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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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September 13, 1995

Copy TA Section of the Permit Binder

TO: File

FROM: Susan M. White, Senior Reclamation Biologist SMW

RE: Alternative Sediment Control Amendment, Deer Creek Mine, PacifiCorp, ACT/015/018-95H, Folder #2, Emery County, Utah

ANALYSIS AND FINDINGS

The above reference amendment incorporates typical designs for the already approved alternative sediment controls structures which are in place on site and delineated on the Facilities map. This amendment is in response to the Coal Regulatory Program Directive, Sediment Control Measures for Disturbed Coal Mine Lands dated June 7, 1995. The amendment satisfies the directives instructions that sediment control measures will be designed.

Consultation was made with Steve Johnson, Senior Reclamation Hydrologist, and it is determined that the amendment should be approved and incorporated into the permit.

INCORPORATED
EFFECTIVE:
SEP 13 1995
UTAH DIVISION OIL, GAS AND MINING

TECHNICAL ANALYSIS
DEER CREEK WASTE ROCK FACILITY
ACT/015/018

Utah Power and Light Company
September 13, 1988

UMC 783.27 Prime Farmland Investigation - (JSL)

Existing Environment and Applicant's Proposal

Discussion referring to the land use can be found in Chapter 10 of the PAP. The soils mapped at the proposed waste rock disposal facility are in the Mesic moisture regime, average annual precipitation of 6 to 8 inches, with no available irrigation water for agricultural activities. The Soil Conservation Service (SCS) has determined that the proposed disturbance area soil series, Badlands and Persayo, to be in the capability-subclass VIIIs-7 (non-irrigated) and VIIe-D4 (non-irrigated), respectively. The area primarily consists of alkali soils with non-agriculturally beneficial plant species. The proposed area is located in undeveloped rangeland with the ecosystem classification ranging from a desert shale D34 for the Persayo soil and a non-existing classification for the Badland soil series. Therefore, the Division has determined that the proposed waste rock storage facility site is not prime farmland.

Compliance

The applicant's proposal adequately meets the requirements of this section. The applicant complies with this section.

Stipulations

None.

UMC 785.19 Underground Coal Mining Activities on Areas or Adjacent to Areas Including Alluvial Valley Floors in the Arid or Semi-Arid Areas of Utah - (RVS/TM/BAS)

Existing Environment and Applicant's Proposal

The waste rock storage sites designated Area 1 and Area 2 within the permit area are located approximately 2,000 feet northeast from Huntington Creek. A reconnaissance study (Nimick, et al. 1985) delineated potential alluvial valley floors in the Castledale area, and identified a potential alluvial valley floor along Huntington Creek from southeast of the town of Huntington to northwest of the Huntington Power Plant. The reconnaissance study recognized surface irrigation, subirrigation and potentially irrigable sites to delineate potential alluvial valley floors.

Plate 5-1 identifies the presence of a relatively smooth surface composed of Quarternary alluvium within and adjacent to Huntington Creek. Moreover, Huntington Creek is a perennial stream occurring within a topographic valley that has a channel exceeding three feet in width and six inches in depth.

The surface drainage at the waste rock storage site consists of a few dry washes which drain to Huntington Creek one-half mile to the south as described on page 6-1 of the PAP and shown on Plates 4-5 through 4-8.

The permit area consists of undeveloped range land, vegetated by salt and drought tolerant species. Gardner and mat saltbush are major components of the vegetation community. The permit area has not been developed for any agricultural activity or farming practice, including the pasturing of livestock, production of hay, or any other crop.

The applicant concedes the presence of an alluvial valley floor on page 11-1 of the PAP and asserts that the ground-water conditions delineated by drilling preclude operationally-induced impacts to the hydrologic system in the alluvial valley floor.

Compliance

The Division herein determines on the basis of published information and information provided on Plate 5-1 that unconsolidated streamlaid deposit-holding streams are present and there is sufficient water to support agricultural activities along Huntington Creek in T17S, R8E, Section 6. Accordingly, the Division designates the area in Section 6 that is underlain by Quarternary alluvium to be an alluvial valley floor.

Permeability data given in Chapter VI indicate a relatively low rate (less than 0.3 ft/day) of hydraulic conductivity in the Masuk member of the Mancos Shale. In addition, borehole data suggest that the Masuk member is not everywhere saturated at depth, but rather ground water tends to occur along fractures and/or faults at from 6,210 to 6,220 feet.

Surface drainage controls provide for total containment of all disturbed area runoff from two 100-year, 24-hour storms as described on page 6-1 of the PAP and shown on Plates 4-5 through 4-8.

The Division considers the proposed areas of waste rock disposal to have a low potential for being hydrologically connected, in the subsurface, to the designated alluvial valley floor. However, since available data do not preclude the possibility of a hydrologic connection, the applicant has committed to completing a monitoring well between the alluvial valley floor and waste rock disposal areas to identify any adverse impacts to the ground-water system.

The Division determines that the proposed operation:

1. Does not include the extraction of coal;

2. Will not result in significant disturbance to the surface or ground-water regime; and

3. Occurs on undeveloped range land which is not significant to farming, grazing, or any other agricultural activity.

4. The requirements of paragraphs (d) and (e) of this section are hereby waived, as provided by UMC 785.19(c)(3)(ii).

UMC 800 Bonding - (PGL)

The reclamation cost estimate (subtotal) was adequate; $412,164. However, an error was found in the 10 percent contingency and 2.3 percent escalation factor.

The applicant must post $463,808 (1989 dollars) for the Deer Creek Waste Rock Storage Facility.

Reclamation Subtotal	$ 412,164
10% Contingency	$ 41,216
Subtotal	$ 453,380
Inflate to 1989 dollars at 2.3%	$ 10,428
Total	$ 463,808

The applicant currently has a bond posted for the Deer Creek Mine in the amount of $1,224,000 (1989 dollars). A rider should be added to bond #927-21-58 (American Casualty Company of Reading, Pennsylvania) for a total bond amount of $1,687,808.

UMC 817.11 Signs and Markers - (RVS)

Existing Environment and Applicant's Proposal

The applicant describes signs and markers on page 2-10 as follows:

1. Signs and markers will be constructed of durable material, designed uniformly, maintained and removed according to UMC 817.11 (page 2-10).

2. A permit identification sign will be posted at the entrance to the access road, according to UMC 817.11(c)(2) (page 2-10).

3. Perimeter markers will be posted to clearly delineate areas affected by surface operations or facilities. Plate 5-1 identifies the permit area and the extent of Area 1 and Area 2 where surface operations will occur.

4. Blasting signs will be conspicuously placed within the immediate vicinity of blasting activities and at the entrance to the facility.

5. Topsoil markers will be installed on all stockpiles.

Compliance

The applicant has committed to posting and maintaining signs and markers according to UMC 817.11 and installing a permit identification sign along the access road according to UMC 817.11(c)(2). Moreover, the applicant commits to posting perimeter markers, blasting signs and topsoil markers.

The applicant has specifically committed to placing, as necessary, blasting signs that state "Warning: Explosives in Use" at entrances to surface operations as required by UMC 817.11(f)(2).

The applicant has committed to removing signs and markers, as appropriate, upon cessation of operations or bond release.

The applicant complies with this section.

Stipulations

None.

UMC 817.21-.25 Topsoil Management - (JSL)

Existing Environment and Applicant's Proposal

The Deer Creek Waste Rock Disposal Site soil resources are discussed in Chapter 7 and delineated on a soil survey map, Plate 7-1, No. CM-10775DR. The soil survey was developed from the USDA Soil Conservation Service, Soil Survey Carbon-Emery Area, Utah, December 1970. The soils in the proposed 29.5 acres of disturbance at the waste disposal area consist primarily of the Badland and Persayo soil series.

The Persayo soil is taxonomically classified as a loamy, mixed (calcareous), mesic, shallow Typic Torriorthent. This soil is primarily residuum and alluvium, derived mainly from shale.

The Badland soil consists of nearly barren beds of actively eroding shale and shale interbedded with gypsum.

Results of the soil analysis are listed on pages 7-2 and 7-3 of the PAP. The Persayo soil average pH is neutral, ranging from 7.49 to 7.83. The soil is considered non-saline and non-sodic with an electrical conductivity ranging from 1.73 to 2.26 mmhos/cm and the average sodium adsorption ratio is 1.1. The Badland soil series average pH is slightly alkaline, ranging from 7.94 to 8.02. The soil is considered a saline sodic material with electrical conductivity ranging from 6.0 to 10.6 mmho/cm and the average sodium adsorption ratio ranging from 6.5 to 28.1.

Removal

Use of the proposed 29.5 acre disposal area is planned to take place in two phases. The soil removal plan is discussed in the operation plan, Chapter 3, Section III, pages 3-3 through 3-4. Topsoil will be salvaged after vegetation has been removed from the site. The soil survey indicates a topsoil depth of one inch. The top six inches of soil will be removed and salvaged. Following topsoil removal, the remaining soil will be excavated to the soil berms and to the lines and grades as required to construct cuts and fills.

Storage

The salvaged upper six inches of soil will be temporarily stockpiled and then redistributed on the embankment slopes of the access road and over the top and outslope of the soil berms (Plate 4-3). Temporarily stockpiled topsoil will be placed away from construction activity. Silt fences will be established around the perimeter of temporary stockpiles if the pile exists for more than seven days (page 3-1). Following topsoil placement, the soil will be reseeded with the interim seed mix found in Section VI of Chapter 3. Silt fencing will be established around the embankment slopes until interim vegetation is established.

Redistribution

The soil redistribution plan is discussed in Chapter 3, Section III. Reclamation will take place in two phases. When Area 1 reaches capacity, the topsoil will be removed from the earthen berm and temporarily stockpiled. The subsoil material from the south berm will be spread over the south section of Area 1 and the north berm will be spread over the northern half of Area 1.

After the subsoil has been spread over the waste rock, the topsoil material will be loaded and dumped over the top section of the fill and a D6 dozer will spread the topsoil over the fill slopes. The subsoil material will be scarified prior to topsoil distribution. The topsoil and subsoil will be scarified again after topsoil redistribution. This operation will be duplicated when Area 2 is full of underground development waste material.

Nutrients and Amendments

The operator will apply a combination of 50 pounds of Ammonia Nitrate plus 75 pounds of triple superphosphate per acre by hand broadcasting or by hydroseeding.

Compliance

The proposed topsoil removal, storage and redistribution plan meets the requirements of this section. The applicant has committed to place the salvaged topsoil excavated from the road construction away from the road construction activity and protect with silt fencing.

The applicant complies with this section.

Stipulations

None.

UMC 817.41 Hydrologic Balance: General Requirements - (TM/RVS)

Existing Environment and Applicant's Proposal

Surface Water

Discussion of the applicant's disturbed and undisturbed area drainage conveyance systems, peak flow determinations and methodologies, sediment controls, channel and spillway flow designs, channel linings, and culvert designs are shown on pages 4-8 through 4-13, Exhibits A through J and Maps 4-4 through 4-10.

The undisturbed drainage plan for the site will consist of two permanent diversion systems diverting ephemeral streamflows around the Deer Creek Waste Rock Storage Facility fill structure. These diversions will empty into an existing drainage channel in one case and into a natural drainage channel in the other. The disturbed drainage plan will consist of two sediment basins, small diversion ditches along the toe of the storage facility slopes, and sheet flow off the top surface of the storage facility fill pad. A phased approach to construction will dictate the sequence of construction for all structures (page 2-4 and 2-5).

Ground Water

The applicant provides information about ground water in Chapter VI of the PAP.

