Alton Coal Development, LLC

Coal Hollow Project

Mining and Reclamation Plan
Technical Review 2 (Task ID #3100) - Revisions

Chapters 7 and 8

August 2009

C/025/0005

0021

#3371

Alton Coal Development, LLC
463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435) 867-5331 • Fax (435) 867-1192

COPY

August 27, 2009

Daron R. Haddock
Department of Natural Resources
Utah Division of Oil, Gas & Mining
1594 West North Temple, Suite 1210
Salt Lake City, UT 84114

Re: Response to Technical Review (Task ID #3100)
Coal Hollow Project, Kane County, Utah, C/025/0005

Dear Mr. Haddock:

Alton Coal Development, LLC is pleased to provide this submittal addressing the deficiencies outlined in your correspondence dated April 20, 2009 for the Coal Hollow Project application (C/025/0005) for a surface mining operation near Alton, Utah. The enclosed information, in combination with the Initial Response (enclosed) provided to the Division on June 15, 2009, directly address each item specified in the written correspondence from your office. As previously requested, confidential materials are provided separate from the main body of the submittal and are located in the inside pocket of this binder.

Please let me know if there is any other assistance that we can provide.

Sincerely,

Chris McCourt

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DIV. OF OIL, GAS & MINING

C/025/005 Incoming
#3371
ok

APPLICATION FOR COAL PERMIT PROCESSING

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

COPY

Permittee: Alton Coal Development, LLC

Mine: Coal Hollow **Permit Number:** C/025/0005

Title: Mining and Reclamation Plan - Technical Review 2 (Task ID #3100) Revisions - Confidential Information

Description, Include reason for application and timing required to implement:

This confidential document is submitted to address changes in company ownership

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

☐ Yes	☒ No	1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ 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?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) 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.

Chris McCourt
Print Name

[signature], Manager, 8-26-09
Sign Name, Position, Date

Subscribed and sworn to before me this 26 day of August, 2009

[signature]
Notary Public

My commission Expires: 06/06, 2013

Attest: State of Utah } ss:
County of Iron

STEPHEN HYDE
Notary Public
State of Utah
Comm. No. 578719
My Comm. Expires Jun 6, 2013

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining
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Form DOGM- C1 (Revised March 12, 2002)

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

COPY

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow **Permit Number:** C/025/0005
Title: Mining and Reclamation Plan - Technical Review 2 (Task ID #3100) Revisions - Confidential Information

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	Volume 7 Confidential, Appendix 1-1, 112.310 Members and Managers of Alton Coal page
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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
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APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

COPY

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow **Permit Number:** C/025/0005
Title: Mining and Reclamation Plan - Technical Review 2 (Task ID #3100) Revisions

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.

Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Volume 1, Chapter 1 Table of Contents (TOC) and Text Redline/Strikeout
☒ Add	☐ Replace	☐ Remove	Volume 1, Chapter 1, Appendix 1-8 Robinson Creek Road Agreement
☒ Add	☐ Replace	☐ Remove	Volume 1, Chapter 1, add K3900 Agreement Exhibits 1, 2 and 3 to Appendix 1-7
☒ Add	☐ Replace	☐ Remove	Volume 1, Chapter 1, Appendix 1-9 Kane County Conditional Use Permits
☐ Add	☒ Replace	☐ Remove	Volume 1, Chapter 2, Page 2-28
☐ Add	☒ Replace	☐ Remove	Volume 2, Chapter 3 Table of Contents and Chapter 3 Text pp. 3-1 thru 3-86
☐ Add	☒ Replace	☐ Remove	Volume 2, Chapter 3, Drawings 3-2, 3-3, 3-4 and 3-5
☒ Add	☐ Replace	☐ Remove	Volume 2, Chapter 3, Drawing 3-7 Reclamation Treatments, Monitoring and Sampling
☐ Add	☒ Replace	☐ Remove	Volume 2, Chapter 4, Page 4-10
☐ Add	☒ Replace	☐ Remove	Volume 2, Chapter 4, Appendix 4-5 Redline/Strikeout
☐ Add	☐ Replace	☒ Remove	Volume 2, Chapter 4, Appendix 4-2 UDAQ Notice of Intent
☐ Add	☒ Replace	☐ Remove	Volume 2, Chapter 4, Page 4-3, Exhibit 4-1
☐ Add	☒ Replace	☐ Remove	Volume 2, Chapter 4, Table of Contents
☐ Add	☒ Replace	☐ Remove	Volume 3, Chapter 5, Table of Contents and Text Redline/Strikeout
☒ Add	☐ Replace	☐ Remove	Volume 3, Chapter 5, Appendix 5-6 Post Mining Roads Backfill Analysis
☐ Add	☒ Replace	☐ Remove	Volume 3, Chapter 5, Drawings 5-22E, 5-22F and 5-22G
☒ Add	☐ Replace	☐ Remove	Volume 3, Chapter 5, Drawing 5-22H Option A County Road Reestablishment
☐ Add	☒ Replace	☐ Remove	Volume 5, Chapter 6, Pages 6-6 thru 6-19 Redline/Strikeout
☐ Add	☒ Replace	☐ Remove	Volume 5, Chapter 6, Replace Drawing 6-9 with new 6-9a and 6-9b
☐ Add	☒ Replace	☐ Remove	Volume 6, Chapter 7, Table of Contents and Text Redline/Strikeout
☐ Add	☒ Replace	☐ Remove	Volume 6, Chapter 7, Tables 7-4 thru 7-7
☒ Add	☐ Replace	☐ Remove	Volume 6, Chapter 7, Tables 7-10, 7-11 and 7-12
☒ Add	☐ Replace	☐ Remove	Voluime 6, Chapter 7, Drawings 7-15 and 7-15B
☐ Add	☒ Replace	☐ Remove	Volume 6, Chapter 7, Drawings 7-2, 7-3 and 7-7
☐ Add	☒ Replace	☐ Remove	Volume 6, Chapter 7, Replace water rights data sheets for springs in Appendix 7-3
☒ Add	☐ Replace	☐ Remove	Volume 6, Chapter 7, Appendix 7-5, 7-9 and 7-10
☐ Add	☒ Replace	☐ Remove	Volume 6, Chapter 7, Appendix 7-7, TOC and Text; Figures 13, 14 and Plate 1
☒ Add	☐ Replace	☐ Remove	Volume 6, Chapter 7, Appendix 7-7, Figures 15, 16(A-D) and 17

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

Additional instructions and description are provided on the colored sheets seperating the individual submittals. These colored sheets also contain responses to some deficiencies that did not require revisions to the MRP to be addressed.

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Deficiency:

R645-302-320 Refer to Alluvial Valley Floor Findings, p. 47 of the TA: Information in the MRP indicates that there are stream laid deposits in the area of the stream channel in Sink Valley, below Swapp Hollow (the center of the SW ¼ , Sec 29), east of the permit area, which are important to agriculture. The applicant will have to show that the proposed operations will not interrupt, discontinue or preclude farming on this potential alluvial valley floor in the adjacent area, and that the groundwater system in Sink Valley can be restored. The Applicant was directed to show cross-sections on 1000 ft. intervals as to how the mine would intercept the Sink Valley trough, see deficiency R645-301-624, -724 and R645-301-728.100 in the Environmental Resource/Hydrology section of this Technical Analysis. [DWD]

ACD response
It is the opinion of Alton Coal Development, LLC that an alluvial valley floor does not exist in the proposed Coal Hollow Mine permit or adjacent area. Alton Coal Development will provide information regarding how the proposed operations will not interrupt, discontinue or preclude farming on a potential alluvial valley floor in the adjacent area if an alluvial valley floor is positively identified in the adjacent area.

Cross-sections on 1000 ft. intervals that show how the proposed mining operations would intercept the Sink Valley Trough have been provided in Drawings 7-15 and 7-15B.

Deficiency:

R645-301-121.200, Refer to AVF Findings, p. 47 of the TA
Dwg. 7-7 was field checked in September 2007 and several modifications should have been made to reflect the increased area under cultivation owned by Sorensen, to clarify the pond structures 29-6 through 29-9 are semi-circle dams, to place the Dame fenceline adjacent to the road etc.

ACD response:

Text has been added to 722.200 to reflect the semi-circular construction for some of the dams.

The side-hill areas recently planted by Sorensen are non-irrigated grazing areas. Such areas are not included in Drawing 7-7, which shows flood irrigated or sub-irrigated lands.

Fence lines are not shown on Drawing 7-7. Some fence lines are shown on the 7.5minute USGS topographic map which is the base map for drawing 7-7.

Deficiency:

R645-301-121.200, Refer to AVF Findings, p. 47 of the TA
Please provide information on well C5 in Table 8, App. 7-1

ACD response:

The information in Table 8 provides estimates of groundwater inflow rates from saturated alluvium along the eastern margins of the proposed mine pit areas. Well C5-130 is not located adjacent to any pit areas and consequently, the hydrologic information necessary to estimate groundwater flow in that location was not collected.

Deficiency:

R645-302-321.260, Refer to Alluvial Valley Floor Findings, p. 48 of the TA: ***(EP)*** *Section 6.4 states that "the topographic characteristics of most lands within the project area are compatible with flood irrigation techniques". Available water rights and historical irrigation indicate flood irrigation is important to agricultural use. The application needs to include a mitigation plan for restoring water to these areas. [JH]* • ***(EP, RC, CM)*** *Plates 3 and 4 include color infrared aerial imagery taken in July of 2006 and November of 2007. Moist areas in Plate 3 appear to be grey and moist areas in Plate 4 appear to be red. To enable a comparison between plates, the presentation of these two plates should be equivalent (developed with the same exposure time), such that moist areas are the same color on both plates. [PB]* • ***(EP, RC)*** *Restated from Task 2910, During the site visit on October 2, 2008, Dr. Collins and Joe Helfrich discussed the requirements of R645-302-321.260 and concluded that "an analysis of a series of aerial photographs including infrared imagery flown at a time of year to show any summer and fall differences between upland and valley floor vegetation" had been completed by the applicant (personal conversation with Patrick Collins, 10/2/2008). Although it was not specifically stated during the discussion in the field, the Division came away with the understanding that the results and conclusions of the analysis were readily available in the application and therefore the information in the application partially met the requirements of this section of the regulations. However, a discussion of the results and specific conclusions from the comparative analysis of the color infrared aerial imagery, plates 3 and 4 still needs to be included in section 7.1 page 31of Appendix 7-7. Although the Applicant utilized the aerial photos in their analysis, a discussion of the results and specific conclusions from the comparative analysis of the color infrared aerial imagery, Plates 3 and 4 still needs to be included in section 7.1 page 31of Appendix 7-7. (repeated request from Task 2910)* [JH]

ACD response:

- It is the opinion of Alton Coal Development, LLC that an alluvial valley floor does not exist in the proposed Coal Hollow Mine permit or adjacent area. Alton Coal Development will provide information regarding mitigation plans for restoring water to potentially flood irrigated areas if an alluvial valley floor is positively identified in the adjacent area.

- Both of the infrared color infrared images provided in Appendix 7-7 (Plates 3 and 4) were produced and provided in digital format from Olympus Aerial Surveys, Inc. of Salt Lake City, Utah. In telephone conversations with personnel from Olympus Aerial Surveys, Inc. they indicated that the two images were processed using their standard methods and they did not indicate that there were any known differences in the techniques by which the two images were produced.

- As stated in the deficiency above by the Division, this deficiency was addressed in the field visit with Division representatives on October 2, 2008. Field notes from Patrick Collins for that day stated this deficiency was sufficiently addressed with Joe Helfrich and supported that conclusion. The Division's follow up inspection report (Inspection ID 1789 by Priscilla Burton) confirmed this conclusion by stating: "*The deficiencies noted in the review of the Biology section of the application were reviewed with Pat Collins. One of the deficiencies dealing with the analysis of color aerial photography during the AVF evaluation was resolved on site. It was concluded that the information in the application had met the requirements of this section of the regulations*". Nonetheless, as requested by the Division in the deficiency above, additional information has been provided for this document.

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R645-301-300

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CHAPTER 7

R645-301-700. HYDROLOGY

711. GENERAL REQUIREMENTS

711.100 – 711.500 Contents

This chapter provides a description of the hydrology and hydrogeology of the proposed Coal Hollow Mine permit and adjacent area. Specifically, this permit section includes descriptions of existing hydrologic resources according to R645-301-720, proposed operations and potential impacts to the hydrologic balance according to R645-301-730, methods and calculations utilized to achieve compliance with the hydrologic design criteria and plans according to R645-301-740, applicable hydrologic performance standards according to R645-301-750, and reclamation activities according to R645-301-760.

This information is presented in subsequent sections of this chapter and in Appendix 7-1. Appendix 7-1 includes a comprehensive characterization of groundwater and surface-water systems in the proposed Coal Hollow permit and adjacent areas, recommendations for groundwater and surface-water monitoring, and the results of a field investigation regarding the potential for alluvial valley floors in the proposed Coal Hollow Mine permit and adjacent area. It should be noted that Appendix 7-1 may be updated periodically in the future as additional hydrologic and hydrogeologic data become available.

712 CERTIFICATION

All cross sections, maps, and plans have been prepared per R645-301-512. Compliance with this section has been completed and certifications are available on all Drawings. The cross sections and maps that are included in this permit application and are required to be certified have been prepared by or under the direction of a qualified, registered, professional engineer or a professional geologist, with assistance from experts in related fields such as hydrology, geology and landscape architecture.

713 INSPECTION

Impoundments will be inspected as described under R645-301-514.300. Designs for proposed impoundments in the proposed Coal Hollow permit area are shown in Drawings 5-25 through 5-31 and Appendices A5-1 and A5-2. No impoundments or sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) exist or are planned within the proposed Mine Permit Area.

A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments. Inspections will be made regularly during construction, upon completion of construction, and at least yearly until removal of the structure or release of the performance bond. The qualified registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. A copy of the report will be retained at or near the mine site.

720 ENVIRONMENTAL DESCRIPTION

721 GENERAL REQUIREMENTS

The existing, pre-mining hydrologic resources within the permit and adjacent areas that may be affected by coal mining and reclamation operations are described in Appendix 7-1 and are summarized below.

Groundwater Resources

A spring and seep survey of the proposed Coal Hollow Mine permit and surrounding area has been conducted by Petersen Hydrologic, LLC (see sub-appendix B of Appendix 7-1). The locations of springs and seeps in the proposed permit and adjacent area are shown on Drawing 7-1. Seasonal discharge and field water quality measurements for springs and seeps in the proposed Coal Hollow Mine permit and adjacent area have been submitted electronically to the Utah Division of Oil, Gas and Mining Utah Coal Mining Water Quality Database (UDOGM, 2007). Baseline discharge and water quality data for groundwater resources in the proposed Coal Hollow Mine permit and adjacent area are have also been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007). Locations of baseline monitoring stations are shown on Drawing 7-2. Locations of water rights in and adjacent to the proposed Coal Hollow Mine permit area are shown on Drawing 7-3. Water rights data from the proposed Coal Hollow Mine permit and adjacent area are detailed in Appendix 7-3. A plot showing potentiometric levels in alluvial groundwater systems in the proposed Coal Hollow Mine permit and adjacent area is presented in Drawing 7-13.

There are no domestic water supply springs or wells in the proposed mine disturbance ~~permit~~ area. However, ~~wells and~~ springs that provide water for domestic and livestock use are located on and adjacent to the proposed permit area (See Drawing 7-2 and Appendix 7-3). Spring SP-23 (Spring House Spring) is located on the eastern boundary of the proposed Coal Hollow Mine permit area. Spring SP-23 is a groundwater seepage area with both discrete and diffuse flow with a total discharge that is usually about one gallon per minute or less. Historically, this seepage area was used as a domestic water source for the Pugh property (personal communication, Burton Pugh, 2008). However, water from SP-23, which is not developed, has not been used for this purpose for many years.

Spring SP-35 is located along the eastern boundary of the proposed Coal Hollow Mine permit area. Discharge from SP-35 averages less than 0.25 gallons per minute and is occasionally used for drinking water during camping trips or visits to the Pugh property (personal communication, Burton Pugh, 2008). However, there is apparently no associated domestic water right associated with this spring.

Two additional springs, which are located more distant from the proposed mining areas are also used for domestic water supply sources. These include SP-40, which is located at the Sorensen property, and SP-33, which is located at the Johnson property. Springs with stockwatering rights are listed in Appendix 7-3

Some lands east of and adjacent to the proposed Coal Hollow Mine permit area have historically been irrigated using water from alluvial springs. However, irrigation from these springs was apparently limited to home gardens and a few fruit trees. No irrigation of these lands (other than some yard watering at the Swapp Ranch house) is currently occurring nor has it occurred in at least the past 10 years (Personal communication, Burton Pugh, 2008; Richard Dames, 2007). Additionally, limited irrigation of lands occurs east of the proposed Coal Hollow permit area using surface waters derived from runoff from the adjacent Paunsaugunt Plateau area. Irrigation of these lands is largely limited to years with appreciable precipitation and stream runoff (Personal communication, Darlynn Sorensen, 2008).

Groundwater discharge occurs from springs and seeps in the upland areas of the Paunsaugunt Plateau east of the permit area (Tilton, 2001; Appendix 6-3). However, these springs discharge from rock strata that are topographically and stratigraphically up-gradient of and considerable distances from the proposed Coal Hollow Mine permit area. Consequently, groundwater systems in these areas will not be impacted by mining activities and these are not considered further here.

Groundwater resources in the Tropic Shale and underlying Dakota Formation in the permit and adjacent area are not appreciable. During drilling activities in the proposed Coal Hollow Mine permit and adjacent area, appreciable groundwater inflows were not encountered in the Tropic Shale. Other than a single seep (SP-37; Drawing 7-1) which discharges at a rate of less than 0.05 gpm from an apparent fracture system in a sandy horizon along the eastern margin of lower Sink Valley, no springs or seeps with measurable discharge have been identified in the Tropic Shale. The lack of appreciable groundwater discharge in the Tropic Shale is a result of the poor water transmitting properties of the marine shale unit. While sandstone units occur stratigraphically higher in the Tropic Shale in the surrounding area, in areas proposed for surface mining, the unit present consists of a fairly uniform sequence of soft shale, silty shale, and claystone with minor siltstone horizons. Competent sandstone strata in the Tropic Shale overlying proposed mining areas was not observed during drilling. The Tropic Shale acts as a barrier impeding downward migration of groundwater in the proposed Coal Hollow Mine permit and adjacent area where it is present. The unit also forms a basal confining layer for alluvial groundwater systems in the proposed permit area.

Groundwater discharge from the Dakota Sandstone in the permit and adjacent area is also meager. The Dakota Formation consists of shaley strata interbedded with lenticular, fine- to medium-grained sandstone and coal. Because of the pervasiveness of interbedded low-permeability horizons in the formation and the vertical and lateral discontinuity of sandstone horizons, the potential for vertical and horizontal movement of groundwater is limited. While no springs discharge from the Dakota Formation in the permit area, a spring with a discharge of about 1 gpm and displaying little seasonal variability in discharge (SP-4; Drawing 7-1) discharges from an apparent fault zone in the Dakota Formation approximately 1.1 miles south of the proposed Coal Hollow permit area. Additionally, two seeps with discharges of less than 0.05 gpm (SP-27 and SP-34; Drawing 7-1) seep from the Dakota Formation in lower Sink Valley more than ½ mile south of the proposed Coal Hollow Mine permit area. The results of slug testing performed on wells screened in the Smirl coal seam indicate relatively low values of hydraulic conductivity for the coal seam (Table 7-8). In much of the proposed mining area, the coal seam is dry (UDOGM, 2007). Thus, appreciable migration of groundwater through the Smirl coal seam is not anticipated.

No water wells are known to exist in the Tropic Shale or Dakota Formation in the proposed Coal Hollow Mine permit and adjacent area, demonstrating the inability of these formations to transmit useful quantities of water to wells. Groundwaters from the Tropic Shale and Dakota Formation do not contribute measurable baseflow to streams in the proposed permit and adjacent area (at least at the surface in stream channels).

Natural groundwater discharge in the permit and adjacent area occurs primarily from alluvial sediments. Alluvial discharge occurs both as discrete springs and seeps (Drawing 7-1) and also locally as diffuse seepage to the surface. Groundwater discharge areas in the proposed Coal Hollow Mine permit and adjacent area are shown on Drawing 7-4 (see also photograph section). The area of most appreciable alluvial groundwater discharge occurs in central Sink Valley in the northwest quarter of Section 29, T39S, R5W (see Drawing 7-4; groundwater discharge area A). The alluvial groundwater system in this area exists under artesian conditions, resulting from the presence of a considerable thickness of sloping, low permeability clayey sediments overlying coarser, water-bearing alluvial sediments at depth (See ~~cross-section Y—Y' in~~ Drawing 6-3~~6-9~~). The artesian alluvial groundwater system in Sink Valley is likely recharged via mountain-front-recharge along the flanks of the Paunsaugunt Plateau to the east and north of the proposed Coal Hollow Mine permit area. This artesian alluvial groundwater system that exists along the eastern margins of Sink Valley is likely continuous from near mountain-front recharge areas southward along the eastern margins of Sink Valley to the lower portion of Sink Valley. Discharge from the alluvial groundwater systems in and adjacent to the proposed Coal Hollow Mine permit area occurs primarily in two areas (Drawing 7-4). In the northwest quarter of Section 29, T39S, R5W, considerable natural discharge from the alluvial groundwater system occurs through springs and seeps (Drawing 7-4; groundwater discharge area A). Minor discharge from several flowing artesian wells also occurs in this area. The artesian alluvial groundwater system in eastern Sink Valley also likely provides recharge to the clayey alluvial sediments in the southwestern portion of the valley in the proposed Coal Hollow Mine permit area. Discharge from the alluvial groundwater system in groundwater discharge area A area results in decreases to the amount of water in storage in the alluvial groundwater system and also decreases in artesian hydraulic pressure in the aquifer.

Appreciable discharge from the alluvial groundwater system also occurs in lower Sink Valley in the northwest quarter of Section 32, T39S, R5W (see Drawing 7-4; groundwater discharge area B). Sink Valley constricts markedly in this area, which forces shallow alluvial groundwaters flowing down the valley to discharge at the land surface as springs, seeps, and diffuse discharge to the surface (i.e., there is a significant decrease in the cross-sectional area of the alluvial sediments). Groundwater discharge in this area occurs from diffuse seepage to the surface and also as discharges to two springs and several small seeps (Drawing 7-1).

Much of the alluvial groundwater in Sink Valley likely ultimately leaves the valley via evapotranspiration. This conclusion is based on the observation that there is very rarely any discharge of surface water (at least at the surface in the channel) in Sink Valley Wash below Sink Valley (See site SW-9; Drawing 7-2; UDOGM, 2007). The clayey, low-permeability sediments present at the surface over most of Sink Valley also impede appreciable infiltration of precipitation and snowmelt waters into the deeper subsurface. Hence, groundwater recharge to the lower half of the Sink Valley sediments (including the proposed Coal Hollow Mine permit area) likely occurs primarily via horizontal migration of alluvial groundwaters from up-gradient areas.

Flowing artesian groundwater conditions are also observed in monitoring wells screened near the base of the alluvial sediments in the northwest corner of Section 32 T39S, R5W. It is probable that the artesian alluvial groundwater system in Section 29, T39S, R5W is continuous with that in the northwest corner of Section 32. It should be noted that within the proposed Coal Hollow permit area, artesian conditions were not observed in monitoring wells. While the thickness of the alluvial sediments in the artesian groundwater system east of the proposed Coal Hollow permit area range up to 150 feet thick, the thickness of alluvium overlying areas with mineable coal in the proposed Coal Hollow permit area generally does not exceed about 50 feet and in many locations it is considerably thinner.

Natural discharge of alluvial groundwater in the Robinson Creek drainage area is meager. This condition is largely due to the presence of the elevated ridge of impermeable Tropic Shale bedrock associated with the Sink Valley Fault that dissects and effectively isolates the alluvium east of the fault from that west of the fault (See Drawing 6-1). Because of the low permeability of the Tropic Shale, this condition apparently forces alluvial groundwater east of the Tropic Shale ridge to flow to the south toward Sink Valley that would otherwise report to the Robinson Creek drainage. During high flow conditions in the alluvial groundwater system east of the Tropic Shale ridge, minor amounts of groundwater "overtop" the bedrock ridge and drain via surface flow over the Tropic Shale bedrock, where it either recharges shallow alluvial sediments to the west of the fault or is lost to evapotranspiration. The influence of the Tropic Shale ridge is readily evident in field observations, with marked differences in vegetation and soil moisture being apparent on opposite sides of the ridge. During low-flow conditions, discharge from the overtopping of the bedrock ridge has generally not been observed. Isolated areas of soil wetness and shallow perched alluvial groundwater systems that exist west of the bedrock ridge in the northeast corner of Section 30 and the southeast corner of Section 19, T39S, R5W are likely sourced via this mechanism.

Seepage of alluvial groundwater into the deeply incised lower Robinson Creek stream channel occurs near the contact with the underlying Dakota Formation in the southeast quarter of Section 19, T39S, R5W. This water is likely related to saturated alluvial deposits underlying the Robinson Creek stream channel. The alluvial groundwater emerges near where the stream channel intersects the alluvial groundwater system. It is noteworthy that the location of the emergence of alluvial water in the channel has varied somewhat over time. The bank seepage water is likely alluvial groundwater that seeps to the surface where the incised stream channel intersects the potentiometric surface of the alluvial groundwater system. Typically, this is near the contact with the underlying Dakota Formation bedrock in the bottom of the stream channel. Because of the seasonal changes in the elevation of the potentiometric head in the alluvial groundwater system, the location of the bank seepage is variable over time (i.e. the variability in the bank seepage locations are likely controlled primarily by temporal variability in potentiometric levels in the alluvial groundwater system rather than by fixed, permeability-controlled groundwater preferential pathways in the aquifer skeleton). Consequently, the bank seepage locations are not well-defined point sources, but rather dynamic seepage fronts along this general reach of the stream.

The Robinson Creek stream channel above this location is almost always dry (except for in direct response to torrential precipitation events or during the springtime runoff season during wet years. This seepage of alluvial water in the Lower Robinson Creek channel is typically about 5 to 10 gpm or less and is routinely monitored at monitoring station SW-5 (Drawing 7-2).

Information on water quality for groundwaters and surface-waters has been uploaded into the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007) and is summarized and described in Appendix 7-1.

Appreciable spatial variability exists in water quality in groundwaters and surface waters in the proposed Coal Hollow permit and adjacent area. Stiff diagrams depicting solute compositions and overall water quality for groundwaters and surface waters in the proposed Coal Hollow Mine permit and adjacent area are shown in Appendix 7-1. Important water quality characteristics for groundwaters are summarized below.

Groundwater Source	**Chemical type**	**TDS (mg/L)**
Alluvial groundwaters, coarse-grained system east of proposed permit area	Calcium-magnesium-bicarbonate	380 mg/L to 500 mg/L typically, Little seasonal variability
Alluvial groundwaters in south sink valley	Variable, magnesium-bicarbonate sulfate, calcium-magnesium-bicarbonate	450 mg/L to 3,600 typically, Highly variable based on season and climate for shallow systems, less variability in deeper system
Dakota Formation, fault groundwater system south of proposed permit area	Sodium-bicarbonate	500 mg/L to 600 mg/L typically, Little seasonal variability

It is apparent that the overall water quality of alluvial groundwater degrades from the mountain-front recharge water to the artesian groundwater system east of the proposed Coal Hollow permit area to the non-artesian shallow alluvial groundwater systems located in the more distal portions of Sink Valley. These changes are due to groundwater interaction with soluble minerals in the primarily Tropic Shale-derived sediments that make up the shallow alluvial materials in the proposed permit area.

This down-gradient degradation in water quality is shown graphically on Drawing 7-5. In Drawing 7-5, the average specific conductance values in μS/cm for representative springs and seeps in the Sink Valley drainage are plotted on the map as circles with the circle areas being proportional to the specific conductance average for the spring or seep. The specific conductance information used in generating Drawing 7-5 has been submitted electronically to the Division's hydrology database (UDOGM, 2007). It is readily apparent from Drawing 7-5 that the specific conductance (which is a reflection of the dissolved solids concentration) is degraded from the mountain-front recharge water (represented by stream SW-8) to the artesian alluvial groundwater system in the northwest quarter of Section 29, T5W, R39S, to the alluvial groundwaters in the southern portion of Sink Valley below the Coal Hollow Mine permit area.

Specific conductance values were used for plotting in Drawing 7-5 because specific conductance values are available for all springs and seeps, while laboratory chemical analyses are available for only some of the springs and seeps. Stiff (1951) diagrams for selected springs along this geochemical evolutionary pathway are shown on Figure 14 of Appendix 7-1. It is apparent from the Stiff diagrams and from geochemical information submitted to the Division (UDOGM, 2007) that the mountain-front recharge water (represented by monitoring site SW-8 in upper Swapp Hollow) is of the calcium-magnesium-bicarbonate chemical type with an average TDS concentration of 333 mg/L. Groundwater downgradient of the mountain-front recharge areas in the artesian alluvial groundwater system in Section 29, T5W, R39S, is also of the calcium-magnesium-bicarbonate chemical type, with an average TDS concentration at artesian well Y-61 of 400 mg/L. Further downgradient in the artesian alluvial groundwater system in Section 29, the geochemical composition at SP-8 is of the calcium-magnesium-bicarbonate chemical type with a somewhat increased TDS concentration of 425 mg/L. In the lower portions of Sink Valley in Section 32, T5W, R39S, the chemical quality of the alluvial groundwater is appreciably degraded relative to that in the upper portions of the groundwater system. At spring SP-6, the composition of the alluvial groundwater is seasonally variable and is of the magnesium-bicarbonate-sulfate, or calcium-magnesium-bicarbonate-sulfate chemical type. The TDS concentrations at SP-6 average 970 mg/L. The chemical composition of alluvial groundwater at SP-33 is of a geochemical type similar to that at SP-6, although TDS concentrations are somewhat lower, averaging 795 mg/L. The spatial variability apparent in the TDS concentrations in the alluvial groundwater in Section 32 is likely related to flushing effects resulting from higher groundwater fluxes through zones of increased permeability in the alluvium. It is noteworthy that groundwater in the gravelly zones in the deeper alluvial east of the permit area in Section 32 monitored at the 85-foot deep well LS-85 is considerably lower in TDS concentration with an average of 457 mg/L. The lower TDS concentrations of artesian alluvial groundwater in the deeper, coarser-grained portions of the alluvium are likely attributable to the isolation of these groundwaters from the shallow, clayey, Tropic Shale derived alluvial sediment in the near-surface alluvial groundwaters.

The appreciable temporal variability in the solute geochemical compositions of the shallow alluvial groundwaters in Section 32 is likely attributable to seasonal and climatic variability in the groundwater flux rate through these systems and corresponding variability in rock/water ratios and residence time in the evaporate mineral rich Tropic Shale derived shallow alluvial sediments present in this portion of Sink Valley. Alluvial groundwaters in the deeper portions of Sink Valley to the east in Section 32 are part of a larger, more continuous groundwater system that is hydraulically isolated from overlying shallow recharge sources, and consequently have not exhibited similar temporal variability in solute geochemical composition.

Surface Water Resources

Surface water resources in the proposed Coal Hollow Mine permit and adjacent area are described in Appendix 7-1 and are summarized below.

Surface waters in the proposed Coal Hollow Mine permit and adjacent area are tributary to Kanab Creek. Surface waters in the northern portion of the proposed permit and adjacent area drain into the Robinson Creek and upper Kanab Creek drainages. Surface waters in the southern portion of the proposed permit and adjacent area drain into the Sink Valley Wash drainage which is tributary to Kanab Creek about 6 miles below the proposed Coal Hollow Mine permit area. Surface water drainages in the permit and surrounding areas are shown in Appendix 7-1. Surface water baseline monitoring stations are shown on Drawing 7-2. Locations of surface-water water rights in and adjacent to the proposed Coal Hollow Mine permit and adjacent area are shown on Drawing 7-3. Water rights data from the proposed Coal Hollow Mine permit and adjacent area are detailed in Appendix 7-3.

Information on water quality for groundwaters and surface-waters has been uploaded into the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007) and is summarized and described in Appendix 7-1.

Surface waters in Kanab Creek are used for stock watering and crop irrigation in the irrigable lands adjacent to Kanab Creek west of the proposed Coal Hollow Mine permit area. Discharge in Kanab Creek measured near the town of Alton (SW-1) is seasonally dependent and largely influenced by upstream water use. Discharge in Kanab Creek monitored at SW-1 typically ranges from 10 cfs or less during the springtime runoff period to 1 cfs or less during the summertime.

Discharge in Lower Robinson Creek drainage is meager. Other than during the springtime runoff event in wet years or during torrential precipitation events, flow has not been observed at monitoring stations SW-4 and SW-101 (Drawing 7-2). Discharge at the lower monitoring site on Lower Robinson Creek (SW-5; Drawing 7-2) is meager. The small discharge occasionally present at SW-5 is derived from the seepage of alluvial groundwater into the Lower Robinson Creek stream channel between monitoring sites SW-101 and SW-5

Tributaries to the Sink Valley Wash drainage in the proposed Coal Hollow Mine permit and adjacent areas include (from north to south) Water Canyon, an unnamed drainage south of Water Canyon in Section 21 T39S, R5W, and Swapp Hollow. Discharge rates in these drainages are highly seasonally dependent (UDOGM, 2007; Appendix 7-1). Discharges in the Water Canyon and Swapp Hollow drainages are intermittent or perennial in nature with discharge peaks occurring during the springtime runoff season and much lower flows occurring during the late summer and fall months. Discharge in the unnamed drainage in Section 21 T39S, R5W is ephemeral.

The water quality and discharge characteristics of surface waters in the proposed Coal Hollow Mine permit and adjacent area are presented in UDOGM (2007) and described in Appendix 7-1. Solute compositions of stream waters are also depicted graphically as Stiff diagrams in Appendix 7-1. The solute compositions of surface waters in the proposed Coal Hollow Mine permit and adjacent area are summarized below.

Source	Chemical type	TDS (mg/L)
Robinson Creek/Dry Fork	Calcium-magnesium-bicarbonate	300 mg/L typical
Lower Robinson Creek	Variable, magnesium-sulfate-bicarbonate	300 – 3,000 mg/L typical, dependent on discharge
Swapp Hollow	Calcium-magnesium-bicarbonate	250-350 mg/L typical
Kanab Creek	Magnesium-calcium-bicarbonate-sulfate during high flow, variable during low-flow, variability likely due largely to interaction with Tropic Shale soils and irrigation return flows	500-1,300 mg/L typical, Variable dependent on season and irrigation use
Sink Valley Wash	Magnesium-calcium-bicarbonate	600 -1,500 mg/L typical, variable dependent on discharge

Considerable seasonal variability exists in the solute compositions of stream waters in Kanab Creek in the proposed Coal Hollow Mine permit and adjacent area (UDOGM, 2007; Appendix 7-1). During low-flow conditions, interactions between stream waters and Tropic Shale or Tropic Shale-derived alluvial sediments likely result in increased TDS concentrations. Return flow from irrigated fields and interactions with soils rich in soluble minerals also likely contribute to increased TDS concentrations in the summertime. During the spring runoff season, high surface-water flows that originate from the adjacent upland areas dominate the flow in the channel. The TDS concentrations of Kanab Creek waters during high-flow conditions are thus lower than during the low-flow season. Much less seasonal variability in solute content in surface water flows from the mountain stream in Swapp Hollow (UDOGM, 2007; Appendix 7-1). This condition is likely attributable to the fact that the stream in Swapp Hollow, which originates on geologic formations overlying the Tropic Shale, has considerably less contact with the Tropic Shale than does Kanab Creek. Additionally, there are no known irrigation diversions or returns above the stream monitoring point (SW-8; Drawing 7-2) in Swapp Hollow.

722 CROSS SECTIONS AND MAPS

722.100 A map showing the locations of springs and seeps in the proposed Coal Hollow Mine permit and adjacent area is presented in Drawing 7-1. A map showing potentiometric levels in alluvial groundwater systems in the proposed Coal Hollow and adjacent areas is presented in Drawing 7-13. It is important to note that the alluvial groundwater potentiometric contours depicted in Drawing 7-13 ~~2~~ are not representative of a laterally or vertically continuous groundwater system. Within the proposed Coal Hollow Mine permit and adjacent area, appreciable portions of the alluvial sediments are not saturated. Additionally, perched groundwater conditions are present in many locations in the alluvium in the area. In other words, the alluvial groundwater systems in the proposed Coal Hollow Mine permit and adjacent area are not a single, interconnected aquifer. Rather, there exist several areas of saturated alluvium, which may or may not be in good hydraulic communication with adjacent areas. Consequently, it is not possible or meaningful to construct a true potentiometric contour map in the strict sense. Consequently, it is not appropriate to evaluate regional potentiometric trends over large distances or to infer precise groundwater flow directions or hydraulic gradients in the alluvial groundwater system based on Drawing 7-13 ~~2~~. The alluvial groundwater system potentiometric map presented in Drawing 7-13 ~~2~~ is useful for evaluating approximate local potentiometric conditions and general saturation trends.

722.200 Location of surface water bodies

Within the proposed Coal Hollow Mine permit and adjacent area, no significant natural ponds or lakes occur. The locations of springs and streams are shown in Drawing 7-1. Many small earthen impoundments and ponds have been created to store surface-water runoff and spring discharge water for stock watering and irrigation use. Some of these impoundments were created by constructing straight or semi-circular berms across ephemeral surface water drainages to impound surface runoff. Because of the character of the alluvial sediments, some of the ponds have become filled with sediment over time and the holding capacities have diminished. The locations of ponds and associated conveyance ditches are shown on Drawing 7-7.

722.300 Baseline monitoring stations

Baseline monitoring stations are shown on Drawing 7- 2. A map showing the locations of monitoring wells in the proposed Coal

Hollow permit and adjacent area is presented in Drawing 7-12 and on Figure 12 of Appendix 7-1. Drawing~~s 7-2 and~~ 7-12 also shows monitoring stations from which baseline hydrologic data were collected in previous studies. Monitoring station locations, elevations, and other details are presented in Table 7-1.

722.400 Location of water wells

Water well locations are shown in Drawing 7-2 and Drawing 7-12. Well construction details and locations are presented in Table 7-2.

722.500 Contour map(s) of disturbed area(s)

Surface contours representing the existing land surface configuration of the proposed permit area (including potentially disturbed areas) are shown on Drawing 5-1 and the post mining land configuration is shown on 5-35. Cross sections with both these landforms are shown on Drawing 5-36. The premining landform, with exception of the Facilities area and Lower Robinson Creek, are from an aerial flight that was limited to a five foot contour interval. Therefore, contours have been interpolated down to a 2 foot level using the available aerial flight information. This interpolation provides accuracy for the Division to make the necessary determinations. The Facilities area and portions of Lower Robinson Creek are actual survey data to the accuracy of 2-foot contours.

723 SAMPLING AND ANALYSIS

Water quality sampling and analyses have been and will be conducted according to the "Standard Methods for the Examination of Water and Wastewater" or EPA methods listed in 40 CFR Parts 136 and 434. Information regarding laboratory analytical methods utilized in performing water quality analyses at the analytical laboratories has been submitted to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007).

724 BASELINE INFORMATION

Baseline groundwater, surface-water, geologic, and climatologic data are described in Appendix 7-1 and summarized below.

724.100 Groundwater Information

The location of wells and springs in the proposed Coal Hollow Mine permit and adjacent area are shown on Drawings 7-1 (Spring and seep survey map), 7-2 (Baseline monitoring locations), and 7-12 (Monitoring well location map). Groundwater rights in and around the proposed Coal Hollow Mine permit area are shown on Drawing 7-3 and tabulated in Appendix 7-3.

Seasonal quality and quantity of groundwater and usage is presented in Appendix 7-1 and UDOGM (2007). Baseline discharge and water quality data have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality (UDOGM, 2007).

Baseline monitoring of groundwater resources in and around the proposed Coal Hollow permit area have been carried out by several entities. Previous hydrologic studies of the region have been made in the Alton Coal Field area by Goode (1964, 1966), Sandberg (1979), Cordova (1981), and Plantz (1983). Selected hydrologic data collected in conjunction with these studies have been incorporated into the hydrologic analysis and baseline data included in this permit application.

During the 1980's, extensive monitoring of groundwater resources in the proposed permit and surrounding areas was performed by Utah International, Inc. Utah International Inc.'s groundwater monitoring activities included the construction of numerous groundwater monitoring wells, aquifer testing activities, and the performance of discharge, water level, and field and laboratory water quality monitoring of springs, seeps, and wells. These baseline monitoring activities were performed as part of a proposed coal mine permitting action in the Alton Coal Field. Ultimately, the proposed coal mining action did not proceed. Relevant monitoring information from the Utah International, Inc. baseline monitoring activities have been included as supplemental baseline data included in this permit application.

Commencing in the 2nd quarter of 2005, regular quarterly baseline monitoring of groundwater resources has been commissioned by Alton Coal Development, LLC. Baseline monitoring of springs, seeps, and groundwater wells in and around the proposed Coal Hollow Mine permit area have been routinely performed. Data collected in the baseline monitoring activities have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007).

Baseline potentiometric information from wells has been input into the DOGM database. For non-flowing-artesian wells, this information has been input in a depth-to-water-relative-to-the-top-of-the-well-casing format using units of feet. For wells experiencing flowing artesian conditions, the potentiometric data are reported to the database in feet as a height-of-the-potentiometric-surface-above-the-top-of-the-well-casing format expressed as a negative number (which makes the flowing-artesian and non-flowing-artesian potentiometric measurements directly comparable). For both conditions, the reported measurements can be directly converted to an absolute water elevation by subtracting the reported value from the elevation of the top of the well casing.

The potentiometric head in monitoring wells experiencing flowing-artesian conditions is measured either 1) by temporarily extending the height of the well casing and allowing the water level to stabilize and the performing a height of the water column measurement (where the artesian pressure is small), or 2) by using a pressure gauge to measure the shut-in artesian pressure in the well and then converting that number to an equivalent height in feet.

During December 2006 and January 2007 an extensive drilling and monitoring well construction program was implemented. This hydrogeologic program included the installation of 30 groundwater monitoring wells in and adjacent to the proposed Coal Hollow Mine permit area. The focus of the drilling program was to characterize the stratigraphy and hydrogeologic properties of alluvial groundwater systems in and adjacent to proposed mining areas. Aquifer characterization of the alluvial groundwater system was also performed using pump testing and slug testing techniques. Investigative methods utilized and the results of the analysis of the data are described in Appendix 7-1.

724.200 Surface Water Information

The locations of streams, stock watering ponds, and conveyance ditches in the proposed Coal Hollow Mine permit and adjacent area are shown on Drawing 7-7. Surface-water rights in and adjacent to the proposed Coal Hollow Mine permit area are shown on Drawing 7-3 and tabulated in Appendix 7-3. Surface-water discharge rates and water quality data have been submitted electronically to the Utah Division of Oil, Gas and

Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007). Additional surface-water information is provided in Appendix 7-1.

It is not anticipated currently that discharge from the proposed Coal Hollow Mine will be necessary. Where necessary, alluvial groundwater that may be intercepted by mining will be placed in drains and diverted away from disturbed areas and discharged (i.e., as groundwater dewatering). However, a Utah UPDES discharge permit will be obtained so that if discharge of mine water becomes necessary, it can be discharged in accordance with the UPDES discharge permit. The exact locations of mine water discharge points will be established upon issuance of the UPDES discharge permit. Any mine discharge water will be placed in either the Lower Robinson Creek drainage or the Sink Valley Wash drainage. Both of these drainages are tributary to Kanab Creek.

As described in R645-301-728.320, acid drainage is not expected from the proposed mining operation. This is due to the pervasiveness of carbonate minerals in the mine environment that will neutralize any acid produced.

Seasonal quality and quantity of groundwater and usage is described herein and in Appendix 7-1. Baseline discharge and water quality data have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality (UDOGM, 2007).

Baseline monitoring of surface-water resources in and around the proposed Coal Hollow permit area have been carried out by several entities. Previous hydrologic studies of the have been made in the Alton Coal Field area by Goode (1964, 1966), Sandberg (1979), Cordova (1981), and Plantz (1983). Selected hydrologic data collected in conjunction with these studies have been incorporated into the baseline data as part of this permit application.

During the 1980's, extensive monitoring of surface water resources in the proposed permit and surrounding areas was performed by Utah International, Inc. Utah International Inc.'s groundwater monitoring activities included the operation of continuous recording stations on selected streams, and the performance of routine surface-water discharge measurements and field and laboratory water quality analyses. These baseline monitoring activities were performed as part of a proposed coal mine permitting action in the Alton Coal Field. Ultimately, the proposed coal mining action did not proceed. Relevant monitoring information from the Utah International, Inc. baseline monitoring activities have been included as supplemental baseline data as part of this permit application.

Commencing in the 2nd quarter of 2005, regular quarterly baseline monitoring of surface-water resources has been commissioned by Alton Coal Development, LLC. Baseline monitoring of surface-waters in and around the proposed Coal Hollow permit area, including surface-water discharge measurements and field and laboratory water quality analyses, have been routinely performed.

All surface waters in the proposed Coal Hollow Mine permit and adjacent area are tributary to the Kanab Creek drainage. Surface-water monitoring stations from which baseline data have been collected are shown on Drawing 7-2 and include the following:

Sink Valley Wash drainage

SW-8 (Swapp Hollow above proposed mining areas), SW-7 (unnamed drainage in Section 21, T39S, R5W), RID-1 (irrigation diversion of water from Water Canyon drainage above proposed mining areas), SW-6 (headwaters of unnamed tributary to lower Sink Valley Wash), ~~and~~ SW-9 (Sink Valley Wash below proposed mining areas), and SW-10 (unnamed tributary to Sink Valley Wash approximately 1.7 miles south of proposed mining areas).

Lower Robinson Creek drainage

SW-4 (Robinson Creek above proposed mining areas), SW-101 (Lower Robinson Creek near proposed mining areas), BLM-1 (Lower Robinson Creek adjacent to proposed mining areas) and SW-5 (Lower Robinson Creek below proposed mining areas).

Kanab Creek drainage

SW-1 (Kanab Creek near Alton, Utah; above proposed mining areas), SW-3 (Kanab Creek above proposed mining areas), and SW-2 (Kanab Creek below Lower Robinson Creek and below proposed mining areas). Additionally baseline hydrologic data from Lamb Canal, which is an irrigation ditch that conveys water from a diversion in Kanab Creek to irrigated lands adjacent to Kanab Creek west of proposed mining areas, is also collected.

724.300 Geologic Information

Geologic information in sufficient detail to determine the probable hydrologic consequences of mining and determine whether reclamation as required by R645 can be accomplished is given in Chapter 6 of this permit application package and in Appendix 7-1.

724.400 Climatological Information

Climatological information, including temperature and precipitation data, have been routinely measured and recorded at the Alton, Utah weather station (420086) since 1928. The station is located in the town of Alton, approximately two miles north of the proposed Coal Hollow Mine permit area. Climatological data collected at the Alton station for the 77 year period from 1928 to 2005 are summarized in Table 7-3.

Climatological data from the proposed Coal Hollow Mine permit and adjacent area are plotted in Drawing 7-8.

An automated weather station was installed in the proposed Coal Hollow Mine permit area in December 2005. The station is configured to continuously monitor and record temperature, wind velocity, and wind direction data. The station is also configured to continuously measure and record precipitation, although the tipping rain-gauge is not operative during winter months. Climate data from the proposed Coal Hollow Mine and adjacent area are also presented in Appendix 7-6.

724.411 Seasonal precipitation

Precipitation data from the Alton, Utah weather station indicates average annual precipitation of 16.38 inches per year. Doelling (1972) reports average annual precipitation in the Alton Coal Field area ranging from 9 to 20 inches annually with slightly higher increments likely in the higher parts of the plateau (Doelling, 1972). There are generally two annual wet periods in the region. During the wintertime, cyclonic storms bring precipitation (mainly snowfall) to the region. During the summertime, storms originating from convection of air from the Gulf of Mexico or the Pacific Ocean bring rains to the region. Of the two annual wet cycles, the summer rainfall is most reliable. Average monthly precipitation at the Alton station ranges from a low of 0.57 inches in June to a maximum of 1.80 inches in February. Daily temperature and precipitation data recorded at the Coal Hollow Project weather station during 2006 and early 2007 are presented in Appendix 7-6.

The Palmer Hydrologic Drought Index (PHDI; NCDC, 1997) indicates long-term climatic trends for the region. The PHDI is a monthly value generated by the National Climatic Data Center (NCDC) that indicates the severity of a wet or dry spell. The PHDI is computed from climatic and hydrologic parameters such as temperature, precipitation, evapotranspiration, soil water recharge, soil water loss, and runoff. Because the PHDI takes into account parameters that affect the balance between moisture supply and moisture demand, the index is a useful for evaluating the long-term relationship between climate and groundwater recharge and discharge. A plot of the PHDI for Utah Region 4 (which includes the proposed Coal Hollow Mine permit and surrounding area) is shown in Drawing 7-9. It is apparent in Drawing 7-9 that the region has experienced cyclical periods of drought and wetness since 1980. Baseline hydrologic monitoring performed by Utah International, Inc in 1987 and 1988 occurred during a period of near normal wetness. Recent baseline hydrologic monitoring conducted in 2005 and 2006 occurred during a period of moderate to severe wetness, with 2005 being wetter than 2006.

