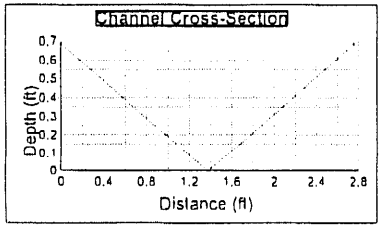
Depth (Min. Slope):	0.19	feet
Q-1.49AR(2/3)S(1/2)/n =	0.000	Accuracy
Required Depth:	0.69	feet
Area:	0.07	ft2
Perimeter:	0.85	feet
Hydraulic Radius:	0.08	feet
Velocity:	2.80	ft/sec
Froude Number:	1.60	

Velocity Check

Depth (Max. Slope):	0.19	feet
Q-1.49AR(2/3)S(1/2)/n =	0.000	Accuracy
Required Depth:	0.69	feet
Area:	0.07	ft2
Perimeter:	0.85	feet
Hydraulic Radius:	0.08	feet
Velocity:	2.80	ft/sec
Froude Number:	1.60	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.038	ft/ft
Max. Bottom Slope:	0.038	ft/ft
Min. Channel Depth:	0.69	feet
Channel Top Width:	2.76	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DD-1)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	0.20		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	3.8	%	
Max. Bottom Slope:	3.8	%	
Flow Depth (Min. S):	0.19		feet
Flow Depth (Max. S):	0.19		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.32
Reynolds # for Smin	11,487
U=(gRS)^0.5 for Smax	0.32
Reynolds # for Smax	11,487

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.50	0.50	feet
T	0.45	0.45	lb/ft2
Nb	0.14	0.14	
Tmax	0.34	0.34	lb/ft2
Ns	0.11	0.11	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	6.10	6.10	degrees
Nsp	0.06	0.06	
SFb	5.47	5.47	
SFs	1.61	1.61	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DD-2)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

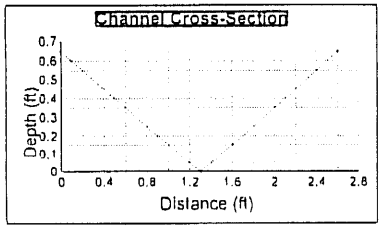
	Design Flow:	0.20	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	m1
	Side Slope2:	2.0	m2
	Friction Factor:		
	Assumed D50:	1.00	
Anderson et al. (1970)	If X = 1, n=0.0395(D50)^1/6		
Abt. et al. (1987, 1988)	If X = 2, n=0.0456(D50*S)^0.0159		
	If X = 3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}		
	Generally Applicable for R/D50 > 0.5		
Jarrett (1984)	If X = 4, n=0.39*(S^0.38)*(R^0.16)		
	If X = 5, n = input n value		
	X:	1	
	Input n Value when X = 5:		
	Calc (used) n Value:	0.020	
	Min. Bottom Slope:	0.130	ft/ft
	Max. Bottom Slope:	0.130	ft/ft
	Freeboard:	0.5	feet

Depth Check			
	Depth (Min. Slope):	0.15	feet
	Q-1.49AR(2/3)S(1/2)/n =	0.000	Accuracy
	Required Depth:	0.65	feet
	Area:	0.05	ft2
	Perimeter:	0.67	feet
	Hydraulic Radius:	0.07	feet
	Velocity:	4.44	ft/sec
	Froude Number:	2.85	

Velocity Check			
	Depth (Max. Slope):	0.15	feet
	Q-1.49AR(2/3)S(1/2)/n =	0.000	Accuracy
	Required Depth:	0.65	feet
	Area:	0.05	ft2
	Perimeter:	0.67	feet
	Hydraulic Radius:	0.07	feet
	Velocity:	4.44	ft/sec
	Froude Number:	2.85	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.13	ft/ft
Max. Bottom Slope:	0.13	ft/ft
Min. Channel Depth:	0.65	feet
Channel Top Width:	2.60	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DD-2)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	0.20		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	13.0	%	
Max. Bottom Slope:	13.0	%	
Flow Depth (Min. S):	0.15		feet
Flow Depth (Max. S):	0.15		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U = Shear Velocity, v = viscosity

U=(gRS)^0.5 for Smin	0.53
Reynolds # for Smin	37,866
U=(gRS)^0.5 for Smax	0.53
Reynolds # for Smax	37,866

T = G*d*S where G = Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.063
K for S max (See K vs. R Chart)	0.063
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar)) + Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.00	1.00	feet
T	1.22	1.22	lb/ft2
Nb	0.19	0.19	
Tmax	0.93	0.93	lb/ft2
Ns	0.14	0.14	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.08	8.08	degrees
Nsp	0.09	0.09	
SFb	2.96	2.96	
SFs	1.53	1.53	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DD-3)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.30	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.50	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.038	ft/ft
Max. Bottom Slope:	0.038	ft/ft
Freeboard:	0.5	feet

Depth Check

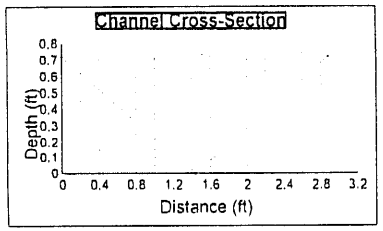
Depth (Min. Slope):	0.22	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.72	feet
Area:	0.10	ft2
Perimeter:	0.98	feet
Hydraulic Radius:	0.10	feet
Velocity:	3.10	ft/sec
Froude Number:	1.64	

Velocity Check

Depth (Max. Slope):	0.22	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.72	feet
Area:	0.10	ft2
Perimeter:	0.98	feet
Hydraulic Radius:	0.10	feet
Velocity:	3.10	ft/sec
Froude Number:	1.64	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.038	ft/ft
Max. Bottom Slope:	0.038	ft/ft
Min. Channel Depth:	0.72	feet
Channel Top Width:	2.88	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DD-3)	Chck'd	
Project #	308.01.400	Date	08-Jan-08

DESIGN CRITERIA:

Design Flow:	0.30		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	3.8	%	
Max. Bottom Slope:	3.8	%	
Flow Depth (Min. S):	0.22		feet
Flow Depth (Max. S):	0.22		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.35
Reynolds # for Smin	12,395
U=(gRS)^0.5 for Smax	0.35
Reynolds # for Smax	12,395

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.50	0.50	feet
T	0.52	0.52	lb/ft2
Nb	0.16	0.16	
Tmax	0.40	0.40	lb/ft2
Ns	0.12	0.12	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	7.09	7.09	degrees
Nsp	0.07	0.07	
SFb	4.86	4.86	
SFs	1.58	1.58	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DE-1)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.60	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.20	

Anderson et al. (1970) If X = 1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X = 2, n=0.0456(D50*S)^0.0159

If X = 3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X = 4, n=0.39*(S^0.38)*(R^0.16)

If X = 5, n=input n value

X:	1	
Input n Value when X = 5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.009	ft/ft
Max. Bottom Slope:	0.009	ft/ft
Freeboard:	0.5	feet

Depth Check

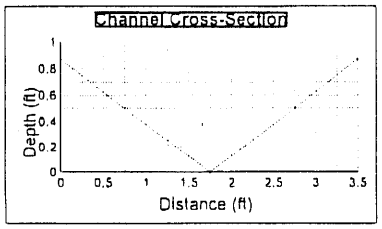
Depth (Min. Slope):	0.37	feet
Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
Required Depth:	0.87	feet
Area:	0.28	ft2
Perimeter:	1.67	feet
Hydraulic Radius:	0.17	feet
Velocity:	2.15	ft/sec
Froude Number:	0.87	

Velocity Check

Depth (Max. Slope):	0.37	feet
Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
Required Depth:	0.87	feet
Area:	0.28	ft2
Perimeter:	1.67	feet
Hydraulic Radius:	0.17	feet
Velocity:	2.15	ft/sec
Froude Number:	0.87	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.009	ft/ft
Max. Bottom Slope:	0.009	ft/ft
Min. Channel Depth:	0.87	feet
Channel Top Width:	3.50	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DE-1)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	0.60		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	0.9	%	
Max. Bottom Slope:	0.9	%	
Flow Depth (Min. S):	0.37		feet
Flow Depth (Max. S):	0.37		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U = Shear Velocity, v = viscosity

U=(gRS)^0.5 for Smin	0.22
Reynolds # for Smin	3,145
U=(gRS)^0.5 for Smax	0.22
Reynolds # for Smax	3,145

T = G*d*S where G = Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks:	0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.20	0.20	feet
T	0.21	0.21	lb/ft2
Nb	0.16	0.16	
Tmax	0.16	0.16	lb/ft2
Ns	0.13	0.13	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	7.16	7.16	degrees
Nsp	0.07	0.07	
SFb	5.73	5.73	
SFs	1.59	1.59	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DE-2)	Chck'd	
Project #	308.01.400	Date	02-Jan-08

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.20	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.25	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.020	ft/ft
Max. Bottom Slope:	0.020	ft/ft
Freeboard:	0.5	feet

Depth Check

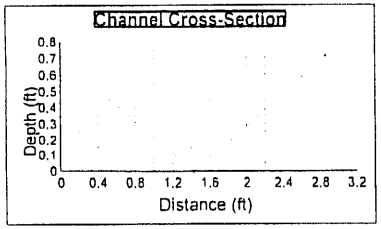
Depth (Min. Slope):	0.21	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.71	feet
Area:	0.09	ft2
Perimeter:	0.96	feet
Hydraulic Radius:	0.10	feet
Velocity:	2.18	ft/sec
Froude Number:	1.18	

Velocity Check

Depth (Max. Slope):	0.21	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.71	feet
Area:	0.09	ft2
Perimeter:	0.96	feet
Hydraulic Radius:	0.10	feet
Velocity:	2.18	ft/sec
Froude Number:	1.18	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.01961	ft/ft
Max. Bottom Slope:	0.01961	ft/ft
Min. Channel Depth:	0.71	feet
Channel Top Width:	2.86	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DE-2)	Chck'd	
Project #	308.01.400	Date	08-Jan-08

DESIGN CRITERIA:

Design Flow:	0.20		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	2.0	%	
Max. Bottom Slope:	2.0	%	
Flow Depth (Min. S):	0.21		feet
Flow Depth (Max. S):	0.21		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.25
Reynolds # for Smin	4,390
U=(gRS)^0.5 for Smax	0.25
Reynolds # for Smax	4,390

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.25	0.25	feet
T	0.26	0.26	lb/ft2
Nb	0.16	0.16	
Tmax	0.20	0.20	lb/ft2
Ns	0.12	0.12	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	7.14	7.14	degrees
Nsp	0.07	0.07	
SFb	5.38	5.38	
SFs	1.59	1.59	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	West Side Ditch Design (DE-3)	Chck'd	
Project #	308.01.400	Date	20-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	4.10	cfs
Bottom Width:	2.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.25	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	5	
Input n Value when X=5:		
Calc (used) n Value:	0.030	
Min. Bottom Slope:	0.01	ft/ft
Max. Bottom Slope:	0.01	ft/ft
Freeboard:	0.5	feet

Depth Check

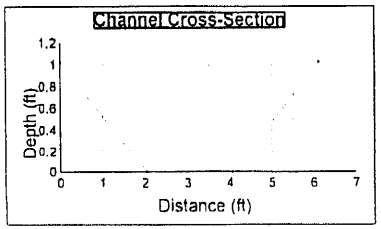
Depth (Min. Slope):	0.53	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	1.03	feet
Area:	1.61	ft2
Perimeter:	4.35	feet
Hydraulic Radius:	0.37	feet
Velocity:	2.55	ft/sec
Froude Number:	0.72	

Velocity Check

Depth (Max. Slope):	0.53	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	1.03	feet
Area:	1.61	ft2
Perimeter:	4.35	feet
Hydraulic Radius:	0.37	feet
Velocity:	2.55	ft/sec
Froude Number:	0.72	

Channel Design Summary:

Bottom Width:	2.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.01	ft/ft
Max. Bottom Slope:	0.01	ft/ft
Min. Channel Depth:	1.03	feet
Channel Top Width:	6.10	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	West Side Ditch Design (DE-3)	Chck'd	
Project #	308.01.400	Date	08-Jan-08

DESIGN CRITERIA:

Design Flow:	4.10		cfs
Bottom Width:	2.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.03		
Min. Bottom Slope:	1.0	%	
Max. Bottom Slope:	1.0	%	
Flow Depth (Min. S):	0.53		feet
Flow Depth (Max. S):	0.53		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.34
Reynolds # for Smin	6,154
U=(gRS)^0.5 for Smax	0.34
Reynolds # for Smax	6,154

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	0.2	Smax	
D50	0.25	0.25	feet
T	0.33	0.33	lb/ft2
Nb	0.21	0.21	
Tmax	0.25	0.25	lb/ft2
Ns	0.16	0.16	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.93	8.93	degrees
Nsp	0.09	0.09	
SFb	4.61	4.61	
SFs	1.54	1.54	

HANSEN ALLEN & LUCE inc ENGINEERS		
Client: Carbon Resources	Sheet:	
Project: Kinney Mine Hydrology	Comp.: TDS	
Feature: West Side Ditch Design (DE-4)	Chck'd:	
Project #: 308.01.400	Date: 20-Dec-07	

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	4.20	cfs
Bottom Width:	2.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.25	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	5	
Input n Value when X=5:		
Calc (used) n Value:	0.030	
Min. Bottom Slope:	0.01	ft/ft
Max. Bottom Slope:	0.01	ft/ft
Freeboard:	0.5	feet

Depth Check

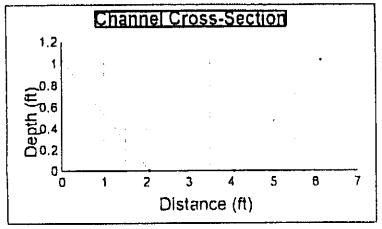
Depth (Min. Slope):	0.53	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	1.03	feet
Area:	1.63	ft2
Perimeter:	4.38	feet
Hydraulic Radius:	0.37	feet
Velocity:	2.57	ft/sec
Froude Number:	0.72	

Velocity Check

Depth (Max. Slope):	0.53	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	1.03	feet
Area:	1.63	ft2
Perimeter:	4.38	feet
Hydraulic Radius:	0.37	feet
Velocity:	2.57	ft/sec
Froude Number:	0.72	

Channel Design Summary:

Bottom Width:	2.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.01	ft/ft
Max. Bottom Slope:	0.01	ft/ft
Min. Channel Depth:	1.03	feet
Channel Top Width:	6.13	feet



HANSEN ALLEN & LUCE inc ENGINEERS		
Client: Carbon Resources	Sheet: of	
Project: Kinney Mine Hydrology	Comp.: TDS	
Feature: West Side Ditch Design (DE-4)	Chck'd:	
Project #: 308.01.400	Date: 08-Jan-08	

DESIGN CRITERIA:

Design Flow:	4.20		cfs
Bottom Width:	2.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.03		
Min. Bottom Slope:	1.0	%	
Max. Bottom Slope:	1.0	%	
Flow Depth (Min. S):	0.53		feet
Flow Depth (Max. S):	0.53		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.35
Reynolds # for Smin	6,186
U=(gRS)^0.5 for Smax	0.35
Reynolds # for Smax	6,186

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	0.2	Smax	
D50	0.25	0.25	feet
T	0.33	0.33	lb/ft2
Nb	0.21	0.21	
Tmax	0.25	0.25	lb/ft2
Ns	0.16	0.16	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	9.04	9.04	degrees
Nsp	0.09	0.09	
SFb	4.56	4.56	
SFs	1.53	1.53	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-1))	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.40	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.25	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.033	ft/ft
Max. Bottom Slope:	0.143	ft/ft
Freeboard:	0.5	feet

Depth Check

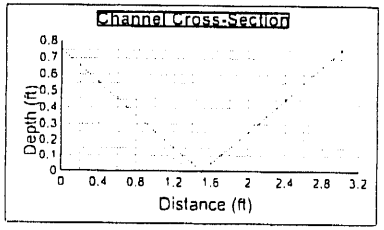
Depth (Min. Slope):	0.25	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.75	feet
Area:	0.13	ft2
Perimeter:	1.13	feet
Hydraulic Radius:	0.11	feet
Velocity:	3.16	ft/sec
Froude Number:	1.57	

Velocity Check

Depth (Max. Slope):	0.19	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.69	feet
Area:	0.07	ft2
Perimeter:	0.86	feet
Hydraulic Radius:	0.09	feet
Velocity:	5.47	ft/sec
Froude Number:	3.12	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.033	ft/ft
Max. Bottom Slope:	0.143	ft/ft
Min. Channel Depth:	0.75	feet
Channel Top Width:	3.01	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-1))	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	0.40		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	3.3	%	
Max. Bottom Slope:	14.3	%	
Flow Depth (Min. S):	0.25		feet
Flow Depth (Max. S):	0.19		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.35
Reynolds # for Smin	30,883
U=(gRS)^0.5 for Smax	0.63
Reynolds # for Smax	56,029

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.063
K for S max (See K vs. R Chart)	0.063
F for S min	16.1
F for S max	15.7

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.25	1.25	feet
T	0.52	1.71	lb/ft2
Nb	0.06	0.21	
Tmax	0.39	1.30	lb/ft2
Ns	0.05	0.16	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	2.84	8.75	degrees
Nsp	0.03	0.10	
SFb	0.83	2.70	
SFs	1.71	1.51	

HANSEN ALLEN & LUCE INC ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-2)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	0.40	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	0.75	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrell (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.061	ft/ft
Max. Bottom Slope:	0.061	ft/ft
Freeboard:	0.5	feet

Depth Check

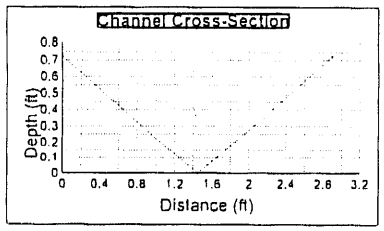
Depth (Min. Slope):	0.22	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.72	feet
Area:	0.10	ft2
Perimeter:	1.00	feet
Hydraulic Radius:	0.10	feet
Velocity:	3.97	ft/sec
Froude Number:	2.09	