The waste rock facility will be located on the Masuk member of the Mancos Shale. Chapter VI gives data from 11 boreholes (see Plate 5-1) that were drilled for the purpose of identifying and evaluating ground-water resources in the vicinity of the proposed permit area. Eight boreholes did not encounter water, whereas three boreholes penetrated ground water in the Masuk member. Ground water in the Masuk member was encountered at elevations between 6,210 and 6,223 feet, and located within 650 feet from Huntington Creek. Water level data suggest ground water moves westward towards Huntington Creek.

The applicant infers that there is a limited amount of ground water flowing along fractures within the Masuk member. Permeability tests indicate the Masuk member has a hydraulic conductivity of less than 0.3 feet/day (page 6-29).

No springs occur within or adjacent to the waste rock facility permit area. However, a wet weather seep occurs within Area #1. The applicant proposes to construct a drainage system to collect and divert this water to the surface water diversion system (page 2-5).

Compliance

Surface Water

The information contained in the plan meets the requirements of these regulations regarding the treatment of disturbed and undisturbed surface waters to demonstrate that changes to the prevailing hydrologic balance will not occur during the operational phase of this operation.

The applicant has provided the necessary detailed information regarding reclaimed channels and post-mining monitoring to demonstrate that changes to prevailing hydrologic balance will not occur following reclamation and that the applicant will meet all applicable state and federal water quality laws following reclamation.

Ground Water

The applicant has provided information that identifies the occurrence of ground water adjacent to the permit area. Although the applicant had provided these data, boreholes were plugged and abandoned, and are no longer available for ground-water monitoring. Accordingly, the applicant has proposed to complete a borehole to assess if operations induce adverse changes in water quality and depth to ground water (page 6-3).

The designs given for collecting and diverting water from the wet weather seep will adequately contain this flow.

The applicant is in compliance with this section.

Stipulations

None.

UMC 817.43, .45 and .47 Design Considerations of Diversions and Impoundments - (TM)

Existing Environment and Applicant's Proposal

The discussion of the applicant's disturbed and undisturbed area drainage conveyance system, peak flow determinations and methodologies, sediment controls, channel and spillway flow designs, channel linings, and culvert designs are shown on pages 4-8 through 4-13, Exhibits A through J, and Maps 4-4 through 4-10.

The undisturbed drainage plan for the site will consist of two permanent diversion systems diverting ephemeral streamflows around the Deer Creek Waste Rock Storage Facility fill structure and into an existing drainage channel in one case and into a natural drainage channel in the other. The disturbed drainage plan will consist of two sediment basins, small diversion ditches along the toe of the storage facility slopes, and sheet flow off the top surface of the storage facility fill pad. A phased approach to construction will dictate the sequence of construction for all structures (page 2-4 and 2-5).

Compliance

The applicant has met all the sizing requirements regarding routing of peak flows and the sizing of riprap protection on all ditches and impoundments, providing for adequate treatment of all disturbed and undisturbed waters during the operational phase of this facility.

Stipulations

None.

UMC 817.44 Hydrologic Balance: Stream Channel Diversion - (TM)

Existing Environment and Applicant's Proposal

The applicant shows reclaimed channels leaving the reclaimed storage facility on Map 4-8, Phase IV. The reclamation of the storage area will occur in phases as outlined on page 3-4 and 3-5 of the PAP. All calculations for reclaimed channels 1, 2A, and 2B are found on pages 4-13.1, 4.13.2, Exhibit K, L, M, N, O, P, and Q. Figure 4-8 details the channel cross sections for Channels 1, 2A, and 2B, as well as typical riprap lined channels to replace culverts on the access road.

Compliance

The applicant has provided the calculations necessary to show that the various riprap channels to be constructed during reclamation of the area are stable. Channels sized for the 100-year, 24-hour storm event, cross sections and riprap installations are shown on Figure 4-8.

The applicant complies with this section.

Stipulations

None.

UMC 817.46 Hydrologic Balance: Sedimentation Ponds - (PGL)

Existing Environment and Applicant's Proposal

Two detention basins are planned and designed to collect and retain the surface runoff from the disturbed areas for the Deer Creek Waste Rock Storage Facility. Both basins are over-designed to provide total containment of two 100-year, 24-hour storm events (pages 4-8 through 4-13).

Basin Number 1 is located in the western portion of the permit area and will be constructed by excavating six feet of soil material. Basin Number 2 is located along the southern berm in Area 2. This basin will be formed by excavating some soil and using the perimeter berm as a dam to achieve the required storage volume. The dam is designed to ensure that the safety factor against failure for the embankments is at least 1.5. At least 120 days prior to construction of Basin Number 2 (15 years hence), the Division will be provided with data from geotechnical tests to determine if soil materials with adequate strength parameters are available in quantity and quality for the construction of the basin. If not, the necessary design changes will be made.

Page 4-12 delineated the required runoff and sediment volumes for the two basins during phases I and II.

Both basins will be reclaimed after the reclamation of the storage facility (page 3-2).

Compliance

Basins 1 and 2 are over-designed as total containment structures.

Basin Number 1 is an incised structure that will contain the design events with fill slopes of 2:1. A stability analysis of the slopes of the embankments of Basin Number 2 demonstrated a static safety factor of 1.5 (page 4-14 and 4-15). The applicant committed to resubmit data for Division review regarding the quality and quantity of material for the construction of Basin Number 2 and verify the stability analysis at least 120 days prior to construction (15 years hence).

The applicant committed to inspect the ponds during construction and certify them after construction by a registered professional engineer. The applicant also committed to examine these structures quarterly for structural weakness, erosion and other hazardous conditions (page 2-10.1).

These ponds will be removed after the waste rock area has been topsoiled and revegetated.

The applicant complies with this section.

Stipulations

None.

UMC 817.47 Hydrologic Balance: Discharge Structures - (PGL)

Existing Environment and Applicant's Proposal

Plates 4-9 and 4-10 portray spillway details for Sediment Basin Area 1 and Sediment Basin Area 2. The designs for both of these spillways are discussed on page 4-12.

Compliance

Spillways are designed using standard engineering practices.

The applicant complies with this section.

Stipulations

None.

UMC 817.48 Hydrologic Balance: Acid-Forming and Toxic-Forming Materials - (JSL)

Existing Environment and Applicant's Proposal

The applicant has committed to dispose of all acid- or toxic-forming waste material under four feet of non-toxic cover material (Chapter 2, Section III, part c, and in Chapter 4, Section II, part c). The PAP describes the acid- or toxic-forming potential sampling program for the underground development waste in Chapter 7, page 7-4. Sampling will be taken on a biannual basis starting fall of 1988 at a rate of two samples per acre. Samples will consist of a grab sample of the upper one foot of waste material. If potential acid- or toxic-forming material is identified in the sampling program, additional sampling will be implemented to delineate the extent of the acid- or toxic-forming material. Sampling results will be submitted to the Division for review within two weeks of operational inspection or upon receipt of the analysis. Current analysis can be found in Chapter 7, pages 7-6 and 7-6.1.

Compliance

The applicant's proposal adequately addresses the requirements of this section.

Stipulations

None.

UMC 817.49 Permanent and Temporary Impoundments - (PGL)

(See UMC 817.46)

UMC 817.52 Hydrologic Balance: Surface and Ground-Water Monitoring - (RVS/TM)

Existing Environment and Applicant's Proposal

Ground Water - (RVS)

The applicant commits to conduct baseline and operational monitoring, according to the Division Guidelines, on ground-water encountered by the proposed borehole (page 6-3).

Surface Water - (TM)

The applicant proposes two no-discharge structures which will contain two 100-year, 24-hour storms to treat disturbed area runoff. Since there is no surface water in the area other than drainage in response to storm events, the applicant has not proposed any operational or postmining monitoring of surface water.

Compliance

Ground Water

The applicant's ground-water monitoring proposal is in compliance with this section.

Surface Water

The applicant has provided information regarding postmining water monitoring locations to ensure compliance with applicable state and federal water quality laws. The monitoring of runoff from the reclaimed area will be undertaken to demonstrate that water quality without treatment is adequate to minimize disturbance to the prevailing hydrologic balance and provide a basis for removal of water quality control systems. Postmining monitoring points will be located at the inlets to each sediment basin (see Plate 4-7 for locations) (page 6-3).

The applicant complies with this section.

UMC 817.56 Postmining Rehabilitation of Sedimentation Ponds, Diversions, Impoundments, and Treatment Facilities - (PGL)

There are no permanent ponds or impoundments proposed, therefore this section is not applicable.

UMC 817.61-.68 Use of Explosives - (PGL)

Existing Environment and Applicant's Proposal

All blasting will be conducted by certified blasters (page 2-9). The specific regulations that will be followed by UP&L regarding explosives are included on page 2-9 and 2-9.1.

Compliance

The applicant commits to conduct blasts only by certified blasters and has detailed when and how blasting will be undertaken. The information for blasting records was given.

The applicant complies with this section.

Stipulations

None

UMC 817.71 Disposal of Underground Development Waste and Excess Spoil and Non-Acid and Non-Toxic Forming Coal Processing - (PGL)

Existing Environment and Applicant's Proposal

The waste rock PAP addresses the disposal of underground development waste generated during coal mining, sediments from the sedimentation pond, and trommel rejects. These materials will be hauled to the disposal site by truck.

Compliance

The design of the waste rock storage facility incorporates recognized professional standards and was certified by a professional engineer. The waste rock will be dumped, spread and compacted in 24-inch thick horizontal lifts with side slopes of 2h:1v. The stability analysis, using site-specific parameters, demonstrates a long-term static safety factor of 1.8 (page 4-30). The applicant has committed to sample the waste material every five years to determine the strength of the material. If it is found the strength of the material has decreased, a stability analysis will be performed to determine the proper slope for construction to maintain the required factor of safety (page 4-30).

A foundation investigation of the waste rock area was performed to determine the design requirements for stability (page 4-32 through 4-52). This investigation defined the characteristics of the subsurface material throughout the soil profile in the waste rock storage area and determined the slopes at which the rock pile could be safely built. The designed slopes of 2h:1v demonstrated a factor of safety of at least 1.5 (page 4-40).

The design of the fill is, by definition, neither a valley nor a head-of-hollow fill. Therefore, requirements of 817.72-.73 are not applicable.

The operation of the facility will be inspected quarterly by a registered professional engineer and during critical construction periods (page 2-9).

The applicant complies with this section.

Stipulations

None.

UMC 817.81-.88 Coal Processing Waste Banks - (PGL)

No coal is processed at the Deer Creek Mine, therefore these sections are not applicable.

UMC 817.89 Disposal of Non-Coal Wastes - (PGL)

Existing Environment and Applicant's Proposal

During the levelling process, trash will be separated from the fill material and disposed of in an approved sanitary landfill (page 2-8).

Compliance

Non-coal waste will be properly handled at the waste rock storage facility.

The applicant complies with this section.

Stipulations

None.

UMC 817.91-.93 Coal Processing Waste: Dams and Embankments - (PGL)

No coal is processed at the Deer Creek Mine, therefore these sections are not applicable.

UMC 817.95 Air Resources Protection - (PGL)

Existing Environment and Applicant's Proposal

The applicant will apply water to the fill surface to aid in control of fugitive dust (page 2-7).

Compliance

The applicant committed to control fugitive dust. An air quality permit is pending. The Bureau of Air Quality authorized construction to begin prior to issuance of this permit (personal communication with Dave Kopta, Bureau of Air Quality, on August 30, 1988).

Stipulations

None.

UMC 817.97 Protection of Wildlife and Related Environmental Values - (BAS)

Existing Environment and Applicant's Proposal

Wildlife information is based on site-specific surveys, data, and reports compiled from state and federal land and wildlife management agencies. The approved Deer Creek Mine PAP, Volume 2, is referenced, which contains a species list and discussion of wildlife occurring within the Wasatch Plateau biogeographic area. Wildlife protection and impact mitigation measures are discussed on pages 9-1 to 9-7.