724.412 Wind direction and velocity

Wind data have been collected at the Coal Hollow Project weather station since December 2005. Monthly wind data from the Coal Hollow Project weather station are available from January 2006 through March 2006, and from November 2006 through May 2007. Monthly wind data are plotted as wind rose diagrams, which depict the average direction and velocity of prevailing winds, in Appendix 7-1. Based on recent data from the Coal Hollow Project weather station, it is apparent that the predominant wind direction in the proposed Coal Hollow Mine permit area (during the months for which data are available) are from the northeast, with secondary peaks from the north and south-southwest (Appendix 7-1). Surface winds recorded at the Coal Hollow Project weather station averaged about 6.4 miles per hour. Tabulated hourly wind data from the Coal Hollow Project weather station are maintained on file at Alton Coal Development, LLC.

Wind data have also been collected historically at nearby locations by governmental and other entities. The regionally predominant direction of winds in the region is southwest through west. Secondary peaks are from southeast and northwest. Surface winds in the area average approximately 8 miles per hour. Higher wind speeds are associated with fronts and storms and generally occur during the springtime.

724.413 Seasonal temperature ranges

Temperature data from the region are summarized in Table 7-3. Temperatures in the permit area vary greatly. Temperature data from the Alton station (1928-2005) indicate that monthly average low temperatures are below freezing for the 6-month period from November to April. Monthly average minimum temperatures range from a low of 15.1 °F during January to a high of 49.8 °F in July. Monthly average maximum temperatures range from a low of 39.5 °F in January to a high of 82.6 °F in July. Daily maximum and minimum temperature data collected at the Coal Hollow Project weather station during 2006 and the first quarter of 2007 are presented in Appendix 7-6 and plotted in Drawing 7-8. The maximum temperature recorded during this period was 93.3 °F in July 2006. The minimum temperature recorded during this period was -7.3 °F in January 2007.

724.500 Supplemental Information

Other than the possible short-term diminution in discharge rates from alluvial groundwater systems, including the potential short-term diminution of discharge rates from some springs and seeps in Sink Valley, adverse impacts to the hydrologic balance, either on or off the permit area are not expected to occur. It is not anticipated that acid- and toxic-forming materials will cause significant contamination of groundwater or surface-water supplies. Any discharges of mine waters to surface-water systems will be regulated under and meet the criteria of a UPDES discharge permit. The mining and reclamation plan has been designed to minimize the potential for disturbance or disruption of the hydrologic balance and to protect groundwater and surface-water resources in the area.

If substantial alluvial groundwater inflows into mining areas occur as mining progresses in close proximity to alluvial springs and seeps in the eastern ¼ of Section 30, T39S, R5W and the northwest ¼ of Section 29, T39S, R5W or in close proximity to coarse-grained alluvial sediments in the artesian groundwater system along the eastern side of Sink Valley, Alton Coal Development, LLC will evaluate hydrogeologic conditions at the time such may occur. It should be noted that very large discharges into mine workings are not anticipated based on the results of recent drilling and aquifer testing performed in these areas (see Appendix 7-1). Based on the hydrogeologic conditions encountered, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine, which may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to protect groundwater resources up-gradient of mining activities. The potential for success of such protective measures in minimizing drainage of alluvial deposits up-gradient of proposed mining areas is believed to be good, given that the thickness of the alluvium in these areas is generally on the order of about 20 to 50 feet and these sediments are directly underlain by essentially impermeable Tropic Shale in proposed mining areas. It is important to note that while temporary impacts to groundwater discharge rates from alluvial springs and seeps could possibly occur, these impacts will likely be short-lived. This conclusion is based on the fact that individual mine pits in most instances will remain open for no more than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled). The variability in the time individual pits remain open is related to the thickness of overburden at the pit and the state of the overall spoil balance. It should be noted that these times could be somewhat greater if the mining production rate is less than the currently anticipated rate (in the event that contracts for the full 2 million tons of coal per year are not in place). However, the backfilling and rough grading requirements of R645-301.553 will be met (except where a variance to this regulation has been requested to assist with the transition to the adjacent federal coal reserves in the south pits area). After mine pits are backfilled and reclaimed, the potential for appreciable continued drainage of up-gradient alluvial groundwater through the backfilled pits in that area is low. When mining is complete in an area, seasonal recharge to alluvial groundwater systems will gradually replenish groundwater to the alluvial groundwater system. Large-scale dewatering of the alluvial groundwater system, such that appreciable compaction of the aquifer skeleton could occur, is not anticipated (see Appendix 7-1).

If diminution of discharge rates from seeps and springs does occur as a consequence of mining and reclamation activities, any lost water will be replaced according to all applicable Utah State laws and regulations using the water replacement source specified in R645-301-727. The quantity and quality of replacement water detailed in R645-301-727 will be suitable for the existing premining uses and approved postmining land uses.

It should be noted that the proposed Coal Hollow Mine plan calls for the temporary ~~permanent~~ diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of groundwater or surface-water resources, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

If excess groundwater were to be encountered during mining operations such that it could not be adequately managed or discharged in compliance with the Utah UPDES discharge permit (which is considered unlikely), Alton Coal Development, LLC may when necessary and with the approval of the Utah Division of Oil, Gas and Mining construct supplemental containment and settlement ponds in which mine discharge waters may be held for treatment (where necessary) and subsequent discharge through UPDES discharge points in compliance with the UPDES discharge permit.

724.700 Alluvial Valley Floor Determination

A field investigation has been performed in the proposed Coal Hollow Mine permit and adjacent area to provide to the Division the information required to make an evaluation regarding the existence of a probable alluvial valley floor in the proposed Coal Hollow Mine permit and adjacent area. The results of this field investigation and related information is provided in Appendix 7-1. Additional information regarding potential alluvial valley floors in the area is provided in Appendix 7-7.

A report detailing the findings of a previous field investigation performed by Water Engineering & Technology, Inc., entitled "Geomorphological and sedimentological characteristics of Sink Valley, Kane County, Utah" is included as Appendix 7-4.

725 BASELINE CUMULATIVE IMPACT AREA INFORMATION

Appendix 7-1 contains the results of a comprehensive investigation of groundwater and surface-water systems in the proposed Coal Hollow Mine permit and adjacent area. Appendix 7-1 also includes information regarding the probable hydrologic consequences of coal mining in the proposed Coal Hollow Mine permit area and recommendations for hydrologic monitoring. Appendix 7-1 also includes the results of a field investigation performed in the proposed Coal Hollow Mine permit and adjacent area to provide to the Division of Oil, Gas and Mining the information required to make an evaluation regarding the existence of a probable alluvial valley floor in the proposed Coal Hollow Mine permit and adjacent area. This Information together with the information submitted herein can be used to assess the probable cumulative hydrologic impacts of coal mining and reclamation operations in the proposed Coal Hollow Mine permit and adjacent area as required by R645-301-729.

R645-301-726 Modeling

No numerical models have been created for the permit area nor are any planned.

727 ALTERNATIVE WATER SOURCE INFORMATION

This section provides information on the alternative water source that will be used to replace water from groundwaters or surface waters should they be impacted by mining and reclamation activities in the proposed Coal Hollow Mine permit and adjacent area. The alternative water source is a water production well planned for construction on private land leased by Alton Coal Development, LLC in the northwest quarter of Section 29, Township 39 South, Range 5 West. The planned location for the well, which is situated within the proposed Coal Hollow Mine permit area, is shown on Drawing 5-8C. The well will produce water from the alluvial groundwater system in Sink Valley in locations up-gradient of proposed mining operations. Based on aquifer testing performed in the alluvial groundwater system near the proposed water well (using the existing well Y-61 as a pump testing well), it is believed that adequate water can be produced from the new well to satisfy the potential water replacement needs of the mine. Details of the aquifer testing and information on the hydrogeologic characteristics of the Sink Valley alluvial groundwater system are presented in Appendix 7-1.

Water quality data from the Sink Valley alluvial groundwater system near the location of the proposed new water well have been collected from well Y-102 and have been submitted electronically to the Utah Division of Oil, Gas and Mining Utah Coal Mining Water Quality Database (UDOGM, 2007). It is anticipated that the quantity and quality of water produced from the new water production well will be suitable for the existing premining uses and approved postmining land uses.

It should be noted that the proposed water replacement well source will produce water from the coarse-grained alluvial groundwater system in Sink Valley. Nearby springs that could potentially be impacted by mining and reclamation activities are supported by the same alluvial groundwater system. However, while modest decreases in the artesian hydraulic pressures in the alluvial groundwater system could potentially result in diminution of spring flows, the planned new water well will likely be approximately 100 feet deep and will be equipped with an electric well pump giving it the capacity to produce groundwater from the alluvial system even if the hydraulic head in the area were to be diminished such that artesian flow conditions temporarily ceased to exist.

An analysis of the total average discharge of state appropriated groundwaters from the permit and adjacent area has been performed to determine whether the quantity of water that could likely be produced from the new water replacement well will be adequate for potential replacement needs. Based on baseline spring discharge data submitted to the Division (UDOGM, 2007), it is determined that the average discharge of all state appropriated groundwater from groundwater discharge area A (Drawing 7-3, Drawing 7-4) is approximately 35 gpm. The state appropriated waters in groundwater discharge Area A include most of the significant springs in the area and essentially all of the largest springs in the area (Drawing 7-3; Appendix 7-3). The average discharge of all state appropriated groundwater from groundwater discharge area B (Drawing 7-4) is approximately 17 gpm. Using an unlikely worst-case scenario and assuming that all springs with state appropriated waters in both Areas A and B were to cease flowing, a total replacement of approximately 52 gpm would be required. The proposed new water well located in Section 29, Township 39 South, Range 5 West will be designed to produce water at that quantity and, therefore, should be able to provide adequate replacement water in even this worst-case scenario (which is not considered likely). Aquifer analysis described in Appendix 7-1 suggests that the yield of the alluvial groundwater system in which the new water well will be constructed should be capable of sustaining discharges of the required magnitude and for the lengths of time that the need for replacement water would be likely. It should be noted that if the need arises to provide replacement water for impacted state appropriated waters, the duration of the need will likely be of a relatively short duration (see Section 728 below).

Alton Coal Development, LLC has entered into a written agreement with the town of Alton, Utah to transfer the point of diversion for 50 acre-feet of water for use at the Coal Hollow Mine. A copy of this agreement is included in Appendix 7-8 (in confidential binder). This water will be available for all uses at the mine including potential use for water replacement. The planned new water well will be constructed on lands currently leased by Alton Coal Development, LLC. Consequently, no new landowner access agreement will be required for the drilling of the well.

728 PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION

This section describes the probable hydrologic consequences of surface coal mining in the proposed Coal Hollow Mine permit area. This determination is based on data presented herein and on information provided in Appendix 7-1. This mining and reclamation plan has been designed to minimize potential adverse impacts to the hydrologic balance. It should be noted that this PHC and also Appendix 7-1 may be updated periodically as required as additional hydrogeologic information and mining data become available in the future.

728.310 Potential adverse impacts to the hydrologic balance

Other than the possible short-term diminution in discharge rates from alluvial groundwater systems, including the potential short-term diminution of discharge rates from some springs and seeps in Sink Valley, appreciable adverse impacts to the hydrologic balance, either on or off the permit area are not expected to occur. The basis for this determination is discussed below.

As discussed in Section 721 above, minimal groundwater resources exist in the Tropic Shale, which directly overlies the coal reserves in proposed mining areas. Groundwater in the Tropic Shale does not provide measurable baseflow discharge to streams in the area. The lack of appreciable groundwater flow in the Tropic Shale is a result of the poor water transmitting properties of the marine shale unit. Consequently, it is anticipated that little groundwater will be encountered in the Tropic Shale in mining areas. Thus, the potential for adverse impacts to the hydrologic balance resulting from mining through the Tropic Shale in the proposed Coal Hollow Mine permit area is minimal.

Similarly, as described in Section 722 above, groundwater resources in the Dakota Formation underlying the coal seam to be mined are not appreciable. This condition is fundamentally a result of the heterogeneity of the rock strata in the Dakota Formation which impedes the ability of the formation to transmit groundwaters significant distances vertically or horizontally. The presence of the essentially impermeable Tropic Shale on top of the Dakota Formation also minimizes the potential for vertical recharge to the Dakota Formation. Mining operations will remove the overlying Tropic Shale rock strata from the Dakota Formation in addition to the Smirl coal seam deposit at the top of the Dakota Formation in mined areas. However, because the pre-mining hydraulic communication between the Tropic Shale and the underlying Dakota Formation in planned mining areas is believed to be minimal, the removal of the Tropic Shale overburden and Smirl coal seam from the Dakota Formation, followed by the rapid backfilling of pit areas with low-permeability fill materials should not result in adverse impacts to the hydrologic balance in the Dakota Formation (i.e., the post-mining degree of hydraulic communication between the Dakota Formation and the overlying low-permeability backfill material will be similar to that of the pre-mined condition).

It should be noted that the first water-bearing strata underlying the coal seam to be mined in the proposed Coal Hollow Mine permit area from which appreciable quantities of groundwater can be produced is the Navajo Sandstone. The Navajo Sandstone aquifer is of regional significance in that it provides groundwater of good quality to domestic, agricultural, and municipal wells regionally and provides baseflow to springs and streams. The Navajo Sandstone does not crop out in the proposed Coal Hollow Mine permit and adjacent area. The formation is effectively isolated from proposed mining areas by more than 1,000 feet of rock strata of the Dakota and Carmel Formations (which includes large thicknesses of low-permeability shales and siltstones). The Navajo Sandstone aquifer will not be impacted by proposed mining operations. It should be noted that some previously proposed mining operations in the Alton Coal Field have proposed drilling and pumping of large amounts of groundwater from high-capacity production wells in the Navajo Sandstone aquifer for operational use. No such wells are planned in the proposed Coal Hollow Mine permit and adjacent area.

Of primary importance to the hydrologic balance in the proposed Coal Hollow Mine permit and adjacent area are alluvial groundwater systems. As discussed in Section 722 and in Appendix 7-1, alluvial groundwater systems in the area support springs, seeps, diffuse groundwater discharge, and a limited number of wells. The bulk of the alluvial groundwater flux through the area occurs in alluvial sediments that include coarse-grained and finer-grained sediments near the eastern margins of Sink Valley, east of the proposed Coal Hollow Mine permit area. Lesser quantities of alluvial groundwater migrate through finer-grained alluvial sediments (predominantly clays, silts, and sands) in the western portions of Sink Valley and in the Lower Robinson Creek drainage within the proposed Coal Hollow Mine permit area. Discharges from alluvial groundwater systems in Sink Valley do not contribute measurable quantities of baseflow to streams (at least at the surface in the stream channel). Alluvial groundwater systems in the Lower Robinson Creek area are much less extensive than the alluvial groundwater systems in Sink Valley. Other than the emergence of small quantities of alluvial groundwater from the stream banks where the stream channel intersects the alluvial groundwater system, discharge from the alluvial groundwater system as springs or seeps in Lower Robinson Creek is generally not observed. Perched groundwater conditions exist locally in the alluvial groundwater system in the Lower Robinson Creek drainage.

In the general sense, surface coal mining activities in the proposed Coal Hollow Mine permit area have the potential to impact groundwater systems primarily through three mechanisms:

1) Where water-bearing strata in proposed mining areas are mined through, groundwater systems within these strata will obviously be directly intercepted,
2) Where groundwater flow paths through mine openings are interrupted, groundwater flow in down-gradient areas could be diminished, and

3) Where mine openings intercept permeable strata, groundwater resources in up-gradient areas could potentially be diminished if appreciable quantities of groundwater were to be drained from up-gradient areas.

The potential for the occurrence of each of these potential impacts are described in the following.

Direct Interception of Groundwater Resources

As discussed above, groundwater resources in the relatively impermeable Tropic Shale in the proposed permit area are meager. Consequently, it is improbable that direct interception of appreciable groundwater in the Tropic Shale will occur. Additionally, because Tropic Shale groundwater systems generally do not support discharges to springs or provide baseflow to streams, the potential interception of limited quantities of groundwater in the Tropic Shale will not adversely impact the hydrologic balance. Similarly, groundwater resources in the Dakota Formation (including within the Smirl coal seam) are meager. While the Smirl coal seam will be extracted through mining operations, the underlying strata of the Dakota Formation will not be disturbed. Consequently, adverse impacts to groundwater systems in the Dakota Formation through direct interception of groundwater resources are not anticipated.

Alluvial groundwater systems in planned mining areas in the proposed Coal Hollow Mine permit area will be directly intercepted by the mine openings. It is not anticipated that the direct interception of shallow alluvial groundwater will adversely impact the overall hydrologic balance in the region. This is because no substantial springs, seeps or other important groundwater resources have been identified in proposed mine pit areas (Drawing 7-1). In the pre-mining condition, any diffuse groundwater discharge to the ground surface that occurs is primarily lost to evapotranspiration and does not contribute appreciably to the overall hydrologic balance in the area.

Because of the prevailing low-permeabilities of the alluvial sediments within the proposed mine disturbance area, it is unlikely that the direct mining of the alluvial groundwater system within these areas could cause impacts to subirrigation and soil moisture contents in up-gradient areas.

It is considered likely that the average hydraulic conductivity of the placed run-of-mine backfill material will be low. This is because of the pervasiveness of low-permeability, clay-rich materials in the mine overburden and the anisotropic nature of the placed fill material. Consequently, the potential for the migration of appreciable quantities of groundwater through the fill is considered low. However, to minimize the potential for long-term impacts to the alluvial groundwater system in Sink Valley up-gradient of mining areas that could occur as a result of the long-term draining of alluvial groundwater into the pit backfill area, a permanent, engineered low-permeability barrier will be emplaced adjacent to the undisturbed alluvial sediments along the eastern edge of the pit 15 disturbance area. Information and design details for this low-permeability barrier are provided in Appendix 7-10. Accordingly, the potential for impacts to subirrigation and soil moisture in the lands up-gradient of mining areas will be minimized by both the placment of the low-permeability backfill, and the emplacement of the low-permeability engineered barrier adjacent to Pit 15.

The potential for short-term impacts to subirrigation and soil moisture in the lands up-gradienet of proposed mining areas will be minimized through the implementation of the hydrology resource contingency plan described in Appendix 7-9.

Diminution of down-gradient groundwater resources

Where groundwater flow paths that convey groundwater to down-gradient areas exist in areas that will be mined, there is the potential that diminution of down-gradient groundwater resources could occur. In the proposed Coal Hollow Mine permit area, it is considered unlikely that appreciable diminution of down-gradient resources will occur as a result of mining and reclamation activities. The basis of this conclusion is presented below.

Groundwater resources in the Tropic Shale are meager and groundwater flow rates are very slow through the marine shale unit. Groundwater systems in the Tropic Shale do not support appreciable spring or seep discharge nor do they provide measurable baseflow to streams down-gradient of mining areas. Consequently, the potential for adverse impacts to the hydrologic balance as a result of mining through Tropic Shale is considered minimal.

Similarly, groundwater resources in the Dakota Formation are meager. The potential for lateral and vertical migration of groundwater through the formation is limited by the pervasiveness of low-permeability shaley strata in the formation and the lateral discontinuity of permeable strata. Groundwater systems in the Dakota Formation do not support appreciable spring or seep discharge nor do they provide measurable baseflow to streams down gradient of mining areas. Additionally, with the exception of the relatively low-permeability Smirl coal seam located at the top of the formation, groundwater systems in Dakota Formation rock strata below the coal seam will not be disturbed by mining and reclamation activities. Consequently, the potential for adverse impacts to the hydrologic balance as a result of mining through Dakota Formation strata is considered minimal. It should be noted that spring SP-4 discharges at about 1 gpm approximately 1.1 miles south of the proposed Coal Hollow Mine permit area from an apparent fault/fracture system in the Dakota Formation that may be related to the Sink Valley Fault. It is unlikely that appreciable migration of groundwater through the Sink Valley Fault system in the relatively impermeable Tropic Shale or shallow alluvium in the proposed Coal Hollow Mine permit area occurs. Consequently, it is considered unlikely that mining and reclamation activities in the proposed Coal Hollow Mine permit area will cause a diminution of discharge from spring SP-4.

Alluvial groundwater systems in proposed mining areas area supported primarily by clays, silts, and fine-grained sands. In proposed mining areas in Sink Valley, appreciable coarse-grained alluvial sediments were not encountered in drill holes or back-hoe excavations. Significant layers of clean coarse alluvium, which could rapidly convey significant amounts of groundwater, were likewise not observed. The results of slug testing performed on wells in and adjacent to proposed mining areas likewise suggest that the potential for rapid migration of groundwaters through alluvial sediments in proposed mining areas is low (Tables 7-8 and 7-9). These data and observations suggest that the flux of groundwater migrating through the alluvial sediments in proposed mining areas in Sink Valley (that could support down-gradient groundwater systems) is not large. Much of the groundwater migrating through the alluvial sediments in proposed mining areas (in the East ¼ of Section 30, T39S, R5W) likely leaves the groundwater system through diffuse discharge to the land surface and is lost evapotranspiration and does not contribute to the overall hydrologic balance in the area. In Sink Valley, a preferential pathway for alluvial groundwaters through deep coarse-grained alluvial sediments likely exists along the east side of Sink Valley. While the thickness of the alluvium in proposed mining areas in Sink Valley generally does not exceed 50 feet (and in many locations is much less), the alluvial sediments along the eastern side of Sink Valley adjacent to proposed mining areas range from about 120 to 140 feet. Of the total flux of groundwater through the alluvial groundwater systems in Sink Valley, most of the flux is likely through this coarse-grained portion of the system. The percentage of the total flux that migrates through clayey and silty alluvial sediments in proposed mining areas along the western flanks of Sink Valley is likely much less.

It should be noted that highly permeable strata were encountered from about 60 to 75 feet depth just above the bedrock interface at the SS well cluster (monitoring well SS-75; Table 7-2). This well is screened in an area of burned or eroded coal (the coal is absent) and consequently, mining will not occur at this location. The coal seam is present at the nearby C9 cluster area. Were mining operations to intercept this highly permeable zone, substantial groundwater inflows into the mine openings could occur. Consequently, prior to surface mining in this area, the boundary between the competent coal seam and the area of burned or eroded coal will be more precisely defined by drilling or other suitable techniques such that mine openings can be designed to avoid these areas of potentially large groundwater inflows.

As discussed in Section 722 above, alluvial groundwater from Sink Valley discharges to several springs and seeps and as diffuse discharge to the ground surface in the northwest ¼ of Section 32, T39S, R5W (see Drawing 7-4; groundwater discharge area B). This groundwater discharge is likely a result of the constriction in Sink Valley in this area and the corresponding decrease in the cross-sectional area of the alluvial sediments in the valley, which forces groundwater to discharge at the surface. Most of the groundwater discharge in this area is likely derived from the up-gradient alluvial groundwater systems in the eastern portion of the valley (i.e., the coarse-grained portion of the alluvial groundwater system), which is situated east of the proposed Coal Hollow Mine permit area. This conclusion is based on 1) the substantially larger cross-sectional area of the alluvium in the deeper eastern portion of the valley relative to that in proposed mining areas near the western margins of the valley, 2) the higher hydraulic conductivity of the sediments in the coarse-grained part of the alluvial system, and 3) the lack of other apparent discharge mechanisms for the coarse-grained system further downstream in Sink Valley Wash (i.e., there are no significant alluvial springs or seeps further downstream in Sink Valley Wash and the system apparently does not contribute measurable baseflow to Sink Valley Wash further downstream (at least at the surface in the stream channel, as evidenced by the lack of baseflow in the wash monitored at SW-9).

Because most of the alluvial groundwater discharge supporting springs and seeps in this area is likely not derived from groundwater systems that underlie planned mining areas in the proposed Coal Hollow Mine permit area, it is considered unlikely that discharges from the springs and seeps in northwest ¼ of Section 32 T39S, R5W will be appreciably diminished as a result of the proposed mining and reclamation activities. While considered unlikely, some temporary impacts to discharge rates from springs and seeps in this area are possible. In particular, it should be noted that mining in the southernmost portions of the proposed Coal Hollow Mine permit area has a somewhat greater potential to decrease groundwater discharge rates at spring SP-6, which is located about 600 feet below the southernmost proposed mining areas (Drawing 7-2). SP-6 is an alluvial seep which has been impounded with an earthen dam from which measurable discharge is generally not present.

It is critical to note that individual mine pits in this area will remain open for short lengths of time, generally no more than about 60 to 120 days. (measured from the time the mining of the pit is completed to the time the pit is backfilled). Mining operations in the vicinity near the alluvial groundwater discharge area in the northwest ¼ of Section 32 T39S, R5W are planned to be completed in about 1 year. Thus, any potential impacts to discharge rates from down-gradient groundwater systems will be short-lived. Following the backfilling and reclamation of mine openings, the potential for interception or re-routing of alluvial groundwater away from the groundwater discharge area in northwest ¼ of Section 32 T39S, R5W will be negligible. As stated above, most of the flux through the Sink Valley alluvial groundwater system that supports springs and seeps in the area occurs in the eastern portion of the valley, which will not be impacted by mining and reclamation activities. Consequently, long-term impacts to discharge rates from springs and seeps in this area are not anticipated. It should also be noted that if increased quantities of groundwater were to be encountered in mine workings in lower Sink Valley such that the water would need to be discharged to surface drainages, the mine water will ultimately be discharged to the Sink Valley Wash drainage (i.e., the water will remain in its drainage basin).

Alluvial groundwater systems in the Lower Robinson Creek area are much less extensive than the alluvial groundwater system in Sink Valley. Perched groundwater conditions exist locally in the alluvial groundwater system in the Lower Robinson Creek drainage. Other than the re-emergence of alluvial groundwater flowing beneath the Lower Robinson Creek stream channel where the stream channel exists directly on bedrock substrate, discharges from the alluvial groundwater system as springs or seeps in Lower

Robinson Creek are not observed. Consequently, mining operations in the Lower Robinson Creek drainage will likely not result in diminution of down-gradient groundwater resources.

It should be noted that the proposed Coal Hollow Mine plan calls for the temporary ~~permanent~~ diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of groundwater or surface-water resources, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

If any Utah State appropriated water rights are impacted by mining and reclamation operations in the proposed Coal Hollow Mine, these will be replaced according to all applicable Utah State laws and regulations using the designated water replacement source described in Section 727 above.

Draining of up-gradient groundwater resources

Where surface mining occurs adjacent to up-gradient groundwater systems, there is a potential that draining of groundwater from the up-gradient groundwater system into the mine voids could occur. This condition could occur if a sufficiently large and permeable stratum were to be intercepted that is in good hydraulic communication with the up-gradient groundwater system through which appreciable quantities of water could be transmitted.

To more fully evaluate the potential for draining of up-gradient groundwater resources, a field investigation was performed during the winter of 2006-2007 that was designed to facilitate the characterization of the alluvial groundwater system in the proposed Coal Hollow Mine permit and adjacent area. Specifically, this program was designed 1) to better define the vertical and lateral extent of permeable, coarse-grained sediments in the alluvial groundwater system, 2) to characterize the water bearing and water transmitting properties of alluvial sediments, and 3) to evaluate the degree of hydraulic communication between the coarse-grained portion of the alluvial system in Sink Valley and the clayey alluvial sediments in proposed mining areas.

This field investigation included 1) the drilling and installation of 30 monitoring wells, 2) the performance of a 28-hour pumping and recovery test on the alluvial testing production well Y-61 (which is a 6.625-inch well constructed in 1980 as part of a previous coal mining application for groundwater pumping for alluvial aquifer testing) with contemporaneous measuring of water levels in the monitoring well network and contemporaneous measuring of spring discharge rates at three alluvial springs, and 3) the slug testing of 20 monitoring wells to determine approximate values of hydraulic conductivity. The results of the field investigation including analysis of the data collected in the investigation are presented in Appendix 7-1 and are summarized below.

Other than occasional pebbles or small rocks, coarse-grained sediments (i.e., gravels and coarse sands) were not encountered in the drilling of wells along the eastern margins of proposed mining areas in Sink Valley (C1, C2, C3, and C4 well clusters). (It should be noted that the C2 well cluster is located west of the eastern limit of the mine disturbance. The mine openings will intercept the C2 well cluster and the area to the east to locations west of well Y-102). Rather, the sediments encountered in the drilling of these wells were dominated by clays and silts with subordinate amounts of fine-grained sand. Similarly, coarse-grained deposits were not encountered in well clusters C6, C7, C8, and C9. There was no indication during drilling of any appreciable thickness of highly permeable strata through which groundwater could rapidly be transmitted (although it should be noted that the presence of thin sand layers are difficult to identify in wet auger drilling returns). Similarly, appreciable amounts of high-permeability coarse-grained alluvial sediments were not noted in alluvial sediments investigated in backhoe excavated pits and erosional escarpments in Sink Valley.

The hydraulic heads measured in alluvial monitoring wells near proposed mining areas in Sink Valley (C2, C3, C4, C7, C8, and C9) did not indicate artesian pressures. Rather, marked upward or downward vertical hydraulic gradients were not observed in any of these areas and water levels were consistently within several feet of the ground surface.

The results of pump testing in the alluvial groundwater system demonstrate that the springs in the northwest ¼ of Section 29, T39S, R5W are in direct hydraulic communication with the coarse-grained alluvial groundwater system in which the pumping well Y-61 is screened. Discharge rates (or water levels at Sorensen Spring) measured at each of the four springs (SP-8, SP-14, SP-20, and Sorensen spring) monitored during the 28-hour pumping test responded to pumping at the well. Monitoring wells at clusters C2, C3, and C4 near the easternmost proposed mining areas also showed small, muted responses, with declines measured in water levels during the 28-hour test ranging from about 0.05 to 0.10 feet. Other monitoring wells in proposed mining areas did not respond measurably to pumping at Y-61. It should be noted that after the pumping well was turned off at the end of the 28-hour pumping test, spring discharge rates and water levels in alluvial monitoring wells recovered to approximate pre-testing levels.

The results of slug testing of wells in the proposed Coal Hollow Mine and adjacent area are presented in Table 7-8. Using these hydraulic conductivity values together with measured thicknesses of saturated alluvial sediments determined during drilling, and hydraulic gradient values determined from water levels measured in monitoring wells, rates of estimated groundwater inflows to mine openings have been calculated using Darcy's Law (Table 7-9).

Darcy's Law may be expressed as.

$$Q = KIA$$

Where	Q	=	groundwater discharge rate
	K	=	hydraulic conductivity
	I	=	hydraulic gradient
	A	=	cross-sectional area

The values listed in Table 7-9 are reported as inflow rates per 100 lineal feet of mine openings oriented perpendicular to the groundwater flow direction. Calculations at individual locations are adjusted for the thickness of the saturated alluvium at that location. For all calculations in Table 7-9, a gradient of 0.10 has been used, which is considered a conservative estimate for the alluvial groundwater system in the vicinity of the planned Coal Hollow Mine workings. It is important to note that while values for saturated aquifer thickness and local hydraulic gradient in the alluvial groundwater system can be determined relatively precisely, hydraulic conductivity values determined from slug testing methods are generally considered as order-of-magnitude estimates. Consequently, the information from Table 7-9 should be used for general purposes only. The estimated groundwater inflow rates presented in Table 7-9 suggest that copious, unmanageable amounts of alluvial groundwater will likely not be encountered. It should be noted, however, that alluvial sediments located east of the C2 well cluster may contain coarser grained sediments similar to those intercepted in well Y-102. Special mining protocols will be employed (See Appendix 7-9) when mining in this ~~these and adjacent~~ areas (pits ~~13-~~15; see Section 728.333) to minimize the potential for interception of large groundwater inflows.

As surface mining operations advance toward the alluvial groundwater discharge area in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A), the information in Table 7-9 suggests that groundwater inflow rates in this area will be modest, generally on the order of a few tens of gallons per minute or less per 100 lineal feet of mine opening. However, it should be noted that, as discussed above, if mine openings in this area were to intersect a substantial thickness of coarse-grained alluvial material that was in good hydraulic communication with the coarse-grained alluvial system located along the eastern margins of Sink Valley, substantially greater rates of groundwater inflow could occur. Based on the information in Tables 7-8 and 7-9, this is not considered likely.

As mining operations advance toward the alluvial groundwater discharge area in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A) and groundwater discharge from up-gradient alluvial groundwater systems occurs, there is the potential that discharge rates from alluvial springs in this area could be diminished. The magnitude of this potential impact will be largely dependent on the drainage rate and volume of groundwater that may be drained from the up-gradient alluvial groundwater system.

The potential for diminution of discharge from alluvial springs near proposed mining areas near the northwest ¼ of Section 29, T39S, R5W will be minimized because:

1) As mining progresses toward the groundwater discharge area in the northwest ¼ of Section 29, T39S, R5W (see Drawing 7-4, groundwater discharge area A), groundwater inflows into mine openings and discharge rates from the nearby alluvial springs will be closely monitored. If groundwater inflow rates into mine openings are excessive, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities, and

2) Individual mine pits in the proposed Coal Hollow Mine will remain open for short lengths of time, generally no more than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled). Consequently, any potential impacts to spring discharge rates in the alluvial groundwater system in this area will likely be short-lived. Because the alluvial groundwater recharge areas are located well up-gradient of proposed mining areas (mountain-front recharge) and will not be impacted, recharge to the alluvial system should continue uninterrupted, it is anticipated that water levels in the artesian groundwater system should recover from any mining-related declines in hydraulic head subsequent to the completion of mining in the area.

Groundwater discharge from the springs in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A) do not contribute any measurable baseflow discharge to streams in the area. This conclusion is based on the lack of any baseflow discharge in streams down-gradient of this area in Sink Valley (see monitoring data for SW-6 and SW-9). Rather, most of this discharge is likely ultimately lost to evapotranspiration as the water migrates across the low-permeability, near-surface clayey sediments in Sink Valley. Consequently, the potential temporary diminution of discharge from alluvial springs in the northwest ¼ of Section 29, T39S, R5W would not result in appreciable adverse impacts to the surrounding hydrologic balance.

It is considered likely that the average hydraulic conductivity of the placed run-of-mine backfill material will be low. This is because of the pervasiveness of low-permeability, clay-rich materials in the mine overburden and the anisotropic nature of the placed fill material. Consequently, the potential for the migration of appreciable quantities of groundwater through the fill is considered low. However, to minimize the potential for long-term impacts to the alluvial groundwater system in Sink Valley up-gradient of mining areas that could occur as a result of the long-term draining of alluvial groundwater into the pit backfill area, a permanent, engineered low-permeability barrier will be emplaced adjacent to the undisturbed alluvial sediments along the eastern edge of the pit 15 disturbance area. Information and design details for this low-permeability barrier are provided in Appendix 7-10. An evaluation of the permanent barrier for pit 15 has been performed by Mr. Alan O. Taylor of Taylor Geo-Engineering, LLC. Information in the Taylor Geo-Engineering report indicates that the 50-foot wide barrier will prevent any appreciable drainage of alluvial groundwater from the coarse-grained alluvial groundwater system centered east of the permit area into the backfilled pit areas. Laboratory analysis of the Tropic Shale material from which the barrier will be constructed indicates that the compacted shale material will perform adequately to successfully contain the alluvial groundwater. Using this technique, the pit areas will be reclaimed to restore the approximate pre-existing groundwater levels in Sink Valley.

Accordingly, the potential for impacts to subirrigation and soil moisture in the lands up-gradient of mining areas will be minimized by both the placment of the low-permability backfill, and the emplacement of the low-permeability engineered barrier adjacent to Pit 15.

The potential for short-term impacts to subirrigation and soil moisture in the lands up-gradienet of proposed mining areas will be minimized through the implementation of the hydrology resource contingency plan described in Appendix 7-9.

If any Utah State appropriated water rights are impacted by mining and reclamation operations in the proposed Coal Hollow Mine, these will be replaced according to all applicable Utah State laws and regulations using the designated water replacement source described in Section 727 above.

728.320 Presence of acid-forming or toxic-forming materials

Chemical information on the acid- and toxic-forming potential of earth materials naturally present in the proposed permit area are presented in Appendix 6-2. Chemical information on the low-sulfur Smirl coal seam proposed for mining is presented in Appendix 6-1 (confidential binder). Based on laboratory analytical data, it is apparent that acid-forming and toxic-forming materials that could result in the contamination of surface-water or groundwater supplies in the proposed Coal Hollow Mine permit and adjacent area are generally not present.

Selenium was not detected in any of the samples from the proposed Coal Hollow Mine permit area. Likewise, concentrations of water-extractable boron were also low, being less than 3 mg/kg in all samples analyzed. The pH of groundwaters in and around the proposed Coal Hollow Mine permit area are moderately alkaline (UDOGM, 2007). Data in Appendix 6-2 likewise indicate moderately alkaline conditions in sediments in the proposed permit area. The solubility of dissolved trace metals is usually limited in waters with alkaline pH conditions. Consequently, high concentrations of these metal constituents in groundwaters and surface waters with elevated pH levels are not anticipated. Additionally, most of the materials that will be handled as part of mining and reclamation activities in the proposed Coal Hollow Mine area are of low hydraulic conductivity (i.e. clays, silts, shales, siltstones, claystones, etc.). Consequently, it is anticipated that groundwater seepage volumes through low-permeability backfill and reclaimed land surfaces in reclaimed mine pit areas and excess spoils storage areas will not be large. Additionally, reclaimed areas will be regraded, sloped, and otherwise managed to minimize the potential for land erosion, to restore approximate surface-water drainage patterns, and also to minimize the potential for ponding of surface waters on reclaimed areas (other than "roughening" or "gouging" of some areas to enhance reclamation). Thus, the potential for interactions between large amounts of disturbed earth materials and groundwaters and surface waters, which could result in leaching of chemical constituents into groundwater and surface-water resources, will be minimized.

Additionally, the mining plan calls for the emplacement of 40 inches of suitable cover material over backfilled areas made up of material types which could appreciably impact vegetation (materials with elevated SAR ratios or other physical or chemical characteristics that could adversely impact vegetation).

The neutralization potential greatly exceeded the acid potential in all samples analyzed, with the neutralization potential commonly exceeding the acid potential by many times, suggesting that acid-mine-drainage will not be a concern at the proposed Coal Hollow Mine. Acid-forming materials in western coal mine environments often consist of sulfide minerals, commonly including pyrite and marcasite, which, when exposed to air and water, are oxidized causing the liberation of H^+ ions (acid) into the water. Oxidation of sulfide minerals may occur in limited amounts in the mine pits where oxygenated water encounters sulfide minerals. However, the acid produced by pyrite oxidation is quickly consumed by dissolution of abundant, naturally occurring carbonate minerals (Appendix 6-2). Dissolved iron is readily precipitated as iron-hydroxide in well aerated waters, and consequently excess iron is not anticipated in mine discharge water.

Other acid-forming materials or toxic-forming materials have not been identified in significant concentrations nor are such suspected to exist in materials to be disturbed by mining.

Because of the overall low-permeability of the rock strata and sediments surrounding the mine workings (primarily the shales and claystones of the lower Tropic Shale), the potential for seepage of mine water outward into adjacent stratigraphic horizons is low. Additionally, because the floors of the mine pits need to be accessible in order to extract the coal, the mining operations will be carried out in such a manner that the accumulation of large amounts of water in the mine pits will be avoided.

728.331 Sediment yield from the disturbed area.

Erosion from disturbed areas will be minimized through the use of silt fences and other sediment control devices. Surface runoff occurring on disturbed areas will be collected and treated as necessary to remove suspended matter. Four diversion ditches along with four sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

The smallest practicable area, consistent with reasonable and safe mine operational practices will be disturbed at any one time during the mining operation and reclamation phases. This will be accomplished through progressive backfilling, grading, and prompt revegetation of disturbed areas. The backfilled material will be stabilized by grading to promote a reduction of the rate and volume of runoff in accordance with the applicable requirements. The excess spoil and fill above approximate original contour will be graded to a maximum 3h:1v slope and revegetated to minimize erosion.

Cut ditches will be established on the shoulders of all primary roads to control drainage and erosion. Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles. The location and details for roads can be viewed on Drawings 5-3 and 5-22 through 5-24.

Through the implementation of these sediment control measures, it is anticipated that sediment yield from disturbed areas in the proposed Coal Hollow Mine permit area will be minimized.

728.332 Impacts to important water quality parameters

As discussed above, appreciable quantities of groundwater are not anticipated to be intercepted in the Tropic Shale overlying proposed mining areas. Consequently, discharge of Tropic Shale groundwaters from mining areas is not anticipated. Because of the very low hydraulic conductivity of the marine Tropic Shale unit which immediately overlies the coal in proposed mining areas, the lateral migration of appreciable amounts of groundwater outward from proposed mine pit areas is not anticipated. Therefore, no impacts to important water quality parameters in surrounding groundwater and surface-water resources that could result from the interception of Tropic Shale groundwaters are anticipated.

Similarly, appreciable quantities of groundwater are not expected to emanate from the Dakota Formation in the mine floor into the mine openings. This conclusion is based on the fact that 1) vertical and horizontal groundwater flow in the Dakota Formation is impeded by the presence of low-permeability shales that encase the interbedded lenticular sandstone strata in the formation (i.e., the formation is not a good aquifer), 2) appreciable natural discharge from the Dakota Formation in the surrounding area to springs or streams is not observed, supporting the conclusion that the natural flux of groundwater through the formation is meager, and 3) mining will commence near the truncated up-dip end of the formation, minimizing the potential for elevated hydraulic head in the Dakota Formation. The results of slug testing performed on wells screened in the Smirl coal seam indicate relatively low values of hydraulic conductivity for the coal seam (Table 7-8). In much of the proposed mining area, the coal seam is dry. Thus, large inflows of groundwater from the coal seam into mine workings are not anticipated. Likewise, the potential for seepage out of mine pits through the coal seam is minimal. Consequently, impacts to important water-quality parameters in the Dakota Formation potentially resulting from mining operations are not anticipated, nor are impacts to important water-quality parameters in surrounding groundwater and surface-water systems anticipated as a result of interactions with intercepted Dakota Formation groundwater.

The water quality of groundwaters in the alluvial groundwater system up-gradient of mining operations will likely not be impacted by mining and reclamation activities in the proposed Coal Hollow Mine. Were alluvial groundwaters intercepted by mine openings allowed to flow into the mine pits, there would be the potential for substantially increased TDS concentrations as the water interacts with the marine Tropic Shale and the Smirl coal seam. This occurrence will be avoided.

As groundwater naturally migrates through the shallow, fine-grained alluvial sediments in the proposed Coal Hollow Mine permit and adjacent area (most evident in Sink Valley), the quality of the water is naturally degraded (see Appendix 7-1). In the distal portions of Sink Valley, most notably concentrations of magnesium, sulfate, and bicarbonate are elevated in the alluvial groundwater.

The potential for TDS increases associated with interaction of waters with the Tropic Shale can be minimized by avoiding contact where practical between water sources and earth materials containing soluble minerals. Where possible, groundwater that will be encountered in alluvial sediments along the margins of mine pit areas will be routed through pipes, ditches or other conveyance methods away from mining areas via gravity drainage so as to prevent or minimize the potential for interaction with sediments disturbed by mining operations (including contact with the mined coal seam). If diverted alluvial groundwater were allowed to interact extensively with the Tropic Shale bedrock or Tropic Shale-derived alluvial sediments, similar increases in magnesium, sulfate, bicarbonate, and TDS concentrations would be anticipated. Consequently, where intercepted groundwaters will be routed around disturbed areas through pipes or well-constructed and maintained ditches, it is anticipated that detrimental impacts to important water quality parameters in these waters will be minimal.

The pumping and discharging of mine water from mine pits at the proposed Coal Hollow Mine permit area is not anticipated. The impoundment of substantial quantities of water within the mine pits would likely result in degradation of groundwater quality and is also not compatible with the proposed surface mining technique (the coal extraction operations occur at the bottom of the mine pit and thus they cannot be performed in flooded mine pits). As discussed above, the only likely foreseeable source of appreciable quantities of groundwater is from the alluvial groundwater systems overlying the low-permeability Tropic Shale in proposed mining areas. Where this alluvial groundwater is encountered in mining areas, it will be diverted away from mine workings prior to significant interaction with sediments in disturbed areas. Any discharge from the mine pits that does occur will be regulated under a Utah UPDES discharge permit.

Acid mine drainage is not anticipated at the proposed Coal Hollow Mine permit area. This is due primarily to the relatively low sulfur content of the coal (see Appendix 6-1; confidential binder) and rock strata in the permit and adjacent area, and to the pervasiveness of carbonate minerals in the soil and rock strata which neutralize the acidity of the water if it occurs. If sulfide mineral oxidation and subsequent acid neutralization via carbonate dissolution were to occur, increases in TDS, calcium, magnesium, sulfate, and bicarbonate concentrations (and possibly also sodium concentrations via ion-exchange with calcium or magnesium on exchangeable clays) would be anticipated.

An analysis of the acid/base potential of samples collected from the overburden and underburden in the proposed mining area indicates that acid mine drainage will be unlikely to occur at the Coal Hollow Mine. The results of laboratory analysis of the acid/base potential of samples collected from the overburden, underburden, and Smirl coal zone are presented in Appendix 6-2. None of the overburden or underburden samples were acid forming, as each of the intervals sampled showed excess neutralization potential. Taken as a whole, the un-weighted composite average acid/base potential of the 57 overburden and underburden samples indicates a net neutralization potential of 174 tons per kiloton. The neutralization potential of the composite overburden/underburden (180 tons per kiloton) exceeds the acid potential (5.5 tons per kiloton) by more than 32 times. A general consensus opinion mentioned by the National Mine Land Reclamation Center (OSM, 1998) is that if the net acid/base potential exceeds 30 tons per kiloton, and the ratio of neutralization potential to acid potential exceeds two, then *alkaline* water will be generated and acid mine drainage will not occur. The acid/base characteristics of composite overburden and underburden in the Coal Hollow Mine area greatly exceed both of these two criteria, suggesting the strong likelihood that acid mine drainage will not be an issue at the Coal Hollow Mine.

Because of the net neutralization potential of the composite overburden/underburden in the Coal Hollow Mine area described above, the pH values of groundwater in fill areas will likely be neutral to alkaline. Accordingly, the solubility of dissolved trace metal species in the alkaline water will likely be low. Consequently, the potential for the mobilization and transport of trace metals in groundwater in the fill will likely also be low. Concentrations of total selenium, water extractable selenium, water extractable boron and other important chemical species in the overburden samples from the Coal Hollow Mine area are generally low. Water extractable selenium concentrations in the analyzed Dakota Formation underburden samples range from 0.05 to 0.2 mg/kg (see Appendix 6-2). Water extractable boron concentrations in the Dakota Formation underburden in a single location (CH-08; 6.5 mg/kg) marginally exceed the Division standard of 5 mg/kg. The limited quantities of material containing water extractable selenium and boron in these concentration ranges in backfill materials are not anticipated to result in appreciably elevated selenium or boron concentrations in groundwater or surface water supplies. Because the hydraulic conductivity of the composite run-of-mine backfill material (which will be rich with clays, silts, and shale) is expected to be low, the flux of groundwater that might migrate through the backfilled pit areas is likely to be low. Additionally, the reclaimed land surface will be graded to promote runoff of surface waters overlying backfilled areas, thus minimizing the potential for infiltration of surface waters into backfilled areas. Consequently, the potential for acid mine drainage or toxic drainage from backfilled areas to surrounding groundwater and surface-water supplies will be minimized.

As outlined in the topsoil and subsoil sampling plan in Chapter 2 of this MRP, materials with poor quality SAR, elevated selenium or boron concentrations, or poor pH as defined by Division guidelines will not be placed in the upper four feet of the reclaimed surface. These materials will also not be placed in the backfill within the top four feet of ephemeral drainages with 100 year flood plains, or in the top four feet in surface water impoundments, or in the top four feet in intermittent or perennial drainages including 100 year flood plains as outlined in the Division guidelines. Materials placed in the top four feet will be sampled to ensure that only suitable materials are placed in the top four feet of the reclaimed surface.

It is noteworthy that in the neighboring state of Wyoming, a water extractable selenium standard of 0.3 mg/kg is considered suitable for topsoil and topsoil substitutes, with concentrations ranging from 0.3 to 0.8 mg/kg being considered marginally suitable for topsoil and topsoil substitute.

As is typical with coal seams regionally, laboratory analyses of coal samples from the Coal Hollow Mine area indicates that there is a net acid forming potential in the coals of the Smirl coal zone (see Appendix 6-2). However, the mining plans call for the mining and removal of 95% of the total coal seam thickness from mining areas, leaving only minor amounts of coal in backfilled areas. Consequently, the potential contribution to the overall acid/base potential of the composite backfill material would be small. Assuming a worst-case-scenario – that all the coal would be retained in the backfill material – the calculated acid/base potential of the composite backfill material is still well within the limits suggested by OSM (1998) to indicate that alkaline discharge without acid mine drainage would be likely.

As described in Chapter 5, Section 532, surface runoff that occurs on disturbed areas will be treated through sedimentation ponds or other sediment-control devices and particulate matter will be allowed to settle prior to the discharging of the water to the receiving water, thus controlling suspended solids concentrations.

At any mining operation there is the potential for contamination of soils, surface-water and groundwater resources resulting from the spillage of hydrocarbons. Diesel fuels, oils, greases, and other hydrocarbons products will be stored and used at the mine site for a variety of purposes. A spill Prevention Control and Countermeasure Plan will be implemented that will help minimize any potential detrimental impacts to the environments.