Velocity Check

Depth (Max. Slope):	0.22	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.72	feet
Area:	0.10	ft2
Perimeter:	1.00	feet
Hydraulic Radius:	0.10	feet
Velocity:	3.97	ft/sec
Froude Number:	2.09	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.061	ft/ft
Max. Bottom Slope:	0.061	ft/ft
Min. Channel Depth:	0.72	feet
Channel Top Width:	2.90	feet



HANSEN ALLEN & LUCE INC ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-2)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	0.40		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	6.1	%	
Max. Bottom Slope:	6.1	%	
Flow Depth (Min. S):	0.22		feet
Flow Depth (Max. S):	0.22		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.44
Reynolds # for Smin	23,786
U=(gRS)^0.5 for Smax	0.44
Reynolds # for Smax	23,786

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.75	0.75	feet
T	0.85	0.85	lb/ft2
Nb	0.18	0.18	
Tmax	0.65	0.65	lb/ft2
Ns	0.14	0.14	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	7.69	7.69	degrees
Nsp	0.08	0.08	
SFb	4.05	4.05	
SFs	1.56	1.56	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-3)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	1.30	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.50	

Anderson et al. (1970) If X = 1, n = 0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X = 2, n = 0.0456(D50*S)^0.0159

If X = 3, n = {D50^1/6*(R/D50)^1/6}/{3.82*[2.25 + 5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X = 4, n = 0.39*(S^0.38)*(R^0.16)

If X = 5, n = input n value

X:	1	
Input n Value when X = 5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.100	ft/ft
Max. Bottom Slope:	0.100	ft/ft
Freeboard:	0.5	feet

Depth Check

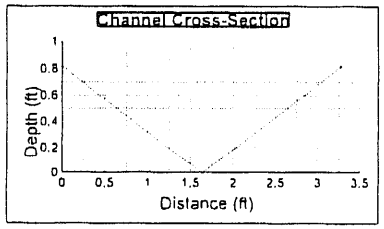
Depth (Min. Slope):	0.32	feet
Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
Required Depth:	0.82	feet
Area:	0.20	ft2
Perimeter:	1.42	feet
Hydraulic Radius:	0.14	feet
Velocity:	6.42	ft/sec
Froude Number:	2.84	

Velocity Check

Depth (Max. Slope):	0.32	feet
Q-1.49AR(2/3)S(1/2)/n =	-0.000	Accuracy
Required Depth:	0.82	feet
Area:	0.20	ft2
Perimeter:	1.42	feet
Hydraulic Radius:	0.14	feet
Velocity:	6.42	ft/sec
Froude Number:	2.84	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.1	ft/ft
Max. Bottom Slope:	0.1	ft/ft
Min. Channel Depth:	0.82	feet
Channel Top Width:	3.27	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-3)	Chck'd	
Project #	308.01.400	Date	03-Jan-08

DESIGN CRITERIA:

Design Flow:	1.30		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	10.0	%	
Max. Bottom Slope:	10.0	%	
Flow Depth (Min. S):	0.32		feet
Flow Depth (Max. S):	0.32		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U = Shear Velocity, v = viscosity

U = (gRS)^0.5 for Smin	0.68
Reynolds # for Smin	72.524
U = (gRS)^0.5 for Smax	0.68
Reynolds # for Smax	72.524

T = G*d*S where G = Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F = (1/0.047) = 21.3 for flat slopes with Reynolds No. < 500

F = (1/0.062) = 16.1 for 500 < Reynolds No. < 40,000

F = varies from (1/0.062) = 16.1 for Reynolds No. = 40,000 to (1/0.25) = 4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.063
K for S max (See K vs. R Chart)	0.063
F for S min	15.2
F for S max	15.2

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax = Ks*G*d*S

Set Ks = 0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks:	0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar)) + Sin(Ar))

Nsp = Ns(1 + Sin(Ar + B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar) + Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.50	1.50	feet
T	1.99	1.99	lb/ft2
Nb	0.20	0.20	
Tmax	1.51	1.51	lb/ft2
Ns	0.15	0.15	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	8.36	8.36	degrees
Nsp	0.09	0.09	
SFb	3.24	3.24	
SFs	1.53	1.53	

HANSEN ALLEN & LUCE inc ENGINEERS

Client: Carbon Resources
Project: Kinney Mine Hydrology
Feature: Ditch Design (DF-4)
Project #: 308.01.400

Sheet:
Comp.: TDS
Chk'd:
Date: 26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	1.70	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.00	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt, et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.057	ft/ft
Max. Bottom Slope:	0.057	ft/ft
Freeboard:	0.5	feet

Depth Check

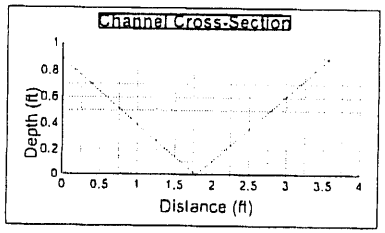
Depth (Min. Slope):	0.39	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.89	feet
Area:	0.31	ft2
Perimeter:	1.75	feet
Hydraulic Radius:	0.17	feet
Velocity:	5.56	ft/sec
Froude Number:	2.22	

Velocity Check

Depth (Max. Slope):	0.39	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.89	feet
Area:	0.31	ft2
Perimeter:	1.75	feet
Hydraulic Radius:	0.17	feet
Velocity:	5.56	ft/sec
Froude Number:	2.22	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.057	ft/ft
Max. Bottom Slope:	0.057	ft/ft
Min. Channel Depth:	0.89	feet
Channel Top Width:	3.56	feet



HANSEN ALLEN & LUCE inc ENGINEERS

Client: Carbon Resources
Project: Kinney Mine Hydrology
Feature: Ditch Design (DF-4)
Project #: 308.01.400

Sheet: of
Comp.: TDS
Chk'd:
Date: 03-Jan-08

DESIGN CRITERIA:

Design Flow:	1.70		cfs
Bottom Width:	0.00		feet
Side Slope1:	2.00		1/m1
Side Slope2:	2.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	5.7	%	
Max. Bottom Slope:	5.7	%	
Flow Depth (Min. S):	0.39		feet
Flow Depth (Max. S):	0.39		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.57
Reynolds # for Smin	40,463
U=(gRS)^0.5 for Smax	0.57
Reynolds # for Smax	40,463

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.063
K for S max (See K vs. R Chart)	0.063
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan(Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.00	1.00	feet
T	1.39	1.39	lb/ft2
Nb	0.22	0.22	
Tmax	1.06	1.06	lb/ft2
Ns	0.17	0.17	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	9.33	9.33	degrees
Nsp	0.10	0.10	
SFb	3.56	3.56	
SFs	1.51	1.51	

HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-5)	Chck'd	
Project #	308.01.400	Date	26-Dec-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	1.70	cfs
Bottom Width:	0.0	feet
Side Slope1:	2.0	m1
Side Slope2:	2.0	m2
Friction Factor:		
Assumed D50:	1.00	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	1	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.057	ft/ft
Max. Bottom Slope:	0.057	ft/ft
Freeboard:	0.5	feet

Depth Check

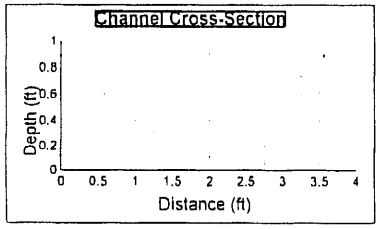
Depth (Min. Slope):	0.39	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.89	feet
Area:	0.31	ft2
Perimeter:	1.75	feet
Hydraulic Radius:	0.17	feet
Velocity:	5.56	ft/sec
Froude Number:	2.22	

Velocity Check

Depth (Max. Slope):	0.39	feet
Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
Required Depth:	0.89	feet
Area:	0.31	ft2
Perimeter:	1.75	feet
Hydraulic Radius:	0.17	feet
Velocity:	5.56	ft/sec
Froude Number:	2.22	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Min. Bottom Slope:	0.057	ft/ft
Max. Bottom Slope:	0.057	ft/ft
Min. Channel Depth:	0.89	feet
Channel Top Width:	3.56	feet



HANSEN ALLEN & LUCE inc ENGINEERS			
Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (DF-5)	Chck'd	
Project #	308.01.400	Date	08-Jan-08

DESIGN CRITERIA:

Design Flow:	1.70	cfs
Bottom Width:	0.00	feet
Side Slope1:	2.00	1/m1
Side Slope2:	2.00	1/m2
Friction Factor:	0.02	
Min. Bottom Slope:	5.7	%
Max. Bottom Slope:	5.7	%
Flow Depth (Min. S):	0.39	feet
Flow Depth (Max. S):	0.39	feet
Angle Repose (Ar):	42.0	degrees
Specific Gravity	2.65	

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.57
Reynolds # for Smin	40,463
U=(gRS)^0.5 for Smax	0.57
Reynolds # for Smax	40,463

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.063
K for S max (See K vs. R Chart)	0.063
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	1.00	1.00	feet
T	1.39	1.39	lb/ft2
Nb	0.22	0.22	
Tmax	1.06	1.06	lb/ft2
Ns	0.17	0.17	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	9.33	9.33	degrees
Nsp	0.10	0.10	
SFb	3.56	3.56	
SFs	1.51	1.51	

d	=	Depth of flow;
S	=	Channel slope in feet per feet;
SG	=	Specific gravity of rock, and
D_{50}	=	Mean riprap size, in feet.

An analysis of side slope stability was completed by applying equations 784.14-12 through 784.14-14.

$$SF = \frac{\cos \alpha \tan \phi}{\eta' \tan \phi + \sin \alpha \cos \beta} \qquad (742.312\text{-}12)$$

$$\beta = \arctan \left(\frac{\cos \theta}{\frac{2 \sin \alpha}{\eta \tan \phi} + \sin \theta} \right) \qquad (742.312\text{-}13)$$

$$\eta' = C \eta \left(\frac{1 + \sin (\theta + \beta)}{2} \right) \qquad (742.312\text{-}14)$$

where

α	=	Tan^{-1} (1/sideslope); and
C	=	0.76 for 2H:1V sideslopes
	=	0.86 for 3H:1V sideslopes.

Sideslope is defined as the number of feet horizontal per foot vertical of the channel embankments. All other variables are as previously defined.

Once mean riprap size is determined, a riprap gradation and thickness must be determined. Table 742.312a, Recommended Riprap Gradation Limits, shows the recommended gradation for both mild and steep channel conditions. In some cases, grout was used in riprapped sections to increase channel stability and/or reduce riprap size.

Conveyor Lining. A second type of channel lining utilized consists of overlapped conveyor belt material. This lining was installed in excavated channels in short pieces so that the upstream belt material overlapped the downstream piece thereby preventing water from washing beneath the downstream liner. Each section of channel lining was secured with wire and rebar anchors. The locations of lined channel sections are shown on Maps 731.720a through 731.720c.

TABLE 742.312a
Recommended Riprap Gradation Limits

DESIGN RATIO	STEEP SLOPE	MILD SLOPE
$\frac{D_{max}}{D_{50}}$	1.25	2
$\frac{D_{50}}{D_{10-20}}$	2-3	2-3

From "Surface Mining Water Diversion Design Manual", 1982

Half Round CMP Pipe. In other locations such as around Ponds 4 and 6, half round CMP pipe has been placed to provide the required erosion protection. CMP pipe has also been used in steep areas where channel flow is infeasible but yet the water must be conveyed down a hillside. Examples of such areas are noted near the upper mine portals and along the roadway leading to the upper mine offices located on the Lion Deck.

Ditch sections requiring erosion protection are shown on Maps 731.720a through 731.720c. Areas downstream from culvert installations requiring similar protection are shown on Maps 731.720d through 731.720f. Specific mention should be made with regard to the design of erosion protection at some of the locations shown on the maps. Current riprap design methodologies do not allow for the design of erosion protection on extremely steep slopes using such materials as rock riprap. In some locations, however, such as at Culverts 57A through 60A (as well as at other locations within the mine permit area), consideration must be given to the fact that local drainage must be transferred down a steep hillside or stream channel. At such locations, procedures are not available for designing riprap erosion protection and, therefore, calculations under such conditions have not been, nor can they be made.

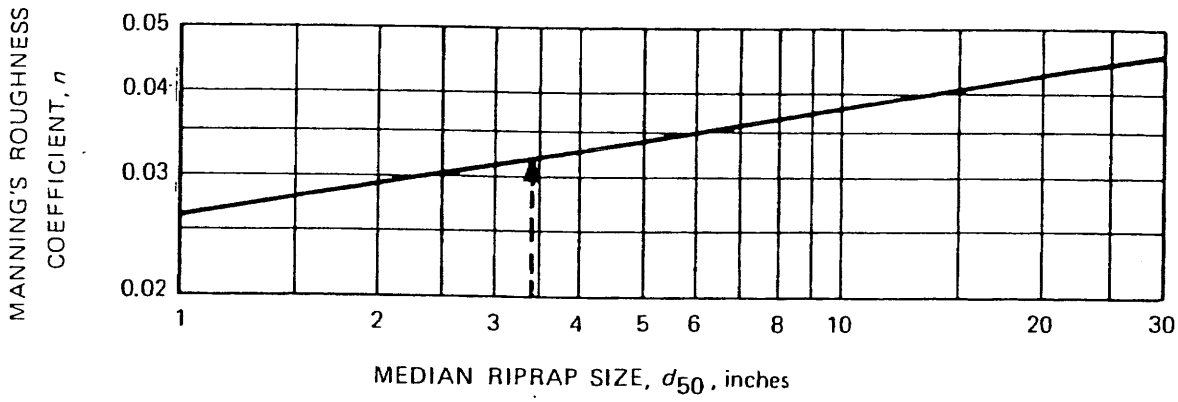
An effort has been made by CPMC to reduce or eliminate the potential for serious erosion at these locations by placing culvert exits onto existing or man-made rock rubble piles, or onto rock ledges which act as energy dissipation devices and effectively reduce downstream erosion. CPMC will continue to monitor culvert outfalls at these locations and thereby determine the efficiency of the rock rubble piles and what additional action, if any, should or can be taken.

Conditions related to lining of individual ditches are shown on Maps 731.720a through 731.720c. Conditions related to culvert outfall linings are shown on Maps 731.720d through 731.720f. Channel and Culvert riprap calculations are presented in Exhibit 742.312a, Riprap Calculations.

Culvert Design.

Following the determination of a given peak watershed discharge, design sizes for culverts were calculated as part of the runoff diversion and conveyance facilities. Flow capacity calculations were made

In the design of riprap-lined channels, National Cooperative Highway Research Program Report No. 108, "Tentative Design Procedure for Riprap-Lined Channels"[10] details the procedure for determining a design stone size such that the stone is stable under the design flow conditions with a reasonable factor of safety. The design stone size used is the d_{50}, or median stone diameter, defined as that stone size which is exceeded in weight by 50 percent of the mixture.



$n = 0.0395\,(d_{50})^{1/6}$

Figure I-17. Manning's n for riprap-lined channels.[1]

Erosive forces of flowing water are greater in bends than in straight channels. Therefore, riprap size for bends and straights in the channel must be computed. If the riprap size (d_{50}) computed for bends is less than 10 percent greater than the riprap size for straight channels, then the riprap size for straight channels shall be considered to be of adequate size; otherwise, the larger riprap size shall be used in the bend. This is done in order to minimize the number of riprap sizes required. No more than two riprap sizes should be used on any single contract, in order to minimize construction problems caused by too many sizes. The riprap size to be used in a bend shall extend upstream from the point of curvature, and downstream from the point of tangency a distance equal to five times the channel bottom width (length = 5 b). This riprap size shall extend across the bottom and up both sides of the channel.

Riprap

The riprap shall be composed of a well-graded mixture down to the 1-inch size particle, such that 50 percent of the mixture by weight shall be larger than the d_{50} size. A well-graded mixture is defined as a mixture composed primarily of the larger stone sizes but with a sufficient mixture of other sizes to fill the progressively-smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be considered to be 1.5 times the d_{50} size. The riprap size as shown on the plans and specifications or for other construction purposes shall be the size of the largest stone in the mixture, i.e., 1.5 x d_{50}. The minimum thickness of the riprap layer shall be 1.5 times the maximum stone diameter but not less than 6 inches. The riprap shall extend up the banks to a height equal to maximum depth of flow or to a point where vegetation can be established to adequately protect the channel.

Ref: "Erosion and Sediment Control Surface Mining in the Eastern U.S" EPA Technology Transfer Seminar Publication October 1976

In channels where there is no riprap or paving in the bottom, the toe of the bank riprap shall extend below the channel bottom a distance at least 1.5 times the maximum stone size, but in no case less than 1 foot. The only exception to this would be in the event that there is a non-erodible hard rock bottom. The channel bank shall not be steeper than 2.0 horizontal to 1.0 vertical.

After determining the riprap size that will be stable under the flow conditions, the designer shall consider that size to be a minimum size and then, based on riprap graduations actually available in the area, shall select the size or sizes that equal or exceed the minimum size. The possibility of damage by children shall be considered in selecting a riprap size, especially if there is nearby water to to toss the stones into.

Filter

A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap.

Riprap shall have a filter placed under it when either of the following conditions exist:

1. The riprap is not well graded down to the 1-inch size particle.

2. Riprap is placed on the side slopes of a channel and the soil is sand-size or finer with a plasticity index, *PI*, less than 10. This requirement applies to slopes having this soil in lenses or layers greater than 3 inches in thickness.

A filter can be of two general forms. One is a single layer of plastic filter cloth manufactured for that express purpose. The plastic filter cloth shall be woven of polypropylene monofilament yarns and shall be equivalent to "Poly-Filter X" as manufactured by Carthage Mills, Inc., Cincinnati, Ohio. Another is a properly graded layer of sand, gravel, or stone.

The criteria for the design of an aggregate filter are as follows:

$$\frac{d_{15}\ \text{Riprap}}{d_{85}\ \text{Filter}} \leqslant 5 \qquad \frac{d_{15}\ \text{Filter}}{d_{85}\ \text{Base}} \leqslant 5$$

in which d_{15} or d_{85} is the size of base, filter or riprap material. In these equations, 15 and 85 percent, respectively, are finer. The base is the soil layer underneath the filter. The filter shall be graded down to sand-size particles. Riprap 12 inches and larger shall not be dumped directly onto the plastic filter cloth, since it may tear or displace the filter cloth. Instead, a 4-inch-minimum thickness blanket of gravel shall be placed over the filter cloth or the riprap shall be placed directly on the filter cloth by hand or by the bucket of the equipment. Side slopes shall be 2:1 or flatter to prevent the gravel from sliding down the filter cloth before placing the riprap.

