Trail Mountain Coal Mine Permit Application

Permit No. C/015/0009

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

Amendment to Modify the Permit Area for the Trail Mountain Min
in Compliance with State and Federal Regulations
June 7, 2011

Volume 1

Incoming, C0150009
#3858

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

P.O. Box 310
15 North Main Street
Huntington, Utah 84528

June 7, 2011

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DIV. OF OIL, GAS & MINING

Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

(Hand Delivered)

Subj: Amendment to Modify the Permit Area for the Trail Mountain Mine in Compliance with State and Federal Regulations, PacifiCorp, Trail Mountain Mine, C/015/0009, Emery County, Utah.

PacifiCorp, by and through its wholly-owned subsidiary, Energy West Mining Company ("Energy West"), as mine operator, hereby submits an amendment to the Trail Mountain MRP to modify the permit area boundary of the Trail Mountain Mine. This amendment also includes creation of an adjacent area and potential hydrologic impact area in compliance with State and Federal regulations. This action follows the partial relinquishments of coal leases UTU-64375 and UTU-49332 as explained below.

In January 2009, Energy West submitted documentation in support of partial relinquishment of lease UTU-64375 and UTU-49332 to the Bureau of Land Management (BLM). The purpose of the partial relinquishment was to reduce the overall lease acreage in a housekeeping effort to manage those lands for future use by surrendering the acreage that had been mined out and depleted. Those mining efforts achieved maximum economic recovery and met the BLM's subsidence guidelines for substantial completeness. At that time, Energy West provided the legal descriptions of those lease areas to be relinquished and those areas to be retained. A total of 2,504.01 acres in UTU-64375 and 261.47 acres in UTU-49332 were proposed for surrender.

On September 24, 2010, BLM approved PacifiCorp's partial relinquishment request for the two leases. A total of 640.00 acres will be retained (UTU-64375 = 260.00 ac. and UTU-49332 = 380.00 ac.) and is now proposed for inclusion in the adjacent or active mining area of the Trail Mountain Mine.

This permit amendment includes revisions to the following volumes:

Volume 1 – Revisions to Text and Figures (five copies)
Volume 2 – Revisions to Text and Figures (five copies)
Volume 3 - Revisions to Maps (one hard copy and 4 CD's)
Private and Confidential Volume – Revision to Map 1395C (inserted into "CONFIDENTIAL" envelope)

The Adjacent Area and Potential Hydrologic Impact Area are outlined on certain maps in Volume 3. The Adjacent Area Map proposed for this amendment action includes all adjacent or active mining areas (including the permit area) of the Trail Mountain Mine. The Potential Hydrologic Effects Map encompasses all springs and surface waters that have the potential to be impacted by underground and surface mining activities. All other maps of Volume 3 will be revised/removed (as needed) to incorporate these proposed boundary revisions.

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Date Folder 060911 C/0150009
Incoming
See Confidential

All information concerning this permit boundary reduction is included for your review. C1/C2 forms are attached. All new text in the volumes is identified by a yellow highlight. Deleted text is marked out with a line through the text. The Chapters in Volumes 1 and 2 have been reformatted; therefore, all Chapters are included with this amendment. The revised maps in Volume 3 have been made available in electronic format and copied to a CD. The CD is found in the sleeve of Volume 1. One hard copy of the maps is included with this submittal. Maps will be professionally certified when this amendment is approved and finalized.

One separate map from the Private and Confidential Volume is included in its own separate envelope marked "CONFIDENTIAL". Once this amendment has been approved, the Legal and Financial Volume will be updated to include the modified permit and adjacent boundary.

If any additional information is required, or if you have concerns regarding this permit amendment application, please feel free to contact myself at 435-687-4712 or Dennis Oakley at 435-687-4825.

Sincerely,

Kenneth S. Fleck

Kenneth Fleck
Manager of Geology and Environmental Affairs

Cc File

Enclosures C1/C2 Forms
Revised Volume 1 (five copies)
Revised Volume 2 (five copies)
Revised Volume 3 Maps as outlined on C2 Form (one hard copy)
Revised Volume 3 Maps as outlined on C2 Form (four CD copies)
Revised Private and Confidential Map (one hard copy in separate envelope)

APPLICATION FOR COAL PERMIT PROCESSING

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

Permittee: PacifiCorp

Mine: Trail Mountain Mine **Permit Number:** C/015/0009

Title: Amendment to Modify the Permit Area for the Trail Mountain Mine in Compliance with State and Federal Regulations, PacifiCorp, Trail Mountain Mine, C/015/0009, Emery County, Utah.

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

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

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

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

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

Kenneth Fleck — Kenneth S. Fleck — Manager of Environmental Affairs — 6/7/11
Print Name — Sign Name, Position, Date

Subscribed and sworn to before me this 7th day of June, 2011

Chris M. Christensen
Notary Public

My commission Expires: April 24, 2015

Attest: State of Utah } } ss:
County of Emery

NOTARY PUBLIC
CHRIS M CHRISTENSEN
607905
COMMISSION EXPIRES
APRIL 24, 2015
STATE OF UTAH

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

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

Permittee: PacifiCorp
Mine: Trail Mountain Mine **Permit Number:** C/015/0009
Title: Amendment to Modify the Permit Area for the Trail Mountain Mine in Compliance with State and Federal Regulations, PacifiCorp, Trail Mountain Mine, C/015/0009, Emery County, Utah.

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

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Volume 1, entire volume, replace with amended and reformatted text.
☐ Add	☒ Replace	☐ Remove	Volume 2, entire volume, replace with amended and reformatted text.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-2, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-3, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-4, TMS1680C, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-5, TMS 1376D, 1 of 2 and 2 of 2, replace both maps.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-6, TMU1375D, 1 of 2 and 2 of 2, replace both maps.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-7, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 3-8, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 4-1, TMS1454C, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 4-2, TMS1458C, replace map.
☐ Add	☒ Replace	☐ Remove	Private and Confidential Volume, Trail Mountain Tab, Plate 5-1, TMS1395C, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 6-1, TMS1503D, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 6-2, TMS1510D, replace map.
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☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-2, TMS1450C, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-3, , replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-4, TMS1456C, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-5, TMS1371D, replace map.
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☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-7, TMS1452D, replace map.
☐ Add	☐ Replace	☒ Remove	Volume 3, Plate 7-8, TMS1452D, 2 of 2, remove map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-9, TMS1459C, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-10 TMS1770D, replace map.
☐ Add	☒ Replace	☐ Remove	Volume 3, Plate 7-11, GENS1555A, replace map.

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

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

Permittee: PacifiCorp
Mine: Trail Mountain Mine **Permit Number:** C/015/0009
Title: Amendment to Modify the Permit Area for the Trail Mountain Mine in Compliance with State and Federal Regulations, PacifiCorp, Trail Mountain Mine, C/015/0009, Emery County, Utah.

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

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CHAPTER 1

INTRODUCTION AND SUMMARY OF PERMIT APPLICATION

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APPLICATION FOR MINING PERMIT

The application for mining permit is submitted to the State of Utah, Division of Oil Gas and Mining, in accordance with the Utah Coal Mining and Reclamation Act, Title 40, Chapter 10, U.C.A., 1953 (as amended); the applicable rules and regulations adopted thereunder, rules R645 approved ~~April 12, 1990 and September 11, 1992~~ March 2009; Surface Mining Control & Reclamation Act of 1977 (P.L. 95-87), and applicable regulations adopted thereunder (30 C.F.R. 700, et seq.); the Cooperative Agreement between the State of Utah and the United States Secretary of the Interior, and other applicable laws and regulations.

1.1 INTRODUCTION

PacifiCorp's Trail Mountain Mine is located in Cottonwood Canyon, 12 miles west of Orangeville, Utah (See Figure 1-1). A mining and reclamation permit, ACT/015/009, which incorporates the Office of Surface Mining (OSM) permit UT-0017, was issued by the State of Utah, Division of Oil, Gas and Mining (DOGM) to Trail Mountain Coal Company on February 19, 1985. The subsequent permit, ACT/015/009-1, was modified to include the Tract II area on April 30, 1987. A permit transfer from Arch Minerals (Trail Mountain Coal Co.) to Beaver Creek Coal Company (Trail Mountain No. 9 Mine) was approved by DOGM on 11/23/87. A permit transfer from Beaver Creek Coal Company (Trail Mountain No. 9 Mine) to PacifiCorp (Trail Mountain Mine) was approved on 11/13/92. The most up to date permit issued by DOGM (C/015/0009) was issued February 21, 2010.

The following Permit Application will focus on the entire mine which from this time forth will be referred to as the Trail Mountain Mine.

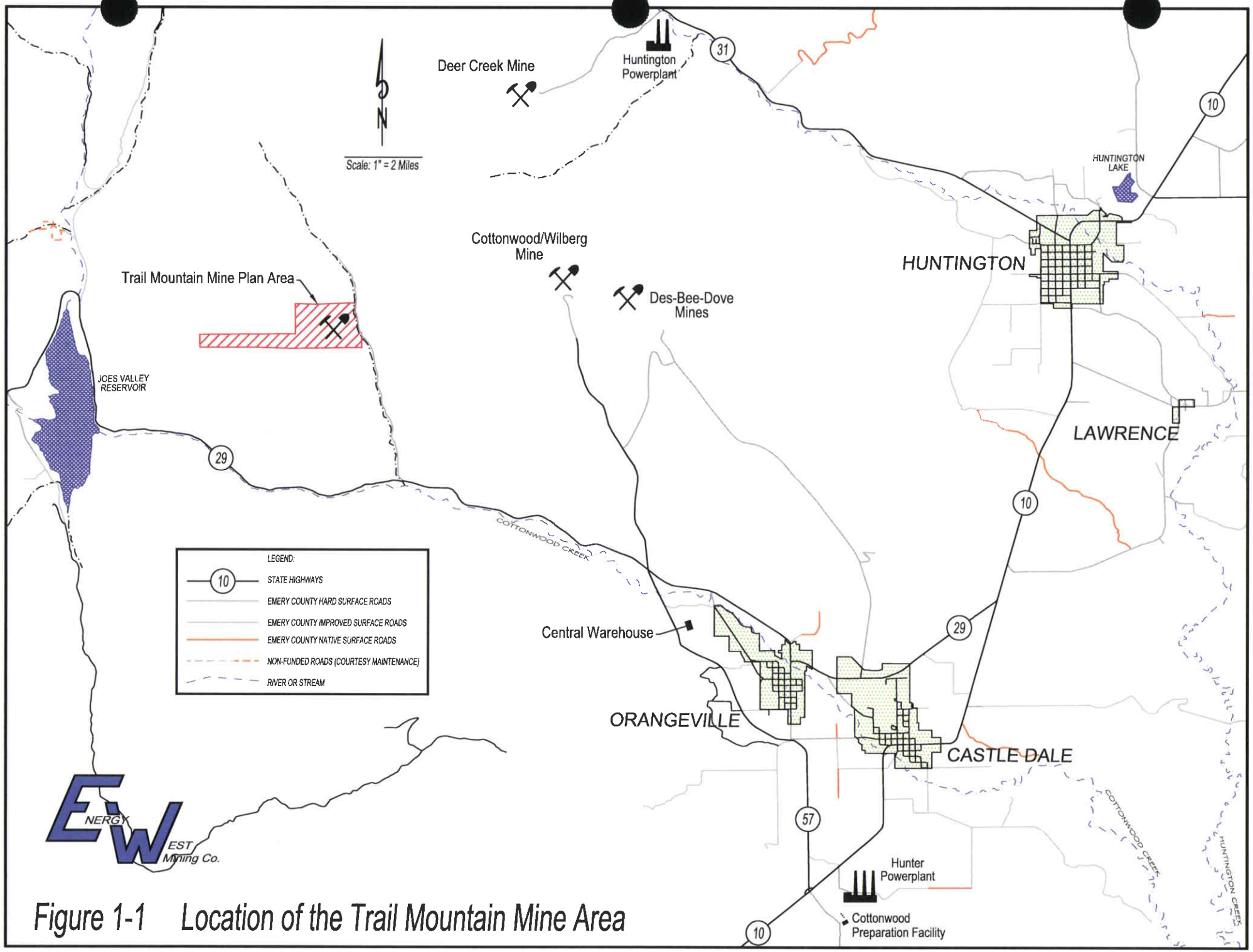

Figure 1-1 Location of the Trail Mountain Mine Area

Figure 1-1

1.2 SOCIOECONOMICS

The Trail Mountain Mine surface facilities are ~~is~~ located in Sections 25, ~~26, 27, 34, and 35 in~~ T.17S, R 6 E., ~~Sections 1, 2, and 3 in T. 18S, R 6 E. and Section 6 in T. 18S , R 7 E.~~, SLB&M, in Emery County, twelve miles west of Orangeville, Utah.

The Trail Mountain Mine~~, at the present time,~~ has been developed to operate~~s~~ with longwalls and continuous miners in the Hiawatha Coal Seam. The Hiawatha seam is the only minable seam in the Trail Mountain Mine area. Trail Mountain Mine can work~~s~~ approximately 220 days per year, three shifts per day, eight hours per shift with two production shifts and one maintenance shift. Historically, annual production from Trail Mountain Mine ~~is~~ has been approximately 3,500,000 to 5,000,000 tons. Annual production is dictated by the demand requirements of the Hunter Power Plant. ~~With current reserves, PacifiCorp projects that the longwalls, continuous miners, employees and production will be in place for the duration of this permit term.~~

~~There will be a maximum of approximately 300 employees working at the Trail Mountain Mine site.~~

1.3 Scope of Operation

The Trail Mountain Mine is an underground coal operation. These operations have historically extended throughout ~~located in~~ Sections 25, 26, 27, 34, ~~and~~ 35, and 36 in Township 17 South, Range 6 East; and Sections 1, 2, and 3 in Township 18 South, Range 6 East; and Section 6 in Township 18 South, Range 7 East, Salt Lake Base and Meridian, Emery County, Utah. The ~~mine is located on~~ underground working covered an area of approximately 3538.98 acres of Federal leases and fee coal lands. However, most of those areas have been relinquished back to the Federal and State agencies. For the current permit and adjacent area acreages and descriptions, refer to the Legal and Financial Volume. ~~Annual production of the mine is approximately 3,500,000 to 5,000,000 tons per year.~~

Underground mining ~~is occurring~~ occurs in the Hiawatha seam of the Blackhawk Formation. Surface facilities, including the offices, bathhouse, shop, storage facilities and tipple are located at the intersection of the coal seam and the canyon floor. Surface facilities occupy approximately ~~10.02~~ 10.39 acres.

1.4 Summary of Environmental Impacts

Similar to many other coal operations along the east front of the Wasatch Plateau, the Trail Mountain Mine is located in a steep walled canyon. Vegetation, soils, geology, hydrology, and wildlife of the mine plan area are typical of the general area.

As mining has been conducted in the area for over 50 years with rather minimal impact to the environmental resources, it is expected that continued operation of the Trail Mountain Mine will also have minimal impact. Impacts are expected to be minimal due to implementation of mining practices which incorporate sound and practical engineering and environmental considerations in the mine planning process.

CHAPTER 2

LEGAL AND FINANCIAL

PacifiCorp
Energy West Mining Company

TRAIL MOUNTAIN MINE

Legal and Financial Information

This application for a mining and/or reclamation permit is submitted to the State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining, in accordance with the Utah Coal Mining and Reclamation Act, Title 40, Chapter 10, U.C.A., 1953 (as amended); the applicable rules and regulations adopted thereunder; the Surface Mining Control & Reclamation Act of 1977, and applicable regulations adopted thereunder (30 CFR 770, et seq.), the Cooperative Agreement between the State of Utah and the United States Secretary of Interior, and other applicable laws and regulations.

R645-301-100 GENERAL CONTENTS

All Legal and Financial Information pertaining to the Trail Mountain Mine is located in the Supplemental Volume entitled:

PacifiCorp Legal and Financial Volume

Cottonwood Mine C/015/0019
Des-Bee-Dove Mine C/015/0017
Deer Creek Mine C/015/0018
Trail Mountain Mine C/015/0009

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OPERATION AND RECLAMATION PLAN

3.1 SCOPE

Chapter 3 sets out the plans that PacifiCorp intends to undertake during the permit term and life of the operation. The chapter is divided into five sections: surface facilities, operation plan, environmental protection, reclamation plan, and bibliography.

PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all mining equipment including; production (longwall and continuous miner), belt haulage and electrical were removed from the mine. Verification of equipment removal was conducted on April 6, 2001 with Bureau of Land Management (Steve Falk) and Division of Oil, Gas and Mining (Pete Hess) participating in the review. A plan to construct permanent seals was submitted to and approved by Mine Safety Health Administration. Sealing of the mine portals was completed on May 1, 2001.

3.2 SURFACE FACILITIES

The Trail Mountain Mine is an existing operation that was started in the 1940's. All surface facilities are in place under an approved mining and reclamation plan C/015/0009.

3.2.1 Site Selection and Preparation

The mine site was selected for its location. Access to the coal seam is facilitated by the intersection at the mine site of the coal outcrop and the canyon floor.

Site preparation consisted of clearing the site, construction of pads and facilities, and development of portals.

3.2.2 Portals

Five portals provide access to the Trail Mountain Mine. One portal located on the corner of the outcrop of Cottonwood Canyon and a small side-drainage canyon is a fan portal. The second portal, 150 feet south of the fan portal, is the main intake and travel portal. The third portal is the belt portal. It is located just to the south of the main portal. The fourth portal is south of the belt portal and is used as a ventilation portal.

A fifth portal has been driven to the outside approximately 1000' south of the fourth portal. This is a ventilation portal, and surfaces just south of the old sealed entry at this location. Complete description of this project is found in Appendix 3-7. (See Plate 3-1 for locations). An old sealed entry is found 500 feet south of the fourth portal (ventilation portal). It is not used in this operation. Trail Mountain Mine went into temporary cessation on May 4, 2001. All portals associated with the Trail Mountain Mine were sealed as specified in 30CFRPart 75.335 (except one (1) opening which was inaccessible, this opening was completely backfilled with non-combustible fill from the surface).

3.2.3 Surface Building and Structures

The buildings and structures associated with the Trail Mountain Mine are shown in Plate 3-1. They consist of an office, bathhouse, shop, power substation, fan control house, coal handling system, explosive magazines, sediment control facilities, and fuel storage tank farm area. The following table describes the tanks within the tank farm area:

	Diesel	Unleaded Gasoline	Emulsion Oil	Calcium Chloride
	15,000 gal.	4,100 gal.	6,300 gal.	500 gal.

* Spill containment and cleanup is outline in the Trail Moutain SPCC Plan.

The office, shop, sub-station, fan control house, fuel storage tank farm area, and sediment controls were all in place prior to 1987. A new bathhouse, coal handling facility, explosive magazines, ventilation portal, and culinary water system were added in late 1990. The main canyon culvert was also extended approximately 300' at that time. After PacifiCorp purchased

the Trail Mountain Mine in 1992, surface modifications have taken place such as, concrete portal liners, new travel portal, new twin fan, new fuel storage area, high pressure water building and tank, relocation of water treatment plant, storage shed, storage dock, modified ROM transfer and a 60" overland tube conveyor. See Appendix 3-4 for the Operation Plan for the structures. Also see Appendices 3-7, 3-8, 3-9, 3-10 and 7-13 for details on the new facilities.

3.2.4 Coal Handling, Processing, Preparation, and Storage

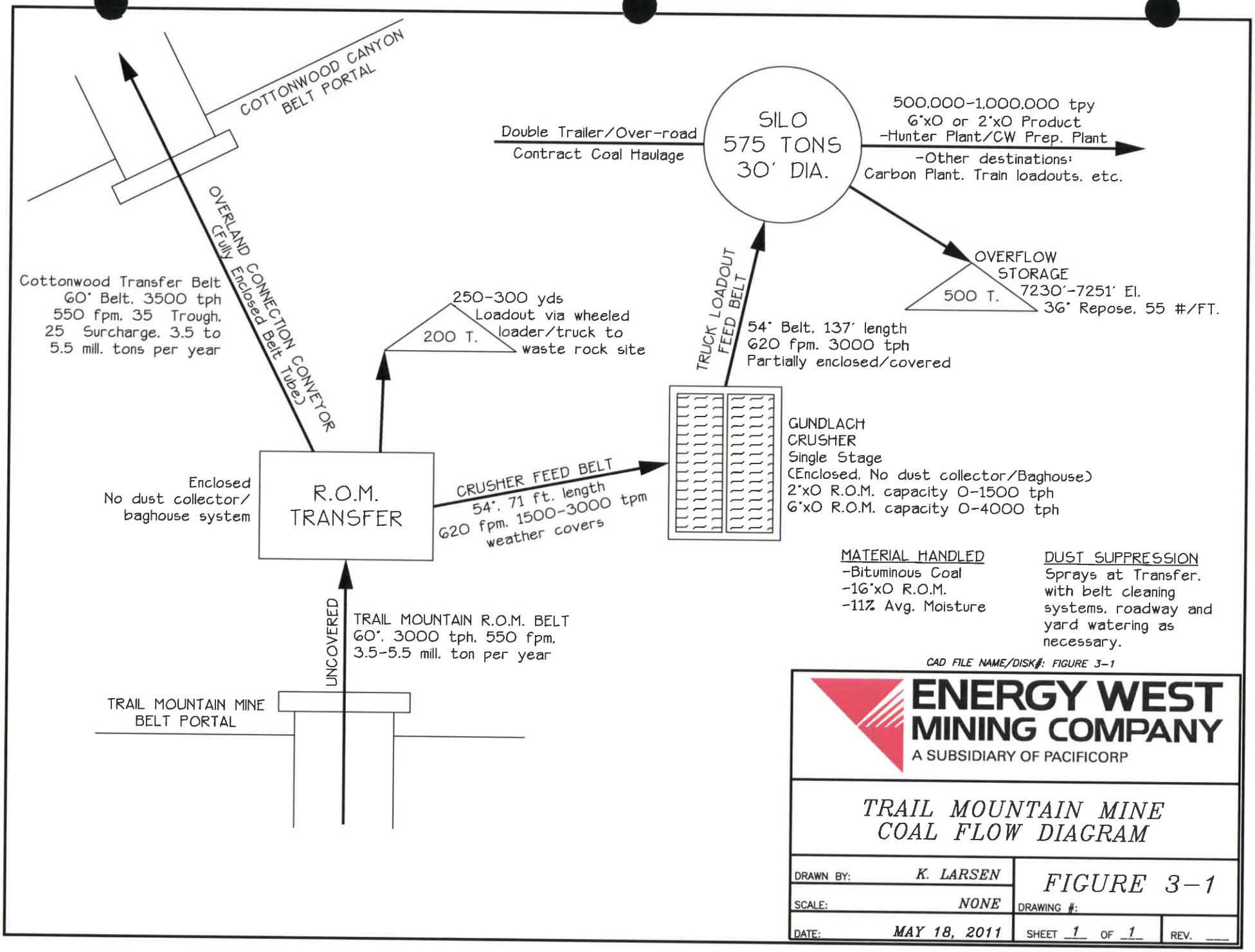
Coal in the Trail Mountain Mine ~~was~~ has been mined by longwalls and continuous miners. The 48 inch section belts transferred coal to the 60 inch main belt. The 60 inch main belt conveyed the coal to the surface where a magnet at the ROM transfer removed metal from the coal stream. The coal could then be shipped on a 60 inch belt to the Cottonwood Mine via the tube conveyor or could be shipped to the 575 ton silo and coal storage area via the crusher and the 54 inch belt. When the coal was shipped to the Cottonwood Mine it was sized from 16" x 0" run of mine to 6" x 0". When the coal was shipped to the Trail Mountain Facilities it passed through a crusher. The crusher at the Trail Mountain Mine has the capability of sizing the coal from 16" x 0" through 2" x 0". The crushed coal was then conveyed to a 575-ton bin where it was loaded by a short belt into on-road trucks for shipment. In the event the crusher failed or the bin was full, coal was diverted by a flop gate into a chute and placed in an open storage pile. Figure 3-1 shows a generalized schematic of the coal handling system. Appendix 3-8 describes further details on the coal handling system. PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all mining equipment including; production (longwall and continuous miner), belt haulage and electrical were removed from the mine. Verification of equipment removal was conducted on April 6, 2001 with Bureau of Land Management (Steve Falk) and Division of Oil, Gas and Mining (Pete Hess) participating in the review. A plan to construct permanent seals was submitted to and approved by Mine Safety Health Administration. Sealing of the mine portals was completed on May 1, 2001.

3.2.5 Power System Transmission Lines, Substation, Mine Feeders

The present utility power is supplied by Utah Power at 25,000 volts, 60 HZ, 3Ø. This incoming line supplies the mine substation located south of the office building. The existing 25,000 volts primary, 12,470 volts secondary, substation rate at 7500 KVA is connected to this transmission line in a delta primary, wye secondary configuration for underground distribution. Underground power was distributed by three (3) 4/0 mine feeder cables at 12,470 volts. At each working section, belt drive location, compressor station, high pressure pump station, etc., a transformer reduces the 12,470 volts to 950/480 machine voltage. As stated previously, PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all electrical equipment was removed from the mine. Verification of equipment removal was conducted on April 6, 2001 with Bureau of Land Management (Steve Falk) and Division of Oil, Gas and Mining (Pete Hess) participating in the review.

A 400 KVA 4160 volt primary, 480 volt secondary transformer supplies power to miscellaneous surface areas (tipple, shop, etc.). The mine office receives power from a pole mounted 480/220/120 transformer.

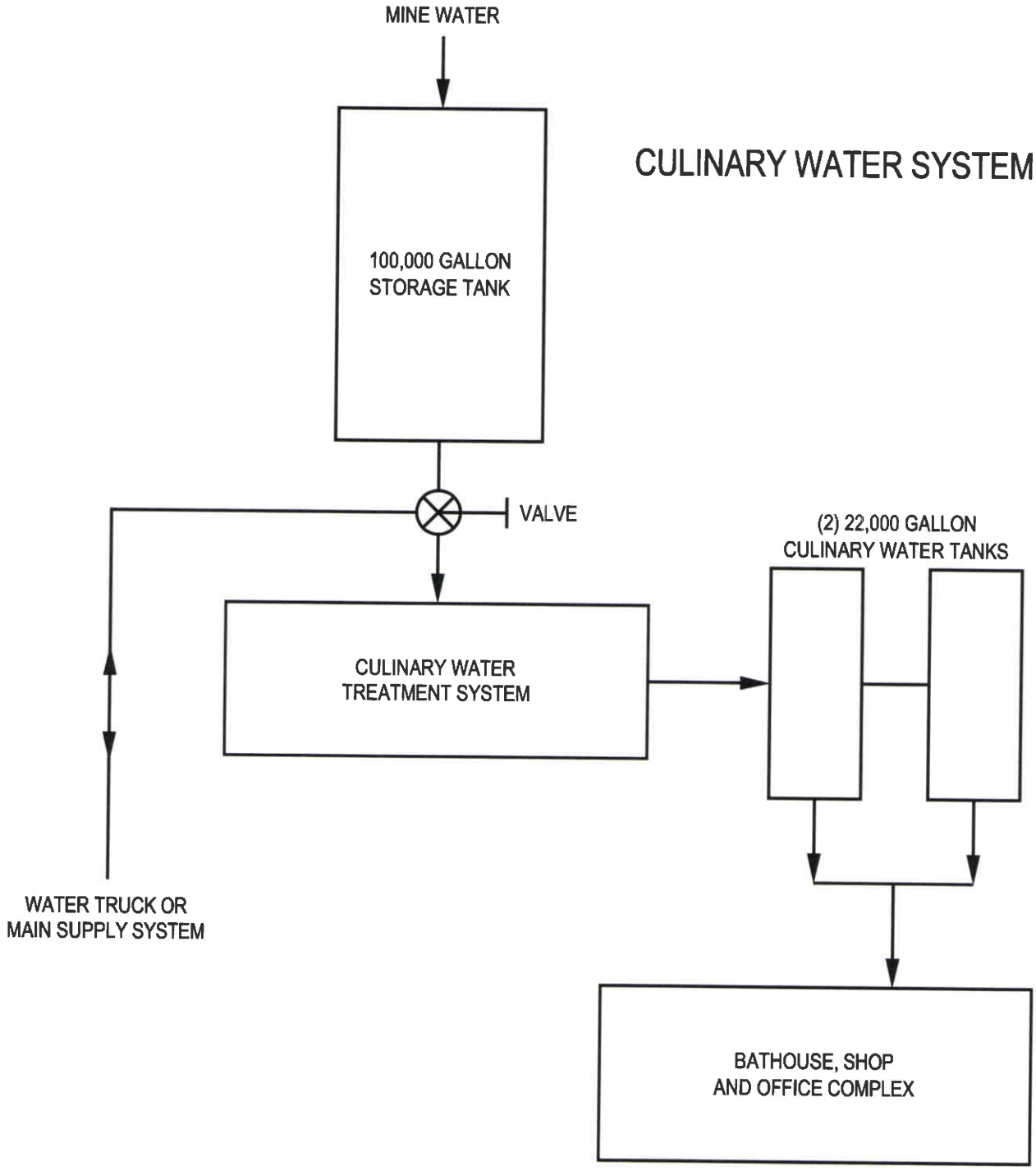
PacifiCorp upgraded the power system on August 5, 1995 which consisted of the following: 1) incoming utility power upgraded by Utah Power to 69,000 volts, 60 HZ, phase 3 Ø, 2) installation of two (2) identical substation transformers (one of which is a standby/backup unit) rated at 10 MVA. These transformers are located southwest of the office building. The primary voltage is 69,000 volts delta connected and the secondary will be 12,470 volts wye connected. The existing 7500 KVA transformer will remain in place for a secondary backup power system. All power from the substation on will remain the same as mentioned above.