Spill control kits will be provided on all mining equipment and personnel will be trained to properly control spills and dispose of any contaminated soils in an appropriate manner.

Based on these findings, it is concluded that the potential for mining and reclamation activities in the proposed Coal Hollow Mine permit area to cause detrimental impacts to important water quality parameters is minimal.

728.333 Flooding or streamflow alteration

As described above, appreciable groundwater inflow from the Tropic Shale and Dakota Formation into mine pits at the proposed Coal Hollow Mine are not anticipated. Appreciable groundwater inflows are anticipated only from the relatively thin, overlying alluvial groundwater systems. The thicknesses of the alluvium adjacent to mine openings in the proposed mining areas is generally less than 40 to 50 feet. The hydraulic conductivities of the predominantly clayey and silty alluvial sediments are low, and consequently, very large or sudden groundwater inflows into mine openings are not anticipated. Where appreciable alluvial groundwater is encountered adjacent to mine openings, it will be routed away from mining areas through ditches of other conveyance mechanisms. Consequently, discharge of mine water from the mine pits is not anticipated. The rates of alluvial groundwater drainage that could occur will likely not be of a magnitude that could potentially cause flooding or streamflow alteration in either the Sink Valley Wash or Lower Robinson Creek drainages.

If excess groundwater were to be encountered during mining operations such that it could not be adequately managed or discharged in compliance with the Utah UPDES discharge permit (which is considered unlikely), Alton Coal Development, LLC may when necessary construct supplemental containment and settlement ponds in which mine discharge waters may be held for treatment (where necessary) and subsequent discharge through UPDES discharge points in compliance with the UPDES discharge permit, minimizing the potential for flooding or streamflow alteration in areas adjacent to mining. To ensure that the mine is able to deal with any unforeseen

When coal mining near the eastern edge of the Coal Hollow Mine permit area occurs (mine pits 13-15), special measures will be taken to minimize the potential for the interception by the mine openings of large quantities of groundwater from artesian groundwater system in the northwest ¼ of Section 29, T5W, R39S, and to adequately deal with groundwater inflows if such occur. Details of the contingency plan for this occurrence are provided in Appendix 7-9.

When mining operations advance toward the eastern edge of the permit boundary in pits 13, 14, and 15, material excavating in the alluvial sediments will be performed incrementally and with caution. As excavation proceeds, if coarse, water-bearing alluvial sediments (gravels) are encountered, overburden removal in that area will be stopped. The excavation equipment operator will recover the exposed gravel zone with local impermeable sediments (abundant in the alluvium in the area) to halt groundwater inflow if possible. The hydrogeologist will be called to the site to access the hydrogeologic conditions. An investigation of the situation will be performed and a suitable work plan will be developed prior to the resumption of overburden removal in that area. The work plan will be designed to minimize the potential for intercepting unacceptably large inflows of groundwater into the mine pits. The work plan will most likely involve trenching in the alluvium in zones up-gradient of the mine pit area and the emplacement of a low-permeability cut-off wall. The cut-off wall would be emplaced in the excavated trench using bentonite or other acceptable native low-permeability materials. The cut-off wall would be designed to isolate the mine openings from the coarse-grained alluvial groundwater system sufficient to decrease mine inflows to acceptable levels (i.e. so as to minimize the potential for detrimental impacts to the hydrologic balance and to minimize the potential for flooding of mine pits or causing flooding or stream alteration).

As a temporary measure to manage any potential large groundwater inflows that may occur in these areas prior to the installation of a suitable up-gradient hydraulic barrier, the intercepted alluvial groundwaters would be routed along mine benches that "daylight" to the natural land surface in areas to the south. The water would be diverted into pond 4 which has an appreciable storage capacity and discharge structure.

It should be noted that the interception of moderate amounts of groundwater from shallow alluvial groundwater systems in these areas is considered likely. Modest inflows of shallow groundwater intercepted by the mine workings in these areas would be manageable and not of significant concern. The objective of the work plan would be to ensure that strong hydrodynamic communication between the coarse-grained artesian alluvial groundwater systems in the eastern portion of Sink Valley with the Coal Hollow Mine workings is not established.

To prevent the migration of alluvial groundwater from the coarse-grained alluvial groundwater system centered east of the mine permit area into mine pit backfill areas after the completion of mining, a permanent low-permeability barrier will be constructed along the eastern edge of the pit 15 area. Details of this plan are provided in Appendix 7-10.

The rate at which alluvial groundwater will be intercepted by the proposed Coal Hollow Mine will be variable by location and time in permit area. Because of the heterogeneity inherent in most alluvial deposits, the quantifying of precise aquifer parameters in the various mining areas is not straightforward. Additionally, the geometry of the mine openings including the horizontal lengths and heights of mine pit faces adjacent to saturated groundwater systems that are exposed at any point in time are dynamic variables in the surface mining environment. Consequently, precise quantifications of mine groundwater interception rates are not readily obtainable. However, using the estimated mine pit groundwater inflow rates presented as discharge per linear foot of open pit in Table 7-9, it is considered likely that mine interception will be on the order of a few tens of gallons per minute in dry areas and at times when open pit sizes are small, to several hundred gallons per minute in wetter areas and at times when the open pit size is large. It is important to note that inflows into individual pit areas will be short lived, as the individual pits will commonly remain open for a few weeks to a few months.

The reasonably foreseeable maximum quantity of water that could be intercepted by the Coal Hollow Mine is largely a function of the manner in which coal mining operations are conducted in areas where the potential for encountering appreciable groundwater inflows is greatest. If large areas of water-bearing coarse-grained sediments were to be rapidly exposed in mine pit areas, large quantities of water would be anticipated (likely several thousands of gallons per minute). However, as described above, mining operations will be carried out in these areas using the special mining protocols described above. Consequently, large cross-sectional exposures of water-bearing coarse-grained alluvial sediments will not be allowed to be exposed to the mine pits and large inflows of groundwater on that magnitude are not anticipated.

In the unanticipated event that excessive quantities of water were to flow into the mine pits by any mechanism, the water would be pumped from the pits using a suitable pump and piping equipment that will be located on-site at the Coal Hollow Mine for such a contingency. Such water would be managed appropriately as required by all applicable State and Federal regulations. It should be noted that it is not in the mine's interest to allow excessive water to flow into the mine pits. All reasonable efforts will be taken to minimize the potential for flooding of the mine pits (an event that is not considered reasonably foreseeable or probable to occur).

Through the implementation of the above described mining protocols in areas where potentially large groundwater inflows could reasonably be anticipated to occur, the potential for the interception of large quantities of water by the mine is minimized. Consequently, the potential for flooding or streamflow alteration that could occur as a result of intercepting and discharging large quantities of water will be minimized and is considered unlikely.

The principal surface-water drainages in and adjacent to the proposed Coal Hollow Mine permit area are in many locations not stable in their current configurations (see photograph section). Currently, these stream drainages are actively eroding their channels during precipitation events, resulting in down-cutting and entrenchment of stream channels, the formation of unstable near-vertical erosional escarpments adjacent to stream channels (which occasionally spall off into the stream channel), aggressive headward erosion of stream channels and side tributaries, and the transport of large quantities of sediment associated with torrential precipitation events. These processes are currently actively ongoing in the proposed permit and adjacent area and the upper extents of these erosional processes are in many locations migrating upward in stream channels, resulting in increasing lengths of unstable stream channels.

Hereford (2002) suggests that the valley fill alluviation in the southern Colorado Plateau occurred during a long-term decrease in the frequency of large, destructive floods, which ended in about 1880 with the beginning of the historic arroyo cutting. Hereford (2002) further suggests that the shift from deposition to valley entrenchment coincided with the beginning of an episode of the largest floods in the preceding 400-500 years, which was probably caused by an increased recurrence and intensity of flood-producing El Nino Southern Oscillation events beginning at ca. A.D. 1870.

The exact causes of the entrenchment of stream channels and the creation of the numerous arroyos currently in existence in the southwestern United States are not completely understood. Vogt (2008) suggests that three primary factors resulted in the arroyo formation. These factors included 1) changes in climate that produced heavy rainfall, 2) land-use practices such as livestock grazing, and 3) natural cycles of erosion and deposition caused by internal adjustments to the channel system. The temporal coincidence of the causes may have magnified the effect of each factor.

Each of these factors likely contributed to the formation of the entrenched stream drainages and arroyos in the Coal Hollow Project area. Gregory (1917) states that historical evidence indicates that the cutting of Kanab Creek began when a large storm occurred on 29 July 1883, and that unusually large amounts of precipitation were received in 1884-85. In this period the Kanab Creek channel was down-cut by 60 feet and widened by 70 feet for a distance of about 15 miles. The lowering of Kanab Creek may have resulted in a lowering of the local base level and consequent incision of both Sink Valley Wash and Lower Robinson Creek. As suggested by Vogt (2008), other factors, such as the heavy livestock grazing in the local area, which was occurring contemporaneously with the heavy thunderstorm events, likely also contributed to the overall conditions that brought about the stream down-cutting episode in the late 1800s.

While the precise sequence of events and conditions that triggered the arroyo formation and stream entrenchment in the principle surface drainages in and adjacent to the Coal Hollow Project area is not known, it is readily apparent that the principle surface water drainages are not currently in a condition of equilibrium. Stream head-cutting (headward erosion), bank erosion, and spalling of the steep stream channel walls are ongoing processes in the Coal Hollow Project area.

The mining and reclamation plan for the Coal Hollow Mine has been designed to minimize the potential for sediment yield and erosion in the mine permit area. Accordingly, the mining and reclamation plan minimizes the potential for stream channel erosion and instability within the permit area. No mining-related activities are planned that would likely result in a worsening of the current instability of the surface water drainages in the permit and adjacent area.

The Coal Hollow Mine mining and reclamation plan calls for reclamation activities concurrent with mining progression, which results in the smallest disturbed area footprint and minimizes the length of time that the land surface is susceptible to erosion. The plan also calls for soil tackifiers to be used as a temporary soil stabilizer on reclamation areas prior to seeding. Seeded areas will be mulched. Vegetation established in final reclamation areas will minimize the potential for sediment yield and stream erosion in the long term.

The potential for erosion on the planned excess spoils pile will likewise be minimized. The design plans for the excess spoils pile call for the side slopes exceeding 60 feet in height to be constructed with concave slopes to promote slope stability and to minimize the erosion potential. The excess spoils pile will also be revegetated to minimize the erosion potential.

The Lower Robinson Creek reconstruction will likewise be constructed to promote stability and resistance to erosion. Details of the Lower Robinson Creek reconstruction are shown on Drawings 5-20A and 5-21A. The construction of the channel will include riprap of the channel bottom and the inclusion of an inner flood plane to minimize erosion during flooding events. The stream channel will be revegetated to minimize erosion potential. The Lower Robinson Creek reconstruction is designed to leave the drainage in a condition at final bond release that is at least as stable as the current pre-mining condition.

Following reclamation, stream channels will be returned to a stable state to the extent possible given the currently unstable state of natural drainage channels in the area. Stream channels will be designed to withstand anticipated storm events, thus minimizing the potential of flooding in the reclaimed areas.

The overall condition of the land surface and the surface-water drainages within the permit area at final bond release will likely meet or exceed the current pre-mining conditions. However, it should be noted that Alton Coal Development, LLC will have no control over the land management practices and landowner activities that may be implemented on the privately owned lands of the reclaimed Coal Hollow Mine area after final bond release. Accordingly, the degree of erosional stability and overall conditions in the reclaimed lands and stream drainages in the post bond-release period is not in the control of Alton Coal Development, LLC.

The existing principle surface-water drainages adjacent to the proposed Coal Hollow Mine permit area have large discharge capacities (lower Sink Valley Wash below the County Road 136 crossing, Lower Robinson Creek, and Kanab Creek). These drainages periodically convey large amounts of precipitation runoff water associated with torrential precipitation events. The anticipated discharge rates from alluvial groundwater drainage and the maximum reasonably foreseeable amount of mine discharge water that could potentially be required to be discharged from mine pits is much less than that periodically occurring during major torrential precipitation events. The addition of modest amounts of sediment-free water into these stream channels has the potential to cause minor increases in channel erosion. However, the magnitude of this potential impact will likely be small relative to that occurring during torrential precipitation events.

Most precipitation waters falling on disturbed areas will be contained in diversion ditches and routed to sediment impoundments that are designed to impound seasonal water and storms. Sediment control facilities will be designed and constructed to be geotechnically stable. This will minimize the potential for breaches of sediment control structures, which if they occur could result in down-stream flooding and increases in stream erosion and sediment yield. Emergency spillways will be part of the impoundment structures to provide a non-destructive discharge route should capacities ever be exceeded.

Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

It should be noted that during the startup and construction phase of the mine operation, while the ditches and sediment control ponds are being constructed, temporary silt control measures will be utilized. These measures may include the use of silt fences or other appropriate sediment control measures as necessary.

As shown on Drawing 5-26, there are two sediment impound watershed areas within the mine permit area (Watershed 5 and Watershed 6) from which precipitation runoff water will not be routed through sediment ponds.

Watershed 5 area includes 28 acres near the Sink Valley Wash/Lower Robinson Creek drainage divide. The land surface in Watershed 5 is relatively flat, sloping at about a one percent grade. Because of the flatness of the land surface in Watershed 5, it is not practical to construct ditches to convey water from this area to a sediment pond. Consequently, control of sediment in runoff water from Watershed 5 will be accomplished through the use of a silt fence or other appropriate sediment control measure placed along the western permit boundary adjacent to Watershed 5 (see Drawing 5-26). Precipitation water falling on Watershed 5 will be retained as soil moisture, retained in the lowest portions of the watershed and allowed to evaporate or infiltrate or, after treatment with silt fences or other appropriate sediment control measures, allowed to flow down gradient onto lower lying adjacent areas.

Watershed 6 includes 19 acres located within the permit boundary east of the proposed Lower Robinson Creek reconstruction (see Drawing 5-26). The land surface in this area slopes gently toward the west at an approximately three to four percent grade. The Watershed 6 area will be isolated from a sediment pond by the reconstructed Lower Robinson Creek stream channel. Control of sediment in Watershed 6 will be accomplished through the installation of a silt fence or other appropriate sediment control measure along the margin of the watershed as shown on Drawing 5-26. The soils on the post-mining land surface in Watershed 6 will initially be stabilized with the use of tackifiers. Subsequent revegetation of the land surface in Watershed 6 will minimize the potential for erosion. After treatment with silt fences or other appropriate sediment control measures, precipitation water falling on Watershed 6 will be allowed to flow down-gradient toward adjacent lands or toward the Lower Robinson Creek stream channel.

The potential for flooding or streamflow alteration resulting from mining and reclamation activities at the proposed Coal Hollow Mine permit area is considered minimal.

728.334 Groundwater and surface water availability

Groundwater use in the proposed Coal Hollow Mine permit and adjacent area is generally limited to stock watering and domestic use in Sink Valley. Some limited use of spring discharge water for irrigation has occurred in Sink Valley, although such irrigation is not occurring presently nor has it occurred in at least the past 10 years. The areas of groundwater use in the proposed Coal Hollow Mine permit and adjacent area are located in the northwest ¼ of Section 29, T39S, R5W (see Drawing 7-4; groundwater discharge area A), and in the northwest ¼ of Section 32, T39S, R5W (see Drawing 7-4; groundwater discharge area B). The likely future availability of groundwater in each of these areas is discussed below.

Groundwater discharge area A (Northwest ¼, Section 29, T39S, R5W)

Groundwater use in area A occurs from several alluvial springs and seeps that are used for stock watering and limited domestic use. As described in Section 728.311 above, short-term diminution in discharge rates from springs in northwest ¼ of Section 29, T39S, R5W are possible as mining operations advance toward these springs. This potential impact is associated with the possible drainage of up-gradient alluvial groundwater into mine openings as mining advances toward groundwater discharge area A. Because individual mine pits will typically remain open for less than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled) before subsequently being backfilled and reclaimed, the potential for long-term drainage of alluvial groundwater into the mine voids is negligible, and thus any potential decreases in alluvial discharge in groundwater discharge area A is anticipated to be short-lived.

If groundwater inflow rates into mine openings in this area are excessive, such that appreciable impacts to the springs and seeps in groundwater discharge area A are likely, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine voids. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities. Consequently, the potential that groundwater could become unavailable in this area is minimal. Additionally, if alluvial groundwater resources were to become unavailable in this area due to mining and reclamation activities in the proposed Coal Hollow Mine permit area, groundwater will be replaced according to all applicable State laws and regulations using the replacement water source described in Section 727 above. Details of the contingency plan for this occurrence are provided in Appendix 7-9.

To prevent the migration of alluvial groundwater from the coarse-grained alluvial groundwater system centered east of the mine permit area into mine pit backfill areas after the completion of mining, a permanent low-permeability barrier will be constructed along the eastern edge of the pit 15 area. Details of this plan are provided in Appendix 7-10.

It should be noted that the proposed water replacement source is a new well that will produce groundwater~~, water well Y-61, produces water~~ from the coarse-grained alluvial groundwater system in Sink Valley. Nearby springs that could potentially be impacted by mining and reclamation activities are supported by the same alluvial groundwater system. However, while modest decreases in the artesian hydraulic pressures in the alluvial groundwater system could potentially result in diminution of spring flows, the new well ~~water well Y-61 is 150 feet deep and~~ will be equipped with an electric well pump providing the capability to produce groundwater from the alluvial system even if the hydraulic head in the alluvial groundwater system were to be diminished such that artesian flow conditions temporarily ceased to exist.

Groundwater discharge area B (Northwest ¼, Section 32, T39S, R5W)

Groundwater use in groundwater discharge area B occurs at alluvial springs and seeps located southeast of the proposed Coal Hollow Mine permit area that are used for stock watering and limited domestic use. As described in Section 728.311 above, although some temporary and short-lived diminution in discharge rates from springs in northwest ¼ of Section 29, T39S, R5W is possible, this potential impact is not considered likely.

In the event that alluvial groundwater resources were to become unavailable in this area due to mining and reclamation activities in the proposed Coal Hollow Mine permit area, groundwater will be replaced according to all applicable State laws and regulations using the replacement water source described in Section 727 above.

Surface-water availability

Surface-water use in the proposed Coal Hollow Mine permit and adjacent area occurs in the Sink Valley Wash drainage and in Lower Robinson Creek. Surface waters in the Sink Valley Wash drainage (primarily from Water Canyon via an irrigation diversion and from Swapp Hollow; appreciable discharge in Sink Valley Wash below Section 29 T39S, R5W is usually absent) are utilized for both stock watering and limited irrigation use. Stream water in the Sink Valley Wash drainage is derived from runoff from the adjacent Paunsaugunt Plateau area. Because the surface water in the drainage originates from areas up-gradient areas located large distances from proposed mining areas, and because the stream channel is entirely outside the permit area and will not be impacted by mining and reclamation activities, there is essentially no probability that surface water availability in the Sink Valley Wash drainage could become unavailable as a result of mining and reclamation activities.

Discharge in Lower Robinson Creek immediately above the proposed Coal Hollow Mine permit area typically occurs only in direct response to significant precipitation or snowmelt events. Thus, surface-water availability is currently limited in this drainage prior to any mining activities.

Seepage of alluvial groundwater into the deeply incised lower Robinson Creek stream channel occurs near the contact with the underlying Dakota Formation in the southeast quarter of Section 19, T39S, R5W. This water is likely related to saturated alluvial deposits directly underlying the Robinson Creek stream channel and emerges near where the stream channel intersects the alluvial groundwater system. This seepage of alluvial water is usually about 5 - 10 gpm or less and is routinely monitored at monitoring station SW-5 (Drawing 7-2).

It should be noted that the proposed Coal Hollow Mine plan calls for the permanent diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of the meager discharge of surface water in the drainage below the planned diversion, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

The information presented above suggests that the potential for significant impacts to groundwater and surface-water availability resulting from mining and reclamation activities in the proposed Coal Hollow Mine permit and adjacent systems in the region is low.

728.340 <u>Whether mining and reclamation activity will result in contamination, diminution or interruption of State-appropriated waters</u>

State appropriated water rights in the proposed Coal Hollow Mine permit and adjacent area are shown on Drawing 7-3 and tabulated in Appendix 7-3.

Appropriated groundwaters include alluvial springs and seeps in the northwest ¼ of Section 29, T39S, R5W (groundwater discharge area A), springs and seeps in the northwest ¼ of Section 32, T39S, R5W (groundwater discharge area B). State appropriated surface waters include reaches of Sink Valley Wash east of the proposed Coal Hollow Mine permit area, and reaches of Lower Robinson Creek.

The potential for mining and reclamation activities at the proposed Coal Hollow Mine permit area to result in contamination, diminution or interruption of State-appropriated water in the proposed Coal Hollow Permit and adjacent area are described in detail in Sections 728.310, 728.320, 728.332, and 728.334.

With the possible exception of short-term diminution in discharge rates from springs and seeps in the northwest ¼ of Section 29, T39S, R5W, Contamination, diminution, or interruption of State-appropriated waters in the proposed Coal Hollow Mine permit and adjacent area are not anticipated. It should be noted that if groundwater inflow rates into mine openings in this area are excessive, such that appreciable impacts to the springs and seeps in groundwater discharge area A are likely, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine voids. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities, minimizing the potential for diminution of discharge rates from these springs.

Additionally, it should be noted that the proposed Coal Hollow Mine plan calls for the <u>temporary</u> ~~permanent~~ diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of the meager discharge of surface water in the drainage below the planned diversion, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

In the event that any State appropriated waters were to be contaminated, diminished, or interrupted due to mining and reclamation activities in the proposed Coal Hollow Mine permit area, groundwater will be replaced according to all applicable State laws and regulations using the replacement water source described in Section 727 above.

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730 OPERATION PLAN

Coal mining in the proposed Coal Hollow Mine permit area will occur using surface mining techniques. All coal mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area and support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302. Operations will be conducted to assure the protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

In order to maximize the use and conservation of the coal resource, coal will be recovered using large hydraulic backhoes or front end loaders and off-road trucks. Mined coal will be hauled to a central coal processing area for crushing and placement into a stockpile. Coal from the stockpile will be transferred into a bin and loaded into over the road trucks for transport.

The plan, with Drawings, cross sections, narrative, descriptions, and calculations indicates how the relevant requirements will be met. The lands subject to coal mining and reclamation operations over the estimated life of the operations are identified and briefly described. All appropriate information is located in the subsequent sections and Drawings 5-1 through 5-39 and Appendices A5-1 through A5-3.

731 GENERAL REQUIREMENTS

Operations will be conducted to assure protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

<u>Groundwater and Surface-Water Protection</u>

To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acid, toxic, or other harmful infiltration to the groundwater system. Additionally, excavations, and disturbances will be managed to prevent or control discharges of pollutants to the groundwater.

Products including chemicals, fuels, and oils used in the mining process will be stored and used in a manner that minimizes the potential for these products entering groundwater systems. Concrete oil and fuel containments will be constructed as shown on Drawings 5-3 and 5-8.

A facilities spill plan for the Coal Hollow Mine is provided in Appendix 7-5. When operations begin, there will be an EPA SPCC plan available on site for inspection.

The wash bay sump sludge will be removed as necessary and transported off site to an approved hazardous waste disposal facililty.

The wash bay at the mine site will include a closed circuit water recycle system. This system will eliminate and store water impurities and reroute water back through the wash bay for cleaning equipment, thus minimizing water consumption the potential for contamination of groundwater resources. Details for this structure can be viewed on Drawings 5-3, and 5-8.

As mining operations approach springs and seeps in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A), there is the potential for drainage of up-gradient into mine openings to cause short-lived diminution of discharge from these springs. If groundwater inflow rates into mine openings in this area are excessive, such that appreciable impacts to the springs and seeps in groundwater discharge area A are likely, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine voids. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities, minimizing the potential for diminution of discharge rates from these springs. Details of the contingency plan for this occurrence are provided in Appendix 7-9.

To prevent the migration of alluvial groundwater from the coarse-grained alluvial groundwater system centered east of the mine permit area into mine pit backfill areas after the completion of mining, a permanent low-permeability barrier will be constructed along the eastern edge of the pit 15 area. Details of this plan are provided in Appendix 7-10.

The mine will replace loss of water identified for protection in this MRP that are impacted by mining and reclamation operations.

To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acidic or toxic drainage, prevents to the extent possible, additional contributions of suspended solids to streamflow outside the permit area and otherwise prevents water pollution. Runoff and sediment control measures are described in detail in Chapter 5 of this MRP. The mine will maintain adequate runoff- and sediment-control facilities to protect local surface waters.

Discharge of mine water that has been disturbed by coal mining and reclamation operations is not anticipated. However, any discharges of water from areas disturbed by coal mining and reclamation operations that do occur will be made in compliance with all

Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR part 434. Discharge of mine waters will be regulated by a Utah UPDES discharge permit.

Water pollution associated with mining and reclamation activities within the permit areas will be controlled by:

- Construction of berms and/or diversion ditches to control runoff from all facilities areas.
- Roads will be constructed with ditches to capture runoff
- Diversion ditches will be constructed as necessary around active mining and reclamation areas to capture runoff from those areas.
- Sedimentation impoundments will be constructed to control discharges
- In areas where impoundments or diversions are not suitable to the surrounding terrain, silt fence or straw bales will be utilized to control sediment discharge from the permit area.

In order to accomplish these objectives, watershed analysis of the permit and adjacent areas has been completed and specific designs are established for each water pollution control structure. Primary control structures include four sediment impoundments, four diversion ditches and miscellaneous berms. The locations of these structures can be viewed on Drawing 5-3. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-25 through 5-34. In addition, a geotechnical analysis of the impoundments to ensure stability can be viewed in Appendix 5-1. The watershed and structure sizing analysis can be viewed in Appendix 5-2. In addition to these primary structures, temporary diversions and impoundments may also be implemented, as necessary, in mining areas to further enhance pollution controls.

Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760. Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763. Storm water and snow melt that occurs within the facilities area will be routed to an impoundment that will contain sediment. This impoundment will have a drop-pipe spillway installed that will allow removal of any oil sheens that may result from parking lots or maintenance activities by using absorbent materials to remove the sheen. Details for this impoundment can be viewed on Drawings 5-28.

There are four sediment impoundments proposed for the permit area. These structures will be constructed using a combination of dozers and backhoes. The structures have been designed to contain the required storm events as specified in Appendix 5-2. The structures will have sediment removed as necessary to ensure the required capacities. Details for these structures can be viewed on Drawings 5-25, 5-26 and 5-28 through 5-32. Calculations and supporting text can be viewed in Appendix 5-2.

Four diversion ditches along with four sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

The smallest practicable area, consistent with reasonable and safe mine operational practices will be disturbed at any one time during the mining operation and reclamation phases. This will be accomplished through progressive backfilling, grading, and prompt revegetation of disturbed areas.

There are no other coal processing waste banks, dams or embankments proposed within the permit area.

Diesel fuels, oils, greases, and other hydrocarbons products will be stored and used at the mine site for a variety of purposes. A spill Prevention Control and Countermeasure Plan will be implemented that will help minimize any potential detrimental impacts to the environments.

Products including potentially hazardous chemicals, fuels, and oils used in the mining process will be stored and used in a manner that minimizes the potential for these products to contaminate surface-water resources. Concrete oil and fuel containments will be constructed as shown on Drawings 5-3 and 5-8.

The wash bay at the mine site will include a closed circuit water recycle system. This system will eliminate and store water impurities and reroute water back through the wash bay for cleaning equipment, thus minimizing water consumption the potential for contamination of surface-water resources. Details for this structure can be viewed on Drawings 5-3, 5-8, and Appendix 5-4. .

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to R645-301-732.400, R645-301-742.400 and R645-301-762. The specific plan for road locations and design are presented in R645-301-534. The location and details for roads can be viewed on Drawings 5-3 and 5-22 through 5-24.

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed to 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 given under R645-301-751; minimize the diminution to or degradation of the quality or quantity of surface- and ground-water systems; and refrain from significantly altering the normal flow of water in streambeds or drainage channels. No acid- or toxic-forming substances will be used in road surfacing.

All roads will be removed and reclaimed according to Drawings 5-35 and 5-36. The estimated timetable for removing these roads is shown on Drawing 5-38. Cut ditches will be established on the shoulders of all primary roads to control drainage and erosion. Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles.

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738.

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Water wells less than thirty feet deep are not regulated by the Utah Division of Water Rights. The permanent closure and abandonment of water wells less than 30 feet deep will be accomplished by filling the well casing with neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other appropriate materials. The well casing will then be cut off below the ground surface and native materials placed over the abandoned well site.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731 and be managed according to the following.

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

If mining and reclamation activities result in the contamination, diminution, or interruption of State appropriated groundwater or surface-water sources, replacement water will be provided using the alternate water source described in R645-301-727.

Seasonal baseline water monitoring information for all water rights that could be affected by mining in the permit and adjacent area have been submitted electronically to the Division's on-line hydrology database.

731.200 Water Monitoring

This section describes the hydrologic monitoring plan. Locations of surface-water and groundwater monitoring sites are indicated on Drawing 7-10. Hydrologic monitoring protocols, sampling frequencies, and sampling sites are described in Table 7-4. Groundwater and surface-water monitoring locations are listed in Table 7-5. Operational field and laboratory hydrologic monitoring parameters for surface water are listed in Table 7-6, and for groundwater in Table 7-7. The hydrologic monitoring plan during reclamation will be the same as during the operational phase. The hydrologic monitoring parameters have been selected in consultation with the Division's directive Tech-006, *Water Monitoring Programs for Coal Mines.*

The groundwater and surface-water monitoring plan is extensive and includes 54 monitoring sites. The monitoring plan is designed to monitor groundwater and surface-water resources for any potential impacts that could potentially occur as a result of mining and reclamation activities in the proposed Coal Hollow Mine permit and adjacent area. Each of the sampling locations and their monitoring purpose are described below.

Streams

Kanab Creek will be monitored at sites SW-3 (above the permit area), and SW-2 (below the permit area). Lower Robinson Creek will be monitored at sites SW-4 (above the permit area), SW-101 (within the permit area), and SW-5 (below the permit area above the confluence with Kanab Creek). The irrigation water near SW-4 will also be monitored at site RID-1. Swapp Hollow creek will be monitored above the permit area at site SW-8. Sink Valley Wash will be monitored at SW-6 (a small tributary to the wash immediately below the permit area) and at SW-9, located in the main drainage below the permit area. All of these locations, with the exception of RID-1) will be monitored for discharge and water quality parameters specified in Table 7-6 quarterly, when reasonably accessible. Additionally, Lower Robinson Creek will be monitored at site BLM-1, which is near the location of alluvial groundwater emergence in the bottom of the stream channel. BLM-1 and RID-1 will be monitored for discharge and field water quality parameters.

Springs

Eight springs from alluvial groundwater area A will be monitored including SP-8, SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and Sorensen Spring. Spring SP-8 is a developed spring in area A that provides culinary water for the Swapp Ranch house. SP-8 will be monitored for discharge and operational laboratory water quality measurements quarterly when reasonably accessible. Springs SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and Sorensen Spring springs will be monitored for discharge and field water quality measurements quarterly when reasonably accessible.

Springs SP-4 and SP-6, and SP-33, which are located in Sink Valley below the proposed mining area, will also be monitored. SP-6 is an area of diffuse seepage above an earthen impoundment in the wash immediately below the permit area. Spring SP-33 is a developed spring that discharges into a pond below the permit area and provides culinary water to two adjacent cabins. Each of these Springs SP-6 and SP-33 will be monitored for discharge and operational laboratory water quality measurements quarterly when reasonably accessible. SP-4 discharges from a fault/fracture system in the Dakota Formation near the canyon margin in Sink Valley Wash below the permit area. Spring SP-4 will be monitored for discharge and field water quality measurements quarterly when reasonably accessible. Spring SP-3 discharges from pediment alluvium in the upland area above Sink Valley Wash more than a mile from the permit area. It is extremely unlikely that discharge rates or water quality at this spring could be impacted as a result of mining-related activities in the mine permit area. However, this spring will be monitored for discharge and field water quality measurements quarterly, primarily to provide background data from springs in the region.

Wells

Wells Y-98 (Robinson Creek alluvium above the permit area), Y-45 (coal seam well in Swapp Hollow above permit area), Y-102 (flowing alluvial well in alluvial groundwater discharge area A), Y-36 (coal seam well in Sink Valley above the permit area), Y-38 (coal seam well in Sink Valley permit area), Y-61 (alluvial well at the Sorenson Ranch), and C5-130 (new monitoring well in alluvial groundwater discharge A) will be monitored quarterly when reasonable accessible. Well Y-61 will be monitored for groundwater operational laboratory water quality parameters to monitor groundwater quality in alluvial groundwater discharge area A. The other wells will be monitored for water level only.

Additionally, 19 newly constructed monitoring wells constructed in the Sink Valley alluvial groundwater system will be monitored quarterly. These include C2-15, C2-28, C2-40, C3-15, C3-30, C3-40, C4-15, C4-30, C4-50, C7-20, C9-15, C9-25, C9-40, LS-28, LS-60, LS-85, SS-15, SS-30, and SS-75. All of these wells will be monitored quarterly for water level. Additionally, wells LS-85 and SS-30 will be monitored for groundwater operational laboratory water quality measurements.

Additionally two wells in the Lower Robinson Creek alluvium will be monitored for water level and groundwater operational laboratory chemistry. These include UR-70 located above proposed mining locations in the Lower Robinson Creek drainage, and LR-45, located below proposed mining areas adjacent to Lower Robinson Creek. It should be noted that LR-45 is located near a proposed sediment pond impoundment. Consequently, if this well becomes unsuitable for monitoring, an alternate location will be used to monitor the Lower Robinson alluvial groundwater system in this area.

Wells C0-18 and C0-54 are located near the initial proposed mining areas in the Lower Robinson Creek drainage. These will be monitored for water level quarterly.

It should be noted that many of the wells specified for monitoring in this monitoring plan will at some point be destroyed or rendered inoperable as the mine workings precede through the area. These wells will be monitored until such a time as they are destroyed or become inoperable.

Groundwater and surface-water monitoring will continue through the post-mining periods until bond release. The monitoring requirements, including monitoring sites, analytical parameters and the sampling frequency may be modified in the future in consultation with the Division if the data demonstrate that such a modification is warranted.

731.530 State-appropriated water supply

The proposed water replacement well will be used both as a water supply source for the mine and for water replacement if needed. Alton Coal Development, LLC commits to having the water-replacement well (or other appropriate water replacement source as approved by the Division) drilled and developed before beginning overburden removal for Pits 13, 14, and 15.

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731.600 Stream Buffer Zones

Any perennial or intermittent streams in the mine area will be protected by 100 foot stream buffer zones on either side of these streams. Coal mining and reclamation operations will not cause or contribute to the violation of applicable Utah or federal water standards and will not adversely affect the water quality and quantity or other environmental resources of the stream.

Temporary or permanent stream channel diversion will comply with R645-301-742-300. It should be noted that the proposed Coal Hollow Mine plan calls for the temporary ~~permanent~~ diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of the meager discharge of surface water in the drainage below the planned diversion, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

The areas surrounding the streams that are not to be disturbed will be designated as buffer zones, and will be marked as specified in R645-301-521.260.

731.700 Cross sections and Maps

The locations of springs and seeps identified in the proposed Coal Hollow Mine permit and adjacent area are shown in Drawing 7-1. The locations of baseline hydrologic monitoring locations are shown on Drawing 7-2. The locations of water rights in the proposed Coal Hollow permit and adjacent area are provided on Drawing 7-3. Cross-sections depicting the stratigraphy and hydrostratigraphy of the proposed Coal Hollow Mine permit and adjacent area are presented in Chapter 6, Drawing 6-2. Designs for proposed impoundments in the proposed Coal Hollow permit area are shown in Drawings 5-25 through 5-31

731.800 Water Rights and Replacement

Alton Coal Development, LLC commits to replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from the underground or surface source, where the water supply has been adversely impacted by contamination, diminution, or interruption proximately resulting from the surface mining activities. Baseline hydrologic information required in R645-301-624.100 through R645-301-624.200, R645-301-625, R645-301-626, R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be used to determine the extent of the impact of mining upon ground water and surface water.

Sorensen Spring (SP-40) is the current domestic water supply for the Sorensen Ranch (Personal communication, Darlynn Sorensen, 2008). There is currently no development at the spring that would convey water to the ranch house. Rather, water from the spring is obtained directly from the spring for use at the ranch. Monitoring of discharge rate and water quality is included in the proposed water monitoring plan for the Coal Hollow Mine. The operational and reclamation phase water monitoring protocols for this spring are listed in Tables 7-5 and 7-7A. Should the water source be interrupted, diminished, or contaminated, replacement water will be provided from the new water well that will be constructed prior to the beginning of overburden removal for pits 13, 14, and 15 (see description in section R645-301-727 above, and Drawing 5-8C) or other suitable water replacement source as approved by the Division.

Reclamation designs for the eastern permit boundary where the mining pits meet the undisturbed alluvium are provided in Appendix 7-10. These designs specify engineering methods to be used to minimize drainage from the alluvium into the fill in the reclaimed pits (as the pits are filled and reclaimed) thereby protecting the hydrologic balance in Sink Valley. Through the emplacement of a permanent engineered low-permeability barrier between the alluvial groundwater systems to the east of the mining area and the mine backfill areas, the alluvial groundwater system will be effectively isolated from the mine backfill areas. An evaluation of the permanent barrier for pit 15 has been performed by Mr. Alan O. Taylor of Taylor Geo-Engineering, LLC. Information in the Taylor Geo-Engineering report indicates that the 50-foot wide barrier will prevent any appreciable drainage of alluvial groundwater from the coarse-grained alluvial groundwater system centered east of the permit area into the backfilled pit areas. Laboratory analysis of the Tropic Shale material from which the barrier will be constructed indicates that the compacted shale material will perform adequately to successfully contain the alluvial groundwater. Thereby water levels in the alluvial groundwater systems in Sink Valley east of the pit areas will be reclaimed to approximate pre-mining levels.

As specified in R645-301-112, groundwater quantity will be protected by handling earth materials and runoff in a manner that will restore approximate premining recharge capacity of the reclaimed area as a whole, excluding coal mine waste disposal areas and fills, so as to allow the movement of water to the groundwater system.

732 Sediment Control Measures

Sediment control measures have been designed, constructed and maintained to prevent additional contributions of sediment to streamflow or to runoff outside the permit area.

732.100 Siltation Structures

Siltation structures within the permit area are described in Section 732.200

732.200 Sedimentation Ponds

Four diversion ditches along with four sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

Sedimentation ponds have been designed in compliance with the requirements of R645-301-356.300, R645-301-356.400, R645-301-513.200, R645-301-742.200 through R645-301-742.240, and R645-301-763.

No sedimentation ponds or earthen structures that will remain open are planned.

The sedimentation plan has been designed to comply with the MSHA requirements given under R645-301-513.100 and R645-301-513.200.

732.300 Diversions

The runoff control plan is designed to isolate, to the maximum degree possible, runoff from disturbed areas from that of undisturbed areas. Where possible, this has been accomplished by allowing up-stream runoff to bypass the disturbed area, and routing any runoff from undisturbed areas that enter the disturbed area into a sediment control system.

Four diversion ditches along with four sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

732.400 Road Drainage

All roads will be constructed, maintained and reconstructed to comply with R645-301-742.400. Road drainage facilities include diversion ditches, culverts, containment berms, and/or water bars. Specific plans for road drainage, road construction, and road maintenance are presented in Chapter 5, Section 534 of this MRP.

A description of measures to be taken to obtain division approval for alteration or relocation of a natural drainage way will be presented to the Division when necessary.

A description of measures to be taken to protect the inlet end of a ditch relief culvert will be submitted to the Division when necessary.

All road drainage diversions will be maintained and repaired to operational condition following the occurrence of a large storm event. Culvert inlets and outlets will be kept clear of sediment and other debris.

733 IMPOUNDMENTS

733.100 General Plans

A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments.

The plans have been certified and a detailed geotechnical analysis has been provided in Appendix 5-1. The certifications, drawings and cross sections can be viewed in Drawings 5-25 through 5-31 and Appendices 5-1 and 5-2.

Five impoundments are proposed to control storm water runoff and sediment from disturbed areas. Each impoundment is designed to contain the run off from a 100 year, 24 hour duration storm event. The locations of the impoundments and the associated watersheds can be viewed on Drawing 5-26. The following table summarizes the final capacity results for each impoundment:

Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
1	2.6	3.1	119	0.5
2	1.7	2.3	135	0.6
3	6.3	7.7	122	1.4
4	5.7	7.5	132	1.8
1B	0.5	0.8	160	0.3

Structure 1 is a rectangular impoundment approximately 136 feet long by 81 feet wide and 9 feet in depth. This impoundment will control storm water run off from the facilities area. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 3 feet freeboard. This pond will control storm water from a watershed of approximately 27 acres. The cleanout and spillway elevation are 6909' and 6918', respectively. The top of the embankment is at elevation 6922'. Details for the design can be viewed on Drawing 5-28.

Structure 1B is a small rectangular impoundment that is approximately 40 feet long by 20 feet wide. This impoundment will control storm water run off from the facilities access road system. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 5 acres. The cleanout and spillway elevation are 6892' and 6904', respectively. The top of the embankment is at elevation 6906'. Details for the design can be viewed on Drawing 5-28B.

Structure 2 is a rectangular impoundment approximately 188 feet long by 36 feet wide and 9 feet in depth. This impoundment will control storm water runoff from the disturbed areas immediately south of Lower Robinson Creek. The impoundment will be constructed with a 24" drop pipe spillway. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum 3 feet freeboard. This pond will control storm water runoff from a watershed of approximately 74 acres. The cleanout and spillway elevation are 6889' and 6898', respectively. Top of the embankment is at elevation 6901'. Details for the design can be viewed on Drawing 5-29.

Structure 3 is a valley fill impoundment that will impound an area approximately 484 feet long by 229 feet wide and 9 feet deep. The fill for the impoundment will be constructed from an excavation 198 feet wide by 229 feet long and 8 feet deep. The embankment will be constructed in 2 foot lifts utilizing a dozer. The top of the embankment will be a minimum 12 feet wide. The spillway will be an open channel that will have vegetated slopes. This pond will control storm water runoff from a watershed of approximately 300 acres. The cleanout and spillway elevation are 6802' and 6810', respectively. Top of the embankment is at 6814'. Details for the design can be viewed on Drawing 5-30.

Structure 4 is a rectangular pond located at the south end of the permit area that is approximately 92 feet wide by 628 feet long and 11 feet deep. This impoundment will be incised into the existing ground. Part of the excavation will be used to construct a 12 foot wide embankment. The spillway will be an open channel that will have vegetated slopes. This pond will control storm water runoff from a watershed of approximately 256 acres. The cleanout and spillway elevation are 6823' and 6834', respectively. Top of the embankment is at elevation 6838'. Details for the design can be viewed on Drawing 5-31.

Open channel spillway details for impoundments 3 and 4 are provided in Drawing 5-32. These spillways are designed for emergencies and are not expected to be used during normal operations.

The outer slopes of the impoundments will be sloped to a maximum grade of 3h:1v. Inside slopes will be graded to a maximum 2h:1v. The slopes will be graded and revegetated for erosion control.

No underground mine workings exist near or under the impoundment structures; therefore subsidence surveys are not provided.

Geologic data for the area where impoundments will be located consists of mainly fine grained alluvium with high clay content. Seepage from the impoundments is expected to be minimal based on the high clay content of the existing materials. Characterization of the soils is contained in Chapter 2. Acid and Toxic analysis of the soils indicates that water seeping through the alluvium layer will not result in reducing water quality. The acid and toxic analysis for the alluvium can be viewed in Appendix 6-2.

Hydrologic data for the permit area is provided in Appendix 7-1. This data indicates that there will be some seepage through the subsurface that may travel to adjacent drainages. The quantities for this seepage are expected to be minimal and will have minimal impact to the overall hydrologic balance. Even though seepage may occur, analysis of the soils indicates that water quality will not be diminished.

The above information provides a summary of all the impoundment structures that are proposed for the Coal Hollow Project. Detailed designs and calculations are provided in this section, Drawings 5-26 through 5-32 and Appendix 5-2. No other impoundments are anticipated.

733.200 Permanent and Temporary Impoundments

All impoundments have been designed and constructed using current, prudent engineering practices and have been designed to comply with the requirements of R645-301-512.240, R645-301-514.300, R645-301-515.200, R645-301-533.100 through R645-301-533.600, R645-301-733.220 through R645-301-733.226, R645-301-743.240, and R645-301-743.

No impoundments or sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) exist or are planned within the proposed Mine Permit Area. Should impoundments and sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) become necessary, compliance with the requirements of MSHA, 30 CFR 77.216 will be met.

All five planned impoundments have been evaluated by a professional engineer to ensure stability of each structure. The stability analysis performed resulted in a static safety factor of at least 2.2 for each structure. The details for this analysis can be viewed in Appendix 5-1.

No permanent impoundments are planned in the project area.

If any examination or inspection discloses that a potential hazard exists, the person who examined the impoundment will promptly inform the Division according R645-301-515.200.

734 Discharge Structures

Discharge structures will be constructed and maintained to comply with R645-301-744.

The proposed impoundments are designed to temporarily store water from storm events and snow melt. Long term standing water in the impoundments is anticipated to be seasonal and sediment will be removed as necessary to provide the required storage capacities. Emergency spillways have been included in the designs to provide a non-destructive discharge route should the capacities ever be exceeded. Surveys of these impoundments will be regularly conducted to ensure that the required design capacities are available.

Impoundments 3 and 4 will be constructed with open channel spillways. These spillways are designed to discharge a 6 hour duration, 100 year storm event even though they are not expected to be used. They will be vegetated to minimize erosion and spillway slopes will not exceed 3h:1v. Drawing 5-32 provides the details for the open channel spillways.

Impoundments 1, 1B and 2 will be constructed with a drop pipe spillway system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. These impoundments will have the drop-pipe spillways installed which will allow removal of any oil sheens that may result from parking lots, primary roads or maintenance activities by using absorbent materials to remove the sheen. The drop-pipe spillways are 24" diameter pipes that are vertical in the impoundment. These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. This system was chosen for these three impoundments based on their locations in relation to the facilities and primary roads. This discharge system will be constructed for precautionary measures only since pollutants are not expected in the impoundments during normal operations.

735 Disposal of Excess Spoil

Areas designated for the disposal of excess spoil and excess spoil structures will be constructed and maintained to comply with R645-301-745.

Details of proposed excess spoil disposal plans are presented in Chapter 5, Section 535 of this MRP and are summarized below.

A geotechnical analysis has been completed for the proposed excess spoil structure. This analysis estimates the long-term safety factor to be 1.6 to 1.7 based on the proposed design. Following proper construction practices of building the structure in maximum four foot lifts and meeting 85% compaction based on the standard Procter will ensure that the structure will be stable under all conditions of construction. This construction will occur only in the designated excess spoil area as shown on Drawing 5-3 and 5-35. The fill will be placed with end dump haul trucks and lifts will be constructed using dozers. High precision GPS systems will be regularly utilized to check grades and appropriate lift thickness. The geotechnical analysis for this structure can be viewed in Appendix 5-1.

The excess spoil is planned to be placed in an area where natural grades range from 0 to 5%. This is one of the most moderately sloping locations in the Permit Area. Stability of this structure is estimated to be 1.6 to 1.7 based on the Appendix 5-1.

Geotechnical borings were completed in the foundation of the proposed disposal area. Laboratory analysis of these borings has also been completed. Details of this analysis can be viewed in Appendix 5-1.

Permanent slopes for the proposed excess spoil will not exceed 3h:1v (33 percent), therefore no keyway cuts have been proposed in the design. Appendix 5-1 details the stability analysis for the proposed structure.

Excess spoil will not be disposed of in underground mine workings.

Horizontal lifts will not exceed four feet in thickness unless otherwise approved by the Division. The lifts will be concurrently compacted to meet 85% of the standard Procter. The geotechnical analysis (Appendix 5-1), provides information showing that these construction standards will provide mass stability and will prevent mass movement during and after construction. The excess spoil will be graded to provide drainage similar to original flow patterns. Topsoil and subsoil as designated in Chapter 2 will be removed and separated from other materials prior to placement of spoil.

A description of the character of the bedrock and any adverse geologic conditions in presented in Appendix 5-1.

Spring and seep survey information is provided on Drawing 7-1. There are no springs or seeps identified in the excess spoil area.

There are no historical underground mining operations in the proposed excess spoil area. There are also no future underground operations proposed.

There are no rock chimneys or drainage blankets proposed.

A stability analysis including strength parameters, pore pressures and long-term seepage conditions is presented together with all supporting data in Appendix 5-1.

Neither rock-toe buttresses nor key-way cuts are required under R645-301-535.112 or R645-301-535.113.

No valley fills or head-of-hollow fills are proposed.

No durable rock fills are proposed.

No disposal of waste on preexisting benches is planned

The excess spoil structure and fill above approximate original contour are the only alternative specifications proposed. A geotechnical analysis has been completed for this proposal and can be viewed in Appendix 5-1. All other mined areas will be restored to approximate original contour.

736 <u>Coal Mine Waste</u>

Areas designated for disposal of coal mine waste and coal mine waste structures will be constructed and maintained to comply with R645-301-746.

No structures for the disposal of coal mine waste are planned.