Soil Size Classification

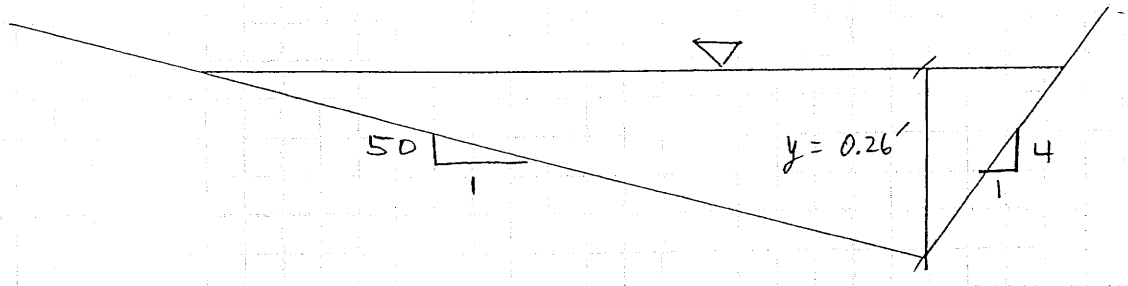
Soil sizes given herein are according to the Unified Soil Classification System as shown on the following page.

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Road / Ditch Design (VDD-1)
PROJECT NO 308.01.400

SHEET 1 OF 3
COMPUTED TDS
CHECKED
DATE 8-6-07

Road / Ditch design to contain 100 yr 6hr discharge of 9.4 cfs.



Road w/ these minimum dimensions will pass the 100yr 6hr event of 9.4 cfs.

Client	Carbon Resources	Sheet	
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (UDD-1)	Chck'd	
Project #	308.01.400	Date	06-Jul-07

Trapezoidal Channel Flow Calculations

GENERAL CRITERIA:

Design Flow:	9.40	cfs
Bottom Width:	0.0	feet
Side Slope1:	50.0	m1
Side Slope2:	4.0	m2
Friction Factor:		
Assumed D50:	0.1	

Anderson et al. (1970) If X=1, n=0.0395(D50)^1/6

Abt. et al. (1987, 1988) If X=2, n=0.0456(D50*S)^0.0159

If X=3, n={D50^1/6*(R/D50)^1/6}/{3.82*[2.25+5.23*LOG(R/D50)]}

Generally Applicable for R/D50 > 0.5

Jarrett (1984) If X=4, n=0.39*(S^0.38)*(R^0.16)

If X=5, n=input n value

X:	5	
Input n Value when X=5:		
Calc (used) n Value:	0.020	
Min. Bottom Slope:	0.07	ft/ft
Max. Bottom Slope:	0.07	ft/ft
Freeboard:	0.0	feet

Depth Check

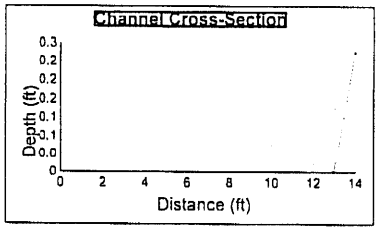
Depth (Min. Slope):	0.26	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.26	feet
Area:	1.81	ft2
Perimeter:	14.03	feet
Hydraulic Radius:	0.13	feet
Velocity:	5.18	ft/sec
Froude Number:	2.54	

Velocity Check

Depth (Max. Slope):	0.26	feet
Q-1.49AR(2/3)S(1/2)/n=	0.000	Accuracy
Required Depth:	0.26	feet
Area:	1.81	ft2
Perimeter:	14.03	feet
Hydraulic Radius:	0.13	feet
Velocity:	5.18	ft/sec
Froude Number:	2.54	

Channel Design Summary:

Bottom Width:	0.00	feet
Side Slope1:	50.00	1/m1
Side Slope2:	4.00	1/m2
Min. Bottom Slope:	0.074	ft/ft
Max. Bottom Slope:	0.074	ft/ft
Min. Channel Depth:	0.26	feet
Channel Top Width:	14.00	feet



Client	Carbon Resources	Sheet	of
Project	Kinney Mine Hydrology	Comp.	TDS
Feature	Ditch Design (UDD-1)	Chck'd	
Project #	308.01.400	Date	06-Aug-07

DESIGN CRITERIA:

Design Flow:	9.40		cfs
Bottom Width:	0.00		feet
Side Slope1:	50.00		1/m1
Side Slope2:	4.00		1/m2
Friction Factor:	0.02		
Min. Bottom Slope:	7.4	%	
Max. Bottom Slope:	7.4	%	
Flow Depth (Min. S):	0.26		feet
Flow Depth (Max. S):	0.26		feet
Angle Repose (Ar):	42.0		degrees
Specific Gravity	2.65		

Reynolds No. = U*D50/v, where U=Shear Velocity, v=viscosity

U=(gRS)^0.5 for Smin	0.56
Reynolds # for Smin	3,964
U=(gRS)^0.5 for Smax	0.56
Reynolds # for Smax	3,964

T = G*d*S where G=Unit weight of Water

Nb = F*T/(G(SD-1)D50)

F=(1/0.047)=21.3 for flat slopes with Reynolds No. < 500

F=(1/0.062)=16.1 for 500 < Reynolds No. < 40,000

F=varies from (1/0.062)=16.1 for Reynolds No. = 40,000 to (1/0.25)=4 for Reynolds No. = 500,000 or larger

K for S min (See K vs. R Chart)	0.062
K for S max (See K vs. R Chart)	0.062
F for S min	16.1
F for S max	16.1

SFb = (Cos a tan b)/(sin a + Nb tan b)

Tmax= Ks*G*d*S

Set Ks=0.75 for 1.5:1 slope, 0.76 for 2:1 slope, and 0.85 for 3:1 slope

Ks: 0.76

Ns = F*Tmax/(G(SG-1)D)

A = Atan(1/m)

B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))

Nsp = Ns(1+Sin(Ar+B)/2)

SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

RIPRAP DESIGN:

	Smin	Smax	
D50	0.10	0.10	feet
T	1.20	1.20	lb/ft2
Nb	1.87	1.87	
Tmax	0.91	0.91	lb/ft2
Ns	1.42	1.42	
m Critical	4.00	4.00	
A (m crit)	14.04	14.04	degrees
B	65.63	65.63	degrees
Nsp	1.38	1.38	
SFb	0.51	0.51	
SFs	0.65	0.65	

1/3

Area tributary
to UDD-1
(65.0 acres)
CN = 75

Q (100 yr 6 hr) = 9.4 cfs

↑ N

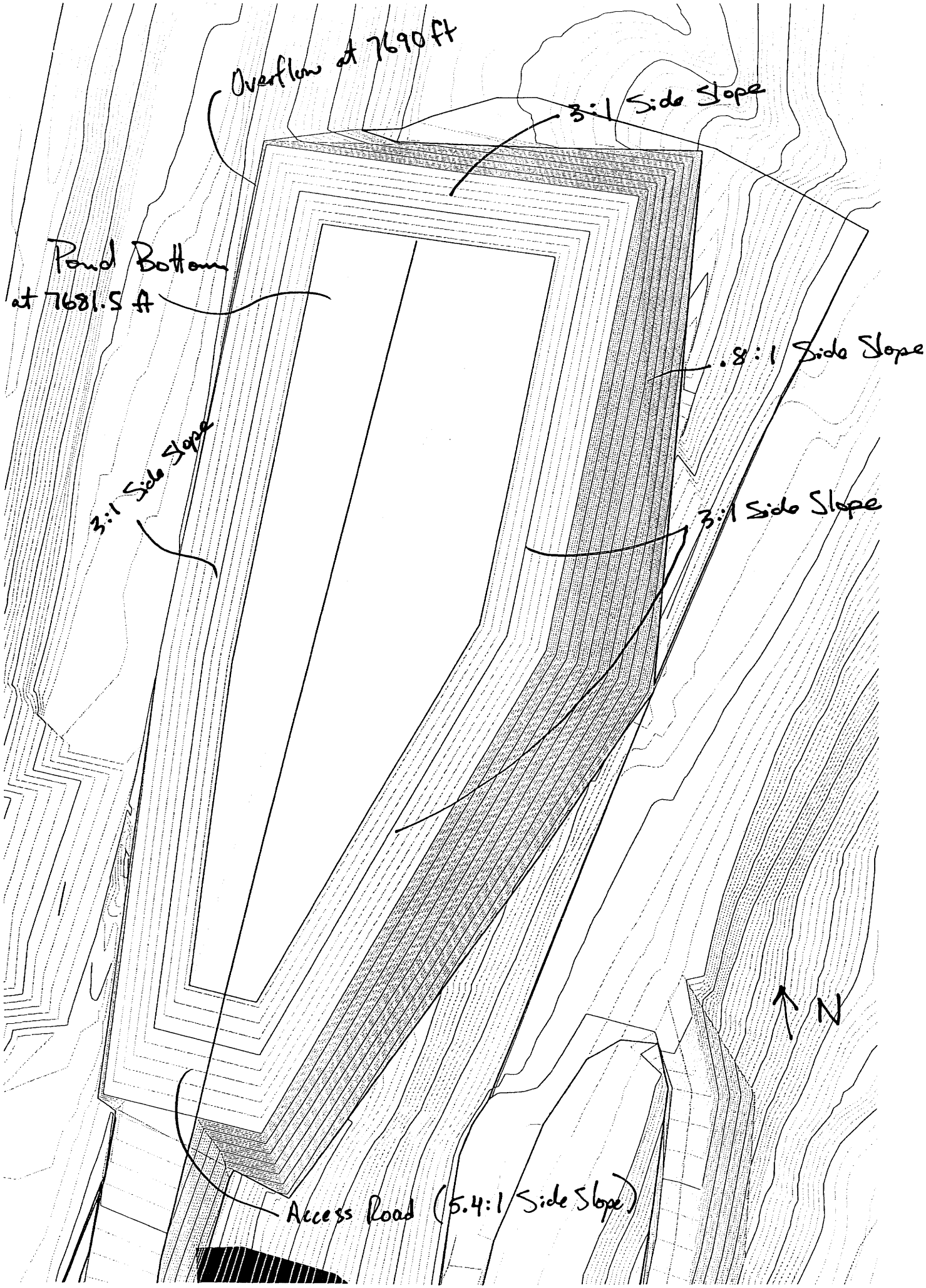
Sedimentation Pond 1

Storage Element	Volume (ac-ft)	Cumulative Volume (ac-ft)	Depth (ft)	Elevation (ft)
1. Pond Bottom	0.00	0.00	0.0	7681.5
2. 5.3yr Sediment	1.12	1.12	2.3	7683.8
(calculated a required 0.64 ac-ft but increased to 1.12 ac-ft)				
3. 10yr 24hr	2.06	3.18	5.4	7686.9
4. 100yr 6hr	1.67	4.85	7.5	7689.0
(A depth of 2.1 ft was calculated to pass the 100yr 6hr flow of 22.5 ft³/s through a 24-in diameter overflow pipe. Cumulative volume was taken from stage-volume spreadsheet)				
5. Freeboard	0.89	5.74	8.5	7690.0

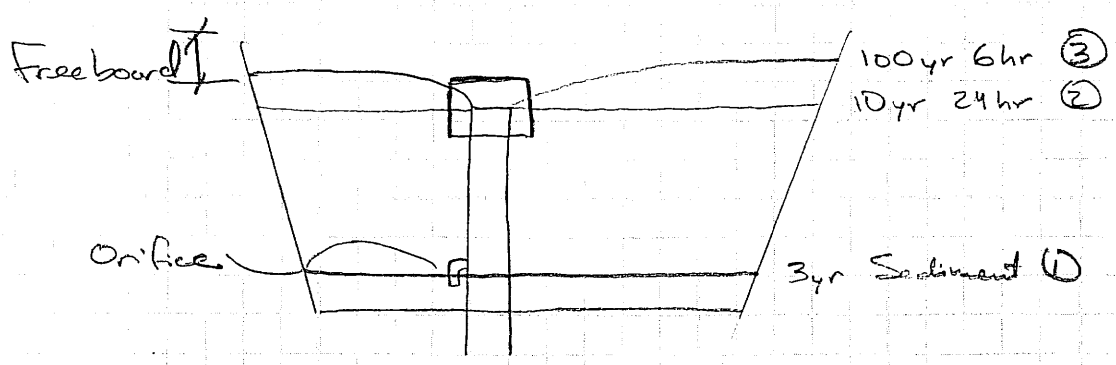
HANSEN ALLEN & LUCE inc ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Detail Volume
PROJECT NO. 308.01.400

SHEET ___ OF 7DS
COMPUTED ___
CHECKED ___
DATE 12/26/07


Overflow at 7690 ft
3:1 Side Slope
Pond Bottom
at 7681.5 ft
.8:1 Side Slope
3:1 Side Slope
3:1 Side Slope
N
Access Road (5.4:1 Side Slope)

Sediment / Detention Volumes



① 3yr Sediment Volume

$A = (R)(K)(LS)(C)(P)$ → Universal Soil Loss Equation (USLE)

where:

A = Soil loss (tons/acre/yr)
R = Rainfall factor (ft-tons/acre/hr)
K = Soil Erodibility Factor
LS = Topographic factor
C = Cover or cropping management factor
P = Erosion Control Practice factor

Values of R and K were determined from Clyde et al. (1978)

R = 22.0 tons/acre/yr ←

K = 0.28 tons/acre/yr/Unit of R ←

$$LS = \frac{(650 + 4505 + 65S^2)(L/72.6)^m}{10{,}000 + S^2}$$

where:

L = average overland flow length (ft)
S = Slope (%)
m = exponent dependent upon steepness of slope

$m = 0.3$ for $S < .5\%$, $m = 0.5$ for $0.51\% < S < 10\%$

$m = 0.6$ for $S > 10\%$

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CLIENT Carbon Resources
PROJECT Kinney Mine Hydrology
FEATURE Detention Volume
PROJECT NO 308.01.400

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L & S Calculations

Subbasin	L (ft)	S (%)
SB L 1.5	640	2.0
SB L 2	1840	9.5
SB L 3	830	20.7
SB Access A	560	9.3
SB L 1	840	0.9
SB Access B	520	2.8
SB L 5	1540	7.2
SB L 2.5	800	14.2
SB L .75	1250	4.2
SB Ditch B	1310	2.4
SB Ditch A	590	4.4
SB Pond	610	9.1
Average	944	7.2

$$LS = \frac{(650 + 450(7.2) + 65(7.2)^2)\left(944\text{ ft}/72.6\right)^{0.5}}{10{,}000 + (7.2)^2}$$

$$= 2.6$$

Values of C and P were determined from the U.S. Soil Conservation Service (1977)

C = 1.0 (for disturbed)

P = 1.0

$$A = (R)(K)(LS)(C)(P)$$

$$= (22.0 \text{ tons/acre/yr})(0.28 \text{ tons/acre/yr/Unit of R})(2.6)(1.0)(1.0)$$

$$= 16.0 \text{ tons/acre/yr}$$

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FEATURE Detention Volume
PROJECT NO 303.01.400

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Sediment density of 75 lb/ft^3 was used in conjunction with the USLE to determine volume of reservoir sediment storage required.

Pond is designed so that sediment will be removed when the sediment volume reaches 60% of accumulated sediment storage volume.

$$A(0.6) = 16.0 \text{ tons/acre/yr } (0.6)$$
$$= 9.6 \text{ tons/acre/yr}$$

$$\forall \text{ (ac-ft/ac/yr)} = \frac{A}{\gamma_{sediment}}$$

$$= \frac{(9.6 \text{ tons/acre/yr})\left(\frac{2000 \text{ lb}}{1 \text{ ton}}\right)}{75 \text{ lb/ft}^3 \left(\frac{43{,}560 \text{ ft}^3}{1 \text{ acre-ft}}\right)}$$

$$= 0.00588 \text{ acre-ft/acre/yr}$$

$$\forall (3 \text{ yrs}) = (0.00588 \text{ acre-ft/acre/yr})(3 \text{ yr})(36.3 \text{ ac})$$

$$= \underline{\underline{0.64 \text{ acre-ft}}}$$

(2) 10yr 24hr Volume was determined from spreadsheet calculations.

$$V_{10yr\text{-}24hr} = \underline{\underline{2.06 \text{ ac-ft}}}$$

- The orifice was sized to drain the 10yr 24hr runoff volume over a 24hr period. See spreadsheet

$$D_{orifice} = \underline{\underline{6.2 \text{ in}}}$$

(3) Volume in the detent basin required to pass the 100yr 6hr flow is based on the heigth required to pass the flow (22.5 ft^3/s). Volume of 1.67 ac-ft is required above 10yr 24hr volume. (Cumulative volume selected from stage-volume spreadsheet)

- h required above 10yr 24hr depth to pass the 100yr 6hr flow

$$Q_{100yr6hr} = 22.5 \text{ ft}^3/\text{s} \quad \text{(from HMS model)}$$

$$Q = C_d A \sqrt{2gh}$$

$$= C_d \left(\frac{\pi d^2}{4}\right) \sqrt{2gh}$$

$d = 24$ in
$C_d = 0.62$
$g = 32.2$ ft/s^2
$h = ?$

$$h = \frac{\left[\dfrac{Q}{C_d\left(\frac{\pi d^2}{4}\right)}\right]^2}{2g}$$

$$= \frac{\left[\dfrac{22.5 \text{ ft}^3/\text{s}}{0.62\left(\frac{\pi(2\text{ ft})^2}{4}\right)}\right]^2}{2(32.2 \text{ ft/s}^2)} = 2.1 \text{ ft}$$

Orifice Sizing to Drain 10-yr 24-hr Volume Over a 24 hour Period

V initial = 2.67 ac-ft (10-yr 24-hr + 3yr sediment volume)
116305 ft3

Orifice Design Parameters
D = 6.2 in
Cd = 0.62
Heigth to center of orifice above pond bottom = 1.60 ft (top of 3yr sediment volume + orifice diameter/2)