COTTONWOOD CANYON BELT PORTAL
OVERLAND CONNECTION CONVEYOR (Fully Enclosed Belt Tube)
Cottonwood Transfer Belt
60" Belt. 3500 tph
550 fpm. 35 Trough.
25 Surcharge. 3.5 to
5.5 mill. tons per year
Double Trailer/Over-road
Contract Coal Haulage
SILO
575 TONS
30' DIA.
500,000-1,000,000 tpy
6"x0 or 2"x0 Product
-Hunter Plant/CW Prep. Plant
-Other destinations:
Carbon Plant. Train loadouts. etc.
OVERFLOW
STORAGE
500 T.
7230'-7251' El.
36" Repose. 55 #/FT.
250-300 yds
Loadout via wheeled
loader/truck to
waste rock site
200 T.
TRUCK LOADOUT FEED BELT
54" Belt. 137' length
620 fpm. 3000 tph
Partially enclosed/covered
GUNDLACH
CRUSHER
Single Stage
(Enclosed. No dust collector/Baghouse)
2"x0 R.O.M. capacity 0-1500 tph
6"x0 R.O.M. capacity 0-4000 tph
Enclosed
No dust collector/
baghouse system
R.O.M.
TRANSFER
CRUSHER FEED BELT
54". 71 ft. length
620 fpm. 1500-3000 tpm
weather covers
UNCOVERED
TRAIL MOUNTAIN R.O.M. BELT
60". 3000 tph. 550 fpm.
3.5-5.5 mill. ton per year
TRAIL MOUNTAIN MINE
BELT PORTAL
MATERIAL HANDLED
-Bituminous Coal
-16"x0 R.O.M.
-11% Avg. Moisture
DUST SUPPRESSION
Sprays at Transfer.
with belt cleaning
systems. roadway and
yard watering as
necessary.
CAD FILE NAME/DISK#: FIGURE 3-1
ENERGY WEST
MINING COMPANY
A SUBSIDIARY OF PACIFICORP
TRAIL MOUNTAIN MINE
COAL FLOW DIAGRAM
DRAWN BY: K. LARSEN
SCALE: NONE
DATE: MAY 18, 2011
FIGURE 3-1
DRAWING #:
SHEET 1 OF 1
REV.

3.2.6 Water Supply System

The culinary water supply for the Trail Mountain Mine was drawn from underground mine water. Mine water was collected in an underground sump and skimmed of oil. Approximately 10,000 gallons per day of this water was prepared in the treatment plant for use as potable water. Some mine water was used for wash down. Water was treated on the surface at a maximum rate of 10 gpm and then stored in two 22,000 gallon capacity fresh water storage tanks. The treatment plant and process are approved by the State of Utah, Department of Environmental Quality, Division of Drinking Water. A schematic of the water system is shown in Figure 3-2. This system is connected to the mine water system at the belt portal location. If the need should develop for filling water trucks, or supplying alternate water to the mine or surface system, this water would be drawn from the 2-22,000 gallon surface storage tanks referred to in Figure 3-2.

Refer to Figure 3-3 for typical underground water system schematic. As stated previously, PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all of mine de-watering system was removed from the mine, except for a six (6) inch steel supply line (9066') and a twelve (12) inch PVC de-watering line (9066), refer to Plate 3-8 for details. Verification of equipment removal was conducted on April 6, 2001 with Bureau of Land Management (Steve Falk) and Division of Oil, Gas and Mining (Pete Hess) participating in the review.



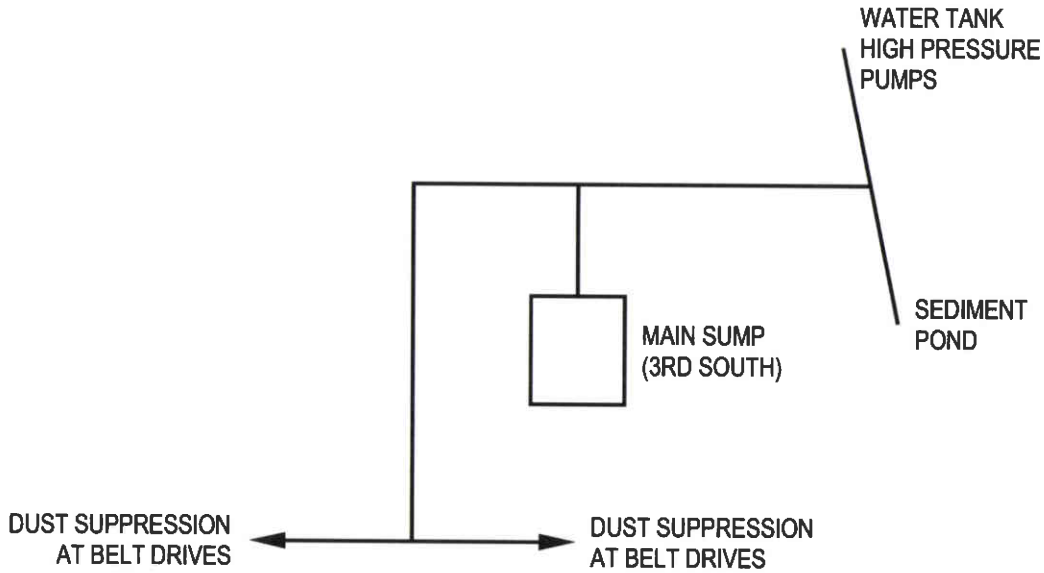
CAD FILE NAME/DISK#: FIGURE 3-2

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
CULINARY WATER SYSTEM

DRAWN BY: K. LARSEN	FIGURE 3-2	
SCALE: NONE	DRAWING #:	
DATE: MAY 18, 2011	SHEET 1 OF 1	REV. ___

TYPICAL UNDERGROUND WATER SYSTEM



CAD FILE NAME/DISK#: FIGURE 3-3

ENERGY WEST
MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
TYP. UNDERGROUND WATER SYSTEM

DRAWN BY:	K. LARSEN	FIGURE 3-3	
SCALE:	NONE	DRAWING #:	
DATE:	MAY 13, 2011	SHEET 1 OF 1	REV. ___

3.2.7 Sewage System

The septic system for the Trail Mountain Facility was approved by the Division of Water Quality on March 17, 1995. The system is somewhat unique in that the grey-water portion of the sewage is separated and eventually enters the Cottonwood Mine sewage system and leach field for final disposal.

The sewage enters one of three septic tanks, depending on location, removing the majority of solids from the sewage. The grey-water then flows, via an 8 inch line, to the collection/pumping station, located south of the rock dust silo. The collection/pumping station contains a 10,000 gallon holding tank and two pumps. From this station, the grey-water is pumped under the county road and into the Cottonwood Mine belt entry, through a 4 inch buried line. The 4 inch line follows an underground workings route to the Cottonwood Mine sewage system and leach field.

In the case of emergencies, the system can dispose of the sewage grey-water at the collection/pumping station by haulage truck to the Cottonwood Mine sewage system or to another facility licensed to accept septic tank waste. For short term emergencies, the storage capacity of the collection tank can handle more than the 24 hour sewage waste generation of the mine.

3.2.8 Water Diversion Structures

Three water diversion structures are maintained at the Trail Mountain Mine. A concrete curb and gutter running north-south through the facilities area diverts water from the disturbed area into the sediment pond. A 66 inch culvert that has been placed in Cottonwood Creek has allowed the facilities pad area to be extended, and also allow Cottonwood Creek to flow beneath the mining operation. The length of this culvert is approximately 1,900 feet, extending from below the sedimentation pond to the property boundary north of the bathhouse (see Chapter 7). A 48 inch culvert located at the mouth of the side canyon, just west of the fan portal, diverts water from the canyon directly into the 66 inch culvert of Cottonwood Creek without crossing the mine property (see Chapter 7).

3.2.9 Sedimentation Control Structures and Water Treatment Facilities

A sedimentation pond is located on the southern end of the permit area. All surface water that has crossed the mine property is diverted to this structure. Mine water can also be periodically pumped directly into the sediment pond. The pond contains a 48 inch emergency overflow culvert and a decant pipe, located on the east side of the pond (see Chapter 7).

3.2.10 Transportation, Roads, Parking Areas

Access to the mine is provided by county road, Forest Service road, and private right-of-way along Cottonwood Creek. The road is paved and used by mine personnel private vehicles, coal trucks for haulage, and by the public for access to the upper canyon.

The facilities area of the Trail Mountain Mine is accessed from a county road (see Plate 3-1 and Appendix 3-5). The facilities area consists of: coal storage areas, parking lot, supply yard, equipment and material storage areas. ~~Only one~~ No primary road exists on the mine site. ~~This is a coal haulage road, and is shown on Plates 3-1A and 3-1B of this plan. The road is approximately 905' long, 20' wide, and is on a grade of approximately 7%. The primary road has been designed and constructed to meet the requirements of R645-301-534.300 and R645-301-742.420, and is certified as such.~~ Controlled pad and ~~road~~ parking lot drainage ~~crosses the haul road~~ flow across the facility and enters the curb and gutter system which reports to the sediment pond.

All ~~other~~ roads on the site are ancillary roads. These include the upper terrace access road, portal access road and the tipple access road. Ancillary roads are used on an occasional, as needed basis only, and therefore are classed as ancillary roads according to R645-301-527.100.

All roads are constructed and maintained to minimize disturbance and adverse impacts on fish, wildlife and related environmental values. Roads will be maintained to meet applicable design standards throughout their use, by blading, watering and resurfacing as necessary. Roads are also located, designed, constructed, reconstructed, used, maintained, and will be reclaimed so as

to prevent or control damage to public or private property; using non-acid or non-toxic forming substances in surfacing; and will have a static safety factor of 1.3 for all embankments.

The mining operation is conducted within 100 feet of a public (county owned) road. The requirements of R645-103-234 and protection of the public interests are met in the following ways:

(1) This is a pre-law operation, and has always been located adjacent to the public road which provides access to the public and private lands in and beyond Cottonwood Canyon;

(2) The road has been upgraded and paved through cooperation of the Mine, Emery County Road Department, and the US Forest Service;

(3) Necessary approvals for the road have been obtained from the authorities with jurisdiction over the public road through the cooperative effort of upgrading and paving of the road to the mine site. Necessary encroachment permits have been obtained from Emery County for accesses to and from the public road.

(4) Required public notices concerning the operation have been posted in local newspapers for Permit Approvals, Permit Renewals and Permit Transfers.

3.2.11 Total Area for Surface Disturbance During the Permit Term

The total area of present surface disturbance at the Trail Mountain Mine plan area, including all compliance activities (sediment pond, upper and lower culvert installation, borrow area, portal areas, and surface pad extension), is ~~10.69~~ 10.39 acres (see Plate 3-1).

3.2.12 Detailed Construction Schedule

Construction of basic facilities was completed prior to the 1977 Act. Sediment controls, including the sediment pond, curb/gutter and bypass culverts were completed in late 1987. Minor system enhancements were completed from 1987 through the fall of 1990. Construction details and schedules for these projects are found in Appendices 7-13, 3-9, 3-7, 3-8, 3-9 and 3-10 respectively.

3.3 OPERATION PLAN

During the operational phase of Trail Mountain, the mine employed a maximum of approximately 300 people to conduct its underground mining activities. Underground mining consisted of longwall retreat mining and continuous miner development. Production ranged from 3,500,000 to 5,000,000 tons per year. Coal was conveyed to the surface at approximately 16" x 0" run of mine product. It was then conveyed through an overland tube conveyor to the Cottonwood Mine Portal on the opposite canyon side. It then traveled underground until it reached the Cottonwood Mine Facility, where it was crushed to a 6" x 0" run of mine product before shipment via triple trailers to the Hunter Power Plant. Coal could also be crushed to 6" x 0" run of mine product at the existing Trail Mountain Mine facilities and shipped via double trailers.

3.3.1 Mining Plans

The layout of the mine ~~and areas extracted~~ are shown on Plate 3-2. Historically, first and second mining occurred in the areas within the southern end of Trail Mountain. Those area have been mined out and the leases have been relinquished backed to the federal agencies who manage the surface and subsurface resources.

3.3.1.1 Orientation and Multiple Seam Considerations

As shown on Plate 3-2, the original mains were driven north to south, with panels being driven off the mains in an east to west orientation. This mine layout was developed prior to the Act. Longwall section development was in an east to west orientation. Surface exploration drilling, along with geologic mapping, have been utilized to document the coal resources of the Trail Mountain area. (United States Department of the Interior. Memorandum Resource Recovery Report, March 25, 1982, states that the Hiawatha is the only coal seam of current economic interest known to occur in the vicinity of the Trail Mountain tract). Coal resources above the Hiawatha seam to date show the seams to be thin, discontinuous and of poor

quality[1]. PacifiCorp has no plans to mine the upper coal seam (see Appendix 3-2).

3.3.1.2 Portals, Shafts, and Slopes

Portals have been previously addressed in the Surface Facilities section. Shafts and slopes do not apply to this property because of the geology of the coal seam.

3.3.1.3 Mining Methods – Continuous Miner and Longwall

No Room and pillar mining is anticipated during the permit term. Longwall retreat mining with continuous miner development of mains, longwall panels and gate road development will be employed during the life of the mine.

Continuous Mining Units

The principal purpose of continuous mining units at the Trail Mountain Minewas mine development; i.e., section development of mainline entries, longwall sections - gate road development and longwall section - setup/bleeder entry development.

Figure 3-4 illustrates the basic configuration of a typical five entry main, consisting of 20 ft. wide entries and crosscuts driven on 80 ft. x 100 ft. pillar centers. The pillars created measure a nominal 60 ft. wide x 80 ft. long; a size which has been developed for sufficient support of the main entries and overlying strata.

Figure 3-4 also illustrates the basic configuration of a typical two-entry longwall panel development, consisting of 20 ft. wide entries and crosscuts driven on 50 ft. x 100 ft. pillar centers. Bleeder and setup development consists of 20 ft. wide entries and

[1] US Department of the interior memorandum March 25, 1982 page 2, paragraph 4, page 3 paragraph 2 and US Department of Interior memorandum May 10, 1982 page 1, paragraph 3.

crosscuts on nominal 50 ft. x 100 ft. pillar centers. With the retreating longwall mining system, all panel development work is accomplished by continuous mining units prior to longwall equipment installation.

Longwall Mining System

The predominant mining method at the Trail Mountain Mine will be longwall retreat mining. This method, as practiced by PacifiCorp, presents the safest and most efficient underground resource recovery mining method available.

As referenced above, the two-entry gate road system is developed with 20 ft. wide entries and crosscuts on nominal 50 ft. x 100 ft. pillar centers. This type of "yield pillar" configuration is designed so that the gate road support pillars will gradually yield as longwall retreat proceeds from panel to panel. The purpose of this design is to prevent the buildup of unrelieved stresses within the pillar; stresses which, in the past have resulted in pillar failure and the accompanying danger to personnel and property.

Figure 3-5 illustrates the basic configuration of a retreating longwall system. After gate road entries are driven to the extent of the longwall panel length, on both sides of the longwall face, setup and bleeder entries are driven to connect the gate roads. A solid coal barrier is left between the setup and bleeder entries, sized based on geologic parameters, to insure long term bleeder stability.

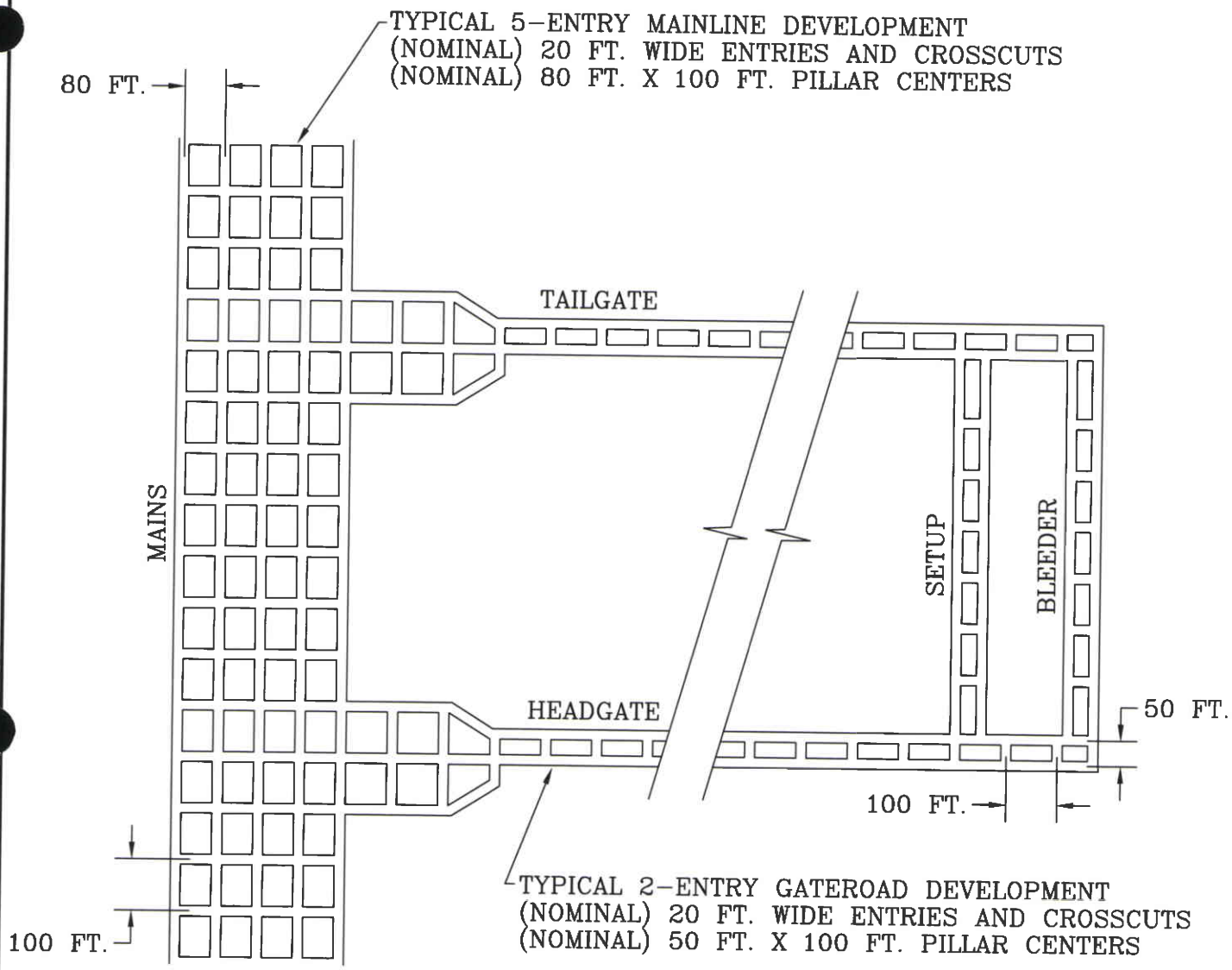


FIGURE 3-4
TYPICAL MAIN ENTRY AND PANEL DEVELOPMENT
AT THE TRAIL MOUNTAIN MINE

CAD FILE NAME/DISK#: FIGURE 3-4

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
TYPICAL MAIN ENTRY AND PANEL DEVELOPMENT

DRAWN BY:	K. LARSEN	FIGURE 3-4	
SCALE:	NONE	DRAWING #:	
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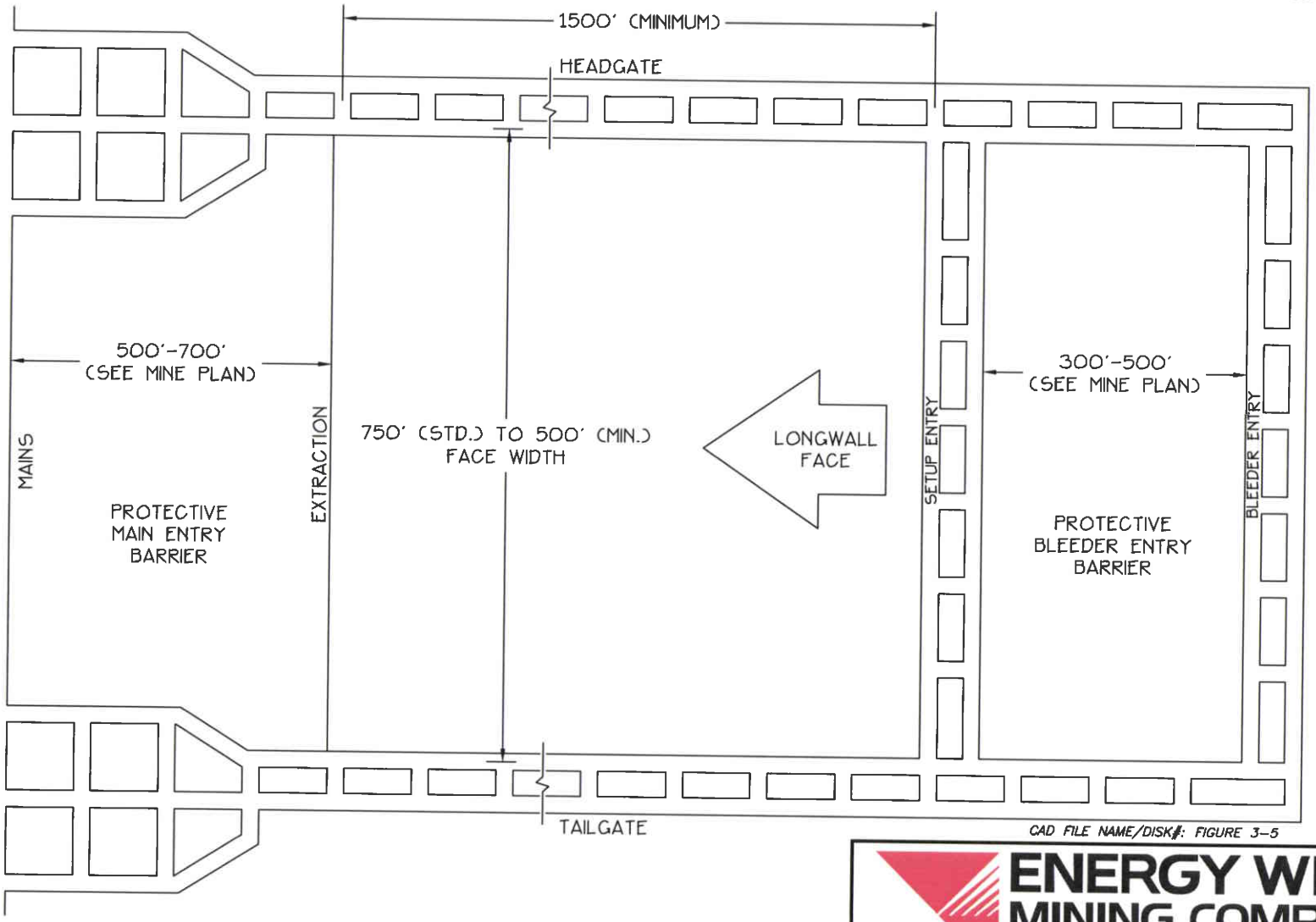


CAD FILE NAME/DISK#: FIGURE 3-5

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
TYPICAL LONGWALL PANEL RETREAT

DRAWN BY:	K. LARSEN	FIGURE 3-5	
SCALE:	NONE	DRAWING #:	
DATE:	MAY 13, 2011	SHEET 1 OF 1	REV. ___

FIGURE 3-5
TYPICAL LONGWALL PANEL RETREAT AS USED AT THE TRAIL MOUNTAIN MINE

Long wall face width, depending on geologic parameters of the coal deposit, varies from 500 ft. to 1000 ft. wide. Standard face width is 750 ft., from center-line of headgate entry to center-line setup entry, the longwall begins retreat mining; from the setup entry, "outby" toward the mainline entries. A protection barrier is left between the mined out longwall panel (extraction face) and the mainline entries; sized to insure long term mainline entry stability.

Panels are designed within the mining area, bounded by natural and imposed limits with varying degrees of confidence as to location and extent. Lease boundaries are definitely located and invariable in the short term. Faults may vary somewhat from currently assumed locations. Geologic limitations; such as seam splits, channel scours, spars, stratigraphic thinning, etc. may affect the mining limits by varying hundreds of feet as information becomes available and as mining recovery economics and practicality are further refined. Underground burned areas, from a practical point of view, are indeterminate prior to mining. Regulatory mining restrictions, such as escarpment protection barriers and perennial stream buffer zones further confine the mining extent.

Within the limitation of the above boundaries, longwall panel length and width are maximized to the extent possible due to the economic cost and production loss associated with longwall moves. The minimum panel length, currently considered economical, is 1500 ft. of recoverable reserves. The minimum panel width, currently considered economical, is 500 ft. of recoverable reserve.

3.3.1.4 Projected Mine Development – Mains, Submains, Panels, Etc.

The plan of mine development projected for the Trail Mountain Mine is shown in Plate 3-2.

After the mine acquisition, development of the fifth left mains and third west mains continued. The panels east of fifth left main were driven west to east and the panels west off the fifth left mains were driven east to west. Panel sequence for extraction was from second east to fifth east and tenth right to first right. The

coal lease of these underground areas (with exception of 3rd West) were partially relinquished effective January 9, 2009.

3.3.1.5 Retreat Mining

Panel extraction commenced once the fifth left mains were developed below the second east panel and the second east tailgate, headgate and bleeders were completed. All coal leases containing panels off the 5th Left mains below 1st Right have been relinquished effective January 9, 2009.

3.3.1.6 Roof Control, Ventilation, Water Systems, Dust Suppression, Dewatering, Electrical, Etc.

Plans for roof control, ventilation, water system, dust suppression, etc., have been submitted to MSHA and are on file at the MSHA district office; Mine Safety and health Administration, P.O. Box 25367, Denver Colorado 80225.

3.3.2 Barrier Pillars

PacifiCorp will be leaving barrier pillars around oil and gas wells, surface structures and streams, property boundaries, and outcrops. These barriers will protect the recovery of the resource and the environment. A complete discussion of barrier pillars is presented in Chapter 12, Geotechnical.

3.3.2.1 Protection of Oil and Gas Wells

Presently no oil or gas wells exist ~~on the property~~ in the areas of underground mining activities. However, should any well be drilled, a barrier of 300 feet in diameter will be left unless a variance from MSHA is obtained to leave a smaller barrier.

3.3.2.2 Protection of Surface Structures and Streams

No surface structures or perennial stream beds will be undermined during the life of the mine.

3.3.2.3

~~Property~~ Lease, permit, and adjacent area boundaries are designated in accordance with both State and Federal mining regulations.

3.3.2.4 Outcrop Protection

Outcrop protection is provided by leaving a minimum barrier of 200' between mine workings and the coal outcrop. One exception to the above is the eastern most entry of the 3-entry system driven north and northeast to the ventilation portal. The eastern entry is located within the 200' barrier for a distance of approximately 240' and at no time comes closer than 160' from the outcrop. The 3-entries were necessary to meet MSHA regulations and provide adequate ventilation. The location of this variance is in the side canyon approximately 1700' south of the forth portal, and is shown on Figure A-3-7-2, Appendix 3-7. Outcrop protection is further addressed in the geotechnical chapter of this permit.

3.3.3 Conservation of Coal Resources

3.3.3.1 Projected Maximum Recovery

~~Maximum~~ There is no amount of coal recoverable from the historical (relinquished) Trail Mountain ~~property~~ mine plan area. ~~is approximately 1,026,564 tons.~~ The approved Resource Recovery and Protection Plan (R2P2) shows approximately 1.7 million tons of recoverable coal in the current Logical Mining Unit (LMU). Table 3-1 shows the breakdown of coal recovery (refer to Plate 3-2: Mining Plan and Plate 3-3: Areas of Coal Recovery).

3.3.3.2 Justification of Non-Recovery

It is estimated that resource recovery rate of 80% or better can be obtained within the proposed longwall panels. Overall minable reserve recovery for the Trail Mountain Mine is estimated at 60%. The maximum amount of economically

recoverable coal will be extracted with the exception of protective coal, which must be left in place to ensure the integrity of the mine. This protective coal falls into two categories. The two categories are barrier coal and strata control coal. (See appendix 12-1).

TABLE 3-1
RECOVERABLE RESERVES

LEASE AREA	IN-PLACE TONS	RECOVERABLE TONS	ACTUAL PRODUCED TONS By EWMC (as of 6/1/2001)	TOTAL PRODUCED TONS BY ALL
*Federal Lease UTU-49332	4,361,837	~~874,126~~ 1,239,936	~~14,127~~ 22,917	1,509,199
Federal Lease U-082996	276,954	~~49,179~~ 56,718	0	219,755
**Federal Lease U-64375	45,404,832	~~103,259~~ 433,363	~~21,514,932~~ 21,508,007	21,938,730
TOTAL TONS	50,043,623	~~1,026,564~~ 1,730,017	21,530,924	23,667,684
TOTAL REMAINING TONS		~~1,026,564~~ 1,730,017		

*Partial relinquishment of 261.47 acres effective January 9, 2009.
**Partial relinquishment of 2504.01 acres effective January 9, 2009.

3.3.3.3 Access to Future Reserves

There are two (2) areas currently designated as future reserve access points at the Trail Mountain Mine: 1) 3rd West Mains and 2) ~~North Mains~~ 1st West Mains.

Access to future western reserves will be by western extension of the existing 3rd West Mains, running east/west, at the northern boundary of Federal Lease U-64375. Access to future ~~northern~~ longwall and piller reserves will be by ~~northern extension of~~ the existing ~~North Mains~~ 1st West mains, running ~~north/south~~

east/west, at the ~~western~~ eastern boundary of Federal Lease U-49332 from the western boundary of the Pacificorp fee lands. Solid coal barrier pillars are to be left on either side of these main entries to ensure their long term stability for access.

Mining plans and projections may change between permit submittal and actual mining. However, PacifiCorp will commit to conducting operations in accordance with accepted industry practices, so as to achieve maximum economic recovery as specified by 43 CFR 3482.1 (c) (7). PacifiCorp also commits to professional cooperation with the Bureau of Land Management (BLM) in achieving MER on all Federal Coal leases.

3.3.4 Equipment Section

3.3.4.1 Surface Equipment

As stated previously, PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all surface equipment was transferred to remaining operations.

3.3.4.2 Underground Equipment

The permit and adjacent area will be mined with longwall and continuous mining equipment.

Typical continuous mining equipment is;

Section Scoops	Continuous Miners
Section Scoops	Shuttle Cars
Roof Bolters	Face Fans
Feeder Beakers	PowerCenters

Feeder Beakers	Welders
Rock Dusters	ShopCar

Typical longwall mining equipment is;

Longwall Shearer	Power Center
Face Conveyor	Electrical Controls
Longwall Supports	Emulsion pumps
Stageloader	Shield Movers
Crusher	Pod
Scoop/Forklift	Rock
Shop Car	Duster

Typical general mine equipment is;

Diesel Scoops	Conveyors
Diesel Trucks	Belt Storage
Diesel Pickups	Road Grader
Mantrips	Dozer
Trailers	Power Centers
Compressors	Section Switches
Welders	Submersible Pumps
Belt Drives	Rock Dusters

3.3.5 Mine Safety, Fire Protection, and Security

During mining operations, PacifiCorp maintained a safety department at the mine site. All new miners were trained in basic first aid before working underground. Once each year all miners were given an eight hour retraining class. All working sections maintained the necessary first aid items including stretchers, bandages, splints, tourniquets, etc. Fire protection-All machines underground are equipped with a fire suppression system. On portable non-water machines a

dry-type chemical system is used. On machines equipped with water, a deluge system or a dry type chemical system is maintained. All belt drives and takeups were equipped with these systems. An adequate supply of rock dust and a dry-type fire extinguisher were located at belt drives transformers, oil storage areas, and other dangerous areas in and around the mine.