No threatened or endangered species or habitat is present in the permit area. The nearest known raptor nest is 1.3 miles northeast of the site. Golden eagles have been observed soaring over the permit area, but no on-site hunting or perching activity has been documented. No electric powerlines or transmission facilities will be constructed to serve the facility.

The site occurs in part on critical-valued big game winter range. The location, operation, and reclamation plan of the disposal site have taken big game winter use into consideration. Operation and reclamation will occur in phases. The development and reclamation of the north portion of Area 1 will precede development of Area 2 by seven years (page 9-2). Revegetation of 4.5 acres in Area 1 is expected to compensate for lost forage on the 4.5 acres of critical-valued habitat in Area 2. Interim and permanent seed mixes (pages 3-6 and 3-8) were selected for their nutrition, cover characteristics, and ability to support wildlife habitat.

No water or riparian habitat occurs within the permit area.

Compliance

The operation, reclamation plan, and attendant seed mix have satisfied the concerns of state and federal wildlife management agencies.

The applicant complies with this section.

Stipulations

None.

UMC 817.99 Slides and Other Damage - (PGL)

Existing Environment and Applicant's Proposal

The applicant committed to notify the Division by the fastest available method any time a slide occurs that may have a potential adverse effect on public, property, health, safety, or the environment (page 2-10.1).

Compliance

The applicant complies with this section.

Stipulations

None.

UMC 817.100 Contemporaneous Reclamation - (BAS)

Existing Environment and Applicant's Proposal

Contemporaneous reclamation plans are described on pages 3-1 and 3-2 and shown on Plates 4-5 to 4-8. Interim revegetation will be implemented during the fall planting season on road embankment slopes, top, and outslopes of the soil berm and sediment pond banks.

Compliance

The applicant commits to timely interim or final reclamation on all areas not in use.

The applicant complies with this section.

Stipulations

None.

UMC 817.101 Backfilling and Grading - (PGL)

Existing Environment and Applicant's Proposal

The waste rock storage facility will be built in four phases over the 30 year plus life of the site. Spreading of subsoil and topsoil will initiate approximately seven years following the construction of Area #1. Contemporaneous reclamation will occur throughout the life of the facility as shown on Plates 4-5 through 4-8. Cross sectional views of the waste rock storage facility are shown on Plate 4-3.

Compliance

A stability analysis of the waste rock material currently produced at the Deer Creek Mine demonstrated a safety factor of 1.8 (page 4-30 and attachments). Reclamation will consist of spreading subsoil and topsoil on the engineered grade.

The applicant complies with this section.

Stipulations

None.

UMC 817.106 Regrading or Stabilizing Rills and Gullies - (PGL)

Existing Environment and Applicant's Proposal

The applicant committed to stabilize rills and gullies deeper than 9 inches in areas that have been regraded and topsoiled (page 2-10.1).

Compliance

The applicant complies with this section.

Stipulations

None.

UMC 817.111 Revegetation: General Requirements - (BAS)

Existing Environment and Applicant's Proposal

Following completion of topsoiling and seedbed preparation, areas will be seeded with the approved seed mix (page 3-8) at a rate of 62 grass, 58 forb and 77 shrub seeds/ft^2 . Rate of application will be reduced by half for drill-seeding: the applicant wishes to choose from among three seeding options, depending on size of area, slope, equipment availability, and past successes. Seeding methods may include drill-seeding, hydroseeding, or hand-broadcasting with a "hurricane" spreader (page 3-9). Seeded areas will be fertilized and mulched (page 3-9).

Compliance

The seed mix and seeding rate has been calculated to produce prompt revegetation compatible with the post-mining land use which is wildlife habitat. Plant species were selected for their suitability to local conditions, ease of establishment and compatibility with surrounding vegetation.

Shrub seeds and seeding rates are designed to replace important browse species for wintering big game. Supplemental shrub stocking will be implemented if monitoring shows that the required shrub density has not been achieved (page 3-12). Revegetation cover will be self-regenerating and at least equal to pre-mining conditions.

The applicant complies with this section.

Stipulations

None.

UMC 817.112 Revegetation: Use of Introduced Species - (BAS)

Existing Environment and Applicant's Proposal

Yellow sweetclover (*Melilotus officinalis*) and alfalfa (*Medicago sativa*) are proposed for use in both interim and final revegetation seed mixes. With the exception of these two species, the applicant's seed mixes (pages 3-6 and 3-8) consist of native species indigenous to the locality.

Compliance

Both introduced species are widespread in Huntington Canyon. Yellow sweetclover is valuable as a fast-growing, non-permanent, nitrogen-fixing soil stabilizer. Alfalfa was added at the request of the Utah Division of Wildlife Resources for its high forage value. In a non-irrigated situation, and under browsing pressure, alfalfa is not expected to dominate or outcompete native forbs in the seed mixes.

The applicant complies with this section.

Stipulations

None.

UMC 817.113 Revegetation: Timing - (BAS)

Existing Environment and Applicant's Proposal

Following soil placement and seedbed preparation, seeding will take place as contemporaneously as practicable (pages 3-6 and 3-9). Final seedbed preparation will be delayed until late September (pages 3-7 and 3-9). Planting will occur in late fall and not sooner than October 1.

Compliance

Field research and reclamation experience demonstrates that late fall is the optimum period for planting. Seeds are less vulnerable to rodent depredation. Dormancy is broken over winter, and seeds are poised to take advantage of optimum moisture conditions, resulting from snowmelt or spring rain.

The applicant complies with this section.

Stipulations

None.

UMC 817.114 Revegetation: Mulching and Other Soil Stabilizing Practices - (BAS)

Existing Environment and Applicant's Proposal

The applicant has opted to choose from three types of mulch, each tailored to a specific planting method. Where planting is done by hand broadcasting, seeded slopes will be covered with a mechanically-anchored erosion-control blanket. Where hydroseeding is used, a hydromulch with tackifier will be applied at a rate of 2,000 lbs/acre. If drill-seeding is used, alfalfa hay mulch will be applied at a rate of two tons/acre (page 3-7).

Compliance

Mulch will be important for soil moisture retention, temperature moderation, and runoff protection due to the southern exposure and soil erosion potential. All mulch options and rates of application have been used successfully at other Utah mine reclamation operations, and are acceptable to the Division.

The applicant complies with this section.

Stipulations

None.

UMC 817.115 Revegetation: Grazing - (BAS)

Existing Environment and Applicant's Proposal

No grazing is proposed. Therefore, this section does not apply.

UMC 817.116 Revegetation: Standards for Success - (BAS)

Existing Environment and Applicant's Proposal

The applicant has established two reference areas (Plate 8-1). Vegetation sampling data (Chapter 8) will be used for the revegetation standard. Final reclamation sampling of ground cover and woody plant density will follow the same methods used in initial reference area sampling. Productivity sampling for bond release will be conducted using the double sampling method (page 3-11).

The bond release ground cover standard will be 70 percent of reference area ground cover with 90 percent statistical confidence. Woody plant stocking level shall be at least 90 percent of the reference area stocking level with 80 percent statistical confidence. Productivity shall be 90 percent of reference area production at 90 percent statistical confidence.

Final reclamation monitoring will include two qualitative inspections yearly. Quantitative measurements will be conducted during years 2, 3, 5, 9 and 10 (page 3-13).

Compliance

Vegetation information (Chapter 8) adequately addressed UMC 783.19 requirements, and provides an acceptable standard for determination of revegetation success. Sampling techniques proposed to measure revegetation success have been approved by the Division and are accepted by the scientific community. The applicant has committed to adhere to Division-approved standards of success for cover, productivity and woody plant density at the required statistical levels.

The applicant complies with this section.

Stipulations

None.

UMC 817.117 Revegetation: Tree and Shrub Stocking for Forest Land - (BAS)

Existing Environment and Applicant's Proposal

The applicant proposes to apply shrub seed at a rate of 77 PLS/ft^2 (page 3-8). If monitoring indicates that adequate shrub density will not be achieved, then supplemental shrub stocking will be initiated, using plant species from the final revegetation mix (page 3-12).

Compliance

On areas developed for wildlife management, shrub and half-shrub stocking must meet standards described under this section, which is at least 90 percent of the reference area stocking rate. If the reference area stocking rate (page 8-4) is not realized by seeding, the applicant commits to initiate supplemental stocking in order to achieve the standard.

The applicant complies with this section.

Stipulations

None.

UMC 817.131 Cessation of Operations: Temporary - (PGL)

Existing Environment and Applicant's Proposal

The applicant commits to notify the Division if operations cease for a period beyond 30 days. The information to be included in the notice is outlined on page 2-10.1.

Compliance

The applicant complies with this section.

Stipulations

None.

UMC 817.132 Cessation of Operations: Permanent - (PGL)

Existing Environment and Applicant's Proposal

The PAP addresses the permanent reclamation of the Deer Creek Waste Rock Storage Site.

Compliance

The applicant complies with this section.

Stipulations

None.

UMC 817.133 Postmining Land Use - (BAS)

Existing Environment and Applicant's Proposal

The applicant describes land use on page 10-5, which is primarily wildlife habitat. Page 3-1 states that land will be returned to wildlife habitat as its postmining land use.

Compliance

The operation and reclamation plan identified in Chapter 3 is designed to mitigate wildlife impacts. Reclamation is consistent with the postmining land use, and is expected to enhance the area's forage and cover characteristics, promoting a higher level of wildlife use than existed prior to development.

The applicant complies with this section.

Stipulations

None.

UMC 817.160-.166 Roads: Class II - (PGL)

Existing Environment and Applicant's Proposal

The access road gradient is designed with an overall grade of 3 percent and a maximum pitch grade of 7.5 percent for 400 feet, and is located to minimize the volume of material to be disturbed during construction (page 3-3). Foundations for embankments will be free from organic material and topsoil. The top layer of the ground underlying the proposed roadway embankment will be moistened and scarified to a depth of 6 inches and then compacted to 90 percent of standard proctor, according to AASHTO Designation T-99 Method D (page 4-1). The final road surface will be composed of crushed gravel. As the road surface deteriorates due to usage and weather, a blade will be used to recontour the travel surface of the road. Road base gravel will be added as needed (page 2-3).

Upon termination of use of the facility, the gravel road surface and subgrade material will be removed and placed against the inside cut slope of the road cross section. Subsoil from the embankment slopes will be spread over the road. Topsoil material from the temporary stockpile will be evenly spread over the area and seeded (page 3-3).

Compliance

The access road has been located and designed according to required criteria. The applicant will construct, maintain, and reclaim according to the required criteria.

The applicant complies with this section.

Stipulations

None.

UMC 817.180 Other Transportation Facilities - (PGL)

There are no other transportation facilities associated with this facility, therefore this section does not apply.

UMC 817.181 Support Facilities and Utility Installations - (PGL)

Support facilities for the waste rock disposal site are located at the Deer Creek Mine (approved permit No. ACT/015/018), therefore this section does not apply.

GENTRY MOUNTAIN

CUMULATIVE HYDROLOGIC IMPACT

ASSESSMENT

Bear Canyon Mine, ACT/015/025

Deer Creek Mine Waste Rock Storage Facility, ACT/015/018

Hiawatha Mines Complex, ACT/007/011

Star Point Mines, ACT/007/006

Trail Canyon Mine, ACT/015/025

Carbon County and Emery County, Utah

Revised September 1988

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I. INTRODUCTION

The purpose of this report is to provide a Cumulative Hydrologic Impact Assessment (CHIA) for Gentry Mountain located in Carbon and Emery counties, Utah. This assessment encompasses the probable cumulative impacts of all anticipated coal mining in the general area on the hydrologic balance and whether the operations proposed under the application have been designed to prevent damage to the hydrologic balance outside the proposed mine plan area. This report complies with legislation passed under Utah Code Annotated 40-10-1 et seq. and the attendant State Program rules under UMC 786.19(c).