Time (min)	Time (hr)	Volume (ft3)	Depth (ft)	Q (ft3/s)	ΔVolume (ft3)
0	0.00	116305	4.7	1.84	1653
15	0.25	114652	4.6	1.81	1627
30	0.50	113025	4.6	1.81	1627
45	0.75	111399	4.5	1.78	1599
60	1.00	109799	4.5	1.78	1599
75	1.25	108200	4.4	1.75	1571
90	1.50	106629	4.4	1.75	1571
105	1.75	105057	4.3	1.71	1543
120	2.00	103514	4.2	1.68	1514
135	2.25	102000	4.2	1.68	1514
150	2.50	100486	4.1	1.65	1485
165	2.75	99001	4.1	1.65	1485
180	3.00	97516	4.0	1.62	1455
195	3.25	96061	4.0	1.62	1455
210	3.50	94606	3.9	1.58	1424
225	3.75	93182	3.9	1.58	1424
240	4.00	91757	3.8	1.55	1393
255	4.25	90364	3.8	1.55	1393
270	4.50	88971	3.7	1.51	1361
285	4.75	87610	3.7	1.51	1361
300	5.00	86249	3.6	1.48	1328
315	5.25	84921	3.6	1.48	1328
330	5.50	83593	3.5	1.44	1295
345	5.75	82298	3.5	1.44	1295
360	6.00	81003	3.4	1.40	1260
375	6.25	79743	3.4	1.40	1260
390	6.50	78483	3.4	1.40	1260
405	6.75	77223	3.3	1.36	1225
420	7.00	75998	3.3	1.36	1225
435	7.25	74773	3.2	1.32	1188
450	7.50	73585	3.2	1.32	1188
465	7.75	72397	3.1	1.28	1150
480	8.00	71247	3.1	1.28	1150
495	8.25	70096	3.0	1.24	1112
510	8.50	68985	3.0	1.24	1112
525	8.75	67873	3.0	1.24	1112
540	9.00	66762	2.9	1.19	1071
555	9.25	65690	2.9	1.19	1071
570	9.50	64619	2.8	1.14	1029
585	9.75	63590	2.8	1.14	1029
600	10.00	62561	2.7	1.09	985
615	10.25	61576	2.7	1.09	985
630	10.50	60590	2.7	1.09	985
645	10.75	59605	2.6	1.04	940
660	11.00	58665	2.6	1.04	940

Time (min)	Time (hr)	Volume (ft3)	Depth (ft)	Q (ft3/s)	ΔVolume (ft3)
675	11.25	57726	2.6	1.04	940
690	11.50	56786	2.5	0.99	891
705	11.75	55895	2.5	0.99	891
720	12.00	55003	2.4	0.93	841
735	12.25	54162	2.4	0.93	841
750	12.50	53322	2.4	0.93	841
765	12.75	52481	2.3	0.87	786
780	13.00	51695	2.3	0.87	786
795	13.25	50908	2.3	0.87	786
810	13.50	50122	2.2	0.81	728
825	13.75	49394	2.2	0.81	728
840	14.00	48666	2.2	0.81	728
855	14.25	47937	2.2	0.81	728
870	14.50	47209	2.1	0.74	665
885	14.75	46544	2.1	0.74	665
900	15.00	45879	2.1	0.74	665
915	15.25	45214	2.0	0.66	595
930	15.50	44619	2.0	0.66	595
945	15.75	44024	2.0	0.66	595
960	16.00	43429	2.0	0.66	595
975	16.25	42834	1.9	0.57	516
990	16.50	42319	1.9	0.57	516
1005	16.75	41803	1.9	0.57	516
1020	17.00	41287	1.9	0.57	516
1035	17.25	40772	1.9	0.57	516
1050	17.50	40256	1.8	0.47	422
1065	17.75	39834	1.8	0.47	422
1080	18.00	39413	1.8	0.47	422
1095	18.25	38991	1.8	0.47	422
1110	18.50	38570	1.8	0.47	422
1125	18.75	38148	1.7	0.33	299
1140	19.00	37849	1.7	0.33	299
1155	19.25	37549	1.7	0.33	299
1170	19.50	37250	1.7	0.33	299
1185	19.75	36951	1.7	0.33	299
1200	20.00	36651	1.7	0.33	299
1215	20.25	36352	1.7	0.33	299
1230	20.50	36053	1.7	0.33	299
1245	20.75	35753	1.6	0.04	38
1260	21.00	35715	1.6	0.04	38
1275	21.25	35677	1.6	0.04	38
1290	21.50	35638	1.6	0.04	38
1305	21.75	35600	1.6	0.04	38
1320	22.00	35562	1.6	0.04	38
1335	22.25	35523	1.6	0.04	38
1350	22.50	35485	1.6	0.04	38
1365	22.75	35447	1.6	0.04	38
1380	23.00	35408	1.6	0.04	38
1395	23.25	35370	1.6	0.04	38
1410	23.50	35332	1.6	0.04	38
1425	23.75	35293	1.6	0.04	38
1440	24.00	35255	1.6	0.04	38

Detention Basin Stage-Volume

Elevation (ft)	Area (ft2)	Volume (ft3)	Cum Volume (ft3)	Cum Volume (ac-ft)
7681.5	19356.6	0	0	0.00
7681.6	19561	1946	1946	0.04
7681.7	19765	1966	3912	0.09
7681.8	19970	1987	5899	0.14
7681.9	20174	2007	7906	0.18
7682.0	20379	2028	9934	0.23
7682.1	20596	2049	11982	0.28
7682.2	20813	2070	14053	0.32
7682.3	21030	2092	16145	0.37
7682.4	21248	2114	18259	0.42
7682.5	21465	2136	20395	0.47
7682.6	21682	2157	22552	0.52
7682.7	21900	2179	24731	0.57
7682.8	22117	2201	26932	0.62
7682.9	22334	2223	29154	0.67
7683.0	22551	2244	31399	0.72
7683.1	22778	2266	33665	0.77
7683.2	23004	2289	35954	0.83
7683.3	23230	2312	38266	0.88
7683.4	23457	2334	40600	0.93
7683.5	23683	2357	42957	0.99
7683.6	23909	2380	45337	1.04
7683.7	24135	2402	47739	1.10
7683.8	24362	2425	50164	1.15
7683.9	24588	2447	52612	1.21
7684.0	24814	2470	55082	1.26
7684.1	25050	2493	57575	1.32
7684.2	25285	2517	60092	1.38
7684.3	25520	2540	62632	1.44
7684.4	25756	2564	65196	1.50
7684.5	25991	2587	67783	1.56
7684.6	26227	2611	70394	1.62
7684.7	26462	2634	73028	1.68
7684.8	26697	2658	75686	1.74
7684.9	26933	2682	78368	1.80
7685.0	27168	2705	81073	1.86
7685.1	27412	2729	83802	1.92
7685.2	27657	2753	86555	1.99
7685.3	27901	2778	89333	2.05
7685.4	28146	2802	92136	2.12
7685.5	28390	2827	94962	2.18
7685.6	28634	2851	97814	2.25
7685.7	28879	2876	100689	2.31

Elevation (ft)	Area (ft2)	Volume (ft3)	Cum Volume (ft3)	Cum Volume (ac-ft)
7685.8	29123	2900	103589	2.38
7685.9	29367	2925	106514	2.45
7686.0	29612	2949	109463	2.51
7686.1	29865	2974	112437	2.58
7686.2	30119	2999	115436	2.65
7686.3	30372	3025	118460	2.72
7686.4	30626	3050	121510	2.79
7686.5	30879	3075	124586	2.86
7686.6	31133	3101	127686	2.93
7686.7	31386	3126	130812	3.00
7686.8	31639	3151	133963	3.08
7686.9	31893	3177	137140	3.15
7687.0	32146	3202	140342	3.22
7687.1	32409	3228	143570	3.30
7687.2	32671	3254	146824	3.37
7687.3	32934	3280	150104	3.45
7687.4	33196	3306	153410	3.52
7687.5	33459	3333	156743	3.60
7687.6	33721	3359	160102	3.68
7687.7	33983	3385	163487	3.75
7687.8	34246	3411	166899	3.83
7687.9	34508	3438	170337	3.91
7688.0	34771	3464	173800	3.99
7688.1	35042	3491	177291	4.07
7688.2	35314	3518	180809	4.15
7688.3	35585	3545	184354	4.23
7688.4	35857	3572	187926	4.31
7688.5	36129	3599	191525	4.40
7688.6	36400	3626	195152	4.48
7688.7	36672	3654	198805	4.56
7688.8	36943	3681	202486	4.65
7688.9	37215	3708	206194	4.73
7689.0	37486	3735	209929	4.82
7689.1	37767	3763	213692	4.91
7689.2	38047	3791	217482	4.99
7689.3	38328	3819	221301	5.08
7689.4	38609	3847	225148	5.17
7689.5	38889	3875	229023	5.26
7689.6	39170	3903	232926	5.35
7689.7	39450	3931	236857	5.44
7689.8	39731	3959	240816	5.53
7689.9	40011	3987	244803	5.62
7690.0	40292	4015	248818	5.71

SCS CURVE NUMBER
Kinney Mine Hydrology

SB_F1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	2288.29	0.05	0.00008	1.4	98	0.20	1.1	202.9	1.7	323.2	1.9	353.5
Pad	122526.6	2.81	0.00440	75.7	90	1.11	0.5	5267.5	1.0	10478.0	1.2	11869.8
Natural	21443.42	0.49	0.00077	13.2	75	3.33	0.1	170.3	0.3	612.0	0.4	752.0
Revegetated	15641.47	0.36	0.00056	9.7	82	2.20	0.2	303.6	0.6	777.7	0.7	915.0
TOTALS	161899.8	3.72	0.00581	100	87			5944.3		12190.9		13890.2
										0.28 ac-ft		0.32 ac-ft

SB_D1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	2165.29	0.05	0.00008	2.5	98	0.20	1.1	192.0	1.7	305.9	1.9	334.5
Pad	40914.9	0.94	0.00147	33.7	90	1.11	0.5	1758.9	1.0	3498.9	1.2	3963.6
Natural	67374.28	1.55	0.00242	55.5	75	3.33	0.1	535.2	0.3	1922.9	0.4	2362.7
Revegetated	10895.72	0.25	0.00039	9.0	82	2.20	0.2	211.5	0.6	541.7	0.7	637.4
TOTALS	121350.2	2.79	0.00435	101	81			2697.6		6269.3		7298.2
										0.14 ac-ft		0.17 ac-ft

SB_D2

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	2442.07	0.06	0.00009	2.8	98	0.20	1.1	216.5	1.7	345.0	1.9	377.2
Pad	12679.13	0.29	0.00045	14.8	90	1.11	0.5	545.1	1.0	1084.3	1.2	1228.3
Natural	59411.24	1.36	0.00213	69.1	75	3.33	0.1	471.9	0.3	1695.6	0.4	2083.5
Revegetated	11426.79	0.26	0.00041	13.3	82	2.20	0.2	221.8	0.6	568.1	0.7	668.4
TOTALS	85959.23	1.97	0.00308	100	79			1455.3		3693.0		4357.4
										0.08 ac-ft		0.10 ac-ft

SB_F2

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	10732.04	0.25	0.00038	19.4	98	0.20	1.1	951.5	1.7	1516.0	1.9	1657.8
Natural	0	0.00	0.00000	0.0	75	3.33	0.1	0.0	0.3	0.0	0.4	0.0
Revegetated	44561.29	1.02	0.00160	80.6	82	2.20	0.2	865.0	0.6	2215.6	0.7	2606.7
TOTALS	55293.33	1.27	0.00198	100	85			1816.6		3731.6		4264.5
										0.09 ac-ft		0.10 ac-ft

SB_E1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Pad	143106.9	3.29	0.00513	74.1	90	1.11	0.5	6152.2	1.0	12237.9	1.2	13863.5
Natural	9446.91	0.22	0.00034	4.9	75	3.33	0.1	75.0	0.3	269.6	0.4	331.3
Revegetated	40693.85	0.93	0.00146	21.1	82	2.20	0.2	789.9	0.6	2023.3	0.7	2380.5
TOTALS	193247.7	4.44	0.00693	100	88			7017.2		14530.8		16575.3
										0.33 ac-ft		0.38 ac-ft

SB_D3

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	11513.94	0.26	0.00041	19.7	98	0.20	1.1	1020.9	1.7	1626.4	1.9	1778.6
Natural	39630.22	0.91	0.00142	20.5	75	3.33	0.1	314.8	0.3	1131.0	0.4	1389.8
Revegetated	7211.62	0.17	0.00026	12.4	82	2.20	0.2	140.0	0.6	358.6	0.7	421.9
TOTALS	58355.78	1.34	0.00209	53	80			1475.6		3116.0		3590.2
										0.07 ac-ft		0.08 ac-ft

SB_A1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	19147.5	0.44	0.00069	32.8	98	0.20	1.1	1697.7	1.7	2704.7	1.9	2957.8
Natural	63174.77	1.45	0.00227	32.7	75	3.33	0.1	501.8	0.3	1803.0	0.4	2215.5
Pad	42016.47	0.96	0.00151	21.7	90	1.11	0.5	1806.3	1.0	3593.1	1.2	4070.4
Revegetated	54006.16	1.24	0.00194	30.3	82	2.20	0.2	1048.4	0.6	2685.2	0.7	3159.2
TOTALS	178344.9	4.09	0.00640	118	83			5054.1		10786.0		12402.8
										0.25 ac-ft		0.28 ac-ft

SB_B1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Pad	91371.01	2.10	0.00328	47.3	90	1.11	0.5	3928.1	1.0	7813.7	1.2	8851.6
Natural	26384.94	0.61	0.00095	13.7	75	3.33	0.1	209.6	0.3	753.0	0.4	925.3
Revegetated	34907.15	0.80	0.00125	22.9	82	2.20	0.2	677.6	0.6	1735.6	0.7	2042.0
TOTALS	152663.1	3.50	0.00548	84	86			677.6		1735.6		2042.0
										0.04 ac-ft		0.05 ac-ft

SB_C1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	0	0.00	0.00000	0.0	98	0.20	1.1	0.0	1.7	0.0	1.9	0.0
Pad	91265.3	2.10	0.00327	136.8	90	1.11	0.5	3923.5	1.0	7804.6	1.2	8841.3
Natural	52325.33	1.20	0.00188	27.1	75	3.33	0.1	415.6	0.3	1493.4	0.4	1835.0
Revegetated	38502.3	0.88	0.00138	21.1	82	2.20	0.2	747.4	0.6	1914.3	0.7	2252.3
TOTALS	182092.9	4.18	0.00653	185	84			5086.5		11212.3		12928.6
										0.26 ac-ft		0.30 ac-ft

SB_E2

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Roads	13703.95	0.31	0.00049	7.5	98	0.20	1.1	1215.0	1.7	1935.8	1.9	2116.9
Pad	0	0.00	0.00000	0.0	90	1.11	0.5	0.0	1.0	0.0	1.2	0.0
Natural	26904.93	0.62	0.00097	13.9	75	3.33	0.1	213.7	0.3	767.9	0.4	943.5
Revegetated	32464.12	0.75	0.00116	17.8	82	2.20	0.2	630.2	0.6	1614.1	0.7	1899.1
TOTALS	73073	1.68	0.00262	39	82			2058.9		4317.8		4959.5
										0.10 ac-ft		0.11 ac-ft

SB_E4

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Natural	50993.98	1.17	0.00183	76.5	75	3.33	0.1	405.0	0.3	1455.4	0.4	1788.3
Revegetated	15708.03	0.36	0.00056	23.5	82	2.20	0.2	304.9	0.6	781.0	0.7	918.9
TOTALS	66702.01	1.53	0.00239	100	77			710.0		2236.4		2707.2
										0.05 ac-ft		0.06 ac-ft

SB_E3

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Revegetated	23139.08	0.53	0.00083	34.7	82	2.20	0.2	449.2	0.6	1150.5	0.7	1353.6
TOTALS	23139.08	0.53	0.00083	35	82			449.2		1150.5		1353.6
										0.03 ac-ft		0.03 ac-ft

SB_Pond1

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	Vol (cf)
Detention Pond	19356.6	0.44	0.00069	20.6	100	0.00	1.3	2064.7	1.9	3097.1	2.1	3355.1
Revegetated	46571.36	1.07	0.00167	69.8	82	2.20	0.2	904.0	0.6	2315.5	0.7	2724.3
Natural	28145.53	0.65	0.00101	29.9	75	3.33	0.1	223.6	0.3	803.3	0.4	987.0
TOTALS	94073.49	2.16	0.00337	120	84			3192.3		6215.8		7066.5
										0.14 ac-ft		0.16 ac-ft

SB_AltA

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Revegetated	111806.6	2.57	0.00401	167.6	82	2.20	0.2	2170.4	0.6	5559.0	0.7	6540.3
TOTALS	111806.6	2.57	0.00401	168	82			2170.4		5559.0		6540.3
										0.13 ac-ft		0.15 ac-ft

SB_AltB

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	4030.63	0.09	0.00014	2.2	98	0.20	1.1	357.4	1.7	569.4	1.9	622.6
Revegetated	21513.94	0.49	0.00077	32.3	82	2.20	0.2	417.6	0.6	1069.7	0.7	1258.5
TOTALS	25544.57	0.59	0.00092	34	85			775.0		1639.0		1881.1
										0.04 ac-ft		0.04 ac-ft

SB_AltC

Subbasin Area	AREA (ft2)	AREA (acres)	AREA (mi2)	% AREA (%)	CN	S	10-YR 6-HR Rainfall (in) 1.28 Runoff (cfs)	10-YR 6-HR Vol (cf)	10-yr 24-HR Rainfall (in) 1.92 Runoff (cfs)	10-yr 24-HR Vol (cf)	100-YR 6-HR Rainfall (in) 2.08 Runoff (cfs)	100-YR 6-HR Vol (cf)
Roads	3773.2	0.09	0.00014	2.1	98	0.20	1.1	334.5	1.7	533.0	1.9	582.9
Revegetated	15615.05	0.36	0.00056	23.4	82	2.20	0.2	303.1	0.6	776.4	0.7	913.4
TOTALS	19388.25	0.45	0.00070	25	85			637.7		1309.4		1496.3
										0.03 ac-ft		0.03 ac-ft

Overall Totals	1602934	36.80	0.0575		84

Total Approximate Storage Volumes = 2.06 ac-ft 2.37 ac-ft

Pond No.	Available Sediment Storage Volume (acre-feet)	Required 3-year Accumulated Sediment Storage Volume (acre-feet)	Available Runoff Storage Volume (acre-feet)	Required 10-yr, 24-hr Runoff Storage Volume (acre-feet)	Comments and Recommendations
7	0.04	0.04	0.63	0.58	Pond Adequate
8	1.1	1.1	2.77	2.20	Pond Adequate
9	2.02	1.98	4.50	4.45	Pond Adequate

Note: Pond No. 1 is classified as a treatment facility and not a sedimentation pond.