Surface Fire Fighting Plan

In compliance with Title 30 Code of Federal Regulations Part 77.215(j) and R645-301-528.323.1 the following plan to extinguish surface fires and coal waste fires will be adhered to in the advent of a fire.

I. PREVENTION

A. All warning and non-smoking signs will be observed by employees and visitors to the mine.

B. Accumulations of oil, grease, diesel fuel, coal fines and other combustibles will not be allowed to accumulate as a possible source of fire.

C. Coal stock piles and coal waste piles will be closely monitored to detect symptoms of a possible fire.

D. All employees will be trained as to their responsibilities in the advent of a fire.

II. EXTINGUISHING SURFACE FIRES

A. In the advent of a fire on the surface area of the coal mine all employees both in the mine and on the surface will be notified immediately, all persons will be accounted for and evacuated to a safe place.

B. The local fire departments, mine rescue teams and other trained and qualified persons experienced in fighting fires will be notified immediately, equipped with the appropriate equipment, and the proper action will be taken to extinguish the fire.

C. Measures will be taken to prevent unauthorized persons interfering or being endangered by the fire and the methods to extinguish the fire.

D. All necessary controls available to prevent adverse impact on water quality and other environmental concerns will be incorporated immediately.

III. REPORTING PROCEDURES

A. All necessary reports and accident claims will be completed and filed with the appropriate state and/or federal agency.

Security - Trail Mountain Mine operated three 10 hour shifts, 4 days a week. Security is maintained with company personnel during operating hours. During off shift hours, a security system is installed that notifies the Sheriffs Department.

3.3.5.1 Signs

Required signs are maintained at the Trail Mountain Mine. Property boundary signs are posted along the access to the mine property and at the northern and southern property boundaries. Buffer zone signs are maintained on the west side of Cottonwood Creek (see Figure 3-6).

All signs will be maintained throughout the operational life of the facility, or at least as long as they are required and relevant. Permit ID signs and required perimeter markers will be maintained until bond release.

3.3.5.2 Fences and Gates

Approximately 2,000 feet of chain link fence, containing three access gates, is maintained at the Trail Mountain Mine site. This chain link fence also serves to alienate the east boundaries of the surface disturbance of the mine plan area. Identification and perimeter signs are installed on the fence. Also, a substation is

enclosed by a seven foot chain link fence with a three strand barb-wire cap and two gates.

INSERT FIGURE 3-6

TRAIL MOUNTAIN MINE
OWNER: PACIFICORP

1407 WEST NORTH TEMPLE
SUITE 310
SALT LAKE CITY, UTAH 84116
PHONE: 801-220-4612

UTAH PERMIT NO. C/015/0009
U.P.D.E.S. PERMIT NO. UT-0023728

OPERATOR: ENERGY WEST MINING CO.

P.O. BOX 310
HUNTINGTON, UTAH 84528
PHONE: 435-687-9821

MSHA ID. NO. 42-01211

BUFFER ZONE
DO NOT DISTURB

PERIMETER
DO NOT DISTURB

CAD FILE NAME/DISK#: FIGURE 3-6

ENERGY WEST
MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
IDENTIFICATION SIGNS

DRAWN BY:	K. LARSEN	FIGURE 3-6	
SCALE:	NONE	DRAWING #:	
DATE:	MAY 18, 2011	SHEET 1 OF 1	REV. ___

3.3.5.3 Facilities – Coal Stockpiles, Refuse Piles, Coal Seams

~~Coal stockpiles –~~ Coal ~~is~~ conveyed from the mine ~~and~~ is transferred via a tube conveyor to the Cottonwood Mine or to a 575-ton storage bin at the Trail Mountain Mine. In the event of a system failure or if the bin is full, coal is diverted and stockpiled north of the bin. The size of this pile will vary greatly depending on conditions; however, extreme dimensions are approximately 300' by 150'. This pile is recovered by front-end loaders which place the coal back into the handling system going to the loadout bin. All runoff from the stockpile, as well as other coal handling facilities, is directed to the sediment pond. All conveyors are covered, and water sprays are used as necessary to reduce fugitive dust emissions. There are no refuse piles at this mine site. Any coal refuse or waste generated will be hauled to the approved Cottonwood/Wilberg Waste Rock disposal area.

3.3.5.4 Explosive – Storage and Handling

Storage - Explosives and caps are stored in separate MSHA approved explosive magazines. The magazines are of approved steel construction. The doors are so constructed to prevent easy access and tampering with the locking mechanisms. All magazines are properly electrically grounded. The magazines are located as required to provide added security. Locations of the magazines are shown on Plate 3-1.

Handling - All materials are transported in an approved boxes separated into two compartments with a divider. These boxes are then carried on trailers and diesel powered tractors.

Use - Explosives are primarily used underground. Underground explosives are used to blast rock to make room for overcasts, belt drives, and at other areas where extra height is required. Other uses underground include grading of roadways and to facilitate cleaning up of unintentional roof falls, etc.

When surface blasting is done it will be in accordance with the applicable R645-301-524 rules. Surface blasting will be done by a certified blaster under the Utah Blaster Certification Program. This certification will be carried by the blaster or kept on file during the blasting operations. At least one other person will be present during the blast. Proper training will be given to crews associated with the blast or explosive handling. The blast design will be prepared by a certified blaster and will be submitted to the Division at a time before the blast.

No blasts will utilize more than five (5) pounds of blasting agent or explosives detonated in any eight-millisecond period; therefore a pre-blast survey is not required.

When using explosives on the surface, all blasting will be done between sunrise and sunset. No residents are located within a half mile radius of the permit area.

Blasting signs will meet R645-301-521.200 and be conspicuously placed along the edge of the blasting area or road entrance. Signs will be placed at all accessible entrances to the blasting area from public roads stating " Warning! Explosives in Use". Access control will be exercised preventing unauthorized access to the blasting area. No structures exist within a distance that would present concerns from air blast or ground vibration.

Blasting records will be kept on file for review by the Division. Blasting records will comply with R645-301-524.700. Exhibit 1 shows a typical report which will be compiled to satisfy these requirements.

Energy West Mining Co.

Blasting Record

(R645-301-524.700)

(R645-301-524.711) Name of Operator Conducting Blast.

_____
(Company Name)

_____
(Address)

_____
(City - State)

_____
(Telephone Number)

(R645-301-524.712) Location, Date and Time of Blast.

_____
(Mine)

_____
(Location)

_____
(Date) (Time of Blast)

(R645-301-524.713) Name, Signature, and Certification Number of Blaster in Charge.

_____
(Name)

_____
(Signature) (Certification Number)

(R645-301-524.720) Direction and Distance, in feet from the nearest blast hole to the nearest dwelling, public building, school, church, community or institutional building outside the permit area.

_____
(Direction)

_____
(Distance in Feet)

(R645-301-524.730) Weather Conditions.

_____
(Wind Direction & Approximate Velocity)

(R645-301-524.741) Type of Material Blasted

_____
(Material)

(R645-301-524.742) Sketchs of the blast pattern including number of holes, burden, spacing, decks, and delay pattern.

(R645-301-524.743) Diameter and Depth of Holes.

(R645-301-524.744) Types of Explosives Used.

(R645-301-524.745) Total Weight of Explosives Used.

_____

(R645-301-524.746) Maximum Weight of Explosives Detonated in an Eight (8) Millisecond Period.

_____

(R645-301-524.747) Initiation System.

_____

(R645-301-524.748) Type and Length of Stemming.

_____

(R645-301-524.749) Mats or Other Protection Used.

_____

(R645-301-524.750) Seismographic Records and Airblast Information.

_____

(Type of instrument, sensitivity, Certification of Calibration)

_____

(Reading)

_____
(Location & Distance)

_____
(Name of Person Taking Reading)

(Name of Person & Firm Analyzing Reading)

(R645-301-524.760) Reason for Unscheduled Blast.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

3.3.6 Operation Schedule

Trail Mountain Mine operated with longwalls and continuous miners for development of longwall panels and mains. The longwall operated two shifts a day or two machine shifts and the continuous miners operated two shifts a day or four machine shifts.

3.3.6.1 Annual Production Per Year for the Permit Term

The Trail Mountain Mine produced approximately 3,500,000 to 5,000,000 tons per year until notifying the Division of temporary cessation on May 4, 2001.

3.3.6.2 Operating Schedule – Days, Shifts

The Trail Mountain Mine operated as follows:

208-240 days/year
3 shifts/day
10 hours/shift
2 production shift/day
1 maintenance shift/day
2 continuous miner shifts/production shift
1 longwall shift/production shift

This schedule is a general outline and subject to change.

3.3.6.3 Operation Employment

During coal mining operations, Trail Mountain Mine employed approximately 300 people, 66 salaried and 234 hourly employees.

3.3.6.4 Temporary Cessation

Whenever it is known that operations are to be temporarily ceased for more than 30 days, PacifiCorp shall submit to the Division a notice of intention to cease or abandon the operations, in accordance with R645-301-515.320 and to MSHA standards.

This notice will describe mitigation measures to be employed in accordance with the terms and conditions of the permit approval, such as a statement of the number of surface acres involved in the cessation, extent of sub-surface strata, prior reclamation efforts accomplished on the property, and identification of all backfilling, regarding, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

If underground openings are to remain inactive for a period greater than 90 days, such openings will be temporarily closed off from access. Such closures will consist of a chain link or other substantial wire mesh fabric fence placed over the portals to prevent public access while allowing for air flow. Locked gates may be installed in the portal to allow for mine inspection.

PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all mining equipment including; production (longwall and continuous miner), belt haulage and electrical were removed from the mine. Verification of equipment removal was conducted on April 6, 2001 with Bureau of Land Management (Steve Falk) and Division of Oil, Gas and Mining (Pete Hess) participating in the review. A plan to construct permanent seals was submitted to and approved by Mine Safety Health Administration. Sealing of the mine portals was completed on May 1, 2001.

3.3.7 Mine Plan Area

The mine plan area of the Trail Mountain Mine is outlined in Figure 3-10. A total of ~~3,538.98~~ 773.50 acres are included in the mine plan area.

3.3.7.1 Projected Mining By Year

The mine development and projected mining schedule are shown on Plate 3-2. As shown, additional permit terms will be required.

3.3.7.2 Acreage and Delineation

As described in Chapter II, the mine plan area consists of approximately ~~3538.98~~ 773.50 acres of fee and federal land. Federal land consists of three leases totaling ~~3485.48~~ 720.00 acres. The remainder of the mine plan area (53.50 acres) is fee land held by PacifiCorp.

3.4 ENVIRONMENTAL PROTECTION

This section addresses the environmental concerns and impact of the mining operation. The aspects of land-use, cultural resources, hydrology, soils, vegetation, fish and wildlife, air quality, subsidence, and waste disposal are addressed. Each aspect is addressed in terms of projected impacts and control measures. For those aspects that warrant it (hydrology, vegetation, fish and wildlife, air quality, and subsidence) a discussion of monitoring procedures are also included.

3.4.1 Preservation of Land Use

The post-mining land-uses of the Trail Mountain Mine, owned by PacifiCorp, are anticipated to remain the same as the pre-mining land-uses of grazing, wildlife habitat and recreation. A full discussion of these uses area found in Chapter ~~IV~~ 4.

Following completion of the mining operations, the mine site will be reclaimed and revegetated. The area will be graded, scarified, and seeded before the next growing season. The seed mixtures to be used are discussed in Chapter 9 and Section 3.5 of this Chapter.

The site will receive treatments of fertilizer and additional seedings until it is determined stable for the bond release period.

During low run off, the stream diversion culvert will be removed and the stream channel will be restored. No reclamation work is contemplated on the access road to the site. This road has varied ownership (county, federal and private) and provides access for Forest Service and private land up Cottonwood Canyon.

Lands held by PacifiCorp are classified by Emery County, the US Forest Service, and the State of Utah as a recreation, forestry and mining area.

3.4.1.1 Projected Impacts of Mining on Current and Future Land Use

Within the permit area, approximately ~~10.69~~ 10.39 acres has been disturbed by surface facilities of the mine. This disturbance has affected the soils and vegetation of the area. The effect on vegetation is temporary and will be eliminated by revegetation of the disturbed area. Wildlife loss of habitat in the riparian community has occurred. The acreage is small; however, the riparian area is considered to be of critical value to the overall density of terrestrial wildlife. Continued operation of the surface facilities will have no significant impact on the local wildlife. A full discussion can be found in Chapter 10.

3.4.1.2 Control Measures to Mitigate Impacts

Careful planning of the reclamation activities will help to minimize the impact of the Trail Mountain Mine on land-use. Return of the mine site to the premining land-use of grazing, wildlife, and recreation at the conclusion of mining will be accomplished according to the steps outlined below:

1) Seal all large diameter openings with non-combustible material.
2) Remove all surface structures, equipment and facilities, followed by trash and debris removal.

3) Re-establishment of drainages and grading and contouring of disturbed areas.

4) Establishment of a permanent diverse vegetative cover suited to the post-mining land-use on all affected land will be done as soon as practicable following reclamation.

Contemporaneous reclamation of those areas not needed during operation will take place throughout the life of the mine. All other areas (building and equipment sites, storage and parking areas) will not be reclaimed until the conclusion of mining.

3.4.2 Protection of Cultural Resources

No public parks or historical sites worthy of preservation have been found in the ~~mine plan~~ permit or adjacent areas. Chapter 5 contains a discussion of cultural resources.

3.4.2.1 Projected Impacts of Mining on Cultural Resources

Two types of projected impacts exist on cultural resources as a result of mining. Direct impacts are a direct result of mine development or operation. Indirect impacts result from activities that are not directly associated with the mine development or operation.

Any effect of the Trail Mountain Mine on cultural resources probably occurred during development. No cultural resources have been found in the area of the mine, therefore no direct impacts from any future development are likely to occur.

The inventory indicated two CRRS:2 sites located in the lower canyon. These sites are vulnerable to indirect impact from vandalism. During development of the canyon road by Emery County, measures to avoid impact were observed.

3.4.2.2 Control Measures to Mitigate Impacts

Measures used to mitigate the effects of the mining operation on cultural resources ~~must be~~ were implemented prior to any disturbance associated with the ~~proposed~~ development. Once construction ~~has begun~~ began, only avoidance procedures ~~are~~ were the only feasible mitigation measures. ~~Although in a narrow canyon, avoidance is sometimes impractical.~~

During 1985 and 1986, the proposed construction and realignment of three miles of county road from Highway 29 to the Trail Mountain Mine site was completed. Two CRRS: sites were located and all engineer and design work conducted by the Emery County Engineering departments was done in such a manner as to avoid these cultural sites.

In 1990, additional facilities were constructed at the mine site. Construction details, as well as control measures to mitigate impacts for each of these projects are described in Appendices 7-13, 3-9, 3-7, 3-8, 3-9 and 3-10 respectively.

The Trail Mountain Mine site contains no know cultural resources that are liable to be impacted by the continued operation or compliance construction.

3.4.3 Protection of Hydrologic Balance

The Trail Mountain Mine operates all mine activities in such a way as to minimize potential impacts to surface and groundwater resources. Drainage control facilities will contain and hold the required volume for the specified period for water flowing through or originating in the disturbed area. Suspended material will be allowed to settle in a sediment control pond before discharge into natural drainages. Such discharges will be in accordance with an approved UPDES Discharge Permit.

Sedimentation production from the berm outslope to the creek has been greatly reduced by a portion of the creek being placed in a bypass culvert. This bypass culvert was installed in 1983, and extended some 300' to the north in 1990 and 70' further north in 1996.

All mine portals are designed in accordance with R645-301-731.521. This ensures that water will not discharge from the portal by gravity flow. Upon reclamation of the mine, portal seals will be placed in all entries as soon as underground reclamation has been completed. PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001. In preparation of temporary cessation, all mining equipment including; production (longwall and continuous miner), belt haulage and electrical were removed from the mine. Verification of equipment removal was conducted on April 6, 2001 with Bureau of Land Management (Steve Falk) and Division of Oil, Gas and Mining (Pete Hess) participating in the review. A plan to construct permanent seals was submitted to and approved by Mine Safety Health Administration. Sealing of the mine portals was completed on May 1, 2001.

3.4.3.1 Projected Impacts of Mining on the Groundwater Hydrologic Balance

Geology controls movement of groundwater. Because of the low permeability of the consolidated sedimentary rocks in the Trail Mountain area, groundwater is primarily through fractures. Data has been collected from numerous coal exploration drill holes, from within the mine workings, from surface drainages, and from spring surveys. The data have identified two separate isolated aquifer systems ~~on~~ within the vicinity of the Trail Mountain ~~property~~ mine; the first is localized perched water tables in the North Horn Formation, and the second is a combination of localized perched water tables in the Blackhawk Formation and the Starpoint Sandstone which exhibits some limited potential as a regional aquifer. The generally discontinuous nature of the Blackhawk and apparent low specific yield (Cordova, 1964) indicates that the water yielding capabilities of the Blackhawk are only of local importance. A complete description of the

hydrologic/geologic resources of the Trail Mountain area is discussed in Chapter 7, section 7.1, and Appendix 7-10 (PHC).

Groundwater Quantity

Mining occurs in the lower Blackhawk Formation, which consists of interbedded layers of sandstone and mudstone separated by mineable and non-minable coal seams. The sandstonebeds-fluvial channel systems are generally massive while the mudstone layers are fine textured and have a tendency to swell when wet and decompose into an impervious clay. Because of the aquiclude formed by mudstone layers in the North Horn Formation, recharge to the Blackhawk Formation is limited, even along major fault systems. Due to the lithologic characteristics of the Blackhawk, both vertical and horizontal migration is constricted. Refer to Chapter 7, Hydrology, for a detailed discussion of the Hydrologic Balance.

The interception of groundwater varies and is dependent on several factors. One of the moist significant is that when the mine enters virgin country, a significant amount of water is liberated. In virtually all cases the amount of water which flows into the mine exceeds the recharge and, in time, the water inflow decreases in volume. If new areas are not mined, the discharge from the mine will decrease accordingly.

Ground Water Quality

Groundwater chemical quality is very good in strata above the Mancos Shale. The USGS reports a range in dissolved solids from 50 to 750 mg/l for samples from 140 springs in the region issuing from the Starpoint Sandstone and overlying formations (Danielson et al., 1981). Danielson et al. (1981) identified the regional trends of decreasing water quality from north to south and west to east across the Wasatch Plateau. Waters

percolation through the underlying mancos Shale quickly deteriorate, with total dissolved solids concentrations frequently exceeding 3000 mg/l.

The quality also decreases vertically because of the influence of marine sediments along with the trend of decreasing quality from north to south. The predominant dissolved chemical constituents of the groundwater from both surface springs and samples collected in the mine are calcium, bicarbonate, magnesium and sulfate. Concentrations of magnesium are normally about one-half the concentration of calcium. Sulfate concentrations are typically higher in water from springs issuing from the Starpoint-Blackhawk aquifer zone or confined aquifers intersected by mine workings. As mentioned earlier water quality degrades from the north to the south and also vertically.

3.4.3.2 Control Measures to Mitigate Impacts

Although the analysis of the overburden samples tested has shown that no toxic or hazardous materials are present, groundwater quality will be protected by handling earth materials and runoff in a manner that minimizes infiltration to the groundwater system. Mine water encountered in the mine, which is not needed for dust suppression or mining, will be discharged according to stipulations in UPDES Permit No. UT- 0023728.

State and federal regulations (R645-301-727) require that an alternate water supply be provided to replace any water source disrupted, degraded, or diminished by the mining operation. Though the mining operation is unlikely to affect the water supplies in the Trail Mountain area, PacifiCorp will provide this alternate supply if needed.

In the unlikely event of mining adversely affecting a water source, PacifiCorp will review and select an alternative after considering all possibilities of each site-specific circumstance.

3.4.3.3 Groundwater Monitoring Plan

Representative springs (see Chapter 7) will be monitored in accordance with the monitoring program. In addition, data will be collected from within the mine.

3.4.3.4 Projected Impacts of Mining on the Surface Water Hydrologic Balance

As has been previously mentioned, the occurrence and quality of water in any region is highly controlled by geology. The PacifiCorp adjacent and permit area is located in the headwater region of the San Rafael River Basin. The surface drainage system of the permit area is within the Cottonwood Creek drainage system.

Quantity

Cottonwood Creek above Straight Canyon drains approximately 21.9 square miles. The average channel gradient of Cottonwood Creek above Straight Canyon is 300 feet/mile (5.7 percent). Only a short period of record (October 1978 to present is available for the USGS stream gaging station (09324200) on Cottonwood Creek above Straight Canyon. Danielson et al. (1981) estimate the average annual precipitation to be on the order of twenty two (22) inches, or 26,000 acre-feet, on the Cottonwood Creek drainage above Straight Canyon. Danielson et al. (1981) also estimate that only two percent of the precipitation on Cottonwood Creek above Straight Canyon leaves the basin as stream flow compared to thirty percent for Huntington Creek above Huntington. The suggested reasons for the wide difference in percent of precipitation contributing to stream flow are: 1) Cottonwood Creek Basin has a greater portion of area with southern exposure with more gradual slopes than

Huntington Creek Basin and 2) possible subsurface movement of water through fractures associated with Joe's Valley Fault. About seventy percent of the total discharge at the Cottonwood Creek station above Straight Canyon for the water year 1979 occurred during the snow melt period (April-July).

Sixty years of data are available for the gaging station on Cottonwood Creek near Orangeville (9324500). The drainage area above Orangeville contributing to Cottonwood Creek is approximately 208 square miles. Cottonwood Creek has an average discharge near Orangeville of about ninety-five (95) cfs, or 69,000 acre-feet per year. The maximum and minimum discharges of record on Cottonwood Creek near Orangeville are 7,220 cfs (August 1, 1964) and 1.2 cfs (April 8, 1966), respectively.

The mine adjacent and permit area is drained by minor drainage systems associated with Cottonwood Canyon Creek. Cottonwood Canyon Creek is a major drainage system which borders the eastern limit of the Trail Mountain ~~permit~~ mine plan area. Based on data collected by PacifiCorp, (see 1992 Annual Hydrologic Report) Cottonwood Canyon Creek is an ephemeral stream from its headwaters to the northeast quarter of Section 24 Township 17 South, Range 6 East and intermittent from that point to its confluence with Cottonwood Creek at Straight Canyon. During periods of drought, flow in Cottonwood Canyon Creek is limited to flow emanating from the alluvial deposits at the intersection with Roans Canyon. From the intersection with Roans Canyon to Section 36 the stream loses water to alluvial deposits. The drainage is dry from Section 36 to Section 6 except during spring runoff which normally occurs from late April through June or during precipitation events. Flow in the channel re-emerges in Section 6 and continues to the confluence with Cottonwood Canyon at Straight Canyon.

The quality of flow from the headwaters of the San Raffle River Basin is excellent. However, this quality rapidly deteriorates downstream as streams cross shale formations and receive irrigation return flow from Mancos-derived soils. The impact of the mining on this system will be quite limited.

The existence of runoff and sediment control structures should minimize the potential for degradation of the quality of stream waters due to runoff from disturbed areas of the Trail Mountain Mine. The construction and upgrading of surface facilities utilized in conjunction with the Trail Mountain Mine (yard areas, road, etc.) ~~will~~ may result in temporary increases in the suspended sediment concentration of the adjacent stream. However, because of the regulatory requirement that sediment control be provided for all areas of surface disturbance, concentrations should be quickly normalized.

3.4.3.5 Mitigation and Control Plans

Runoff from all disturbed areas will be passed through sediment control facilities, as discussed earlier in this report. Any discharge from facilities will be monitored in accordance with UPDES permit standards and state and federal regulations.

The effects of the mining operation on the surface water system will be analyzed through the surface water monitoring plan described in Chapter 7. In the unlikely event that monitoring shows that the surface water system is being adversely affected by mining activities, additional steps will be taken to rectify the situation in consultation with state and federal regulatory agencies.

3.4.3.6 Surface Water Monitoring Plan

An ongoing hydrologic monitoring program will be conducted at each of the stations shown in Figure 7-9. Stations have been established to monitor water quality and quantity above and below the mine plan area.

3.4.4 Preservation of Soil Resources

The Trail Mountain Mine site is a previously disturbed site. Topsoil resources were not protected during development activities from 1948 to 1967. A small amount of topsoil has been removed and stockpiled from the more recent channel/culvert construction. In the event of any future disturbances, soil resources will be protected. Protection will involve the removal, stockpiling and stabilizing of soils suitable for reclamation. Suitability will be determined by analyses of soil samples.

3.4.4.1 Projected Impacts of Mining on Soil Resources

Little soil exists on the presently disturbed mine site. What soil existed prior to commencement of mining activities has long been buried by construction of the pads and buildings.

A small pile of topsoil has been stored just northwest of the fan portal area. This material was salvaged prior to the recent installation of the 48" culvert in the side canyon. The topsoil pile has been marked and reseeded according to requirements.

The remaining ~~surficial~~ surface soil materials are being compacted and mixed with crushed coal and coal fines. Operation and maintenance of equipment ~~contributes~~ could potentially contribute oil, gasoline and diesel fuel to the soil in some places.

3.4.4.2 Control Measures to Mitigate Impacts

As only limited amounts of soil remain on the disturbed site due to previous disturbance and no further disturbances are proposed, few, if any, mitigation measures can be implemented.

In the event future disturbances of operations uncover or encounter salvageable soils, PacifiCorp will remove, stockpile and stabilize the soils for use in future reclamation work.

Testing is planned to determine if the ~~surficial~~ surface soil materials can be used for revegetation work. Historic plots were set up on the mine site in cooperation with the regulatory agency to determine the feasibility of using the existing material for revegetation.

In 1984, a test plot area was installed just north of the bathhouse at the Trail Mountain Mine site. For a complete description of this test plot and record of yearly sampling, please refer to Chapter 9.

3.4.5 Protection of Vegetative Resources

The mine site was disturbed during development activities from 1948-1967. As such no vegetative protection activities were implemented during development of the mine site. Future disturbances will require verification that threatened and endangered species do not exist on the area of proposed disturbance. If any threatened and endangered species are found, the appropriate authorities will be contacted.

3.4.5.1 Projected Impacts of Mining on Vegetative Resources

The mine has been in existence since 1948 and development work since that time has removed or covered vegetative resources. Impact has been to portions of the riparian and grassland-shrub communities. The extent of impact is not great due to the limited areal extent of the disturbance.

3.4.5.2 Mitigating Measures to be Employed to Reduce Impacts to Vegetative Resources

As previously mentioned, the mine site was disturbed during development activities for 1948-1967. Disturbance of the vegetative resources has already occurred. Any further disturbance will require the verification that threatened and endangered species do not exist on the proposed site. If any threatened and endangered species are found, the appropriate authorities will be contacted

3.4.5.3 Monitoring Procedures – Reference Areas and Revegetation

Revegetation of the disturbed area will be undertaken following the completion of the mining activities. Success of the revegetation activities will be determined yearly through quantitative and qualitative data. The vegetation test plot methods and design that were used are described in Chapter 9.

3.4.6 Protection of Fish and Wildlife

The presence of wildlife in the mine plan area indicates their adaptability to the impacts of the mine. As a result, the overall impacts to wildlife are expected to be very minor. In addition, PacifiCorp is committed to practical mitigation of adverse effects of construction and maintenance of the mine operation.

3.4.6.1 Projected Impacts of Mining on Fish and Wildlife

The known impacts of mining on fish and wildlife resources are many and varied according to the type, location, and age of the mine and technology used to remove the coal. Additionally the floral and faunal components in the mining area determine the resultant impact. It is desirable that environmental protection be accomplished during all aspects of the life of the mine from construction through final reclamation, but the degree of environmental protection is often difficult to determine. This is particularly true in cases where mining operations have been functioning for many years prior to serious environmental awareness

and new improved standards of protection. Such mining operations do not have the benefit of modern sites, design, construction, and technology and have often already impacted the environmental resources such that continued operation will not be a serious additional consequence.

Continued operation of Trail Mountain Mine will continue to have the same affect on the fish and wildlife resources in the area; therefore consideration of these affects is warranted. Reclamation also needs to be considered since discontinuation of the Trail Mountain operation would potentially facilitate a return of the habitat to its "normal state". The impacts of concern that have and could result in perturbations to the environment and ultimately relate to the stability of fish and wildlife in the area of concern are directly related to: (1) surface disturbance, (2) loss of habitat, (3) noise and (4) human activity. Both aquatic and terrestrial habitats are of concern since the portals, loading facilities and haul roads occupy riparian habitat adjacent to a small stream, and the mine underlies a variety of terrestrial communities that are considered of high interest to various management agencies because these species are of economic or recreational value.

3.4.6.2 Mitigating Measures to be Employed to Protect Fish and Wildlife

PacifiCorp will perform the following mitigation measures in order to minimize disturbances and impacts on wildlife and their habitats that could be impacted during continued operation of the mine. The mitigating measures will meet the requirements of R645-301-322 and will be consistent with the performance standards of R645-301-358.

PacifiCorp will make significant efforts to educate all employees associated with their on-site mine operation to the intricate values of the wildlife resources within

the mine plan permit and adjacent areas. High interest species, critical habitats and critical life history periods will be emphasized.

The company will maintain the relative inaccessibility of the mine plan area.

Discharge of firearms by employees will be prohibited on company controlled property during working hours.

In winter a portion of the mine plan area, particularly the canyon bottom along the stream and haul and access road is inhabited by mule deer, and the potential is present for road strikes and harassment when the animals are in a weakened energy state due to snow and cold. These impacts need to be reduced. Drivers will be informed of the concerns for protection of wildlife, and encouraged to reduce speed in the canyon between November 1 and May 15 when mule deer are abundant.

PacifiCorp will take precautions to keep all forms of coal or other sediments generated by operation of the mine from inadvertently entering the stream.