Gentry Mountain occurs within the Wasatch Plateau Coal Field approximately 10 miles southwest of Price, Utah (Figure 1). The eastern margin of the Wasatch Plateau forms a rugged escarpment that overlooks Castle Valley and the San Rafael Swell to the east. Elevations along the eastern escarpment of the Wasatch Plateau range from approximately 6,500 to over 9,000 feet.

Precipitation varies from 40 inches at higher elevations to less than 10 inches at lower elevations. The area encompassed by the Wasatch Plateau may be classified as semiarid to subhumid.

GEOLOGY

Outcropping rocks of the Wasatch Plateau Coal Field range from Upper Cretaceous to Quarternary in age. The rock record reflects an overall regressive sequence from marine (Mancos Shale) through littoral (Star Point Sandstone) and lagoonal (Blackhawk Formation) to fluvial (Castlegate Sandstone, Price River Formation and North Horn Formation) and lacustrine (Flagstaff Limestone) depositional environments. Oscillating depositional environments within the overall regressive trend are represented by lithologies within the Blackhawk Formation. The major coal-bearing unit within the Wasatch Plateau Coal Field is the Blackhawk Formation.

VEGETATION

Vegetation of the Wasatch Plateau area is classified within the Colorado Plateau Floristic Division (Cronquist et al., 1972). The area occupies parts of both the Utah Plateaus and the Canyon Lands Floristic Sections. Vegetation communities of the area include Desert Shrub (Shadscale) at the lowest elevations through Sagebrush, Sagebrush-Grassland, Pinyon-Juniper, Mountain Brush, Douglas Fir-White Fir-Blue Spruce and Englemann Spruce-Subalpine Fir.

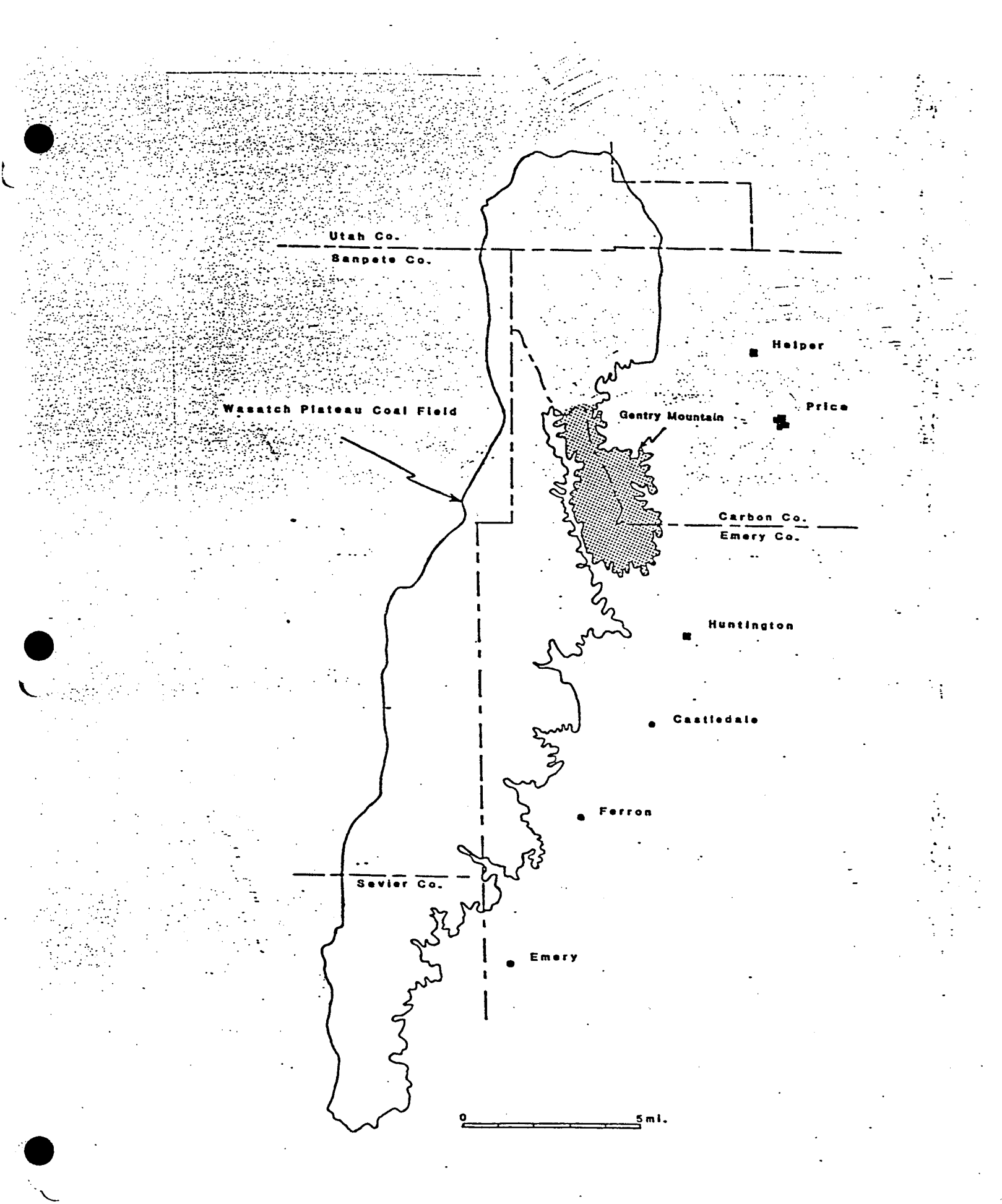

Figure 1. Wasatch Plateau Coal Field.

Desert Shrub communities are sparsely vegetated shrublands that, depending on elevation and soils, may be dominated by Shadscale (Atriplex confertifolia), Fourwing saltbush (A. canescens), Castle Valley clover (A. nuttallii) or Mat saltbush (A. corrugata) and can include Winter fat (Ceratoides lanata), Mormon tea (Ephedra spp.), Budsage (Artemisia spinescens), miscellaneous buckwheats (Erigonum spp.), Indian ricegrass (Oryzopsis hymenoides), Galleta grass (Hilaria jamesii), Grama grass (Bouteloua spp.), Needle and thread grass (Stipa comata), Sand dropseed (Sporobolus airodies) and Squirrel tail (Sitania hystrix). Greasewood (Sarcobatus vermiculatus) - Saltgrass (Distichlis stricta) can dominate bottomlands.

Many Sagebrush communities of the area are relatively dense shrub stands of (Artemisia tridentata var tridentata) with very little understory growth. In relatively undisturbed Sagebrush communities, Rabbitbrush (Chrysothamnus nauseosus or C. viscidiflorus), Mormon tea, and several perennial grasses including Thickspike and Western wheatgrass (Agropyron dasystachyum and A. smithii), Great Basin wildrye (Elymus cinereus), Indian ricegrass and Dropseed species may be common.

In the Sagebrush-Grassland type, the typical Big sage may give way to Artemisia tridentata var vaseyana (Mountain big sage) with a co-dominant perennial grass understory. Salina wildrye (Elymus salinus) can be co-dominant in these communities and may dominate an herbaceous Grassland type. Black sage (A. nova) with Salina Wildrye or Western wheatgrass understory is also common.

Pinyon-Juniper woodlands occupy drier sites often with stoney to very rocky soils. Pinus edulis and Juniperus osteoperma are co-dominant in the overstory. Understory vegetation ranges from sparse to moderate ground cover on range sites in poor to excellent condition. Understory species include Sagebrush, Mountain mahogany (Cercocarpus montanus), Snowberry (Symphoricarpus oreophilus), and several perennial grasses including Slender wheatgrass (Agropyron trachycaulum), Salina wildrye, Junegrass (Koeleria cristata) and Indian ricegrass.

Dominant shrubs of the Mountain Brush communities will vary depending on elevation and aspect. The drier south and west facing slopes may support dense stands of Gambel's oak (Quercus gambellii). Other dominants of this community may include Serviceberry (Amelanchier utahensis), Mountain mahogany (Cercocarpus montanus or C. ledifolius), Bitterbrush (Purshia tridentata) and Snowberry.

The range of the Douglas Fir-White Fir-Blue Spruce community is about 8,000 to 10,000 feet. Douglas Fir (Pseudotsuga mensiesii) is usually the dominant tree with White Fir (Abies concolor) and Blue

Spruce (Picea pungens) usually limited to the most mesic sites, often along streams. With dense canopies, understory vegetation may be sparse. Common shrubs include Serviceberry (Amelanchier spp.), Oregon grape (Berberis repens), Chokecherry (Prunus virginiana), Rocky Mountain Maple (Acre glabrum), Mountain lover (Pachistima myrsinites) and Snowberry. Bluebunch wheatgrass (Agropyron spicatum), Mountain brome (Bromus marginatus), and Kentucky bluegrass (Poa pratensis) are common grasses. Aspen stands (Populus tremuloides) can be found throughout the zone, particularly in mesic sites and as successional communities.

Picea engelmannii and Abies lasiocarpa dominate the Spruce-Fir zone at the highest elevations of the hydrologic impact area. While receiving about the same precipitation as the Douglas Fir communities, lower evapo-transpiration with cooler temperatures can permit a more lush vegetation in the Spruce-Fir zone. Limber pine (Pinus flexilis) often occupies steep or rocky, drier sites of this zone.

Small riparian communities are found at all elevations within the impact assessment area. With greater water availability and cooler temperatures, the riparian zone often includes more mesic species, e.g., those from a higher vegetation zone. Shrub species from the Mountain Shrub type may be found at most elevations.

Additional riparian zone shrubs include Narrowleaf cottonwood (Populus angustifolia), Redosier dogwood (Cornus stolonifera), Skunk bush (Rhus trilobata), river birch (Betula occidentallis) and various willows (Salix spp.). Grass species from the mesic zones may be represented (Mountain Shrub and higher zones) along with fescues (Festuca spp.) and miscellaneous sedges (Carex spp.). Small wet areas around springs and seeps will often support a dense growth of grasses, sedges and willows.

HYDROLOGY

Surface runoff from the Wasatch Plateau area flows either to the Price River Basin or the San Rafael River Basin. The Price River Basin, which includes about 1,800 square miles in six counties, is located primarily in Carbon and Emery Counties in East-Central Utah. The San Rafael River Basin, which includes about 2,300 square miles in three counties, is located mainly in Emery County to the south of the Price River Basin. The Price River drainage originates in the Wasatch Plateau about 12 miles west and south of Scofield Reservoir. Downstream from the reservoir the river flows in a generally southeasterly direction. The drainage is bounded by the Book Cliffs on the northeast, the Wasatch Plateau on the west, and the San Rafael Swell on the south. The San Rafael River Basin occupies part of two physiographic sections of the Colorado Plateau - The High Plateaus to the north and west and

Canyonlands to the south and east (Fenneman, 1946). Principal streams in the basin are Huntington and Cottonwood creeks, which merge to form the San Rafael River, and Ferron Creek, which joins the San Rafael River within a mile of that confluence. The San Rafael River also flows in a southeasterly direction to eventually join the Green River, after travelling from its headwaters in the Wasatch Plateau.

The water quality of both the Price River and the San Rafael Rivers is good in the mountainous headwater tributaries, but deteriorates rapidly as flow traverses the Mancos Shale. The shale lithology typically has low permeability, is easily eroded and contains large quantities of soluable salts that are major contributors to poor water quality. Depending upon the duration of contact, water quality degrades downstream to where Total Dissolved Solids (TDS) levels of 4,000 milligrams per liter (mg/l) are not uncommon. The predominant ion leached from the Mancos Shale is sulfate (SO_4) with values over 1,000 mg/l common in the lower reaches of the Price River.