The sediment ponds and treatment facility were designed (where possible) to contain the accumulated sediment volume from a three-year period and to prevent short circuiting. The amount of sediment to be yielded to the sedimentation ponds was determined from the Universal Soil Loss Equation (USLE) (Clyde et al., 1978, and U. S. Soil Conservation Service, 1977). In accordance with this equation, soil erosion caused by water is determined from

$$A = R*K*LS*C*P \qquad (742\text{-}2)$$

where:

A = computed amount of soil loss, in tons/acre/year;
R = rainfall factor, in foot-tons/acre/hour;
K = soil erodibility factor, in tons/acre/year/unit of R;
LS = topographic factor (length and steepness of slope), dimensionless;
C = cover or cropping management factor, dimensionless; and
P = erosion control practice factor, dimensionless.

Values for R and K were determined from Clyde et al. (1978). The topographic factor (LS) was determined from

$$LS = \frac{(650 + 450\,S + 65\,S^2)\,(L/72.6)^m}{10,000 + S^2} \qquad (742\text{-}3)$$

where:

L = average overland flow length, in feet;
S = average steepness of slope, in percent; and
m = an exponent dependent upon the steepness of slope (0.3 for slopes less than 0.5%, 0.5 for slopes 0.51% to 10%, and 0.6 for slopes greater than 10%).

The average overland flow length (L) was determined from Williams and Berndt (1972) as defined by the equation

$$L = \frac{0.5\ DA}{LCH} \qquad (742\text{-}4)$$

where:

DA = drainage area, in square feet; and
LCH = total length of channels in the watershed, in feet.

Values for C and P were determined from the U. S. Soil Conservation Service (1977).

A sediment density of 75 lb/ft^3 was used in conjunction with the USLE to determine the volume of reservoir sediment storage required. This value was obtained based upon on-site soil surveys (see Section 200 for more soils related information) which show that local soils consist mostly of a mixture of silty clayey sands. Sands commonly have unit weights in the order of 85-100 pcf based upon ASCE findings (see Sedimentation Engineering - ASCE M & R No. 54) with values more commonly used in the order of 95 pcf. Other references confirm this and indicate that silts and clays usually have lower unit weights, but at times do range from 27 to 100 pcf. Because local soil complexes do contain substantial quantities of silts and clays, a more conservative sediment density of 75 pcf was chosen as the appropriate value to use for calculation of sediment volume.

The ponds have been designed so that sediment will be removed when the sediment volume reaches 60 percent of the accumulated sediment storage volume. All sediments will be disposed of in the washed coal refuse pile. Sediment yield parameters and the accumulated sediment volume for each pond (including Treatment Facility No. 1) are contained in Table 742.221b, Sediment Design Parameters for Sediment Ponds 1 through 9.

TABLE 742.221b
Sediment Design Parameters for Sediment Ponds 1 through 9.

Sedimentation Pond No.	Contributing Area D-Disturbed U-Undisturbed	Rainfall Factor (R) ft-tons/ac/hr	Soil Erodibility Factor (K) tons/ac/yr per unit of R	Slope Length Factor L ft.	Slope Gradient Factor S percent	LS	Cover Factor	Erosion Control Practice Factor (P)	Estimated Soil Loss (A) ton/ac/yr	Sediment Delivery Ratio	Estimated Sediment Contribution in Sedimentation Ponds: ac-ft/ac/yr	ac-ft/yr	Accumulated Sediment Volume ac-ft: 3-year	2-year
1	D-5.1 U-9.5	22.0 22.0	0.28 0.28	82 105	3.0 70.0	0.28 29.4	1.0 0.2	1.0 1.0	1.7 36.2	0.65 0.60	0.0007 0.0133	0.004 0.126	0.39	0.26
2	D-9.1 U-6.0	22.0 22.0	0.28 0.28	200 220	34.0 39.0	11.9 19.8	1.0 0.2	1.0 1.0	73.3 24.4	0.60 0.56	0.0269 0.0084	0.245 0.050	0.89	0.59
3	D-5.0 U-52.1	22.0 22.0	0.28 0.28	63 140	2.0 65.0	0.17 31.7	1.0 0.2	1.0 1.0	1.0 39.0	0.60 0.45	0.0004 0.0107	0.002 0.557	1.68	1.11
4	D-23.0 U-17.6	22.0 22.0	0.28 0.28	160 84	12.8 45.0	2.7 13.8	1.0 0.2	1.0 1.0	16.6 17.0	0.52 0.60	0.0053 0.0062	0.122 0.109	0.69	0.46
5	D-65.6 U-29.4	22.0 22.0	0.28 0.28	205 118	16.0 54.0	4.5 22.2	1.0 0.2	1.0 1.0	27.7 27.4	0.45 0.50	0.0076 0.0084	0.499 0.247	2.24	1.49
6	D-27.5 U-6.5	22.0 22.0	0.28 0.28	99 99	10.0 43.5	1.4 14.5	1.0 0.2	1.0 1.0	8.6 17.9	0.50 0.65	0.0026 0.0071	0.072 0.046	0.35	0.24

Energy Dissipation Structures

Design of rip-rap apron for outlets of ICP-2 and UDC-1 using Drainage Criteria Manual (V.2)

	Pipe Size (in)	Design Flow (cfs)	
CP-2	42	33.8	
UDC-1	30	14.3 + 1 cfs = 15.3 cfs	(Assumed minimal irrigation pipe)

Design of rip-rap apron completed for both throughout.

$$Q_{full} = \frac{1.49}{n} A_{full} (R_{full})^{2/3} (S_o)^{1/2}$$

$n = 0.024$ (Ref: Civil Engineering Reference Manual, 2006)

$$A_{full} = \frac{\pi D^2}{4}$$

$$= \frac{\pi \left(\frac{42\,in}{12\,in}\right)^2}{4} = 9.6211\ ft^2 \quad (4.9087\ ft^2)$$

$$R_{full} = \frac{D}{4} = \frac{\left(\frac{42\,in}{12\,in}\right)}{4} = 0.875\ ft \quad (0.625\ ft)$$

$$S_o = \frac{(7667.61\ ft - 7655.45\ ft)}{74.1\ ft} = 0.1641\ ft/ft \quad (0.0761\ ft/ft)$$

$$Q_{full} = \frac{1.49}{0.024} (9.6211\ ft^2)(0.875\ ft)^{2/3} (0.1641\ ft/ft)^{1/2}$$

$$= 221.357\ ft^3/s \quad (61.455\ ft^3/s)$$

$$V_{full} = \frac{Q_{full}}{A_{full}} = \frac{221.357\ ft^3/s}{9.6211\ ft^2} = 23.01\ ft/s \quad (12.52\ ft/s)$$

Q_{design} (see culvert design calcs) = 33.8 ft^3/s

(15.3 ft^3/s)

$$\frac{Q_{design}}{Q_{full}} = \frac{33.8\ ft^3/s}{221.357\ ft^3/s} = 0.153$$

(0.249)

Using Figure HS-18b $\frac{d}{D} = 0.30$

(0.38)

Using Figure HS-19 $\frac{d}{D} = 0.42$

(0.435)

$$\frac{Q_{design}}{D^{2.5}} = \frac{33.8\ ft^3/s}{(3.5\ ft)^{2.5}} = 1.47 \quad (1.55)$$

Using Figure HS-18b: $\frac{A}{A_{full}} = 0.25$ (0.35)

$$A = \left(\frac{A}{A_{full}}\right) A_{full}$$

$$= (0.25)(9.6211\ ft^2) = 2.4053\ ft^2$$

(1.7180 ft^2)

$$V_{design} = \frac{Q_{design}}{A}$$

$$= \frac{33.8\ ft^3/s}{2.4053\ ft^2} = 14.05\ ft/s$$

(8.91 ft/s)

$$P_d = (V^2 + gd)^{1/2} \quad (HS-16)$$

$V = 14.05$ ft/s (8.91 ft/s)
$g = 32.2$ ft/s^2
$d = 1.05$ ft (0.95)

$$\frac{d}{D} = 0.3 \quad (0.38)$$

$$d = 0.3\,(3.5\ ft) = 1.05\ ft \quad (0.95)$$

$$P_d = \left[(14.05\ ft/s)^2 + (32.2\ ft/s^2)(1.05\ ft) \right]^{1/2}$$

$$= 15.21\ ft/s$$

$$(10.49\ ft/s)$$

* Based on the 42-inch pipe and a P_d of 15.21 ft/s, rip-rap type L should be used.

$\rightarrow D_{50} =$ 9 inches (0.75 ft)

* Based on the 30-inch pipe and a P_d of 10.49 ft/s, rip-rap type L should be used.

$\rightarrow D_{50} =$ 9 inches (0.75 ft)

$$T = 1.75\,(D_{50})$$

$$= 1.75\,(0.75\ ft) = 1.31\ ft\ (1.31\ ft)$$

$$L = 4\,D$$

$$= 4\,(3.5\ ft) = 14\ ft\ (10\ ft)$$

$$L = (D)^{1/2}\left(\frac{V}{2}\right)$$

$$= (3.5\ ft)^{1/2}\left(\frac{14.05\ ft/s}{2}\right) = 8.90\ ft\ (7.04\ ft)$$

$$L = 14\ ft\ (10\ ft)$$

$$W = 4\,D$$

$$= 4\,(3.5\ ft) = 14\ ft\ (10\ ft)$$

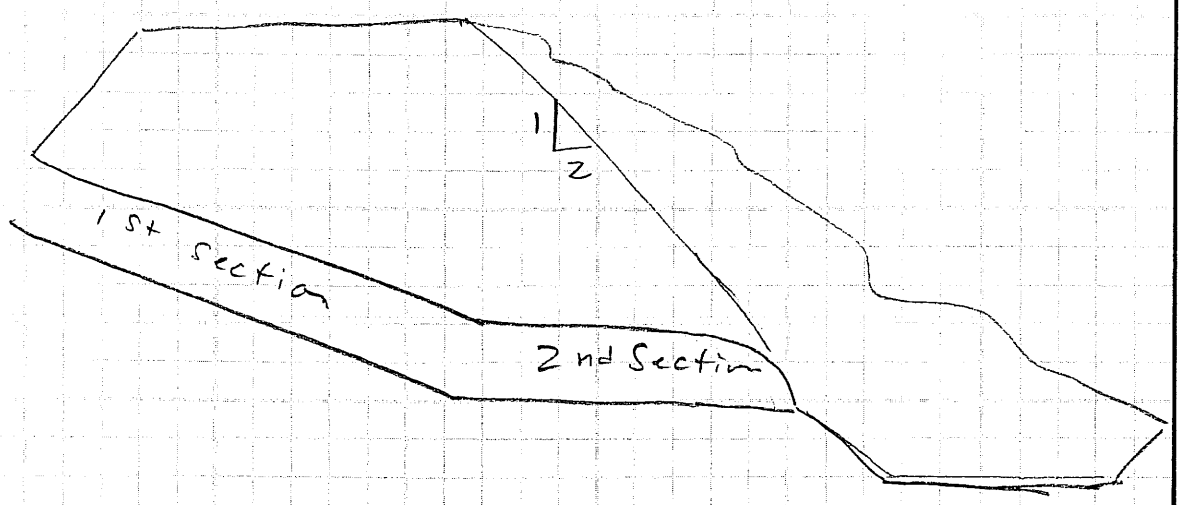
HANSEN ALLEN & LUCE INC
ENGINEERS

CLIENT Carbon Resources
PROJECT Kinney Mine
FEATURE Rip-rap apron design
PROJECT NO 368.01.400

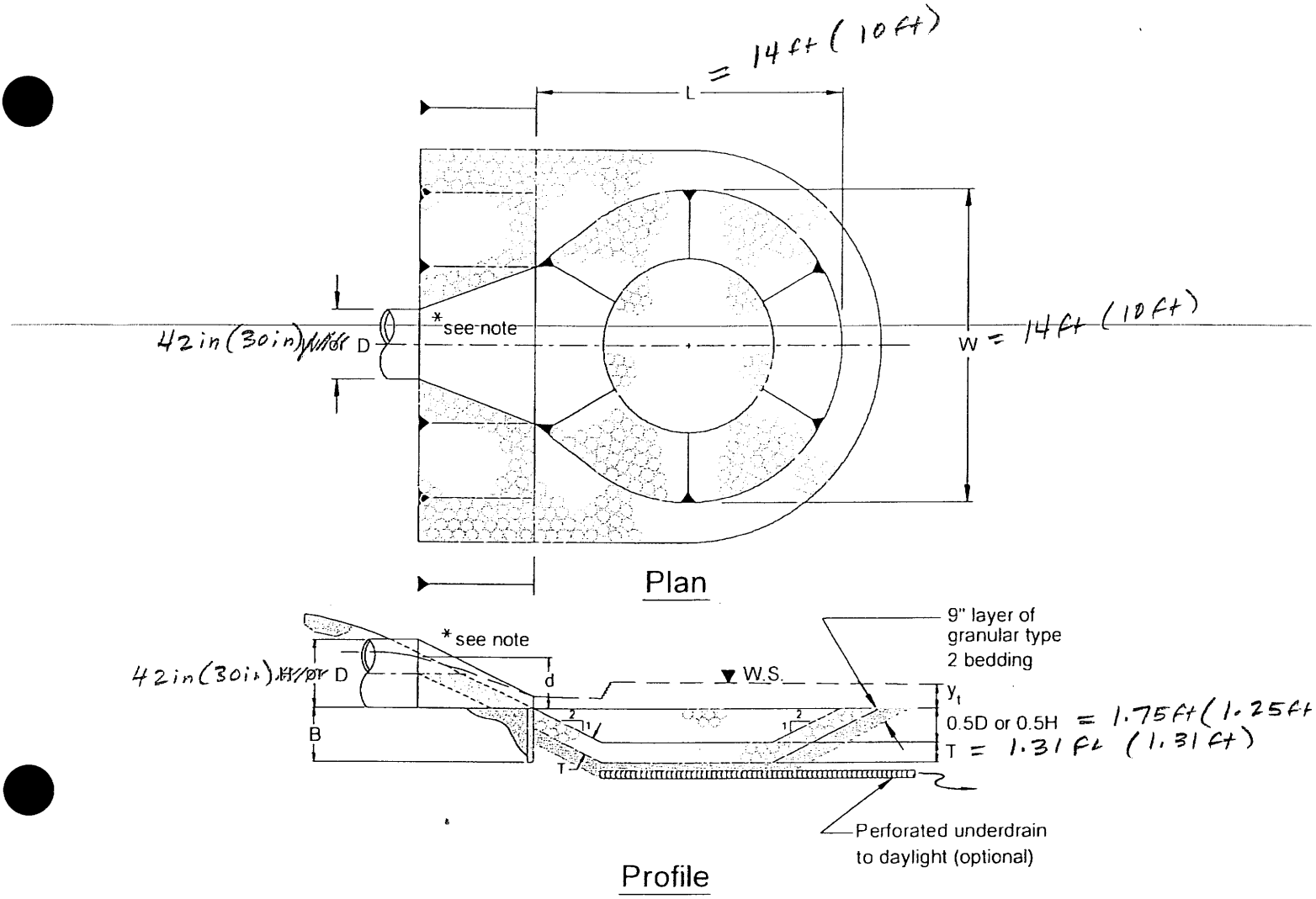
SHEET 4 OF 1
COMPUTED TDS
CHECKED
DATE 1-23-08

- Refer to page HS-76 for typical rip-rap apron outlet.

- In order to maintain the flat bottom for the rip-rap apron, a change in grade of the outlet pipes may require a deflection when going under the highway (see drawing). The second section of pipe should be installed with a slope of 0.16 ft/ft (CP-2) and 0.08 ft/ft (UDC-1) or less.



SPECIAL NOTE:
ENERGY DISSIPATION POOL WILL BE COORDINATED WITH UDOT. IF INSUFFICIENT ROW CAN BE UTILIZED FOR CONSTRUCTION, AN ALTERNATIVE WILL BE WORKED OUT WHEREIN A CONCRETE ENERGY DISSIPATION DEVICE CAN BE USED TO MINIMIZE REQUIRED AREA.