Since the major area of concern in introduction of sediments into the stream is the portal and load-out facilities immediately adjacent to the stream, the company has put the stream into a bypass culvert. This will prevent sediment input. This was done in consultation with the appropriate management agency to alleviate the problem. The main canyon culvert was extended approximately 300' upstream in late 1990. This extension impacted approximately 0.21 acres of riparian habitat. As mitigation for this removal of riparian area, 20 small rock check dams were installed in the lower portion of Cottonwood Creek to enhance water retention and possible fish survival. This mitigation was performed in accordance with approval from DWR. Details on location and installation of these structures (as well as the culvert extension) are found in Appendix 7-13 of this MRP. All

wildlife habitats will be maintained or improved if disturbed. This will be done by using native or other vegetation approved for reclamation or habitat improvement. No new actions will be undertaken that compromise wildlife or their use areas without prior approval by the appropriate management or regulatory agency.

3.4.6.3 Monitoring Procedures

There are few species that will be seriously impacted by the proposed actions. There are no identified active aeries being occupied by high interest species of raptors, nor any readily accessible reproductive sites for game species that are critical to perpetuation of the species. However, should raptors, moose or any threatened or endangered species subsequently move into or be found in the mine plan area, appropriate UDOGM, UDWR and USWS personnel will be notified and mutually agreed upon monitoring instituted.

The mitigation action planned is such that it will require little to no monitoring, but enforcement by company officials and management or law enforcement personnel will be necessary. An exception might be the activities planned to reduce sediment loads in the stream. This is covered by the surface water monitoring program.

3.4.7 Protection of Air Quality

3.4.7.1 Projected Impacts of Mining Operations on Air Quality

The Trail Mountain mining operation has some affect on the air quality of Cottonwood Canyon. Dust production by the mining operation is the main contribution. The areas that are the highest producers of dust are coal haulage down canyon from the mine, coal handling, and surface winds over the disturbed area.

3.4.7.2 Mitigating Measures to be Employed to Control Air Quality

Several practices are incorporated in the operations of the mine to protect the air quality in the mine vicinity. Protection of the air quality is mainly accomplished by reduction of dust production by the mine operations. Practices used to reduce dust production are:

1) Periodic watering, scraping, and compaction of coal loading area, and paving of the coal haulage road.
2) Wetting of coal during handling activities.
3) Keeping the size of the disturbed area to a minimum.
4) Revegetation of disturbed areas as soon as practicable.

3.4.7.3 Air Quality Monitoring Plans

Plans to monitor the air quality in the vicinity of the Trail Mountain Mine have not been considered or incorporated in the mining and reclamation plan. The affect on air quality by the mine will be minimal due to the limited area and the mitigation measures incorporated in the operation.

3.4.8 Subsidence Control Plan

The subsidence monitoring requirements were first imposed by the 211 US Geological Survey regulations. Later with the formation of the Office of Surface Mining and the realignment of the USGS responsibilities subsidence monitoring became the authority of OSM. Chapter 11 describes in detail the Applicant's plan to ensure minimal environmental impacts from mine induced subsidence.

3.4.8.1 Projected Subsidence Effects

Several surveys have been conducted over the area presently controlled by PacifiCorp which may be affected by mining operations. Timber, wildlife, grazing areas, water seeps and springs are the renewable resources occurring within the permit and adjacent areas. There are no oil and gas wells, pipelines, utility structures or high power lines that will be affected by any surface subsidence within the permit or adjacent boundary. No buildings or dwellings have been constructed on any surface that will be subject to subsidence within the mine plan area. Timber growth and wildlife should not be affected as regional subsidence is anticipated rather than cracking the surface due to the thickness of overburden. Seeps and springs within ~~and adjacent to the~~ mine permit and adjacent areas have been surveyed and are currently being monitored (refer to Chapter 7 - Hydrology, for a description of groundwater resources and monitoring).

3.4.8.2 Control Measures to Mitigate Impacts

Should material damage be incurred by any structure despite the planned subsidence damage prevention measures, the applicant will repair the damage caused by subsidence resulting from the applicant's activities or will compensate the owner of the structure for such damage.

Any roads, fences, stock ponds, earth dams, or water troughs which are materially damaged by subsidence will be repaired and regraded to restore them to their pre-subsidence usefulness.

Should significant subsidence impacts occur, the applicant will restore, those surface lands that were reduced in reasonably foreseeable use as a result of such subsidence to a condition capable of supporting reasonably foreseeable uses that such lands were capable of supporting before subsidence.

In order to restore any land affected by Applicant's mining operations to a condition capable of supporting the current and postmining land uses stated herein, the Applicant will replace water determined to have been lost or adversely affected as a result of Applicant's mining operations if such loss or adverse impact occurs prior to lease relinquishment. The water will be replaced from an alternate source in sufficient quantity and quality to maintain the current and postmining land uses as stated herein.

During the course of regular monitoring activities required by the permit, or as the Applicant otherwise acquires knowledge, the Applicant will advise the Division of the loss or adverse occurrence discussed above, within ten working days of having determined that it has occurred. Within ten working days after the Division notifies Applicant in writing, that it has determined that the water loss is the result of the Applicant's mining operation, the Applicant will meet with the Division to determine if a plan for replacement is necessary and, if so, establish a schedule for submittal of a plan to replace the affected water. Upon acceptance of the plan by the Division, the plan shall be implemented. Applicant reserves the right to appeal the Division's water loss determinations as well as the proposed plan and schedule for water replacement as provided by Utah Code Ann. 40-10-22(3)(a).

PUBLIC NOTICE

Applicant will not mine in any areas that would allow potential subsidence effects (as indicated by the angle of draw) to affect any area outside of the lease, ~~and~~ permit or adjacent boundary until this constraint on coal recovery is resolved by the OSM and the BLM Branch of Solid Minerals or permission is granted by the adjacent surface agencies.

A mining schedule which details the area in which mining is to take place and the planned date of the mining activity will be submitted to the affected surface owners, following approval of the application and prior to mining.

3.4.8.3 Subsidence Monitoring

The subsidence monitoring at Trail Mountain Mine prior to PacifiCorp's acquisition (November 1992) was conducted using conventional surveying methods. No where did monitoring identify subsidence greater than a few tenths of feet. PacifiCorp will use aerial photogrammetric survey methods and annual helicopter reconnaissance flights to monitor subsidence. Baseline photography was conducted August 6, 1993 including color infrared (See Chapter 11 for details on subsidence monitoring.)

3.4.8.4 Slides and Other Damage

At any time a slide occurs which may have a potential adverse effect on public property, health, safety or the environment, PacifiCorp shall notify the Division by the fastest available means and comply with remedial measures required by the Division.

3.4.9 Waste Disposal

PacifiCorp has contracted with local firms to handle and remove all non-coal wastes from the mine site. Non-coal wastes and materials that constitute a potential fire hazard are hauled by a licensed contractor to a state approved waste disposal area.

Waste oil is collected in drums in a designated storage area at the site. A licensed contractor will pick up this material on a regular basis and remove it for recycling purposes.

It should be noted that during a spoils survey, it was pointed out that there was no evidence of toxic materials at this mine site (Mr. George Cook, SCS). Prior to reclamation, all spoil material will be re-sampled in a comprehensive random method and retested in accordance to UDOGM

guidelines for acid and/or toxic forming potential. Sampling will be conducted per Appendix 9-1, Attachment C.

Sediment pond waste is removed from the site and disposed of in the Cottonwood/Wilberg Waste Rock Site in accordance with the Division's "Sediment Pond Clean out Procedural Guidelines". The Division will be notified and procedures will be approved prior to the start of pond cleaning activities. Previous analyses of this material have shown it to be non-toxic and non-acid forming. The sediment material will be sampled and tested according to Division "Title V Coal, Program Policy for Disposal of Sediment Pond Waste".

Underground development waste is kept underground as allowed by MSHA regulations. In the event this material must be brought out of the mine, it will be hauled to the Cottonwood/Wilberg Waste Rock Site and disposed of in an approved manner.

There are no coal washing facilities at this mine site; therefore, there are no refuse or other permanent waste piles located at the Trail Mountain Mine. The waste rock temporary storage area is shown on Plate 3-1.

3.5 RECLAMATION PLAN

Reclamation of the Trail Mountain Mine site will be accomplished in an efficient and environmentally sound manner. This section addresses the reclamation plans for the site. Seven areas are addressed: contemporaneous reclamation, soil removal and storage, final abandonment, backfilling and grading, revegetation, reclamation schedule, and reclamation cost estimate.

3.5.1 Contemporaneous Reclamation

The mine disturbs only a minimal area for surface facilities. Most of the disturbed area will be needed for operations during the life of the mine. Those areas not needed (outslopes, embankments, etc.) will be prepared, seeded with quick growing species and mulched to provide

protection and cover to reduce erosion. (See following section, "Contemporaneous Reclamation Plan for Trail Mountain Mine" and Plate 3-9 for location of contemporaneous reclamation.)

CONTEMPORANEOUS RECLAMATION PLAN FOR TRAIL MOUNTAIN MINE

PLANTING DATES - Seeding will normally occur in October or November of the year, depending on climatic conditions at that time. This will allow little chance of premature germination, increase the likelihood of hibernation (or inactivity) of most seed predators and will allow seed emergence in early spring when moisture conditions are most favorable.

PLANT SPECIES - Plant species used for temporary, contemporaneous reclamation with their respective justifications are listed below:

Agropyron dasystachyum --Thickspike Wheatgrass-- This grass species was chosen for its on-site adaptability of these climatic patterns, high salt tolerance, sod forming characteristics and rapid establishment capabilities.

Oryzopsis hymenoides--Indian Rice grass-- This grass species has excellent success on spoils establishment and has moderate salt tolerance qualities.

Astragalus cicer--Silklepod Milkvetch--This forb will be planted because it is sod forming, nitrogen fixing, has moderate salinity adaptation, has establishment qualities and for aesthetics values.

Melilotus officinalis--Yellow Sweetclover-- This species is an introduced forb that establishes readily on severe disturbed sites. It is also a nitrogen fixing plant that has high affinity for salt tolerance.

No shrub or tree species are included in the seed mix for contemporaneous reclamation.

SEEDING METHODS - Slopes less than 20% will be drill seeded, or seeded by hydro seeder or hand broadcast methods. Slopes greater than 20 % will be seeded by hydro seeder or hand broadcasting.

MULCH - Hydro seeded areas will be sprayed with a wood fiber mulch. Since this is temporary reclamation the application of mulch will be optional on areas of drill seeding or seeded by hand broadcasting.

FERTILIZATION - Contemporaneous reclaimed areas will be visually checked on a yearly basis to determine success. Qualitative observations of interim or contemporaneous revegetation will be submitted in the annual report. An appropriate fertilizer will be applied if it appears necessary to increase plant vigor or to obtain the desired cover.

FUTURE CONTEMPORANEOUS RECLAMATION - If additional areas are disturbed or, if current disturbed areas become idle, contemporaneous reclamation procedures (as described above) will be implemented pursuant to R645-301-352.

*Note: seeding rates of species will be in equal proportions totaling 52 PLS per square foot, with not more than 20 PLS per square foot of any one species.

3.5.2 Soil Removal and Storage

The Trail Mountain Mine site is an active site. The mine was operational before the 1979 State Act or the 1977 Federal Act. Having been constructed prior to the requirement to save and stockpile topsoil, the soils on the site were used in construction of the roads and pads.

A post-law borrow pit was utilized on site to obtain fill material for the 66" culvert for Cottonwood Creek. Topsoil was salvaged from the pit area, and is stockpiled in a protected area just northwest of the intake portal for the mine. The pile has been revegetated, and is further protected by installation of a silt fence around the bottom end.

No additional area is planned ~~on being~~ for disturbance, ~~disturbed,~~ therefore, it is unlikely that any topsoil will be encountered. However, if in the future, during upgrading operations or facility modifications, any salvageable topsoil is found, it will be tested in accordance with the "UDOGM Guidelines for Management of Topsoil and Overburden, Table 1", and if found satisfactory, will be saved and stockpiled in a location acceptable to the regulatory authority.

3.5.3 Final Abandondment

Upon final abandonment of the mining operation, the mine portals and openings will be sealed, the structures removed, and the drainages restored. More detailed description of the procedures to be followed will be found in the following sections. Unmined recoverable coal reserves will be protected in accordance with 43 CFR 3482.1 (c) (3) (IV). Prior to the abandonment of any part of the Trail Mountain Mine, PacifiCorp will get approval from authorized officers of the BLM.

Abandonment of Machinery: To comply with Section 10 of the Federal Coal Lease Stipulations PacifiCorp will request approval prior to abandonment of machinery within the mine. The following table list the machinery abandoned at the Trail Mountain Mine.

LEASE #	LOCATION	TYPE OF EQUIPMENT	BUREAU OF LAND MANAGEMENT APPROVAL DATE
UTU-64375 (Partial relinquishment accepted 1/9/09)	10TH Right	148 Longwall Shields and Face Conveyor *Abandoned Due to Safety Concerns	September 11, 1998 - Verbal February 26, 2001 - Written
UTU-64375 (Partial relinquishment accepted 1/9/09)	3rd Right	3 Longwall Shields *Abandoned Due to Safety Concerns	December 11, 2000 - Written

Abandonment of this machinery is insignificant compared to the other steel materials that must be left underground. Ferrous materials include steel roofbolts, steel wire ceiling mesh and steel covered longwall support cans. These materials are not removed due to safety concerns in all underground coal mines.

Although the shields contained emulsified oil which could eventually enter the hydrologic system, it will have as insignificant impact on the hydrologic balance in the area based on the following criteria:

- It will be a period of many years prior to the sediments being saturated to reach potential areas of discharge
- The combination of water chemistry, temperature, and lack of oxygen will impede the rate of oxidation of the metal
- The combination of specific gravity and dip of the geology will potentially carry any migration away from the surface waters
- The total volume of the potential contaminants is so minute it will be diluted within a short distance
- No municipal or domestic water uses exist within 8,000 feet of the sites

* DOGM Technical Findings Dated November 1, 2000 *

Temporary Cessation: PacifiCorp notified the Division of temporary cessation of coal mining operations at the Trail Mountain Mine effective May 4, 2001. Coal mining at the Trail Mountain Mine ceased as of March 15, 2001.

In preparation of temporary cessation, all mining equipment including; production (longwall and continuous miner), belt haulage and electrical were removed from the mine. The mine de-watering system was removed from the mine, except for a six (6) inch steel supply line (9066') and a twelve (12) inch PVC de-watering line (9066'), refer to Figure 3-8 for details.

3.5.3.1 Sealing of Mine Openings

A. PORTAL SEALING

Upon completion of mining activities, the portals will be sealed in accordance with State and Federal regulation. A typical drawing of portal sealing to be used is shown in Figure 3-7. Seals will be located at least 25' inside the portal entry. All loose material around the seal area will be removed for roof, rib and floor

prior to installation. The mine entry seals will be made of solid concrete blocks to form a wall two blocks thick.

B. DRILL HOLE SEALING

Exploration drill holes will be sealed to BLM specifications which entails sealing each hole from total depth to the surface with cement. See (Figure 3-8).

3.5.3.2 Removal of Surface Facilities

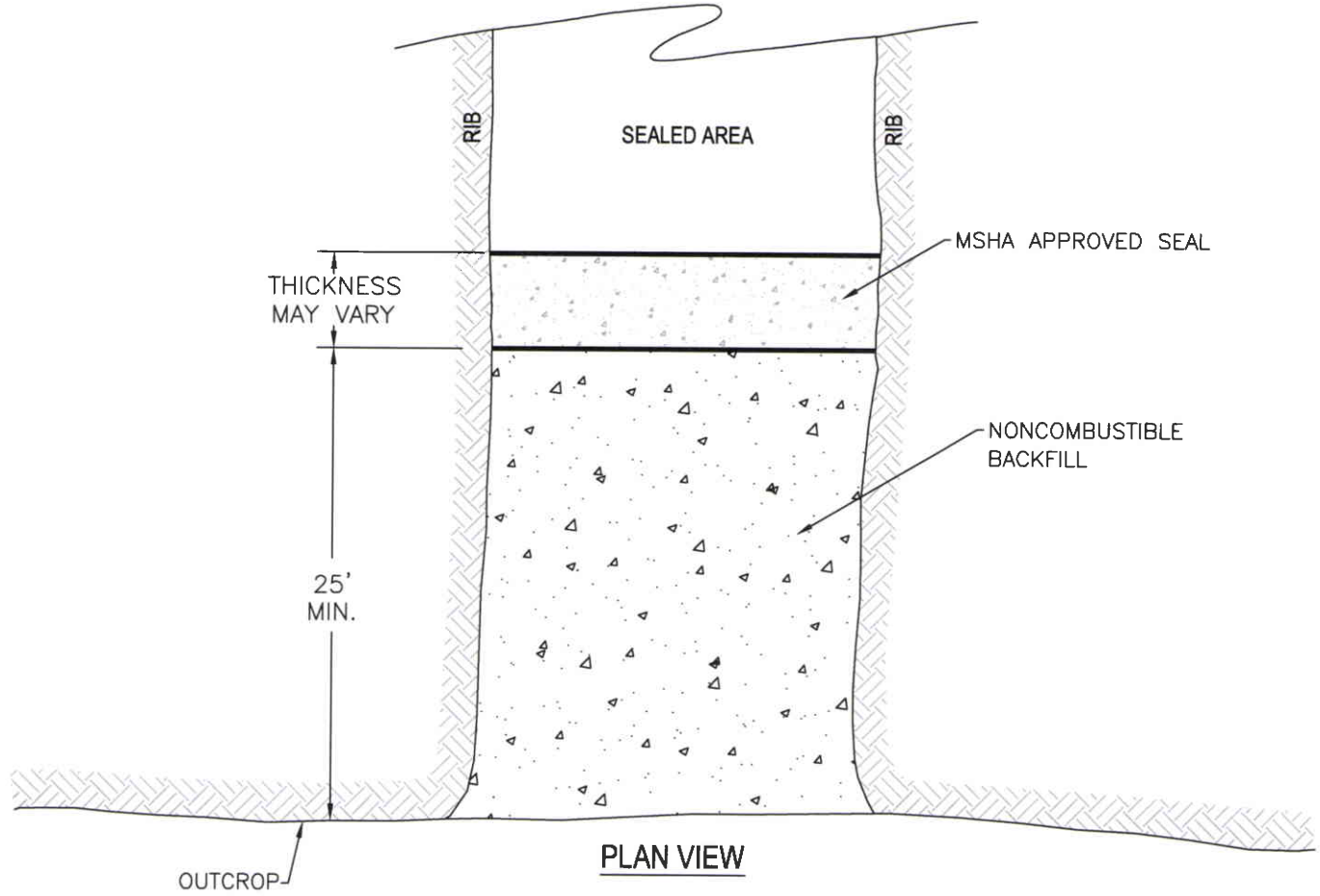
Upon completion of mining activities, all surface structures will be removed, with the exception of portions of the culverts and the sediment pond as described in the following section. Salvageable materials will be hauled off-site to a temporary storage age for re-use or sale. Non-salvageable items will be removed to an approved land fill (i.e. - Emery County Dump). Concrete will be broken up by dozer or other equipment and either placed against the highwall prior to backfilling or hauled to an approved landfill.

3.5.3.3 Disposition of Dams, Ponds, and Diversions

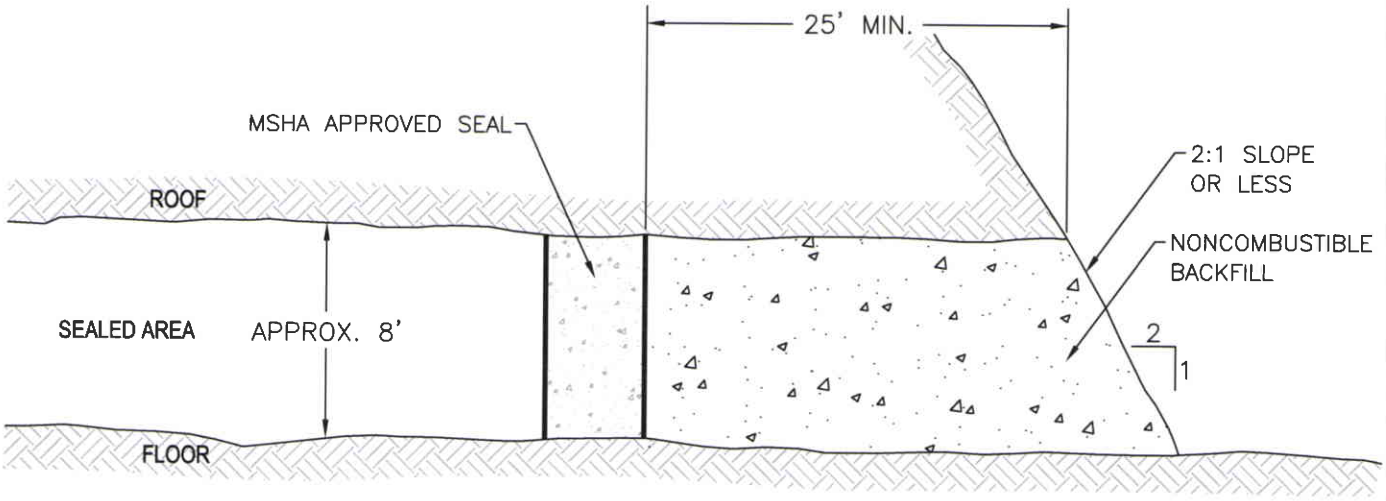
Due to the close proximity of the mine site to a perennial stream, it is proposed to leave the sediment pond in place to treat reclaimed area runoff until revegetation standards are reached. To direct the runoff, a 40' length of 48" cmp will be left in place at the point where the restored side canyon drainage meets the restored main channel, as shown on Plate 3-5.

The reclaimed area will be bermed along the restored side canyon drainage where it meets the restored main channel, as shown on Plate 3-12. The reclaimed area will be bermed along the restored banks of the channels to direct runoff to the sediment pond. Approximately 300' of 66" culvert (with the 96" to 66" transition and trash rack) will be left in place beneath the pond to convey the undisturbed Cottonwood Canyon drainage. All other diversions and culverts will be removed during this Phase I of final reclamation. Once revegetation standards are reached,

the sediment ponds and all remaining culvert sections will also be removed, and the remaining disturbed area will be reseeded. Additional sediment controls, such as straw bales, silt fences, berms, etc., will be placed as needed to ensure protection for the stream during this final phase of reclamation (Phase II).



PLAN VIEW



ELEVATION VIEW

CAD FILE NAME/DISK#: FIGURE 3-7

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

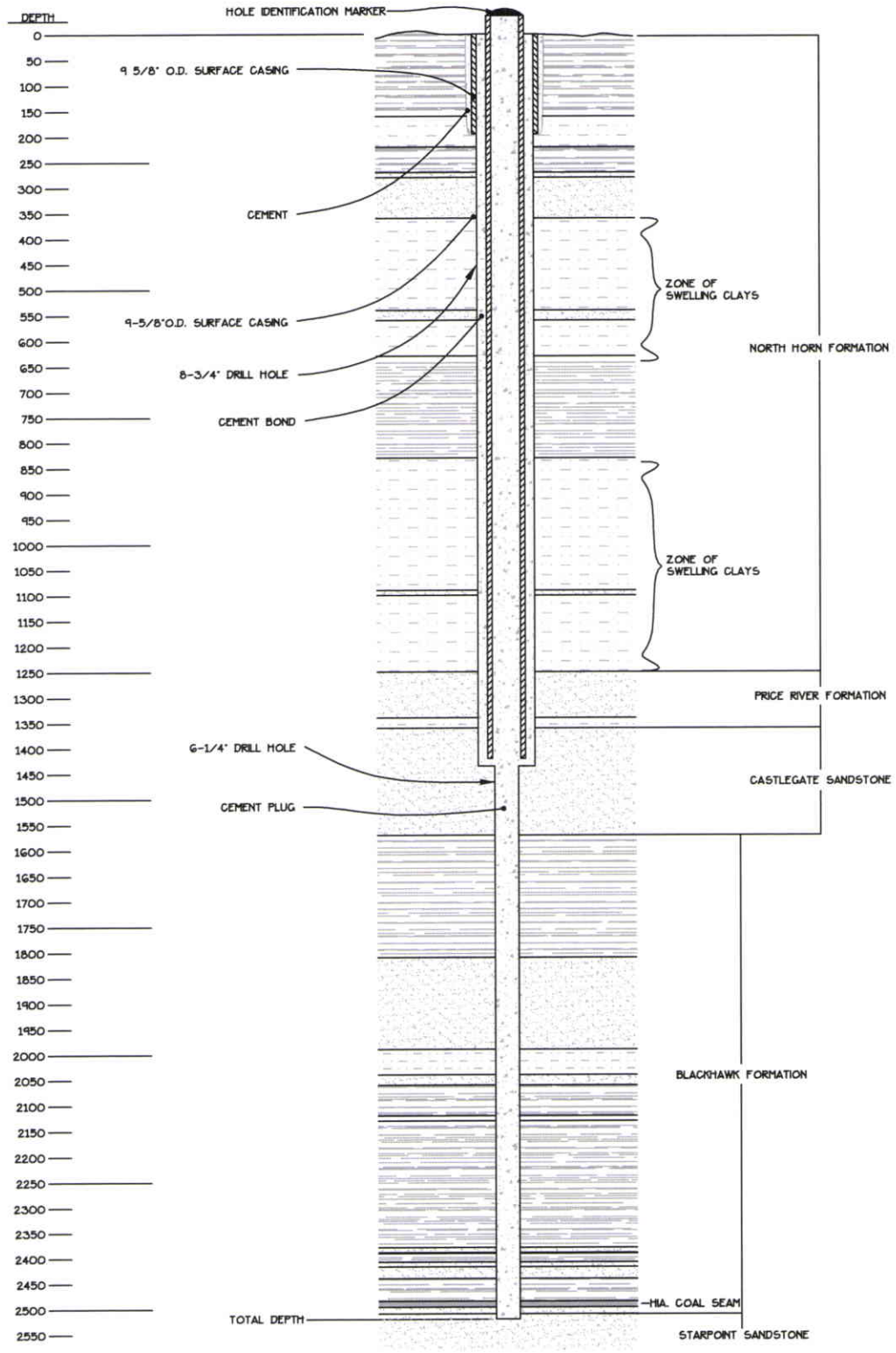
NOTE:

SEAL DESIGN MAY VARY DEPENDING ON THE MSHA REGULATIONS AT THE TIME OF SEALING

TRAIL MOUNTAIN MINE
TYPICAL PORTAL SEAL

DRAWN BY:	K. LARSEN	FIGURE 3-7	
SCALE:	NONE	DRAWING #:	
DATE:	MAY 18, 2011	SHEET 1 OF 1	REV. ___

TYPICAL CROSS SECTION - TRAIL MOUNTAIN DRILL HOLE SEALING



LEGEND

- SANDSTONE
- COAL
- MUDSTONE
- CEMENT
- INTERBEDS

250'

NONE

SCALE

CAD FILE NAME/DISK#: FIGURE 3-8

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
TYPICAL CROSS SECTION
DRILL HOLE SEALING

DRAWN BY:	K. LARSEN	FIGURE 3-8	
SCALE:	AS NOTED	DRAWING #:	
DATE:	MAY 18, 2011	SHEET 1 OF 1	REV. ___

3.5.4 Backfilling and Grading Plan

The surface of this area was originally disturbed in the 1940's by a previous owner. The surface is all privately owned. Since no major effort was made at that time to save or store any topsoil or other material, restoration to approximately original contour is highly impractical. However, it is the intent of PacifiCorp to restore the area to a topography acceptable to the Division and compatible with the post-mining land use, using such materials that are available at the site.

In general, the backfilling and regrading will proceed as follows:

a) After sealing of the portals and removal of all structures, a backhoe will be brought to the upper (portal road) terrace.

b) The backhoe will begin by reaching down over the fill bank and retrieving as much material as can be reached. This material will be placed on the terrace.

c) A Cat will work with the backhoe where possible, taking the retrieved material and spreading and compacting it from the cut outward to reach a configuration as shown on Plate 3-5, Post-Mining Topography.

d) The mine yard will then be re-sloped to drain as shown. A rock-lined natural drainage will be restored in the main and side channels as previously described.

e) The reclaimed area will be left in a roughened condition by placement of material with the backhoe and subsequent ripping and/or tracking with the dozer. This will promote moisture retention on the site to enhance vegetation.

f) Available topsoil, from the storage pile, will be redistributed to a depth of 6", starting at the north end of the storage area, and continuing down as far as material is available.

g) Upon final shaping and preparation of an area, it will be reseeded as per the plan.

h) Soil sampling of the regraded surface will be conducted as per the program described in Appendix 9-1, Attachment C.

3.5.4.1 Contouring

Plate 3-5 shows the post mining contours of the Trail Mountain Mine. Upon abandonment, the post mining land use will not require extensive backfilling or returning the land to the original contours, however, all areas which are compacted through the reclamation activities or during mining will be "deep-ripped" utilizing a dozer ripper to a depth of 12" to 24" prior to seeding.

The drainage channels will be graded to reestablish the streams, following removal of the bypass culverts. Attempts will be made to restore the channels to the pre-mining slopes and conditions.

3.5.4.2 Removal or Reduction of Highwalls

Highwalls will be reclaimed as is practicable for the site and for the post mining land use. A static factor of a least 1.3 will be developed in the reclaimed highwall.

It should be noted that highwalls, by definition, are only those cut areas associated with portals. Other cut areas exist on this site; however, these are ~~primarily~~ ancillary roads or pad cuts and do not fit the definition of a highwall. Portions of these areas may be retained as terraces to enhance the stability of road backfills.

3.5.4.3 Erosion Control

Measures for erosion control will be implemented on a case by case basis. Some methods which might be used are: mulching, straw dikes, water bars, silt fence, and limiting access to the area.

The berms along the reclaimed channels will be checked for erosion in the flow paths. If signs of erosion are evident, erosion controls such as loose rock check dams or silt fences will be installed along at intervals of 500' or less as necessary to control the erosion. Rills or gullies ~~deeper than nine inches~~ that develop in regraded areas will be filled, graded or otherwise stabilized and reseeded as per the plan to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area. This will be accomplished by hand, using adjacent or eroded material whenever possible. If larger gullies develop, a backhoe may be used in addition to hand work. Existing material that has been found satisfactory as a growth media through testing from the site will be used to accomplish this task.