Ground water is present in all lithostratigraphic units within the Wasatch Plateau Coal Field. Ground water occurs under localized conditions that often form a system of "perched" aquifers and associated springs and/or seeps. Significant localized ground-water resources are associated with the North Horn Formation and Price River Formation. The U.S. Geological Survey has identified and formally designated the Star Point-Blackhawk aquifer as the only regional ground-water resource occurring in the Wasatch Plateau Coal Field (Danielson, et al., 1981 and Lines, 1984).

II. CUMULATIVE IMPACT AREA (CIA)

Figure 2 delineates the CIA for current and projected mining in the Gentry Mountain area. The CIA encompasses approximately 118 square miles and includes Gentry Mountain, Wild Cattle Ridge and Star Point. The western and northern CIA boundaries are designated by drainages and drainage divides, whereas the southern boundary is defined by the southern extent of sections 1 through 5, T16S, R8E, and the eastern boundary is defined by the line separating R9E and R7E.

III. SCOPE OF MINING

STAR POINT MINES (PLATEAU MINING COMPANY)

The Plateau Mining Company permit area encompasses approximately 7,000 acres. There are three federal coal leases that are designated by the Bureau of Land Management as "Logical Mining Units" (LMUs): U-13097, SL-031286, and U-037045.

Mining operations began in 1916 when the Wattis Brothers and Mr. Browning bought 160 acres from the United States and developed the property for coal production. Coal was shipped in the autumn of 1917 when the railroad was completed, to the town of Wattis. The Lion Coal Company bought the coal interests in 1919. In 1967 Plateau Limited opened a new mine in the Hiawatha Seam. In 1971 United Nuclear purchased the mine and in July 1980 Plateau Mining Company bought the properties.

Historically, the Star Point #2 Mine (where mining has ceased) developed coal resources in the Hiawatha, Third, and Wattis seams by the room and pillar technique. During the permit term of 1987-1992, mining will occur in the Wattis and Third seams and development work is projected for the Hiawatha seam in the Star Point #1 Mine. Subsequent permit terms will involve further mining in all three of the coal seams through the year 2010. There will be room and pillar mining and longwall mining in the Wattis and Third seams and longwall mining in the Hiawatha seam.

There are certain areas where the cumulative effects of multiple seam mining will be experienced. The area of T15S R7E, Section 12, will have combined subsidence effects, and potentially, Section 18 of T15S R8E.

HIAWATHA MINES COMPLEX (U.S. FUELS COMPANY)

The Hiawatha Mines Complex permit area encompasses about 12,000 acres and is located adjacent to the Plateau Mining Company permit area. The Federal coal leases currently designated as LMUs are SL-025431 and U-026583. A large portion of the remainder of the coal is owned by U.S. Fuels. Coal is projected to be mined until the year 2014.

The Hiawatha Mines Complex is a consolidation of the original King, Hiawatha, Black Hawk, and Mohrland coal mines which began operating in the early 1900's. U.S. Fuels Company was organized in 1915 and began operating in 1916, when it took over the properties of the Consolidation Fuel Company, Castle Valley Coal Company, and Black Hawk Coal Company, all of which were located within the current permit boundary.

Mining has occurred throughout large portions of the permit area by the room and pillar technique: King 4 (A & B Seams), King 5 (B Seam), King 6 (A & Hiawatha Seams), King 7 (Hiawatha Seam), and King 8 (Upper Seam). Future longwall mining will be undertaken in the King 5 (A Seam) and King 8 (Upper Seam).

BEAR CANYON AND TRAIL CANYON MINES (CO-OP MINING COMPANY)

Co-Op Mining Company owns two mines located south of the Plateau Mining Company and Hiawatha Mines Complex permit areas.

The Bear Canyon Mine encompasses 991 acres. Mining during the first five-year permit term will occur in the Bear Canyon coal seam and thereafter, in the Hiawatha seam. There are two federal coal leases designated as LMUs at the Bear Canyon Mine, U-024316 and U-024318. Production will be from room and pillar mining methods with secondary pillaring.

The Trail Canyon Mine, located immediately west of the Bear Canyon property, has been operated by Co-Op Mining Company since 1938. Production to date has been from the Bear Canyon coal seam. The Trail Canyon Mine was declared suspended during 1983 and will be reclaimed.

DEER CREEK MINE WASTE ROCK STORAGE FACILITY (UTAH POWER AND LIGHT COMPANY)

The Deer Creek Mine Waste Rock Storage Facility permit area encompasses 46.22 acres and is located approximately three miles northeast of the Deer Creek Mine. This area will store waste rock from the Deer Creek Mine for at least 30 years. Utah Power and Light Company is owner of all the land within the permit area.

IV. STUDY AREA

GEOLOGY

The Gentry Mountain CIA is characterized by cliffs, narrow canyons and pediments. Stratigraphic units outcropping within the area include, from oldest to youngest, the Mancos Shale, Starpoint Sandstone, Blackhawk Formation, Castlegate Sandstone, Price River Formation, North Horn Formation, Flagstaff Formation and Quarternary deposits. Lithologic descriptions and unit thicknesses are given in Figure 3.

Rocks in the study area strike northwest and dip approximately three degrees to the southeast. Four major normal faults or fault zones (Pleasant Valley Fault, Trail Canyon Fault, unnamed fault, Bear Canyon Fault) trend north in the western portion of the CIA (Figure 4). Displacements range from several feet to approximately 800 feet.

HYDROLOGIC RESOURCES

Ground water

The ground-water regime within the CIA is dependent upon climatic and geologic parameters that establish systems of recharge, movement and discharge.

System	Series	Stratigraphic Unit	Thickness (feet)	Lithology and Water-Bearing Characteristics
Quarternary	Holocene and Pleistocene	Quarternary deposits	0–100	Alluvial and colluvium; clay, silt, sand, gravel, and boulders; yields water to springs that may cease to flow in late summer.
Tertiary	Paleocene	North Horn Formation	300 ±	Varigated shale and mudstone with interbeds of tan-to-gray sandstone; all of fluvial and lacustrine origin; yields water to springs.
Cretaceous	Upper Cretaceous	Price River Formation	200–250	Gray-to-brown, fine-to-coarse, and conglomeratic fluvial sandstone with thin beds of gray shale; yields water to springs locally.
		Castlegate Sandstone	150–200	Tan-to-brown fluvial sandstone and conglomerate; forms cliffs in most exposures; yields water to springs locally.
		Blackhawk Formation	1000 ±	Tan-to-gray discontinuous sandstone and gray carbonaceous shales with coal beds; all of marginal marine and paludal origin; locally scour-and-fill deposits of fluvial sandstone within less permeable sediments; yields water to springs and coal mines, mainly where fractured or jointed.
		Star Point Sandstone	350–450	Light-gray, white, massive, and thin beaded sandstone, grading downward from a massive cliff-forming unit at the top to thin interbedded sandstone and shale at the base; all of marginal marine and marine origin; yields water to springs and mines where fractured and jointed.
		Mancos Shale	1000 ±	Dark-gray marine shale with thin, discontinuous layers of gray limestone and sandstone; yields water to springs locally.

Figure 3. Stratigraphy of the Gentry Mountain Area (modified from Plateau Mining Company PAP, 1986, and Danielson, et al., 1981).

Snowmelt at higher elevations provides most of the ground-water recharge, particularly where permeable lithologies such as fractured or solution limestone are exposed at the surface. Vertical migration of ground water occurs through permeable rock units and/or along zones of faulting and fracturing. Lateral migration initiates when ground water encounters impermeable rocks and continues until either the land surface is intersected (and spring discharge occurs) or other permeable lithologies or zones are encountered that allow further vertical flow.

The Star Point Sandstone and lower portion of the Blackhawk Formation, Castlegate Sandstone, Price River Formation, North Horn Formation, Flagstaff Limestone, and Quarternary deposits are potential reservoirs or conduits for ground water in the CIA. Reservoir lithologies are predominantly sandstone and limestone. Sandstone reservoirs occur as channel and overbank, lenticular and tabular deposits, whereas limestone reservoirs have developed through solution processes and fracturing. Shale, siltstone and cemented sandstone beds act as aquacludes to impede ground-water movement. The Mancos Shale is considered a regional aquaclude that delimits downward flow within the CIA. Localized aquacludes include relatively thin, impermeable lithologies occurring within the stratigraphic section above the Star Point Sandstone.

The Star Point-Blackhawk aquifer is present and represents the only identified regional ground-water resource in the study area (Danielson, et al., 1981). Ground water associated with the Price River Formation and North Horn Formation may be characterized as occurring within an extensive "perched" aquifer zone and represents a significant hydrologic resource.

Faults and fractures act as effective conduits for ground water and allow unsaturated downward flow. Springs having significant discharges (10 gpm or greater) are most commonly located in proximity to major north-south trending fault or fracture zones (Figure 4). In particular, Bear Canyon Fault appears to act as a significant conduit for ground water. Mine workings contact with the Bear Canyon Fault at the 10th West Section in U.S. Fuels' King IV Mine has resulted in a sustained inflow of 900 to 1,000 gpm.

Other encounters with the Bear Canyon Fault in Plateau Mining Company's Star Point No. 1 Mine resulted in an initial high inflow rate that subsequently diminished. Three municipal wells (Huntington) have been developed adjacent to the Trail Canyon Fault near the junction of Wild Cattle Hollow and Gentry Hollow (Figure 4).

Data from seven boreholes located within and adjacent to the Star Point Mines permit area indicate ground water associated with the regional aquifer moves toward the south (Figure 4).

Approximately 325 seeps and springs occur within the CIA. Total spring discharge exceeds 1500 gpm. One hundred eighty-nine springs discharge from the North Horn Formation and Price River Formation (1,200 gpm); 37 springs discharge from the Castlegate Sandstone (80 gpm); 53 springs discharge from the Blackhawk Formation and Star Point Sandstone (200 gpm); and eight springs discharge from the Mancos Shale (40 gpm). Analyses from spring samples indicate water quality progressively decreases from the North Horn Formation to the Mancos Shale.

Mine inflow is estimated to be 134 gpm in the Star Point Mines, 950 gpm in the Hiawatha Mines Complex, and less than 50 gpm in the Trail Canyon Mine and Bear Canyon Mine. The majority of mine inflow (80 percent) is from faults and fractures with a lesser amount from paleochannels and wall weeps. Mine inflow is discharged to Mud Water Canyon at Star Point Mines and to Cedar Creek and Miller Creek at the Hiawatha Mines Complex. Mine inflow is not discharged at Bear Canyon Mine or Trail Canyon Mine. Mine water within the CIA represents ground-water depletion from storage in the Blackhawk Formation and Star Point Sandstone and the interception of flow along faults/fractures.

Surface Water

The CIA has been divided into six major drainage basins representing seventeen sub-drainage areas. The CIA encompasses drainage to both the San Rafael and Price River Basins (see Figure 5 and Table 1).

1. Serviceberry Creek Drainage

The Serviceberry Creek Drainage (1) includes the majority of disturbed area associated with the Plateau Mine. The mine exists in the headwaters of this creek drainage area of 6,135 acres. The average gradient of the creek within the CIA is 21 percent. Serviceberry Creek (1) is ephemeral within the CIA and eventually joins Miller Creek (16), east of the CIA, which is a perennial creek.

Vegetation communities in this drainage system include Douglas Fir-White Fir, Aspen, Mountain Brush, Sagebrush, including both Black sage and Big sage associations, Mixed Grass - Forb communities, and Pinyon - Juniper Woodlands. Riparian communities are generally small and may be dominated by willows, River birch or an occasional Cottonwood. Desert Shrub communities, particularly Shadscale, occupy the lowest elevations in the eastern section of the drainage system.