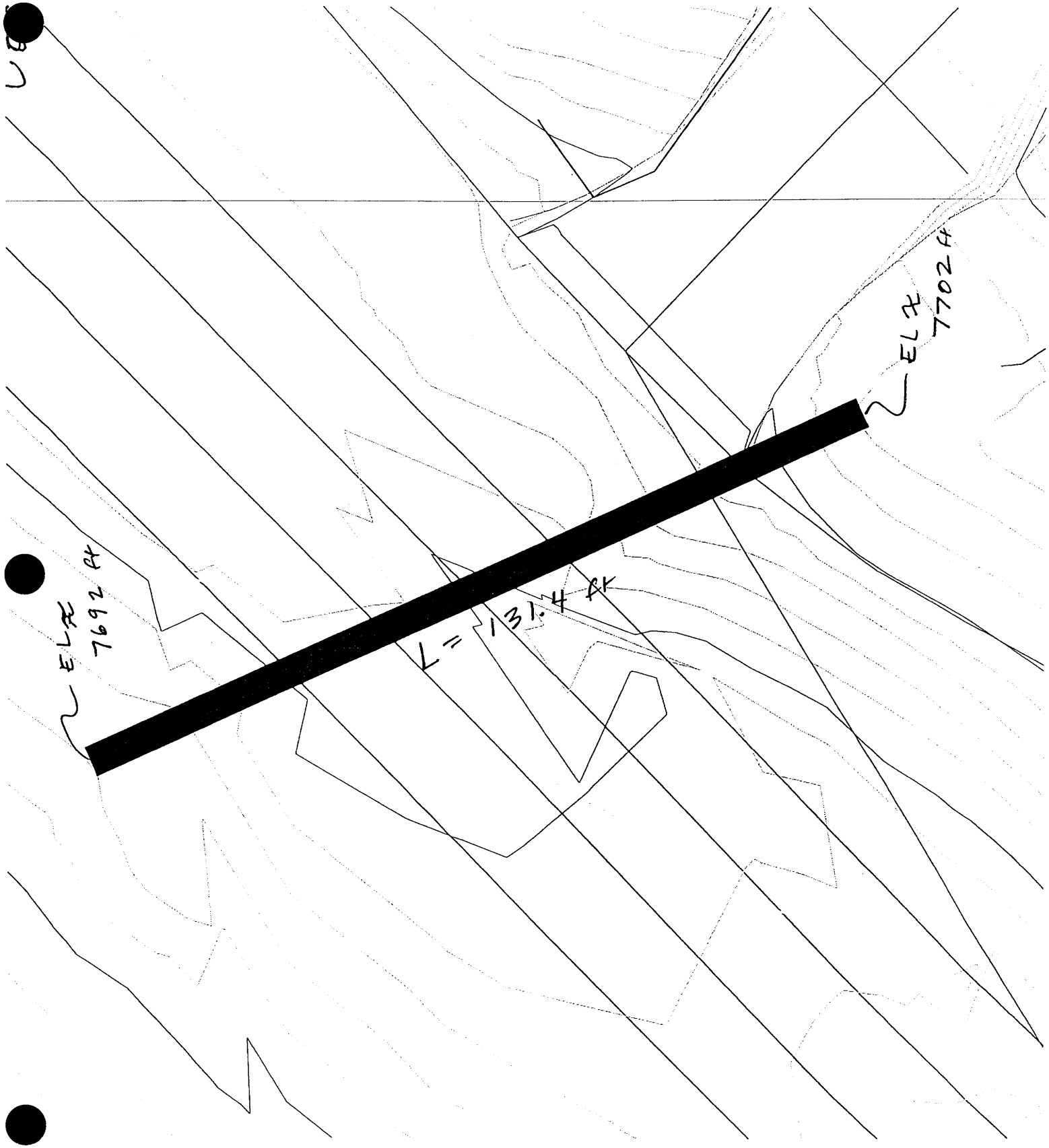


*Note: For rectangular conduits use a standard design for a headwall with wingwalls, paved bottom between the wingwalls, with an end cutoff wall extending to a minimum depth equal to B

Figure HS-18A—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—

Low Tailwater Basin at Pipe Outlets

(Stevens and Urbonas 1996)


N
EL ≈ 7702 ft
EL ≈ 7692 ft
L = 131.4 ft

CP-

386
7658.38
TOP 36IN CMP
FL ≈ 7655.45 ft
L = 74.1 ft
390
7667.61
FL
389
7670.54
TOP 36IN CMP

N

APPENDIX 17.F
Corrugated Metal Pipe

Corrugated metal pipe (CMP, also known as *corrugated steel pipe*) is frequently used for culverts. Pipe is made from corrugated sheets of galvanized steel that are rolled and riveted together along a longitudinal seam. Aluminized steel may also be used in certain ranges of soil pH. Standard round pipe diameters range from 8 to 96 in (200 to 2450 mm). Metric dimensions of standard diameters are usually rounded to the nearest 25 or 50 mm (e.g., a 42 in culvert would be specified as a 1050 mm culvert, not 1067 mm).

Larger and noncircular culverts can be created out of curved steel plate. Standard section lengths are 10 to 20 ft (3 to 6 m). Though most corrugations are transverse (i.e., annular), helical corrugations are also used. Metal gages of 8, 10, 12, 14, and 16 are commonly used, depending on the depth of burial.

The most common corrugated steel pipe has transverse corrugations that are ½ in (13 mm) deep and 2⅔ in (68 mm) from crest to crest. These are referred to as "2½ inch" or "68 × 13" corrugations. For larger culverts, corrugations with a 2 in (25 mm) depth and 3, 5, and 6 in (76, 125, or 152 mm) pitches are used. Plate-based products using 6 in by 2 in (152 mm by 51 mm) corrugations are known as *structural plate corrugated steel pipe* (SPCSP) and *multiplate* after the trade-named product "Multi-Plate™."

The flow area for circular culverts is based on the nominal culvert diameter, regardless of the gage of the plate metal used to construct the pipe. Flow area is calculated to (at most) three significant digits.

A Hazen-Williams coefficient, C, of 60 is typically used with all sizes of corrugated pipe. Values of C and Manning's constant, n, for corrugated pipe are generally not affected by age. *Design Charts for Open Channel Flow* (U.S. Department of Transportation, 1979) recommends a Manning constant of $n = 0.024$ for all cases. The U.S. Department of the Interior recommends the following values. For standard (2⅔ in by ½ in or 68 mm by 13 mm) corrugated pipe with the diameters given: 12 in (457 mm), 0.027; 24 in (610 mm), 0.025; 36 to 48 in (914 to 1219 mm), 0.024; 60 to 84 in (1524 to 2134 mm), 0.023; 96 in (2438 mm), 0.022. For (6 in by 2 in or 152 mm by 51 mm) multiplate construction with the diameters given: 5 to 6 ft (1.5 to 1.8 m), 0.034; 7 to 8 ft (2.1 to 2.4 m), 0.33; 9 to 11 ft (2.7 to 3.3 m), 0.32; 12 to 13 ft (3.6 to 3.9 m), 0.31; 14 to 15 (4.2 to 4.5 m), 0.030; 16 to 18 ft (4.8 to 5.4 m), 0.029; 19 to 20 ft (5.8 to 6.0 m), 0.028; 21 to 22 ft (6.3 to 6.6 m), 0.027.

If the inside of the corrugated pipe has been asphalted completely smooth 360° circumferentially, Manning's n ranges from 0.009 to 0.011. For culverts with 40% asphalted inverts, $n = 0.019$. For other percentages of paved invert, the resulting value is proportional to the percentage and the values normally corresponding to that diameter pipe. For field-bolted corrugated metal pipe arches, $n = 0.025$.

It is also possible to calculate the Darcy friction loss if the corrugation depth, 0.5 in (13 mm) for standard corrugations and 2.0 in (51 mm) for multiplate, is taken as the specific roughness.

Ref: Civil Engineering Reference Manual, 2006

Support Material

accumulation at the upstream row of baffles.

Flow entering the chute should be well distributed laterally across the width of the chute. The velocity should be below critical velocity at the crest of the chute. To insure low velocities at the upstream end of the chute, it may be necessary to provide a short energy dissipating pool. The sequent or conjugate depth in the approach basin should be maintained to prevent jump sweep-out, but the basin length may be considerably less than a conventional hydraulic jump basin since the primary purpose of this pool is only to reduce the average entrance velocity. A basin length of twice the sequent depth will usually provide ample basin length. The end check of the pool may be used as the crest of the chute as shown in Figure HS-17.

3.4 Low Tailwater Basins

3.4.1 General

The design of low tailwater riprap basins for storm sewer pipe outlets and some culverts is necessary when the receiving channel may have little or no flow and uncontrolled pipe velocities would create erosional problems in the channel. Design criteria are provided in Figures HS-18a through HS-20.

3.4.2 Objective

By providing a low tailwater basin at the end of a storm sewer conduit or culvert, the kinetic energy of the discharge is dissipated under controlled conditions without causing scour at the channel bottom. Photograph HS-12 shows a representative low tailwater basin.

3.4.3 Low Tailwater Basin Design

For storm sewers, low tailwater is defined as being equal to or less than ⅓ of the storm sewer height, that is:

$$y_t \leq \frac{D}{3} \quad \text{or} \quad y_t \leq \frac{H}{3}$$

in which:

y_t = tailwater depth at design

D = diameter of circular pipe (ft)

H = height of rectangular pipe (ft)

3.4.3.1 Finding Flow Depth and Velocity of Storm Sewer Pipe Outlets

The first step in the design of a scour protection basin at the outlet of a storm sewer is to find the depth and velocity of flow at the outlet. Pipe-full flow can be found using Manning's equation and the pipe-full velocity can be found using the well-known and standard continuity equation. Namely,

$$Q_{full} = \frac{1.49}{n} A_{full} \left(R_{full}\right)^{2/3} S_o^{1/2}$$

in which:

Q_{full} = pipe full discharge at its slope (cfs)

n = Manning's n for the pipe full depth

A_{full} = cross-sectional area of the pipe (ft^2)

S_o = longitudinal slope of the pipe (ft/ft)

R = hydraulic radius of the pipe flowing full, ft [$R_{full} = D/4$ for circular pipes, $R_{full} = A_{full}/(2H + 2w)$ for rectangular pipes, where D = diameter of a circular conduit, H = height of a rectangular conduit, and w = width of a rectangular conduit (ft)]

Then,

$$V_{full} = Q_{full} / A_{full}$$

In which:

V_{full} = flow velocity of the pipe flowing full (ft/sec)

The normal depth of flow, d, and the velocity at that depth in a conduit can be found with the aid of Figure HS-18b. Using the known design discharge, Q, and the calculated pipe-full discharge, Q_{full}, enter Figure HS-18b with the value of Q/Q_{full} and find d/D for a circular pipe of d/H for a rectangular pipe.

Compare the value of this d/D (or d/H) with that obtained from Figure HS-19 using the Froude parameter, namely,

$$Q/D^{2.5} \quad \text{or} \quad Q/\left(wH^{1/5}\right)$$

Choose the smaller of the two (d/D or d/H) ratios to calculate the flow depth at the end of the pipe, namely,

$$d = D(d/D) \quad \text{or} \quad d = H(d/H)$$

Again, enter Figure HS-18b using the smaller d/D (or d/H) ratio to find the A/A_{full} ratio. Use this to calculate the area of flow at the end of the pipe, namely,

$$A = \left(A/A_{full}\right)A_{full}$$

in which:

A = area of the design flow in the end of the pipe (ft^2)

Finally,

$$V = Q/A$$

in which:

V = design flow velocity at the pipe outlet (ft/sec)

3.4.3.2 Riprap Size

For the design velocity, use Figure HS-20 to find the size and type of the riprap to use in the scour protection basin downstream of the pipe outlet (i.e., B18, H, M or L). First, calculate the riprap sizing design parameter, P_d, namely,

$$P_d = \left(V^2 + gd\right)^{1/2} \qquad \text{(HS-16)}$$

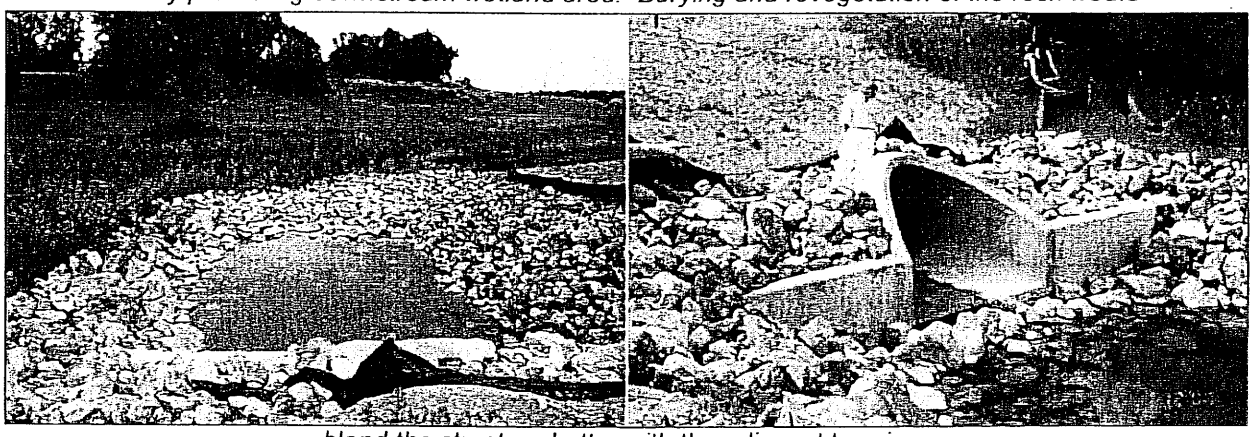
in which:

V = design flow velocity at pipe outlet (ft/sec)

g = acceleration due to gravity = 32.2 ft/sec^2

d = design depth of flow at pipe outlet (ft)

Photograph HS-12—Upstream and downstream views of a low tailwater basin in Douglas County protecting downstream wetland area. Burying and revegetation of the rock would



blend the structure better with the adjacent terrain.

When the riprap sizing design parameter indicates conditions that place the design above the Type H riprap line in Figure HS-20, use B18, or larger, grouted boulders. An alternative to a grouted boulder or loose riprap basin is to use the standard USBR Basin VI, as described in Section 3.2.

After the riprap size has been selected, the minimum thickness of the riprap layer, T, in feet, in the basin is set at:

$$T = 1.75 D_{50} \qquad \text{(HS-17)}$$

in which:

D_{50} = the median size of the riprap (see Table HS-9.)

Table HS-9—Median (i.e., D_{50}) Size of District's Riprap

Riprap Type	D_{50}—Median Rock Size (inches)
L	9
M	12
H	18
B18	18 (grouted)

3.4.3.3 Basin Length

The minimum length of the basin, L, in Figure HS-18a, is defined as being the greater of the following lengths:

for circular pipe,

$$L = 4D \quad \text{or} \quad L = (D)^{1/2}\left(\frac{V}{2}\right) \qquad \text{(HS-18)}$$

for rectangular pipe,

$$L = 4H \quad \text{or} \quad L = (H)^{1/2}\left(\frac{V}{2}\right) \qquad \text{(HS-19)}$$

in which:

L = basin length (Figure HS-18a)

H = height of rectangular conduit

V = design flow velocity at outlet

D = diameter of circular conduit

3.4.3.4 Basin Width

The minimum width, W, of the basin downstream of the pipe's flared end section is set as follows:

for circular pipes,

$$W = 4D \qquad \text{(HS-20)}$$

for rectangular pipe,

$$W = w + 4H \qquad \text{(HS-21)}$$

in which:

W = basin width (Figure HS-18a)

D = diameter of circular conduit

w = width of rectangular conduit

3.4.3.5 Other Design Requirements

All slopes in the pre-shaped riprapped basin are 2H to 1V.

Provide pipe joint fasteners and a structural concrete cutoff wall at the end of the flared end section for a circular pipe or a headwall with wingwalls and a paved bottom between the walls, both with a cutoff wall that extends down to a depth of

$$B = \frac{D}{2} + T \quad \text{or} \quad B = \frac{H}{2} + T \qquad \text{(HS-22)}$$

in which:

B = cutoff wall depth

D = diameter of circular conduit

T = Equation HS-17

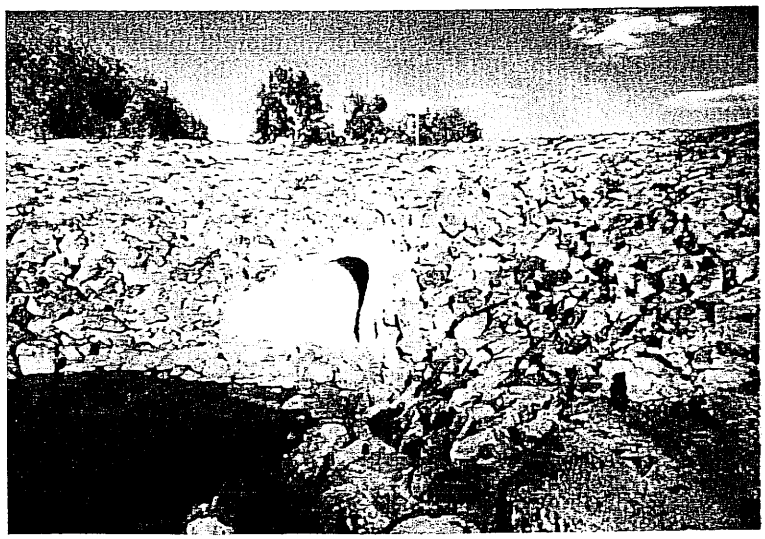
The riprap must be extended up the outlet embankment's slope to the mid-pipe level.

3.5 Culvert Outlets

Culvert outlets in the Denver area represent a persistent problem because of concentrated discharges and turbulence that are not fully controlled prior to the flow reaching the standard downstream channel configuration. Too often the designer's efforts are focused on the culvert inlet and the culvert sizing with the outlet hydraulics receiving only passing attention. A culvert design is not complete until adequate attention is paid to the outlet hydraulics and proper stilling of the design flow.

Culvert outlet energy dissipator and flow spreading may require special structures downstream of the culvert outlet to limit local scour, general stream degradation, and troublesome head cutting.

Local scour is typified by a scour hole produced at the culvert outlet. This is the result of high exit velocities, and the effects extend only a limited distance downstream. Coarse material scoured from the circular or elongated hole is deposited immediately downstream, often forming a low bar. Finer material is transported further downstream. The dimensions of the scour hole change due to sedimentation during low flows and the varying erosive effects of storm events. The scour hole is generally deepest during passage of the peak flow. Methods for predicting scour hole dimensions are found in HEC No. 14 (Corry, et al. 1975).



Photograph HS-13—Culvert outlets are often left unprotected causing downstream degradation. The designer's job is not complete until the outlet hydraulic provisions are made. Burying of riprap and revegetation of the surface would have blended this structure better into the adjacent landscape.