3.5.5 Revegetation Plan

The disturbed areas of the Trail Mountain mine will be revegetated the first normal period for favorable planting conditions after final site preparation. A suitable, diverse seed mix will be used to revegetate the disturbed area. Timing of the revegetation within the mine reclamation schedule is shown in Section 3.5.6, Schedule of Reclamation. Proposed seed mixes for the revegetation are listed in Appendix 9-1 of the MRP.

The method of revegetation will be largely determined by the results of the revegetation test plots. Those test plot methods that yield the best results will be used on the full scale reclamation of the mine site.

3.5.5.1 Soil Preparation

With special handling, the disturbed land fill should provide a suitable seed bed for revegetation. Soil sampling will be conducted per Appendix 9-1, Attachment C. Special handling will include removal of contaminated material and large coarse rock fragments (greater than 18 inches). The large rock fragments will be used as rip-rap in channel restoration, buried with the fill, or randomly placed on the reclaimed surface. The mine coal pad areas will be removed and all

coal/refuse associated with the pads will be hauled to the Cottonwood Waste Rock Site for disposal.

Contaminated soil material which contains greater than 50 percent coal fines, will be disposed of at the Cottonwood Waste Rock Site. Soil contaminated with oil and grease will be disposed of at an approved site. This will be determined by visual inspection, and any material with visible oil or grease contamination will be removed. The volume of such material cannot be accurately estimated; however, it will likely be less than two percent of total volume. Material with less than 50 percent coal fines will be buried against the cut banks and covered with a minimum of four feet of incombustible material. There are no acid-or toxic-forming materials known to exist at this site. Any of these materials discovered will be disposed of on-site and covered with 4' of material or removed to the Cottonwood Waste Rock Site. Salt contamination may also be a problem in soils used for reclamation.

If visible salty areas or analyzed salty areas are found, the soils will be buried along the cut banks or other available sites to a minimum depth of 48".

Non-coal waste will be separated from the soils, loaded into trucks and hauled to an approved landfill for final disposal. All pad areas will be ripped for 12 to 24 inches to loosen the fill profile using the rippers on the dozer, and pulverized if a cloddy surface exists. Once backfilled and graded, the surface will be scarified with the teeth on the backhoe, or using the tracks of the dozer to create "pockets" for water retention and root penetration. Soil samples will be taken to identify the need for replenishment of various soil nutrients, as described in Appendix 9-1, Attachment C.

3.5.5.2 Seeding and Transplanting

Information from the test plots has been utilized together with proven reclamation results in order to arrive at the best treatment and seeding methods. After regrading and top soiling, the disturbed area will be mulched, fertilized and seeded. The steeper areas will be hydroseeded, and areas flat enough to safely allow operation of a drill seeder will be drill seeded. Regraded areas will not be smooth, but will have numerous depressions that will hold moisture and provide a micro-climate for vegetation establishment.

Riparian Community - During reclamation, the culverts will be removed, and the stream channels will be restored. The main channel will be rip-rapped with a 1.4 foot median rock size at least 4 feet above the stream. The flatter, reclaimed area is expected to be 60-70 feet west of the stream bank, and 20-40 feet east to where the public road will remain. Most of this area will consist of a slope of 5-10 degrees; therefore, drill-seeding will be used.

The riparian seed mix (see Table A9-3, Appendix 9-1) will be used approximately 20-40 feet on each side of the rip-rap, leaving a total floodplain area of 50-60 feet.

Grassland - Shrub Community - The seed mix for the grassland - shrub community will be used on the entire mine site, with the exception of the riparian area described above. See Table A9-1, Appendix 9-1 for seed mix and application rates. Portions of the grassland - shrub community area may be flat enough to safely utilize a drill-seeder; however, the majority of this area will be on the steeper slopes and will thus be hydro-seeded.

Containerized Stock - Following the seeding and mulching containerized woody plant species will be planted at a rate of 90 individuals/acre (or 2% of the undisturbed density in equal proportions). Wherever possible, this stock will be spatially arranged in clumps to maximize cover for wildlife. It is recommended

(R645-301-358) that "edge effect" be optimized in support of resident wildlife species. Significant stands of coniferous plant cover (Pinion-Juniper and Douglas Fir) exist throughout the permit and adjacent areas. These stands occur well within the limits of maximum distances required to optimize edge effect. A diagram illustrating the general spatial arrangement of the grassland - shrub community is included in Appendix 9-1, along with the description of the containerized stock proposed for both grassland-shrub and riparian areas.

One proposed option is that fresh-cut willow shoots be used on the riparian area in lieu of containerized stock. These shoots would be cut from local sources along Cottonwood Creek and placed on 3' centers on each side of the reclaimed channels.

3.5.5.2.1 Seed Mix and Rate/Acre

Two seed mixes are proposed for reclamation of the two vegetative communities that existed on the disturbed site. The first seed mix is for the riparian community, the second is for the grassland-shrub community. Lists of the species for both seed mixes can be found in Appendix 9-1.

3.5.5.3 Management

The reclaimed area will be protected from livestock grazing until bond release by fencing. The proposed fence is shown on Figure 3-9, and is not intended to preclude wildlife access. The revegetated area will be observed on a yearly basis. If heavy use occurs by wildlife, rodents, etc. other protection measures may be considered.

3.5.5.4 Vegetative Monitoring

Vegetation monitoring for permanent reclamation will be conducted as indicated in Table 3-2.

Revegetation success at the mine will be based on comparison with the approved reference areas. Ground cover, woody plant density, and shall be considered equal to their respective reference area counterparts, when there is 90 percent success at 90% statistical confidence.

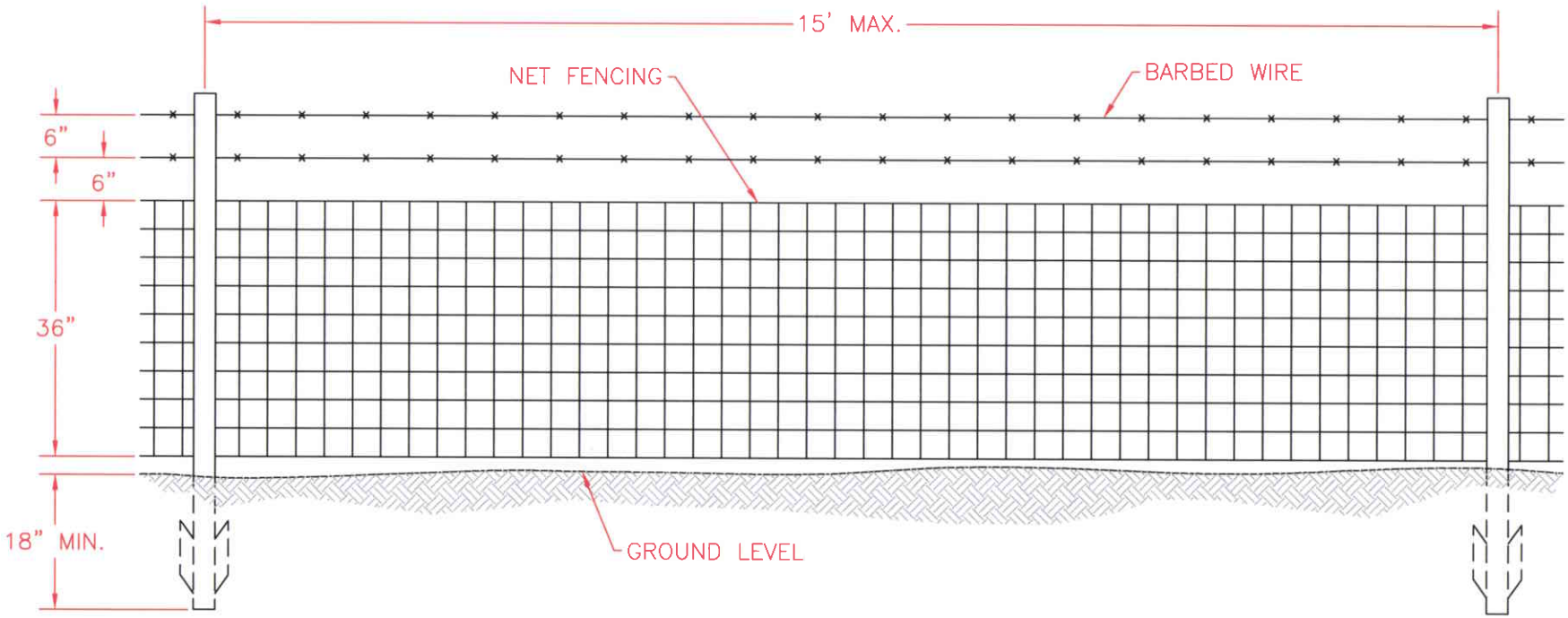
3.5.6 Schedule of Reclamation

3.5.6.1 Detailed Timetable for Completion of Each Major Step in reclamation (See Table 3-3).

3.5.6.2 Reclamation Monitoring

Monitoring of the success of reclamation will encompass subsidence, revegetation and water quality and quantity monitoring.

- Annual surveys will be conducted to determine surface deformation due to subsidence and possible movement of surface subsidence monuments.
- Water Quality and quantity monitoring will continue until reclamation has been accomplished as approved by the regulatory authority.
- All seeded areas will be inventoried to determine success of seeding.



Mine Reclamation Fencing - Typical

CAD FILE NAME/DISK#: FIGURE 3-9

ENERGY WEST MINING COMPANY
A SUBSIDIARY OF PACIFICORP

TRAIL MOUNTAIN MINE
MINE RECLAMATION
FENCING TYPICAL

DRAWN BY:	K. LARSEN	FIGURE 3-9	
SCALE:	1" =2'	DRAWING #:	
DATE:	MAY 18, 2011	SHEET 1 OF 1	REV. ___

TABLE 3-2

TRAIL MOUNTAIN MINE
FINAL RECLAMATION MONITORING

TEN YEAR RESPONSIBILITY PERIOD	1ST YEAR	2ND YEAR	3RD YEAR	4TH YEAR	5TH YEAR	6TH YEAR	7TH YEAR	8TH YEAR	9TH YEAR	10TH YEAR
	QUALITATIVE OBSERVATIONS									
SPRING SITE VISIT		*	*	*	*	*	*	*	*	*
FALL SITE VISIT		*	*	*	*	*	*	*	*	*
	QUANTITIVE OBSERVATIONS									
COVER		*	*		*				*	*
FRENQUENCY		*	*		*				*	*
WOODY PLANT DENSITY		*	*		*				*	*
PRODUCTIVITY									*	*

TABLE 3-3

TRAIL MOUNTAIN MINE
TYPICAL RECLAMATION SCHEDULE
RECLAMATION TIME TABLE

TEN YEAR RESPONSIBILITY PERIOD	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANURARY	FEBRUARY	MARCH	APRIL
SURFACE FACILITY REMOVAL												
COAL WASTE												
CONTOUR TRENCHING												
PORTAL SEALING												
EATHMOVING AND RECONTOURING												
FERTILIZATION												
SEEDBED PREPARATION GRASSLAND-SHRUB												
SEDIMENT POND												
SEEDBED PREPARATION RIPARIAN												
MULCH												
CONTAINERIZED STOCK												

3.5.7 Cost Estimate for Reclamation

The 1979 Act "Regulation of Coal Mining and Reclamation Operations" requires the operator of a coal mine to file with the Utah Division of Oil, Gas and Mining (DOGM) a bond in the amount equal to the estimated cost of completing the work described in the operator's reclamation plan. The bond is to ensure the State of Utah that in the event of the operator being financially unable to reclaim the disturbed areas, such areas can and will be restored by the DOGM at no cost to state residents.

The strata characteristics above the coal seam, the slow and uniform rate of subsidence will not affect the surface terrain to such an extent that reclamation will be necessary. As such, a reclamation bond is not required for the surface lands over the underground workings.

An estimate of the cost of reclamation of the Trail Mountain Mine site is shown on the following pages, in Table 3-4. This table reflects the required bond increase from all additions. Supporting cost calculations for each major reclamation step is also presented. The amount of the bond posted for this operation is broken down on the final page in Table 3-5.

Earthwork estimates for final reclamation are summarized in the Mass Balance Table 3-6. The quantities are taken from cross-sectional areas shown on Plate 3-6. Cross section locations are shown on Plates 3-1 and 3-5. Estimates indicate a cut volume of 38,579 cubic yards and a required fill volume of 39,719 cubic yards for final mine site reclamation.

SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
SURFACE FACILITY REMOVAL										
DEMOLITION							(13)			
Substation, Powerline &	1	5	$224	$1,120	Truck	5	$240	$1,200	$2,320	
Power Poles (23 ea.)	1	5	$224	$1,120	Crane	5	$616	$3,080	$4,200	
	2	5	$176	$1,760	None				$1,760	
Debris					(250cy)(35%)($6.65/cy)				$582	
								Sub-Total	$8,862	$8,862
Office/Shop/Bathouse/					Truck	11	$240	$2,640	$2,640	
Warehouse	1	10	$224	$2,240	Backhoe/loader	10	$280	$2,800	$5,040	
	2	5	$176	$1,760	None				$1,760	
	4	5	$224	$4,480					$4,480	
					Track Hoe	1	$776	$776	$776	
					5DT Crane	1	$616	$616	$616	
					10 YD. Dump Truck	1	$240	$240	$240	
Debris					(6600cy)(35%)($6.65/cy)				$15,362	
								Sub-Total	$30,914	$30,914
Water Treatment, Tanks and	1	5	$224	$1,120	Truck	5	$240	$1,200	$2,320	
Fuel System	1	2	$224	$448	Backhoe/loader	2	$280	$560	$1,008	
	1	2	$224	$448	Crane	2	$616	$1,232	$1,680	
	2	5	$176	$1,760	Laborers				$1,760	
								Sub-Total	$6,768	$6,768
Sewer System/Collection Pumping	1	1.5	$176	$264	Pump and Plug Septic Tanks	1.5	$300	$450	$714	
	2	4	$224	$1,792	Utility Truck	2	$80	$160	$1,952	
	2	3	$224	$1,344	25 Ton Crane	3	$496	$1,488	$2,832	
					235 Hyd. Excavator	1	$776	$776	$776	
								Sub-Total	$6,274	$6,274

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SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
Concrete Pads	1	6	$224	$1,344	235 Trackhoe	6	$776	$4,656	$6,000	
	1	6	$224	$1,344	10yd Rock Truck	6	$296	$1,776	$3,120	
					Pickup	3	$80	$240	$240	
	2	9	$176	$3,168	Laborers				$3,168	
								Sub-Total	$12,528	$12,528
Concrete Pumphouse Pad	1	0.5	$224	$112	235 Trackhoe	0.5	$776	$388	$500	
	1	0.5	$224	$112	10 yd Rock Truck	0.5	$296	$148	$260	
					Pickup	0.5	$80	$40	$40	
	2	0.5	$176	$176	Laborers				$176	
								Sub-Total	$976	$976
Non Coal Waste Bunker	1	1.5	$224	$336	235 Trackhoe	1.5	$776	$1,164	$1,500	
	1	1.5	$224	$336	10 yd Rock Truck	1.5	$296	$444	$780	
					Pickup	1.5	$80	$120	$120	
	2	1.5	$176	$528	Laborers				$528	
								Sub-Total	$2,928	$2,928
Truck Loadout Silo[22]	1	15	$224	$3,360	Truck	15	$240	$3,600	$6,960	
	1	15	$224	$3,360	Crane	15	$616	$9,240	$12,600	
	2	15	$176	$5,280	None				$5,280	
Debris					(1780cy)(20%)($6.65/cy)				$2,367	
								Sub-Total	$27,207	$27,207
Chute and Trusses from Crusher to Silo[22]	1	3	$224	$672	Truck	3	$240	$720	$1,392	
	1	3	$224	$672	Crane	3	$616	$1,848	$2,520	
	1	3	$176	$528	None	-	-		$528	
								Sub-Total	$4,440	$4,440
Main Fan	1	7	$224	$1,568	Truck	7	$240	$1,680	$3,248	
	1	4	$224	$896	Crane	4	$616	$2,464	$3,360	
	1	2	$224	$448	Backhoe/Loader	2	$280	$560	$1,008	
								Sub-Total	$7,616	$7,616
Storage Shed	3	1	$224	$672	Backhoe/Loader	1	$280	$280	$952	
								Sub-Total	$952	$952

(Revised 02/04/2000)

SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM		AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
Pump and Generator		1	2	$224	$448	Truck	2	$240	$480	$928	
House/Water Tank		1	2	$224	$448	Crane	2	$616	$1,232	$1,680	
		3	2	$176	$720	None	-	-		$720	
	Debris					(476cy)(35%)($6.65/cy)				$1,108	
									Sub-Total	$4,436	$4,436
ROM Transfer Building[22]											
	Operator	2	2	$224	$896	25 Ton Crane	2	$496	$992	$1,888	
						Truck Trailer	2	$378	$756	$756	
	Laborer	2	3	$176	$1,056	2 YD. Hyd. Excavator	0.5	$776	$388	$1,444	
	Foreman	1	3	$280	$840	2.5 YD. Loader	0.5	$376	$188	$1,028	
						16 Ton Dump Truck	1	$296	$296	$296	
						Torch, gas and air	3	$80	$240	$240	
	Debris					(1320cu)(35%)($6.65cy)				$3,072	
									Sub-Total	$8,724	$8,724
Tipple /Electrical Facility											
	Operator	3	2	$224	$1,344	25 Ton Crane	0.75	$496	$372	$1,716	
						Truck Trailer	0.75	$378	$284	$284	
	Laborer	1	2	$176	$352	2 YD. Hyd. Excavator	1	$776	$776	$1,128	
	Forman	1	2	$280	$560	2.5 YD. Loader	1	$376	$376	$936	
						16 Ton Dump Truck	1	$296	$296	$296	
						Torch, gas and air	2	$80	$160	$160	
	Debris					(222cy)(35%)($6.65/cy)				$517	
									Sub-Total	$5,036	$5,036

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SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
ROM Overland Tube Conveyor[22]										
(Tube Removal)										
Operator	2	2	$224	$896	80 Ton Crane	1.5	$800	$1,200	$2,096	
					25 Ton Crane	2	$496	$992	$992	
Laborer	3	2	$176	$1,056	Utility Truck	2	$80	$160	$1,216	
Foreman	1	2	$280	$560	Tractor/Flatbed	2	$378	$756	$1,316	
								Sub-Total	$5,620	$5,620
(Suports and Footers)										
Operator	3	0.5	$224	$336	245 Hyd. Excavator	0.5	$1,136	$568	$904	
Laborer	1	0.5	$176	$88	10 YD. Dump Truck	1	$240	$240	$328	
					Utility Truck	0.5	$80	$40	$40	
								Sub-Total	$1,272	$1,272
Conveyor Structure and	1	5	$224	$1,120	Truck	5	$240	$1,200	$2,320	
Crusher Station	1	5	$224	$1,120	Crane	5	$616	$3,080	$4,200	
	1	5	$176	$880	None	-	-		$880	
Debris					(498cy)(35%)($6.65cy)				$1,060	
								Sub-Total	$8,460	$8,460
Loading Dock	1	1	$224	$224	Truck	1	$240	$240	$464	
	1	1	$224	$224	Loader	1	$376	$376	$600	
								Sub-Total	$1,064	$1,064
Coal Pile and Retaining Wall	1	0.5	$224	$112	Jeffery	0.5	$1,000	$500	$612	
	1	0.5	$224	$112	Dozer	0.5	$696	$348	$460	
	1	1	$224	$160	Truck	1	$240	$240	$400	
	1	1	$224	$160	Backhoe	1	$496	$496	$656	
								Sub-Total	$2,128	$2,128

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SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
Sediment Pond	1	2	$224	$448	Dozer	2	$696	$1,392	$1,840	
	1	2	$224	$448	Loader	2	$376	$752	$1,200	
								Sub-Total	$3,040	$3,040
Seal Portals[23] (5 each)	3	10	$624	$6,240	Concrete Block	10	$1,523	$15,228	$21,468	
								Sub-Total	$21,468	$21,468
Culverts[24]	1	29	$224	$6,496	Truck	29	$240	$6,960	$13,456	
	1	29	$224	$6,496	Crane	29	$616	$17,864	$24,360	
	2	29	$176	$10,208	None	-	-		$10,208	
	1	14	$224	$2,240		14	$567	$7,938	$10,178	
								Sub-Total	$58,202	$58,202
Portal Liners[20]	1	6	$224	$960	235 Track Hoe	6	$776	$4,656	$5,616	
	1	3	$224	$480	10 Yd Rock Truck	3	$296	$888	$1,368	
	1	3	$224	$480	D4 Dozer	3	$416	$1,248	$1,728	
					Pickup	6	$80	$480	$480	
	2	6	$176	$1,440	Laborers				$1,440	
								Sub-Total	$10,632	$10,632
Gunite Removal[25]	1	10	$224	$1,600	235 Track Hoe	10	$776	$7,760	$9,360	
	1	10	$224	$1,600	D4 Dozer	10	$416	$4,160	$5,760	
					Pickup	10	$80	$800	$800	
	2	10	$224	$2,400	Laborers				$2,400	
								Sub-Total	$18,320	$18,320
Rock Dust Silo	1	1	$224	$160	25 Ton Crane	1	$496	$496	$656	
	1	1	$224	$160	Truck/Trailer	1	$376	$376	$536	
					Pickup	1	$80	$80	$80	
	1	1	$176	$120	Laborer				$120	
								Sub-Total	$1,392	$1,392

SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
Concrete Strage Pads [20]	1	0.5	$224	$80	235 Track Hoe	0.5	$567	$284	$364	
(South of Silo)	1	0.5	$224	$80	10 yd rock truck	0.5	$296	$148	$228	
	1	1	$224	$160	D4 Dozer	1	$416	$416	$576	
					Pickup	1	$80	$80	$80	
								Sub-Total	$1,248	$1,248
Concrete (Jersey) Barriers[26]	1	2	$224	$320	Loader/Fork Lift	2	$456	$912	$1,232	
	1	2	$224	$320	LHD Loader	2	$456	$912	$1,232	
					Pickup	2	$80	$160	$160	
								Sub-Total	$2,624	$2,624
Fence Removal (780 ft.)	1	2	$224	$320	Loader	2	$456	$912	$1,232	
	1	2	$224	$320	Flatbed	2	$176	$352	$672	
	2	2	$176	$480	Laborers				$480	
					Pickup	2	$80	$160	$160	
								Sub-Total	$2,544	$2,544
								SUB-TOTAL	$265,674	$265,674
EARTH MOVING AND RECONTOURING[10,12]										
EARTH WORK										
(14,17)	1	25	$224	$5,600	Dozer	25	$776	$19,400	$25,000	
(15)	1	62	$224	$13,888	988 Loader	62	$856	$53,072	$66,960	
(16)	1	15	$224	$3,360	Track Excavator	15	$1,136	$17,040	$20,400	
	6	3	$224	$2,880	235 Hyd Exc.	3	$776	$2,328	$5,208	
					2.5 Yd. Loader	3	$256	$768	$768	
					10 yd Dump Truck-4	3	$240	$720	$720	
								SUB-TOTAL	$119,056	$119,056

SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
RIPRAP[19] - REVEGETATION	1	12	$224	$2,688	Truck	12	$240	$2,880	$5,568	
	1	12	$224	$2,688	Backhoe/Loader	12	$280	$3,360	$6,048	
	1	12	$176	$2,112	None	-	-		$2,112	
	2	1.5	$224	$480	235 Track Hoe	1.5	$776		$1,330	
					10Yd Dump Truck	1.5	$296		$339	
								Sub-Total	$15,397	$15,397
REVEGETATION										
Fertilization[27]	1	2.675	$176	$471	Truck	2.675	$176	$471	$942	
					Fertilizer - lbs.	1336.25	$0	$347	$347	
								Sub-Total	$1,289	$1,289
Seedbed Preparation +20% [28]	4	2.35	$176	$1,654					$1,654	
9.38 acres	1	2.35	$280	$658					$658	
								Sub-Total	$2,312	$2,312
Seedbed Preparation - 20% [29]	0	0.65625	$224	$0	Dozer	0.65625	$536	$352	$352	
1.31 acres								Sub-Total	$352	$352
Contour Trenching	1	5	$224	$1,120	Dozer	5	$696	$3,480	$4,600	
								Sub-Total	$4,600	$4,600
Mulch, Park, Etc. [30]	10	21	$176	$36,960	Erosion Mat combined with Fertilizer,	10	$1,100	$11,000	$47,960	
	2	1	$224	$448	Seed, Mulch and Trees			$400	$400	
								Sub-Total	$48,360	$48,360
Plant Materials [31]	2	3	$176	$1,056	Plant Materials @ 90/acre	962	$1	$673	$1,729	
								Sub-Total	$1,729	$1,729
								SUB-TOTAL	$74,040	$74,040
MISCELLANEOUS										
Hand tools	N/A[7]	N/A[7]	N/A	N/A	Cutting Torch, etc	N/A	$2,000	$2,000	$2,000	

(Revised 02/04/2000)

SURETY BOND ESTIMATE
TABLE 3-4

DIRECT COSTS

ITEM	AMOUNT LABOR MAN/SHIFT[1,8]		COST/MAN SHIFT	LABOR COST	EQUIPMENT REQUIREMENTS[3]	MATERIAL[4] EQUIPMENT SHIFT/COST[5]		MATERIAL EQUIPMENT TOTAL/COST	TOTAL LABOR MATERIALS EQUIPMENT[11]	
Soil Analyses (Pregrade)	N/A[18]	N/A[18]	N/A	N/A	Handtools, Backhoe	N/A	$600	$600	$600	
Soil Analyses (Postgrade)	N/A	N/A	N/A	N/A	Handtools, Bags	N/A	$920	$920	$920	
Supervision[8]	1	122	$200	$24,400	N/A	N/A	N/A	N/A	$24,400	
Mobilization	N/A	N/A	N/A	N/A	Miscellaneous Equipment	N/A	$2,000	$2,000	$2,000	
		(yr)			See Handtools	N/A	$1,000	$1,000	$1,000	
								SUBTOTAL	$30,920	$30,920
								TOTAL	$489,689	$489,689

INDIRECT COSTS[32]

Maintenance and Monitoring	10.00%	$48,969	$48,969	
Contingency	10.00%	$48,969	$48,969	
Engineering Redesign	6.75%	$33,054	$33,054	
Mob/Demob	4.00%	$19,588	$19,588	
Contract Management	4.90%	$23,995	$23,995	
Subtotal		$174,574	$174,574	$174,574
		TOTAL		$664,264

(Revised 02/04/2000)

REFERENCE FOR BOND ESTIMATE TABLE

1. Based on 8 hour shifts, overhead included.

2. Cost estimates from: Means 1999 Heavy Construction Cost Data. 1999. 13th Annual Edition. Robert Snow Means Company, Inc., 100 Constuction Plaza, Kingston, MA 02364; and local contractor rates.

3. For description to the equipment listed, refer to Table 1.

4. For a description of plant materials, refer to text.

5. Cost estimates from: Local contractor rates and equipment vendor rental rates

6. Daily charge based on local contractor hourly rates

7. N/A designates " non-applicable". Labor costs for these items were included in previous crew charges.

8. Estimate based on 4-man working crew and 8-hour shifts. Laborer = $22/hr., Equipment Operator = $28/hr. Supervisor = $35/hour

9. Farm implements prices based on Swains John Deere Farm Equipment, Salt Lake City, UT.

10. For cut and fill quantities, calculations and cross-sections, refer to text.

11 Cost estimates assume no salvageable value or surface structures and facilities.

12. Earth moving and recontouring estimates also include material haulage.

13. Example: 3/250 = 3 shifts @ $250/shift.

14.* Number of shifts based on 12,000 yds^3 to be moved at production rate of 98 yds^3/hr determined from maximum production rate of 410 yds'/hr, corrected by .42 for 30% working slope, corrected by .75 for average operator efficiency, corrected by .83 for 50 min. hour, corrected by .90 for moderately hard to drift material.

15.* Number of shifts based on 24,000 yds^3 to be moved at production rate of 2,000 yds^3/shift (6 hrs. production, 2 hrs. move time/shift) determined from maximum production rate of 420 yds^3/hr with 2 cycles/min. corrected for 50 min. hour, assuming average operator efficiency and medium digging difficulty.

*Production rates above are somewhat conservative to allow 10 to 15 percent swell factor and occasional large rock.

17. Estimates include backfilling portal entrances.

18. Labor and equipment costs for soil sampling are included under "Monitoring and Maintenance". Equipment used for soil sampling may also be necessary for rills and gullies and other maintenance procedures, therefore equipment will be available.

19. Additional riprapping costs were included in Item "Culverts".

20 Concrete will be backfilled inside the mine portals.

21 Demolition debris from means: $.247/c.f. = $6.65/cy.

22 As stated in Note 11, no salvage value has been allowed, all steel structure will be backfilled in the portals, thus no off-proprty hauling has been estimated.

23 Seal Construction

Material			Labor			Equipment		
Blocks	400		1 block layer	$28.00	/ hr	1 flatbed truck	$176.00	/day
	$1.51 ea	$604.00	1 helper	$22.00	/ hr	1 crawler tractor	$496.00	/day
Mortar	1 lot	$100.00	1 operator	$28.00	/ hr			
Soil Backfill			sub-total	$78.00	/ hr	sub-total	$672.00	/day
	150 cy							
	$6.65 /cy	$997.50		16	hr/seal	2 days/seal		
Sub-total		$1,701.50		$1,248.00		$1,344.00		
TOTAL							$4,293.50	

24 Culverts will be removed as excavation or fills progress. 330' of 12", 19-- f 12", 1900' of 66" 38' of 96", 85' of 16", 350' of 48", 105' of 24" and 60' of 18". Total of 2868 ft. Average 100 ft. recovery per shift for a total of 29 shifts.

25 There is approximately 10,700 s.f. of gunite sprayed on the slopes by the portal areas. Removal and disposal on site will average 1,000 sf/day.

26 There is approximately 450 ft. of barriers on the site. These concrete barriers will be backfilled in the portals. (10 ft. lengths).