Mining has been confined to the extreme upper reaches of the watershed. The approximately 330 acres of surface disturbance associated with the surface facilities of the Plateau Mine has also been confined to the upper reaches of this watershed. All of Plateau's surface disturbance is treated by maintained sediment controls.

2, 3. Mud Water Canyon Drainage

Approximately 2978 acres drains Mud Water (2) and Los Angeles Canyon (2) to join 7080 acres draining Seely, Corner, and First Water canyons (3) to form Gordon Creek of the Price River Basin. The average gradient in the headwaters of these drainages is 19 percent. Mining has occurred within the extreme headwater reaches of Mud Water (2), Los Angeles (2), and Seely canyons (3), and the South Fork of Corner Canyon (3). Presently, Mud Water, Seely and the South Fork of Corner Canyon are perennial in their lower reaches, sustained by high elevation spring flow and mine water discharge (Mud Water Canyon).

Vegetation communities of the Mud Water Canyon Drainage area include Spruce-Fir, Douglas Fir-White Fir, Aspen, Mountain Brush, Sagebrush, including both Big sage and Black sage associations, Mixed Grass - Forb communities and shrub and grass-forb dominated riparian communities on the headwater streams.

Mining has not occurred beneath any stream channels, but has been restricted to the ridges separating the drainages.

4, 5, 6, 7 & 8 Gentry Ridge Drainage

Approximately 7,777 acres drain Wild Cattle Hollow (6) and Gentry Hollow (7) to form Tie Fork Canyon (8) tributary to Huntington Creek. Approximately 5516 acres drains areas directly tributary to Huntington Creek on Nuck Woodward Canyon (4). The average gradient of Gentry (7) and Wild Cattle Hollow (6) is 13 percent. Tie Fork Canyon's gradient is 44 percent. Miscellaneous side tributaries to Huntington Creek (Pole Canyon, McElprang Canyon, Vicks Canyon, Grange Hole, Biddlecome Hollow) (5) have average gradients of 40-50 percent.

All of the ephemeral drainages are not within the range of current underground mining plans. Portions of the Gentry Hollow (7) and Wild Cattle Hollow (6) drainage areas will be mined under within current mining sequences. Portions of the Gentry Hollow drainage area have been mined under by the Hiawatha Mine. Wild Cattle Hollow's main channel will not be mined under but longwall panels of the current Plateau Mine sequence will abut the channel as the mine progresses in a southwesterly direction. Both Gentry Hollow and Wild Cattle Hollow are designated perennial creeks on the U.S. Geological Survey quadrangle map.

Vegetation communities of the Gentry Ridge Drainage area include Spruce-Fir, Douglas Fir-White Fir, Aspen, Mountain Brush, Sagebrush, including both Big sage and Black sage associations, Mixed Grass - Forb communities and a variety of riparian communities.

The latter range from Cottonwood dominated associations along Huntington Creek to narrow bands of dense fir in the bottoms of steep canyons.

9, 10, 11, 12 & 13 Bear Creek - Trail Creek Drainage

Approximately 8,876 acres of drainage contribute to Trail Canyon (9), Bear Canyon (10), and three miscellaneous tributaries to Huntington Creek (11,12,13). The average gradient of Trail and Bear Canyon is approximately 20-25 percent. The average gradient of the miscellaneous tributaries ranges from 40 to 70 percent.

Bear Creek (10) is characterized by steep gradients, narrow canyons, and large sediment loads (28,092 mg/l Total Suspended Sediments (TSS) measured during a major storm event). Trail Creek (9) is characterized by steep gradients, narrow canyons, and good water quality. Mining occurs above Trail Creek.

About 10 acres of mine surface disturbance occurs in both Bear and Trail canyons. An additional three acres are associated with the living quarters and surface facilities of Co-Op Mining Company. The Trail Canyon Mine is currently in the process of being permitted for reclamation. No future disturbance is planned for either mine, other than reclamation of the Trail Canyon site.

About 29.5 acres of disturbance in drainage area 13 is attributed to the Deer Creek Waste Rock Storage Facility. The undisturbed ephemeral surface drainage will be routed around the site and all disturbed area drainage will be treated in sediment basins.

Vegetation communities in this drainage system include Spruce-Fir, Douglas Fir-White Fir, Aspen, Mountain Brush, Sagebrush, dominated by Black sage associations, Mixed Grass - Forb communities with Salina wildrye and Bluebunch wheatgrass dominants, Pinyon - Juniper Woodlands and a variety of riparian communities including the Huntington and Trail Creek Narrowleaf Cottonwood and willow associations.

(14, 15) Cedar Creek - Fish Creek Drainage

Approximately 22,488 acres drain both the Cedar Creek (15) and Fish Creek (14) drainage areas. The average gradient of Fish Creek is 19 percent and the average gradient of Cedar Creek is 13 percent. Both Cedar Creek and Fish Creek are ephemeral drainages with Cedar Creek exhibiting perennial characteristics in certain reaches due to mine water discharge and spring flow. The Hiawatha Mines Complex permit area encompasses portions of the Right and Left of Cedar Creek. The Right Fork is ephemeral and the Left Fork exhibits perennial characteristics in certain reaches.

Vegetation communities in this drainage system include Spruce-Fir, Douglas Fir-White Fir, Aspen, Mountain Brush, Sagebrush, including both Black sage and Big sage associations, Mixed Grass - Forb communities, Pinyon-Juniper Woodlands, riparian communities which include Narrowleaf cottonwood, Sandbar willow (Salix exigua) and River birch (Betula occidentallis), and Desert Shrub communities at the lowest elevations in the southeastern section of the drainage system.

Surface facilities associated with the Mohrland Mine of U.S. Fuels Company are adjacent to Cedar Creek, and a major mine discharge of 500-1000 gpm occurs at the low point of the Mohrland Mine. Surface facilities disturb less than 25 acres of this drainage area.

(16, 17) Miller Creek - Sand Wash Drainage

Miller Creek (16) and Sand Wash (17) encompass 18,053 acres of the CIA drainage area. Miller Creek has an average gradient of 15 percent and the Sand Wash has an average gradient of 17 percent. The upper reaches of Sand Wash and the Right and Left Forks of Miller Creek contain approximately 350 acres of the surface facilities disturbance of the Hiawatha Mines. These include permanent diversion of a portion of Miller Creek to accommodate the coal processing waste pile. Miller Creek has been mined under by the Hiawatha Mines Complex. Plateau Mining Company will mine under the upper reaches of the North Fork of the Right Fork of (NFRF) Miller Creek. NFRF is perennial and therefore, the North Fork of Miller Creek is also a perennial stream, whereas the Middle Fork and Left Fork of Miller Creek are ephemeral.

Vegetation communities in this drainage system include Spruce-Fir, Douglas Fir-White Fir, Aspen, Mountain Brush, Sagebrush, including both Black sage and Big sage associations, Mixed Grass - Forb communities, and Pinyon - Juniper Woodlands. Riparian communities are generally narrow bands at the edge of intermittent and perennial streams or springs and may be dominated by willows, River birch or an occasional Cottonwood. Riparian zones of the headwaters may be distinguished from the uplands primarily by density and vigor of vegetation. Desert Shrub communities, particularly Shadscale with Slender wheatgrass, occupy the lowest elevations in the southeastern section of the drainage system.

V. POTENTIAL IMPACTS

GROUND WATER

Dewatering and subsidence related to mining have the greatest potential for impacting ground-water resources in the CIA. The impact of changes in vegetation on ground-water recharge should be minimal since mining will disturb less than 1000 acres of the 70,000 acre CIA. Disturbance of phreatophytic vegetation (primarily cottonwoods and some willow) is negligible. The impacts of coal waste disposal on water quality are discussed in the surface water section.

The Deer Creek Mine Waste Rock Storage Facility is located below the coal resource on the Masuk member of the Mancos Shale. Inasmuch as the Mancos Shale is considered a regional aquaclude, the storage facility presents a low risk for impacting ground-water resources.

Dewatering. The volume of water being discharged from mines within the CIA (1,200 gpm) approximates the amount of water that is currently being withdrawn from the ground-water system. The current and projected withdrawal values may be totalled and compared to estimates of ground-water discharge and recharge within the CIA and thereby, allow an assessment of cumulative dewatering impacts.

Approximately 37,000 acres within the CIA overlie the coal resource and represent a potential recharge area (Figure 6). Average annual precipitation is approximately 20 inches over the potential recharge area and hence, the total annual precipitation over the outcropping recharge area is 64,000 acre-feet.

Table 2A gives estimates for the total annual discharge of springs from water-bearing rock units that overlie the coal resource. Discharge also occurs directly to perennial streams where channels intersect ground water within the Blackhawk Formation and Star Point Sandstone. Table 1 identifies the ten perennial streams that occur within the CIA. Nine of these streams intersect the lower Blackhawk Formation and Star Point Sandstone. A study conducted along the NFRF Miller Creek (16) indicates streamflow substantially increased (from 8 to 115 gpm) as a result of discharge from the Blackhawk Formation and Star Point Sandstone (Plateau Mining Company PAP, page 783-40). The results from the Miller Creek study suggest the other eight perennial streams that traverse the regional aquifer also sustain ground-water discharge (or base flow recharge). Accordingly, total base flow recharge to perennial streams within the CIA is estimated to be 900 gpm.

Table 2A. Precipitation and Spring Discharge Estimates for Areas above the Coal Resource, Gentry Mountain, CIA.

Lithologic Unit(s)	Outcrop Area (Acres)	Normal Annual Precipitation on Outcrop (Acre-Feet)	Total Annual Discharge of Springs: Acre Feet	Total Annual Discharge of Springs: Percent of Normal Annual Precipitation on Outcrop
Undivided Flagstaff Limestone, North Horn Formation, Price River Formation	19,500	34,125	1,900	.05
Castlegate Sandstone	3,000	5,250	129	.02
Blackhawk Formation, Star Point Sandstone	14,900	26,075	322	.01
TOTAL	37,400	64,450	2,351	.04

Table 2B. Estimated Ground-water Discharges to Perennial Streams and Wells and from Mines, Gentry Mountain, CIA.

Discharge to Perennial Streams (9 total)	900 gpm
Discharge to Huntington Municipal Wells (3 total)	100 gpm
Discharge from mines (2 total)	1,200 gpm
TOTAL	2,200 gpm

Table 2C. Approximate Atmospheric Discharges from Active Mines, Gentry Mountain, CIA.

Mine(s)	Ventilation Rate (cfm)	Approximate Discharge Rate (gpm)
Bear Canyon	150,000	10
Star Point Mines	650,000	44
Hiawatha Mine Complex	350,000	24
TOTAL	1,150,000	88 gpm

Table 2B lists estimated ground-water discharges to perennial streams and wells and from mines. Table 2C approximates the amount of ground water discharged to the atmosphere by mine ventilation systems. Psychrometric formulas were utilized to derive ventilation discharge values and extrapolated to the mine elevations. Average relative humidity data from the Central Weather Station in the Manti-LaSal National Forest were also used in the psychrometric calculations.

Total ground-water discharge within the CIA (summed from Tables 2A, 2B, and 2C) is currently about 3,800 gpm, where 63 percent (2,400 gpm) of the total represents natural discharge to stream and springs and 34 percent (1,500 gpm) results from mining activities. The remaining 3 percent (100 gpm) may be attributed to well discharge.

Lines (1985) investigated the Trail Mountain area and indicated regional aquifer inflow to mines is derived from aquifer storage (80 percent) and aquifer discharge (20 percent). Extrapolating these percentages to the Gentry Mountain CIA (16 miles) allows depletion, due to present mining activities (7,200 acres mined) of regional aquifer storage and discharge to be estimated at 360 and 90 gpm, respectively. Assuming future mining encompasses 3,300 acres and will continue to encounter steady-state inflow from the regional aquifer, then depletion would increase to 471 gpm for storage and 118 gpm for discharge.