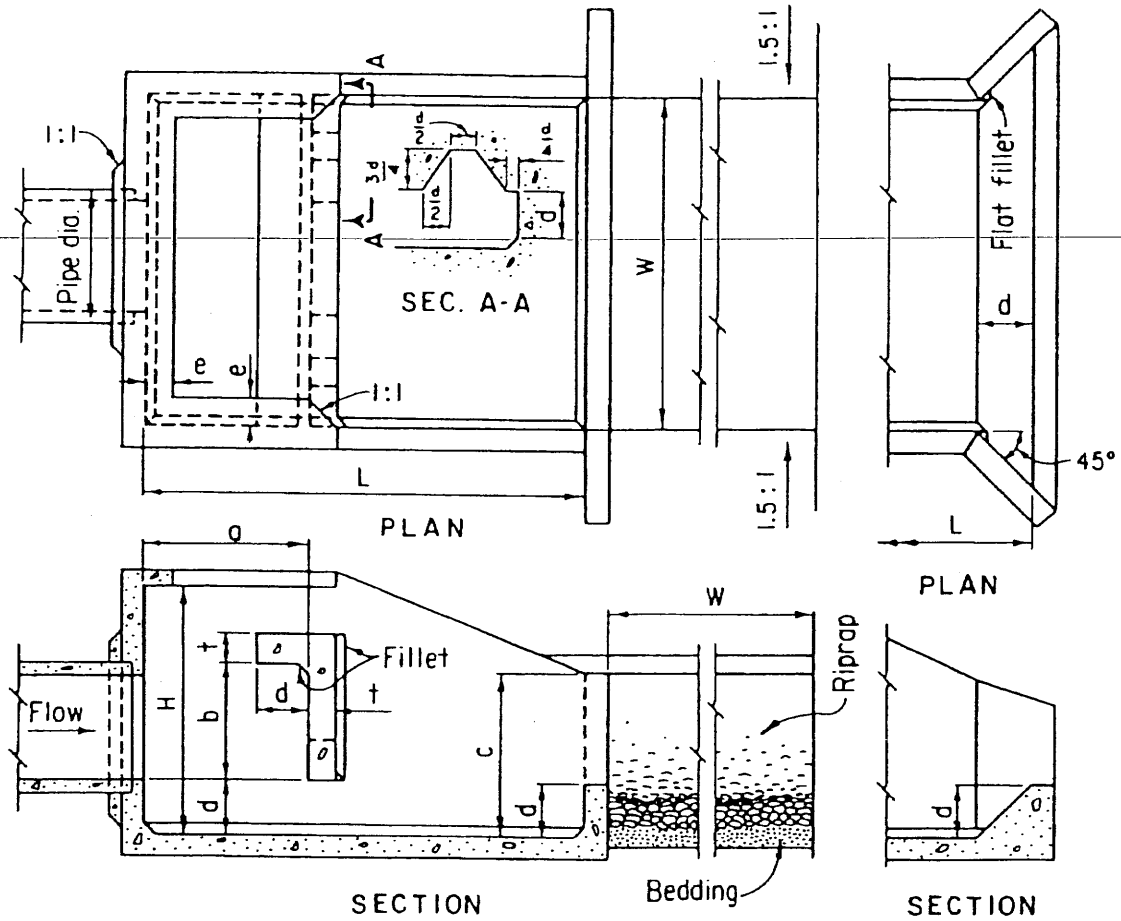
General storm degradation, or head cutting, can be a phenomenon independent of culvert performance. Natural causes produce a lowering of the streambed over time. The identification of a degrading stream is an essential part of the original site investigation. However, high-energy discharges from a culvert often cause stream degradation that is similar to the former, though limited in distance. Both types of scour can occur simultaneously at a culvert outlet.

As described in HEC No. 14, various measures exist to control culvert outlet flow, as listed below. It is beyond the scope of this *Manual* to provide information about these controls, but the District encourages their proper application and design.

1. Colorado State University rigid boundary basin

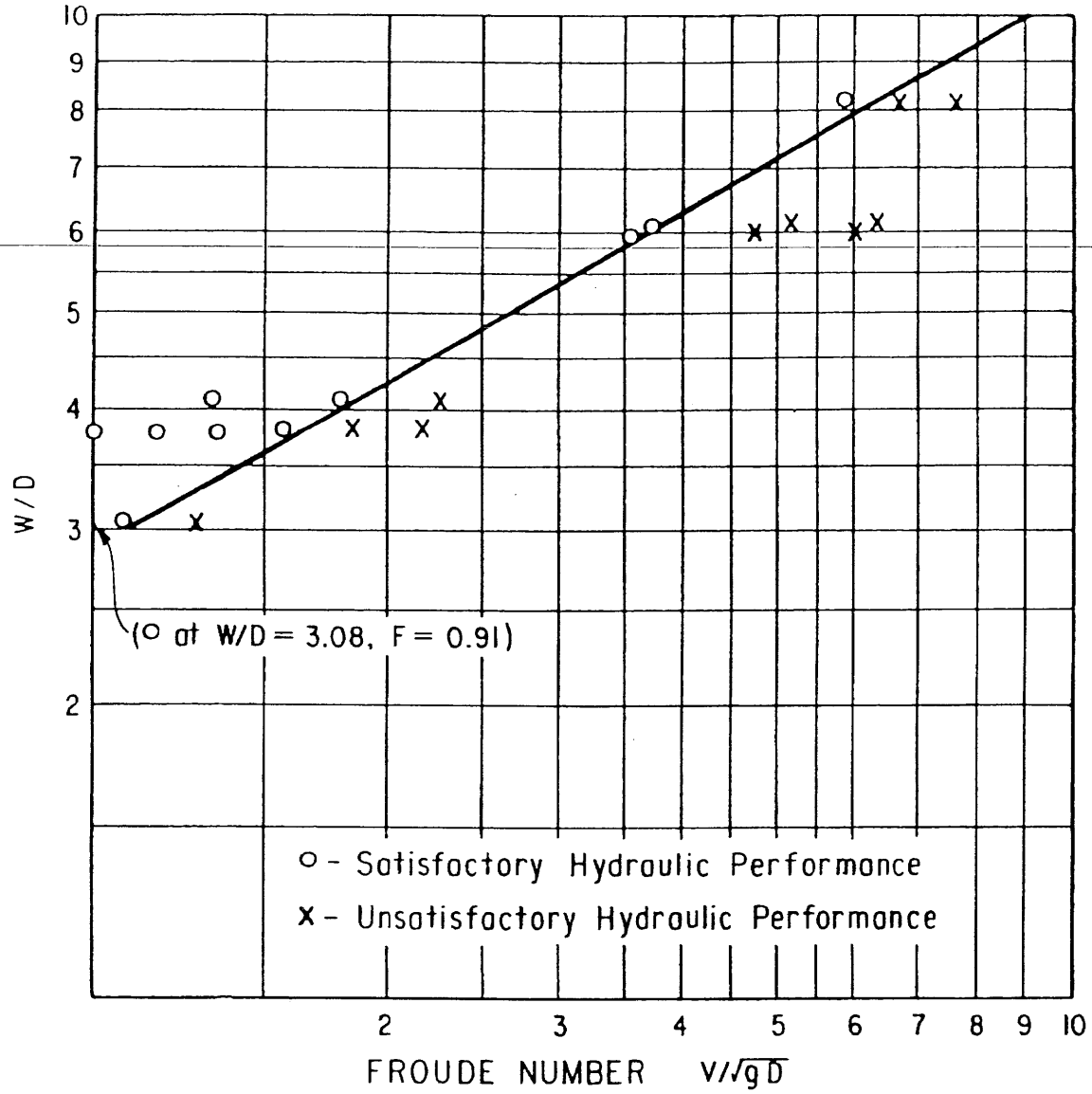
2. Tumbling flow rectangular section
3. Increased resistance—box culverts
4. Roughness elements—circular culverts
5. USBR Type II
6. USBR Type III
7. USBR Type IV
8. Contra Costa
9. Hook-type energy dissipator
10. Straight drop structure
11. Riprap basins

In addition, one might consider an extended culvert apron with one or more rows of baffles, or using large rows of offset racks set downstream of the culvert outlet on a bed of suitable riprap without a basin, but with an adequate tailwater depth, all designed in accordance with the criteria given in Section 2.0 of this chapter.



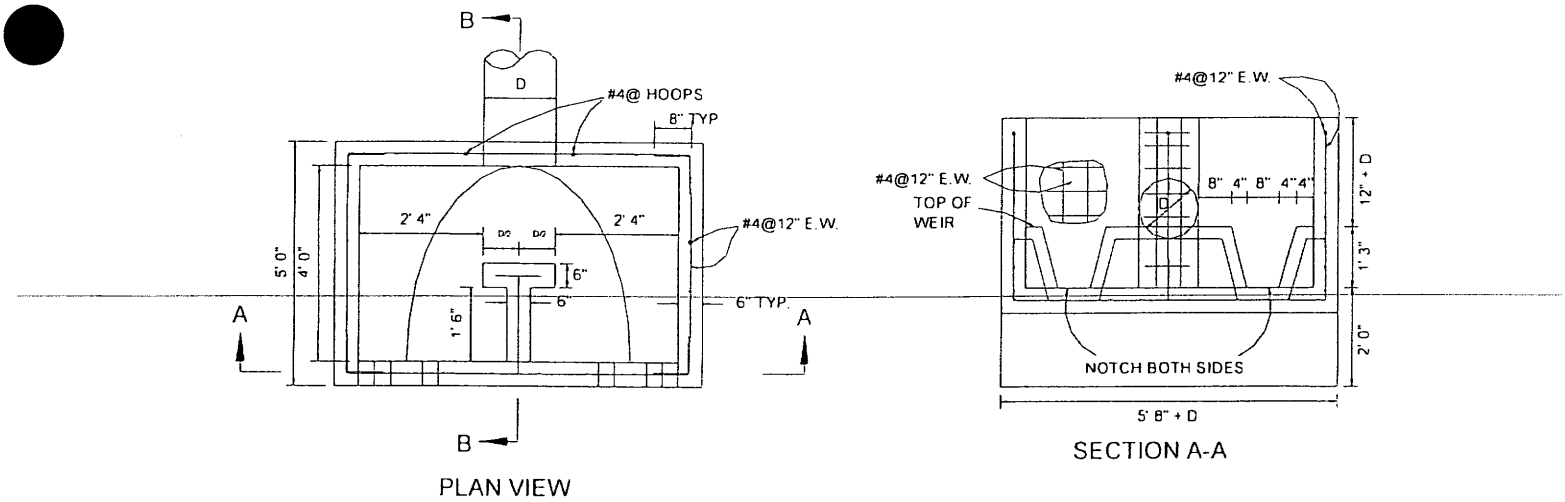
H = 3W/4 c = W/2
L = 4W/3 d = W/6
a = W/2 e = W/12
b = 3W/8 t = W/12 suggested minimum thickness

Figure HS-14—General Design Dimensions Impact Stilling Basin (USBR VI)



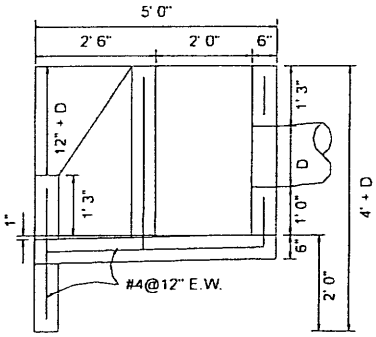
"W" is the inside width of the basin.
"D" represents the depth of flow entering the basin and is the square root of the flow area at the conduit outlet.
"V" is the velocity of the incoming flow.
The tailwater depth is uncontrolled.

Figure HS-15—Basin Width Diagram for an Impact Stilling Basin (USBR VI)



CONCRETE DISSIPATOR NOTES

1. ALL CONCRETE SHALL BE CLASS A UNLESS OTHERWISE APPROVED BY ENGINEER.
2. ALL REINFORCING STEEL SHALL CONFORM TO ATSM A 615, GRADE 60
3. 6 INCHES OF TYPE II BEDDING SHALL BE PLACED UNDER ALL STRUCTURAL SLAB AREAS & COMPACTED PRIOR TO CONCRETE POUR
4. ALL REINFORCING SHALL HAVE 3" CLEAR COVER



ENERGY DISSIPATOR FOR PIPE OULET DIAMETERS ≤ 36"

Figure HS-16—Modifications of Impact Stilling Basin to Allow Basin Drainage for Urban Applications

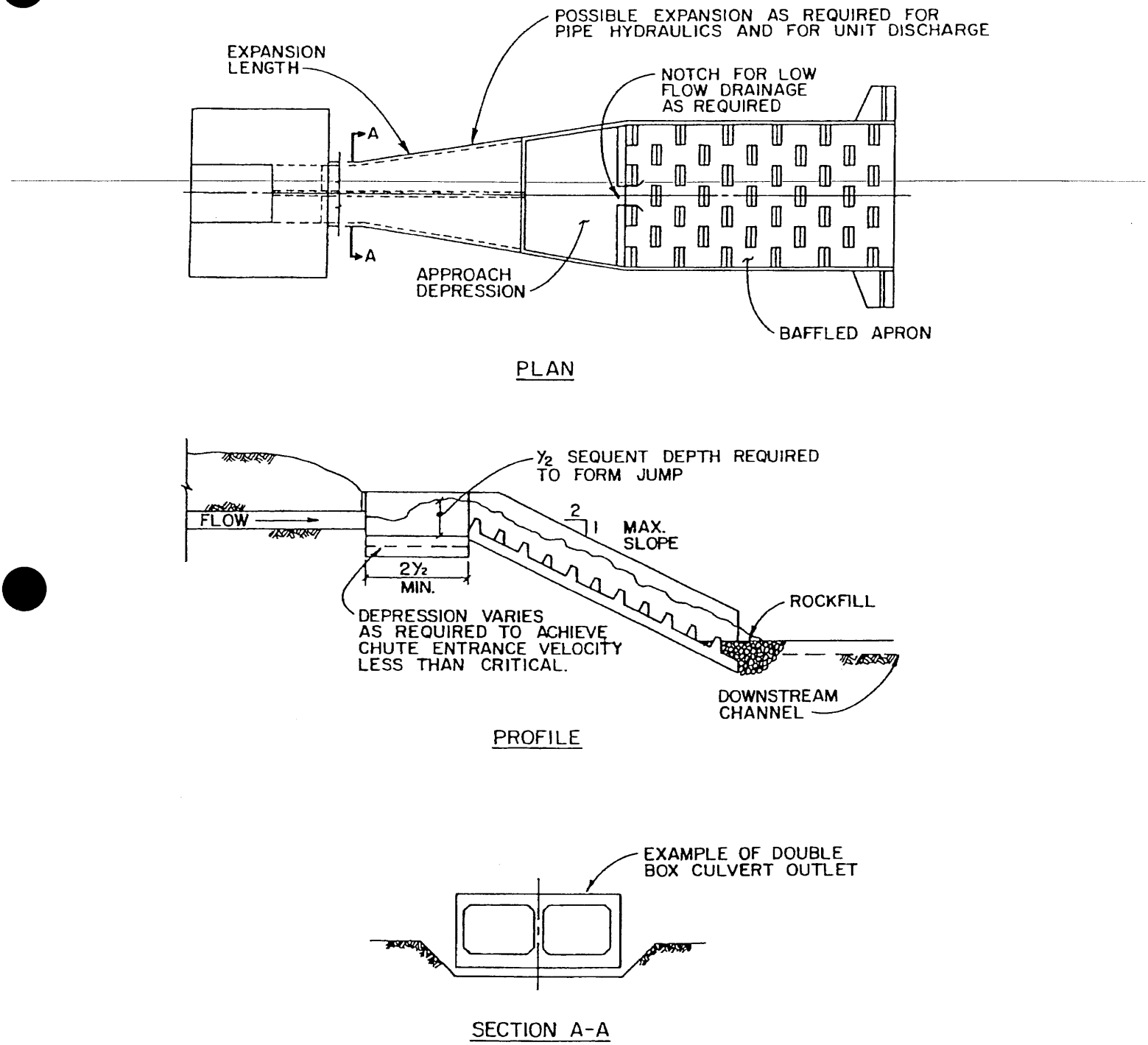


Figure HS-17—Baffle Chute Pipe Outlet

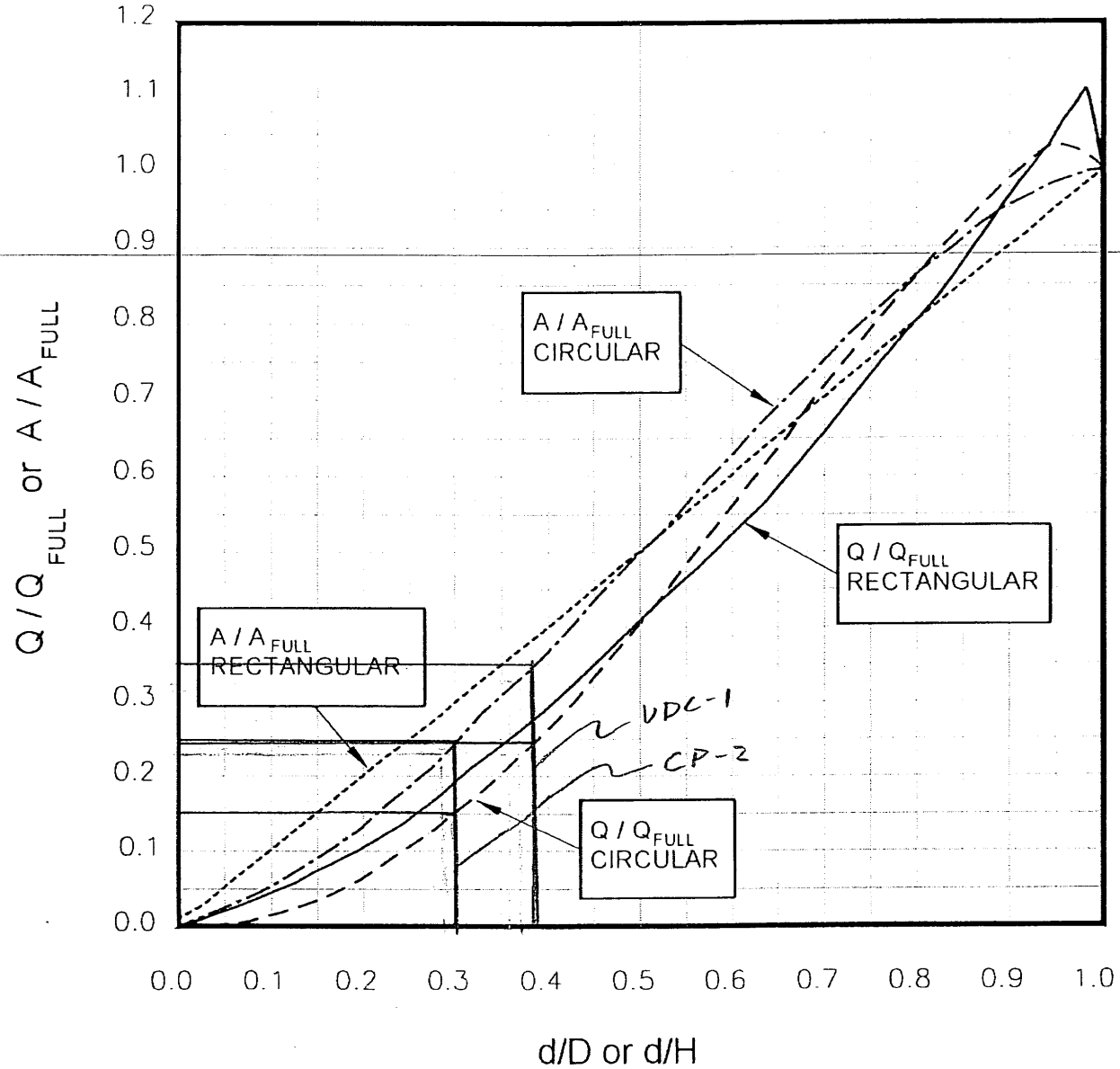


Figure HS-18b—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Discharge and Flow Area Relationships for Circular and Rectangular Pipes