27 Revegetation - 10.69 acres
Fertilization - 125 lbs./acre; 2 hrs. / acre; $ 0.26/ lb

28 Seed Bed Preparation - + 20%
9.38 Acres
Hand till - 4 hrs / acre; 1-Foreman; 3-Laborers

29 Seed Bed Preparation - - 20%
1.31 Acres
2 hrs / acre; 2-operators; 4-laborers; 1-tractor; 1-front-end loader

30 Mulch, Park, Etc.
Mulch Hay - 2 tons/acre; 2 hrs/acre; 1-supervisor, 3-laborers; Equipment - 1- Flatbed
Mulch Crimping - 1.31 acres; Dozer, 2 hrs/acre
Mulch Netting - 9.38 acres; 8 hrs/acre; 1- supervisor, 3-laborers; 1-flatbed
Seeding 10.69 acres; 2 hrs / acre; 3-laborers, 1-supervisor; 1-flatbed; 22.5 lbd/acre, $19.31/lb

31 Plant Materials
90 plants/acre, 20 plants/hr/man, 2 laborers, $.70/plant

32 Indirect Costs derived from OSM Handbook

TABLE 3-5
RECLAMATION COST BREAKDOWN FOR RECLAMATION BOND

DIRECT COSTS			
Demolition		$265,674	
Earthwork		$119,056	
Revegetation		$74,040	
Miscellaneous		$30,920	
			$489,689
INDIRECT COSTS[32]			
Maintenance and Monitoring	10.0%	$48,969	
Contingency	10.0%	$48,969	
Engineering Redesign	6.8%	$33,054	
Mob/Demob	4.0%	$19,588	
Contract Management	4.9%	$23,995	
			$174,574
TOTAL (1999)			$664,264
Inflation @ 3.27% for 6 years			$141,459
Bond Amount in 2005 dollars			$805,723
BOND			$805,723

TABLE 3-6

MASS BALANCE

0+00	0	0	0	0
2+00	1,556	1,467	1,556	1,467
4+00	3,778	3,022	5,334	4,489
6+00	4,889	4,519	10,223	9,008
8+00	6,222	6,148	16,445	15,156
10+00	5,511	5,482	21,956	20,638
12+00	4,341	3,259	26,297	23,897
14+00	3,719	3,170	30,016	27,067
16+00	2,533	3,926	32,549	30,993
18+00	3,185	3,511	35,734	34,504
20+00	2,415	2,400	38,149	36,904
22+00	430	1,200	38,579	38,104
24+00	0	1,274	38,579	39,378
25+00	0	341	38,579	39,719
TOTALS	38,579	39,719	38,579	39,719

NOTES: (1) Refer to Plates 3-1 and 3-5 for cross sections. (2) Refer to Plate 3-6 for cross section

CHAPTER 4

LAND STATUS, LAND USE, AND POST MINING LAND USE

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4.1 SCOPE

This chapter of the mining and reclamation plan describes the status of lands in and adjacent to the mine plan permit and adjacent areas. Present and post-mining land-uses will also be discussed with emphasis on how mining can be integrated in the multiple land-use of the area.

4.2 METHODOLOGY

Information used in preparing this chapter of the mining and reclamation plan has been gathered from published sources and from discussions with the relevant land-management agencies.

4.3 LAND STATUS

4.3.1 Mine Plan Area Surface Land Status

Land status within the Trail Mountain mine plan area is separated into two areas: private, and federal (~~See Figure 4-1~~ Refer to Plate 4-1 in Volume 3).

4.3.1.1 Ownership

PacifiCorp owns 53.35 acres of private land surrounded by federal land of the Manti-LaSal National Forest. Ownership of land was obtained by Beaver Creek Coal Company in October, 1987, through purchase of the mine from the Arch Minerals Company of St. Louis, MO. A legal description of the extent of the property is given below. Also refer to the Legal and Financial Volume for more details:

Beginning point SW corner of NW1/4 SE1/4, Sec. 25, T17S, R6E, SLB&M, thence North 160 rods, thence East 44 rods to center Cottonwood Creek, Southward along creek to a point 76 rods East of the beginning, thence West 76 Rods to the point of beginning.

~~Figure 4-1 Coal Ownership in the Vicinity of the Trail Mountain Mine~~

4.3.1. Surface Managing Authorities

~~The remainder of~~ Historically and/or presently, the surface lands of the mine plan area ~~are~~ have been or are currently managed by the State of Utah, Division of State Lands and United States of America, US Forest Service. Section 36, Township 17 South, Range 6 East, part of the mine plan area, is managed by the Utah Division of State Lands (relinquishment for ML-22603 effective 01/31/1996). Areas within Township 17 South, Range 6 East, Sections 25, 26, 27, 34 and 35, Township 18 South, Range 6 East, Sections 1, 2, and 3, and Township 18 South, Range 7 East are ~~East 1/2 of the East 1/2 of the Southwest 1/4 and Southwest 1/4 of the Southwest 1/4 is~~ managed by the Manti-LaSal National Forest, US Forest Service. The majority of these lands have been mined out and relinquished. Refer to Legal and Financial Volume for lease area, permit area, and adjacent area details.

4.3.1.3 Special Use Permits and Leases

The US Forest Service Manti-LaSal National Forest has issued a special use permit to the Trail Mountain Mine for a right-of-way to the mine property. As discussed previously, the Trail Mountain Mine is surrounded by Forest Service land; therefore, the special use permit was required. A copy of the permit can be found in Appendix 4-1.

4.3.2 Mineral Ownership

4.3.2.1 Coal Ownership and Mines

The Trail Mountain Mine is located in an area of intermixed state (relinquished), federal, and fee coal. Figure 4-1 shows the ownership of the area surrounding the mine plan area. Those areas not outlined are unleased federal coal. The only operating mine in the area is the Trail Mountain Mine.

4.3.2.2 Coal Leases

PacifiCorp has been granted federal coal lease U-082996 for 80 acres, U-49332 for 641.47 acres (partial relinquishment of 261.47 acres accepted as of 01/09/09) and lease U-64375 for 2,630.81 acres (partial relinquishment of 2,504.01 acres accepted

as of 01/09/09). These mineable leases are located in:

Township 17 South, Range 6 East, SLB&M Section 25, (80 acres); T17S. R6E, Sections 25, 26 and 35 (~~641.47~~ 380.00 acres), T17S. R6E, Sections 26, 27~~, 34 and 35~~ (260.00 acres); ~~T18S. R6E, Sections 1, 2 and 3, and T18S. R7E, Section 6 (2,630.81 acres)~~. Copies of the leases are found in Appendix 4-2.

4.3.2.3 Mineral Ownership

Ownership of 53.35 acres of surface and mineral rights is held by PacifiCorp. A description of the extent of the mineral ownership is given below:

> "Beginning point SW corner of NW1/4, SE1/4, Section 25, T17S, R6E, SLB&M, Thence North 160 rods, thence East 44 rods, to center of Cottonwood Creek, southward along creek to a point 76 rods east of the beginning, thence West 76 rods to the point of beginning."

4.3.2.4 Mineral Leases

A copy of the lease agreements ~~is~~ can be reviewed at the Energy West Main Office in Huntington, Utah ~~found in Appendix 4-2~~.

4.3.2.5 Oil and Gas Wells

No oil and gas wells have been or are presently being drilled on or adjacent to the mine plan area.

4.3.2.6 Oil and Gas Leases

Oil and gas lease are held on and adjacent to the mine plan area. A state lease ML-31104 is held by Placid Oil Company, filed in September, 1974. Leases held on federal land are shown in Table 4-1.

4.4 LAND USE

4.4.1 Regional Land Use

Traditionally land use in the Wasatch Plateau has been mining, grazing, recreation, wildlife habitat and timber harvesting. Generally land management of the plateau has been controlled by the Manti-LaSal National Forest due to the large portion of the plateau within the forest boundaries.

Table 4-1: Oil and Gas Lease Ownership for Trail Mountain Mine Area. (See Plate 4-1)

Location	Ownership	Lease
T 17 S, Section 24		**U-15200**
Southland Royalty Company	25%	
Enterprise Gas Company	37½ %	
El Paso Exploration Company	37½ %	
T 17 S, Section 25		**U-24355**
Hawthorn Oil Company		
T17 S Sections 26 & 35		**U-15197**
Southland Royalty Company	25 %	
Enterprise Gas Company	37½ %	
El Paso Exploration Company	37½ %	
T 18 S, R 6 E, Section 1		**U-23208**
Edward Mike Davis	47½ %	
T 18 S, R 6 E, Section 2		**U-15195**
El Paso Exploration Company	37½ %	
Southland Royalty Company	25 %	
Enterprise Gas Company	37½ %	

4.4.2 Mine ~~Plan~~ Permit and Adjacent Area Land Use

4.4.2.1 Existing Use

Existing land uses of the Trail Mountain Mine ~~plan~~ permit and adjacent areas consist of grazing, wild life habitat and recreation. No commercial forest uses have existed on the privately owned or National Forest lands within the ~~mine plan~~ permit or adjacent areas. No farming has or is being done on the ~~mine plan~~ permit or adjacent areas.

Grazing - The National Forest land within the mine plan area is considered as unsuitable range (Niebergall, 1981). Since 1981 when John Niebergall made the preceeding statement, lease U-64375 was added to the mine plan area. Much of this lease, issued in 1990 (2,504.01 acres relinquished effective 01/09/09), is used as rangeland for both domestic livestock and wildlife. Section 36 (relinquished 01/31/1996), owned by the State of Utah, is leased by Emile Luke. Eight cows are allowed on the property from June 21 through September 20 (24 AUM's). The actual land within this section utilized for grazing is probably limited to 120 acres or less in the west portion of the section. The remainder of the ~~mine plan~~ area is unsuitable for range due to the cliff-like nature of the area. A map showing the US Forest Service grazing allotments is provided (see Figure 4-4). Livestock are also trailed on the road in Cottonwood Canyon (Niebergall, 1981). Cattle are moved to summer range at the higher elevations above the mine plan area.

It should be noted, that PacifiCorp has provided for the US Forest Service and the Trail Mountain Cattleman's Association, fences and gates at the Roan Canyon location and the adjacent Cottonwood Canyon location. The company has provided a cattle guard and a stock corral at the Cottonwood Canyon location, (see Figure 4-4) to aid the cattlemen in their efforts to trail cattle to and from summer ranges above the Trail Mountain Mine permit and adjacent areas.

Recreation - Recreational use of the ~~mine plan~~ area consists primarily of sightseeing by people traveling up Cottonwood Canyon to the Upper Joes Valley area. Limited hunting also occurs on the small section of the mine plan area on the plateau. Most of the area is characterized by steep and extremely rugged cliffs which are not conductive to recreational uses (Niebergall, 1981). There is no fishing in the canyon near the mine (Niebergall, 1981).

Access to the mine ~~plan area~~ site is by the ~~gravel~~ paved road in Cottonwood Canyon. ~~or by a~~ Jeep trails allow access to the mine plan or adjacent areas on the high plateau ~~which comes southeast of~~ above the Trail Mountain Mine. Access is gained via road on the upper end of Trail Mountain.

Farming - Farming is not practical ~~on~~ within the permit or adjacent ~~to the mine plan~~ area. Farming is impractical due to the steep and rocky terrain, and therefore, no future farm use is expected within the permit or adjacent ~~to the mine plan~~ area.

4.4.2.2 Previous Mining

Underground Mined Areas - The Johnson mines, located ~~a short distance up~~ across the canyon from the Trail Mountain Mine facilities ~~(in the southwest quarter of the southwest quarter to the northeast quarter of Section 25 of T17S and R6E)~~, were active from 1909 to 1948. The Cottonwood Canyon prospects are located across Cottonwood Canyon from the Trail Mountain Mine. The Cottonwood Canyon prospects were active from 1946 to 1948. No other known minerals of value have been mined within the permit or adjacent ~~to the mine plan~~ area.

Production ~~of~~ from the earlier mines was from the Hiawatha seam by room and pillar mining. An estimated production of 96,000 tons is reported by Doelling (1972) for all mining in the area. Of this, the Cottonwood Canyon mines produced

approximately 54,000 tons.

Surface Mined Areas - There have been no previous surface mines located within the mine ~~plan~~ permit or adjacent areas.

4.4.3 Land Use During Operations

Land use in the area has not changed greatly in the past 20 to 50 years. The following section will look at the potential effects of the operation on the use of the land. At the present time, Applicant has no plans to disturb any additional surface area during the mining permit term.

4.4.3.1 Effect of Operation on Land Use

The Trail Mountain Mine has operated in the Cottonwood Canyon since 1946. Land use in the canyon has adapted to the existence of the mining operation. As described previously, the majority of the mine plan area is not suitable for grazing or forestry. The uses affected are wildlife habitat and recreation. Recreationalists and ranchers use the canyon for access to the upper parts of Cottonwood Canyon and the top of the plateau. Sightseeing and seasonal cattle drives are the only major activity, other than mining, in the lower canyon.

Access up the canyon is not obstructed by the mining operation and facilities. Traffic on the county access road is not a problem. In 1987, three miles of the Cottonwood Canyon road from Highway 29 to the Trail Mountain Mine site was surfaced with six inches of asphalt.

4.4.3.2 Mitigation of Effects of Operation

The realignment and surfacing of the access road has greatly facilitated traffic flow and has mitigated any erosion or fugitive dust pollution problems.

The ~~Tract 2~~ mine plan area due to its ~~totally~~ underground nature will have no adverse impacts other than those which may result through subsidence. Should

subsidence occur and alter springs, ~~and~~ seeps, or ponds that is used as a watering source for wildlife or cattle, PacifiCorp will ~~commit to mitigating the loss of seeps and springs with the installation of 2000 gallon guzzlers. These guzzlers will be fenced with pole fencing to a maximum height of 42 inches with 14 inch spacings between poles to keep out cattle and allow wildlife in. Guzzlers will provide a water supply for wildlife. These guzzlers are fenced to keep cattle out because cattle would de-water guzzlers in a very short time. Man made and natural stock ponds are provided on the Trail Mountain area as a source of water for grazing cattle. These ponds are supplied by snow runoff or springs. There are several developed springs in the allotment areas that have watering troughs. If subsidence affects any ponds, ponds will be rebuilt with equipment and a bentonite liner will be placed in the affected pond. Water could be diverted due to subsidence. Should subsidence alter a seep or spring that is supplying a water source to livestock, PacifiCorp will~~, after consulting with the Forest Service and DOGM, commit to replace or relocate the trough or pond to a suitable range area. PacifiCorp has implemented a subsidence and hydrologic monitoring program whereby, the extent and the effects of subsidence to water resources can be studied, identified, and the appropriate mitigating action taken.

4.5 POST MINING LAND USE

4.5.1 Mine ~~Plan~~ Permit Area

Land use following mining will remain essentially the same on a regional basis. A combination of coal mining, grazing, wildlife habitat and recreation will tend to be the typical uses. These uses will be, as previously described, strongly influenced if not controlled by the Manti-LaSal National Forest.

The post mining use of the ~~mine plan~~ permit and adjacent areas is proposed as a multiple use of grazing, wildlife habitat, ~~hunting~~ and recreation. All of these uses are compatible with the surrounding area.

4.5.2 Mine Site

The mine site will be reclaimed to a grazing, wildlife habitat, and recreational use. Rehabilitation of the site will include removal of all buildings and facilities, regarding the tipple pad and sediment pond, removal of the bypass culvert, and reestablishment of stream, soil preparation, and revegetation of the site.

Use of the site will probably be recreational during late spring, summer, and fall and for wildlife grazing during the winter and early spring. In this area, the recreational use should not interfere with the wildlife use due to limited access during the winter months. This will allow for protection of the deer during the crucial period while on their winter range.

4.5.3 Final Surface Configuration

The graded surface of the mine site will blend existing slopes into the surrounding terrain. The slopes will be stabilized with vegetation, and the erosion hazard reduced. (See Chapter 3.)

4.6 BIBLIOGRAPHY

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Niebergall, John-US Forest Service, District Ranger, Manti-LaSal National Forest, Ferron, Utah - Range Improvement and Allotment Description.

CHAPTER 5

HISTORICAL AND CULTURAL RESOURCES

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HISTORICAL AND CULTURAL RESOURCES

5.1 SCOPE

This chapter reviews the existence and potential for historical, archeological, and paleontological resources in the area of Trail Mountain Mine. Also discussed is the potential effect the mining activities will have on the cultural resources.

5.2 METHODOLOGY

The cultural evaluations of the existence and potential of historical, archeological, and paleontological resources contains information from a record and archival examination and intensive surveys of the mine plan area and all development zones.

Evaluation of cultural resources for historic and prehistoric sites is done by the use of site quality indicators. Assessment of significance of the sites discovered utilizes the Cultural Resource Rating System (CRRS). CRRS is best explained by quoting the Bureau of Land Management definition sheet:

> Cultural Resource Rating System
>
> The following criteria are established as guidelines. The Bureau recognizes that the assignment of a particular rating is a professional judgment; however, the rationale of these judgments will be explicitly documented as part of the evaluation process.
>
> Assign an evaluation rating (S1, S2, S3, S4) to each site according to the following guidelines and record on the BLM Form 6400-3:
>
> S1. S1 sites are those sites which are worthy of preservation in situ. In general they are sites in relatively good condition with integrity (both internal

and external); and the unique or representative; and/or have associations with important events or personages; and/or have yielded, or have a clear potential for yielding, highly significant scientific or educational information.

S2. S2 sites are those sites which contain important scientific or educational data but yet are not worthy of preservation in situ. They are not generally ~~not particularly~~ unique, representative, nor do they have important associations. Many contemporary sites may be S2 sites because, they cannot be clearly and immediately assessed as such, and they may become highly significant when evaluated from a future historical perspective.

S3. S3 sites are those sites whose main worth is their potential for contributing data in regard to solving larger problems, such as reconstruction of paleo-environments and human use patterns. These kinds of sites generally show little concentration of artifacts, few features, no important associations, and little or no uniqueness or ~~representativeness~~ representation.

S4. S4 sites are those sites which have minimal information retrieval possibilities, or which have no integrity, uniqueness, ~~representativeness~~ representation, or no important associations.

5.3 HISTORIC RESOURCES

5.3.1 Historical Inventory

No historical resources are known to exist within the ~~mine plan~~ permit or adjacent areas. A study performed by Archeological Environmental Research Corporation (AERC) in July, 1979 showed no historic sites in the canyon bottom (see Plate 5-1 and Appendices 1 & 2, for a copy of Plate 5-1 and Appendix 1 [including Figure 5-1] refer to PacifiCorp Confidential and Private Information Volume:

Trail Mountain tab).

5.3.2 History of Mining

Mining activities existed on or near the site of the Trail Mountain Mine since 1898 (Doelling, 1972). The first large scale operation on the site, the Johnson Mines, opened in 1909. A series of three mines, the Johnson property operated from 1909 through 1948. The amount of coal produced during that period and the extent of the workings is unknown.

In 1946 three additional operations started in Cottonwood Canyon. Two prospects operated for a short time (1946-1952) (Doelling, 1972). Activity at the Trail Mountain Mine started in 1946 and lasted until 1967. The mine was then shut down for 10 years and reopened under the ownership for Mr. John Bell of Orangeville, Utah. Mr. Bell operated the mine until 1979. The Fetterolf Group then operated the mine until 1981, when it was purchased by Natomas Trail Mountain Coal Company. The property was subsequently purchased by Diamond Shamrock, later by Arch Minerals Corp., by Beaver Creek Coal Company (1987), and finally by PacifiCorp (1992) who presently operates the mine.

5.3.3 Effects of Mining on Historical Resources

There are no sites listed or eligible for listing in the National Register of Historic Places located within the ~~mine plan~~ permit or adjacent areas. Therefore, no effect will occur due to the mining.

5.4 ARCHEOLOGICAL RESOURCES

5.4.1 Archeological Inventory

Five archeological sites (279E/1 through 279E/5) and four isolated artifacts (279E/x1 through 279E/x4) were identified by AERC in the lower section of Cottonwood Canyon (see Plate 5-1: Refer to PacifiCorp Confidential and Private Information Volume: Trail Mountain tab). Two of the archeological sites, 279E/3 and 279E/5 have important data remains. Some vandalism had occurred

at these sites. "The abundance of charcoal and the lack of ceramics, suggests possible datable archaic habitation. Site depths of up to a meter of fill evidently contain important statigraphic data. Both sites have register potential (CRRS: S-2) because of the scientific information potential". (AERC, 1979.)

Site 279E/2, located north of 279E/4 is something of an enigma. The site consists of a rectangular stone foundation, but the lack of other surface materials, and apparent depth, make it difficult to determine whether the site was historic or an unusual, perhaps an uncompleted prehistoric structure. Because of the stone alignments, and its pinon-juniper bench location, the site is suspected as prehistoric. It was judged not to have National Register potential and rated CRRS: S-4.

The two remaining sites 279E/1 and 2 were both CRRS: S-4 lithic scatters. No diagnostic tools were found upon them or any of the other previously described sites (for a complete discussion related to the cultural resources of Cottonwood Canyon refer to "A Preliminary Report on the Cultural Resources and Test Excavations in Cottonwood Canyon, Emery County, Utah [UP&L-79-5A, B, C]", 1979, report prepared for Utah Power & Light Company by Archeological Environmental Research Corporation, Salt Lake City, Utah).

5.4.2 Effects of Mining on Archeological Resources

The Cottonwood Creek area seems to have been the scene of limited but significant prehistoric activities. Two of the isolated artifact locations 279E/X1 and X2 had every appearance of having been sites long since eroded. These isolates compliment the two other lithic scatters and indicate limited hunting activities along the drainage. The depth of charcoal in the rock shelters indicates that their prehistoric occupation could involve a considerable chronological period.

In the area where ~~the~~ artifacts ~~were~~ are located, little impacts from the mining activities will occur. The sites located near the roadside will be and have been subject to vandalism. Future improvements to the road suggested by Emery County and the Forest Service may significantly impact the sites.

If such improvements occur then an intensive study will need to be undertaken to determine mitigation procedures. At the present time no significant impacts are expected.

5.5 PALEONTOLOGICAL RESOURCES

5.5.1 Paleontologic Inventory

Fossils are found on the present and historic ~~mine plan~~ permit and adjacent areas in nearly all of the geologic units. With the exception of dinosaur footprints found in the coal seams of the Blackhawk Formation, no significant paleontologic specimens are known to be present (US Forest Service, 1978).

5.5.2 Effects of Mining on Paleontologic Resources

No significant effects to the paleontologic resources are expected by the mining activities. The occurrence of dinosaur foot prints in the coal seams is not a unique occurrence.

5.6 PUBLIC PARKS

5.6.1 Inventory of Public Facilities

No public facilities are located within the permit or adjacent area. A public road provides access to the site and the upper canyon.

5.6.2 Effect of Mining on Public Facilities

No effect on public facilities is expected from the mining operation. Access on the public road will not be affected.

5.7 BIBLIOGRAPHY

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CHAPTER 6

GEOLOGY

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GEOLOGY INFORMATION

6.1 SCOPE

The purpose of this chapter is to explain the geologic setting and characteristics of the coal and rock units in the Trail Mountain Mine permit area.

6.2 METHODOLOGY

General geology of the area has been described by E. M. Spieker (USGS Bulletin 316, 1931) and H. H. Doelling (Utah Geology & Mineral, Survey Monograph Series No. 3, 1972). Details of the quality and mining characteristics of the Hiawatha seam are based on experience from the Trail Mountain Mine.

6.3 REGIONAL GEOLOGY

The Trail Mountain Mine is located near the center of the Wasatch Plateau coal field (see Figure 6-1 Location Map), 3 miles from the mouth of Cottonwood Canyon and 11 miles from Orangeville. The coal field is oriented nearly north-south and is bounded to the east by an erosional escarpment; the west boundary roughly parallels the drainage divide of the Wasatch Plateau. The plateau has a vertical relief of up to 2,500 feet, rising from the Castle Valley below. In the vicinity of Trail Mountain, the terrain can be characterized by narrow flat-topped mesas surrounded by heavily vegetated slopes which extend to precipitous cliffs leading to the valley below.

The Wasatch Plateau coal field was formed along the western shoreline of the Cretaceous Seaway. Sediments deposited in the sea and coastal areas were derived mainly from western Utah. The Cretaceous Seaway oscillated due to tectonic events forming marine and non-marine sequences characteristic of fluvial, wave-dominated delta, and strand-plain deposits. Formations exposed in the

Trail Mountain region range from Upper Cretaceous to Tertiary. Figure 6-2 (Stratigraphic Correlation Diagram) and Plate 6-1 (Geologic Cross Section) depicts the sequence of rock units which occur in the Wasatch Plateau coal field.

Older Cretaceous formations including members of the Mancos Shale are exposed in Castle Valley and extend to the escarpment at the eastern edge of the Wasatch Plateau. The steeper sections of the escarpment belong to the Mesaverde Group formations and the uppermost units on the plateau are the latest Cretaceous and early Tertiary rocks (Doelling 1972). The stratigraphy of the individual formations will be discussed in the "Geology of the Permit and Adjacent Area - Stratigraphy."

6.4 REGIONAL STRUCTURE

Strata in the northern part of Trail Mountain are gently up-folded into the Flat Canyon anticline. In the southern part of Trail Mountain the strata gently dip into the Straight Canyon syncline. Both structures have a bearing of approximately north 50^0 east and plunge to the southeast. The dips of the strata on Trail Mountain generally are 2^0 or 3^0 and rarely exceed 5^0 (Lines 1984).

The Joe's Valley fault breaks the continuity of the geologic units along the west edge of Trail Mountain. Davis and Doelling (1977) estimate approximately 2,300 feet of vertical displacement along the fault in this area. The Joes Valley fault is the eastern fault boundary of a graben structure, approximately 2 miles in width, and extends at least 20 miles north of Trail Mountain and at least 40 miles to the south.

6.5 GEOLOGY OF THE ~~PERMIT~~ MINE PLAN AREA

The following section will describe the stratigraphy and structure of the ~~permit~~ mine plan area. Plate 6-2 (Geologic Map - Trail Moutain Area) shows the geology of the mine plan and adjacent areas.

6.5.1 Stratigraphy of the ~~Permit~~ Mine Plan Area

The rock formations exposed in the Trail Mountain area range from Upper Cretaceous to Tertiary in age. The formations, in ascending order, are the Masuk Shale member of the Mancos Shale, Starpoint Sandstone, Blackhawk, Castlegate Sandstone, Price River, North Horn, and Flagstaff Limestone. Figure 6-3 is a generalized section of the rock units with range of thickness and a general lithologic description.

The Masuk Shale member of the Mancos Shale, which outcrops along Cottonwood Creek, is the lowermost stratigraghic unit exposed in the ~~permit~~ mine plan area. The Masuk Shale member of the Mancos Shale is about 1300 feet thick and consists mostly of gray shale with occasional yellow-gray sandstone interbeds. Westward thinning wedges of the Masuk Shale interfinger with the basal tongues of the Starpoint Sandstone. It is generally void of water.

The Starpoint Sandstone, which is a prominent cliff former, consists of several eastward thinning marine sandstone tongues of medial Campanian age (Clark, 1928). The three members are the basal Panther Sandstone, the middle Storrs Sandstone, and the upper Spring Canyon Sandstone. These sandstone units are generally separated from each other by westward projecting tongues of Mancos Shale. The basal Panther Sandstone is approximately 100 feet thick and consists of massive, well indurated, crossbedded delta front sandstones. The Storrs Sandstone is located about 120 feet above the top of the Panther Member and consists of 50 feet of soft, friable sandstone. The Spring Canyon is located about 80 feet above the top of the Storrs Member and consist of 100 feet of massive, fine to medium grain, crossbedded delta front sandstones. Even though the Starpoint formation exists throughout the entire Trail Mountain property, the low permeability and lack of recharge limit its usefulness as a water producing aquifer. Permeability and the limiting factors of recharge, i.e., very little outcrop exposure and limited vertical groundwater migration, are caused by the mudstone layers of the North Horn formation. Locally, the Starpoint Sandstone exhibits aquifer characteristics. These are isolated occurrences where regional faults have created secondary permeability and have been intersected by major canyons with perennial streams. An example is Little Bear spring located in Huntington Canyon.

The Blackhawk Formation overlies the Starpoint Sandstone and is 625-800 feet thick in the Trail Mountain area. The Blackhawk consists of alternating sandstones, siltstones, shales and coal deposited in a deltaic environment. Although coal is generally found throughout the Blackhawk Formation, the economic seams are restricted to the lower 150 feet of the formation. The seam mined at Trail Mountain is the Hiawatha seam, which occurs at the contact between the Blackhawk Formation and the Starpoint Sandstone. The sandstones contained within the Blackhawk Formation are fluvial and increase in number in the upper portions of the formation. Many of the tabular sandstone channels form local perched water tables.

The Castlegate Sandstone immediately overlies the Blackhawk; it is 250-300 feet thick and consists of mostly coarse-grained often conglomeratic sandstones. The Castlegate normally forms a massive cliff on the canyon walls. The formation is considered to be fairly permeable but, where it has been intersected by drill holes, has never been found to be water-saturated. It is oftentimes dry or slightly damp in some zones. It is void of significant water because it lacks adequate recharge.

The Price River Formation overlies the Castlegate and consist mainly of medium- to coarse-grained sandstone with occasional interbeds of shale and carbonaceous shale. Individual beds are not as massive as the Castlegate Formation and are more friable, thus eroding more easily and forming step-like outcrops (Doelling, 1972). It is generally void of water because it lacks adequate recharge.

The top of the plateau consist mostly of the North Horn Formation. The North Horn Formation straddles the Cretaceous/Tertiary boundary. According to Spieker (1931), the Wasatch Formation (North Horn) contains a highly varied assemblage of rock types. In the central part of the plateau the lower member of the North Horn consists predominantly of varicolored shale, in which the combinations of various shades of red, purple, chocolate-brown, green and gray are characteristic of the coloring of Wasatch rocks in the general region, but it contains many irregular beds of gray, brown and cream colored sandstone of various texture and thin beds of fresh water limestone. The thickness of the North Horn Formation on Trail Mountain ranges from 750 to 800 feet and increases to the west.

Lenticular sandstone channels are oftentimes present in the upper and lower portions of the formation. Water which percolates down fractures from the overlying Flagstaff Limestone works its way into the sandstones, forming the perched water tables. The actual lateral extent, or correlation, between the perched water tables has not been identified; and it is not practical to do so because the tables are limited in extent and variable in stratigraphic location. Many springs have been identified where the sandstone channels intersect the land surface.

The lower two-thirds (upper Cretaceous in age) of the formation is generally highly bentonitic mudstone, which is impermeable. It is likely that this material is acting as an aquiclude, preventing adequate recharge from reaching the Price River Formation or Castlegate Sandstone below. The mudstones present swell when they come in contact with water; therefore, vertical migration of water along fractures through this material is limited because the fractures are sealed by the swelling clays.