The Hiawatha Mines Complex has encountered major ground-water inflow associated with the Bear Canyon Fault. Diversion of flow from this conduit has altered and will continue to alter (deplete up to 1,000 gpm) recharge to the regional aquifer and, possibly, surface discharge in the Gentry Hollow area. Future development in the Hiawatha Mines Complex will retain a barrier pillar adjacent to the Bear Canyon Fault. Plateau Mining Company has proposed to access coal reserves beneath Gentry Ridge by driving a rock tunnel across the Bear Canyon Graben and associated western (unnamed) and eastern (Bear Canyon) boundary faults. Previous encounters with the Bear Canyon Fault (eastern) in the Star Point Mines have resulted in limited inflow. Data are not available to assess whether the western (unnamed) boundary fault acts as a significant groundwater conduit. A pressure grouting program will be initiated if the tunnel encounters inflow(s) that exceed 50 gpm for more than three months. Thus, tunnel development may result in a maximum diversion of flow from the two Bear Canyon boundary faults that will not exceed a total of 100 gpm.

Future mining-induced dewatering is projected to encompass 141 gpm and hence, the cumulative dewatering total would be approximately 1,650 gpm. Following the cessation of mining, the discharge of ground water to Mud Water Canyon (2), Cedar Creek (15), Miller Creek (16), and the atmosphere, will cease and workings will begin to flood.

The impact associated with the reduction in surface flow is considered temporary. Mine flooding will conceivably recharge regional aquifer storage and re-establish the natural ground-water conduit system that was operational prior to mining. The maximum time span required for complete mine flooding may be derived by assuming the final workings (10,500 acres) will remain open (average 5 foot height) and caving will not occur. Accordingly, for workings that experience inflow (Hiawatha Mines Complex, Bear Canyon Mine, Trail Canyon Mine, Star Point Mines) an upper limit of 20 years may be derived for complete mine flooding. It should be noted that complete flooding will, undoubtedly, never be achieved because the hydraulic head generated as flooding proceeds will increase until the hydraulic properties of the roof, floor and rib are exceeded and flow within the rocks initiates.

Subsidence. Subsidence impacts are largely related to extension and expansion of the existing fracture system and upward propagation of new fractures. Inasmuch as vertical and lateral migration of water appears to be partially controlled by fracture conduits, readjustment or realignment in the conduit system will inevitably produce changes in the configuration of ground-water flow. Potential changes include increased flow rates along fractures that have "opened", and diverting flow along new fractures or within permeable lithologies. Subsurface flow diversion may

cause the depletion of water in certain localized aquifers and potential loss of flow to springs that will be undermined. Increased flow rates along fractures would reduce ground-water residence time and potentially improve water quality.

Mining will occur beneath approximately 80 springs that have a combined flow in excess of 400 gpm. Overburden thickness averages more than 1000 feet beneath areas where springs are located. Diversion of spring flow is considered to be at overall low risk.

Mining will occur beneath a portion of NFRF Miller Creek where overburden thickness ranges from 500 to 825 feet. The risk for development of tension cracks within the stream channel is considered to be moderately high.

SURFACE WATER

The cumulative impacts associated with mining within the CIA will be summarized by individually discussing impacts associated with the Star Point Mines, Hiawatha Mines Complex, Bear Canyon Mine and Trail Canyon Mine and Deer Creek Mine Waste Rock Storage Facility. Creeks or drainage areas which are referenced by (#) or discussed, are shown on Figure 5, Surface Water Drainage Map.

Star Point Mines. The Plateau Mining Company's surface facilities are primarily found in Sage Brush Canyon tributary to Serviceberry Canyon (1). Sage Brush Canyon and Serviceberry Canyon flow only in response to storm events.

The coal processing waste pile (Figure 4) at the Star Point Mines is at 7,400 foot elevation, annual precipitation is 12 inches, and the vegetation surrounding the waste pile are salt desert shrub and pinyon-juniper-sagebrush communities. The waste pile is not adjacent to any perennial streams or known ground-water resources. The mine presently produces 1.2 million tons of coal annually with a capacity of four million tons. Twenty percent of the material mined is processing waste.

Table 64 of the PAP indicates waste materials are sandy or coarse in nature, with a high organic matter content and have a relatively high cation exchange capacity for coarse textured materials. To date, six waste samples have been analyzed for acid-base potential. One sample had a potential to be acid-forming. The other samples tested had excess base, which should be sufficient to neutralize drainage or seepage from areas which could potentially form acid. The alluvium which underlies the coal waste is calcareous and will also neutralize any acid drainage from the refuse.

Selenium was the only parameter tested for in the waste which had concentrations above suspect levels. This suspect concentration is .1mg/kg and is for toxicities which may occur to animals feeding on vegetation grown on this material. The suspect value which may be detrimental to water quality is not known. Selenium in the coal waste should not be a concern to water quality because drainage from the pile should be minor. The waste, although hauled to the pile in a wet form is not a slurry, and most of the water associated with the waste evaporates in the dry climate of the area.

Data given in Table 64 indicate waste could contribute slightly to increasing TDS levels in surface or ground water. The electrical conductivities of four samples were saline (greater than 4mmhos/cm^2).

Although most water associated with the waste will evaporate, some water will inevitably percolate through the pile and underlying alluvial deposits. Eventually, seepage would contact the Mancos Shale and further degradation of water quality would take place. Accordingly, drainage from the waste pile would have little down gradient effect.

All surface water drainage is treated by running disturbed area drainage through sediment ponds. There are no water rights within or adjacent to the mine plan area that could be impacted by operation of surface treatment facilities. Runoff conveyance systems and treatment facilities have been designed to minimize the amount of area that is tributary to the sediment ponds. The quantity of runoff detained by sediment ponds is minimized by diversion of undisturbed waters (PAP, page 784-62).

The Plateau treatment facilities have operated in compliance with all NPDES discharge limitations except for TDS exceedence at the Mud Water Canyon Mine Water and Sediment Pond No. 8. Requests for modifications to the limits currently in effect has been made for these facilities but not yet granted by State Health and EPA. The current TDS limitation for the Mud Water Canyon (2) discharge is 650 mg/1 TDS. The request to raise this limit to 1,450 mg/1 (an average of the naturally occurring concentration of the Mud Water Canyon stream) has been made. The average annual flow for the period of 4/85 through 3/86 is approximately 129 gpm to Mud Water Canyon, associated with the Mine Water Discharge (PAP, page 783-46). Of 15 TDS samples taken from the Mud Water Canyon discharge in 1985, the TDS concentration varied from a low of 598 mg/1 taken in late May to a high of 772 mg/1 taken in late October. The sample mean was 689 mg/1 with a standard deviation of 53 mg/1. TDS effluent concentrations at Pond No. 8 have been recorded as high as 3,913 mg/1 on March 10, 1986. An undisturbed area sample taken on the same day near Pond No. 8 discharge was 6,024.0 mg/1. Plateau Mining Company is in the process of monitoring inflows to Pond No. 8 for a one-year period (PAP, page 784-79).

The effects of the discharge associated with Plateau Mining Company's mine water result in approximately 485.62 Tons/Yr of dissolved solids being added to the surface water system tributary to the Price River and to the Colorado River. This is based on average data for the period of 1/22/86 through 12/18/86 taken from the mine water discharge point.

Of the potential discharge locations (Treatment Facility No. 1, Ponds 2 through 8, and Mud Water Canyon discharge) only five facilities have available water quality data. These include discharges from Ponds 4, 5, 6, and 8, and Mud Water Canyon discharge.

Summary of Water Quality Data

Mean Values	Total Dissolved Solids (mg/l)	Total Suspended Solids (mg/l)	Period
Pond No. 4	1531.7	38.5	10/83-9/85
Pond No. 5	791.1	33.0	4/83-10/85
Pond No. 6	1037.2	18.5	4/83-9/85
Pond No. 8	1846.3	25.0	7/85

All four of the facilities drain to an ephemeral drainage; Serviceberry Creek (1), and then to the Price River, tributary to the Colorado River. Background TDS values for the lower parts of this drainage have been measured at 7,300 mg/l. The discharges from the ponds listed above are less than background TDS measured at Surface Water Station 10-1 in Sage Brush Canyon (1) downstream of the ponds. The average value for TDS at this station in 1985 was 1,932 mg/l. The values ranged from 599 mg/l on 6/13/85 to 3,168 mg/l on 6/27/85. The lowest TDS value is reflective of runoff occurring during a snowmelt period. Figure 14 in the Plateau PAP shows examples of this snowmelt dilution effect. The TSS data given in the above table indicates that Pond #4, 5, 6, and 8 have operated in compliance with the 70 mg/l limit identified in their NPDES permit.

Plateau Mining Company has committed to providing an adequate surface water reclamation plan for the Star Point Mine by October 1, 1987. This plan will identify the necessary measures to provide for contemporaneous reclamation of the disturbed areas preventing impacts to the quality and quantity of surface water. In addition, the use of adequate sediment controls mitigates the overall effects of mining on the surface water system. The effects of discharging mine water into the Mud Water Canyon drainage will be determined by maintaining an effective monitoring system to determine if any adverse impacts to the environment would occur and could be prevented.

As mentioned in the previous section on subsidence, the Star Point Mines will mine a portion of the headwaters of the NFRF Miller Creek (16) and the risk for development of tension cracks within the stream channel is considered to be moderately high. Because of this potential impact, the Plateau Mining Company will be required to develop a sophisticated monitoring system to detect any changes in the hydrologic regime of this stream channel during and after mining. This monitoring system will include identification of gaining and losing reaches through stream surveys and the installation of a continuous monitoring system directly below the area of potential impact.

Plateau Mining Company will use one of the following engineering methods to mitigate any change to the hydrologic regime of the NFRF Miller Creek if an impact is detected through monitoring.

1. Seal the cracks in the stream channel with bentonite or other environmentally safe materials.
2. If cracks are too large, rags or some other material will be hand placed in them at a depth of approximately two feet to provide a stop point for bentonite pellets.
3. Concrete or epoxy mixtures.
4. Surface stabilization accomplished by hand tools.

Implementation of one of these engineering methods will occur following the diversion of surface flow around the impact area by culvert, flexible fabric tubing or plastic liners and an assessment and approval of the appropriate engineering method to mitigate impact to the stream channel.

Hiawatha Mines Complex. In the vicinity of the Hiawatha Mines Complex, the CIA is dissected by two drainage systems, Miller Creek (16) and Cedar Creek (15). The drainage area for Miller Creek, above the confluence with Serviceberry Creek (1), is about 29,700 acres. Streamflow in Miller Creek is perennial from the headwaters of the NFRF Miller Creek. Cedar Creek is also a perennial stream with a drainage area of approximately 5,300 acres. Cedar Creek receives approximately 800 gpm of discharge from the old Mohrland Mine portal located south of the Hiawatha Mines Complex.

Mine water is used by U.S. Fuels Company for fire prevention and dust suppression in King 4 Mine and by the town of Hiawatha for culinary purposes. These uses are covered by water rights claimed by U.S. Fuels Company for 4,758 gpm (3,746 gpm in surface water rights and 1,012 gpm in ground-water rights). Mine water discharge from the Mohrland Mine portal is regulated under the National Pollutant Discharge Elimination System (NPDES) permit UT-0023094.

Water is piped to the town of Hiawatha (20 gpm) and coal preparation facility (545 gpm) from the mines. The Left fork of the North Fork of Miller Creek is diverted into an underground water storage reservoir that provides water for the town of Hiawatha. This water, together with the water intercepted in the mine, is stored in the mined-out section of the abandoned Hiawatha No. 2 Mine. Maximum storage volume in this underground reservoir is about 120 million gallons (368 acre-feet). Approximately 60 million gallons (184 acre-feet) are normally stored in this reservoir.