737 Noncoal Mine Waste

Noncoal mine waste will be stored and final disposal of noncoal mine waste will comply with R645-301-747

Noncoal mine waste, including but not limited to grease, lubricants, paints, flammable liquids, garbage, machinery, lumber and other combustible materials generated during coal mining and reclamation operations will be temporarily stored in a controlled manner. Final disposal of noncoal mine wastes will consist of removal from the project area and transportation to a State-approved solid waste disposal area.

Only sizing of the coal is proposed. This process will not produce any waste.

At no time will any noncoal mine waste be deposited in a refuse pile or impounding structure, nor will any excavation for a noncoal mine waste disposal site be located within eight feet of any coal outcrop or coal storage area.

Notwithstanding any other provision to the R645 Rules, any noncoal mine waste defined as "hazardous" under 3001 of the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580, as amended) and 40 CFR Part 261 will be handled in accordance with the requirements of Subtitle C of RCRA and any implementing regulations.

Debris, acid-forming, toxic-forming materials and materials constituting a fire hazard will be identified and disposed of in accordance with R645-301-528.330, R645-301-537.200, R645-301-542.740, R645-301-553.100 through R645-301-553.600, R645-301-553.900, and R645-301-747. Appropriate measures will be implemented to preclude sustained combustion of such materials.

Plans do not include using dams, embankments or other impoundments for disposal of coal, overburden, excess spoil or coal mine waste.

738 Temporary Casing and Sealing of Wells

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

740 **DESIGN CRITERIA AND PLANS**

741 **GENERAL REQUIREMENTS**

742 **SEDIMENT CONTROL MEASURES**

742.100 General Requirements

742.110 Design

Appropriate sediment control measures will be designed, constructed and maintained using best technology currently available to prevent to the extent possible, contributions of sediment to stream flow or to runoff outside the permit area; meet the effluent limitations under R645-301-751; and minimize erosion to the extent possible.

Four diversion ditches along with five sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2. These impoundments in combination with the ditches will be the primary method that will be used to control sediment resulting from disturbed areas. In addition to the drawings and Appendix 5-2 , the following is a description of the structures:

A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments.

The plans have been certified and a detailed geotechnical analysis has been provided in Appendix 5-1. The certifications, drawings and cross sections can be viewed in Drawings 5-25 through 5-31 and Appendices 5-1 and 5-2.

Five impoundments are proposed to control storm water runoff and sediment from disturbed areas. Each impoundment is designed to contain the run off from a 100 year, 24 hour duration storm event. The locations of the impoundments and the associated watersheds can be viewed on Drawing 5-26. The following table summarizes the final capacity results for each impoundment:

Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
1	2.6	3.1	119	0.5
2	1.7	2.3	135	0.6
3	6.3	7.7	122	1.4
4	5.7	7.5	132	1.8
1B	0.5	0.8	160	0.3

Structure 1 is a rectangular impoundment approximately 136 feet long by 81 feet wide and 9 feet in depth. This impoundment will control storm water run off from the facilities area. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 4 feet freeboard. This pond will control storm water from a watershed of approximately 27 acres. The cleanout and spillway elevation are 6909' and 6918', respectively. The top of the embankment is at elevation 6922'. Details for the design can be viewed on Drawing 5-28.

Structure 1B is a small rectangular impoundment that is approximately 40 feet long by 20 feet wide. This impoundment will control storm water run off from the facilities access road system. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 5 acres. The cleanout and spillway elevation are 6892' and 6904', respectively. The top of the embankment is at elevation 6906'. Details for the design can be viewed on Drawing 5-28B.

Structure 2 is a rectangular impoundment approximately 188 feet long by 36 feet wide and 9 feet in depth. This impoundment will control storm water runoff from the disturbed areas immediately south of Lower Robinson Creek. The impoundment will be constructed with a 24" drop pipe spillway. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum 3 feet freeboard. This pond will control storm water runoff from a watershed of approximately 74 acres. The cleanout and spillway elevation are 6889' and 6898', respectively. Top of the embankment is at elevation 6901'. Details for the design can be viewed on Drawing 5-29.

Structure 3 is a valley fill impoundment that will impound an area approximately 484 feet long by 229 feet wide and 9 feet deep. The fill for the impoundment will be constructed from an excavation 198 feet wide by 229 feet long and 8 feet deep. The embankment will be constructed in 2 foot lifts utilizing a dozer. The top of the embankment will be a minimum 12 feet wide. The spillway will be an open channel that will have vegetated slopes. This pond will control storm water runoff from a watershed of approximately 300 acres. The cleanout and spillway elevation are 6802' and 6810', respectively. Top of the embankment is at 6814'. Details for the design can be viewed on Drawing 5-30.

Structure 4 is a rectangular pond located at the south end of the permit area that is approximately 92 feet wide by 628 feet long and 11 feet deep. This impoundment will be incised into the existing ground. Part of the excavation will be used to construct a 12 foot wide embankment. The spillway will be an open channel that will have vegetated slopes. This pond will control storm water runoff from a watershed of approximately 256 acres. The cleanout and spillway elevation are 6823' and 6834', respectively. Top of the embankment is at elevation 6838'. Details for the design can be viewed on Drawing 5-31.

Open channel spillway details for impoundments 3 and 4 are provided in Drawing 5-32. These spillways are designed for emergencies and are not expected to be used during normal operations.

The outer slopes of the impoundments will be sloped to a maximum grade of 3h:1v. Inside slopes will be graded to a maximum 2h:1v. The slopes will be graded and revegetated for erosion control.

No underground mine workings exist near or under the impoundment structures; therefore subsidence surveys are not provided.

Geologic data for the area where impoundments will be located consists of mainly fine grained alluvium with high clay content. Seepage from the impoundments is expected to be minimal based on the high clay content of the existing materials. Characterization of the soils is contained in Chapter 2. Acid and Toxic analysis of the soils indicates that water seeping through the alluvium layer will not result in reducing water quality. The acid and toxic analysis for the alluvium can be viewed in Appendix 6-2.

Hydrologic data for the permit area is provided in Appendix 7-1. This data indicates that there will be some seepage through the subsurface that may travel to adjacent drainages. The quantities for this seepage are expected to be minimal and will have minimal impact to the overall hydrologic balance. Even though seepage may occur, analysis of the soils indicates that water quality will not be diminished.

Sedimentation ponds have been designed in compliance with the requirements of R645-301-356.300, R645-301-356.400, R645-301-513.200, R645-301-742.200 through R645-301-742.240, and R645-301-763.

No sedimentation ponds or earthen structures that will remain open are planned.

The sedimentation plan has been designed to comply with the MSHA requirements given under R645-301-513.100 and R645-301-513.200.

The diversions ditches will be utilized to direct runoff from disturbed areas to the sediment impoundments. The channel sizing for the four proposed diversion ditches has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 100 year, 24 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. Similar to the impoundment sizing, the Carlson Software Hydrology module was utilized to perform these calculations. The ditch locations, designs and cross sections can be viewed on Drawings 5-33 and 5-34.

The following table summarizes the inputs and results for each diversion based on flows during a 100 year, 24 hour storm event:

Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
1	3.0	0.020	2.8	14.8	0.5	6.8	0.3
2	2.5	0.020	3.5	6.9	0.4	6.0	0.3
3	4.5	0.020	2.4	16.7	0.5	6.3	0.3
4	5.0	0.020	1.8	19.8	0.6	5.4	0.3

*All side slopes are 2h:1v

The sedimentation plan has been designed to comply with the MSHA requirements given under R645-301-513.100 and R645-301-513.200.

These structures will retain sediment within the disturbed area. The diversion ditches are designed in manner that will minimize erosion of the channels and will divert runoff from disturbed areas to the impoundments. These sediment control measures are designed to meet the effluent limitations under R645-301-751.

742.200 Siltation Structures

Siltation structures have been designed in compliance with the requirements of R645-301-742.

Miscellaneous controls such as silt fence and berms are proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-26. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

742.210 General Requirements

Additional contributions of suspended solids and sediment to streamflow or runoff outside the permit area will be prevented to the extent possible using the best technology currently available. Siltation structures for an area will be constructed before beginning any coal mining and reclamation operations in that area and, upon construction, will be certified by a qualified registered professional engineer to be constructed as designed and as approved in the reclamation plan. Any siltation structures which impounds water will be designed, constructed and maintained in accordance with R645-301-512.240, R645-301-514.300, R645-301-515.200, R645-301-533.100 through R645-301-533.600, R645-301-733.220 through R645-301-733.224, and R645-301-743.

The primary controls for limiting suspended solids and sediment to stream flow and runoff outside the permit area is sediment impoundments and diversions ditches. The proposed system described in section 742.110 is designed to control storm water/runoff discharges from the disturbed areas. Discharges from this system are expected to be minimal and infrequent. Discharges that may occur will comply with R645-301-751.

The impoundment and ditch system will be inspected regularly and discharges will be sampled for water quality purposes.

742.220 Sedimentation Ponds.

742.221.1 The proposed sediment ponds are designed to be used individually

742.221.2 The locations for the sediment ponds were selected to be as near as possible to the disturbed areas and are not located in perennial streams

742.221.3 The ponds are designed and will be constructed and maintained to:

742.221.31 The ponds have been designed with excess capacity by at least 15% to allow for adequate sediment storage volume. The following table provides the design capacities in relation to a 24 hour duration, 100 year storm event:

Sedimentation Impoundment Capacities

Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
1	2.6	3.1	119	0.5
2	1.7	2.3	135	0.6
3	6.3	7.7	122	1.4
4	5.7	7.5	132	1.8
1B	0.5	0.8	160	0.3

These sedimentation ponds will be surveyed at least annually to ensure that sufficient sediment storage is available in the impoundment. Sediment will be removed from the ponds as required based on results from the surveys. Calculations related to these design capacities can be viewed in Appendix 5-2. Stage-Storage curves for each pond can be viewed on Drawings 5-28 through 5-31.

742.221.32 The sedimentation ponds are designed to provide detention for a 100 year, 24 hour duration storm event. Calculations for this design can be viewed in Appendix 5-2. This design standard is expected to keep discharges from the structure at a minimum and allow adequate settlement time to meet Utah and federal effluent limitations.

742.221.33 The sedimentation ponds are designed for a 100 year, 24 hour storm event which significantly exceeds a 10 year, 24 hour precipitation event. The 100 year, 24 hour event in the Alton area is 3.1 inches of precipitation. The 10 year, 24 hour precipitation event in this same location is approximately 2.0 inches of precipitation. The design standard used for the Coal Hollow project is 155% of the precipitation for the required "design event".

742.221.34 Each pond will be constructed with an emergency spillway, should the capacities of the ponds ever be exceeded. These spillways will provide a nondestructive route for storm water discharge, though the capacities of the ponds are not expected to be exceeded. The design capacities of the ponds are expected to contain each storm event and therefore will provide sufficient detention time to meet Utah and federal effluent limitations. The following is a description of each spillway:

Impoundments 3 and 4 will be constructed with open channel spillways. These spillways are designed to discharge a 24 hour duration, 100 year storm event even though they are not expected to be used during normal operations. They will be vegetated to minimize erosion and spillway slopes will not exceed 3h:1v. Drawing 5-32 provides the details for the open channel spillways.

Impoundments 1, 1B and 2 will be constructed with a drop pipe spillway system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. These impoundments will have the drop-pipe spillways installed which will allow removal of any oil sheens that may result from parking lots, primary roads or maintenance activities by using absorbent materials to remove the sheen. The drop-pipe spillways are 24" diameter pipes that are vertical in the impoundment. These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. This system was chosen for these two impoundments based on their locations in relation to the facilities and primary roads. This discharge system will be constructed for precautionary measures only since pollutants are not expected in the impoundments during normal operations.

742.221.35 Regular inspections of the sediment pond system during construction and operations will identify any deficiencies that could cause short circuiting. Design standards for the system will ensure proper functioning during extreme storm events which makes it highly unlikely that issues related to short circuiting could occur during normal operations.

742.221.36 Surveys of the pond system will be conducted at least annually. These surveys will be compared against the required "design event" capacity for each pond. Sediment removal will occur as needed to maintain the required capacity.

742.221.37 Geologic conditions in the areas where sediment ponds will be constructed are suitable to the proposed use. Excessive settling of the ponds is not expected based on the high clay content of the soils. Embankments will be constructed in maximum two foot lifts to promote compaction during the construction process, reducing settling during operations. Supporting data for compaction can be viewed in Appendix 5-1.

742.221.38 Any sod, large roots, and/or frozen soil will be removed from sedimentation ponds. No coal processing will be conducted as part of the Coal Hollow Project; therefore wastes from this type of process will not be present.

742.221.39 Embankments will be constructed in maximum two foot lifts to promote compaction during the construction process, reducing settling during operations. Supporting data for this compaction method can be viewed in Appendix 5-1.

742.222 Sedimentation ponds for the Coal Hollow Project do not meet the size or other qualifying standard for MSHA, 30 CFR 77.216(a).

742.223 Each sedimentation pond will be constructed with a spillway that will function as both the emergency and principle spillway. Each of these spillways will safely discharge a 25 year, 6 hour precipitation event. The following table summarizes the spillway discharge designs in relation to the 25 year, 6 hour precipitation event:

Sediment Impoundment – Spillway Flow Capacities		
Impoundment	Required Spillway Discharge (cfs)	Designed Spillway Discharge (cfs)
1	30.4	37.4
2	0.8	30.5
3	2.8	11.5
4	2.4	11.5
1B	6.06	23.9

The drop pipe spillways for impoundments 1, 1B and 2 will be of nonerodible construction. The open channel spillways for impoundments 3 and 4 will be grass lined and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected.

742.224 Either the requirements of 742.223.1 or 742.223.2 will be met for each sediment impoundment.

742.225 No exceptions to the sediment pond location guidance are requested

742.230 Other Treatment Facilities

If other treatment facilities become necessary, they will be designed to treat the 10-year, 24-hour precipitation event unless a lesser design event is approved by the Division based on terrain, climate, other site-specific conditions and a demonstration by the operator that the effluent limitations of R645-301-751 will be met.

No other treatment facilities are planned for the Coal Hollow Project.

742.240 Exemptions

Not Applicable

742.300 Diversions

742.310 General Requirements

742.311 There are no flows from mined areas that have been abandoned prior to May 3, 1978 at the Coal Hollow Project. Diversions at the Coal Hollow Project are planned to minimize water from disturbed areas from directly discharging into drainages without first being treated and to also prevent water from upland, adjacent areas from entering the project area. Four temporary diversion ditches are planned and one temporary diversion of Lower Robinson Creek. Two diversions will be primarily used to route water from upland, undisturbed areas away from the planned disturbed areas. Two diversions are planned to direct water from disturbed areas into sediment impoundments. The temporary diversion of Lower Robinson Creek is for maximum recovery of coal and will route flows around the mining area. Each temporary diversion has been designed to only carry runoff from areas that will or potentially could be affected by the mining operations, except Lower Robinson Creek diversion which will carry intermittent flows from the upstream watershed. Diversion locations were selected to generally carry runoff to the drainage paths that the precipitation would originally follow. These parameters were followed in the designs to minimize impacts to the overall hydrological balance within the permit and adjacent areas. Diversions will not be used to route water into underground mines. Specific design parameters are discussed in the following sections (R645-301-742.312.1 to 742.314).

742.312 Each diversion was designed to ensure stability and to minimize erosion. In order to accomplish this standard, the diversions were each designed for peak flows during a 100 year, 24 hour storm event. The following summarizes the steps used:

The channel sizing for the four proposed temporary diversion ditches has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 100 year, 24 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. Similar to the impoundment sizing, the Carlson Software Hydrology module was utilized to perform these calculations. The ditch locations, designs and cross sections can be viewed on Drawings 5-33 and 5-34.

The following table summarizes the inputs and results for each diversion based on flows during a 100 year, 24 hour storm event:

Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
1	3.0	0.020	2.8	14.8	0.5	6.8	0.3
2	2.5	0.020	3.5	6.9	0.4	6.0	0.3
3	4.5	0.020	2.4	16.7	0.5	6.3	0.3
4	5.0	0.020	1.8	19.8	0.6	5.4	0.3

*All side slopes are 2h:1v

As shown in the above table, flow depths will be shallow, flow velocity will be manageable for temporary flow conditions and sufficient freeboard will be present during a flood event. These conditions will provide diversion stability, protection against flooding and prevent to the extent possible additional contributions of suspended solids to streamflow outside the permit area. These diversions are designed to comply with all applicable local, Utah and federal laws and regulations. Further details related to the temporary diversion designs can be viewed in Appendix 5-2.

Based on the size of the watershed for Lower Robinson Creek, a different method of analysis was used than the method used for the other diversions. The HEC-1 program was used for this analysis and extra erosion protection has been included as part of the design. The channel was designed to safely handle the flows from a 100 year, 6 hour storm event. This diversion will be further discussed in section 742.320 Diversion of Perennial and Intermittent Streams.

742.313 The four temporary diversions will be reclaimed when they are no longer necessary. This will occur once final reclamation is determined to be sufficient within the project area and the sediment impoundments are no longer needed. This is anticipated to occur in the fourth year of operations.

The Lower Robinson Creek temporary diversion will be constructed in a responsible manner. This diversion will experience some erosion during flood events but erosion rates are expected to be generally less than those in the original channel above and below the diversion. The detailed design for this diversion can be viewed in Drawings 5-20 and 21. Calculations related to this diversion design can be viewed in Appendix 5-3.

742.320 Diversion of Perennial and Intermittent Streams.

742.321 Temporary diversion of one intermittent stream is planned for the Coal Hollow Project. The planned diversion is in a length of the stream that appreciable flows only occur during storm events and snow melt periods. This diversion is necessary to recover coal located in the northwest corner of the project area. The diversion would provide mining in an area that is 22 acres and contains approximately 400,000 tons of recoverable coal. Without this diversion, most of this area could not be mined.

742.322 The original unmodified channel immediately upstream and downstream from the Lower Robinson Creek diversion has excessive erosion and is not in stable condition. The channel has incised deeply and has developed into a channel that has a capacity significantly greater than any anticipated storm events. Since these conditions are not desirable for the area, the diversion design instead has dimensions that are suitable to pass a 100 year, 6 hour storm event in compliance with R645-301-742.323.

742.323 The temporary Lower Robinson Creek diversion has been designed to safely pass a 100 year, 6 hour storm event. The watershed for this drainage is 3.64 square miles and has a peak flow of 83.5 cubic feet per second during a 100 year, 6 hour event. Minimum dimensions for carrying this flow was found to be a channel that has the following dimensions:

Bottom width: 2 feet
Side slopes: 3h:1v
Minimum slope height: 3 feet (1 foot freeboard added)

Details related to the design calculations are provided in Appendix 5-3. Rip-rap will be appropriately placed to minimize erosion of the channel.

Cross sections of the channel design are shown in Drawing 5-21. As shown in the drawing, all sections of the diversions exceed the minimum design standard. A plan view of the diversion design can be viewed in Drawing 5-20.

742.324 Design of the Lower Robinson Creek Diversion has been certified by a qualified registered professional engineer.

742.330 Diversion of Miscellaneous Flows.

742.323

As part of the reclamation process, Lower Robinson Creek will be reconstructed to its approximate original location. The design for this reconstruction is shown on Drawings 5-20A and 5-21A. This design includes considerable improvements to the channel compared to the channel's current condition. The current condition is such that less than 25% of the channel within the disturbed area has a flood plain present and most of the slopes are near the angle of repose with fair to poor vegetative cover. The reconstructed sides of the channel for the entire length reconstructed. Sharp corners in the original alignment have been rounded to sinuous curve shapes and rip-rap will be installed in the bottom section of the channel to minimize erosion. The flood plain will be seeded and covered with erosion matting to control erosion until natural vegetative condition can be attained.

742.331 Diversion of miscellaneous flows is planned using four diversion ditches. Two diversions will be primarily used to route runoff from upland, undisturbed areas away from the planned disturbed areas. Two diversions are planned to direct runoff from disturbed areas into sediment impoundments. The locations of these diversions along with the associated watersheds can be viewed on Drawings 5-27, 5-33 and 5-34. Calculations related to the diversions can be viewed in Appendix 5-2.

742.332 Each diversion was designed for stability and to minimize erosion. In order to accomplish this standard, the diversions were each designed for peak flows during a 100 year, 24 hour storm event. The following summarizes the steps used:

The channel sizing for the four proposed temporary diversion ditches has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 100 year, 24 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. Similar to the impoundment sizing, the Carlson Software Hydrology module was utilized to perform these calculations. The ditch locations, designs and cross sections can be viewed on Drawings 5-33 and 5-34.

The following table summarizes the inputs and results for each diversion based on peak flows during a 100 year, 24 hour storm event:

Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
1	3.0	0.020	2.8	14.8	0.5	6.8	0.3
2	2.5	0.020	3.5	6.9	0.4	6.0	0.3
3	4.5	0.020	2.4	16.7	0.5	6.3	0.3
4	5.0	0.020	1.8	19.8	0.6	5.4	0.3

*All side slopes are 2h:1v

As shown in the above table, flow depths will be shallow, flow velocity will be manageable for temporary flow conditions and sufficient freeboard will be present during a flood event. These conditions will provide diversion stability, protection against flooding and prevent to the extent possible additional contributions of suspended solids to stream flow outside the permit area. These diversions are designed to comply with all applicable local, Utah and federal laws and regulations. Further details related to the temporary diversion designs can be viewed in Appendix 5-2.

742.333 All four miscellaneous flow diversions planned for the project are temporary and will be reclaimed when no longer necessary for sediment and storm water control. Therefore, the channels must safely pass the peak runoff from a 2 year, 6 hour event. As previously described, these diversions have been designed to pass a 100 year, 24 hour storm event which significantly exceeds this required design standard. Precipitation from a 100 year, 24 hour storm event for this area is 3.1 inches while precipitation for the 2 year, 6 hour event is less than 1 inch.

742.400 Road Drainage

742.410 All Roads

742.411 To ensure environmental protection and safety appropriate for the planned duration and use, limits have been incorporated in the road designs for the Coal Hollow Project. These limits are applied to drainage control and culvert placement/sizing. These limits take into consideration the type and size of equipment planned for the operation. The following is a description of roads along with the design limits and standards that will be incorporated into construction:

Two primary Mine Haul roads are planned within the permit area. The first road extends from the coal unloading area to the first series of pits along the west side of the property. This road will be utilized for access to pits 1 through 15 (pits shown on Drawing 5-10). This road will be approximately 2,600 feet in length and will be utilized mainly during the first two years of mining. There will be three culverts installed along this road all sized for a 100 year, 6 hour storm event. The first culvert will be across a tributary of Lower Robinson Creek and will be a 36 inch corrugated steel pipe. The second culvert is the main crossing over Lower Robinson Creek and is a 96 inch corrugated steel pipe. Both of these culverts have been sized based on analysis of the Lower Robinson Creek watershed. This analysis can be viewed in Appendix 5-3. The third culvert is a crossing over a diversion ditch that will route water mainly from disturbed areas along the south side of Lower Robinson Creek to a sediment impoundment. This culvert will be a 24 inch corrugated steel pipe.

The second road extends from an intersection with the first road, located just south of the Lower Robinson Creek crossing, and proceeds south to approximately pit 25. This road is approximately 2,500 feet in length and will be used for the south pits 16 through 30. There is one culvert crossing along this road to cross a diversion ditch. This culvert will be a 24 inch culvert.

The following specifications apply to these two Primary Mine Haul roads:

1) Roads will be approximately 80' in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18" of crushed rock or gravel for road surfacing
5) Cut and fill slopes of 1.5h:1v

6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width.

The location and details for all these roads can be viewed on Drawings 5-3 and 5-22 through 5-24.

In addition to the two primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road system will have four culverts and selectively located berms to appropriately route water to the two sediment impoundments for the facilities area. The location of these culverts and berms is shown on Drawing 5-3. This road is referred to as "Facilities Roadway" and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

All roads will be maintained on an as needed basis using motor graders, water trucks for dust suppression, and other equipment as necessary. Crushed stone and/or gravel will be used as a surface course for primary roads outside the active mining area, and may be used as needed for ramps and travelways within the pit. Should the roads be damaged by a catastrophic event, such as an earthquake or a flood, repairs will be made as soon as possible after the damage has occurred or the road will be closed and reclaimed.

Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. The water from roads in the project area will not directly discharge to drainages outside the project area without first being treated by flowing through a sediment impoundment. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles.

742.412 No roads will be located in the channel of an intermittent or perennial stream.

742.413 Primary roads constructed utilized during mining operations have been designed and located to route runoff from the roads to the sediment impoundment system. By routing the runoff to this system, sedimentation and flooding downstream resulting from the roads will be minimized. All other roads located within the active mining area will also follow this standard and runoff from the roads will not be directly discharged to drainages outside the permit area.

742.420 Primary Roads

742.421 To minimize erosion, primary roads will be constructed with a rock surface with minimal cut and fill slopes. These roads are located in the most practicable, stable areas within the permit boundary and mostly outside of the designed pits. These locations can be reviewed on Drawing 5-22 through 5-22G. Further descriptions of these roads can be viewed in Section 742.423.1 and 742.111.

742.422 There are no stream fords by primary roads at the Coal Hollow Project.

742.423 Drainage Control

- 742.423.1 Two primary Mine Haul roads are planned within the permit area. The first road extends from the coal unloading area to the first series of pits along the west side of the property. This road will be utilized for access to pits 1 through 15 (pits shown on Drawing 5-10). This road will be approximately 2,600 feet in length and will be utilized mainly during the first two years of mining. There will be three culverts installed along this road all sized for a 100 year, 24 hour storm event. The first culvert will be across a tributary of Lower Robinson Creek and will be a 36 inch corrugated steel pipe. The second culvert is the main crossing over Lower Robinson Creek and is a 96 inch corrugated steel pipe. Both of these culverts have been sized based on analysis of the Lower Robinson Creek watershed. This analysis can be viewed in Appendix A5-3. The third culvert is crossing over a diversion ditch that will route water mainly from disturbed areas along the south side of Lower Robinson Creek to a sediment impoundment. This culvert will be a 24 inch corrugated steel pipe.

  The second road extends from an intersection with the first road, located just south of the Lower Robinson Creek crossing, and proceeds south to approximately pit 25. This road is approximately 2,500 feet in length and will be used for the south pits 16 through 30. There is one culvert crossing along this road to cross a diversion ditch. This culvert will be a 24 inch culvert sized for maximum anticipated flows in the diversion.

The following specifications apply to these Primary mine haul roads:

1) Roads will be approximately 80' in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18" of crushed rock or gravel for road surfacing
5) Cut and fill slopes of 1.5 h:1v
6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The location and details for Primary Mine Haul roads can be viewed on Drawings 5-3 and 5-22 and 5-23.

In addition to the two roads primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road system will have four culverts and selectively located berms appropriately placed to route water to the two sediment impoundments for the facilities area. The location of these culverts and berms is shown on Drawing 5-3. This road is referred to as "Facilities Roadway" and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

In addition to the primary roads that will be present during active mining, four additional roads are planned to exist postmining and are also classified as primary roads for this reason.

Roads that will remain postmining are the following:

- Road to Water Well with details shown on Drawing 5-22D
- Road to east C. Burton Pugh property with details shown on Drawing 5-22C
- County Road 136 (K3900) with details on Drawing 5-22E, 5-22F and 5-22G. This County road will be reconstructed within the permit area by Kane County. This reconstruction will occur concurrently with the final stage of reclamation as scheduled on Drawing 5-38 and is expected to be completed by the end of Year 4.
- Road to Swapp Ranch (same specification as the Water Well Road)

The location of these roads is shown on Drawings 5-35 and 5-37 along with the post mining topography. With the exception of the County Road, each road will be graded to complement the surrounding topography and drainages. Details for these roads are provided in the above referenced drawings.

County Road 136 will have a cut ditch on the up gradient side of the road as appropriate. The culvert located at the crossing of Lower Robinson Creek will remain. One culvert will be added at Station 21+66 as shown on Drawing 5-22E.

For further details related to reestablishment of County Road 136, refer Drawings 5-22 through 5-22G and 5-35.

742.423.2 Drainage pipes and culverts will be constructed on a minimum 2% grade to avoid plugging. Minimum fill over culverts will be 2 times the diameter of the culvert itself to avoid collapsing. Grades going in and out of each culvert will be similar to the grade of the culvert itself to avoid erosion at the inlet and outlet.

742.423.3 Drainage ditches have been designed to pass a 100 year 24 hour storm event which will prevent uncontrolled drainage over the road surface and embankment. The watersheds associated with drainage in the project area are each relatively small (less than 400 acres) and are not expected to sustain flows that would carry significant debris through the project area. Therefore, trash racks and debris basins are not expected to be necessary at the Coal Hollow Project.

742.423.4 One natural intermittent stream channel is planned to be diverted. This channel is referred to as Lower Robinson Creek and this diversion will be temporary. A section of this stream runs across an area that is planned for mining.

The Lower Robinson Creek diversion has been designed to safely pass a 100 year, 6 hour storm event. The watershed for this drainage is 3.64 square miles and has a peak flow of 83.5 cubic feet per second during a 100 year, 6 hour event. Minimum dimensions for carrying this flow were found to be a channel that has the following dimensions:

Bottom width: 2 feet
Side slopes: 3h:1v
Minimum slope height: 3 feet (1 foot freeboard added)

Details related for the design calculations are provided in Appendix 5-3. Rip-rap will be appropriately placed to minimize erosion of the channel.

Cross sections of the channel design are shown in Drawing 5-21. As shown in the drawing, all sections of the diversions exceed the minimum design standard. A plan view of the diversion design can be viewed in Drawing 5-20. This diversion design is in accordance with R645-301-731.100 through R645-301-731.522, R645-301.600, R645-301-731.800, R645-301-742.300, and R645-301-751.

Design of the Lower Robinson Creek Diversion has been certified by a qualified registered professional engineer.

742.423.5 All stream crossings are planned to be culverts designed to pass the 100 year, 6 hour storm event. There are no plans to use fords as stream crossings.

743 IMPOUNDMENTS

743.100 General Requirements

Five temporary impoundments are planned at the Coal Hollow Project. Design for these structures are shown in Drawings 5-28 through 5-32. These impoundments do not meet the criteria for Class B or C dams as specified in the U.S. Department of Agriculture, Natural Resources Conservation Service Technical Release 60.

743.110 None of the impoundments meet the criteria of MSHA, 30 CFR 77.216(a).

743.120 A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments.

The plans have been certified and a detailed geotechnical analysis has been provided in Appendix 5-1. The certifications, drawings and cross sections can be viewed in Drawings 5-25 through 5-31 and Appendices 5-1 and 5-2.

Each impoundment is designed with a minimum freeboard of 2 feet. Based on the size of the impoundments and the relatively small size of the associated watersheds, this amount of freeboard will be sufficient to prevent overtopping from waves and/or storm events. These impoundments do no meet the criteria for Class B or C dams.

743.130

Each impoundment will be constructed with a spillway that will function as both the emergency and principle spillway. Each of these spillways will safely discharge a 25 year, 6 hour precipitation event. The following table summarizes the spillway discharge designs in relation to the 25 year, 6 hour precipitation event:

Sediment Impoundment – Spillway Flow Capacities		
Impoundment	Required Spillway Discharge (cfs)	Designed Spillway Discharge (cfs)
1	30.4	37.4
2	0.8	30.5
3	2.8	11.5
4	2.4	11.5
1B	6.06	23.9

The drop pipe spillways for impoundments 1, 1B and 2 will be of nonerodible construction. The open channel spillways for impoundments 3 and 4 will be grass lined and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected.

The impoundments at the Coal Hollow project do not meet the criteria for either Class B or C dams or MSHA CFR 77.216 (a).

743.140

A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments. Inspections will be made regularly during construction, upon completion of construction, and at least yearly until removal of the structure or release of the performance bond. The qualified registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. A copy of the report will be retained at or near the mine site.

The MRP does not contemplate construction of any impoundments meeting the NRCS Class B or C criteria for dams in TR-60, or the size or other criteria of 30 CFR Sec. 77.216.

743.200

No permanent impoundments are planned.

743.300

Design capacities for spillways exceed the 25 year, 6 hour event. The design capacities are provided in the table located in section R645-301-743.130.

744 DISCHARGE STRUCTURES

744.100

Each pond will be constructed with an emergency spillway, should the capacities of the ponds ever be exceeded. These spillways will provide a nondestructive route for storm water discharge, though the capacities of the ponds are not expected to be exceeded. The design capacities of the ponds are expected to contain each storm event and therefore will provide sufficient detention time to meet Utah and federal effluent limitations. The following is a description of each spillway:

Impoundments 3 and 4 will be constructed with open channel spillways. These spillways are designed to discharge a 24 hour duration, 100 year storm event even though they are not expected to be used during normal operations. They will be vegetated to minimize erosion and spillway slopes will not exceed 3h:1v. Drawing 5-32 provides the details for the open channel spillways.

Impoundments 1, 1B and 2 will be constructed with a drop pipe spillway system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. These impoundments will have the drop-pipe spillways installed which will allow removal of any oil sheens that may result from parking lots, primary roads or maintenance activities by using absorbent materials to remove the sheen. The drop-pipe spillways are 24" diameter pipes that are vertical in the impoundment. These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. This system was chosen for these two impoundments based on their locations in relation to the facilities and primary roads. This discharge system will be constructed for precautionary measures only since pollutants are not expected in the impoundments during normal operations.

The drop pipe spillways for impoundments 1, 1B and 2 will be of nonerodible construction. The open channel spillways for impoundments 3 and 4 will be grass lined and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected. These designs will minimize erosion and disturbance to the hydrologic balance.

Details related to these designs can be viewed in Drawings 5-28 through 5-32.

744.200

Standard engineering design procedures have been used in the design of the discharge structures along with standard mining industry best management practices that are commonly used at surface mining operations.

745 <u>Disposal of Excess Spoil</u>

745.100 <u>General Requirements</u>

Excess spoil will be placed in designated disposal areas within the permit area, in a controlled manner to minimize the adverse effects of leachate and surface water runoff from the fill on surface and ground waters; ensure permanent impoundments are not located on the completed fill. Small depressions may be created if approved by the Division if they are needed to retain moisture or minimize erosion, create and enhance wildlife habitat or assist revegetation, and if they are not incompatible with the stability of the fill; and adequately cover or treat excess spoil that is acid- and toxic-forming with nonacid nontoxic material to control the impact on surface and ground water is accordance with R645-301-731.300 and to minimize adverse effects on plant growth and the approved postmining land use.

If the disposal area contains springs, natural or manmade water courses or wet weather seeps, the fill design will include diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill and ensure stability.

Details of proposed excess spoil disposal plans are presented in Chapter 5, Section 535 of this MRP and are summarized below.

A geotechnical analysis has been completed for the proposed excess spoil structure. This analysis estimates the long-term safety factor to be 1.6 to 1.7 based on the proposed design. Following proper construction practices of building the structure in maximum four foot lifts and meeting 85% compaction based on the standard Procter will ensure that the structure will be stable under all conditions of construction. This construction will occur only in the designated excess spoil area as shown on Drawing 5-3 and 5-35. The fill will be placed with end dump haul trucks and lifts will be constructed using dozers. High precision GPS systems will be regularly utilized to check grades and appropriate lift thickness. The geotechnical analysis for this structure can be viewed in Appendix 5-1.

The excess spoil is planned to be placed in an area where natural grades range from 0 to 5%. This is one of the most moderately sloping locations in the Permit Area. Stability of this structure is estimated to be 1.6 to 1.7 based on the Appendix 5-1.

Geotechnical borings were completed in the foundation of the proposed disposal area. Laboratory analysis of these borings has also been completed. Details of this analysis can be viewed in Appendix 5-1.

Permanent slopes for the proposed excess spoil will not exceed 3h:1v (33 percent), therefore no keyway cuts have been proposed in the design. Appendix 5-1 details the stability analysis for the proposed structure.

Excess spoil will not be disposed of in underground mine workings.

Horizontal lifts will not exceed four feet in thickness unless otherwise approved by the Division. The lifts will be concurrently compacted to meet 85% of the standard Procter. The geotechnical analysis (Appendix 5-1), provides information showing that these construction standards will provide mass stability and will prevent mass movement during and after construction. The excess spoil will be graded to provide drainage similar to original flow patterns. Topsoil and subsoil as designated in Chapter 2 will be removed and separated from other materials prior to placement of spoil.

A description of the character of the bedrock and any adverse geologic conditions in presented in Appendix 5-1.

Spring and seep survey information is provided on Drawing 7-1. There are no springs or seeps identified in the excess spoil area.

There are no historical underground mining operations in the proposed excess spoil area. There are also no future underground operations proposed.

There are no rock chimneys or drainage blankets proposed.

A stability analysis including strength parameters, pore pressures and long-term seepage conditions is presented together with all supporting data in Appendix 5-1.

Neither rock-toe buttresses nor key-way cuts are required under R645-301-535.112 or R645-301-535.113.

No valley fills or head-of-hollow fills are proposed.

No durable rock fills are proposed.

No disposal of waste on preexisting benches is planned

The excess spoil structure and fill above approximate original contour are the only alternative specifications proposed. A geotechnical analysis has been completed for this proposal and can be viewed in Appendix 5-1. All other mined areas will be restored to approximate original contour.

745.200 Valley Fills and Head-of-Hollow Fills

Valley fills and head-of-hollow fills are not anticipated in the Coal Hollow Mine permit area.

745.300. Durable Rock Fills.

Durable rock fills are not anticipated in the proposed Coal Hollow Mine permit area.

745.400. Preexisting Benches.

The disposal of excess spoil through placement on preexisting benches is not anticipated in the proposed Coal Hollow Mine permit area.

746. COAL MINE WASTE

746.100. General Requirements.

No coal mine waste is anticipated.

746.200. Refuse Piles.

No refuse piles associated with coal mine waste are anticipated.

746.300. Impounding structures.

No impounding structures associated with coal mine waste are anticipated.

746.330. Drainage control.

No coal mine waste and associated drainage control is anticipated.

746.400. Return of Coal Processing Waste to Abandoned Underground Workings.

No coal mine waste is anticipated, nor are any underground workings planned.

747. DISPOSAL OF NONCOAL WASTE

747.100

Noncoal mine waste, including but not limited to grease, lubricants, paints, flammable liquids, garbage, machinery, lumber and other non combustible materials generated during coal mining and reclamation operations will be temporarily placed in covered dumpsters. This waste will be regularly removed from the project area and disposed of at a state approved solid waste disposal site outside the project area.

747.200

Noncoal mine waste will be stored in a metal, covered dumpster which will prevent storm precipitation or runoff from coming in contact with the waste.

747.300

No noncoal mine waste will be disposed of within the permit area.

748. Casing and Sealing of Wells.

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

750 PERFORMANCE STANDARDS

All coal mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area and support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302. Mining operations will be conducted to assure the protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

751. Water Quality Standards and Effluent Limitations.

Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

Discharges from the Coal Hollow project are expected to be minimal based on the storm water and runoff controls that are described in R645-301-740. These structures are designed to contain large storm events without discharging runoff. Any runoff that does discharge will be treated through the sediment pond system.

752. Sediment Control Measures

Sediment control measures will be located, maintained, constructed and reclaimed according to the plans and designs given under sections R645-301-732, R645-301-742 and R645-301-760. Plans and designs are described in these sections.

752.100

Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763. Plans and designs are described in these sections.

752.200. Road Drainage

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to R645-301-732.400, R645-301-742.400 and R645-301-762 and to achieve the following:

Control or prevent erosion, siltation and the air pollution attendant to erosion by vegetating or otherwise stabilizing all exposed surfaces in accordance with current, prudent engineering practices;

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 given under R645-301-751;

Minimize the diminution to or degradation of the quality or quantity of surface- and ground-water systems; and

Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

All plans and designs to meet these standards are described in the above referenced sections and on Drawings 5-22 through 5-24.

753. Impoundments and Discharge Structures

Impoundments and discharge structures will be located, maintained, constructed and reclaimed to comply with R645-301-733, R645-301-734, R645-301-743, R645-301-745 and R645-301-760. Plans and designs are described in these sections.

754. <u>Disposal of Excess Spoil, Coal Mine Waste and Noncoal MineWaste.</u>

Disposal areas for excess spoil, coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed to comply with R645-301-735, R645-301-736, R645-301-745, R645-301-746, R645-301-747 and R645-301-760. Plans and designs are described in these sections.

755. <u>Casing and Sealing of Wells</u>

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738.

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

Water wells less than thirty feet deep are not regulated by the Utah Division of Water Rights. The permanent closure and abandonment of water wells less than 30 feet deep will be accomplished by filling the well casing with neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other appropriate materials. The well casing will then be cut off below the ground surface and native materials placed over the abandoned well site.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

760. RECLAMATION

761. GENERAL REQUIREMENTS

Before abandoning a permit area or seeking bond release, the mine will ensure that all temporary structures are removed and reclaimed, and that all permanent sedimentation ponds, diversions, impoundments and treatment facilities meet the requirements of R645-301 and R645-302 for permanent structures, have been maintained properly and meet the requirements of the approved reclamation plan for permanent structures and impoundments. The mine will renovate such structures if necessary to meet the requirements of R645-301 and R645-302 and to conform to the approved reclamation plan.

762. ROADS

A road not to be retained for use under an approved postmining land use will be reclaimed immediately after it is no longer needed for coal mining and reclamation operations, including restoring the natural drainage patterns, and reshaping all cut and fill slopes to be compatible with the postmining land use and to complement the drainage pattern of the surrounding terrain.

The post mining land configuration is shown on 5-35 along with postmining road locations. Cuts and fills for the reclaimed roads will be minimal which allows for minor construction to grade roads to the approximate landform that existed prior to disturbance.

763. SILTATION STRUCTURES

763.100.

Siltation structures will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated. In no case will the structure be removed sooner than two years after the last augmented seeding.

All impoundments will be reclaimed at the end of operations. The estimated timeline for removal of these structures are shown on Drawing 5-38. Expected removal is year four of the mining and reclamation process. In areas where soils are not stabilized following the removal of these sediment impoundments, silt fence will be appropriately installed and maintained to provide sediment control until stable conditions are met.

763.200.

When the siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan and R645-301-358, R645-301-356, and R645-301-357.

No permanent sedimentation impoundments are planned.

764. STRUCTURE REMOVAL

The application will include the timetable and plans to remove each structure, if appropriate.

All impoundments will be reclaimed at the end of operations. The estimated timeline for removal of these structures are shown on Drawing 5-38. Expected removal is year four of the mining and reclamation process. In areas where soils are not stabilized following the removal of these sediment impoundments, silt fence will be appropriately installed and maintained to provide sediment control until stable conditions are met.

The facilities will be fully reclaimed at the end of mining operations with the exception of the water well shown on Drawing 5- 8B. The final contour for this area can be viewed on Drawing 5-35.

The reclamation sequence and final landform can be viewed on Drawings 5-35 and 5-38.

765. PERMANENT CASING AND SEALING OF WELLS

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

Water wells less than thirty feet deep are not regulated by the Utah Division of Water Rights. The permanent closure and abandonment of water wells less than 30 feet deep will be accomplished by filling the well casing with neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other appropriate materials. The well casing will then be cut off below the ground surface and native materials placed over the abandoned well site.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

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Table 7-4 Hydrologic monitoring protocols ~~and locations~~.

Discharge and water level measurements

Protocol	Applies to	Parameter	Frequency
A	Streams	Discharge	Quarterly
B	Springs	Discharge	Quarterly
C	Monitoring wells	Water elevation	Quarterly

Water quality

Protocol	Applies to	Parameters	Table	Frequency
1	Streams	Operational field and laboratory water quality measurements	7-6A*	Quarterly
2	Streams	Field water quality measurements only	7-6A*	Quarterly
3	Springs	Operational field and laboratory water quality measurements	7-7A*	Quarterly
4	Springs	Field water quality measurements only	7-7A*	Quarterly
5	Monitoring wells	operational field and laboratory water quality measurements	7-7A*	Quarterly
6	Monitoring wells	Field water quality measurements only	7-7A*	Quarterly

*Note: Every 5 years for the third or fourth quarter monitoring event, laboratory analysis will be performed according to the baseline parameter lists specified in Tables 7-6B and 7-7B for surface waters and groundwaters, respectively.

Table 7-5 Hydrologic monitoring locations and protocols for operational and reclamation phase monitoring.

Site	Protocols	Comments
Streams		
BLM-1	A, 2	Lower Robinson Creek adjacent to mined areas
RID-1	A, 2	Irrigation ditch in Robinson Creek
SW-2	A, 1	Kanab Creek below Robinson Creek
SW-3	A, 1	Kanab Creek above permit area
SW-4	A, 1	Lower Robinson Creek above permit area
SW-5	A, 1	Lower Robinson Creek above Kanab Creek
SW-6	A, 1	Sink Valley Wash at permit boundary
SW-8	A, 1	Swapp Hollow Creek above permit area
SW-9	A, 1	Sink Valley Wash below permit area
SW-101	A, 2	Lower Robinson Creek in permit area
Springs		
Sorensen Spring	B,4	Developed alluvial spring in Sink Valley at Sorensen ranch
SP-3	B, 4	Spring in upland pediment alluvium south of permit area
SP-4	B, 3	Developed spring in Sink Valley Wash 1 mile below permit area
SP-6	B, 3	Seep in Sink Valley below permit area
SP-8	B, 3	Developed alluvial spring in Sink Valley at Dames ranch
SP-14	B, 4	Alluvial spring in Sink Valley
SP-16	B, 4	Alluvial spring in Sink Valley
SP-19	B, 4	Alluvial spring in Sink Valley
SP-20	B, 4	Alluvial spring in Sink Valley
SP-22	B, 4	Alluvial spring in Sink Valley
SP-23	B, 4	Alluvial spring in Sink Valley
SP-33	B, 3	Developed spring in lower Sink Valley alluvium
Wells		
Y-36	C	Coal well in Sink Valley above permit area
Y-38	C	Coal well in Sink Valley in permit area
Y-45	C	Coal seam well in Swapp Hollow above permit area
Y-61	C, 5	Water well in Sink Valley artesian alluvial groundwater system above permit area
Y-63	C	Monitoring well in lower Sink Valley Alluvium below mining areas
Y-98	C	Alluvial well in Robinson Creek above permit area
Y-102	C	Alluvial well in upper Sink Valley in permit area
C0-18	C	Alluvial monitoring well in Lower Robinson Creek drainage
C0-54	C	Monitoring well in Lower Robinson Creek drainage near coal seam
C1-24	C	Alluvial monitoring well in Lower Robinson Creek

Site	Protocols	Comments
		drainage
C2-15	C	Monitoring well in Sink Valley alluvium
C2-28	C	Monitoring well in Sink Valley alluvium
C2-40	C	Monitoring well in Sink Valley alluvium
C3-15	C	Monitoring well in Sink Valley alluvium
C3-30	C	Monitoring well in Sink Valley alluvium
C3-40	C	Monitoring well in Sink Valley alluvium
C4-15	C	Monitoring well in Sink Valley alluvium
C4-30	C	Monitoring well in Sink Valley alluvium
C4-50	C	Monitoring well in Sink Valley alluvium
C5-130	C	Monitoring well in Sink Valley artesian alluvial groundwater system above permit area
C7-20	C	Monitoring well in Sink Valley alluvium
C9-15	C	Monitoring well in Sink Valley alluvium
C9-25	C	Monitoring well in Sink Valley alluvium
C9-40	C	Monitoring well in Sink Valley alluvium
LR-45	C, 5	Monitoring well in Lower Robinson Creek alluvium below mine area
LS-28	C	Monitoring well in Sink Valley Alluvium below mining areas
LS-60	C	Monitoring well in Sink Valley Alluvium below mining areas
LS-85	C, 5	Monitoring well in artesian Sink Valley Alluvium below mining areas
SS-15	C	Monitoring well in Sink Valley Alluvium below mining areas
SS-30	C, 5	Monitoring well in Sink Valley Alluvium below mining areas
SS-75	C	Monitoring well in burned coal area material
UR-70	C, 5	Monitoring well in Lower Robinson Creek alluvium above mine area

Table 7-6A Surface water operational and reclamation phase water quality monitoring.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µs/cm @ 25°C
Dissolved Oxygen	mg/L
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L:
Bicarbonate	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Oil and grease	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 7-6B Surface water baseline water quality monitoring

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µs/cm @ 25°C
Dissolved Oxygen	mg/L
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L:
Total Alkalinity	mg/L
Total Hardness ($CaCO_3$)	mg/L
Acidity	mg/L
Aluminum (dissolved)	mg/L
Arsenic (dissolved)	mg/L
Bicarbonate	mg/L
Boron (dissolved)	mg/L
Cadmium (dissolved)	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Copper (dissolved)	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Lead (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Molybdenum (dissolved)	mg/L
Ammonia	mg/L
Nitrate+Nitrite	mg/L
Phosphate (total)	mg/L
Potassium (dissolved)	mg/L
Selenium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Zinc (dissolved)	mg/L
Oil and grease	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 7-7A Groundwater operational and reclamation phase water quality monitoring.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µs/cm @ 25°C
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Carbonate	mg/L
Bicarbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Cations	meq/L
Anions	meq/L
Cation/Anion Balance	%

Table 7-7B Groundwater baseline water quality monitoring.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	μs/cm @ 25°C
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Alkalinity	mg/L
Total Hardness ($CaCO_3$)	mg/L
Acidity	mg/L
Aluminum (dissolved)	mg/L
Arsenic (dissolved)	mg/L
Bicarbonate	mg/L
Boron (dissolved)	mg/L
Cadmium (dissolved)	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Copper (dissolved)	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Lead (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Molybdenum (dissolved)	mg/L
Ammonia	mg/L
Nitrate+Nitrite	mg/L
Phosphate (total)	mg/L
Potassium (dissolved)	mg/L
Selenium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Zinc (dissolved)	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 7-10 Summary information for wells.