The depths of the aquifers in the North Horn Formation are variable due to the rugged topography. The localized perched water tables may either intersect the surface of the ground or be covered by as much as 1,000 feet of overburden. They are located at least 1,400 feet above the coal seam to be mined. Communication of water between the perched aquifers in the North Horn Formation and the water flowing into the mine is limited in quantity and occurs very slowly. The monitoring of the numerous springs located on Trail Mountain gives PacifiCorp the ability to assess any effects that mining might have on the North Horn Formation perched aquifers.

The Flagstaff Limestone forms the uppermost peaks and caps on the Wasatch Plateau. It is a light-medium gray, fine-grained, occasionally fossiliferous limestone. This formation displays a strong joint pattern which permits good groundwater movement both vertically and horizontally through the formation.

6.5.2 Structure - ~~Permit~~ Mine Plan Area

There are no identified faults or major folds within the ~~permit~~ mine plan area. As mentioned earlier, both the Joe's Valley fault and the Straight Canyon Syncline lie west of the ~~permit~~ mine plan area (See Plate 6-3 Structual Contour Map - Hiawatha Seam). Data gathered by PacifiCorp indicate that

the strike-slip component of the Roans Canyon Fault encountered in the East Mountain property may extend into the Trail Mountain area west of the ~~permit~~ mine plan area.. On East Mountain both the Straight Canyon Syncline and the Roans Canyon Fault have a bearing of north 50° east. The Hiawathia seam in the ~~permit~~ mine plan area appears to be free from faulting and has a general dip of approximately 3° to the west-southwest. Depth of cover over the Hiawatha seam ranges from zero at the outcrop to approximately 2000 feet in the west-central portion of Section 36, T 17 S, R 6 E. (See Plate 6-4 Overburden Isopach Map - Hiwawtha).

6.6 GEOLOGY OF THE COAL BED AND ADJACENT STRATIGRAPHIC UNITS

6.6.1 Exploration and Drilling

There are a total of 21 drill holes on and adjacent to the ~~permit~~ mine plan area. All hole locations are shown on the Geology Map, Plate 6-2. Due to the competitive nature of the coal lease sales and the fact that unleased federal coal exist adjacent to the current lease, drill hole logs, coal thicknesses and quality information are considered proprietary at this time. Only general information will be submitted with this application.

6.6.2 Stratigraphy- Mine Horizon

The Hiawatha seam generally lies directly on the top of the Star Point Sandstone, although 1 to 15 feet of intervening shale is present in some locations. The coal seam has a mineable thickness of 6.5 to 13.5 feet in the Trail Mountain ~~permit~~ mine plan area. The immediate roof varies in lithology in the mine area and consists of 1 to 5 feet of alternating mudstone, thin coals, and fine-grained sandstone. Above this variable zone is a thick-bedded fluvial sandstone which forms a competent roof (see Figure 6-4 Detailed Column of Interest). The nature of the coal seam outcrop is concealed by slump and/or natural burn along much of the west side of Cottonwood Canyon.

6.6.3 Structure - ~~Permit~~ Mine Plan Area

The Hiawatha seam in the ~~permit~~ mine plan area appears to be free from faulting and major folds (see Plate 6-3 Structural Contour of the Hiawatha Seam). The dip in the mine ~~permit~~ mine plan area

is approximately 3^0 west-southwest and is part of the east limb of the Straight Canyon Syncline. The Joe's Valley Fault lies approximately 2 miles west of the lease boundary as does the Joe's Valley Reservior. The fault and resulting syncline influences the dip of the coal seam, ultimately placing the mining elevation below the level of the Joe's Valley Reservior. It is recognized that this circumstance will likely increase ground water flows into the mine. Further discussion of potential hydrologic impacts can found in Section 7.1.5 of this application.

6.6.4 Coal Reserves

6.6.4.1 Reserve Calculations

Mine measurements, outcrop measurements and thicknesses penetrated in drill holes were used to construct a mineable coal isopach map of the Hiawatha seam. (See Plate 6-5 Isopach Map - Hiawatha Seam).

No reserves were calculated within 100 feet of property lines. Minimum coal thickness used is 5 feet for in-place and 6 feet for recoverable reserves. Various recovery factors were used reflecting mining conditions and mine development areas. Coal density of 80 lbs/ft^3 was used. Reserve estimates are shown on Table 6-1.

TABLE 6-1: RESERVES

TRAIL MOUNTAIN RESERVES		
LEASE AREA	**IN-PLACE TONS**	**RECOVERABLE TONS**
FEDERAL LEASE U-49332	4,361,837	973,002
FEDERAL LEASE U-082996	276,954	93,618
FEDERAL LEASE U-64375	45,404,832	19,628,728
TOTAL	50,043,623	20,695,348

6.6.4.2 Coal Quality

The Hiawatha seam is the only mineable seam within the ~~permit~~ mine plan area. The seam has had the following quality characteristics:

TABLE 6-2: QUALITY

COAL QUALITY CHARACTERISTICS	
PARAMETER	PROXIMATE ANALYSIS (As Rec'd)
% Moisture	7.5%
%Ash	9.3%
% Sulfur	0.57%
BTU	12,063
Volitile Matter	38.90
Fixed Carbon	43.85

6.6.5 Pyrite Content and Alkalinity

Core Laboratories, Inc. performed an analysis on a sample of the floor and roof material in the center of the ~~permit~~ mine plan area at Section 1 West and 40th cross-cut. The results indicate very low pyritic sulfur and high neutralization potential of high C_1CO_3 equivalent; therefore, mine acid drainage is not a potential problem. (See Table 6-3, end of text.)

Two additional sets of samples have been taken from the northwest and southwest areas of Lease UTU-64375 (Main North and 2nd Left). Analyses of the roof and floor material from these areas were run in accordance with the Division Guidelines. Results of these analyses are in Appendix 6-2.

Samples will be taken of the roof and floor material and analyzed for toxic and acid forming potential. These samples will be collected on an annual basis in areas mined within the past year and will be analyzed in accordance with DOGM Guidelines.

6.6.6 Pyritic Content of Coal Seam

The following table lists the sulfur forms of the Hiawathia Seam based on samples collected in March 1983.

TABLE 6-4: PYRITE CONTENT

PYRITE CONTENT - HIAWATHIA SEAM		
SULFUR FORMS	% WEIGHT	
	As Received	Dry Basis
Pyrite Sulfur	0.10	0.11
Sulfate Sulfur	0.00	0.00
Organic Sulfur	0.41	0.43
Total Sulfur	0.51	0.54

6.6.7 Intercepted Groundwater

Within the current mine workings of Trail Mountain Mine there were only two long-term water producing areas. These areas are designated as UG-2 and UG-3 on Plate 7-3. Former monitoring point UG-1 is in an area that was sealed, and monitoring was discontinued in early 1988. Monitoring point UG-2 has been sampled since 1988; however, the flow decreased to less than 0.1 gallons per minute. This station may be discontinued if the flow continues at this level.

Two types of ground water occurrences have been recognized within the current mine workings. (See Figure 6-5 Ground Water Occurrences).

1. Fractures and joints (lineaments).
2. Roofbolt and in-mine drillholes.

During the mining process ground water encountered from fractures, joints and in-mine drillholes has been very minimal and dries up in the span of a few days, which indicates the presence of small pockets of perched water and not an underground aquifer. (Greg Lines, USGS.) Whenever sufficient quantities of ground water are encountered in new mining activities, (flows exceeding 3

GPM for a least 30 days) PacifiCorp will collect and analyze the samples and incorporate locations and sample analysis into the monitoring program. Groundwater monitoring for the ~~permit~~ mine plan and adjacent areas will also consist of collecting water quality and quantity data from points of significant inflow to the underground workings. An inventory of the active portion of the mine will be conducted on a quarterly basis to identify the location and geologic occurrence of mine inflows that exceed three gallons per minute. In consultation with DOGM, certain of these inflows (if they occur) will be selected for continued monitoring. Samples from all monitoring stations will be collected and analyzed according to DOGM Guidelines. Groundwater monitoring data collected during the calendar year will be summarized and submitted to DOGM on an annual basis. Included in the annual report will be an analysis of the mine working water balance, accounting for mine inflows, outflows, consumptive uses, and sump storage.

6.7 GEOLOGIC EFFECTS OF MINING

A complete description of the geologic effects of mining is found in Chapter 11, Geotechnical.

6.8 BIBLIOGRAPHY

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Open Field Report 81-559, Water Resources Investigation USGS 1981.

Table 6-3
CORE LABORATORIES, INC.
ANALYSIS REOIRT

April 20, 1983

NATOMAS COAL COMPANY

Job No.: 6303-S83027
Chemist: LLZ
Location: Casper, WY

Client I.D.	Interval	Sample Number	% Pyritic Sulfer	Acid/Base Potential*	Neutralization Potential	meq H+/100gr.	% Clay Fraction
Sample No. TMM 1 W, 40 Down	0.0 - 2.7 ft.	1	0.18	+81.6	+87.56	11.9	2.0
Sample No. TMM 1 W, 40 Up	2.0 - 4.0 ft.	2	0.33	+90.2	+106.5	32.5	

* ± Tons $CaCO_3$ Equivalent/1000 Tons Material

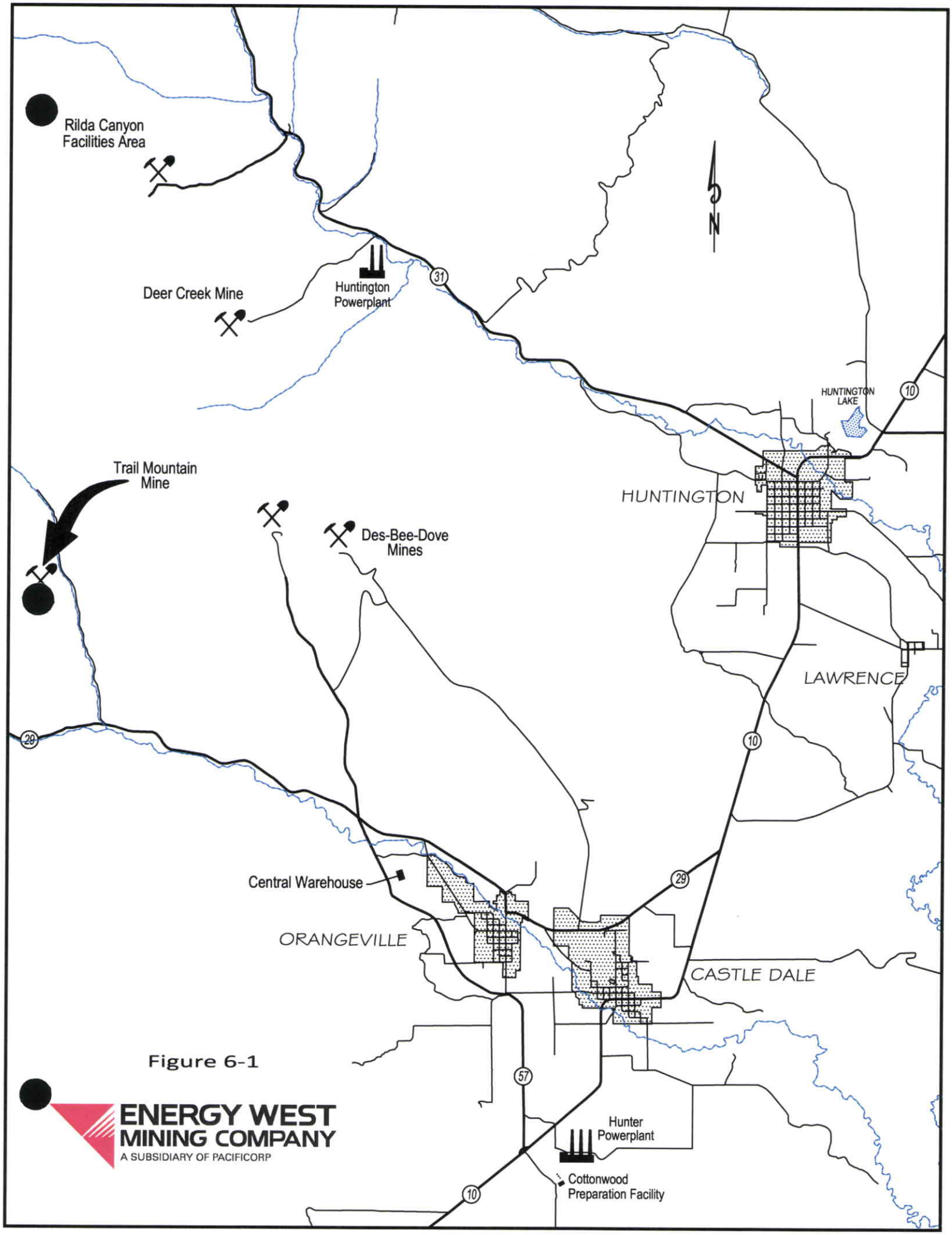

Rilda Canyon
Facilities Area
Deer Creek Mine
Huntington
Powerplant
31
N
HUNTINGTON
LAKE
10
Trail Mountain
Mine
HUNTINGTON
Des-Bee-Dove
Mines
LAWRENCE
29
10
Central Warehouse
29
ORANGEVILLE
CASTLE DALE
57
Hunter
Powerplant
Cottonwood
Preparation Facility
10
ENERGY WEST
MINING COMPANY
A SUBSIDIARY OF PACIFICORP

Figure 6-1

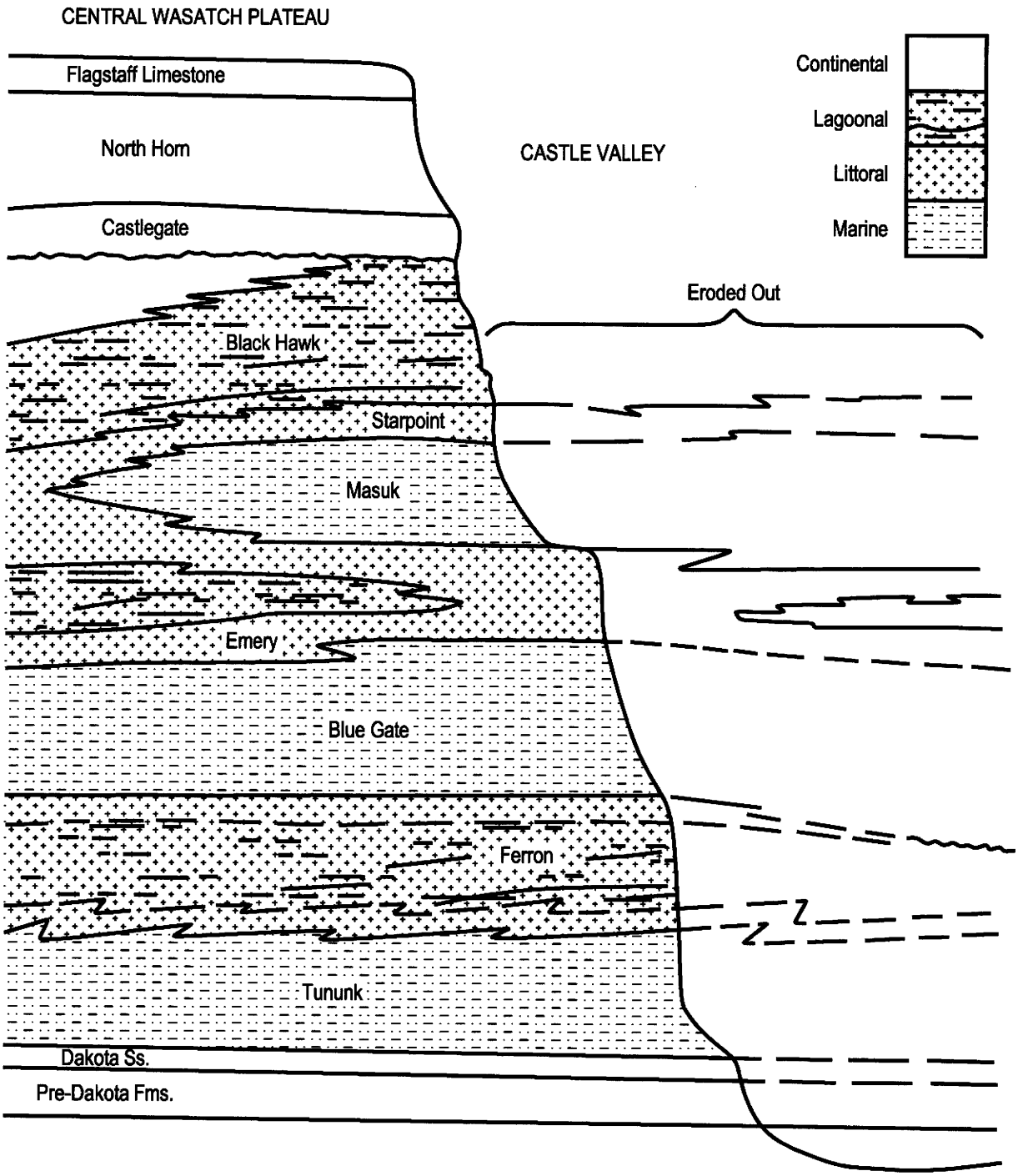


FIGURE 6-2

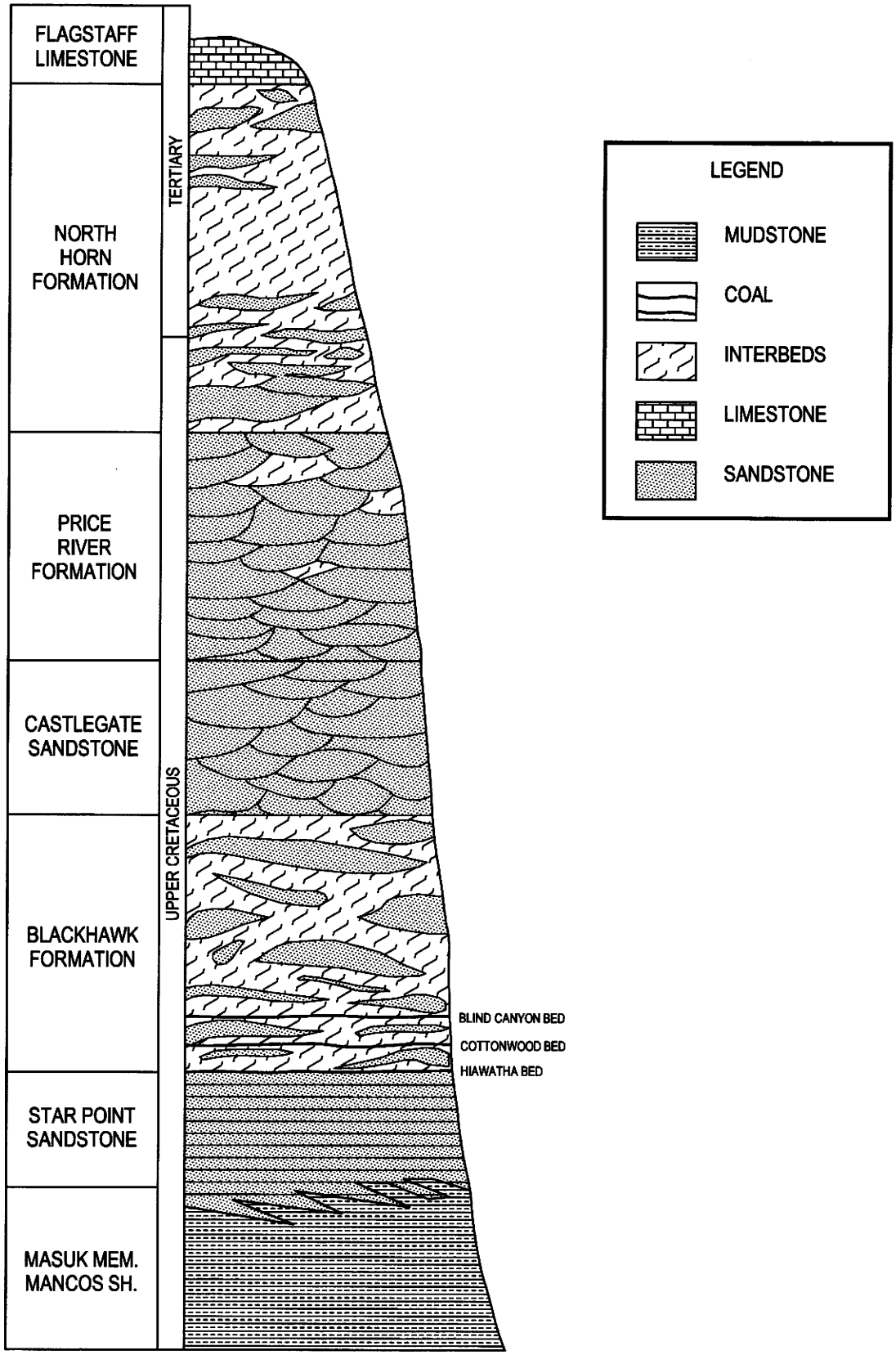
Stratigraphic correlation diagram from central Wasatch Plateau to the Castle Valley

Figure 6-3

Stratigraphy of East Mountain
(Doelling, 1972)

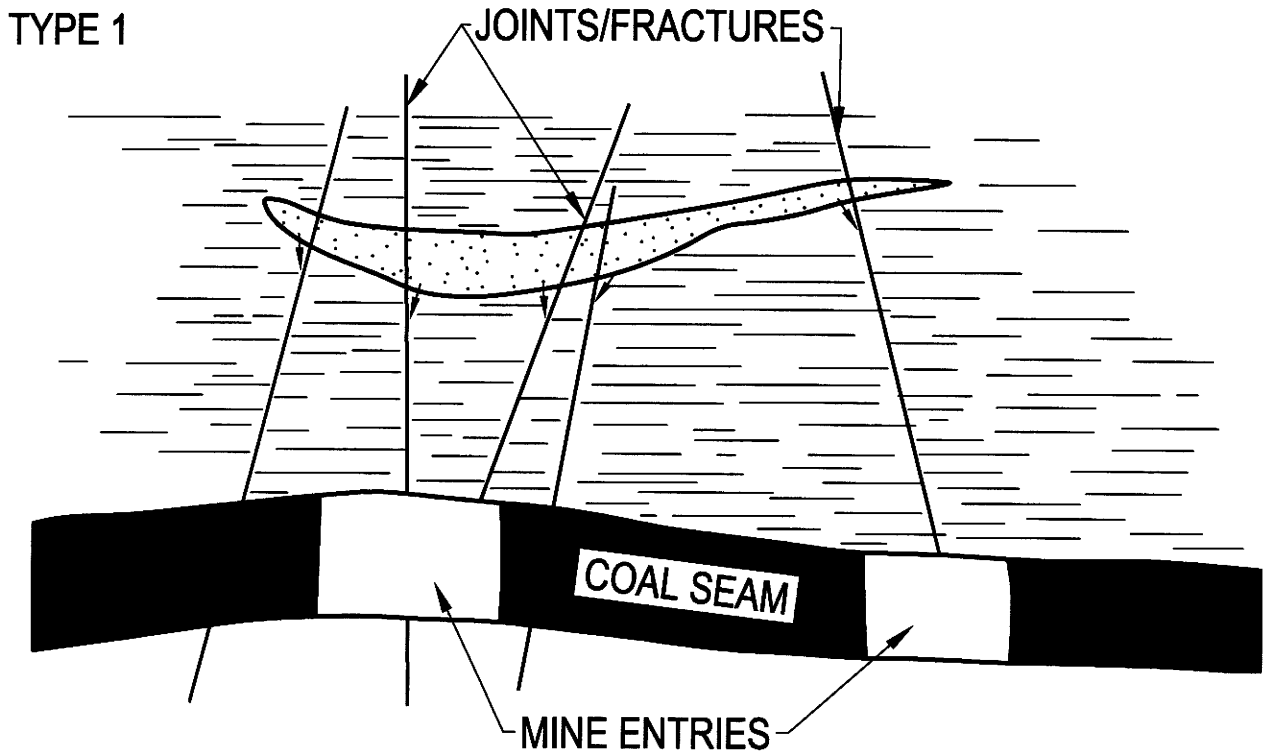
System	Series	Stratigraphic Unit		Thickness (feet)	Description
TERTIARY	Eocene	Green River Formation		-	Chiefly greenish lacustrine shale and siltstone.
		Wasatch Group	Colton Formation	300 -1,500	Varicolored Shale with Sandstone and limestone lenses, thickness to the north.
	Paleocene		Flagstaff Limestone	200 - 1,500	Dark yellow-gray to cream limestone, evenly bedded with minor amounts of sandstone, shale, and volcanic ash, ledge former.
			North Horn Formation (Lower Wasatch)	500 - 2,500	Varigated shales with subondinate sandstone, conglomerate and freshwater limestone, thickens to north, slope former.
CRETACEOUS	? Maestrichthian	Mesaverde Group	Price River Formation	600 - 1,000	Gray to white gritty sanstone interbedded with subordinate shale and conglomerate, ledge and slope former.
	Campanian		Castlegate Sandstone	150 - 500	White to gray, coarse-grained often conglomeratic sanstone, cliff former, weathers to shades of brown.
			Blackhawk Formation ***MAJOR COAL SEAMS***	700 - 1,000	Yellow to gray, fine- to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick *coal* seams.
			Star Point Sandstone	90 - 1,000	Yellow-gray masive cliff-forming sandstone, often in several tongues separated by Masuk Shale, thickens westward.
	Santonian	Mancos Shale	Masuk Shale	300 - 1,300	Yellow to blue-gray sandy shale, slope former, thick in north and central platear area, thins southward.
			Emery Sandstone ***COAL (?)***	50 - 800	Yellow-gray friable sandstone tongue or tongues, cliff former, may contain coal (?) in south part of platear if mapping is correct, thickens to west and south. *Coal* may be present in subsurface to west.
	Coniacian		Blue Gate Member	1,500 - 2,400	Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into low rolling hill and badlands, thickens northerly.
	Turonian		Ferron Sandstone Member ***MAJOR COAL SEAMS***	50 - 950	Alternating yellow-gray sandstone, sandy shale and gray shale with important *coal* beds of Emery coal field, resistant cliff former, thickens to south.
	Cenomanian		Tununk Shale Member	400 - 650	Blue-gray to black sandy marine slope forming mudstone.
	Albian	Dakota Sandstone *MINOR COAL*		0 - 60	Variable assemblages of yellow-gray sandstone, conglomerate shale and *coal*. Beds lenticular and discontinuous.

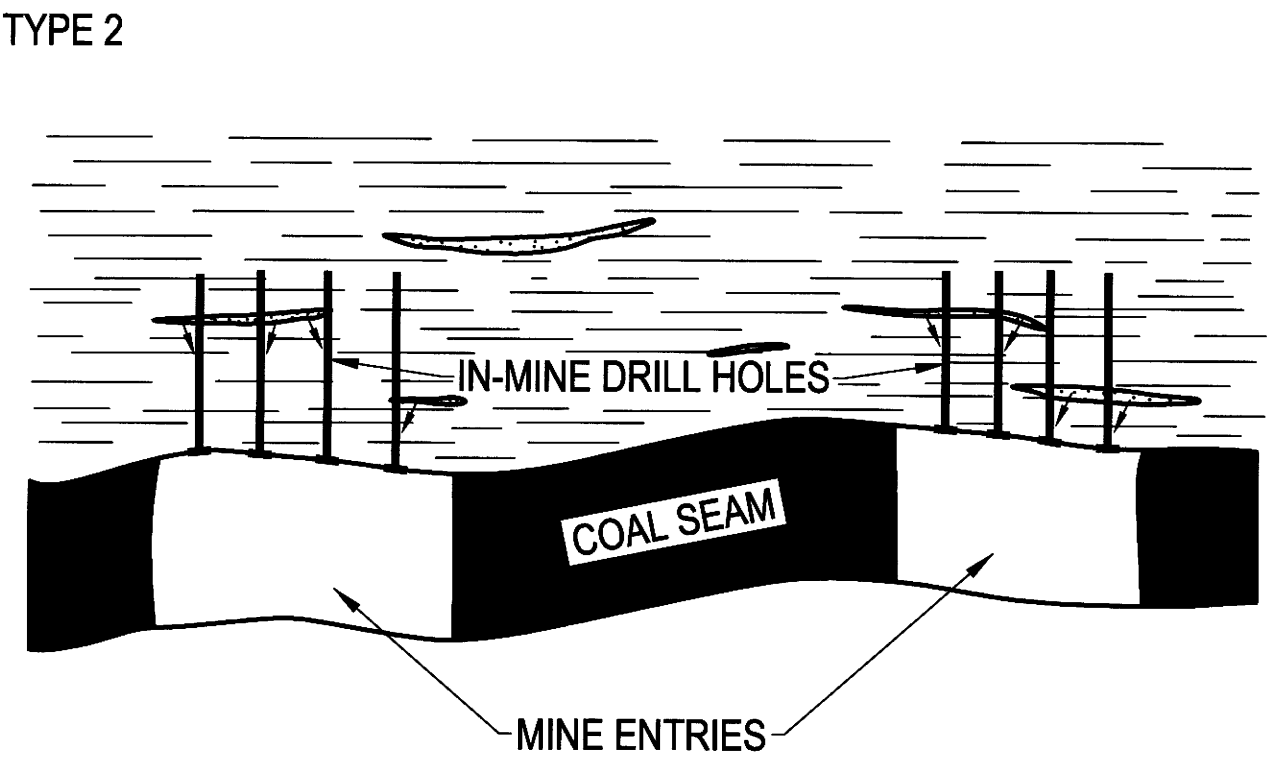
Generalized section of rock formations, Wasatch Plateau coal field.



Detailed Stratigraphic Section

FIGURE 6-4





GROUNDWATER OCCURANCES WITHIN
CURRENT MINE WORKINGS
FIGURE 6-5

CHAPTER 7

HYDROLOGY

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HYDROLOGY

7.1 GROUNDWATER HYDROLOGY

7.1.1 Scope

The scope of the groundwater section of this report is to describe the existing groundwater hydrologic conditions of the ~~mine plan~~ potential hydrologic impact (PHI) area and adjacent areas and to describe the methods that have been and will be used to predict and monitor the impacts from mining (see Figure 7-1 for location of the Trail Mountain Permit Area). Sections within the groundwater section of this report will cover the following major topics: methodology, existing groundwater resources, groundwater hydrologic balance, mitigation and control plans, and groundwater monitoring plans.