Water in excess of that used in the mining operation is routed south by gravity to the Mohrland Mine Portal where it is collected and piped to the town of Hiawatha. Excess water is discharged into Cedar Creek (15). At the town of Hiawatha there are four water storage tanks with a combined capacity of 245,000 gallons (0.75 acre-feet). Water is treated and then stored in the 40,000 gallon (0.1 acre-feet) tank 5A near the preparation plant.

Coal processing waste piles (Figure 4) at Hiawatha Mines Complex are at 7,200 feet elevation and receive 12 inches of annual precipitation. The vegetation in the refuse area is a mixed salt desert shrub community. The waste piles have been in existence since the 1940's, encompass approximately 133 acres and include 4 slurry ponds. Table XIII-11 of the PAP indicates coal waste samples are above suspect levels for selenium with concentrations ranging from 1.93 to .91 mg/kg. However, the contribution of selenium to ground or surface waters by the coal waste should have minimal effects on water quality. Any seepage from the slurry ponds would flow to Miller Creek because of its proximity and the gradient to the creek. The amount of seepage compared to the flow of Miller Creek would dilute any diletarious concentration of selenium in seepage waters. The average flow of Miller Creek is 428 gpm.

Other parameters listed in Table VIII-11 of the PAP were within acceptable limits, except for boron and iron in one sample from slurry pond 3 and 4, respectively. Boron should not pose a problem since this element is of concern in irrigated areas where toxicities can occur in crops. The water quality of adjacent Miller Creek has a high inherent salinity hazard for irrigation waters and should not be used for irrigation without intensive management. Again, the flow of Miller Creek would dilute any boron concentration in seepage water.

Iron is a product of pyrite weathering, and may indicate acid mine drainage. The pH of the sample with the high value was 7.35. At this pH, the material is still buffered and does not indicate acid-forming material. Iron at this pH is also not readily soluable, and therefore, iron should not pose a problem to receiving waters.

The coal waste was not analyzed for acid-base potential, but pH values indicate that the refuse is basic, with only one sample being neutral (pH 6.8). Existing water quality data from Miller Creek, which is adjacent to the waste pile, indicate there are no degrading effects from seepage of the coal waste piles or slurry ponds. Considering the time involved in oxidation of the waste, the calcareous nature of the soils and the buffering capacity of the water in Miller Creek, along with the alkalinity of the slurry pond water (PAP, page 81A), these factors should be great enough to neutralize any acid produced in the coal processing waste piles.

A comparison (PAP, page 81A) of slurry pond water and Miller Creek water sampled adjacent to the slurry ponds shows that the pond water is slightly higher in sulfates, iron, and TDS. Although the slurry water may degrade further with increased contact time with slurry sediments, any seepage should have little consequence on the water quality of Miller Creek. The natural quality of Miller Creek water is poor since it traverses the Mancos Shale. The contribution of salts into the Price River basin by the Mancos Shale has been well documented (Mundorff, 1972; Ponce, 1975; Laronne and Schumm, 1977).

Surface water at a higher elevation in the CIA has a low TDS concentration, usually less than 400 mg/1, and a low TSS concentration, usually less than 30 mg/1. Concentrations of dissolved sodium and chloride are usually less than 15 mg/1. The predominant dissolved chemical constituents are calcium and bicarbonate. Water quality during snowmelt runoff tends to be higher in calcium carbonate and water quality from ground-water discharge tends to have higher concentrations of magnesium and sulphate. Values of pH were fairly constant, ranging from 7.6 to 8.1.

The Utah State Board of Health has established water quality standards to protect against controllable pollution to beneficial use of water. For the Miller Creek basin (16), the pertinent water quality standards are for nongame fish (Class 3c) and irrigation of crops and stockwatering (Class 4) (Utah State Board of Health, 1978).

TDS levels of surface waters immediately below some of the active mine areas exceed the water quality standard for irrigation use, but the effects are mitigated by dilution from undisturbed surface waters. TDS concentrations in Miller Creek are within the water quality standards at the point that it flows out of the Hiawatha Mines Complex permit area; however, TDS concentrations increase about two-fold when comparing above-mining stations and below-mining stations.

Dissolved constituents continue to increase in Miller Creek as water flows across the Mancos Shale. At the junction of Miller Creek and Utah Highway 10 (about 10 miles east of the permit area), TDS concentrations average more than 3,200 mg/1, and the dominant dissolved chemical constituent is sulfate (Mundorff, 1972). The only parameter to exceed pertinent water quality standards is TDS.

The sodium adsorption ratio (SAR) for the area is low. For the headwater areas of the Miller Creek and Cedar Creek drainages, the SAR is less than 0.5. At the base of the Wasatch Plateau, the SAR values are usually between 0.8 and 2.0. On the Mancos Shale, the SAR values range between 1.0 and 4.0. Surface water derived from snowmelt flow usually has a lower SAR value, however, both sodium and SAR increase during the low flow period as streams traverse the Mancos Shale.

Both SAR and TDS combine to degrade irrigation water. All of the water in the study area exhibits a low sodium hazard for snowmelt flows, but Miller Creek at Utah Highway 10 shows a medium sodium hazard during low flow periods. This increase in TDS and SAR as streams cross the Mancos Shales is a natural nonpoint source of pollution.

TDS concentrations in surface water below the elevation of coal mining activities are higher than in areas above coal mining activities. TDS increases are associated with increases in sulfate, chloride, magnesium and sodium concentrations. Current TDS levels do not exceed any existing recommended water quality criteria for current water uses. Future mining will cause an increase in TDS concentration, but this level will also be below state and federal water quality criteria. TDS loads (i.e., concentration multiplied by flow rate) are approximately 900 tons per year from nonpoint sources associated with existing mining operations on Miller Creek. Because no new surface disturbances are proposed, the TDS load should not increase in the future. There is no current active surface mining operation on Cedar Creek, but an increase of 180 tons per year from nonpoint sources is projected in relation to future mining operations on Cedar Creek.

Water chemistry of surface waters in the CIA naturally change from a calcium carbonate type to a magnesium type as streams traverse the Blackhawk Formation and the Mancos Shale. The Mancos Shale has a significant impact on surface water quality. TDS concentrations of streams that interact the Mancos Shale area are as much as 100 times higher than TDS levels of streams that interact overlying lithologies within the CIA. Most of these increases are natural and are probably caused by rain and leaching within stream channels or ground water flowing through the formation leaching available salts from the marine shales, and discharging into the

surface waters. Impacts resulting from the surface facilities associated with mining in the CIA are overshadowed by the degradation of water quality from streams traversing the Mancos Shales.

Sulfate levels are presently below established water quality standards, and if projected estimates by the mine of sulfate increases are accurate, surface disturbances associated with the King 7 and 8 Mines will cause about a two-fold increase in sulfate concentrations. Projected sulfate concentrations will remain below water quality standards.

TSS concentrations are also higher downstream from surface facilities associated with mining. Most of the increased suspended sediment naturally settles out before Miller Creek or Cedar Creek leaves the permit area because of relatively flat stream gradients. In the Office of Surface Mining Technical Analysis a model was used to route the known water quantity and quality of Miller Creek (16) (at the town of Hiawatha) and of Serviceberry Creek (1) (near the town of Wattis) to the confluence of the two streams. According to the results of the model, the TDS concentration below the confluence of Serviceberry Creek and Miller Creek will exceed the water quality standard for irrigation use during the middle and late summer months. Most of the TDS concentration is caused by the Serviceberry Creek traversing the Mancos Shale, however.

Both concentrations of TSS and TDS are higher downstream than upstream of the mine site and can be attributed to both natural and mine-related causes. The Division considers the Mancos Shale as the major source for surface water contamination.

Bear Canyon Mine and Trail Canyon Mine. The Trail Canyon and Bear Canyon mines' surface facilities are primarily found in the Bear Creek-Trail Creek Drainage Areas (9, 10, 12). Both Trail Canyon and Bear Canyon are perennial streams which flow in response to storm events and maintain a base flow associated with perennial springs. The main concern in terms of water quality deterioration downstream is T.S.S. The TSS concentrations in Bear Creek (10) in 1984 varied from a high of 28,092 (mg/l) in May of 1984 to a low of 122 (mg/l) in September of 1984 with five monthly readings within the 1,000-2,000 mg/l range. The suspended sediment concentrations in Trail Creek (9) in 1984 varied from 1,400 mg/l in May of 1984 to a low of 1.0 mg/l in February of 1984 with seven monthly readings below 100 mg/l. These high TSS values are associated primarily with natural climatic and erosional processes, although a proportion may be attributed to removal of vegetation from roads and mine pads and normal mine operations, e.g., loading coal. Sediment controls do exist for all surface disturbances in both canyons. Therefore, the impact associated with 20 acres of mining disturbance in Trail and Bear canyons is minimized by surface controls (i.e., sediment ponds, diversion ditches, filter fences, dugout ponds, etc.).

Deer Creek Mine Waste Rock Storage Facility

The disturbance associated with Deer Creek Mine Waste Rock Storage Facility is found within Drainage Area 13. The storage facility is located in a small ephemeral basin which flows to Huntington Creek. All surface drainage is routed around the site or contained in sediment basins and not discharged. All impacts associated with this storage facility are contained on site and will not effect the natural drainage to Huntington Creek.

Pages 7-6 and 7-6.1 of the PAP indicate that the coal waste material sample is above suspect levels for salinity with an electrical conductivity averaging 5.12 mmhos/cm. However, the contribution of salinity to ground or surface water by the coal waste should have minimal effects on water quality. The salinity of the coal waste material is conducive to the native soil environment. The salinity of the native material that the waste will be backfilled onto is considered a saline sodic shale with an electrical conductivity ranging from 6.5 to 10.6 and sodium adsorption ratio ranging from 6.5 to 28.1.

VI. Summary

Mine operations within the CIA currently intercept regional aquifer (450 gpm) and fault conduit flow (1,050 gpm) at an approximate rate of 1,500 gpm. Of this total, approximately 630 gpm are consumptively lost to mine ventilation (80 gpm) and evaporation at coal preparation facilities (545 gpm). The remaining 870 gpm are discharged, without interbasin transfer of water, to streams.

Mine water discharges, with the exception of Star Point Mines, meet required effluent limitations.

Future mining operations are designed to avoid interception of fault conduit flow and accordingly, inflow from the regional aquifer is estimated to increase from 450 gpm to 591 gpm. Approximately 80 percent of the inflow will be derived from storage and 20 percent from discharge. Consumptive use is not anticipated to increase. Mine water discharge (1,350 gpm) and ventilation losses (300 gpm) will be discontinued upon cessation of mining. Concommitantly, flooding of abandoned workings will initiate. An upper limit of 20 years has been estimated for complete flooding of workings and re-establishment of the premining ground-water system.

Diversion of spring flow is considered to be at overall low risk. However, reduction in flow along the upper reach of the NFRF Miller Creek is considered to be at moderately high risk. A generalized mitigation plan has been proposed for minimizing mining-induced impacts to NFRF Miller Creek. Division approval of the method implemented to restore the stream channel will be contingent upon an assessment of the mining induced impacts.

Sediment control measures have been and will be designed and implemented to reduce and stabilize contamination of surface waters.

Following cessation of mining and coal processing, waste piles will be adequately covered with topsoil and all disturbed areas will be stabilized and revegetated to prevent surface water contamination.

Future development in the Wild Horse Ridge and Mohrland areas and/or the recommencement of mining at the Trail Canyon Mine may result in further dewatering of the ground-water system. Permitting of new development will require implementation of sediment control measures that minimize impacts to surface water.

The designs proposed for all anticipated mining operations within the CIA are herein determined to be consistent with preventing damage to the hydrologic balance outside the proposed mine plan areas.

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