	Well type	Well information in DOGM database	Operational Monitoring	Operational water monitoring protocol	Well collar elevation (feet)	Ground elevation at well (feet)	Typical minimum depth to water (feet bgs)	Typical maximum depth to water (feet bgs)	Total well depth (feet below ground surface)	Well screened interval (from-to feet bgs)		Well screened geologic formation	Well shown on MRP map drawing:
C0-18	monitoring well	Yes	Yes	quarterly water level	6864.14	6859.8	5.7	13.8	22	12	22	*Lower Robinson alluvium*	7-2, 7-10, 7-13
C0-54	monitoring well	Yes	Yes	quarterly water level	6862.59	6859.8	23.4	50.6	54	47	54	Bedrock just above coal	7-2, 7-10, 7-13
C1-24	monitoring well	Yes	Yes	quarterly water level	6949.19	6946.3	13.0	17.7	26.5	16.5	26.5	Lower Robinson alluvium	7-2, 7-10, 7-13
C2-15	monitoring well	Yes	Yes	quarterly water level	6920.28	6918.6	1.3	10.9	15	5	15	Sink Valley alluvium	7-2, 7-10, 7-13
C2-28	monitoring well	Yes	Yes	quarterly water level	6919.81	6918.6	1.5	11.0	28	17	27	Sink Valley alluvium	7-2, 7-10, 7-13
C2-40	monitoring well	Yes	Yes	quarterly water level	6919.58	6918.6	1.5	11.1	40	20	40	Sink Valley alluvium	7-2, 7-10, 7-13
C3-15	monitoring well	Yes	Yes	quarterly water level	6890.41	6889.3	0.2	6.4	15	5	15	Sink Valley alluvium	7-2, 7-10, 7-13
C3-30	monitoring well	Yes	Yes	quarterly water level	6890.77	6889.3	-0.3	6.3	30	10	20	Sink Valley alluvium	7-2, 7-10, 7-13
C3-40	monitoring well	Yes	Yes	quarterly water level	6890.73	6889.3	-0.2	6.3	40	20	40	Sink Valley alluvium	7-2, 7-10, 7-13
C4-15	monitoring well	Yes	Yes	quarterly water level	6873.92	6872.3	-0.9	5.6	15	5	15	Sink Valley alluvium	7-2, 7-10, 7-13
C4-30	monitoring well	Yes	Yes	quarterly water level	6873.91	6872.3	-0.2	5.3	30	10	30	Sink Valley alluvium	7-2, 7-10, 7-13
C4-50	monitoring well	Yes	Yes	quarterly water level	6873.52	6872.3	-0.6	4.8	50	30	50	Sink Valley alluvium	7-2, 7-10, 7-13
C5-130	monitoring well	Yes	Yes	quarterly water level	6938.92	6936.8	-35.4	-21.0	130	90	130	Sink Valley alluvium	7-2, 7-10, 7-13
C6-15	monitoring well	Yes	No	---	6897.63	6895.8	Dry	Dry	15	5	15	Lower Robinson alluvium	7-2, 7-13
C7-20	monitoring well	Yes	Yes	quarterly water level	6872.89	6870.2	5.4	9.1	20	15	20	Sink Valley alluvium	7-2, 7-10, 7-13
C8-25	monitoring well	Yes	No	---	6859.70	6857.0	5.1	8.0	27	7	27	Sink Valley alluvium	7-2, 7-13
C9-15	monitoring well	Yes	Yes	quarterly water level	6846.77	6844.7	0.4	10.2	15	5	15	Sink Valley alluvium	7-2, 7-10, 7-13
C9-25	monitoring well	Yes	Yes	quarterly water level	6846.36	6844.7	0.8	10.4	26	16	26	Sink Valley alluvium	7-2, 7-10, 7-13
C9-40	monitoring well	Yes	Yes	quarterly water level	6846.94	6844.7	1.3	10.4	42	22	42	Sink Valley alluvium	7-2, 7-10, 7-13
SS-15	monitoring well	Yes	Yes	quarterly water level	6831.57	6830.0	-0.1	6.2	15	5	15	Lower Sink Valley alluvium	7-2, 7-10, 7-13
SS-30	monitoring well	Yes	Yes	quaterly water level; lab water quality	6830.47	6830.0	-0.3	6.1	29	19	29	Lower Sink Valley alluvium	7-2, 7-10, 7-13
SS-75	monitoring well	Yes	Yes	quarterly water level	6832.06	6830.0	10.7	13.0	75	54	74	Lower Sink Valley alluvium	7-2, 7-10, 7-13
UR-70	monitoring well	Yes	Yes	quaterly water level; lab water quality	7005.14	7003.2	19.5	21.3	70	50	70	Upper Robinson alluvium	7-2, 7-10, 7-13
LR-29	monitoring well	Yes	No	---	6803.10	6801.1	23.0	Dry	29	19	29	Dakota Formation (uppermost)	7-2, 7-10, 7-13
LR-45	monitoring well	Yes	Yes	quaterly water level; lab water quality	6798.41	6796.7	25.6	26.1	42	21	41	Lower Robinson alluvium	7-2, 7-10, 7-13
LS-28	monitoring well	Yes	Yes	quaterly water level; lab water quality	6810.23	6808.9	0.4	7.5	28	17	27	Lower Sink Valley alluvium	7-2, 7-10, 7-13
LS-60	monitoring well	Yes	Yes	quarterly water level	6810.35	6808.9	-0.6	5.0	60	39	59	Lower Sink Valley alluvium	7-2, 7-10, 7-13
LS-85	monitoring well	Yes	Yes	quaterly water level; lab water quality	6810.53	6808.9	-6.6	-2.6	87	64	84	Lower Sink Valley alluvium	7-2, 7-10, 7-13
Y-36	monitoring well	Yes	Yes	quarterly water level	6956.97	6953.6	79.7	81.0	230	194	214	Smirl coal seam (Dakota Fm)	7-2, 7-10, 7-13
Y-38	monitoring well	Yes	Yes	quarterly water level	6860.85	6857.6	50.2	51.1	105	71	86	Smirl coal seam (Dakota Fm)	7-2, 7-10, 7-13
Y-45	monitoring well	Yes	Yes	quarterly water level	7043.55	7041.8	247.6	248.4	352	314	330	Smirl coal seam (Dakota Fm)	7-2, 7-10, 7-13
Y-59	monitoring well	Yes	No	---	6959.06	6956.6	-22.8	-20.3	110	50	110	Sink Valley alluvium	7-2, 7-13
Y-61	mon well 9-inch	Yes	Yes	quaterly water level; lab water quality	6962.10	6959.3	-15.3	-13.8	150	112	142	Sink Valley alluvium	7-2, 7-10, 7-13
Y-63	monitoring well	Yes	Yes	quarterly water level	6789.34	6786.5	7.1	12.2	51	Open hole	Open hole	Lower Sink Valley alluvium	7-2, 7-10, 7-13
Y-98 (A1)	monitoring well	Yes	Yes	quarterly water level	7173.50	7170.8	76.2	82.5	86	36.6	86	Upper Robinson alluvium	7-2, 7-10, 7-13
Y-99 (A2)	monitoring well	Yes	No	---	7055.54	7052.5	Dry	Dry	22	5.1	13.2	Upper Robinson alluvium	7-2, 7-13
Y-102 (A4)	monitoring well	Yes	Yes	quarterly water level	6950.06	6948.1	-11.5	-8.4	86	43.7	62.94	Sink Valley alluvium	7-2, 7-10, 7-13

Table 7-11 Summary information for springs and seeps.

Spring	Operational Monitoring	Operational monitoring protocol	Water Right (See Appendix 7-1 and Drawing 7-3	Ownership	Average Flow Range	Well shown on MRP map drawing
SP-3	Yes	Field Only	---[A]	---	6 to 8 gpm	7-1, 7-2, 7-10
SP-4	Yes	Field and Chem	---[A]	---	0.5 to 1 gpm	7-1, 7-2, 7-10
SP-5	No	---	---[A]	---	Damp	7-1, 7-2
SP-6	Yes	Field and Chem	85-375	Darlynn & Arlene Sorensen	Seepage, <1 gpm	7-1, 7-2, 7-10
SP-8	Yes	Field and Chem	85-353	Richard L & Alecia S. Dame	9 to 20 gpm	7-1, 7-2, 7-10
SP-14	Yes	Field and Chem	85-214	C. Burton Pugh	4 to 7 gpm	7-1, 7-2, 7-10
SP-15	No	---	---	---	0.2 to 1.3 gpm	7-1
SP-16	Yes	Field Only	85-350	Richard L & Alecia S. Dame	0.35 to 1.5 gpm	7-1, 7-2, 7-10
SP-17	No	---	---	---	Seep	7-1
SP-18	No	---	---	---	Seep	7-1
SP-19	No	---	85-374	Darlynn & Arlene Sorensen	Seep to 0.33 gpm	7-1, 7-2
SP-20	Yes	Field and Chem	85-351	Richard L & Alecia S. Dame	6 to 10.5 gpm	7-1, 7-2, 7-10
SP-21	No	---	---	---	1 gpm	7-1
SP-22	Yes	Field Only	85-352	Richard L & Alecia S. Dame	Seep to 0.4 gpm	7-1, 7-10
SP-22a	No	---	---	---	Seep	7-1
SP-23	Yes	Field Only	85-215	C. Burton Pugh	Seep to 1.2 gpm	7-1, 7-10
SP-24	No	---	---	---	Seep to 0.25	7-1
SP-25	No	---	---	---	Seep to 0.5 gpm	7-1
SP-26	No	---	---	---	Seep to 1.5 gpm	7-1
SP-27	No	---	---	---	Seep to 0.5 gpm	7-1
SP-28	No	---	---	---	Dry to seep	7-1
SP-29	No	---	---	---	Dry to seep	7-1
SP-30	No	---	---	---	Dry to seep	7-1
SP-31	No	---	---	---	Dry to seep	7-1
SP-32	No	---	---	---	Dry to 0.33 gpm	7-1
SP-33	Yes	Field and Chem	85,355, 85-1011	James, Julie & Lloyd Johnsen	3 to 14 gpm [B]	7-1, 7-2, 7-10
SP-34	No	---	---	---	Dry to seep	7-1
SP-35	No	---	---	---	Seep to 0.2 gpm	7-1
SP-36	No	---	---	---	Dry to 5 gpm	7-1
SP-37	No	---	---	---	Seep to 0.1 gpm	7-1
SP-30	No	---	---	---	Seep	7-1
SP-39	No	---	---	---	Damp	7-1
SP-40 (Sorensen Spring)	Yes	Field Only	85-373	Darlynn & Arlene Sorensen	Seep to 0.33 gpm	7-1, 7-2, 7-10

[A] These springs are located outside the permit and adjacent area and water rights information has not been provided.
[B] During March of 2008 during a period of active snowmelt a discharge of 119 gpm was measured

Table 7-12 Water rights details and status.

WR#	Water Right Type	Water Right Amount	Typical Flow Range (gpm)	Status	Potential Impact Mechanism (yes/no)	ACD Monitoring Number (s)	Appendix 7-3 ID	OWNER	SOURCE
Stream Reaches									
85-162	Stockwatering (point to point)	Not given	110-2700	Diligence Claim/Proposed Determination	No	SW-2, SW-3	SR-1	Garn L. Swapp	Kanab Creek
85-303	Stockwatering (point to point)	Not given	110-2700	Diligence Claim/Proposed Determination	No	SW-2, SW-3	SR-2	Sharon C. & Lorene C. Lamb	Kanab Creek
85-608	Stockwatering (point to point)	Not given	0-734	Diligence Claim/Proposed Determination	No	SW-4, SW-101	SR-3	Lloyd, Ross, gail & Vard Heaton	Lower Robinson Creek
85-463	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	No	SW-4, SW-101	SR-4	BLM	Lower Robinson Creek
85-209	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	No	SW-4, SW-101	SR-5	C. Burton Pugh	Lower Robinson Creek
85-210	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	No	SW-4, SW-101	SR-6	C. Burton Pugh	Lower Robinson Creek
85-458	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	Yes	BLM-1, SW-5	SR-7	BLM	Lower Robinson Creek
85-211	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	Yes	BLM-1, SW-5	SR-8	C. Diana & Greg Braund & C. Burton Pugh	Lower Robinson Creek
85-459	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	Yes	BLM-1, SW-5	SR-9	BLM	Lower Robinson Creek
85-393	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	Yes	BLM-1, SW-5	SR-10	Sharon C. & Lorene C. Lamb	Lower Robinson Creek
85-213	Stockwatering (point to point)	Not given	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-1, SVWOBS-2	SR-11	C. Burton Pugh	Right Hand Wash
85-387	Stockwatering (point to point)	Not given	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-1, SVWOBS-2	SR-12	Darlynn & Arlene Sorensen	Right Hand Wash
85-388	Stockwatering (point to point)	Not given		Diligence Claim/Proposed Determination	Yes	SVWOBS-2, SW-9	SR-13	Darlynn & Arlene Sorensen	Sink Valley Wash
Surface Diversions									
85-366	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-1, SVWOBS-2	SD-1	Darlynn & Arlene Sorensen	Right Hand Wash
85-367	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-2, SW-9	SD-2	Darlynn & Arlene Sorensen	Right Hand Wash
85-368	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-2, SW-9	SD-3	Darlynn & Arlene Sorensen	Right Hand Wash
85-365	Irrigation, stockwatering	10.0 cfs	SEE SW-8	Diligence Claim/Proposed Determination	No	SW-8, SW-9	SD-4	Darlynn & Arlene Sorensen	Swapp Canyon Creek
85-369	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-2, SW-9	SD-5	Darlynn & Arlene Sorensen	Sink Valley Wash
85-370	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-2, SW-9	SD-6	Darlynn & Arlene Sorensen	Sink Valley Wash
85-371	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-2, SW-9	SD-7	Darlynn & Arlene Sorensen	Sink Valley Wash
85-372	Irrigation, stockwatering	10.0 cfs	None measured	Diligence Claim/Proposed Determination	No	SVWOBS-2, SW-9	SD-8	Darlynn & Arlene Sorensen	Sink Valley Wash
85-356	Irrigation, stockwatering	0.25 cfs	3-15	Diligence Claim/Proposed Determination	Yes	SVWOBS-2, SP-33, SW-9	SD-9	James, Julie & Lloyd Johnson	Sink Valley Wash
Springs									
85-214	Irrigation, stockwatering	0.033 cfs	4 - 7	Diligence Claim/Proposed Determination	Yes	SP-14	WRS-1	C. Burton Pugh	Tater Patch Spring
85-350	Irrigation, stockwatering	1.0 cfs	0.35 - 1.5	Diligence Claim/Proposed Determination	Yes	SP-16	WRS-2	Richard L. & Alecia S. Dame	Swapp Ranch Spring Area #1
85-373	Domestic, stockwatering	0.011 cfs	seep - 0.33	Diligence Claim/Proposed Determination	Yes	SP-40	WRS-3	Darlynn & Arlene Sorensen	Sorensen Ranch Spring #1
85-374	Stockwatering	0.011 cfs	seep - 0.33	Diligence Claim/Proposed Determination	Yes	SP-19	WRS-4	Darlynn & Arlene Sorensen	Sorensen Ranch Spring #2
85-351	Irrigation, stockwatering	0.25 cfs	6 - 10.5	Diligence Claim/Proposed Determination	Yes	SP-20	WRS-5	Richard L. & Alecia S. Dame	Swapp Ranch Spring Area #2
85-352	Irrigation, stockwatering	0.25 cfs	seep - 0.4	Diligence Claim/Proposed Determination	Yes	SP-22	WRS-6	Richard L. & Alecia S. Dame	Swapp Ranch Spring Area #3
85-215	Domestic, stockwatering	0.007 cfs	seep - 1.2	Diligence Claim/Proposed Determination	Yes	SP-23	WRS-7	C. Burton Pugh	Spring House Spring
85-353	Irrigation, stockwatering	1.0 cfs	9 to 20	Diligence Claim/Proposed Determination	Yes	SP-8	WRS-8	Richard L. & Alecia S. Dame	Swap Ranch Spring Area #4
85-375	Stockwatering	0.022 cfs	seep - 1	Diligence Claim/Proposed Determination	Yes	SP-6	WRS-9	Darlynn & Arlene Sorensen	Sorensen Ranch Spring #3
85-355	Irrigation, stockwatering	31.725 ac-ft	3 - 14	Diligence Claim/Proposed Determination	Yes	SP-33	WRS-10A	James, Julie & Lloyd Johnson	Pulsifer Spring
85-1011	Domestic	0.9 ac-ft	see above	Diligence Claim - Certificate	Yes	SP-33	WRS-10B	James, Julie & Lloyd Johnson	Pulsifer Spring

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-214 WRS-1

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-214 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP***

NAME: C. Burton Pugh
ADDR: 533 North 650 East
Lindon, Utah 84042

DATES, ETC.***

LAND OWNED BY APPLICANT?
FILED: 08/08/1969|PRIORITY: 03/04/1889|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 08/08/1969|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT***

FLOW: 0.033 cfs SOURCE: Tater Patch Spring

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 490 ft E 1040 ft from NW cor, Sec 29, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT***

SUPPLEMENTAL GROUP NO. 612092. Water Rights Appurtenant to the following use(s):
85-100,214

###IRRIGATION: Group Total: 0.6 acres Diversion Limit: 0.0 acft. PERIOD OF USE: 04/01 TO 10/31
Sole Supply for Irrigation for 85-214 in this Group has NOT YET been evaluated

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAST QUARTER NW	NE	SW	SE	Section Totals
Sec 29 T 39S R 5W SLBM	0.6000																0.6000

SUPPLEMENTAL GROUP NO. 612093. Water Rights Appurtenant to the following use(s):
85-100,199,200,201,202,203,204,205,206,207,208,209,210,211,213,214,215

###STOCKWATER: Group Total: 250 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-214 in this Group has NOT YET been evaluated

E N D O F D A T A

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-350 WRS-2

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-350 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP***

NAME: Richard & Alecia S. Dame
ADDR: 1620 Georgia Ave.
Boulder City NV 89005-3643
INTEREST: 100% REMARKS: As Joint Tenants

DATES, ETC.***

LAND OWNED BY APPLICANT?
FILED: 04/27/1970|PRIORITY: 00/00/1889|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 04/27/1970|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT***

FLOW: 1.0 cfs SOURCE: Swapp Ranch Spring Area No. 1

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 510 ft E 1090 ft from NW cor, Sec 29, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT***

SUPPLEMENTAL GROUP NO. 612366. Water Rights Appurtenant to the following use(s):
85-350,351,352,353

###IRRIGATION: Group Total: 93.0 acres Diversion Limit: 0.0 acft. PERIOD OF USE: 04/01 TO 10/31
Sole Supply for Irrigation for 85-350 in this Group has NOT YET been evaluated

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 29 T 39S R 5W SLBM	7.2000	0.2000	23.2000	0.3000					21.1000								52.0000
Sec 30 T 39S R 5W SLBM								1.0000						20.0000		20.0000	41.0000

SUPPLEMENTAL GROUP NO. 612367. Water Rights Appurtenant to the following use(s):
85-350,351,352,353,354,355,356,357,358,359

###STOCKWATER: Group Total: 125 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-350 in this Group has NOT YET been evaluated

E N D O F D A T A

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-373

WRS-3

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-373 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**

NAME: Darlynn and Arlene Sorensen
ADDR: P. O. Box 47
Orderville, UT 84758
INTEREST: 100% REMARKS: joint tenants

DATES, ETC.**

LAND OWNED BY APPLICANT?
FILED: 01/29/1970|PRIORITY: 00/00/1864|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 01/29/1970|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT**

FLOW: 0.011 cfs SOURCE: Sorensen Ranch Spring No. 1

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located in NE4NW4 Sec 29, T39S, R5W, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT**

SUPPLEMENTAL GROUP NO. 612374. Water Rights Appurtenant to the following use(s):
85-362,363,364,365,366,367,368,369,370,371,372,373,374,375,377,378,379,380,381,382,383,384,385,386,387,388,389

###STOCKWATER: Group Total: 300 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-373 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 612386.
85-373

###DOMESTIC: 1 Family Diversion Limit: PERIOD OF USE: 04/01 TO 12/31

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 29 T 39S R 5W 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 29 T 39S R 5W SLBM		X														

E N D O F D A T A

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-374 WRS-4

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-374 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP***

NAME: Darlynn and Arlene Sorensen
ADDR: P. O. Box 47
Orderville, UT 84758
INTEREST: 100% REMARKS: joint tenants

DATES, ETC.***

LAND OWNED BY APPLICANT?
FILED: 01/29/1970|PRIORITY: 00/00/1864|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 01/29/1970|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT***

FLOW: 0.011 cfs SOURCE: Sorensen Ranch Spring No. 2

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located in SE4NW4 Sec 29, T39S, R5W, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT***

SUPPLEMENTAL GROUP NO. 612374. Water Rights Appurtenant to the following use(s):
85-362,363,364,365,366,367,368,369,370,371,372,373,374,375,377,378,379,380,381,382,383,384,385,386,387,388,389

###STOCKWATER: Group Total: 300 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-374 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 29 T 39S R 5W SLBM	* : : : X*	* : : : *	* : : : *	* : : : *

E N D O F D A T A

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-351 WRS-5

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006

WATER RIGHT: 85-351 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Richard L. & Alecia S. Dame
ADDR: 1620 Georgia Ave.
Boulder City NV 89005-3643
INTEREST: 100% REMARKS: As Joint Tenants

DATES, ETC.

LAND OWNED BY APPLICANT?
FILED: 04/27/1970 | PRIORITY: 00/00/1889 | PUB BEGAN: | PUB ENDED: | NEWSPAPER:
ProtestEnd: | PROTESTED: [No] | HEARNG HLD: | SE ACTION: [ ] | ActionDate: | PROOF DUE:
EXTENSION: | ELEC/PROOF: [ ] | ELEC/PROOF: | CERT/WUC: 04/27/1970 | LAP, ETC: | PROV LETTER:
RENOVATE: | RECON REQ: | TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: 0.25 cfs SOURCE: Swapp Ranch Spring Area No. 2

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 1635 ft E 1100 ft from NW cor, Sec 29, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

POINT OF DIVERSION:
(1)Stockwatering directly on spring located in SW4NW4 Sec 29, T39S, R5W, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 612366. Water Rights Appurtenant to the following use(s):
85-350,351,352,353

###IRRIGATION: Group Total: 93.0 acres Diversion Limit: 0.0 acft. PERIOD OF USE: 04/01 TO 10/31
Sole Supply for Irrigation for 85-351 in this Group has NOT YET been evaluated

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 29 T 39S R 5W SLBM	7.2000	0.2000	23.2000	0.3000					21.1000								52.0000
Sec 30 T 39S R 5W SLBM								1.0000						20.0000		20.0000	41.0000

SUPPLEMENTAL GROUP NO. 612367. Water Rights Appurtenant to the following use(s):
85-350,351,352,353,354,355,356,357,358,359

###STOCKWATER: Group Total: 125 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-351 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 29 T 39S R 5W SLBM			X													

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E N D   O F   D A T A
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STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-352 WRS-6

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-352 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**

NAME: Richard L. & Alecia S. Dame
ADDR: 1620 Georgia Ave.
Boulder City NV 89005-3643
INTEREST: 100% REMARKS: As Joint Tenants

DATES, ETC.**

LAND OWNED BY APPLICANT?
FILED: 04/27/1970|PRIORITY: 00/00/1889|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 04/27/1970|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT***

FLOW: 0.25 cfs SOURCE: Swapp Ranch spring Area No. 3

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 1475 ft E 530 ft from NW cor, Sec 29, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT***

SUPPLEMENTAL GROUP NO. 612366. Water Rights Appurtenant to the following use(s):
85-350,351,352,353

###IRRIGATION: Group Total: 93.0 acres Diversion Limit: 0.0 acft. PERIOD OF USE: 04/01 TO 10/31
Sole Supply for Irrigation for 85-352 in this Group has NOT YET been evaluated

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 29 T 39S R 5W SLBM	7.2000	0.2000	23.2000	0.3000					21.1000								52.0000
Sec 30 T 39S R 5W SLBM								1.0000						20.0000		20.0000	41.0000

SUPPLEMENTAL GROUP NO. 612367. Water Rights Appurtenant to the following use(s):
85-350,351,352,353,354,355,356,357,358,359

###STOCKWATER: Group Total: 125 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-352 in this Group has NOT YET been evaluated

END OF DATA

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-215 WRS-7

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-215 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**

NAME: C. Burton Pugh
ADDR: 533 North 650 East
Lindon, Utah 84042

DATES, ETC.**

LAND OWNED BY APPLICANT?
FILED: 08/08/1969 | PRIORITY: 00/00/1864 | PUB BEGAN: | PUB ENDED: | NEWSPAPER:
ProtestEnd: | PROTESTED: [No] | HEARNG HLD: | SE ACTION: [ ] | ActionDate: | PROOF DUE:
EXTENSION: | ELEC/PROOF: [ ] | ELEC/PROOF: | CERT/WUC: 08/08/1969 | LAP, ETC: | PROV LETTER:
RENOVATE: | RECON REQ: | TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT**

FLOW: 0.007 cfs SOURCE: Spring House Spring

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located in SW4NW4 Sec 29, T39S, R5W, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT**

SUPPLEMENTAL GROUP NO. 612093. Water Rights Appurtenant to the following use(s):
85-100,199,200,201,202,203,204,205,206,207,208,209,210,211,213,214,215

###STOCKWATER: Group Total: 250 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-215 in this Group has NOT YET been evaluated

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SUPPLEMENTAL GROUP NO. 612269.
85-215

###DOMESTIC: 1 Family Diversion Limit: PERIOD OF USE: 01/01 TO 12/31

###PLACE OF USE:

	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 29 T 39S R 5W 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 29 T 39S R 5W SLBM	* : : X: *	* : : : *	* : : : *	* : : : *

E N D O F D A T A

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006

WATER RIGHT: 85-353 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Richard L. & Alecia S. Dame
ADDR: 1620 Georgia Ave.
Boulder City NV 89005-3643
INTEREST: 100% REMARKS: As Joint tenants

DATES, ETC.

LAND OWNED BY APPLICANT?
FILED: 04/27/1970 |PRIORITY: 00/00/1889 |PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No] |HEARNG HLD: |SE ACTION: [ ] |ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF: [ ] |ELEC/PROOF: |CERT/WUC: 04/27/1970 |LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: 1.0 cfs SOURCE: Swapp Ranch Spring Area No. 4

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 1930 ft E 570 ft from NW cor, Sec 29, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 612366. Water Rights Appurtenant to the following use(s):
85-350,351,352,353

###IRRIGATION: Group Total: 93.0 acres Diversion Limit: 0.0 acft. PERIOD OF USE: 04/01 TO 10/31
Sole Supply for Irrigation for 85-353 in this Group has NOT YET been evaluated

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 29 T 39S R 5W SLBM	7.2000	0.2000	23.2000	0.3000					21.1000								52.0000
Sec 30 T 39S R 5W SLBM								1.0000						20.0000		20.0000	41.0000

SUPPLEMENTAL GROUP NO. 612367. Water Rights Appurtenant to the following use(s):
85-350,351,352,353,354,355,356,357,358,359

###STOCKWATER: Group Total: 125 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-353 in this Group has NOT YET been evaluated

E N D O F D A T A

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-375 WRS-9

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-375 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP***

NAME: Darlynn and Arlene Sorensen
ADDR: P. O. Box 47
Orderville, UT 84758
INTEREST: 100% REMARKS: joint tenants

DATES, ETC.***

LAND OWNED BY APPLICANT?
FILED: 01/29/1970|PRIORITY: 00/00/1864|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 01/29/1970|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT***

FLOW: 0.022 cfs SOURCE: Sorensen Ranch Spring No. 3

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located in NW4NW4 Sec 32, T39S, R5W, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT***

SUPPLEMENTAL GROUP NO. 612374. Water Rights Appurtenant to the following use(s):
85-362,363,364,365,366,367,368,369,370,371,372,373,374,375,377,378,379,380,381,382,383,384,385,386,387,388,389

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###STOCKWATER: Group Total: 300 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-375 in this Group has NOT YET been evaluated

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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 32 T 39S R 5W SLBM	* X: : : *	* : : : *	* : : : *	* : : : *

****
E N D O F D A T A
****

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-355 WRS-10A

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006 Page 1

WATER RIGHT: 85-355 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP**

NAME: Julie Johnson
ADDR: PO Box 2063
Page AZ

NAME: James Johnson
ADDR: PO Box 2063
Page AZ 86040

NAME: Lloyd Johnson
ADDR: PO Box2063
Page AZ 86040

DATES, ETC.**

LAND OWNED BY APPLICANT?
FILED: 04/27/1970 | PRIORITY: 00/00/1889 | PUB BEGAN: | PUB ENDED: | NEWSPAPER:
ProtestEnd: | PROTESTED: [No] | HEARNG HLD: | SE ACTION: [ ] | ActionDate: | PROOF DUE:
EXTENSION: | ELEC/PROOF: [ ] | ELEC/PROOF: | CERT/WUC: 04/27/1970 | LAP, ETC: | PROV LETTER:
RENOVATE: | RECON REQ: | TYPE: [ ]

PD Book No. 1 Map: 5c

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT**

FLOW: 31.725 acre-feet SOURCE: Pulsifer Spring

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) N 460 ft E 450 ft from W4 cor, Sec 32, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT**

SUPPLEMENTAL GROUP NO. 612367. Water Rights Appurtenant to the following use(s):
85-350,351,352,353,354,355,356,357,358,359

###STOCKWATER: Group Total: 125 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 12/31
Sole Supply for Stockwatering for 85-355 in this Group has NOT YET been evaluated

SUPPLEMENTAL GROUP NO. 612369.
85-355

###IRRIGATION: 4.82 acres Diversion Limit: 0.0 acft. PERIOD OF USE: 04/01 TO 10/31

###STOCKWATER: 125 Stock Units Diversion Limit: PERIOD OF USE: 04/01 TO 10/31

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 32 T 39S R 5W SLBM			X						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 32 T 39S R  5W SLBM       *  :  : X:  *   *  :  :  :  *   * X:  :  :  *   *  :  :  :  *
```

SEGREGATION HISTORY***

This Right was Segregated from , with Appl#: , Approval Date: / / under which Proof is to be submitted.

```
This Right as originally filed:
                         FLOW IN    QUANTITY IN  *-------------------------W A T E R   U S E S--------------------------*
                           CFS       ACRE-FEET    IRRIGATED STOCK  DOMESTIC   MUNICIPAL   MINING    POWER    OTHER
                                                   ACREAGE  (ELUs)(FAM - PER)

                                      32.625       5.0000   125
              5 AF duty area/stockwater supplemental 350/359, based on 9 month period of use
```

```
The following Water Rights have been Segregated from 85-355:
(   1) WRNUM: 85-1011                 0.9          0.1800
       APPL#:
       NAME:  Lloyd Swapp Johnson, et al
       FILED: 01/03/1996 STATUS:
       APPR:
              segregated for change to be filed
```