(Ratios for Flow Based on Manning's *n* Varying With Depth)
(Stevens and Urbonas 1996)

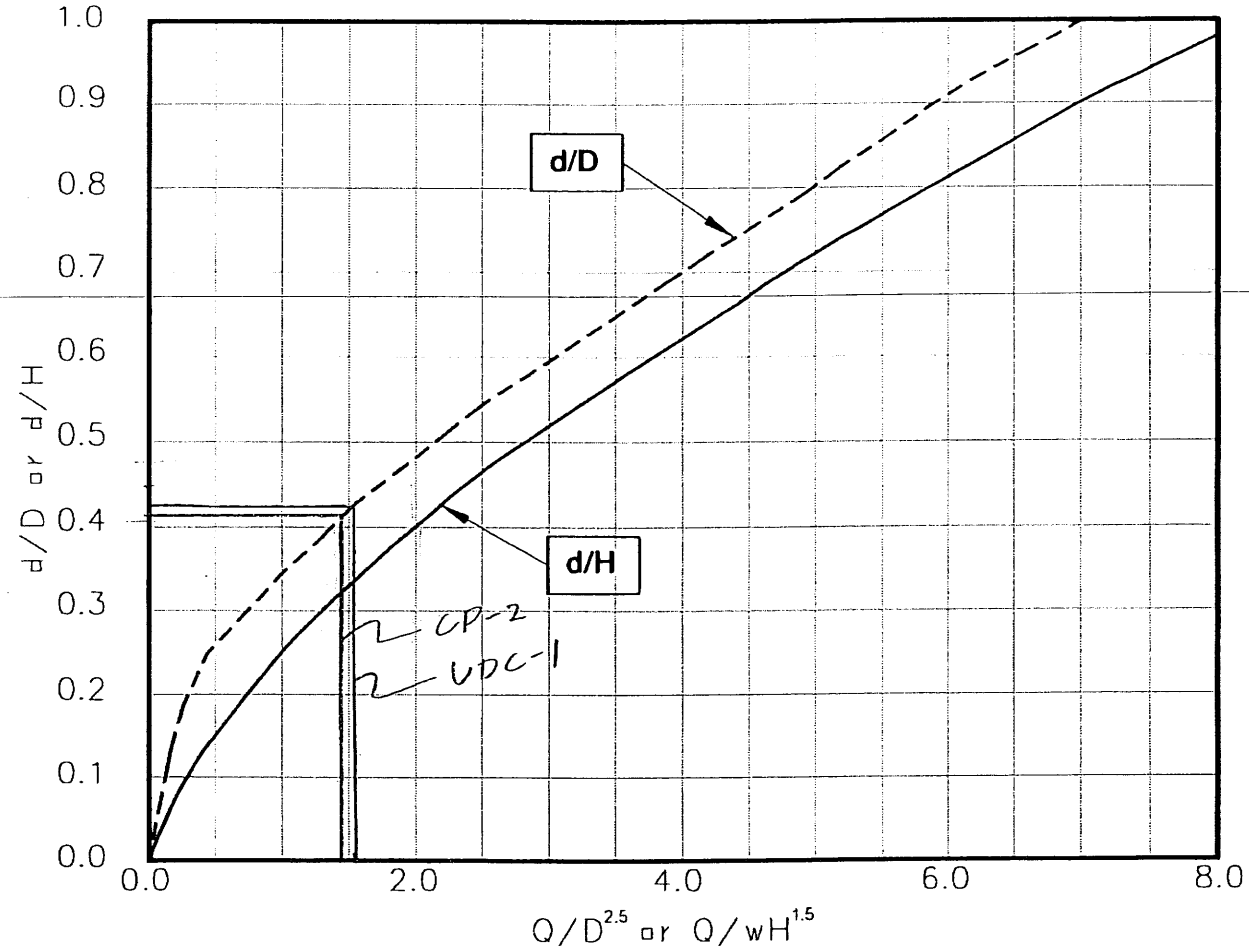


Figure HS-19—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Brink Depth for Horizontal Pipe Outlets

(Stevens and Urbonas 1996)

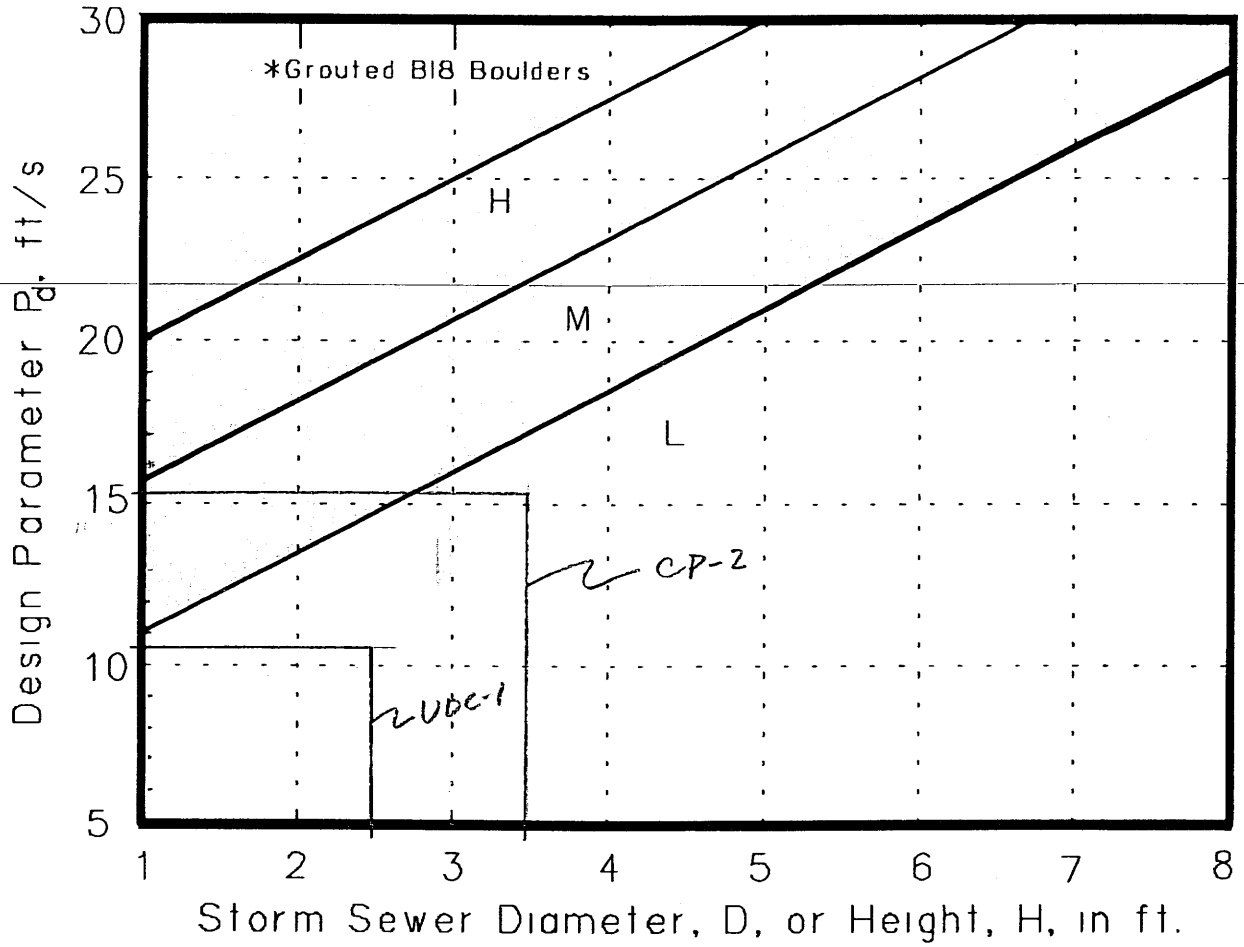
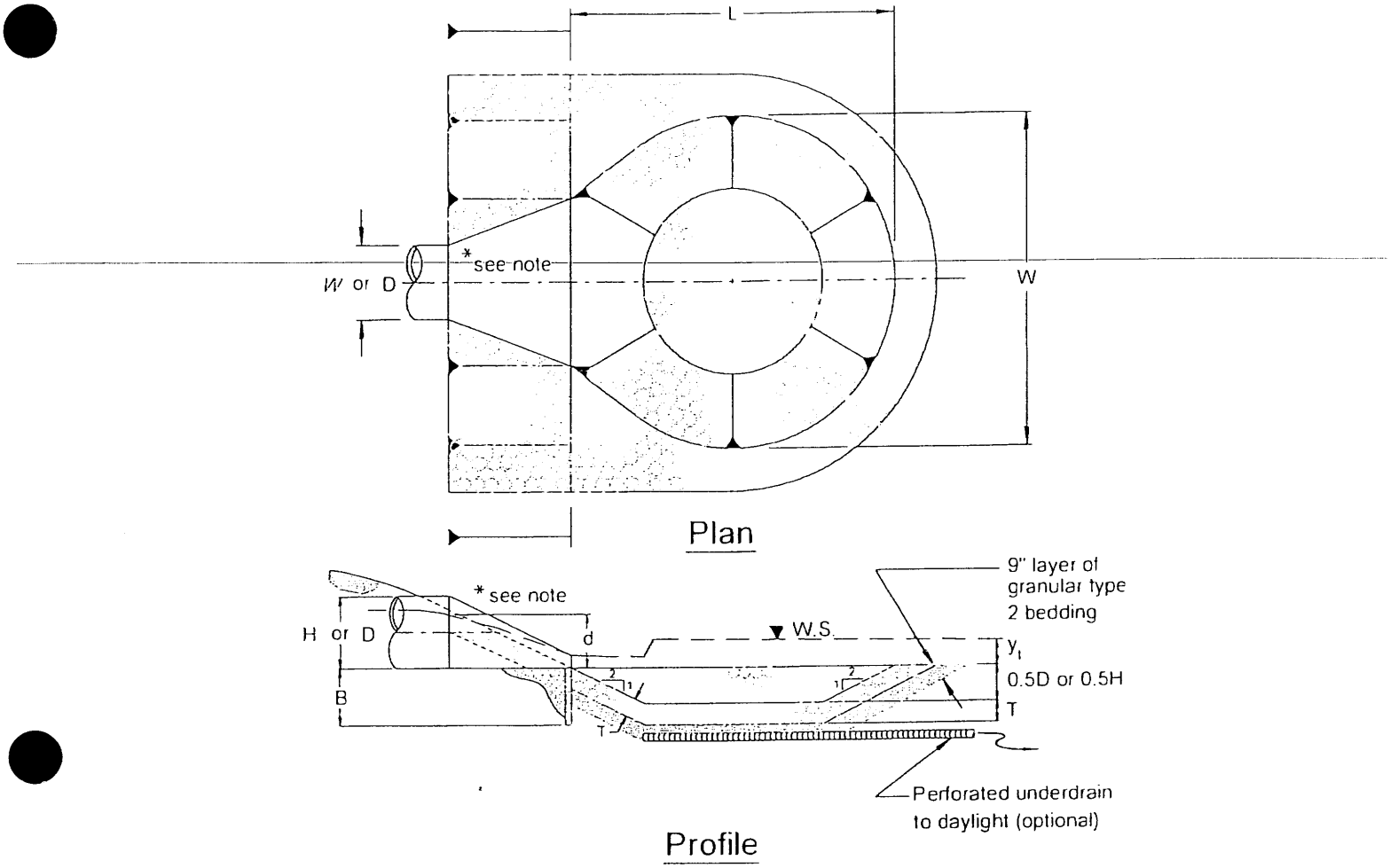


Figure HS-20—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—
Riprap Selection Chart for Low Tailwater Basin at Pipe Outlet
(Stevens and Urbonas 1996)



* Note: For rectangular conduits use a standard design for a headwall with wingwalls, paved bottom between the wingwalls, with an end cutoff wall extending to a minimum depth equal to B

Figure HS-18A—Low Tailwater Riprap Basins for Storm Sewer Pipe Outlets—Low Tailwater Basin at Pipe Outlets

(Stevens and Urbonas 1996)

Exhibit 4.7.5-1

Hydrologic Information

Exhibit 5.4.3-1

Bonding and Insurance Information

Exhibit 8.0

Permit Dcoumentation

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☐ New Permit ☒ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Carbon Resources, LLC

Mine: Kinney No. 2 **Permit Number:**

Title: New Mine Permit Application

Description, Include reason for application and timing required to implement:

Start a new coal mining operation. Timing: As soon as possible.

Instructions: If you answer yes to any of the first eight questions, this application may require Public Notice publication.

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 452.50 Disturbed Area: 27.30 ☒ increase ☐ decrease.

☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO#

☒ Yes ☐ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?

☒ Yes ☐ No 4. Does the application include operations in hydrologic basins other than as currently approved?

☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?

☒ Yes ☐ No 6. Does the application require or include public notice publication?

☒ Yes ☐ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?

☒ Yes ☐ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?

☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV #

☒ Yes ☐ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain:

☒ Yes ☐ No 11. Does the application affect the surface landowner or change the post mining land use?

☒ Yes ☐ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)

☒ Yes ☐ No 13. Does the application require or include collection and reporting of any baseline information?

☒ Yes ☐ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?

☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?

☒ Yes ☐ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?

☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?

☐ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?

☐ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?

☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?

☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?

☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?

☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

☒ Yes ☐ No 24. Does the application include confidential information and is it clearly marked and separated in the plan?

Please attach three (3) review copies of the application. If the mine is on or adjacent to Forest Service land please submit four (4) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Clay Wisdom	C.F.O.	2-20-08	
Print Name	Position	Date	Signature (Right-click above choose certify then have notary sign below)

Subscribed and sworn to before me this 20th day of February, 2008

Notary Public: Barbara A. Mast, state of Utah.

My commission Expires: 3/15/10

Commission Number:

Address: 13 Ranch Road

City: Edgewood State: NM Zip: 87015

ss:

OFFICIAL SEAL
Barbara A. Mast
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 3/15/10

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Carbon Resources, LLC
Mine: Kinney No. 2 **Permit Number:**
Title: New Mine Permit Application

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☒ Add	☐ Replace	☐ Remove	Entire Mining and Reclamation Application consisting of:
☒ Add	☐ Replace	☐ Remove	Table of Contents, List of Tables, List of Figures, List of Maps & List of Exhibits
☒ Add	☐ Replace	☐ Remove	Sections: 1.0, 2.0, 2.1, 2.2, 2.3, 2.4, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5.
☒ Add	☐ Replace	☐ Remove	Sections: 4.6, 4.7, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 6.0, 6.1, & 7.0
☒ Add	☐ Replace	☐ Remove	Tables: 3.3.2.2, 3.6-1, 3.6-2, 3.6-3, 3.7-1, 3.7-2, 3.7.2.1-1, 3.7.2.2-1, 3.7.2.4-1, 3.7.2.5-1,
☒ Add	☐ Replace	☐ Remove	Tables: 3.7.3.5-1, 3.7.4.1-1, 3.7.4.2-1, 3.7.7-3, 3.7.8.2-1, 4.5-1, 4.72.2-1, 4.7.2.2-1, 4.7.2.3-1
☒ Add	☐ Replace	☐ Remove	Tables: 5.3.2.3-1, & 5.3.2.3-2,
☒ Add	☐ Replace	☐ Remove	Figures: 1.0-1, 3.6-1, 3.6-2, 3.6-3, 3.6-4, 3.6-5, 3.6-6, 3.6-7, 3.6-8, 3.6-9, 3.6-10, 3.6-11, 3.6-12
☒ Add	☐ Replace	☐ Remove	Figures: 3.7.1.3-1, 3.7.2.5-1, 3.7.3.3-1, 3.7.3.3-2, 3.7.3.4-1, 3.7.3.4-2, 3.7.3.5-1, 4.1-1, 4.3-1,
☒ Add	☐ Replace	☐ Remove	Figures: 4.5-1, 4.5-2, 4.5-3, 4.5-4A, 4.5-4B, 4.5-5A, 4.5-5B, 4.5-5C, 4.5-5C, 4.5-5D, 4.5-6A,
☒ Add	☐ Replace	☐ Remove	Figures: 4.5-6B, 4.5-6C, 4.7.2.2-1, 5.4-1, & 5.4-2
☒ Add	☐ Replace	☐ Remove	Maps: 3.2.1.2-1, 3.3.1.4, 3.4.1.4-1, 3.4.1.4-2, 3.6-1, 3.7.1.3-1, 3.7.2-1, 3.7.2.1-1, 3.7.2.4-1,
☒ Add	☐ Replace	☐ Remove	Maps: 4.5.1.2-1, 4.5.1.2-2, 4.5.1.2-3, 5.4.1.2-4, 4.5.1.2-5, 4.5.2.3-1A, 4.5.2.3-1B, 4.5.2.3-1C,
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☒ Add	☐ Replace	☐ Remove	Maps: 4.7.2.2-2, 4.7.2.3-1, & 4.7.2.9-1
☒ Add	☐ Replace	☐ Remove	Exhibits: 1.5-1, 2.1.2.2-1, 2.1.3-1, 2.3, 3.1.1.3-1, 3.2, 3.3, 3.7.2.2-1, 3.7.2.2-2, 3.7.2.2-3,
☒ Add	☐ Replace	☐ Remove	Exhibits: 3.7.2.4-1, 3.7.2.5-1, 4.5.2.1-1, 4.5.2.1-2, 4.7.2.2-1, 4.7.5-1, & 5.4.3-1
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**
Exhibit 2.1.2.2-1 is a separate CONFIDENTIAL volume. It is requested that the information in this volume be held confidential.	