```
                           CFS        ACRE-FEET    IRRIGATED STOCK  DOMESTIC   MUNICIPAL   MINING    POWER    OTHER
                                                    ACREAGE  (ELUs)(FAM - PER)
85-355 currently has: -               31.725       4.8200   125
       All IRRIGATION       has been SEGREGATED OFF.
       All STOCKWATERING    has been SEGREGATED OFF.
```

****
E N D   O F   D A T A**********************
****

STATE OF UTAH – DIVISION OF WATER RIGHTS – DATA PRINT OUT for 85-1011 WRS-10B

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 05/24/2006

WATER RIGHT: 85-1011 APPLICATION/CLAIM NO.: CERT. NO.:

CHANGES: a19658 Cert.

OWNERSHIP***

NAME: Lloyd Johnson
ADDR: PO Box 2063
Page AZ 86040

NAME: James Johnson
ADDR: c/o Lloyd Johnson
PO Box 2063
Page AZ 86040

NAME: Julie Johnson
ADDR: c/o Lloyd Johnson
PO Box 2063
Page AZ 86050

DATES, ETC.***

LAND OWNED BY APPLICANT?
FILED: 04/27/1970|PRIORITY: 00/00/1889|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 01/17/2001|LAP, ETC: |PROV LETTER:
RENOVATE: |RECON REQ: |TYPE: [ ]

PD Book No. Map:

Type of Right: Diligence Claim Source of Info: Certificate Status: Certificate

---

LOCATION OF WATER RIGHT***

FLOW: 0.9 acre-feet SOURCE: Pulsifer Spring

COUNTY: Kane COMMON DESCRIPTION: South of Sink Valley

POINT OF DIVERSION -- SURFACE:
(1) N 462 ft E 440 ft from W4 cor, Sec 32, T 39S, R 5W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT***

SUPPLEMENTAL GROUP NO. 612106.

###DOMESTIC: 2 Family Diversion Limit: 0.9 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 32 T 39S R 5W SLBM				X						X							0.0000

SEGREGATION HISTORY***

This Right was Segregated from 85-355, with Appl#: , Approval Date: / / under which Proof is to be submitted.

This Right as originally filed:

FLOW IN CFS	QUANTITY IN ACRE-FEET	IRRIGATED ACREAGE	STOCK (ELUs)	DOMESTIC (FAM - PER)	MUNICIPAL	MINING	POWER	OTHER

0.9 0.1800

****

E N D O F D A T A*

****

Appendix 7-5

Facilities spill plan

ALTON COAL DEVELOPMENT, LLC
COAL HOLLOW MINE
463 NORTH 100 WEST, SUITE 1
CEDAR CITY, UTAH 84721

SPILL PLAN

PREPARED BY:

JBR Environmental Consultants, Inc.
7669 WEST RIVERSIDE DRIVE, SUITE 101
BOISE, IDAHO 83703

AUGUST 2009

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1 Purpose, General Information, and Management Approval

1.1 Purpose and General Information

This Spill Plan (Plan) was developed for the Alton Coal facility located at the Coal Hollow Mine (Coal Hollow) near Cedar City, Utah. The purpose of the Plan is to establish procedures, methods, and equipment to prevent the discharge of oil or other hazardous material from the facility into water or upon the ground or in any way that may affect natural resources. This Plan identifies potential sources of spills, establishes measures of prevention, and defines control, cleanup, and reporting procedures.

1.2 Management Approval

The signature below certifies that the management of Alton Coal fully approves of this Spill Plan and will commit the necessary resources to fully implement this Plan as described.

______________________	______________________
Name	Signature
______________________	______________________
Title	Date

2 Spill Plan Certification and Amendments

2.1 Professional Engineer Review

This Plan has been reviewed and certified by a Registered Professional Engineer. The Professional Engineer's stamp below certifies that:

- The Professional Engineer or their agent has visited and examined the facility;
- The Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards
- Procedures for required inspections and testing have been established; and
- The Plan is adequate for the facility.

Daniel P. Heiser

5161087-2202
Registration Number

Utah
State

8-13-09
Date

LICENSED PROFESSIONAL ENGINEER
No. 5161087-2202
DANIEL PETER HEISER
STATE OF UTAH

2.2 Plan Review

Alton Coal will review and evaluate this Plan at least once every five years to ensure its accuracy and to determine if additional or more effective spill prevention and control technology that is applicable to the facility must be added. The changes will then be implemented as soon as possible. A Spill Plan review form is included in Appendix A. Completed Plan review forms will be contained in Appendix B.

2.3 Plan Availability

Alton Coal will maintain a complete copy of this Plan at the facility and made available as necessary to regulatory agency representatives for on-site review during normal working hours.

3 Facility Information

3.1 General Facility Information

Facility Name and Address:		Facility Owner:	
Company Name:	Alton Coal Development, LLC, Coal Hollow Mine	Company Name:	Alton Coal Development, LLC
Address:	Kane County, UT	Address:	463 North 100 West
City, State, Zip Code:		City, State, Zip Code:	Cedar City, UT 84721

Facility Contact:

Name:	Chris McCourt
Title:	Project Manager
Phone Number:	435.867.5331

Facility Location: The facility is located in Kane County.

Facility Description: The Coal Hollow Mine will be a typical surface coal mining operation. The coal sizing portion of the plant will be similar to a sand and gravel operation, with crushing/sizing, screening, and stockpiling. The coal mining will occur in sequential pits, with backfilling and reclamation immediately following coal removal from each pit. Coal is transported by truck to the on-site processing area for sorting and crushing, then routed via conveyors to the stockpile. A dozer will push the coal from the stockpile into the loadout conveyor for transport. Equipment includes one feeder breaker, one secondary crusher, one stacker belt, and miscellaneous mobile equipment.

Table 3-1 lists the oil storage containers at the facility, including oil-filled equipment and the capacity of each.

Table 3-1 Oil Storage Containers

TYPE OF EQUIPMENT	CONTENTS
Bulk Storage Tanks	Diesel and gasoline tanks
Oil-filled Operating Equipment	Generators
Portable Storage	Totes or 55 gal oil drums

3.2 Physical Layout of the Facility

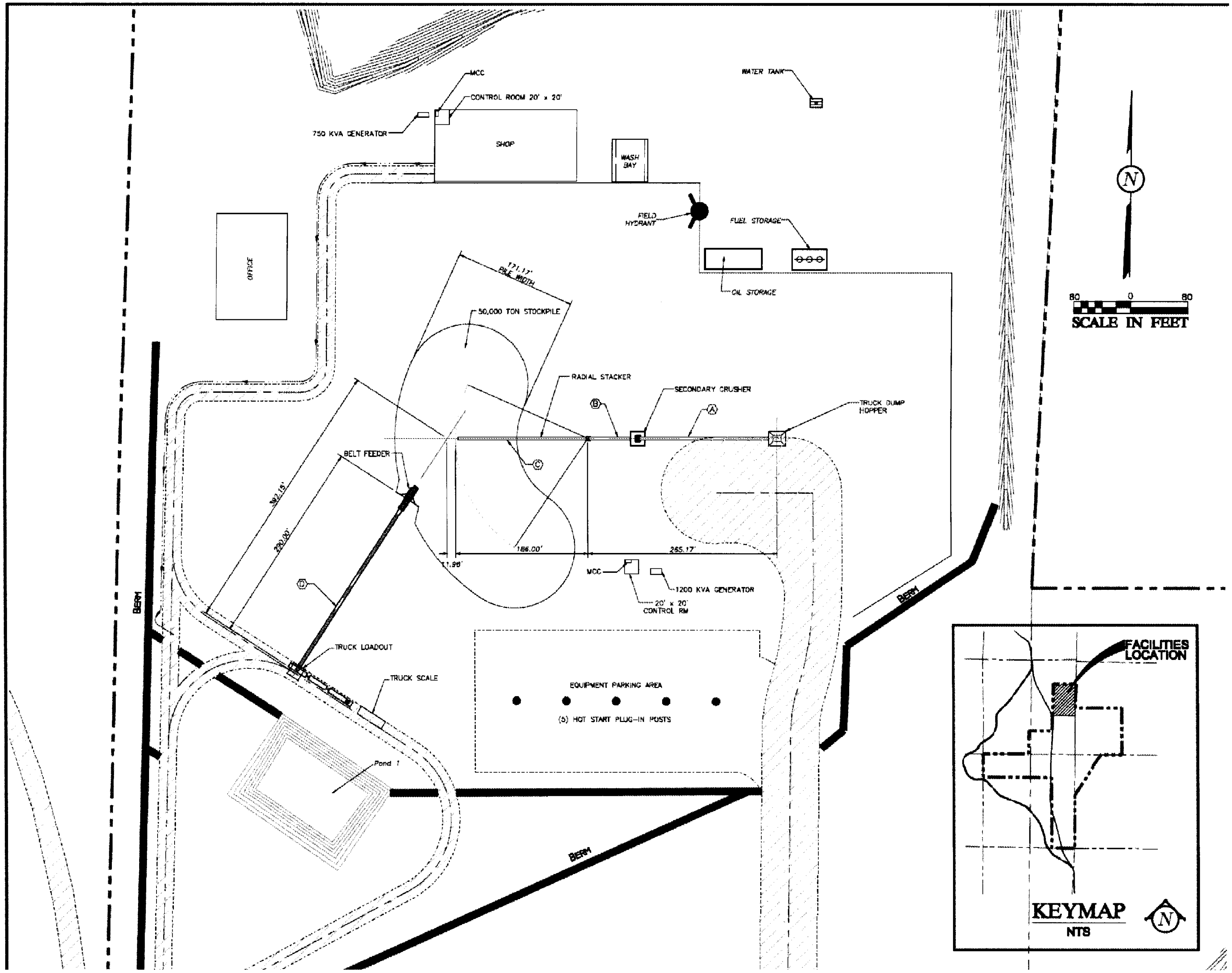
Coal Excavation - Mining at the project site will occur sequentially with work occurring in one 'active disturbed area' at a time, starting at the center of the facility boundaries and then moving towards the southern portion of the facility over a three year period.

Sizing/Sorting Process – This operation involves crushing/breaking, screening, conveying, and stockpiling and occurs at the northern portion of the facility.

Robinson Creek intersects the facility just north of the initial excavation area. Several other ditches and culverts will exist at the site.

The proposed physical layout of the facility is shown in Figure 3-1. The layout of the facility as well as the equipment quantities and types shown are subject to change.

Figure 3-1 Proposed Facility Site Plan



4 Spill Response, Cleanup, and Disposal Procedures

Alton Coal personnel will use established spill response and cleanup procedures in the event of an oil spill. These procedures are outlined below. However, the procedures will be modified as needed when unforeseen circumstances arise.

4.1 Initial Spill Response Actions

⇒ The first person on the scene must immediately notify their Foreman or Lead Man if the oil spill is outside of a secondary containment area or is greater than 10 gallons inside a secondary containment area (see the Internal Spill Reporting requirements in Section 5.1).

⇒ Evaluate the health hazards in the area before proceeding.

⇒ Evacuate the area and establish a security zone around the spill, if needed, and control access into the security zone. Personnel not directly involved with the spill need to stay away from the spill area.

⇒ Stop release when it is safe to do so:

- Implement safety-related measures.
- Mobilize fire control equipment, if needed.
- Don appropriate personal protective equipment before entering the spill area.
- Remove all ignition sources from the security zone.

⇒ Contain the spill by isolating and immobilizing the spill. Construct containment ditches and berms or place absorbent material in front of flowing material.

⇒ Estimate the volume of material that was spilled.

⇒ The environmental specialist must determine if authorities or regulatory agencies need to be notified and make the notifications as required.

4.2 Spill Cleanup Material and Equipment

Spill clean-up equipment and supplies and their storage locations are listed in Table 4-1.

Table 4-1 Spill Cleanup Equipment and Supplies

QUANTITY	EQUIPMENT OR SUPPLY	STORAGE LOCATION
5+	Spill Cleanup Kits	Near tanks, equipment, and totes/drums

4.3 Spill Cleanup Procedures

⇒ If a large spill occurred or the spill reached a waterway, call a cleanup contractor and they will provide additional equipment to clean up the spill. Contact information is located in Table 5-2.

⇒ **DO NOT** use water to clear the spill away! Water will mobilize the spill and require additional cleanup efforts.

⇒ Pick up free liquid that has collected in sumps or containment areas with spill cleanup kits. Place free liquid that has been collected in a tank or drums for temporary storage.

⇒ Clean up liquid that has spread over a non-porous surface with absorbent material such as oil-dry or absorbent socks or booms. Collect oil-soaked cleanup materials (*e.g.,* oil-dry, absorbent socks, or booms) and place them in leak-proof containers.

⇒ For spills on gravel or soil, absorb as much of the liquid as possible with absorbent material and then excavate the oil-contaminated gravel or soil down to visibly clean material. Place the excavated material in piles for temporary storage.

4.4 Disposal Procedures

An oil spill is not considered cleaned up until all waste produced during the cleanup activities are properly disposed. The environmental specialist is responsible for disposing oil-contaminated cleanup materials in accordance with federal, state, and local regulations. General guidelines are listed below; however, the exact means of disposal will depend on the nature and volume of contaminated material and whether the material is contaminated with other substances.

⇒ Liquid oil that has been collected should be recycled at an offsite facility, if possible, or disposed of at a regulated and licensed facility.

⇒ Ship oily soil that has been excavated to a landfill or land farm that is permitted to dispose of or treat oil-contaminated soil.

⇒ Dispose of oil-soaked absorbent material in a landfill permitted for this type of industrial waste.

4.5 Follow-up Response Actions

⇒ The environmental specialist is to complete a Spill Report Form as outlined in Section 5.1 (blank forms are in Appendix C). Completed Spill Report Forms will be maintained in Appendix D.

⇒ Conduct an investigation as needed to

- Determine the cause of the spill;
- Review the response actions that were taken to identify any improvements for response to future incidents; and,
- Determine if any measures need to be implemented to prevent another spill.

⇒ Revise this Plan to reflect any changes at the facility or in operating procedures that result from an evaluation of the spill.

⇒ Replace all spill cleanup equipment that was used during the cleanup of the spill.

5 Spill Reporting

Proper reporting of spills is very critical and must be done carefully, accurately, and in a timely manner. Table 5-1, at the end of the section, summarizes the spill reporting information outlined in Sections 5.1 through 5.4. A call list with contact names and telephone numbers is located in Table 5-2.

5.1 Internal Reporting Requirements

The person who discovers an oil spill that is outside of a secondary containment area must immediately notify their Supervisor. The Supervisor must then notify the environmental specialist. If the Supervisor is unavailable, the person who discovered the spill must notify the environmental specialist directly.

For any oil spill or release outside of a secondary containment area, the Supervisor or the environmental specialist must complete a Spill Report Form (located in Appendix C).

5.2 Federal Reporting Requirements

The environmental specialist or designated representative will determine if an oil spill must be reported to federal agencies. If the spill is determined to be reportable, the environmental specialist or designated representative will complete the required notifications.

5.3 State Reporting Requirements

The Environmental Manager or designated representative will determine if an oil spill must be reported to state agencies. If the spill is determined to be reportable, the Environmental Manager or designated representative will complete the required notifications.

5.4 Local Reporting Requirements

Contact the Local Emergency Response Commission (LERC), or for an emergency call 911.

Table 5-1 Oil Spill Reporting Table

QUANTITY SPILLED	SPILL AREA	WHEN TO REPORT	REPORT TYPE	WHO REPORTS SPILL	REPORT SPILL TO:
Any	Outside of a secondary containment area or building	Immediately	Verbal	Person who discovered the spill	Supervisor
Any amount that creates a sheen, film, or discoloration	Any location where a spill enters, or has the potential to enter, a stream or natural body of water	Immediately	Verbal	Environmental specialist or designee	NRC UDEQ
>42 gallons – twice in any 12-month period	Any water source or outside secondary containment	Within 60 days	Written	Environmental specialist or designee	UDEQ
= or >1,000 gallons	Any water source or outside secondary containment	Within 60 days	Written	Environmental specialist or designee	UDEQ
Any	Impact to waterfowl or endangered species	Immediately	Verbal	Environmental specialist or designee	USFWS

Table 5-2 Spill Contact Information

CONTACT NAMES	CONTACT INFORMATION
Facility Response Coordinator: • Chris McCourt	• 435.867.5331
Other Facility Contacts: • Environmental Specialist	•
Federal Agency Contact Numbers: • National Response Center (NRC)	• 800.424.8802
State Agency Contact Numbers: • Utah Division of Responses and Remediation Emergencies • Utah DEQ Division of Water Quality	• 801.536.4123 • 801.538.6146
Local Agency Contact Numbers: • Local Emergency Response Commission (LERC) • Fire Department	• 435.586.6511 • 911

6 Potential for Equipment Failure

The Coal Hollow facility was inspected to identify each area where a potential for an oil spill exists. The rate of flow of a spill could range from a small drip from a crack in a line or tank to an instantaneous spill caused by the rupture of a tank or container. Table 6-1 lists the sources that have a reasonable potential for equipment failure.

Table 6-1 Potential for Oil Spills

	SOURCE	TYPE of OIL	MAJOR TYPE of FAILURE		DIRECTION of FLOW	SECONDARY CONTAINMENT
	Tank	Diesel or gasoline	Leak		SW	Berm and pond system with a drop pipe spillway
	Generators	Diesel	Leak		SW	Berm and pond system with a drop pipe spillway
	Totes/Drums	Diesel	Leak		SW	Berm and pond system with a drop pipe spillway

7 Containment and Diversionary Structures

The Coal Hollow facility will employ berm and pond systems. This is intended to prevent a discharge of oil to navigable waters of the United States. The berm and pond located near the facility operations and oil storage area will be equipped with a drop pipe spillway

8 Inspections, Tests, and Records

An inspection is conducted monthly at the facility. The inspection includes a visual inspection of all oil containers, oil-containing equipment, piping systems, and secondary containment areas. The blank inspection form located in Appendix E describes the steps to be taken during the inspection and will be used to document the monthly inspections. The inspection form will be signed by the person performing the inspection. The completed inspection forms will be submitted to and maintained by the facility engineer for a period of three years from the date of the inspection.

Secondary containment pits are inspected for an oil sheen prior to discharging or draining any water from them. The inspection is recorded on the Secondary Containment Drainage Log, which is located in Appendix F.

Mechanical integrity testing of bulk oil storage tanks will be conducted as described in Section 12. Integrity testing records will be maintained while the tank is located at Coal Hollow.

9 Personnel Training

9.1 Initial Training

All Alton Coal personnel who have the potential to handle oil will receive initial Spill Plan training. New employees or employees whose job function change will receive the initial training within one month of beginning their assigned duties. The initial training will consist of classroom and/or hands-on training. The initial training will include the following topics:

- Operation and maintenance of equipment to prevent discharges;
- Spill response, cleanup, and disposal procedures;
- Applicable pollution control laws, rules, and regulations;
- General facility operations; and,
- The contents of this Plan.

9.2 Designated Person

The environmental specialist has been designated as the person who is accountable for spill prevention at the Coal Hollow facility.

9.3 Annual Briefings

Oil-handling personnel will participate in an annual briefing. The briefing will ensure that personnel have an adequate understanding of this Plan. They will be informed of any known discharges that occurred during the prior year. The response and cleanup actions that were taken and the mode of failure of each spill will be discussed. The refresher training will also include a discussion of any recently developed precautionary measures.

9.4 Training Records

All training will be documented. The documentation will include who attended the training and what was included in the training. Training records will be maintained in the Safety Office. Individual training records will be maintained for the length of employment of the employee.

10 Site Security

10.1 Fencing

Public access to the facility will be controlled by personnel that are trained to recognize and discourage unauthorized access, along with "No Trespassing" signs to deter public entry.

10.2 Drain Valves

Valves permitting outward flow have adequate security measures to remain in the closed position when in non-operating/ non-standby status.

10.3 Oil Pumps

Alton Coal has locked the starter control on each pump in the "off" position and has located it at a site accessible only to authorized personnel when the pump is in a non-operating or non-standby status.

10.4 Facility Piping

Piping is capped not in service or when in standby service for an extended time.

10.5 Facility Lighting

Due to night sky impact concerns in the surrounding area, the entire facility will not be lighted. However, there will be selective lighting. The outdoor lighting at the Coal Hollow facility is adequate to detect spills, inspect secondary containment structures, and to prevent vandalism during hours of darkness.

11 Facility Tank Car and Tank Truck Loading/Unloading Rack

11.1 Loading/Unloading Area Containment System

Transfer areas are sloped to drain to a low area or catchment area that would serve to hold any spills on-site until it can be cleaned up.

12 Materials of Construction

The bulk storage containers located at the Coal Hollow facility and their material of construction are shown in Table 12-1. All of the bulk storage containers onsite are constructed of materials that are compatible with the material stored in them and the temperature and pressure of storage.

Table 12-1 Bulk Storage Containers

BULK STORAGE CONTAINER	CONTAINER CONTENTS	STORAGE PRESSURE	STORAGE TEMPERATURE	MATERIALS OF CONSTRUCTION
Oil and gas fuel tanks	Diesel oil or gasoline	Atm	Ambient	Steel
Totes/Drums	Oil	Atm	Ambient	Steel or plastic

INTEGRITY TESTING

The bulk oil storage tanks receive an external visual inspection during the monthly inspection. An external inspection will be conducted by an authorized inspector every 5 years per the American Petroleum Institute (API) Standard 653.

Currently, the tank shell corrosion rate is not known and the diesel and gasoline tanks are less than five years old. Therefore, the first set of thickness readings on the tank shell will be obtained in 2014. The second set of thickness readings will be obtained five years after the first set in order to establish the corrosion rate of the tank shell. The thickness inspection interval will then be set at a maximum of 15 years and will be lower if the corrosion rate is higher than expected.

The bottom of the tanks can be accessed externally; therefore, the thickness of the tank bottom will be determined at the time the tank shell thickness is determined.

12.1 DISCHARGE PREVENTION FOR BULK STORAGE CONTAINERS

One of the following high liquid level devices is provided on each bulk oil storage container:

- High liquid level alarm with audible of visual signals
- High liquid level pump cutoff device
- Direct audible or code signal communication
- A fast response system, including direct vision gauge (personnel present).

The liquid level sensing devices are tested regularly during inspections

12.2 VISIBLE DISCHARGES

All visible oil leaks will be promptly corrected. Leaks will be cleaned up and reported as outlined in Sections 4 and 5, respectively. Accumulations of oil within secondary containment areas will be promptly cleaned up and reported, if required.

12.3 MOBILE OR PORTABLE OIL STORAGE CONTAINERS

Mobile or portable containers are located such that any leakage is directed to secondary containment or catchment areas within the facility area.

12.4 FACILITY TRANSFER OPERATIONS

12.4.1 Pipe Supports

Based upon observations at the facility, the pipe supports for the oil transfer lines appear to be designed to minimize abrasion and corrosion and allow for expansion and contraction of the pipelines

12.4.2 Piping Inspections

Aboveground valves, piping, and appurtenances are inspected during the monthly Plan inspection.

Appendix A
Spill Plan Review Form

Spill Plan Review Documentation

"I have completed review and evaluation of the Spill Plan for the Coal Hollow facility in Utah on ____________, 20____, and will / will not amend the Plan as a result."

Signature	Date
Printed Name	Title

For technical amendments to the Plan, the following certification from a Professional Engineer is required.

"I certify that the Alton Coal facility in Utah has been examined that this Spill Plan has been prepared in accordance with good engineering practices and industry standards, the required inspections and testing schedules have been established, and that the plan is adequate for the facility."

____

Name of the Professional Engineer

____

Registration Number

____

State

____

Date

Appendix B
Completed Plan Review Forms

Appendix C
Blank Spill Reporting Form

Spill Reporting Form

GENERAL INFORMATION

FACILITY NAME:______________________________ PHONE NUMBER:____________________

SPILL DISCOVERED BY: ________________________ TITLE:____________________________

PERSON REPORTING SPILL:______________________ TITLE:____________________________

DATE OF SPILL:______________________________ TIME:_____________________________

DATE SPILL WAS DISCOVERED:____________________ TIME:_____________________________

DURATION OF THE INCIDENT:_____________________ hours

MATERIAL SPILLED:____

ESTIMATED QUANTITY SPILLED:____

AMOUNT RECOVERED: AMOUNT UNRECOVERED:

SPILL REPORTING INFORMATION

WHO WAS NOTIFIED OF THE SPILL? _____ Supervisor _____ Plant Engineer

_____ General Manager _____ Production Superintendent _____ Moab Fire Dept.

WAS A REPORTABLE QUANTITY SPILLED? _____ YES _____ NO

WHICH AGENCIES WERE NOTIFIED OF THE SPILL? (Only the General Manager or his/her designee is authorized to make notifications):

UDEQ – DWQ
(801) 536-6146
Date:________________
Time:________________
Name:________________

UDERR
(801) 536-4123
Date:________________
Time:________________
Name:________________

LEPC
(435) 259-5602
Date:________________
Time:________________
Name:________________

National Response Center
(800) 424-8802
Date:________________
Time:________________
Name:________________

USFWS – Spill Response Coordinator
(801) 975-3330
Date:________________
Time:________________
Name :________________

Local Fire Department
911
Date:________________
Time:________________
Name:________________

SPILL INFORMATION

ESTIMATED QUANTITY THAT HAS, OR HAS THE POTENTIAL TO ENTER WATERS OF THE STATE OR UNITED STATES:________________gallons NAME OF WATER BODY:____________________

SPILL WAS RELEASED INTO (land, water, secondary containment, etc.):______________________

WHERE DID THE SPILL GO OR WHICH DIRECTION DID THE SPILL TRAVEL?____________________

ESTIMATED QUANTITY THAT WAS RELEASED OR MIGRATED OFFSITE:_________________________

WEATHER CONDITIONS:____

EXACT LOCATION OF THE SPILL (include type of terrain, nearest waters or drains, direction the spill is moving as applicable):____

SPILL INFORMATION (continued):

SOURCE OF THE SPILL: ____________________

CAUSE OF THE SPILL (include equipment or activities involved in the spill): ____________________

____

____

WAS THE SPILL CONTAINED? _______ YES _______ NO

IF YES, HOW? ____________________

HAZARD/DAMAGE INFORMATION

IDENTIFY HEALTH HAZARDS OR CHARACTERISTICS: ____________________

____

PRECAUTIONS THAT HAVE BEEN OR ARE BEING TAKEN: ____________________

____

____

LIST PERSONAL INJURIES, ENVIRONMENTAL DAMAGE, OR PROPERTY DAMAGE CAUSED BY THE SPILL (environmental damage includes impacts to wildlife, wetlands, or other environmental resources):

____

____

EVACUATION NEEDED? _______ YES _______ NO

SPILL CLEANUP INFORMATION

OUTSIDE CONTRACTOR USED FOR SPILL CLEAN UP? _______ YES _______ NO

CONTRACTOR'S NAME, IF USED: ____________________

CLEAN UP ACTIONS: ____________________

____

____

EFFECTIVENESS OF CLEANUP ACTIVITIES: ____________________

SPILL FOLLOW-UP

ACTION(S) TO BE IMPLEMENTED TO PREVENT FUTURE OCCURRENCES: ____________________

____

____

WAS THE PLAN REVIEWED AFTER THIS SPILL (applies only to oil spills)? ______ YES ______ NO

DOES THE PLAN REQUIRE MODIFICATION (applies only to oil spills)? ______ YES ______ NO

WAS THE SWPPP REVIEWED AFTER THIS SPILL (applies to spills other than oil)? ______ YES ______ NO

DOES THE SWPPP REQUIRE MODIFICATION (applies to spills other than oil)? ______ YES ______ NO

SIGNATURE: DATE:

Appendix D
Completed Spill Reporting Forms

Appendix E
Monthly Inspection Form

MONTHLY SPILL PLAN INSPECTION CHECKLIST

DATE:______________________________

TIME:______________________________

INSPECTOR:

√ = Satisfactory
N/A = Not Applicable
X = Repair or Adjustment Required (see comments under Problems Found

OIL STORAGE TANKS, DRUMS, and CONTAINERS

______ Level gauges and alarms operating properly.
______ No signs of deterioration on shell (*i.e.,* discoloration or flaking of coating, shell distortion, localized corrosion at welds, general corrosion, hairline cracks, or bulging).
______ No damage or deterioration on supports, foundation, and anchor bolts (*i.e.,* cracking, distortion, buckling of supports or saddle, signs of settlement, corrosion, pitting, vehicle damage, or loose anchor bolts).
______ No deterioration or leakage at pipe connections to container.
______ No signs of leakage on container, foundation, or supports.
______ Drain valves on tanks are closed and secured.
______ Pressure relief devices, emergency vents, or relief vents are clean and free of obstructions.
______ Mobile or portable containers are provided with secondary containment or located to prevent a discharge to water.
______ Internal heating coils are operating properly and do not show signs of leakage.

SECONDARY CONTAINMENT AREAS

______ No signs of leakage or spills, such as stained surfaces.
______ Containment walls and floors are intact and are not cracked.
______ Drainage from diked areas is restrained.
______ Drain valves on dikes areas are closed.
______ No visible oil sheen on water in containment areas.
______ No standing water in containment areas.

FACILITY DRAINAGE/TREATMENT

______ No oil sheen or runoff around oil-containing equipment.
______ No ruts or unusual drainage patterns around secondary containment areas.
______ Effluent treatment system operating properly.

SPILL CLEAN UP EQUIPMENT

______ Spill kits contain proper equipment.
______ Oil absorbent material is available.

VALVES/PIPELINES

______ No signs of corrosion or damage on piping, valves, flanges, etc.
______ Terminal connection of out-of-service pipes capped or blind-flanged and origin is marked.
______ No leaks or signs of leakage at valves, flanges, or other fittings.
______ No signs of abrasion or corrosion at pipe support locations.
______ Piping, flanges, expansion joints, and pipe supports in good condition.
______ Starter locked in 'Off' position on oil pumps when not in operation.

OIL-FILLED PROCESS and ELECTRICAL EQUIPMENT

______ Equipment is operating properly.
______ No signs of leakage.
______ No rust, corrosion, or pitting on external surfaces.
______ Equipment foundation/base in good condition.
______ No oil sheen or runoff from around oil-containing equipment.

SECURITY

______ Fence and gates in good condition.
______ Gates around oil tanks/containers are locked.
______ Facility lighting is adequate & working properly.

LOADING/UNLOADING AREAS

______ Loading/unloading connections are capped or blind-flanged when not in service.
______ A means to prevent premature departure of tank trucks is in place and used.

PROBLEMS FOUND: ______________________________

____

____

CORRECTIVE ACTIONS: ______________________________

____

____

Monthly Inspection Procedure

Observe the general condition of the facility and for conformance with the requirements in the facility's SPCC Plan. The following areas must be observed during the inspection. If any problems are observed, make a note on the inspection form.

Oil storage tanks, drums, and containers:

- Drain valves on tanks are closed and secured.
- Inspect for signs of deterioration on containers shell (*i.e.,* discoloration or flaking of coating, shell distortion, localized corrosion at welds, general corrosion, hairline cracks, or bulging).
- Inspect for damage or deterioration on supports, foundation, and anchor bolts (*i.e.,* cracking, distortion, buckling of supports or saddle, signs of settlement, corrosion, pitting, vehicle damage, or loose anchor bolts).
- Inspect for signs of leakage on container, foundation, or supports.
- Pressure relief devices, emergency vents, or relief vents are clean and free of obstructions.
- Level gauges and alarms operating properly.
- Mobile or portable containers are provided with secondary containment or located as to prevent a discharge to water.
- Internal heating coils are operating properly and do not show signs of leakage.

Oil-filled process and electrical equipment:

- Equipment is operating properly.
- Inspect for signs of leakage.
- Inspect for rust, corrosion, or pitting on external surfaces.
- Equipment foundation/base in good condition.
- Inspect for oil sheen or runoff from around oil-containing equipment.

Diked areas or secondary containment areas:

- Containment walls and floors are intact and are not cracked.
- No visible oil sheen on water in containment areas.
- No standing water in containment areas.
- Inspect for signs of leakage or spills, such as stained surfaces.
- Drainage from diked areas is restrained.
- Drain valves on diked areas are closed.

Effluent treatment system: operating properly.

Loading/unloading areas:

- Loading/unloading connections are capped or blind-flanged when not in service.
- A means to prevent premature departure of tank trucks is in place and used.

Monthly Inspection Procedure *(continued)*

Oil piping systems:

- Oil pump starters are locked in the OFF position when not in operation.
- The terminal connection of out-of-service piping is capped or blind-flanged and origin is marked.
- Inspect for signs of abrasion or corrosion at pipe support locations.
- Inspect for signs of leakage around pipe fittings, flanges, valves, instrumentation, and other fittings.
- Piping, flanges, expansion joints, and pipe supports in good condition (*i.e.,* no corrosion or damage).

Site security measures:

- Fencing and gates are in good condition.
- Gates around oil tanks/containers are locked.
- Facility lighting is adequate for discovering spills and working properly.

Spill Clean-up Equipment:

- Spill kits contain proper equipment.
- Oil absorbent material is available.

Appendix F
Secondary Containment Drainage Log

SECONDARY CONTAINMENT DRAINAGE LOG

Record the following information every time water is drained from a secondary containment area.

DATE	TIME	INSPECTOR	SECONDARY CONTAINMENT AREA(1)	WATER DISCHARGED? (YES/NO)	REASON FOR DISCHARGE(2)	APPEARANCE OF WATER (3)	DESTINATION OF DISCHARGED WATER

NOTES:

(1) Record which secondary containment area is being inspected.
(2) Rain, leak, etc.
(3) Clear, cloudy, dirty, oil sheen, etc. Do not discharge the water if it has an oil sheen or contains oil.

Supplemental Information for Utah Division of Oil, Gas and Mining Alluvial Valley Floor Finding for the Proposed Coal Hollow Mine

27 August 2009

Alton Coal Development, LLC
Cedar City, Utah

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Supplemental Information for Utah Division of Oil, Gas and Mining Alluvial Valley Floor Finding for the Proposed Coal Hollow Mine

27 August 2009

Alton Coal Development, LLC
Cedar City, Utah

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Supplemental Information for Utah Division of Oil, Gas and Mining Alluvial Valley Floor Finding for the Proposed Coal Hollow Mine

1.0 Introduction

Alton Coal Development, LLC has made an application for a Utah State coal mining permit from the Utah Division of Oil, Gas and Mining (Division) to mine coal at the proposed Coal Hollow Mine permit area. The proposed Coal Hollow Mine permit area is located on private lands in the Alton Coal Field of south-central Utah, approximately three miles south of the town of Alton, Utah (Figure 1).

In its 27 August 2007 Administrative Completeness Review and 4 August 2008 Technical Review, the Division requested more information from Alton Coal Development, LLC to make alluvial valley floor findings for the permit and adjacent areas. The purpose of this document is to provide the additional information requested by the Division.

This document is organized according to the R645 Rules cited by the Division as the basis for the information request. The information requested by the Division is presented in the following sections of this document.

2.0 R645-302-321.210

2.1 Alluvial sediment deposition

Sink Valley is an upland area located at approximately 7,000 feet elevation, situated at the base of the precipitous Paunsaugunt Plateau escarpment. In such geomorphologic settings, alluvial fan deposition in the arid western United States is common. The alluvial fan system in Sink Valley consists of a series of coalesced fans derived from sediments shed from the adjacent highland regions on the Paunsaugunt Plateau. Sediment deposition processes in ~~the alluvial fan system are likely dominated by~~ Sink Valley include deposition by unconcentrated runoff, sheet floods, mudflows, and debris flows. The sediments near the distal portions of the fan complex in Sink Valley (as observed in drill holes, surface outcrops, and soils pits within the Coal Hollow Project area) are dominated by fine-grained materials including silts, clays, and fine-grained sands (see Chapters 6 and 7, Coal Hollow Project MRP). Coarser sediments are observed in surface exposures nearer the apex of the alluvial fans along the base of the precipitous Paunsaugunt Plateau escarpment. Coarse-grained sediments, including boulders, gravels, and coarse-grained sands were generally not identified in drill holes and surface exposures over most of the proposed Coal Hollow Mine permit area. ~~which would be more typical of stream-laid deposits, were almost entirely absent in at least the upper 50 feet of alluvium drilled in Sink Valley in and around the proposed Coal Hollow Project area.~~ As indicated on Drawing 7-15b and described in Appendix 7-10, coarse-grained alluvial sediments were identified in an isolated area along the eastern margin of the mining area (adjacent to Pit 15.)

As stated in the OSM alluvial valley floor identification and study guidelines (1983), the SMCRA definition of an alluvial valley floor "does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits" (OSM, page II-5). Further, an alluvial valley floor is defined by the existence of flood plains and terraces underlain by unconsolidated stream-laid deposits (page II-11). Included in the AVF definition are only those areas characterized as being "within that valley, those surface landforms that are either flood plains or terraces if these landforms are underlain by unconsolidated deposits…Alluvial valley floors are not merely those valleys filled with alluvium".

Upper Sink Valley Wash is situated in an upland area that is isolated from the flood plain and terrace complex. The associated flood plain and terrace complex is located a considerable distance from the proposed permit area. As indicated in its 26 March 2009 Technical Analysis, the Division determined that "upper Sink Valley Wash, where the mine is proposed, consists of alluvial fan deposits, with no floodplain and terrace complex" (page 33). As defined in R645-100-200, an alluvial valley floor means:

> *the unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities* ***but does not include upland areas*** *which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits. (emphasis added)*

As defined in R645-100-200 "Upland Areas" are defined as follows:

> *"Upland Areas" means, with respect to ALLUVIAL VALLEY FLOORS****, those geomorphic features located outside the floodplain and terrace complex such as isolated higher terraces, alluvial fans,*** *pediment surfaces, landslide deposits, and surfaces covered with residuum, mud flows, or debris flows, as well as highland areas underlain by bedrock as covered by residual weathered material or debris deposited by sheetwash, rillwash, or windblown material. (emphasis added)*

Based on these definitions and the Division's determinations that the area consists of alluvial fan deposits, with no floodplain and terrace complex, it is readily apparent that an alluvial valley floor is not present.

2.2 Lack of continuous stream channel

The locations of existing stream channels in the Coal Hollow Project and adjacent area are plotted on an infrared aerial photograph in Plate 1. Spring discharges are also plotted on Plate 1. It is apparent in this plate, and based on field investigations, that although there are many discontinuous drainage segments in the area, there is no continuous stream channel through Sink Valley. The lack of a continuous stream channel in Sink Valley is likely largely attributable to the manner of sediment deposition in the valley (i.e. mudflows, debris flows, and sheet floods). It should be noted that the various historical activities of landowners in the valley may have influenced surface drainage patterns to some extent. However, it seems likely that prior to the settlement and agricultural development of the valley by humans, conditions in the valley similar to those currently present likely prevailed as a result of the fan depositional regime.

It should also be noted that the greater Sink Valley Wash and Kanab Creek drainages appear to currently be in unstable condition. Significant down-cutting of stream channels is currently occurring throughout large portions of these drainages. The Lower Robinson Creek drainage is deeply incised throughout the extent of the proposed Coal Hollow Project permit area. In several locations in the project area, the Lower Robinson Creek stream bed has been incised several tens of feet below the surrounding topography. Based on recent observations, it is apparent that stream channel down-cutting and erosion/collapse of the steep arroyo walls adjacent to Lower Robinson Creek is actively ongoing at present. As shown on Plate 1, the unstable, incised stream channel in the Lower Robinson Creek drainage (located north of Sink Valley) is continuous through the northern portion of the project.

It is also evident that active head-cutting in the Sink Valley Wash drainage is currently occurring near the southern extent of Sink Valley in the northwest corner of Section 32, T39S, R5W, near Alluvial Groundwater Discharge Area B (see Appendix 7-1 in Chapter 7 of Coal Hollow Project MRP). As the drainage channels become increasingly incised and migrate northward further into Sink Valley, water levels in alluvial groundwaters adjacent to these drainages channels will likely decline (i.e. the incised drainages will act as drains).

2.3 USGS 7.5 minute topographic maps

On the 7.5 minute Alton, Utah USGS topographic map, a continuous stream channel is shown for Sink Valley Wash from its headwaters area to the southern extents of Sink Valley. However, field surveys of stream drainages in Sink Valley indicate that the stream channels are ***not*** continuous through the valley, but rather exist as a series of discontinuous drainage segments. It is not uncommon for inaccuracies of this sort to exist on USGS topographic maps, as these maps are commonly constructed using large-scale aerial photographs and photogrammetric mapping techniques. Ground truthing of all mapped features is not routinely performed. In the absence of ground truthing of the stream drainages in Sink Valley and adjacent areas, it is not unexpected that the delineation of continuous stream channels in Sink Valley has been incorrectly delineated on the topographic map. Field investigations in the Lower Robinson Creek drainage indicate that this drainage is continuous through the Coal Hollow Project and adjacent area.

2.4 Flood plains and terraces

No flood plains or stream terrace deposits have been identified by studies in the Coal Hollow Project area. Consequently, a map showing the locations of flood plains and terraces in the project area has not been prepared. A drawing showing surface drainage patterns, including the flow from springs is provided as Plate 1.

As shown on the USGS 7.5 minute Alton, Utah quadrangle topographic map, the surface morphology of Sink Valley is moderately convex in cross-fan section and consists of several lobes formed by sediment deposition derived from several different drainages. A drawing showing examples of valley cross-sections showing some possible relations in valley alluvium (with terracing) is shown in Figure 2. The surface morphology in Sink Valley is typical of an alluvial fan system. In contrast, a flood plain is, by definition, a planar feature. "Stream terraces are flat surfaces along the valley sides of stream courses marking the level of former valleys. They are vestiges of former flood plains formed by streams which were higher in elevation than the present stream" (OSM, 1983). No such stream terraces are observed in Sink Valley. The lack of a characteristic flood plain, the convex cross-fan surface topography, and the lack of a continuous stream channel through Sink Valley, are all inconsistent with both the scientific and the regulatory definitions of an alluvial valley floor.

2.5 Surface water drainages

A map showing the extent and details for all watersheds that can contribute runoff to the Coal Hollow Project and adjacent area is presented in Plate 2.

2.6 Alluvial groundwater systems potentiometric information

A map showing potentiometric levels in alluvial groundwater systems in the Coal Hollow Project and adjacent area has been previously provided as Drawing 7-13 in Chapter 7 of the Coal Hollow Project MRP. This map was created using the elevations of springs and Alluvial Groundwater Discharge Areas A and B and the elevations of waters encountered in the Sink Valley Wash stream channel. Additional information on alluvial groundwater systems, including the approximate directions of shallow groundwater flow has been provided as Figure 21 in Appendix 7-1 to Chapter 7 of the Coal Hollow Project MRP. Long-term seasonal variability in water levels in alluvial groundwater systems in the project area is documented with historic monitoring data at alluvial monitoring wells and springs in Appendix 7-1 of Chapter 7 of the Coal Hollow Project MRP and in baseline water monitoring data submitted to the Utah Division of Oil, Gas and Mining on-line hydrology database (UDOGM, 2008). Information on depth below the ground surface of potentiometric levels measured in existing and newly constructed alluvial monitoring wells in and around the Coal Hollow Project area during 2007 is presented in Table 1. These data are plotted in a series of hydrographs in Figure 3. It should be noted that the water levels measured in the piezometers are representative of the potentiometric pressure in the piezometer screened intervals. Where confined groundwater conditions exist in the alluvial groundwater system, the water levels measured in the piezometers are generally not the same as the depth at which groundwater would first be encountered in an excavated hole (or the depth at which a plant's roots may encounter water). For example, the shut-in potentiometric head measured at well Y-61 is several feet above the ground surface at the well site. However, an excavated hole near the well may not encounter groundwater in the shallow subsurface, due to groundwater confinement by low-permeability strata overlying the strata with artesian pressure.

To facilitate the evaluation of climatic effects on potentiometric levels in the alluvial groundwater systems, an updated plot of the Palmer Hydrologic Drought Index (PHDI) for the region (Utah Region 4) is provided as Figure 4. A description of the use and interpretation of PHDI data is provided in Appendix 7-1 of Chapter 7 of the Coal Hollow Project MRP.

A perhaps more meaningful measurement of the depth to first water in the shallow alluvial sediments is provided in Table 2 and Figure 5. Table 2 includes hydrologic and soils information obtained from 60 soils pits dug in the Coal Hollow Project and adjacent area. Included in Table 2 and Figure 5 for each soils pit are the depth below the ground surface at which groundwater was first encountered in the soils pit, the uppermost extent of any soil mottling (red or gray coloration in cracks or pores in the soil matrix resulting from iron precipitation related to changing redox conditions with changes in soil water saturation) observed, and the uppermost extent of the presence of any aquic soils observed in the pit. The construction of an isopach map of the depth to groundwater was not created using these data. This is because of the significant heterogeneity of the alluvial groundwater system in the Coal Hollow Project area. Groundwater was encountered in some of the soil pits while other nearby pits were dry. Additionally, groundwater in the alluvial system in many locations in and around the Coal Hollow Project area occurs under perched conditions. Consequently, extrapolation of observed saturation conditions in a soils pit or monitoring well to surrounding areas where saturation data are not available would be arbitrary and not meaningful. Under such groundwater conditions, the direction of groundwater flow is largely constrained by the geometry of permeable and lower-permeability sediments and local microtopography and is not readily predictable. Given these conditions, it is not possible to create a meaningful potentiometric surface map in these areas, or to infer shallow groundwater flow directions and, consequently, no such attempt has been made to do so herein.

The drilling of the shallow exploration boreholes referenced in Appendix 5-1 of Chapter 5 of the Coal Hollow Project MRP occurred during seasonal high-flow runoff conditions in late February and early March 2007. At the time of the drilling of these boreholes, copious amounts of snowmelt water was running over the ground surface and ponding on the low-permeability clayey sediments. While appreciable shallow groundwater was noted during drilling, the groundwater encountered was likely shallow in origin and most likely occurred under perched conditions. Within several weeks of the drilling of the exploration boreholes, the conditions in the soils and shallow alluvial sediments were found to have dried out appreciably and little groundwater was found to be present. This information suggests that, while seasonal snowmelt and shallow perched groundwater was present in the area of the exploration boreholes at the time of the drilling, a continuously saturated alluvial groundwater system through which appreciable groundwater flow was occurring was not present.

2.7 Alluvial groundwater systems maps and cross-sections

A series of six east-west cross-sections through the alluvial sediments in and around the proposed Coal Hollow Mine permit area are presented in Figure 6. A map showing the locations of the cross-sections in Figure 6 is presented in Figure 7. A map showing the locations of streams, ponds, springs, and wells in relation to the surface geology is presented in Figure 8. The locations of proposed disturbances and mine pit locations are also shown on the map in Figure 8. It should be noted that in Figure 6, extrapolation of potentiometric levels between some monitoring wells was not performed. This is because, as discussed previously, alluvial groundwaters in many parts of the Coal Hollow Project area occur under perched conditions with discontinuous zones of saturation. Consequently, the extrapolation of potentiometric levels between distant monitoring wells under such conditions would be incorrect. In other areas, particularly near the eastern margins of Sink Valley, where a more continuous artesian alluvial groundwater system exists, some extrapolation of hydraulic head between piezometers is more meaningful.

In the various field investigations conducted in the Coal Hollow Project, specific correlation between seasonal variation in alluvial water levels and vegetation changes have not been noted.

Additional geologic information on the stratigraphy and hydrostratigraphy of the alluvial sediments, Tropic Shale overburden, the Smirl Coal Zone, and the Dakota Formation underburden is provided in Appendix 6-1 in Chapter 6 of the Coal Hollow Project MRP.

3.0 R645-302-321.220

3.1 Land type map

The locations of undeveloped rangeland, "improved" rangeland and pasture lands are shown on the Vegetation Map, Drawing 3-1 in Chapter 3 of the Coal Hollow Mine MRP. A table correlating the vegetative type map units shown on Drawing 3-1 and the land type as requested by the Division under R645-302-321.220 is provided below.

Drawing 3-1 map unit	R645-302-321.220 description
P-J (Pinyon/Juniper)	Undeveloped rangeland
S/G (Sagebrush / Grass)	Undeveloped rangeland
SB (Sagebrush)	Undeveloped rangeland
SB (chipped P-J)	Improved rangeland for sage-grouse habitat
RB/SB (Rabbitbrush / Sagebrush)	Undeveloped rangeland
P (Pasture Land)	Crop lands and pastures
M (Meadow)	Undeveloped Rangeland
OB (Oak Brush)	Undeveloped rangeland

3.2 Productivity measurements

Annual biomass productivity measurements of the plant communities of the area are provided in Section 321.200 and summarized in Table 3-34 of Chapter 3 of the Coal Hollow Project MRP.

3.3 Subirrigated pasture map

The locations of subirrigated lands are shown in Drawing 7-7 of Chapter 7 of the Coal Hollow Project MRP.

It should be noted that some small areas that may potentially be subirrigated lands, which are identified as dry meadows in the western portion of the project area in Drawing 3-1 in Chapter 3 of the Coal Hollow Project MRP, are not marked as subirrigated lands on Drawing 7-7. The land areas of these dry meadows are small, and conditions in which these dry meadows occur may be at least in part due to microtopgraphy.

3.4 Depth to groundwater information

Potentiometric data from piezometers including the season of use (April – November) in the alluvial groundwater systems in the project area in and near the pastures are provided in Table 1. This information together with additional water level information in the alluvial groundwater systems has been submitted to the Division's on-line hydrology database (UDOGM 2008). Depth to groundwater information in excavated soils pits is provided in Table 2 and Figure 5. Additional characterization of conditions in the soils pits is provided in Chapter 2 of the Coal Hollow Project MRP. Generally, the depths to alluvial groundwater in the subirrigated areas are within several inches to a few feet below the ground surface and are seasonally variable, with water levels typically declining gradually during the summer and fall months. Depths to groundwater in the pastureland areas in the southern portions of the proposed permit area range from about one to two feet under high-flow conditions, and up to several feet below the ground surface during low-flow conditions (see Table 1). During 2007, the depths to shallow groundwater in the subirrigated areas were least during the early winter season and declined gradually during the remainder of the year (Table 1). In most other areas, where subirrigation is not occurring, the depths to alluvial groundwater below the ground surface were generally greater.

Discharge monitoring of seeps SP-28, SP-29, SP-30, SP-31, and SP-32 in lower Sink Valley demonstrate the seasonal variability of the alluvium in this location. Visible discharges were observed in all of these seeps in June 2005, which was a particularly wet year (Figure 4). By August of 2005 all of these seeps were dry as alluvial water levels dropped below the elevations of the spring discharge locations (see Appendix B of Appendix 7-1 of Chapter 7 of the Coal Hollow Project MRP).

4.0 R645-302-321.230

4.1 Locations of flood irrigated or subirrigated lands

The locations of historically flood irrigated and subirrigated lands are shown on Drawing 7-7 in Chapter 7 of the Coal Hollow Project MRP.

The subirrigated lands are located in the meadow areas east of the Tropic Shale ridge that bisects the Coal Hollow Project area (see Drawing 7-7 in the Chapter 7 of the Coal Hollow Project MRP). These areas have been identified as subirrigated based on considerations of alluvial groundwater conditions, water quality, soil moisture, rooting depth, soil mottling, the water requirements of vegetation, and from analysis of the infrared imagery of the region. Additionally, some areas of dry meadow located west of the Tropic Shale ridge in the project area also have also been identified as having localized subirrigation potential. These areas are of limited extent (see "Meadows (dry)" in Drawing 3-1 in Chapter 3 of the Coal Hollow Project MRP. However, based on recent observations, it is apparent that these dry meadows are wet only early in the year and the soils dry out rapidly during the spring. The early-season wet conditions in the dry meadows may be at least in part due to microtopography. Consequently, although there is some potential for these lands to be subirrigated, they are not delineated as subirrigated in Drawing 7-7 of Chapter 7 of the Coal Hollow Project MRP).

The delineation of historically flood irrigated lands in the Coal Hollow Project area is problematic. Historically, attempts at irrigated crop production in the area have occurred in a few homestead locations in and around the Coal Hollow Project area (personal communication, Darlynn Sorensen, 2008). Most of the flood irrigation at these locations was probably of relatively small scale, consisting primarily of irrigation of domestic gardens (personal communication, Darlynn Sorensen, 2008). Some limited flood irrigation occurred at the Swapp Ranch and Pugh Homesteads historically, although there is no indication that any flood irrigation at these properties has occurred in the past several years. Irrigation and crop production on a larger scale has occurred on the Darlynn Sorensen property (discussed below). With the exception of the crop production at the Sorensen property, none of the other attempts at irrigation and crop production were ultimately successful and all have since been abandoned.

Historically, the most significant use of flood irrigation in the Coal Hollow Project area has occurred at the Sorensen property (Drawing 7-7 in Chapter 7 of Coal Hollow Project MRP). Crops (hay and grain) in these fields were periodically flood irrigated using surface water from Swapp Hollow creek stored temporarily in pond 29-7 (see Drawing 7-7 in the Coal Hollow Project MRP). Flood irrigation at the Sorensen property has typically consisted of the application of a single watering event to the fields in the springtime during wet years when adequate water was available for use. The application of the single springtime irrigation watering resulted in improved hay or grain crop yield relative to the yield in years when no irrigation water could be applied (personal communication, Darlynn Sorensen, 2008). During years with dryer climatic conditions, there was not sufficient surface water available to flood irrigate the lands. Recently (for the past many years) the quantity of water in Swapp Hollow creek has not been sufficient to allow flood irrigation. During this many year period, flood irrigation of the Sorensen property has occurred on only one occasion (during the very wet year 2005). During other recent years, adequate water for useful irrigation of the fields has not been available and flood irrigation of Mr. Sorensen's fields has not been performed (personal communication, Darlynn Sorensen, 2008).

It should be noted that the lack of appreciable flood irrigation currently in Sink Valley and the failures of historic flood irrigation attempts is a direct result of the lack of a reliable supply of water in sufficient quantities to irrigate useful acreage of agricultural lands in the valley.

4.2 General construction and use of water holding ponds

The water holding ponds identified in Drawing 7-7 in the Coal Hollow Project MRP have the appearance of having been constructed as simple earthen embankments. Discussions with the local property owners support this conclusion (personal communication, Darlynn Sorensen, 2008). The earthen embankments for the water holding ponds are typically situated across the bottoms of surface water drainages and are intended to store surface-water runoff. Most of the water holding ponds are used to impound water for stock watering use. A few water holding ponds have also been equipped with water outlet control devices to facilitate the release of the stored water for irrigation or other use. The outlet control structure typically consists of a pipe buried near the base of the pond which is equipped with a control valve to regulate the flow from the pond. The water holding ponds that are equipped with water outlet controls to facilitate irrigation releases include the following:

Water holding ponds equipped with outlet structure for irrigation use

Pond	Water source	Use
29-7	Swapp Hollow creek	Stock watering and flood irrigation of the Sorensen property irrigated lands
20-1	Groundwater diversion from Water Canyon high elevation spring (via some sections of irrigation pipe and some sections of unlined earthen ditches)	Stock watering and historic flood irrigation of Pugh Homestead
29-3	Groundwater from alluvial spring SP-20	Stock watering and historic flood irrigation of Swapp Ranch
24-1 25-1	Kanab Creek	Stock watering and flood irrigation of lands in Kanab Creek drainage (not in project area)

See Drawing 7-7 in the Coal Hollow Project MRP for pond locations

4.3 Conveyance systems between ponds

For most of the ponds in the Coal Hollow Project area, there are no constructed conveyance systems between ponds. Rather, pond overflow or bypass typically runs down the surface drainage to a pond lower in the same drainage (if any). The conveyance systems for the water holding ponds used either currently or historically for irrigation consist of unlined earthen ditches as shown in Drawing 7-7 in Chapter 7 of the Coal Hollow Project MRP.

5.0 R645-302-321-240

5.1 Subirrigation potential (groundwater monitoring)

Monitoring information from shallow groundwater systems in the proposed Coal Hollow Project and adjacent area has been submitted electronically to the Division's on-line hydrology database (UDOGM, 2008). These data have been analyzed and a characterization of the shallow groundwater systems in the area is provided in Appendix 7-1 of Chapter 7 of the Coal Hollow Project MRP. Potentiometric data from alluvial monitoring wells as monitored during 2007 is presented in Table 1. Depth to water hydrographs for these wells are presented in Figure 3. Additional information pertinent to alluvial saturation levels in near-surface sediments in the Coal Hollow Project area is provided in Table 2 and Figure 5.

5.2 Subirrigation potential (water quality)

As described previously, subirrigated lands in the Coal Hollow Project area include lands in two regions. Both of these regions are located east of the north-south trending Tropic Shale bedrock ridge that bisects the Coal Hollow Project area into eastern and western regions (see Appendix 7-1 of the Coal Hollow Project MRP for information on the hydrogeologic influence of the Tropic Shale ridge). To characterize the suitability of shallow groundwater for subirrigation use in these two areas, the average water quality characteristics of two nearby alluvial springs is evaluated here. Spring SP-8 discharges to the surface from the artesian alluvial groundwater system in the vicinity of the northern potentially subirrigated area. Spring SP-6 discharges to the surface from the alluvial groundwater system in the vicinity of the southern potentially subirrigated area. Water quality characteristics of shallow groundwaters in the northern and southern subirrigation areas, as represented by groundwaters from springs SP-8 and SP-6, respectively, are presented in Table 3. These data have also been submitted electronically to the Division's on-line hydrology database (UDOGM, 2008). Water quality suitability criteria for irrigation use as presented in the OSM Alluvial Valley Floor Identification and Study Guidelines (1983) are used in this analysis. The water quality suitability for the northern and southern subirrigation areas are depicted on Figure 9.

5.2.1 Northern subirrigation area water quality

It is apparent from Figure 9 that the shallow groundwater available for subirrigation in the northern subirrigation area plots near the boundary between C2-S1 and C3-S1 class waters on the SAR – conductivity classification of irrigation water (OSM, 1983). This indicates a medium to high salinity hazard with low sodium danger. As a result of the medium to high salinity hazard, the groundwater could be used if a moderate amount of leaching occurs. Waters falling in the C3-S1 area indicate that waters in this class cannot be used on soils with restricted drainage. Special management for salinity control may be required and plants with good salt tolerance should be selected. Shallow alluvial groundwater from the northern subirrigation area as represented by SP-8, averages 424 mg/L (Table 3). Based on the dissolved-solids hazard for irrigation water (Table B-5, OSM, 1983) as a result of irrigation using this water, no detrimental effects will usually be noticed, and the salinity hazard is low. Using the criteria shown on Table B-6 (OSM, 1983), which considers boron, SAR, chloride, sulfate, specific conductance, and TDS levels, the water in the northern subirrigation area is a Class I, which is excellent to good for overall soil/climate management, and suitable for irrigation of all or most plants, including boron-sensitive species.

5.2.2 Southern subirrigation area water quality

It is apparent from Figure 9 that the shallow groundwater available for subirrigation in the southern subirrigation area plots near the boundary between C3-S1 and C4-S1 class waters on the SAR – conductivity classification of irrigation water (Figure B-5, OSM, 1983). This indicates a high to very high salinity hazard with a low sodium danger. Waters classified as C3-S1 indicate that the water cannot be used on soils with restricted drainage. Special management for salinity control may be required and plants with good salt tolerance should be selected. Waters falling in the C4-S1 area contain very high salinity water, which is not suitable for irrigation under normal conditions. Shallow alluvial groundwater from the northern subirrigation area averages 1,330 mg/L (Table 3). Based on the dissolved-solids hazard for irrigation water (Table B-5, OSM, 1983) irrigation with this water can have detrimental effects on sensitive crops. Using the criteria shown on Table B-6 (OSM, 1983), which considers boron, SAR, chloride, sulfate, specific conductance, and TDS levels, the water in the northern subirrigation area is a Class II water, which is good to injurious; harmful under certain conditions of soil, climate, and practices. Irrigation with Class II water is not suitable for most salinity- and boron-sensitive plants, but is suitable for all tolerant and many semitolerant species.

It should be noted that shallow alluvial groundwaters in areas west of the subirrigated lands in the Coal Hollow Project and adjacent area commonly contain water that is appreciably elevated in dissolved solids concentrations (UDOGM, 2008). Shallow alluvial groundwaters were sampled from trenches in the alluvial system in the eastern ¼ of Section 30 T39S, R5W in April 2006. Locations and chemical information for these trenches is provided in Appendix 7-1 of Chapter 7 of the Coal Hollow Project MRP and has been submitted electronically to the Division's on-line hydrology database. Alluvial groundwater sampled from these trenches had specific conductance values ranging from 1,142 to 3,700 uS/cm with TDS concentrations ranging from 903 to 3,608 mg/L. This information suggests that shallow groundwater in some of these areas may not be suitable for subirrigation.

Monitoring of alluvial seeps SP-28, SP-29, SP-30, SP-31, and SP-32 in the southern end of Sink Valley near the southern subirrigation area indicate that the quality of shallow groundwater potentially available for subirrigation in this area is of poor quality, with measured specific conductance values ranging from 2,110 to 4,150 uS/cm, and averaging about 2,900 uS/cm. Waters of this quality are classified as high-salinity waters and are not usually useful for crop irrigation.

5.3 Subirrigation potential (soil moisture)

Qualitative soil moisture evaluations were performed in excavated soils pits by qualified soil scientists. Information on soil moisture is provided in Chapter 2 of the Coal Hollow Project MRP. This information has been utilized in performing the analysis of alluvial systems presented in this document.

5.4 Subirrigation potential (soil mottling, rooting depth, soil moisture)

Root size and density (abundance) data was collected at each soil pit as part of the description of the soils. Data for each individual soil pit was provided on the profile description sheets of the soil survey report (MRP Appendix 2-1). Summarized depths of roots including sizes, densities and mottles of the major soil types (named) for each soil map unit (by plant community) was evaluated and has been presented in Table 4.

The parameters for root density and size are described in the Field Book for Describing Soils, version 2 (Schoeneberger et. al., 2002). Table 5 defines the terms used to describe roots in the Coal Hollow Project soil survey.

5.4.1 Soil Mottles

The presence of soil mottles suggests that the soil depths where they appear were saturated with water at some time. Groundwater studies in the Coal Hollow Project area indicated that the periods of highest groundwater elevations are during late winter and early spring before the plants' consumptive use of water is at their peak. In addition, lab analysis of the groundwater indicated that it has TDS values that may diminish the benefit of the water to plants.

Figure 10 and Figure 11 illustrate the relationship of average root density and size versus depth for each plant community identified in the MRP for the Coal Hollow Project area. The figures also compare root density and size with the depth to soil mottles for specific plant communities when mottling was the dominant condition. The *dominant condition* is justified in the "Notes" on Table 4. This data evaluation was limited by the variety of soil pit depths.

5.4.2 Results of the Root Data Evaluation by Plant Community

The **meadow** (M) plant community was characterized by sedges, rushes, and wild iris. There were "many" roots in the upper 11 inches of the soil profile. The root density was "common" from 11 inches down to 37 inches and a "few" roots extended down to 52 inches. The depth of the "many" roots zone corresponds closely with the average depth to soil mottles of 10 inches. The meadow plant community is analogous to soil map unit 7. *Coarse* roots were not "common" in these soils, but *medium* roots extended down to 39 inches. *Fine* roots extended to 44 inches and *very fine* roots to 49 inches. This soil type and plant community could be classified as sub-irrigated.

The **dry meadow** [M(dry)] plant community had characteristics of both meadow and upland (pasture and sagebrush/grass) plant communities. Delineations of this plant community and soil type were in micro-depressions where off-site surface runoff collects and perches on deep clay horizons. The dominant vegetation consisted of upland grasses with scattered shrubs and some meadow vegetation. There were "many" roots in the upper 8 inches of the soil profile. "Common" roots extended from 8 to 18 inches. A "few" roots extended from 18 inches to 79 inches. *Coarse* roots from shrubs were limited to the upper 8 inches. *Medium* roots extended to 18 inches. *Fine* roots extended to 72 inches and *very fine* roots to 80 inches. The depth to soil mottles ranged from 6 to 58 inches with an average of 36 inches. The average soil mottle depth corresponds with depth of "common" root density. This soil type and plant community demonstrates characteristics of potential sub-irrigation in localized area, but it is of limited extent in the Coal Hollow Project area.

The **oak brush** (OB) plant community had roots that extended to 90 inches. "Many" roots were limited to the upper 3 inches. "Common" roots extended from 3 to 35 inches. A "few" roots extended to 91 inches. *Coarse* roots from the oak brush extended to 69 inches. *Medium* and *fine* roots extended to 78 inches. *Very fine* roots reached to 90 inches. One of two data points representing this plant community had a few soil mottles at 15 inches, but none in the other soil pit. The dominant soils and vegetation for this plant community indicate that it is not sub-irrigated.

The **pasture land** (P) plant community was dominated by introduced upland grass species. "Many" roots were limited to the upper 3 inches. "Common" roots extended from 3 to 23 inches. A "few" roots extended to 65 inches. Only one of the 16 soil data points had *coarse* roots (limited to upper the 10 inches at that soil pit). *Medium* roots extended to 18 inches. *Fine* roots extended to 46 inches. *Very fine* roots reached to 64 inches. Only seven of the 16 soil data points had any soil mottles (average 50 inches for the seven soil pits). Soil and vegetation characteristics suggest that this plant community is not sub-irrigated. Small localized areas within the pasture land community may have potential for sub-irrigation.

The **pinyon-juniper** (PJ) plant community was dominated by pinyon pine and Utah juniper. The average soil depth was 41 inches to Tropic Shale. "Common" roots were in the upper 15 inches. A "few" roots extended to 30 inches. *Coarse* roots occurred in the upper 14 inches. *Medium* roots extended to 18 inches. *Fine* roots extended to 24 inches. *Very fine* roots reached 30 inches. Soil mottles occurred in one of five pits, but were most likely the result of moisture perching in the very fine clay textures (greater than 60 percent clay). Soil and native vegetation suggest that this plant community is not sub-irrigated.

The **rabbitbrush/sagebrush** (RB/SB) plant community was limited to disturbed areas. It was of very limited extent in the Coal Hollow Project area and there was only one soil data point. This soil type and plant and soil community does not exhibit any characteristics of being sub-irrigated.

The **sagebrush/grass** (S/G) plant community was dominated by big sagebrush and upland grasses. "Many" roots were in the upper 4 inches. "Common" roots were from 4 to 18 inches. A "few" roots reached to 57 inches. *Coarse* roots were in the upper 7 inches. *Medium* roots extended to 17 inches. *Fine* roots extended to 34 inches. *Very fine* roots extended to 57 inches. Soil mottles occurred in only 5 of 20 soil data points (average 52 inches for the 5 soil pits). Soils and native vegetation indicate this plant community is not sub-irrigated.

5.4.3 Soil Map Units

Soil map unit 7 had characteristics of sub-irrigation (Table 6). Soil mottling was identified within one foot of the soil surface. The presence of water is usually at or near the soil surface during the spring and early summer depending on the annual precipitation. Occasional seasonal localized ponding may also occur in this map unit.

Map units 6 and 13 have localized potential for sub-irrigation depending on the soil type. Upland soils comprise 80 percent of the soil map unit. Aquic soils occurred in micro-depressions and may be the result of localized runoff water perching on top of deep clay layers.

5.4.4 Summary

Table 7 identifies the plant communities that exhibit soil and plant characteristics of sub-irrigation. Only the meadow and dry meadow plant communities exhibit characteristics of sub-irrigation in the major soil types of the associated soil map units.

5.5 Subirrigation potential (water requirements of pasture and meadow vegetation)

The areas called "pasture lands" in the Coal Hollow Project area are plant communities that have been altered to increase herbaceous cover and productivity for domestic livestock. Prior to pasture lands, these communities were probably native sagebrush/grass plant communities. Like the native and unaltered plant communities in the area, and because they are not irrigated, the water requirements for the pasture lands in the study area are solely dependent on the annual precipitation regime (which averages about 16 inches per year; see MRP Chapter 7, Section 724.400) and other environmental variables described below.

Native plant communities called "meadows" are also present in and adjacent to the project area. Dry meadows are located on the west side of the permit area and wetter meadows can be found on the east side. Factors that influence establishment and survival of these meadows are local climatic conditions as well as other environmental variables such as: exposure to light, soil texture, salinity and permeability, hydrologic regimes, saturation periods in the growing season, stratigraphy, topography, morphological, physiological and reproductive adaptations of the plant species present, and evapotranspiration rates. For specific onsite quantitative data and other applicable information regarding the above environmental conditions at the Coal Hollow Project area, refer to MRP Chapter 2 (soils), Chapter 3 (vegetation) and Chapter 7 (hydrology and climate).

Published information regarding water requirements of selected plant types for Alton, Utah area is presented in Table 8.

6.0 Mapping of Subirrigated Lands in Section 32, T39S, R5W

At the request of the Division, the valley areas in Section 32 T39S, R5W that are situated south of the proposed Coal Hollow Mine permit area were investigated by Dr. Patrick Collins of Mt. Nebo Scientific, Inc, and Mr. Robert Long, CPSS of Long Resource Consultants, Inc. on 15 August 2009. It should be noted that while the primary focus of the field investigation was to evaluate potential subirrigation areas in Section 32, T39S, R5W, the lands in the southwest corner of Section 29 T39S, R5W (which have previously been evaluated for subirrigation potential) were also revisited on the 15 August 2009 field visit. The purpose of the field investigation was to map the extent of subirrigated lands in these areas. Dr. Collins and Mr. Long did not find evidence of subirrigated lands in these areas. The conclusion that subirrigation was not present in these areas was based largely on field observations of plant species present and the soil conditions observed by digging soil auger holes. Moderately deep to deep, well-drained soils were observed in auger holes throughout these areas. Indications of soil saturation at depth were not observed. Although soil mottling was sometimes observed in the top few inches of the soils pits, mottles were uncommon at greater depths, suggesting that subirrigation was not occurring. Narrow zones of increased hydrophytic vegetation were observed in areas downslope from impounded surface waters. Soil moisture observations in areas with hydrophytic vegetation were typically slightly moist in the surface few inches and dry below the surface in the paralithic (shale) or lithic (sandstone) contacts. Weathered shale was observed on the sides of eerosion channels on the Sorensen property. Sandstone outcrops were observed near the Sorensen-Johnson property line. Based on field observations at these sites, it was determined that these zones were most likely due increased water supply to plants resulting from seepage from the surface water impoundments and not from subirrigation processes.

Based on the follow up field investigations on the "potential" subirrigated areas, the lack of this condition was also observed in an area previously mapped on Drawing 7-7 as subirrigated. This area was located near the border of Sections 29 and 30, T39S, R5W. As a result, the delineation of subirrigated areas has been correspondingly modified on Drawing 7-7.

7.0 R645-301-321-250

7.1 Flood irrigation potential (streamflow and water yield)

The potential for successful flood irrigation of lands in the Coal Hollow Project area is directly limited by the amount of water available for that use. Discharge and water quality data for waters that could potentially be utilized for flood irrigation in the Coal Hollow Project and adjacent area are presented in Table 9. Baseline monitoring data including discharge and water quality measurements for these potential sources of flood irrigation water have been submitted electronically to the Division's on-line hydrology database (UDOGM, 2008). Each of the potential surface water sources for flood irrigation in the Coal Hollow Project and adjacent area is discussed below.

7.1.1 Swapp Hollow creek

The largest source of surface water for potential flood irrigation use in the Coal Hollow Project area is from Swapp Hollow creek. Monitoring on Swapp Hollow creek has been performed at monitoring site SW-8 (see Drawing7-10 in Chapter 7 of the Coal Hollow Project MRP). Historical discharge and water quality data for Swapp Hollow creek are provided in Table 9. Discharge measurements performed at SW-8 indicate considerable seasonal and climatic variability. The long-term average instantaneous discharge in the creek as monitored at SW-8 is 55 gpm (0.12 cfs). Flow has been present during all monitoring events at SW-8. Assuming an average discharge of 55 gpm, an annual yield of 88.7 acre-feet is calculated.

Assuming an alfalfa plant evapotranspiration requirement of 27.2 inches over the irrigation season (May – early September; Table 8) and an average precipitation during the same irrigation period of about 5 inches, it was calculated that about 1.85 acre-feet per acre of alfalfa is required for the growing season. Thus, during an average year a total of about 48 acres of alfalfa could be irrigated, assuming that ***all*** of the water that flowed in the creek could successfully be applied to the irrigated crop. Similarly, the requirement for pasture irrigation is 23.31 inches in the Alton area over the irrigation season (April through September; Table 8). Thus, assuming a seasonal irrigation requirement of 1.35 acre-feet per acre of irrigated pasture, and assuming average precipitation occurred during the growing period, it is calculated that about 66 acres of pasture could be irrigated assuming that ***all*** of the water flowing through Swapp Hollow creek during an average year could be efficiently applied to the pasture vegetation. However, for several reasons, both of these approximations likely considerably overestimate the actual acreage that could be flood irrigated. Using a commonly used "rule-of-thumb" approximation, about 50 percent of the flood irrigation water transmitted through an earthen ditch from the point of diversion to the point of application to the crops is lost in transmission. Consequently, a more realistic estimate of the amount of flood irrigation that could be accomplished using the entire annual yield from Swapp Hollow creek is about half of that estimated above, or about 24 acres of alfalfa, or about 33 acres of pasture land using all of the average annual yield for flood irrigation. Additionally, it should be noted that groundwater and surface-water resources in the region are fully appropriated by the State of Utah. Consequently, no new water rights are available that could be used for this potential flood irrigation. Much of the water in Swapp Hollow creek is currently being used for stock watering use and would not be available for flood irrigation. Thus, the acreage that could be irrigated is likely appreciably less than that estimated above. Additionally, it should be noted that these calculations are based on the *average* annual yield from Swapp Hollow creek. The annual yield in the drainage will fluctuate year to year because of climatic variability. Because there is no excess capacity in the creek, the actual amount of land that could be flood irrigated will vary correspondingly. Such conditions are not conducive to agricultural planning and successful flood irrigation in the area.

The results of these calculations are not intended to provide specific flood irrigation requirements for crop irrigation in the Coal Hollow Project area. Rather these calculations are presented to demonstrate the very limited potential for flood irrigation in the Coal Hollow Project and adjacent area.

The other potential sources of flood irrigation waters in the Coal Hollow Project area include the Lower Robinson Creek/Dry Canyon drainage, Section 21 canyon drainage, the spring diversion in upper Water Canyon, and Sink Valley Wash. Discharge measurements from these waters are listed in Table 9. Additionally, while not surface-water related, spring discharge from some alluvial groundwater systems has historically provided limited quantities of water for irrigation use. None of these sources of flood irrigation water are as significant as that in Swapp Hollow creek and none of these are deemed as acceptable sources for successful flood irrigation of lands in the Coal Hollow Project area. The streamflow and water yield characteristics of these potential sources are described below.

7.1.2 Lower Robinson Creek/Dry Canyon

Discharge in the Lower Robinson Creek/Dry Canyon drainage occurs only in direct response to torrential precipitation events or substantial snowmelt. Discharge measurements from Lower Robinson Creek (below the confluence with Dry Canyon) have been performed historically at monitoring site SW-4 (see Drawing 7-10 in Chapter 7 of the Coal Hollow Project MRP). Monitoring site SW-101 is also located on this drainage. During baseline monitoring at the project area, discharge has been monitored at SW-4 only during a snowmelt event in May of 2005, which was a very wet year (Figure 4). Additionally, in direct response to a torrential thunderstorm event, surface water in the drainage at SW-101 was monitored. It should be noted that the duration of the surface flow at that time was only a few minutes. On all other monitoring events, this stream has been dry. Consequently, the Lower Robinson Creek/Dry Canyon drainage is not considered a reasonably potential source for flood irrigation activities in the Coal Hollow Project and adjacent area.

7.1.3 Section 21 canyon drainage

Discharge has not been observed in Section 21 canyon during the period of baseline monitoring (as monitored at baseline monitoring site SW-7). This drainage is not considered a reasonably potential source for flood irrigation activities in the Coal Hollow Project and adjacent area.

7.1.4 Upper Water Canyon spring diversion

Historically, water from a spring in the upper reaches of the Water Canyon drainage about two miles east of the Coal Hollow Project area has been conveyed to pond 20-1 (see Drawing 7-7 of Chapter 7 of the Coal Hollow Project MRP). Discharge is monitored in this diversion at site RID-1, located near the USDA Forest Service boundary above pond 29-1 (see Drawing 7-10 of Chapter 7 of the Coal Hollow Project MRP). Discharge and water quality data for this site are presented in Table 9. Discharge at RID-1 averages 21.7 gpm or 35.0 acre feet per year. As discussed above (see Swapp Hollow creek discussion), quantities of water on this scale are not sufficient to sustain appreciable flood irrigation activities in the Coal Hollow Project area.

7.1.5 Sink Valley Wash

Sink Valley Wash is monitored at site SW-6 (see Drawing 7-10 in Chapter 7 of the Coal Hollow Project MRP). Discharge data for SW-6 are presented in Table 9. It is apparent that discharge in Sink Valley Wash is not useful for subirrigation purposes in the Coal Hollow Project area. During baseline monitoring activities, flowing water has only been observed on one occasion at SW-6 during March of 2006. On this occasion, sheet floods were occurring in Sink Valley in direct response to the copious melting of snow in the valley. It is noteworthy that on this occasion the waters in the fields above SW-6 were not flowing through any discernable stream drainage. Rather the surface flow was running down the valley over a large upstream area in an unconcentrated sheet flood.

7.1.6 Alluvial groundwater spring discharges

Historically, some small-scale domestic flood irrigation (likely domestic flood irrigation of gardens for family use) of lands near the historic homestead locations has occurred using water from alluvial springs in the Coal Hollow Project and adjacent area. Currently, groundwater from spring SP-20 gravity flows from the spring discharge area to pond 29-3. At the current time, when available, water from this pond overtops the water holding pond and runs into the field below the pond and is lost to evapotranspiration. The water is used currently for stock watering, and is not used for irrigation. The discharge from alluvial spring SP-20 averages about 6 gpm. Groundwater from spring SP-8 is currently collected in a spring box and conveyed via a buried pipe to the Swapp Ranch house for domestic use. Surplus water from SP-8 is piped to a newly constructed water holding pond (pond 29-5; see drawing 7-7 of the Coal Hollow Project MRP) adjacent to the ranch house. The water in the pond is not currently used for irrigation. Discharge from spring SP-8 averages about 13.8 gpm, or about 22.3 acre-feet per year.

7.2 Flood irrigation potential (water quality)

Groundwater discharge data for all streams that may potentially provide surface water for flood irrigation in Sink Valley have been submitted electronically to the Division's on-line hydrology database. Discharge and water quality data for streams that could potentially be used for flood irrigation are presented in Table 9. As described above, the two streams with the greatest annual discharge, and consequently the best potential for flood irrigation use in the project area are Swapp Hollow creek and the Water Canyon spring diversion. The water quality characteristics of these two sources are described below.

7.2.1 Swapp Hollow creek

Surface water at Swapp Hollow creek is monitored at site SW-8 (see Drawing 7-10 in Chapter 7 of the Coal Hollow Project MRP). It is apparent from Figure 12 that the surface water in Swapp Hollow creek is a C2-S1 class water on the SAR – conductivity classification of irrigation water (Figure B-5, OSM, 1983). This indicates medium-salinity water. The water may be used for flood irrigation if a moderate amount of leaching occurs. The sodium hazard is low. The surface water in Swapp Hollow creek averages 311 mg/L (Table 9). Based on the dissolved-solids hazard for irrigation water (Table B-5, OSM, 1983) irrigation with this water will not usually result in detrimental effects. Using the criteria shown on Table B-6 (OSM, 1983), which considers boron, SAR, chloride, sulfate, specific conductance, and TDS levels, the Swapp Hollow water is a Class I water. This indicates excellent to good water with a low salinity hazard that is suitable for most conditions. It is suitable for irrigation of all or most plants, including salinity- and boron-sensitive species.

7.2.2 Water Canyon spring diversion

Waters in the Water Canyon spring diversion are monitored at site RID-1 (see Drawing 7-10 in Chapter 7 of the Coal Hollow Project MRP). It is apparent from Figure 12 that waters in the Water Canyon spring diversion are C2-S1 class waters on the SAR – conductivity classification of irrigation water (Figure B-5, OSM, 1983). This indicates medium-salinity water. The water may be used for flood irrigation if a moderate amount of leaching occurs. The sodium hazard is low. The waters in the Water Canyon spring diversion average 248 mg/L (Table 9). Based on the dissolved-solids hazard for irrigation water (Table B-5, OSM, 1983) irrigation with this water will not usually result in detrimental effects. Using the criteria shown on Table B-6 (OSM, 1983), which considers boron, SAR, chloride, sulfate, specific conductance, and TDS levels, the Water Canyon spring diversion waters are Class I waters. This indicates excellent to good water with a low salinity hazard that is suitable for most conditions. The water in this class is suitable for irrigation of all or most plants, including salinity- and boron-sensitive species.

7.2.3 Alluvial groundwater springs

A characterization of the water quality characteristics of alluvial groundwater systems from which spring discharges could potentially be used for flood irrigation (SP-20 and SP-8) is presented in Section 5.2.1 above. In that analysis, the water quality conditions at spring SP-8 were characterized. The water quality characteristics of springs SP-8 and SP-20 are similar to each other and to other springs originating in Alluvial Groundwater Discharge Area A (see Appendix 7-1 in Chapter 7 of the Coal Hollow Project MRP). Water quality data for springs and wells in the alluvial groundwater system in this area have been submitted electronically to the Division's on-line hydrology database (UDOGM, 2008).

7.3 Flood irrigation potential (soils measurements)

Information on soil characteristics in the Coal Hollow Project area are provided in Chapter 2 of the Coal Hollow Project MRP. This information includes physical and chemical properties of the soils sampled in 60 soils pits excavated and surveyed by qualified soils scientists. Also included in Chapter 2 are qualitative evaluations of prevailing soil moisture conditions in the shallow subsurface in the project area.

7.4 Flood irrigation potential (topographic characteristics)

The topographic characteristics of the land surface in the Coal Hollow Project have been documented using high-accuracy aerial surveys. A contour map depicting this information is provided in Drawing 5-1 in Chapter 5 of the Coal Hollow Project MRP. The surface topography of the Coal Hollow Project and adjacent area is also shown on a digitally shaded USGS topographic map in Figure 1. Based on this information, it is apparent that the topographic characteristics of most lands in the project and adjacent area are compatible with flood irrigation techniques. This conclusion is based on the fact that 1) the streams entering the project area originate in upland areas with hydraulic head appreciably greater than the elevations in the project area, and 2) consequently, based on the surface topography, it is apparent that conveyance ditches could be constructed that could convey surface waters from the highland areas in the east to most locations within the project area. Areas that could not reasonably be irrigated by flood irrigation techniques include the steep, isolated hills located mostly in the western portions of the project area.

8.0 R645-302-321-260

8.1 Aerial photographs and infrared imagery

Aerial photographs of the Coal Hollow Project and adjacent area are provided in Plates 3 and 4. The late summer/fall infrared imagery has been analyzed extensively in the analysis of the valley floor in Sink Valley. The infrared imagery has been utilized by researchers in each of the various scientific disciplines and was an important investigative tool in developing the conclusions presented in this report

Several botanical, soils and hydrologic studies prepared for this document utilized aerial photographs for their analyses. Color and infrared imageries flown at different times of the year were used for this work.

In the botanical studies, the infrared and color aerial photographs were used extensively for mapping the plant communities within and adjacent to the permit area. For preliminary mapping, the images were first used in the office. They were later utilized in the field for site-specific verifications in the "ground-truthing" process. Seasonal changes reflected in the infrared photographs were used to delineate the differences in the plant community types including the dry and wet meadows. The ground-truthing methods confirmed similarities or declared differences in the composition and structure of the vegetation and therefore helped drive the process in selecting the sample locations in areas where quantitative data were collected.

Infrared photographs were also utilized for mapping the areas where sub-irrigation was possible. Similar to mapping the plant communities described above, areas that appeared to have vigorous plant growth later in the growing season were more likely to be sub-irrigated. These areas were first delineated on a field map, followed by the ground-truthing process onsite where the plant species were identified, soil pits were dug and soil descriptions were made.

Color and infrared images were also employed in the soils studies to map contrasting soil types by identifying different vegetation types and densities. Aerial photo images were also used to identify the different vegetation types and then to determine soil pit locations. Stereo pairs of the natural color images were used to delineate areas by geomorphology and slope.

Information obtained from aerial photographs was also used extensively in various hydrological studies in the Coal Hollow Permit and adjacent areas. Analysis of color infrared images was utilized to evaluate alluvial groundwater discharge areas and to assist in the spring and seep survey in the area. Shallow groundwater flow patterns were also evaluated using color infrared imagery.

8.2 Analysis of a series of aerial photographs

A comparative analysis of a series of aerial photographs including color infrared imagery flown at a time of year to show any late summer and fall differences between upland and valley floor vegetative growth has been performed as part of this investigation. The results of this comparative analysis are presented below.

The color infrared image presented in Plate 3 was taken during the summertime (15 July 2006) and shows conditions in the proposed Coal Hollow Mine permit and surrounding areas. The color infrared image shown in Plate 4 was taken during the fall time of year (2 November 2007) and shows approximately the same region. Both of the infrared images were produced and provided in digital format from Olympus Aerial Surveys, Inc. of Salt Lake City, Utah.

It is readily apparent when comparing Plate 3 and Plate 4 that there was considerably more vegetative growth activity (as represented by the intensity of the red colors on the infrared image) during the summertime than there was in the fall time of year. When comparing Plates 3 and 4, it is apparent that the most pronounced variability between the two seasons is apparent in the Sink Valley area. While much of this area appears red on Plate 3, a much more muted shade of grayish-red is evident in these same areas on Plate 4, suggesting a marked decrease in vegetative growth/vigor in these areas during the fall. This conclusion is consistent with field observations made in the region during the past five years. In field observations it has been noted that the overall wetness of the land surface in Sink Valley area declines markedly in the summer and fall months relative to conditions in the springtime. Vegetative growth also wanes markedly during the late summer and fall. The pronounced decline in vegetative growth in the Sink Valley area during the fall time of year suggests that, while water is available to vegetation early in the growing season, a persistent and reliable source of water is apparently not readily available to vegetation in these areas during the fall. Some of the decline in vegetative growth is also likely attributable to the decreased vegetative growth that naturally occurs in the fall time of the year. The upland pinyon and juniper vegetation present in areas surrounding Sink Valley shows a much lesser degree of variability in vegetative growth activity between the summer and fall (as indicated by the similar intensity of the red colors on the two infrared images). Where upland vegetation is present in other areas in the proposed permit and surrounding area, decreases in vegetative growth between the July and November images are also apparent.

In the context of a preliminary alluvial valley floor assessment, this information is useful to assist the Division in determining whether vegetation adjacent to a stream is receiving water in greater quantities or for a longer duration in the growing season than is adjacent upland vegetation. The availability of a persistent source of water to the vegetation may allow vegetative growth in plants to continue into the fall months after the early season water is gone. The noted decrease in vegetative growth in the fall suggests that water is not continuously available to plants in these areas late in the growing season. It is also apparent that some degree of vegetative growth (as indicated by the muted red-gray colors) in Sink Valley in Plate 4 is still present in the November image. Upland pinyon and juniper vegetation does not show a marked decline from summer to fall while vegetative growth in other upland vegetation species appears to decline noticeably from the summer to the fall.

9.0 Supplemental AVF Information for Adjacent Areas

In its 4 August 2008 technical review of the Coal Hollow Mine permit application, the Division of Oil, Gas and Mining suggested that alluvial valley floors are present to the west of the permit area along Kanab Creek, and to the south of the area in lower Sink Valley Wash. Supplemental information is provided in this section to assist the Division in making a determination regarding the presence or absence of alluvial valley floors in these areas. The supplemental information for the Kanab Creek and lower Sink Valley Wash probable AVF areas are presented separately below.

9.1 Kanab Creek probable AVF area

9.1.1 Mapping the extent of probable AVF

An area of probable alluvial valley floor has been delineated in the Kanab Creek drainage west of the Coal Hollow Mine permit area as shown in Plate 5. The probable AVF encompasses portions of Section 24, 25, 26, 35, and 36, T39S, R6W. The area consists predominantly of relatively flat fields situated on benches adjacent to Kanab Creek. The land has been used historically for hay production and for cattle grazing. Irrigation of these lands is performed exclusively using surface water diverted from Kanab Creek. The water is diverted from the creek into ditches that convey water into irrigation holding ponds as shown on Plate 5. Water from the ponds is conveyed to the fields and applied using sub-ditches, berms, and dikes (not shown on Plate 5).

In reconnaissance-level surveys of the alluvial sediments in the Kanab Creek stream banks adjacent to the probable AVF, stream channel deposits have been identified. The lateral extents of the stream channel deposits in the subsurface in locations further away from the Kanab Creek stream channel are not known. The land surface in the area has the appearance of containing flood plains and terraces. Subirrigation of the flood-irrigated fields is not readily apparent.

9.1.2 Land productivity

Based on vegetative investigations and conversations with landowners and land managers in the Kanab Creek probable AVF area, productivity information for the Kanab Creek probable AVF area lands are provided here. The landowners and managers contacted include Mrs. Lorene Lamb, Mr. Brigham Johnson, and Mr. Brian Lamb.

The agricultural fields in the Kanab Creek probable AVF area are currently used primarily for livestock grazing (personal communications, Brigham Johnson, Brian Lamb, 2008). The lands are irrigated when sufficient water for irrigation activities is available in Kanab Creek. Typically, water for irrigation has been available in the spring and early summer only. Historically, alfalfa and grass hay has been produced on these lands. However, no hay production has occurred in the Kanab Creek probable AVF in the past seven years because there has not been sufficient water for irrigation (personal communication, Brigham Johnson and Brian Lamb, 2008). Mr. Johnson and Mr. Lamb both indicated their belief that the decrease in water availability in Kanab Creek is largely because of changes in the irrigation practices of upstream Kanab Creek water users. They suggested that much of the water that previously flowed to their Kanab Creek diversions during the irrigation season was derived from flood irrigation return flows from upstream irrigated lands. When the upstream irrigated lands transitioned from flood irrigation to sprinkler irrigation techniques, the irrigation return flows were diminished. Consequently, because of the inadequate water supply currently available for irrigation, hay production and cutting is not occurring presently.

When the lands in the Kanab Creek probable AVF were utilized for hay production, the quantity of hay produced on the lands was largely a function of the water availability in Kanab Creek. Mr. Johnson indicated that in the approximately 100 acre hay field he worked in the northern portion of the Kanab Creek probable AVF area, a crop of approximately 75 tons was produced in the single cutting. This equates with a production of 1,500 pounds per acre for the early season alfalfa. For the fields of the southern portion of the probable AVF, Mr. Lamb provided a rough estimate of production at about 94 to 113 tons per cutting on fields of roughly similar size. This equates with a production of approximately 1,880 to 2,260 pounds per acre, which is a somewhat higher estimate than that provided for the northern field. Mr. Lamb also indicated that they were sometimes able to get two hay cuttings per year during wet years when adequate water in Kanab Creek was available for irrigation. During the years that hay cutting was occurring on these lands, the fields were commonly also used as pastures for livestock grazing for part of the year after the hay crop was harvested. Production from the pasture lands during the growing season after the hay cutting had occurred may have yielded perhaps an additional 800 to 1,000 pounds per acre (personal communication, Patrick Collins, 2008). It should be noted that the estimates of hay production by both Mr. Johnson and Mr. Lamb were based on recollection from memory and should be considered as approximate values.

In recent years, when sufficient soil moisture for hay production was unavailable through normal precipitation patterns, the fields were irrigated to increase the vegetative production of the pasture land, which is currently dominated by pasture grasses. In dryer years, lesser or no irrigation of the pastures has occurred. Productivity information for various vegetative types in the Coal Hollow Project area is provided in Section 321.200, Table 3-34 of the Coal Hollow Mine MRP. As indicated in Table 3-34, the productivity of unirrigated pasture in the area is about 1,100 pounds per acre. The productivity of pasture lands with limited irrigation in the area is probably about 2,100 pounds per acre (personal communication, Patrick Collins, 2008).

9.1.3 Potential for impacts to the Kanab Creek probable AVF

Proposed mining and reclamation activities at the Coal Hollow Mine will not cause or present and unacceptable risk of causing material damage to the quantity or quality of surface or groundwater that supplies the lower Sink Valley Wash probable AVF.

The water source for the Kanab Creek probable AVF is surface water from Kanab Creek. As described in the Coal Hollow Mine MRP, the Kanab Creek stream channel and adjacent valley bottom will not be disturbed by mining and reclamation activities at the proposed Coal Hollow Mine. The recharge areas for Kanab Creek are located considerable distances upstream of the mining area and will likewise not be disturbed or impacted by mining-related activities at the Coal Hollow Mine. Consequently, the potential for mining and reclamation activities to cause material damage to the quantity or quality of the water supply for the Kanab Creek probable AVF is essentially nonexistent.

It should be noted that there are no irrigation diversions from Lower Robinson Creek to the Kanab Creek probable AVF and water from Lower Robinson Creek is not a supply to the probable AVF. The discharge in Lower Sink Valley (as monitored at site SW-5; DOGM 2007) is usually meager and not sufficient for appreciable irrigation of the lands in the Kanab Creek probable AVF. Appreciable discharge in the drainage occurs only during the snowmelt event and in direct response to torrential rainfall events. As indicated in the statement of probable hydrologic consequences for the Coal Hollow Mine (see section 728 of Chapter 7 of the Coal Hollow Mine MRP) adverse impacts to groundwater or surface water availability and to water quality in the Lower Robinson Creek drainage are considered unlikely.

The rate at which alluvial groundwater will be intercepted by the proposed Coal Hollow Mine will be variable by location and time in permit area. Because of the heterogeneity inherent in most alluvial deposits, the quantifying of precise aquifer parameters in the various mining areas is not straightforward. Additionally, the geometry of the mine openings including the horizontal lengths and heights of mine pit faces adjacent to saturated groundwater systems that are exposed at any point in time are dynamic variables in the surface mining environment. Consequently, precise quantifications of mine groundwater interception rates are not readily obtainable. However, using the estimated mine pit groundwater inflow rates presented as discharge per linear foot of open pit in Table 7-9 of Chapter 7 of the Coal Hollow Mine MRP, it is considered likely that mine interception will be on the order of a few tens of gallons per minute in dry areas and at times when open pit sizes are small, to several hundred gallons per minute in wetter areas and at times when the open pit size is large. It is important to note that inflows into individual pit areas will be short lived, as the individual pits will commonly remain open for a few weeks to a few months.

As described above, the quantity of water currently used for flood irrigation in the Kanab Creek probable AVF area is highly variable. During wet years, several applications of flood irrigation water may be applied to all or portions of the irrigated fields. During dry years, little or no irrigation of the lands may occur. As an order of magnitude estimate, using the monthly water requirements for alfalfa and pasture lands in the Alton area in Table 8, it is calculated that to fully irrigate 200 acres of land for pasture or alfalfa would require about 305 and 370 acre-feet of irrigation water per year for pasture and alfalfa production, respectively (assuming a typical precipitation during the growing season of 5 inches). This equates with an average continuous usage of about 190 and 240 gpm for pasture land and alfalfa land, respectively (averaged over the entire year). This approximation represents a maximum usage when all lands are irrigated and ample irrigation water is present. When water availability is lower, the amount of water usage will, accordingly, be lower and less acreage could be irrigated or fewer irrigation applications could be applied.

It is important to note that the above provided estimates of water usage at the Kanab Creek probable AVF represent water diverted exclusively from Kanab Creek. None of the water utilized for irrigation of the Kanab Creek probable AVF area is derived from or transits through the proposed Coal Hollow Mine permit area.

9.2 Lower Sink Valley Wash probable AVF area

9.2.1 Mapping the extent of probable AVF

An area of probable alluvial valley floor has been delineated in the lower Sink Valley Wash area south of the Coal Hollow Mine permit area as shown in Plate 5. The mapped probable AVF encompasses portions of Sections 5 and 6, T40S, R5W. Similar valley features extend further down Sink Valley Wash below the area delineated in Plate 5, but these are not evaluated herein. The land in the lower Sink Valley Wash probable AVF area consists predominantly of relatively flat or gently sloping lands situated on a bench adjacent to the deeply incised (>20 feet) lower Sink Valley Wash stream channel (Plate 5). The land surface in the lower Sink Valley Wash probable AVF area is vegetated mostly with grasses and sagebrush. It was apparent in field reconnaissance that the land in this area has been used primarily for livestock grazing on undeveloped range land. There was no indication that flood irrigation or appreciable crop production has occurred in this area in the recent past. The Sink Valley Wash stream channel in this area is incised by more than 20 feet below the surrounding land surface. Surface-water monitoring at site SW-9 on Sink Valley Wash within the probable AVF area indicates the scarcity of water in the drainage. On only two of the 17 monitoring events at SW-9 from June 2005 to August 2008 was any water present in the drainage (see UDOGM hydrology database, 2008). During March 2006, a flow of 10.6 gpm was measured. During March 2008, a flow of 182 gpm was measured.

In reconnaissance-level surveys of the alluvial sediments in the lower Sink Valley Wash steam banks adjacent to the probable AVF, stream channel deposits have been identified. The lateral extents of the stream channel deposits in the subsurface at locations further away from the Sink Valley Wash stream channel are not known. The land surface in the area has the appearance of containing flood plains.

It is notable that there is a marked change in the geomorphology of the alluvial sediments in lower Sink Valley Wash that occurs near the County Road 136 crossing of Sink Valley Wash in Section 5, T40S, R5W (Plate 5). The Sink Valley Wash canyon bottom above the county road crossing is characterized by a narrow-bottomed valley with only a minor associated alluvial system and discontinuous stream channels. Below the county road crossing, the channel widens significantly, a flood plain becomes apparent, and stream channel deposits are visible in stream banks.

The area designated as probable AVF in lower Sink Valley Wash on Plate 5 is so designated based on several observed valley characteristics that are consist with the definition of probable alluvial valley floors. Namely, 1) it is a topographic valley holding a continuous stream channel, 2) there is the probable existence of stream laid deposits in the subsurface, and 3) the land area appears capable of being flood irrigated based on topography. However, the absence of any reasonable source of water that could be used to irrigate the valley floor or used for subirrigation seems to limit its potential for current or future agricultural activity.

9.2.2 Land Productivity

The land surface in the lower Sink Valley Wash AVF area is dominated by sagebrush and grass vegetation. Under normal conditions, the annual biomass productivity of the lower Sink Valley bottomlands that are dominated by basin big sagebrush, rubber rabbitbrush plant communities and have loamy soils have been estimated at 1,500 pounds per acre (USDA, 1990).

9.2.3 Potential for impacts to the lower Sink Valley Wash probable AVF

Proposed mining and reclamation activities will not cause or present any unacceptable risk of causing material damage to the quantity or quality of surface or groundwater that supplies the lower Sink Valley Wash probable AVF. Currently, there is no reasonably dependable water source for irrigation or subirrigation activities at the lower Sink Valley Wash probable AVF. Because there is no appreciable baseflow discharge component to the wash, the limited water that is available periodically is derived from rainfall or snowmelt runoff water. The potential for adverse impacts to water quantity or water quality in the lower Sink Valley Wash area as a result of mining and reclamation activities at the Coal Hollow Mine is considered very low (see section 728.334 of the Coal Hollow Mine MRP).

The volume of water currently used in the lower Sink Valley probable AVF for irrigation or subirrigation is zero. As described above, there is very little water available in the drainage that could potentially be used for irrigation.

The proposed mining and reclamation activities will not discontinue or preclude farming at the lower Sink Valley Wash probable AVF. Currently, no farming operations are present in this probable AVF. No irrigation of the lands in the lower Sink Valley probably AVF is presently occurring, nor is subirrigation of these lands apparent. As stated above, adverse impacts to water quantity or quality in lower Sink Valley Wash are not anticipated. Consequently, the potential for discontinuing or precluding farming at the lower Sink Valley Wash probable AVF is considered remote.

As discussed in Section 8.1.3 above, the rate of interception of alluvial groundwater by the Coal Hollow Mine is anticipated to be on the order of a few tens of gallons per minute in dry portions of the mine and when the exposed mine pit area is small, to several hundreds of gallons per minute in wet areas and when the exposed pit areas are large. Based on reconnaissance investigations in the lower Sink Valley Wash probable AVF area, there appears to have been no water utilized there for irrigation in the recent past.

10.0 Seasonal Variability and Depth to Water Information

As requested by the Division, additional information regarding seasonal variability in groundwater systems in the Coal Hollow Mine permit and surrounding areas is provided herein. A map showing contoured values of seasonal variation in wells in the alluvial groundwater systems is provided as Figure 14. A map showing contoured values of typical depths to groundwater below the land surface in alluvial wells in the permit and surrounding area is provided as Figure 13.

11.0 Deep Alluvial Groundwater Discharge

Monitoring well SS-75 is located on the southern permit boundary of the proposed Coal Hollow Mine permit area (see Drawing 7-2 in the Coal Hollow Mine MRP). Alluvial wells SS-15 and SS-30 are also located at this approximate surface location. Well SS-75 is approximately 75 feet deep and is screened from 54 to 74 feet below the ground surface (See Table 7-2 in the Coal Hollow Mine MRP) in a zone likely influenced by burned, oxidized, or eroded coal. A zone of burned or eroded coal has been mapped in the south-central portion of Sink Valley (see Figure 8 in Appendix 7-1 of the Coal Hollow Mine MRP). The exact discharge locations for groundwaters in the burned or eroded coal zone have not been identified. However, it is likely that groundwaters from this groundwater system discharge in the southern end of Sink Valley where the burned or eroded coal zone intersects the ground surface as seeps, springs, or diffuse seepage to the surface.

12.0 Potential Recharge to Alluvial Groundwater Systems Through the Colluvium

Recharge to the alluvial groundwater systems in Sink Valley likely occurs primarily from mountain-front recharge mechanisms along the base of the adjacent Paunsagunt Plateau escarpment. Mountain-front recharge is generally understood to include infiltration of meteoric water from ephemeral and perennial streams into the coarse-grained sediments that are commonly present along the bases of mountain ranges. Discharge from bedrock groundwater systems in the mountain block to the adjacent alluvial sediments may also contribute to mountain-front recharge. Accordingly, it is likely that most of the recharge to the Sink Valley alluvial groundwater systems occurs adjacent to the mountainous areas to the north and east of the proposed mine permit area. Field observations of the unconsolidated sediments in these areas indicate the abundant presence of coarse-grained sediments.

Fine-grained, clayey sediments dominate the near-surface sediments in Sink Valley in the proposed Coal Hollow Mine permit and adjacent area. In Sink Valley east of the proposed permit area, these low-permeability sediments form a confining layer that creates flowing artesian conditions in the deeper alluvial sediments. Consequently, groundwater flow conditions in these sediments are likely dominated by horizontal flow occurring preferentially through laterally continuous zones of increased permeability. The pervasiveness of the near-surface low-permeability sediments in these areas likely also limits the potential for appreciable groundwater recharge to the alluvial systems through downward vertical migration through any saturated colluvial sediments along the surrounding low-lying hillsides. Consequently, the potential for appreciable recharge to the deeper alluvial groundwater systems through percolation from adjacent colluvial sediments is likely not substantial, although the local infiltration of torrential precipitation and snowmelt waters likely contributes to near-surface soil moisture and localized perched alluvial groundwater systems.

13.0 Discharge and water-level variability in early part of Y-61 pump test.

Water level and discharge data were collected from monitoring wells and springs in the proposed Coal Hollow Mine permit and adjacent area in conjunction with the pumping test of well Y-61 in January 2007. These measurements were performed prior to the commencement of pumping, during the 28-hour pumping period, and during the well recovery period. It should be noted that the pump test was performed during wintertime conditions with appreciable snow cover in January of 2007. Water level and spring discharge measurements were performed during both daylight and nighttime hours with nighttime air temperatures dipping to near 0 degrees Fahrenheit during the data collection period.

Discharge measured at SP-8 immediately prior to and during the first four hours of the pump test ranged from 19.25 to 19.78 gallons per minute. Although it is possible that other factors are responsible for this modest (2.7%) discharge variability early in the pump test, it is considered most likely that the observed differences in the measured discharge rates are a reflection of the inherent error of the measurement technique (time-to-fill in a calibrated container), particularly as performed under the less-than-ideal field conditions.

Water levels in monitoring wells SS-30 and C2-40 varied somewhat in the time period prior to and during the first approximately four hours of the pump test. Depth to water measurements in well SS-30 ranged from 2.77 to 2.81 feet during this period, which represents a difference of 0.04 feet, or about ½ inch. Similarly, depth to water measurements in well C2-40 ranged from 8.32 to 8.34 feet during this period, which represents a difference of 0.02 feet, or about ¼ inch. While the variability in the measured water levels may be reflective of other factors, it is considered likely that these small fluctuations are primarily reflective of the inherent error associated with the measurement technique, particularly in the less-than-ideal field conditions.

14.0 References Cited

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OSM, 1983, Alluvial valley floor identification and study guidelines, U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement.

Personal communication, Lorene Lamb, Orderville, Utah, December 2008, Landowner in the Kanab Creek probable AVF area.

Personal communication, Brigham Johnson, St. George, Utah, December 2008, Agricultural manager in the Kanab Creek probable AVF area.

Personal communication, Brian Lamb, Mount Carmel, Utah, December 2008, Agricultural manager in the Kanab Creek probable AVF area.

UDOGM, 2007, Utah Division of Oil, Gas and Mining, Utah coal mine water quality database, on-line at http://ogm.utah.gov/coal/edi/wqdb.htm.

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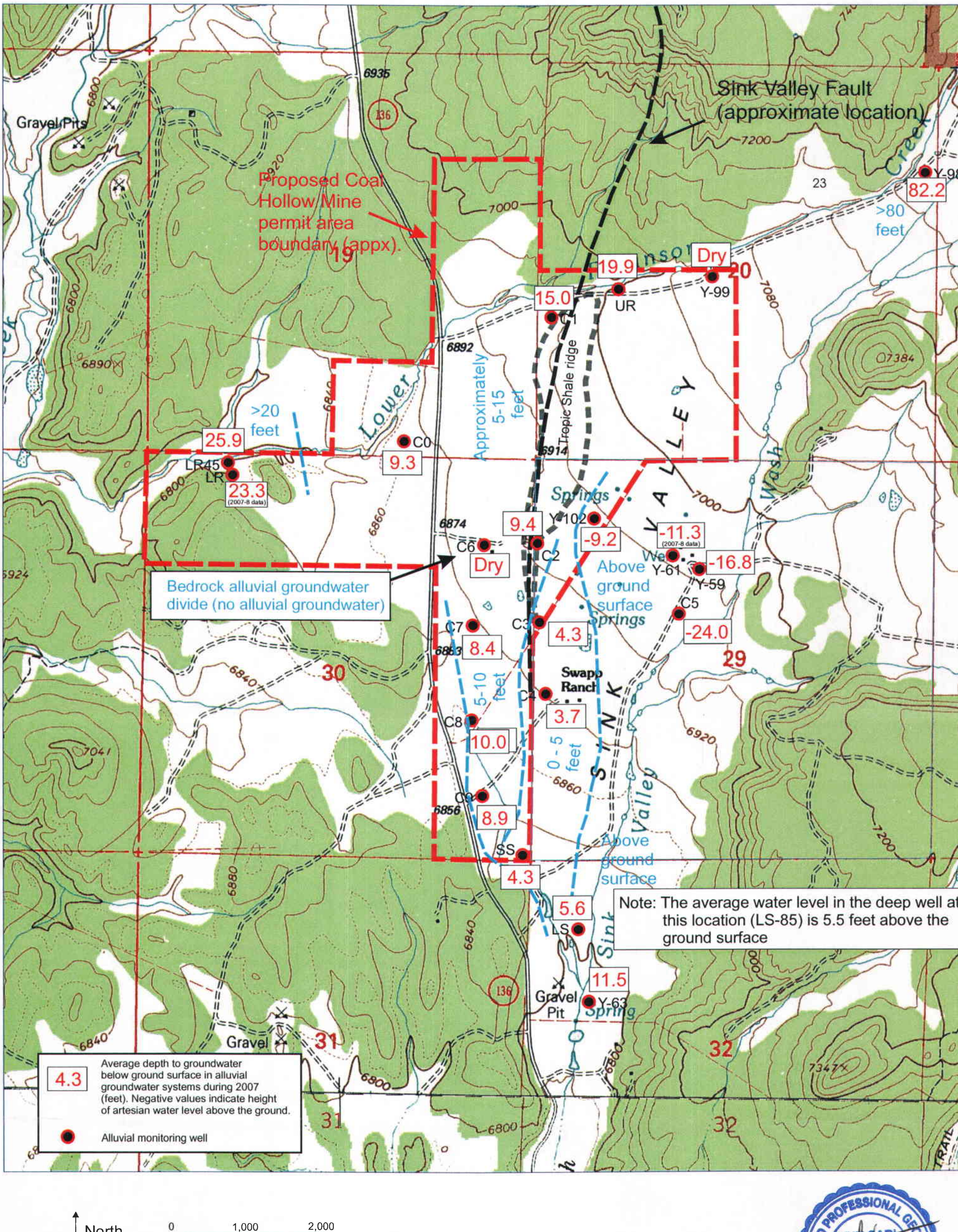

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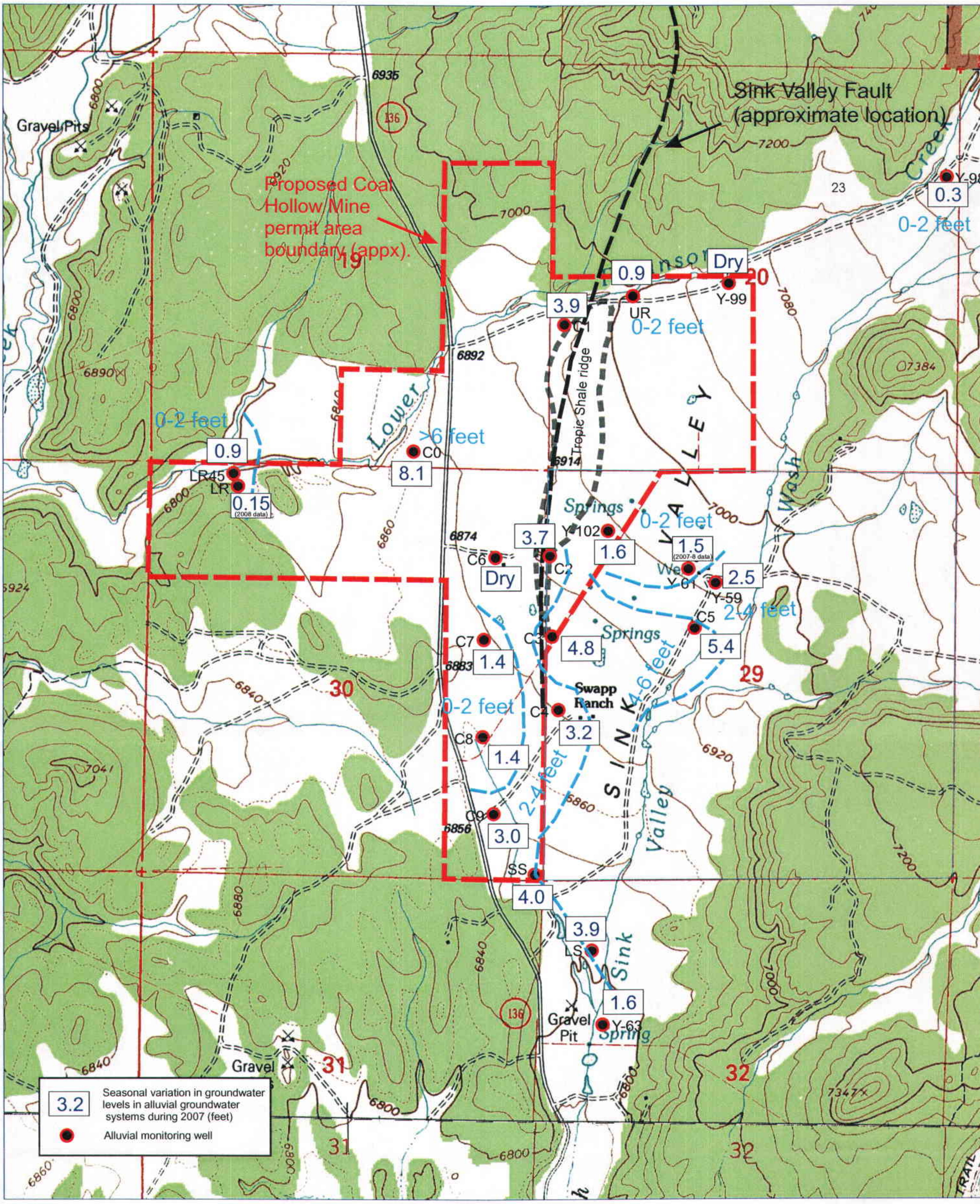
Figure 13 Average depths to groundwater relative to ground surface in the alluvial groundwater systems in the Coal Hollow Mine permit and surrounding area during 2007.



North

0 1,000 2,000

Note: The values presented here represent the difference between the maximum and minimum water level value measured for each well during 2007. Water levels in most wells declined from springtime to fall. Water levels in some wells increased during the late fall, likely in response to the seasonal decrease in the evapotranspiration rate. For specific information for each well, see Figure 3 and Table 1.

Figure 14 Seasonal variation in groundwater levels in the alluvial groundwater systems in the Coal Hollow Mine permit and surrounding area during 2007.

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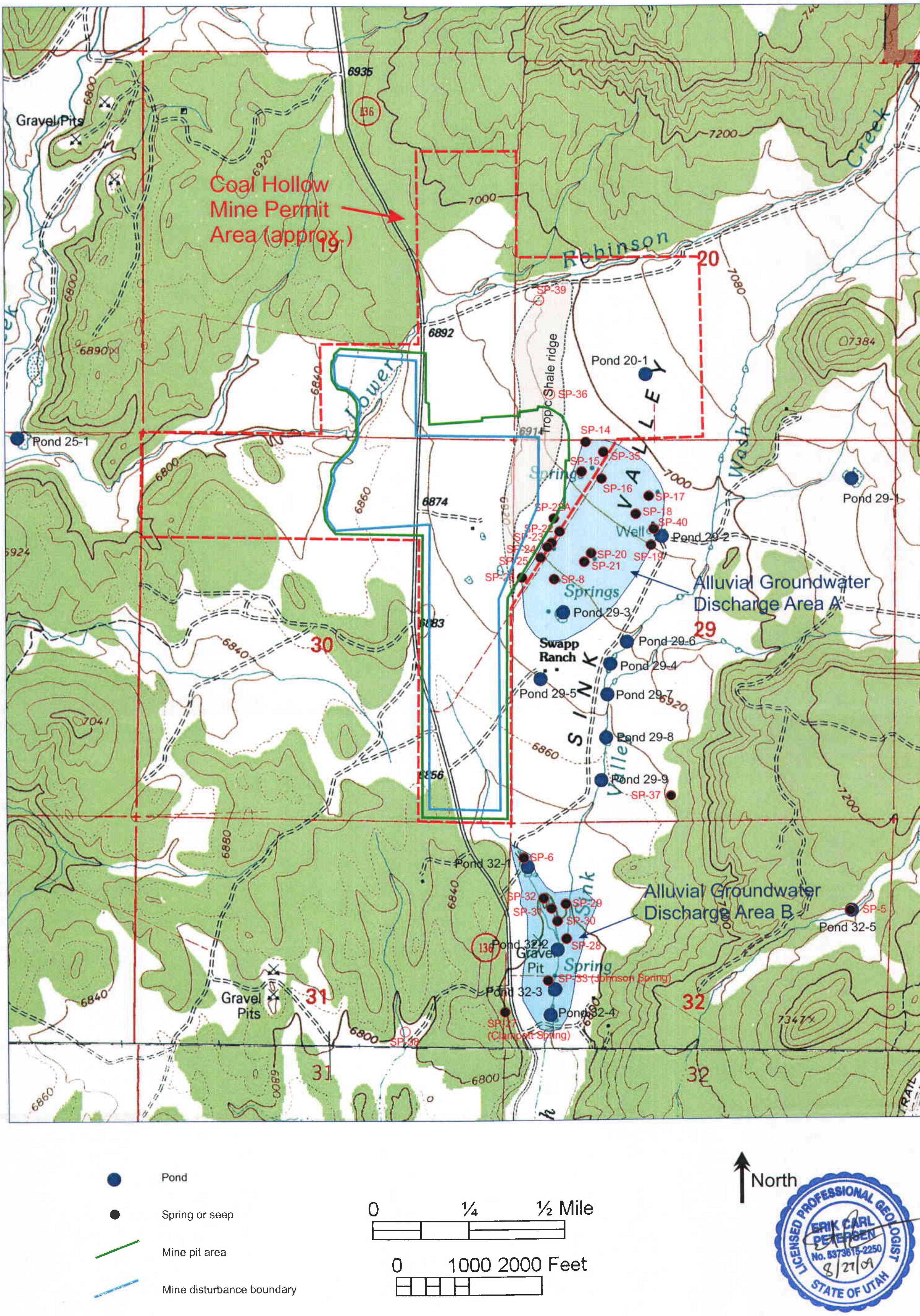

Figure 15 Locations of springs, seeps, ponds, alluvial groundwater discharge areas, Tropic Shale ridge, Sink Valley Fault, mine pit areas, and the extent of the mine disturbance.

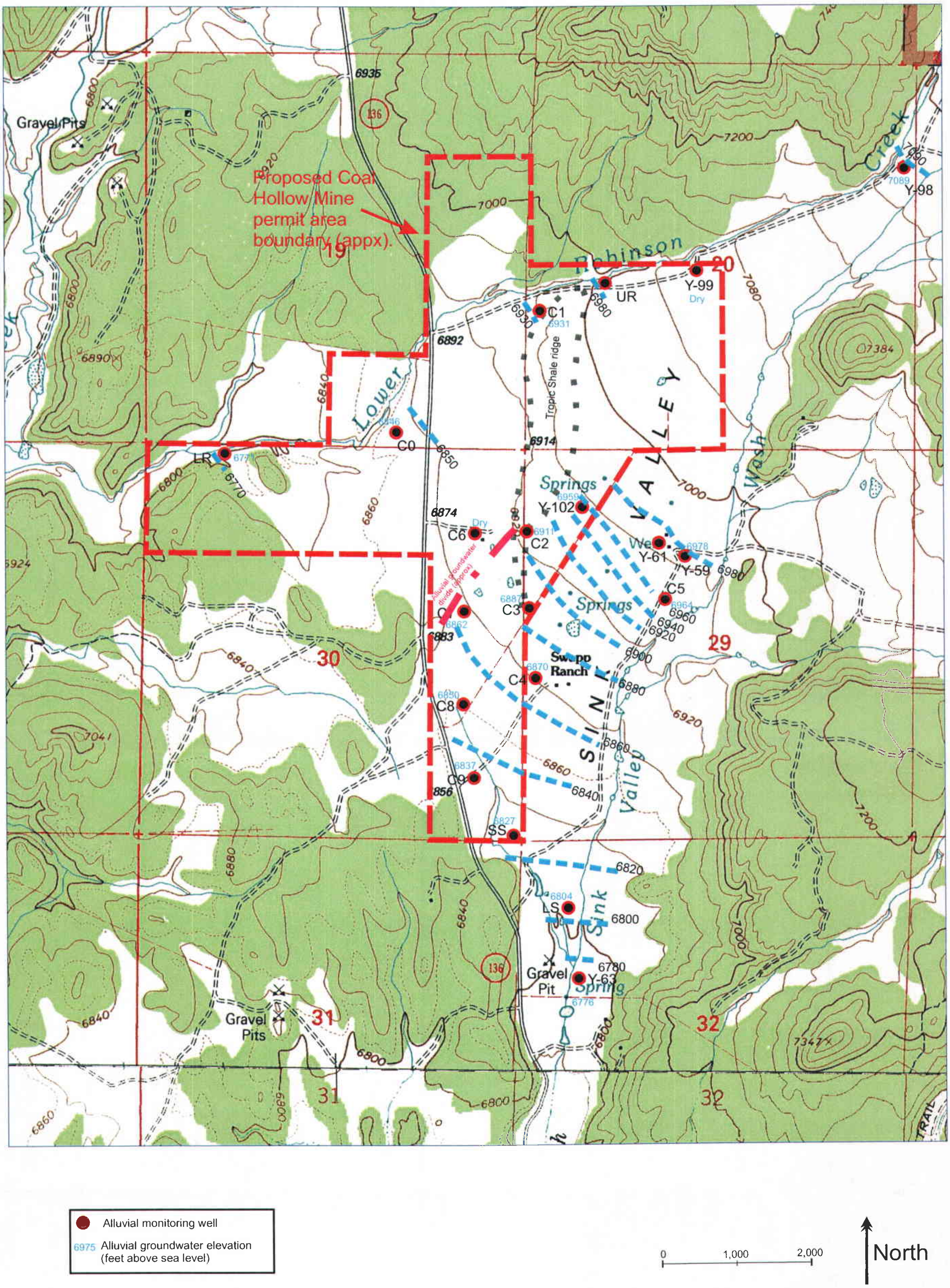

Figure 16a January-February 2007 alluvial groundwater levels.

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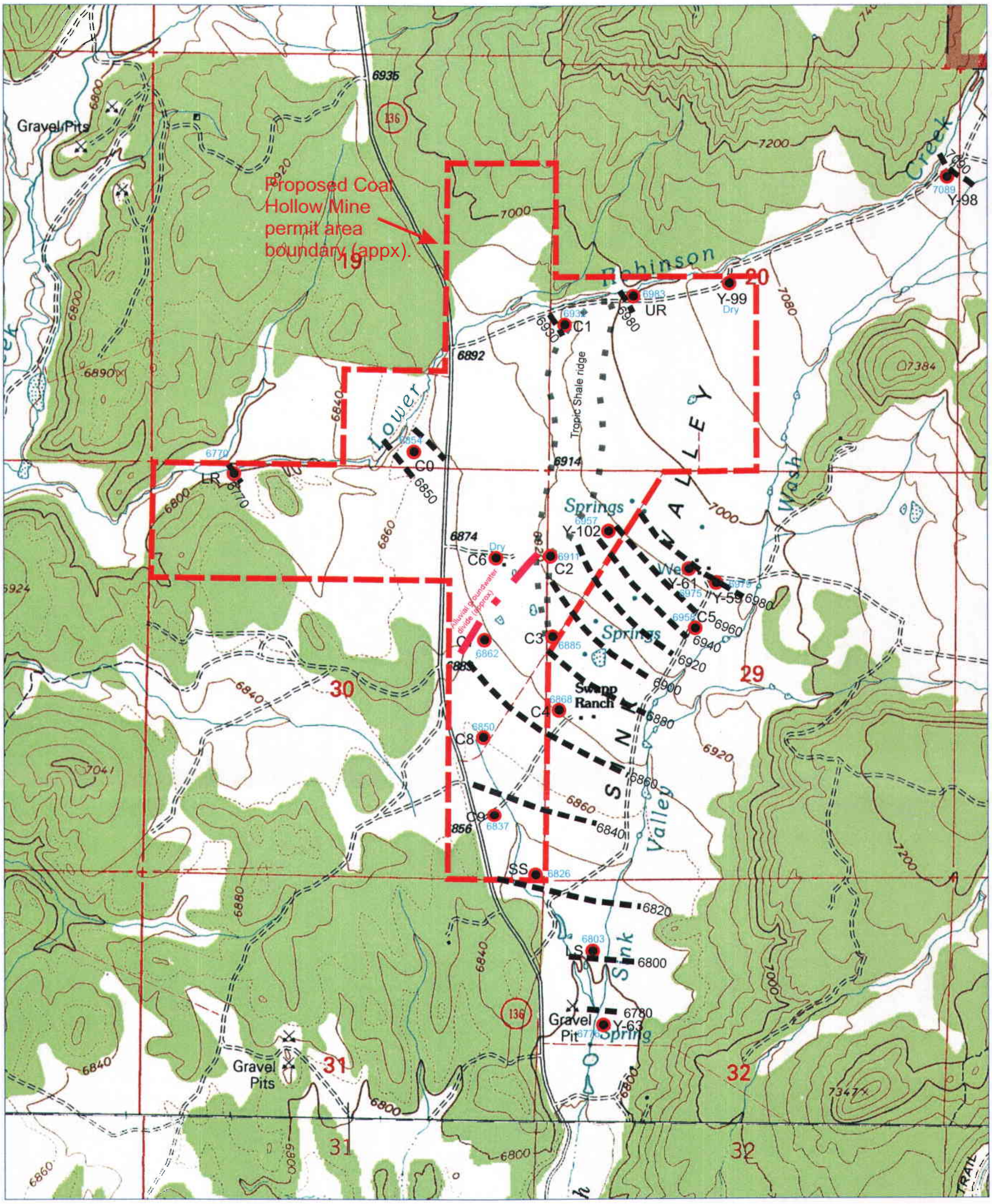

Figure 16b June 2007 alluvial groundwater levels.

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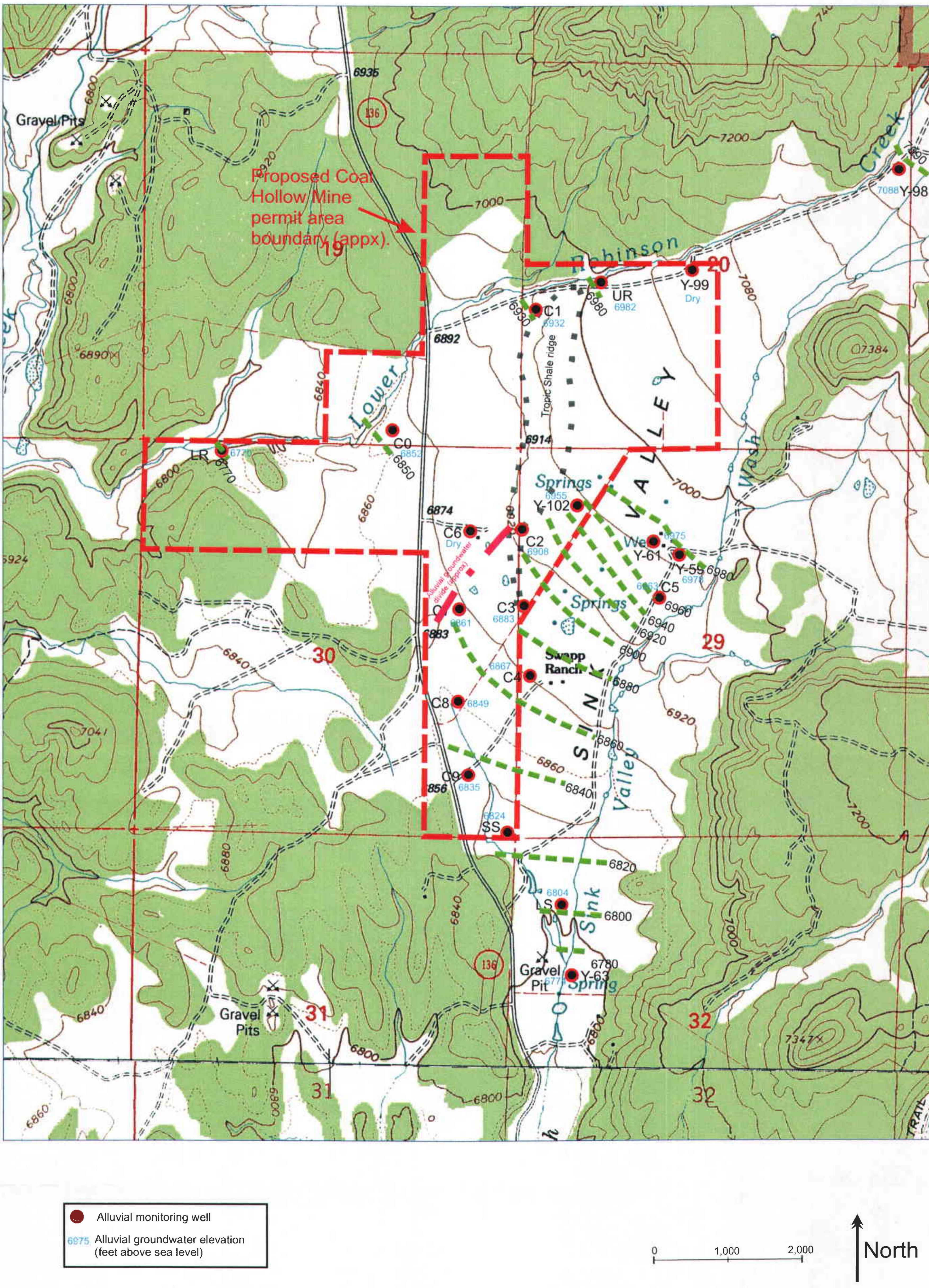

Figure 16c September 2007 alluvial groundwater levels.

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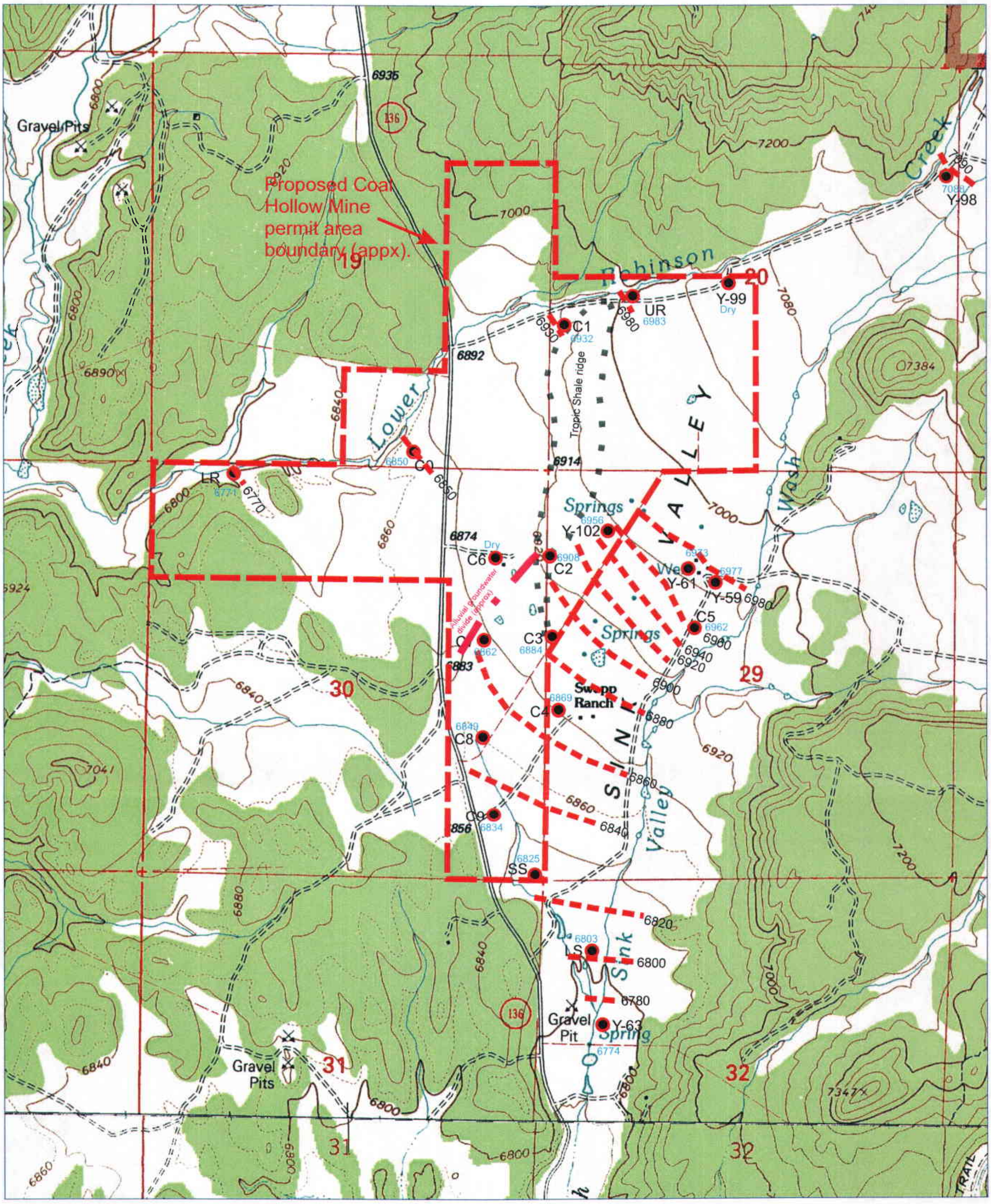
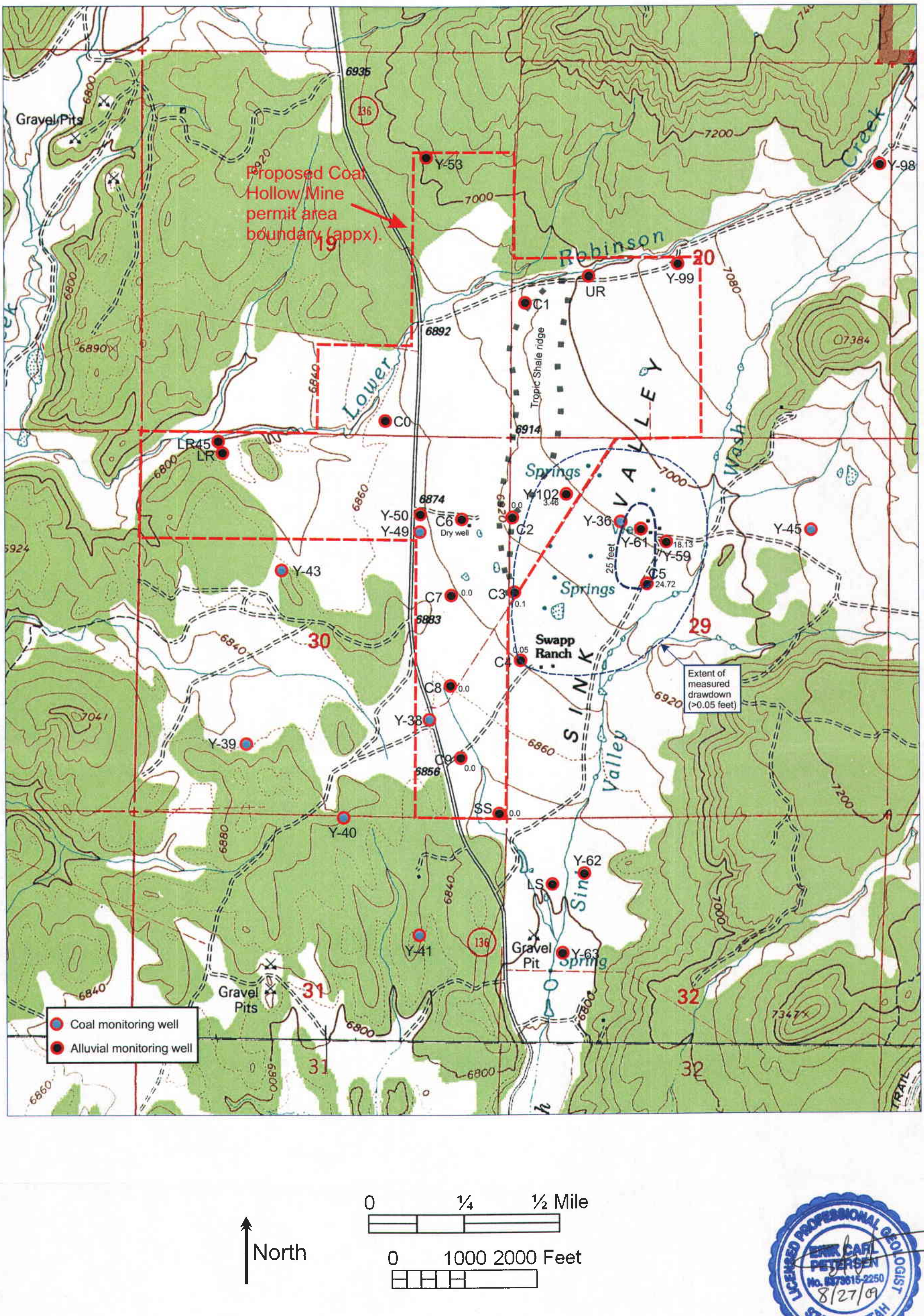


Figure 16d November-December 2007 alluvial groundwater levels.



LICENSED PROFESSIONAL GEOLOGIST
ERIK CARL PETERSEN
No. 5373615-2250
STATE OF UTAH
8/27/09

Figure 17 Approximate water level drawdown contour map for the January 2007 pump test of alluvial well Y-61 after 28 hours of pumping. The outer contour shows the limit of measurable drawdown (>0.05 feet). The inner contour shows 25 feet of drawdown. The measured drawdowns are posted next to the monitoring well locations.

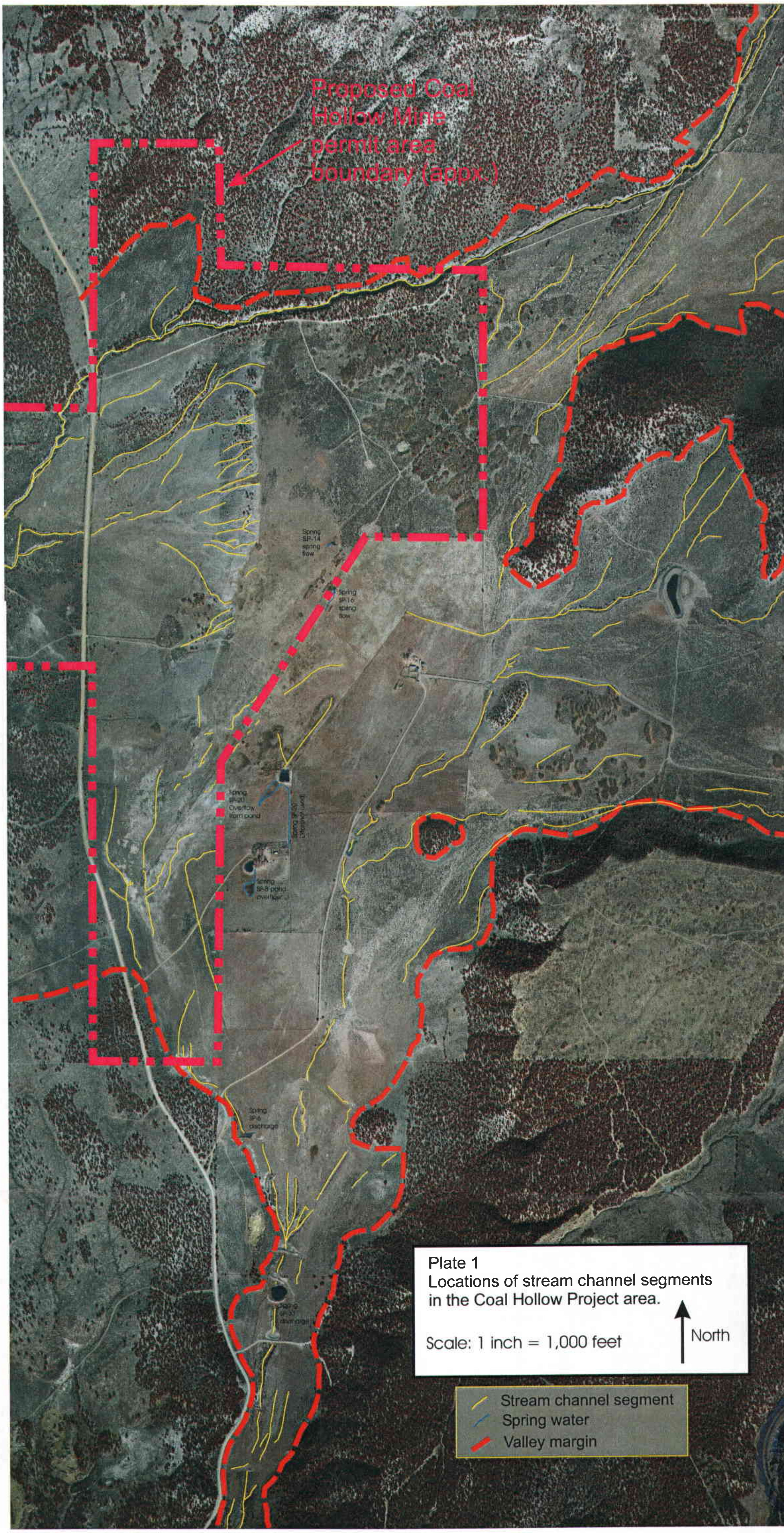


Plate 1
Locations of stream channel segments in the Coal Hollow Project area.

Scale: 1 inch = 1,000 feet

PROFESSIONAL GEOLOGIST
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APPENDIX 7-9

Alluvial Water Contingency Plan

By: Erik Petersen, Petersen Hydrologic and
Chris McCourt, Alton Coal Development, LLC

8-26-09

275875-2202
CHRIS R.
MCCOURT
8-26-09

Coal Hollow Mine – Alluvial Water Contingency Plan

Introduction

As a method to minimize disturbance to the hydrologic balance in the permit and adjacent area, Alton Coal Development, LLC (ACD) has developed a contingency plan to address the potential for coal mining operations to intersect the distal fringes of an alluvial groundwater system centered to the east of proposed mining areas. This alluvial groundwater system exists in coarse-grained alluvial sediments and in some areas exists under marginally-flowing artesian conditions. Projections of the locations of the coarse-grained sediments associated with this alluvial groundwater system suggest that the westernmost fringes of the system might be intersected by the easternmost extent of the mine workings in mine Pit 15. This contingency plan has been designed to address the "worst case scenario" related to this circumstance and provides a step by step process for minimizing the impacts to the hydrologic balance that could potentially occur.

This plan has been developed using all available geologic and hydrogeologic data, including borehole geologic data, surface geologic mapping, and monitoring well potentiometric information. The data and information have been thoroughly evaluated by Erik Petersen (Hydrogeologist, Petersen Hydrologic) and Chris McCourt (Mine Engineer, Alton Coal Development). Information from the hydrogeologic evaluation has been used to develop a practical contingency plan that is designed to prevent excessive groundwater discharge from the coarse-grained alluvial groundwater system and to prevent the flooding of the mine pit should these circumstances occur.

This report outlines this evaluation and the resulting contingency plan.

Summary

ACD acquired the consulting expertise of Erik Petersen, hydrogeologist beginning in 2005. Mr. Petersen has been commissioned to investigate both the geology and hydrology of Sink Valley and the surrounding areas. Mr. Petersen has extensive experience performing these types of investigations in both practical and coal regulatory settings. He has had 18 years of experience performing detailed hydrogeologic and geologic investigations in coal mining environments in Utah. Investigations performed in the Coal Hollow Mine project area include characterizations of groundwater recharge and discharge mechanisms, determinations of aquifer parameters through pump testing and slug testing analysis, characterization of subsurface sediments and stratigraphy, investigations of groundwater and surface water solute and isotope geochemistry, performance of spring and seep surveys and baseline hydrologic monitoring, and surficial geologic mapping. As a result of this extensive study, Mr. Petersen has acquired an in-depth understanding of both the geology and hydrology of Sink Valley.

Using the considerable quantity of subsurface hydrostratigraphic data available from drilling programs performed by ACD and previous investigators in the Sink Valley area, detailed east-west hydrogeologic cross-sections showing the subsurface geology have been created as requested by the Utah Division of Oil, Gas and Mining (UDOGM) . Subsurface zones that are believed to have significant potential to contain coarse-grained alluvial sediments associated with the artesian alluvial groundwater system are also shown. It should be noted that areas identified on the cross-sections as "potential coarse-grained zone" are meant to delineate zones associated with an elevated probability of containing coarse-grained water-bearing alluvium. While the delineation of these zones is based on detailed drilling data, these zones do not necessarily indicate continuous sedimentary layers and are not intended for use in stratigraphic interpretation.

A plan view of the cross-section locations, and the plotted cross-sections are provided in Drawings 7-15 and 7-15B, respectively. In these cross-sections, the alluvium has been divided into two zones, an upper fine-grained alluvium zone and the potential coarse grained alluvium zone discussed above. The potential coarse grained alluvium zone has potential for transporting significant quantities of groundwater because of relatively high hydraulic conductivity. The hydraulic conductivity of the saturated upper fined-grained alluvium zone is much lower than is the coarse-grained zone. Consequently, the potential groundwater flow rates through the fine-grained clayey alluvium are likely orders of magnitude less than that in the deeper coarse-grained zone. Because of the low hydraulic conductivity of the clayey fine-grained alluvium, drainage of large amounts of water through these clayey sediments such that result in adverse impacts to the overall hydrologic balance in Sink Valley would not be anticipated. Accordingly, the focus of this contingency plan is on the coarse-grained alluvial sediments that could potentially be in good hydraulic communication with the alluvial artesian groundwater system centered east of proposed mining areas. Uncontrolled, sustained flows of groundwater from this system could potentially impact the hydrologic balance in the alluvial groundwater system while this drainage persists.

In order to evaluate the potential of the mining process to intersect the coarse-grained alluvium zone, an overlay of the pits on the land surface has been provided in Drawings 7-15 and 7-15B. It is apparent in the review of these cross-sections that the potential to intersect the coarse-gravel zone is isolated to the Pit 15 area. Therefore, the mining process in Pit 15 is the main subject for this plan.

Even though there is the potential for the mining operations to come in contact with the coarse-grained alluvial groundwater system, the following conditions make it practical to minimize potential impacts:

A) The area of potential intersection is isolated to Pit 15.

B) The zone of potential coarse-grained alluvium is within 50 feet of the ground surface where intersection may occur.

C) The coarse-grained alluvium zone is expected to be from 0 to about 30 feet in thickness where it could potentially be contacted.

D) Pit 15 is on the fringe of the probable location of the coarse-grained sediments. Mining equipment will likely first contact thinner distal gravely layers, giving an initial indication of the presence of the coarse-grained system prior to contacting large thicknesses of gravel or large quantities of water.

E) In the worst case, the bench level in Pit 15 at which the alluvium exists daylights to natural surface topography to the south providing a route to discharge water to Pond 4 until the flows can be controlled. This flow path is shown on Plate 1.

F) The Tropic shale has a high clay content, very low hydraulic conductivity (10^{-8} range), and good compactions characteristics that make it an optimal material for constructing barriers that will impede water flow.

G) The large mining equipment that will be on site is capable of constructing compacted barriers and ditching in a highly efficient and effective manner.

Because of these factors, it is believed that the amounts of water that could reasonably be anticipated to be contacted in the system should be readily manageable as discussed below.

Based on these conditions and the mining process, the following steps have been developed as an action plan should the coarse-grained alluvial groundwater system be intersected:

1) When removing overburden on the initial bench (alluvium) in Pit 15, the shovel operators and operation supervisors will be instructed to proceed with caution, watching for gravels and/or coarse alluvium with water.

2) If the operators contact a gravel layer with a large associated outflow of groundwater (generally considered to be about 1 cubic foot per second (cfs) or more in the initial exposure), the operator will take immediate steps to place shale across the exposed gravel layer to slow the flow.

3) Once the flow is slowed, the operator will contact the operations supervision.

4) The shovel will progress no further to the east and dozers will then be utilized to push the alluvium above the gravel layer to the shovel.

5) Once the dozers have pushed the alluvium down to within approximately five feet of the coarse-gravel supported alluvial groundwater system, removal of overburden will then cease.

6) An excavator will then be placed on the bench that the dozers have created above the system and near the toe of the highwall. The excavator will dig a trench through the coarse alluvium to the Tropic shale. As the trench advances, the excavator will also be used to backfill the trench with shale, using the bucket to compact the shale backfill. This compacted shale will be used as a temporary cutoff wall to impede water flow while mining is completed in Pit 15.

7) Once the trench and the shale barrier have been constructed, mining of Pit 15 will be completed.

8) A permanent barrier will then be constructed as part of the pit backfilling process. Details for this permanent barrier can be viewed in Appendix 7-10.

A cross sectional view of this step by step process can be viewed on Plate 2 of this appendix. Specifics related to this process are explained further in the Details section of this report and on Plates 1 and 2.

Details

Data Analysis for Cross Sections

The first step toward developing a detailed contingency plan included analysis of all available data to determine where and to what extent the coarse-grained alluvial groundwater system may be intersected. Large amounts of geologic and hydrogeologic data are available for the Sink Valley area. This information has been collected in conjunction with mine permitting activities carried out over the last four years by ACD and also by Utah International as part of previous investigative activities in the area during the 1980's. The geologic and hydrologic information utilized in the development of this contingency plan includes the following:

a) Geologic logs for 35 drill borings located in and adjacent to the permit area

b) Groundwater potentiometric monitoring data from 8 wells in and adjacent to the permit area

c) Groundwater discharge location information

d) Surface geologic mapping and flight photo information

e) Photogrammetric surface topography and gradient information

Five cross-sections showing the details of the geology and hydrology of the Sink Valley area on and adjacent to the proposed Coal Hollow Mine permit area were constructed from this information. Each cross-section extends across Sink Valley west to east, spaced 1,000 feet apart in the north to south direction starting in the center of Pit 15. The cross-section locations can be viewed on Drawing 7-15 and the sections can be viewed on Drawing 7-15B. The proposed mining pits were superimposed onto the cross-sections so that potential impacts to the system associated with mining could be evaluated.

The artesian, coarse-grained alluvial groundwater system in Sink Valley is generally isolated to the deeper portions of the alluvium in the valley. The upper portions of the alluvium are generally comprised of fine-grained sediments, including clays, silts, and fine-grained sands. These two hydrostratigraphic zones are identified on the cross-sections in Figure 7-15B.

The fine-grained alluvium zone is mostly saturated in the pit 15 area, but the potential flux rate through these clayey and silty sediments is low because of the overall low hydraulic conductivity of these sediments. Flowing artesian conditions are generally not observed in wells screened in the fine-grained alluvium zone.

The potential coarse-grained zone is also saturated in the pit 15 area and is typically situated at or shortly above the contact with the underlying Tropic Shale bedrock formation. The coarse-grained system contains gravels and other coarse materials, typically with generally minor clay content. Because of the higher hydraulic conductivity values associated with the coarse-grained sediments, this layer has capacity for high outflows of groundwater where it is exposed in mine openings near the base of the alluvium. Based on the current knowledge of the groundwater systems in the area, mining operations will advance cautiously in those areas where reasonable potential for intersection of the mine workings with this coarse-grained zone has been defined.

The mapped locations of subsurface zones considered to have an appreciable probability of containing coarse-grained alluvial sediments that could be in good hydraulic communication with the artesian alluvial groundwater system in Sink Valley are shown on the cross-sections in Drawing 7-15B. The locations of potential coarse-grained alluvium were mapped using all available geologic data. Because of the inherent uncertainties associated with mapping the internal structure of alluvial sediments, conservative assumptions were utilized in the plotting of the locations of the probable coarse-grained alluvium zones (i.e., the lateral extents of the probable coarse-grained zones are generally projected as far to the west as could reasonably be extrapolated based on the drillhole data). The cross-sections were utilized to determine where the coarse-grained sediments were most likely to exist and to determine the best methods to control the flows should the coarse-grained artesian system be contacted in the mine workings.

The cross-sections show that the area with appreciable potential for the intersection of the mine workings and the coarse-grained zone is in the upper bench in Pit 15 (Refer to Drawings 7-15 and 7-15B). This area of focus makes the plan achievable and practical for the planned operations.

Contingency Plan Steps

Mining at the Coal Hollow Mine will be conducted using primarily truck and shovel equipment. This equipment will move overburden from over the coal in benches that are approximately 40 feet in height. These benches are the width of each designed pit (refer to Plate 1 to see numbered pits) which is approximately 200 feet wide. A cross section showing the general steps for this benching process is shown on Plate 2.

The area of concern for contacting the coarse-grained artesian groundwater system is limited to the first bench because the successive benches are located in the Tropic Shale which is highly impermeable. This will allow the equipment to operate at the top of the Tropic Shale when removing the alluvium layer. This provides a solid layer beneath the equipment.

The shovel will advance the overburden face in general from west to east. When moving the alluvium layer in Pit 15 the shovel operator(s) will be instructed to proceed with caution, regularly observing the face for gravel layers that contain water. If a gravel layer is encountered that has a flow of at least 1 cfs, the shovel advance will stop the advance and the operator will take immediate steps to place shale across the exposed gravels to slow the flow. The operations supervision will then be contacted to begin organizing the subsequent steps.

The next step is to place dozers on the fine-grained alluvium overlying the coarse gravels/artesian system. These dozers will push the material in a benched manner to the shovel. This will prevent additional disturbance to the artesian system by allowing the shovel to not excavate through the gravels but still remove the fine-grained alluvium over the system so that a cutoff wall can be installed across the coarse grained/gravel alluvium layer. The dozers will move the fine alluvium to within approximately 5 feet of the gravels.

This process has now resulted in a fine-grained alluvium bench overlying the coarse grained layer. The remaining fine-grained alluvium combined with the coarse-grained layer are now a thickness that an excavator can excavate through the layers and into the top of the Tropic Shale. The excavator is placed as close to the toe of the now existing alluvium highwall as can be safely accomplished. The excavator will then begin digging a trench approximately 10 feet in width that, as described above, will transect through the alluvium layers down into the top of the shale. As the excavator digs this trench, the truck and shovel fleet will haul Tropic Shale that will be piled next to the excavation. As the excavator advances the trench, it will use the Tropic Shale to backfill the trench, compacting the shale with the bucket. This will construct a cutoff wall across the artesian system that will significantly minimize flows from the system. This trench will be constructed the length of the pit in which the artesian system is present.

Once the cutoff wall is in place, minimizing the flows, the truck and shovel will then proceed with moving the remaining alluvium, leaving a buffer along the cutoff wall. This buffer of alluvium along the cutoff wall will be at minimum 10 feet wide at the top of wall and the slope down to the top of the shale will be at minimum a 1.5:1 slope or the angle of repose for the alluvium.

The truck and shovel fleet will then proceed with removing the Tropic Shale above the coal seam. The highwall below the cutoff wall and the alluvium will be adjusted as necessary to provide a sufficient bench (minimum 40 feet wide) at the alluvium/shale contact elevation. Once the overburden is removed in the steps shown on the Plate 2 cross section, the coal is then mined for Pit 15.

Following the mining of coal, backfill of the Pit 15 will follow. As part of the backfill process, a permanent barrier will constructed along the highwall to prevent or minimize the flow of water from the artesian system into the pit backfill. The details for this permanent barrier are provided in Appendix 7-10.

It should be noted that the primary purpose of this contingency plan is to minimize the potential for any large-scale depletion of the important coarse-grained alluvial groundwater resource in Sink Valley centered east of the proposed mine workings. Groundwater inflows into the mine openings from alluvial horizons that are not in good hydraulic communication with the primary coarse-grained alluvial system are anticipated. Discharges from such hydraulically isolated systems might initially be appreciable, but discharge rates will gradually decline after interception and flows from such systems will likely not persist for long periods of time. The prevention of such inflows is not the intended purpose of this contingency plan. The drainage of saturated alluvial sediments that may exist under perched or hydraulically isolated conditions within and immediately adjoining the mine pit areas is not unanticipated.

Conclusions

Alton Coal Development, LLC with the assistance of Erik Petersen has performed a thorough investigation of the hydrogeology of Sink Valley. From this evaluation a practical contingency plan has been developed for the "worst case scenario" of the mine workings intercepting an appreciable thickness of coarse-grained alluvial sediments that are in good hydraulic communication with the alluvial artesian groundwater system centered east of proposed mining areas. This plan will minimize the impacts to the alluvial artesian water system that is present in the valley during the active mining process. The permanent barrier described in Appendix 7-10 will provide a long term barrier to prevent or minimize long-term flows from the alluvial artesian groundwater system into the backfilled pits.

APPENDIX 7-10

Permanent Shale Barrier

By: Erik Petersen, Petersen Hydrologic
Chris McCourt, Alton Coal Development, LLC and
Alan O. Taylor, Taylor Geo-Engineering, LLC

TAYLOR GEO-ENGINEERING, LLC
2650 NORTH 180 EAST
LEHI, UTAH 84043
TELEPHONE NUMBER 801-400-9784
FAX NUMBER 801-766-3246

August 26, 2009

Mr. Chris McCourt
Alton Coal Development
463 North 100 West, Suite 1
Cedar City, Utah 84721

Subject: **Contingency Temporary Cutoff Wall and Permanent Barrier for Pit 15**
Alton Coal Development Coal Hollow Project
Alton, Utah
TGE Project No. 307001-2

Dear Mr. McCourt,

As requested, Taylor Geo-Engineering, LLC (TGE) has completed seepage and stability calculations for the proposed contingency cutoff wall and permanent barrier plan for Pit 15. TGE understands that a contained groundwater system is present to the east or up-gradient to the proposed Pit 15. A previous investigation and report by Peterson Hydrologic, LLC (2007) indicated that alluvial groundwater system is characterized by a thick saturated gravel layer contained by impervious shale below the gravel and a less permeable silt and clay layer above the gravel. Hydraulic gradients in the area indicate artesian pressure east of Pit 15 that dissipates to below the surface in the vicinity of pit 15.

The following was provided to TGE: (1) Hydraulic gradients in relation to Pit 15 and east of Pit 15; (2) The stratigraphy of the subsurface through Pit 14 and 15; and, (3) The proposed course of action or contingency plan if the gravel stratum east of Pit 15 is encountered. The purpose of the analysis by TGE was to determine short term seepage through the temporary cut and cutoff wall on the east side of Pit 15 and seepage through the long term barrier as proposed by Alton Coal Development. Additionally TGE was to determine the embankment profile to be used during mining operations that would be located west of the cutoff trench. The results of our analysis are provided below.

Contingency Plan

Alton Coal Development has proposed a contingency plan if the groundwater system located east of Pit 15 is encountered. As part of the plan, a cutoff trench would be installed along the east side of Pit 15. The cutoff trench is to be installed by excavating down 40 feet to the base of the alluvium, and then cut a 10-foot wide trench. The trench is be backfilled with Tropic shale. After the cutoff trench is installed, the mining operations would continue as planned. During backfilling operations of the pit, a permanent 50-foot wide barrier be installed. The barrier will consist of Tropic shale placed to at least 90 percent compaction as per ASTM D698 and extend from the existing shale bench up to the surface. The Tropic shale, located above the coal bed, will be derived from mining operations.

Analysis and Conclusions

For analysis purposes, the coefficients of permeability from Boring C-2 as presented by Peterson Hydrologic (2007) Tables 7 and 8 were used for the overburden alluvium silt and clay layers and the water bearing gravel layer. A sample of the Tropic shale obtained from previous investigations was provided to TGE. The sample tested was derived from CH-5-05 at a depth of 55 feet. The sample was delivered to RBG Engineering for a permeability test. The sample was crushed, remolded, moisture conditions to optimum moisture content and compacted to 90.6 percent of the maximum dry density as per ASTM D698 (see attached lab results). The coefficients of permeability from the Peterson report and from the recent laboratory test is provided in the table below.

Location of Sample	Coefficient of Permeability (cm/sec)
C-2 – Clay Alluvium	1×10^{-5}
C-2 – Silty Alluvium	5.3×10^{-3}
C-2 – Gravel	6.0×10^{-2}
C-5-5 – 55 feet - Remolded Tropic Shale 55 feet	8.24×10^{-8}

Using the coefficients of permeability indicated above, water table elevations, and depth of cuts, TGE determined seepage rates for the various proposed conditions. The results of the analysis indicated that the maximum seepage rate from the alluvium after the cut is complete is 46.8 gpm per 100 lineal feet of open cut. The seepage downstream of the cutoff wall after the cut is complete will be .01 gpm or 15.72 gpd per 100 lineal feet of open cut. These are maximum rates that will decrease as the phreatic surface slowly decreases during mining operations. These flow rates are slightly higher than predicted by Peterson Hydrologic since they are maximum seepages rates used by TGE for stability purposes.

The seepage rate through the 50 foot thick permanent barrier will be 0.08 gpm or 101 gpd per 100 lineal feet of barrier. This seepage rate is based on post mining conditions when the water table has returned to pre-mining activities or when the hydraulic gradient is at its maximum. It is TGE's opinion that this flow rate would classify the barrier as fairly impermeable.

Based on seepage forces, the slope profile downstream of the cutoff trench should consist of a 1.5H:1V slope with a 10-foot flat bench between the top of slope and the cutoff wall. Based on this profile, the cut will have a F.S. of 2.0 from lateral movement. For short term basis, it is TGE's opinion that this will provide safe conditions during mining operations.

The temporary cut in the alluvium will need monitored during cut activities. The rate of cut may need to be slowed to as much as 2 feet per day to prevent slope failure due to seepage pressure. The alluvium slope on the east side of Pit 15 will probably vary from 3H:1V to 5H:1V. If the slope is not saturated, then slope recommendations previously provided by TGE may be steepened to 2V:1H. The 5V:1H slope will be required if excessive sloughing is reported. This can be monitored by TGE if the contingency plan is needed.

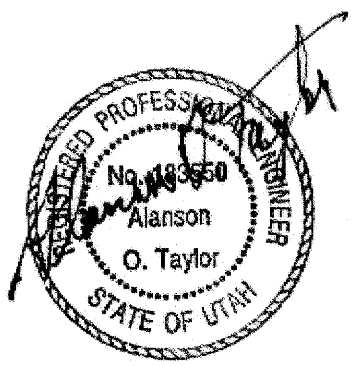
The permanent barrier did not need any stability analysis based on seepage since it will be bounded by backfill up to current surface grades.

Closure

TGE appreciates the opportunity to be of service to Alton Coal Mine. The results of the analysis are based on information provided by Alton Coal Mine, Peterson Hydrologic and laboratory data collected by TGE. Any changes to the proposed contingency plan may require additional analysis by TGE.

If you have any questions, please feel free to contact the undersigned. The opportunity to be of service on this project is appreciated.

Respectfully submitted,
TAYLOR GEO-ENGINEERING, LLC



Alanson O. Taylor, P.E.
Principal

REFERENCES

Peterson Hydrologic, LLC, June 12, 2007, "Investigation of groundwater and surface-water systems in the proposed coal hollow mine permit and adjacent area."

Alton Coal Development, Sheet A7-10 Plate 2, "Coal Hollow Project," August 15, 2009.

Alton Coal Development, Sheet 7-15, "Coal Hollow Project," August 4, 2009.

Alton Coal Development, Draft Sheet 7-15B, "Coal Hollow Project," November 20, 2008.

RB&G ENGINEERING, INC.
1435 West 820 North, Provo, Utah 84601
801 374-5771 Provo ▮ 801 521-5771 SLC ▮ 801 374-5773 Fax
AASHTO Accredited Laboratory

Project no.	200908-010
Report no.	908059
Sheet	1 of 1

Coefficient of Permeability

Project	TAYLOR GEO-ENGINEERING, LLC
Location	Lehi, Utah
Sample no.	Tropic Shale
Description of soil	Fat clay
Date Tested	8-18-09
Report by	J. Boone/K. Bradford
Staff position	Lab Manager/Materials Technician

Results

Date Cast	Date Tested	Location	Description of Soil	Permeability (cm/sec)	% Moisture
	8-18/8-19-2009		Fat clay	$k = 8.24 \times 10^{8}$	20.5

Comments

TECHNICAL RESPONSIBILITY: Bradford E. Price, PE, principal; Jacob Boone, materials laboratory manager
DISTRIBUTION LIST:
CLIENT/CLIENT REP: TAYLOR GEO-ENGINEERING LLC/Alan O. Taylor, P.E.
DATE PRINTED: 08/26/2009

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R645-301-830.140, Refer to Bonding and Insurance Findings, p. 162 of the TA: The Division needs the Stage 1, 2 and 3 costs broken out such that incremental bonds may be implemented for the coal mining area in accordance with the requirements of **R645-301-820.111, 820.112 through 820.133,** and in agreement with Alton Coal Development. Alton Coal Development must provide a detailed cost estimate, with supporting calculations for the following Coal Hollow areas:

1) Demolition of the Facilities and Structures / Loadout as shown on Drawing 5-4.

2) Reclamation costs for ponds 2 and 3, including backfilling and grading, re-soiling and re-vegetating.

3) Reconstruction of Robinson Creek

4) Total Reclamation Costs for Stage 1, to include backfilling and grading, topsoiling and re-vegetation of the 69 acres associated with the mining area.

5) Total Reclamation Costs for Stage 2, to include backfilling and grading, topsoiling and re-vegetation of the 68 acres.

6) Total Reclamation Costs for Stage 3, to include backfilling and grading, topsoiling and re-vegetation of the 99 acres

7) These total costs must include reclamation costs for the final (or Stage 3 remaining pit) pit area depicted on Drawing 5-19.

8) Total Reclamation Costs for the Stage 1 excess spoil reclamation.

*As written in the Mine and Reclamation Plan - Chapter 8, page 8-2, Section 830.140, ACD has requested that this information be supplied once an "**approved** permit and reclamation plan" is available. In contrast to underground mining operations where the bond amount is based primarily on surface facilities, the Coal Hollow Mine bond amount is based primarily on the details related to the mine and reclamation plan, which is yet to be approved by the Division.*

This request is based on R645-301-830.100 which states:

830.100. The amount of the bond required for each bonded area will:
830.110. Be determined by the Division;
830.120.Depend upon the requirements of the ***approved*** *permit and reclamation plan;*

A preliminary bond estimate has previously been provided to the Division and is included in the MRP as Appendix 8-1. Though there has been changes to the mine plan since this estimate was provided (June 2007), this preliminary estimate still provides the Division a ball-park estimate for a bond amount.

Since the requirements of the approved plan are not available at this time, ACD would like the Division to reconsider the original request made in the MRP, which is to delay submittal of this information until the Division has approved the mine plan and notified ACD of any additional requirements that may be included in the permit. ACD can then provide a revised bond amount estimate that is based on accurate and complete information.