7.1.2 Methodology

Information used in preparing the groundwater hydrologic section of this report has been gathered by field investigations conducted on the ground and in the mine. Water quality samples have been collected and analyzed. Pertinent literature has been examined. In addition, experience of personnel working in the mine has been utilized to obtain estimates of the quantity of water encountered in the mine.

A seep and spring survey was conducted on October 29, 1985 in the vicinity of lease UTU-64375 (previously referred to as Tract 2). Data collected from this survey are supplemental to data collected in June 1981 as part of the investigation conducted for leases U-49332, U-082996, ML-22603 (previously referred to as Tract 1) for the PAP.

All water quality samples have been and will continue to be analyzed by a certified laboratory. Water rights were determined by examining current records of the Utah Division of Water Rights.

7.1.3 Existing Groundwater Resources

This section of the report deals with the groundwater resources of the ~~mine plan~~ adjacent area as well as the region as a whole. The "region" or "regional area" is considered to be the area where hydrologic resources could potentially be impacted by mining operations of the Trail Mountain Mine. Map 7-X illustrates the three regulated boundaries of the Trail Mountain Mine; potential hydrologic impact (PHI) boundary, adjacent area boundary, and permit area boundary. The PHI is described above. The adjacent area is described as the area within the PHI, but outside the permit area, that could reasonably be expected to be adversely impacted by coal mining and reclamation operations, including impacts from underground workings. The permit area is described as the area of land upon which the operator conducts coal mining and reclamation operations (i.e. disturbed area).

7.1.3.1 Regional Groundwater Hydrology

Geology, an important factor in the groundwater hydrology, is discussed briefly in this section to provide a basis for better understanding of the groundwater hydrologic regime.

Geology - The Trail Mountain Mine plan area is located in the central portion of the Wasatch Plateau coal field (Doelling, 1972). The dip of the strata is generally toward the southwest, ranging from approximately five to eleven percent (three to six degrees) over the ~~mine plan~~ potential hydrologic impact (PHI) area and adjacent area. The geologic formations exposed on or ~~adjacent to the mine plan~~ contiguous to the PHI and adjacent areas are Cretaceous members of the Mesaverde group, overlain by the North Horn and Flagstaff Limestone formations, which are Tertiary Formations (see Plate 6-2).

Star Point Sandstone - The Star Point Sandstone, the basal formation of the Mesaverde group (Doelling, 1972), is a light colored, massive, medium to fine-grained sandstone (Spieker, 1931). The Star Point ranges in thickness from 250 to

450 feet (Doelling, 1972, and Spieker, 1931). The sandstone is relatively impermeable with groundwater movement occurring mainly in fractures.

Blackhawk Formation - Overlying the Star Point is the Blackhawk Formation which is the middle and coal-bearing division of the Mesaverde group. The Blackhawk consists of alternating sandstone, shale and coal beds and is approximately 700 to 800 feet thick with the valuable coal seams located within the lower 400 feet (Doelling, 1972).

The sandstone beds are fine to medium-grained (Spieker, 1931) and yellow-gray to tan in color (Doelling, 1972). The sands of the Blackhawk are cemented by calcium carbonate or silica with the exception of a few localized areas in which the cement consists almost entirely of clay. Iron is also present in the cement of all but the pure white sandstones (Spieker, 1931). The generally discontinuous nature of the Blackhawk and apparent low specific yield (Cordova, 1964) indicates that the water yielding capabilities of the Blackhawk are only of local importance.

Spieker (1931) identifies three general types of shale in the Blackhawk Formation: ordinary clay shale, carbonaceous shale, and smoke-gray shale (all continental in origin). The ordinary clay shale is gray to green, granular and normally soft at the outcrop; the carbonaceous shale is brown to black, massive and laminated; and the smoke-gray shale is tough and leathery, and in its unweathered state is hard and homogeneous (Spieker, 1931). The presence of shale acts as a significant barrier to the vertical movement of water within the Blackhawk Formation.

Castlegate Sandstone - The Castlegate Sandstone, generally considered a member of the Price River Formation (Spieker, 1931), consists of massive, medium to coarse-grained sandstone beds, containing conglomerate with a matrix of grit (Doelling, 1972) in places. The Castlegate overlies the Blackhawk Formation, and its beds are

occasionally broken by sandy, hard, gray shale and at times by thin lenses of coal (Doelling, 1972).

Price River Formation - The lithologic characteristics of both the Price River Formation and the underlying Castlegate Sandstone are similar. The Castlegate member is separated from the Price River due to its cliff-forming characteristics (Spieker, 1931). Like the Castlegate, the Price River Formation consists of medium- to coarse-grained sandstone beds with occasional lenses of shale. Although the unit has a high porosity, its apparent low permeability (Cordova, 1964) reduces its water-yielding capabilities except through fractures.

North Horn Formation - The youngest geologic formation within the ~~mine plan~~ PHI and adjacent areas is the North Horn Formation. The North Horn is the lowermost member of the Wasatch Group, consisting of variegated shales, irregular beds of gray, brown or cream-colored sandstone of various texture and thin beds of steel gray and cream-colored limestone (Spieker, 1931). Like the Blackhawk Formation, the shales in the Castlegate, Price River, and North Horn formations act as significant barriers to the vertical movement of water within the formations; therefore, a significant portion of the water which reaches these underlying formations percolates downward until encountering a shale layer, which then causes horizontal movement to the surface or another "drain," i.e., sandstone finger within the formation.

Flagstaff Limestone - Although not located within the ~~mine plan~~ adjacent area, erosional remnants of the Flagstaff Limestone are located on summits and ridges ~~adjacent to~~ neighboring the Trail Mountain Mine (Davis and Doelling, 1977). The unit forms a white cliff, consisting of white, light gray and thin-bedded lacustrine limestone with some thin beds of gray shale and white volcanic ash. On top of Trail Mountain in the NW 1/4 of Section 22, T17S, R6E the thickness of the Flagstaff Limestone was measured at 105 feet (Davis and Doelling, 1977).

Faults - No major faults have been found to extend into the ~~mine plan~~ PHI and adjacent areas. The Joe's Valley fault zone, trending north to south, is located approximately three miles to the west of the ~~mine plan~~ PHI area; therefore, no major faults are anticipated to be encountered in the Trail Mountain Mine.

Groundwater - The principal factor controlling the occurrence and availability of groundwater in any area is geology. As noted by Price and Waddell (1973), nearly all of the region surrounding the ~~mine plan~~ PHI area is underlain by rocks of continental and marine origin, consisting predominantly of interbedded sandstones and shales. Although some of the sandstones in the region serve as the principal water-bearing strata, their ability to yield water for extended periods of time is largely controlled by the existence of the relatively impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water.

According to the US Geological Survey (1979), groundwater in the region exists under water table, artesian, and perched conditions. Water table conditions exist primarily in shallow alluvial deposits along larger perennial streams and in relatively flat lying sedimentary rocks. Artesian conditions exist at greater depths where a confining layer overlies a more permeable member; however, pressures are generally not sufficient to produce flowing wells. Perched or impeded conditions exist where the confining layer lies beneath the water-bearing stratum.

As noted by Lines (1985), the Blackhawk Formation and the Star Point Sandstone are considered together in the region as an aquifer. These formations are typically saturated where they exist sufficiently far from the edges of canyons; however, the Blackhawk Formation tends to be drained near the canyons, as is the case in the existing Trail Mountain Mine workings.

Strata that overly the Blackhawk Formation are not completely saturated but do contain perched aquifers (Lines, 1985), which provide water locally to springs and baseflow to some streams.

Investigations in the vicinity of the Trail Mountain Mine by Danielson et al (1981) indicated that most, if not all, groundwater in the region is derived from snowmelt. Recharge tends to be limited in areas underlain by younger rocks due to slope steepness and relative imperviousness, both of which promote runoff rather than infiltration of snowmelt.

The predominant chemical constituents in most springs in the region are calcium, magnesium, and bicarbonate (Lines, 1985). Dissolved solids concentrations generally range from about 250 to 750 milligrams per liter. Regionally, the concentrations of major dissolved constituents in water from individual geologic units are highly variable, due to lithologic complexity in the area.

Spring inventories of the ~~mine plan~~ PHI and adjacent areas were conducted in 1981 and 1985. The springs within and ~~adjacent to~~ neighboring the ~~mine plan~~ PHI and adjacent areas, shown in Plate 7-1, exist under perched conditions because of the existence of relatively impermeable interbedded shales within the North Horn, Price River, Castlegate and Blackhawk Formations. Springs issue from a sandstone layer underlain by shale adjacent to and downslope from a local recharge basin where more than average snow can accumulate. Recharge zones for these local springs are nearby flats along ridges. Springs generally do not occur along narrow ridges with steep side slopes where little opportunity for groundwater recharge exists.

Another interesting groundwater characteristic deals with the origin of springs with regard to geologic formations. The springs sampled on Trail Mountain were associated with the North Horn Formation. As mentioned previously, the North Horn

Formation consists of variegated shale, sandstone, and thin-bedded limestone. The shale layers act as impeding members to deep percolation, diverting a significant portion of water which percolates through the soil mantle and forcing it to move somewhat horizontally to be discharged at the surface as spring water. Most of the springs are located at higher elevations. The North Horn Formation lacks distinct and persistent lithologic units (Spieker, 1931); therefore, the sandstone of water-bearing lenses of the formation is somewhat discontinuous. This fact, coupled with the fact that recharge zones for the springs are in the nearby flats along the ridges, implies that springs are local in extent as opposed to a larger more regional system.

7.1.3.2 ~~Mine Plan~~ Potential Hydrologic Impact and Adjacent Area Aquifers

Seeps and Springs - As indicated previously, springs and seeps within ~~and adjacent to neighboring~~ the ~~mine plan~~ PHI and adjacent areas have been inventoried. The ~~mine plan~~ area was walked over and springs and seeps identified. Water quality samples were collected from the springs associated with the ~~mine plan~~ PHI and adjacent areas and analyzed.

Springs on Trail Mountain generally issue from sandstone overlying a shale layer. Lines (1985) found that the laboratory hydraulic conductivity of the sandstone and shale units within the Blackhawk Formation varies by four to six orders of magnitude. The relative magnitude of the hydraulic conductivity of local sandstones compared with siltstones and shales indicates that the finer grained sediments of the formations serve as barriers to the downward movement of water.

Recharge into local formations, either through snowmelt, rainfall, or subsurface seepage from an adjacent formation, percolates downward within the sandstone beds; however, upon reaching a less-permeable siltstone or shale layer, the water is forced to flow downdip to the surface, issuing at the interface between the two units. Four

wells have been drilled to monitor groundwater conditions in the Star Point Sandstone. The following table lists the well completion data and the status of each well:

WELL ID.	DRILL DEPTH (ft)	STRATA MONITORED	POTENTIMETRIC ELEVATION (ft)	MONITORING STATUS
TM-1	650	Star Point Sandstone (See Notes Below)	7259	Abandoned Relocated to TM-1B (See Notes Below)
TM-1B	480	Star Point Sandstone (See Notes Below)	7272	Monthly See Monitoring Plan
TM-2	60	Spring Canyon Member Star Point Sandstone	7151	Abandoned In-Mine Well Area Sealed
TM-3	560	Spring Canyon Member Star Point Sandstone	6900	Monthly See Monitoring Plan

Well TM-1: Well TM-1 was drilled outside the mine within the permit area boundary near the main manway portal. The hole was drilled to a total depth of 650 feet, beginning at a point 5.0 feet below the top of the Star Point Sandstone. At this location the Star Point was encountered to a depth of 350 feet, with a transition from the Star Point to the Mancos Shale existing from a depth of 350 feet to 500 feet. Below the 500-foot depth, the Mancos shale is present. The elevation of the ground surface at TM-1 is 7276.0 feet. On September 17, 1993 the static water level in TM-1 was at a depth of 17.4 feet below the surface; hence, the elevation of the potentiometric surface at TM-1 is 7258.6 feet. During routine monitoring on December 20, 1993 the bailer utilized to retrieve the quality samples became lodged in the casing at a depth of approximately forty feet. Several unsuccessful attempts were made to retrieve the bailer. Well TM-1 ~~will be~~ has been permanently abandoned using Division of Water Rights specifications. Monitoring potential impacts to the Star Point Sandstone at the mine facility was transferred to Well TM-1B on June 22, 1994.

Well TM-1B: Beaver Creek Coal developed a surface well within the permit area boundary located near the bathhouse (designated as well TM-1B on the enclosed Surface Facilities map 3-1) with the intended purpose of supplying water to the water treatment plant (see Volume 2 Appendix 7-7). During well development it was determined that the well production was insufficient to supply the water treatment plant (production was less than five gallons per minute) and the well was temporarily abandoned. Well TM-1B was drilled in October 1987 to a depth of 480 feet, which fully penetrated the Star Point Sandstone formation. Development included setting 480 feet of 6 inch steel casing, perforating the casing from 380-460, and setting a Grundfos 5-10 GPM pump at 420 feet with a 1 inch galvanized discharge line. Monitoring of well TM-1B was initiated in June 1994 with depth on a monthly basis and quality collected quarterly.

Well TM-2: Well TM-2 was an in-mine well drilled at crosscut 54 in the south mains. The hole was drilled to a total depth of 60 feet, beginning at the top of the Star Point. Only the Spring Canyon Member of the Star Point Sandstone was penetrated in this hole. The elevation of the mine floor and the top of the Star Point Sandstone at TM-2 is 7167.0 feet. On October 24, 1985 the static water level in TM-2 was at a depth of 16.5 feet below the mine floor. Hence, the elevation of the potentiometric surface at this location is 7150.5 feet.

Well TM-3: PacifiCorp drilled and developed well TM-3 on September 28, 1993 to satisfy a special condition request from the mid-term permit review. Results of an aquifer test conducted April 28, 1994 can be found in Appendix 7. Well TM-3 was drilled in Straight Canyon, approximately 11 miles northwest of Orangeville, Utah (SW1/4 NW1/4 of Section 3, Plate 7-2). Well TM-3 was drilled to a total depth of 560 feet. At this location, the Star Point was encountered to a depth of 455 feet, with a transition from the Star Point - Spring Canyon Member to the Mancos Shale existing from a depth of 555 feet to 560 feet. The elevation of the ground surface at

TM-3 is 6750 feet. Water in the Star Point Sandstone is under artesian pressure, with the static pressure on June 22, 1994 of 65 psi. Hence, the elevation of the potentiometric surface at TM-3 is 6900.2 feet.

Results of complete chemical analyses from Well TM-1B are presented with other water monitoring data in the Annual Reports. Plate 7-1 also shows the elevation of the potentiometric surface in the greater Trail Mountain Mine area. This data is taken from Lines (1985) and modified using data from Wells TM-1, TM-1B, TM-2 and TM-3. As noted, the potentiometric surface surmised by Lines should be shifted to the south in the vicinity of Cottonwood Creek. Plate 7-1 indicates that the flow of groundwater in the Star Point Sandstone in the vicinity of the Trail Mountain Mine is to the south-southwest toward Straight Canyon. Springs in the vicinity of the Trail Mountain Mine are used by cattle, deer, elk and other wildlife. Five of the springs (T-4, T-6, T-8, T-9, T-11, T-15) have been developed with watering troughs or ponds.

Data presented by Lines (1985) indicate that the total dissolved solids concentrations of water from springs in the North Horn Formation tend to increase in the direction of groundwater flow, i.e., in the south-southwest direction according to Lines, (1985). A review of TDS data collected from springs monitored by PacifiCorp substantiates this observation (review Annual Hydrologic Monitoring Reports, Springs T-8, T-15 and T-6). The pattern of increasing TDS in a southerly direction could possibly be due to increased leaching of the bedrock in the down gradient direction or contact with altered strata associated with natural burning along the southern outcrop. Insufficient springs were available to determine if such a trend exists within other formations in the vicinity of the mine; however, Lines (1985-Appendix 7-B) found that the pattern did not exist in the Blackhawk-Star Point aquifer.

The pH of water issuing from springs in the survey area showed no trends. Values varied from 7.3 to 8.5, generally falling in the range of 7.3 to 7.6; hence, spring water in the study area is slightly alkaline.

Groundwater Quality - Water quality samples have been collected from seepage within the Trail Mountain Mine to determine the groundwater hydrologic conditions within the Blackhawk Formation in which the coal-bearing zone is located. Water quality samples have also been collected from springs to provide an index of groundwater hydrologic conditions within other overlying formations of the mine plan area.

All samples were collected and preserved as previously outlined. The results of the chemical analyses for samples taken from within the mine are presented in Table 7-1.

Wells and Users - As indicated previously, no wells are known to exist within or ~~adjacent to~~ neighboring the ~~mine plan~~ PHI or adjacent areas except for the wells drilled to monitor potential impacts to the Star Point Sandstone aquifer. Principal groundwater use in the general area is restricted to use of wildlife and for stockwatering from springs or seeps. Groundwater produced within the mine is used for dust suppression and equipment operation within the mine or discharged under an approved UPDES permit (see Appendix 7).

7.1.4 Groundwater Development and Mine Dewatering

This section of the report discusses the groundwater supply and usage in the ~~mine plan~~ PHI and adjacent areas as well as the dewatering taking place in the Trail Mountain Mine.

7.1.4.1 Water Supply

Water required for underground mining operations is supplied from two sources:

1. Underground water from the mine is collected in a sump and recirculated for mining purposes; and

2. Supplemental mine water needs can also be supplied by pumping water from Cottonwood Creek.

Culinary water is supplied from underground sources pumped to a water treatment plant located near the main portal.

Water Rights - A search of water rights from the Utah Division of Water Rights within and ~~adjacent to~~ neighboring the ~~mine plan~~ PHI and adjacent areas showed no claimed groundwater rights within two miles of the permit area.

7.1.4.2 Mine Dewatering

Generally water encountered within the mine has been in the form of roof leakers through bolt holes and tension cracks positioned parallel to the working face of the mine. As mining progresses downdip, leakers further than 500 feet updip of the working face generally dry up. Only a limited amount of water is made within the mine. Water produced within the mine is used for dust suppression and fire protection within the mine and for the operation of in-mine machinery. Occasionally mine water production will exceed usage because of inactivity of the mine operation, short-lived surges of inflow, etc. As a result, a system has been constructed to allow for discharge of the mine water from the sump to Cottonwood Creek, with an option of routing the discharge through the sediment pond if necessary. This discharge point is approved under an UPDES Discharge Permit and is fitted with a flow meter for accurate quantity measurement. Intercepted groundwater will be monitored, quantified and reported annually in the Hydrologic Monitoring Report.

7.1.5 Effects of Mining on the Groundwater Hydrologic Balance

As has been noted, the occurrence and quality water in any region is highly controlled by geology. A structural feature known as the Straight Canyon Syncline may influence the groundwater hydrology

in the northwestern corner of the ~~permit~~ PHI area. The axis of the syncline, plunging NE-SW at approximately 3.5°, passes just to the northwest of the ~~permit~~ lease boundary and is visible on outcrop at the Joe's Valley dam. The syncline is a prominent feature and could provide a conduit from groundwater migration from NE-SW. The only data for this area has been obtained from exploration holes which have been drilled near the syncline axis. No unusual or persistent sources of groundwater at the coal seam horizon were noted in holes TMX-2, TMX-6, and TMX-7 (see Appendix 7). As with any syncline structure, increased amounts of intercepted groundwater could be expected as mining approaches the syncline axis. Rather than rapid inundation which can occur along fault zones, a gradual increase in the amount groundwater entering the mine should be anticipated as mining proceeds downdip below the potentiometric surface toward the syncline axis. Since excess water in the mine is stored in sumps, settled and pumped out into Cottonwood Canyon Creek, the net loss to the general hydrologic regime would be minor or zero. The entire Trail Mountain ~~permit~~ PHI area is within the Cottonwood drainage system. Interbasin transfer will not occur from the interception and discharging of groundwater.

Springs - As noted previously, springs within and surrounding the ~~mine plan~~ PHI and adjacent areas were inventoried in June, 1981 and October 1985. Experience gained from the data collected at nearby mines and from the general area has provided vital information regarding the possible effect of mining on springs.

Plate 7-1 shows the location of all water sources found during the hydrologic inventory of the ~~mine plan~~ PHI and adjacent areas. As shown, only a limited number of springs/seeps were found on the east face of Trail Mountain. The springs located, were mainly confined to the west slopes of the mountain.

Based on the data collected by PacifiCorp and the Bureau of Mines on the adjacent East Mountain property, mining induced impacts have not been identified. As discussed in Chapter 11, subsidence is expected to have no impact on bedrock-aquifer springs in the vicinity of the Trail Mountain Mine.

Four run-off fed ponds were also identified during the October 29, 1985 survey. Their locations are shown on Plate 7-1. These ponds, numbered 35-1P, 26-1P, 26-2P and 26-3P, were sampled for water quality during the 1981 survey and occur within the area of potential subsidence. The subsidence effects on the ponds may result in changes in retention capacity if subsidence fractures intercept them; however, water quality is not likely to be adversely affected.

Inflows to the mine are projected to be insufficient to require other than occasional dewatering; hence, impacts due to dewatering are projected to be minimal. The water supply for use at the mine (culinary and domestic) is obtained from in-mine sources. Lines (1985) states that mining is not expected to adversely impact water quality in the vicinity of the Trail Mountain Mine.

7.1.6 Mitigation and Control Plans

As was previously discussed, no significant impacts to the groundwater system are expected from the mining operation. The groundwater monitoring plan (discussed in the following section) will provide a means to follow the possible effect of the mining activities on the groundwater system. Any roads, fences, stock ponds, earth dams, or water troughs which are materially damaged by subsidence will be relocated (if possible), or repaired and regraded to restore them to their pre-subsidence usefulness. Should significant subsidence impacts occur, the applicant will restore to the extent technologically and economically feasible those surface lands that were reduced in reasonably foreseeable use as a result of such subsidence to a condition capable of supporting reasonable foreseeable uses that such lands were capable of supporting before subsidence.

7.1.6.1 Alternative Water Supply

In order to restore any land affected by Applicant's mining operations to a condition capable of supporting the current and postmining land uses stated herein, the Applicant will replace water determined to have been lost or adversely affected as a result of Applicant's mining operations if such loss or adverse impact occurs prior to final bond release. The water will be replaced from an alternative source in sufficient quantity and quality to maintain the current and postmining land uses as stated herein.

During the course of regular monitoring activities required by the permit, or as the Applicant otherwise acquires knowledge, the Applicant will advise the Division of the loss or adverse occurrence discussed above, within ten working days of having determined that it has occurred. Within ten days after the Division notifies Applicant in writing that it has determined that the water loss is the result of the Applicant's mining operation, the Applicant will meet with the Division to determine if a plan for replacement is necessary and, if so, establish a schedule for submittal of a plan to replace the affected water. Upon acceptance of the plan by the Division, the plan shall be implemented. Applicant reserves the right to appeal the Division's water loss determinations as well as the proposed plan and schedule for water replacement as provided by Utah Code Ann. 40-10-22(3)(a).

7.1.7 Groundwater Monitoring Plan

An inventory of the springs ~~adjacent to~~ within the ~~mine plan~~ PHI and adjacent areas was conducted during the spring of 1981 and the fall of 1985. Water quality and quantity data were collected at springs throughout the ~~mine plan~~ PHI and adjacent areas. After the quantity and quality data was assembled, representative springs were selected for the groundwater monitoring program. These springs are shown in Plate 7-2.

Groundwater monitoring for the ~~permit~~ adjacent area will also consist of collecting water quality and quantity from points of significant inflow to the underground workings. An inventory of the active portion of the mine will be conducted on a quarterly basis to identify the location and geologic occurrence of mine inflows that exceed three gallons per minute. ~~Certain of these inflows, if they occur, will be selected, in consultation with DOGM, for continued monitoring~~. Samples from all monitoring stations will be collected and analyzed according to Appendix 7-1. Groundwater monitoring data collected during a calendar year will be summarized and submitted to DOGM in the Annual Report. Monitoring parameters will be in accordance with DOGM Guidelines for

Groundwater Monitoring. Monitoring schedule and reporting will be in accordance with Appendix 7-1.

7.1.7.1 Baseline Monitoring

Baseline monitoring will be conducted on new sites for a two year period, after which monitoring will revert to the operational parameters list in the Division's guidelines. In addition, all sites, both groundwater and surface water, will be sampled and analyzed for baseline parameters every fifth year (see Appendix 7 for groundwater and surface water locations and frequencies).

7.1.7.2 Operational Monitoring

When two years of baseline data have been collected, the monitoring frequency will be adjusted according to DOGM's guidelines and as shown in Appendix 7-1 for Operational Phase Monitoring.

Mine water and sediment pond discharge will be monitored in accordance with the approved UPDES permit.

7.1.7.3 Post-Mining Monitoring

Post-mining monitoring of groundwater will continue on representative springs, which will be determined with the aid and approval of the UDOGM. Quantity and quality monitoring and analysis will be accomplished biannually for the time period associated with the reclamation bond or until post-mining data approaches preliminary standards. Parameters to be monitored will be selected following consultation with the State and Federal agencies.

7.2 SURFACE WATER HYDROLOGY

As was explained under Section 7.1, OSM and DOGM regulations require that water monitoring programs be established in areas of underground coal mining to monitor the effects of mining activities and protect the hydrologic balance of such area. This section outlines the surface water hydrologic investigation conducted ~~on the permit~~ within the potential hydrologic impact (PHI) area.

7.2.1 Scope

The scope of the surface water section of this report is to describe the existing hydrologic conditions of the ~~mine plan~~ PHI and adjacent areas and to describe the methods that have been and will be used to predict, monitor and mitigate the impacts of mining. Sections within this section will cover the following major topics: methodology, existing surface water resources, surface water development, control and diversions, effects of mining on the surface water hydrologic balance, mitigation and control plans, and surface water monitoring plans.

7.2.2 Methodology

Information used in preparing the surface water hydrologic section of this report has been gathered by field investigations. Pertinent literature has been examined. Numerous water quality samples have been and will continue to be analyzed by a certified laboratory. Water rights have been determined by examining current records of the Utah Division of Water Rights.

The mean annual water yield from the Trail Mountain Mine ~~plan~~ PHI area was calculated by two separate methods and compared with an estimate of the mean annual water yield given in Jeppson et al. (1968) to increase the level of confidence. The first method of calculation, referred to as "Grunsky's Rule," was originally developed by Grunsky (1908) and later adapted by Sellars (1965). In accordance with this method, the average annual water yield can be determined from:

$$Q = \propto P^2 \text{ [for } P \leq 1/(2)] \quad (7\text{-}1)$$

or

$$Q = P - 1/4(\propto) \text{ [for } P \geq 1/(2)] \quad (7\text{-}2)$$

Where "Q" is the mean annual water yield, in inches; "P" is the normal annual precipitation, in inches; and "$\propto$"is the runoff coefficient, in inches^{-1}. Alpha ($\propto$) was determined from guidelines set forth by Hawkins (1976). The second method of calculation is known as Ol'deKop's formula (Sellars, 1965). According to this method, the mean annual water yield is determined from:

$$Q = P - E_o \tanh\left(\frac{P}{E_o}\right)$$

where " Q" and "P" are as previously defined and "E_o" is the annual potential evapotranspiration, in inches.

Estimates of peak flow recurrence intervals for ephemeral streams in the ~~mine plan~~ PHI area were determined from techniques presented by Fields (1975). According to Fields (1975), the 25 and 50 year recurrence interval flood discharge of Utah streams is related to channel geometry characteristics. In this USGS investigation Utah was subdivided into three areas, which were defined from information collected at 85 gaging stations. The locations of the sites used to develop the three appropriate equation sets were of similar streamflow characteristics. Thirty-three sites were studied at mountainous locations in east central Utah [see Figure 2, Fields (1975)] designated as Area 2. Analysis of the data provided reliable estimating equations for flood flows with 25 and 50 year recurrence intervals. Specifically, for the mine ~~plan~~ site area, the following relationships were found to apply:

$$q_{25} = 3.7W^{1.57} \tag{7-4}$$

and

$$q_{50} = 3.9W^{1.58} \tag{7-5}$$

where "W" is the width of the channel bar cross-section in feet, and 25 and 50 are the 25 and 50-year recurrence interval flood discharges in cfs, respectively. The respective standard errors associated with Equations 7-4 and 7-5 are 28 and 33 percent.

The runoff volume resulting from a particular rainfall depth was determined using the runoff curve number technique, as defined by the US Soil Conservation Service (1972). According to the curve number methodology, the algebraic and hydrologic relationship between storm rainfall, soil moisture storage, and runoff can be expressed by the equations;

$$S = \frac{1000}{CN} - 10 \tag{7-6}$$

and

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \tag{7-7}$$

where "Q" is the direct runoff volume in inches, "P" is the storm rainfall depth in inches, "S" is a watershed storage factor in inches (defined as the maximum possible difference between "P" and "Q"), and "CN" is a dimensionless expression of "S" referred to as the curve number. Curve number values were chosen using information supplied by the U.S. Soil Conservation Service (1972), Hawkins (1973), and personal hydrologic judgment following field observations. Weighted curve numbers were used for heterogeneous areas. Kent (1973) gives CN values for the four different hydrologic soil groups and different land use descriptions. The mine site disturbed area has soil characteristics with average runoff potential, i.e., between groups B and C. Land use consists of 70% fair condition range land at CN avg. = 74, 25% industrial area at CN avg. - 89.5, and 5% dirt road at CN avg. = 84.5 (see Table 7-2). The disturbed area weighted CN was found to be 78.5 [from (0.70) (74) = (0.25) (89.5) = (0.05) (84.5)]. The side canyon has soil characteristics with moderately high runoff potential, group C, because of shallow soils and ledges. The area is 85% fair condition range land at CN=79 and 15% poor condition range land at CN=86. This yields a weighted CN for the side canyon of 80 [from (0.85 (79) + (0.15(86)]. This drainage area of North Cottonwood Canyon is moderately low runoff potential soil, group B, and 2/3 good woods and 1/3 good range which are characterized by CN's of 55 and 61 respectively. The weighted CN is 57 [from (0.67)(55) + (0.33)

(61)]. Values of "P" were obtained for selected durations and return periods from Miller et. al. (1973). A 24-hour storm was used for design purposes.

The undisturbed area draining to the sediment pond is predominantly from the soil types classified as Rockland and Stony Sandy Loam, which contain the Grassland Shrub Community. Although these areas do have rock ledges, they are located nearer to the canyon bottom and have slightly flatter slopes and more vegetation between rock outcrops. Based on the soil types (Sandy Loam) and vegetation (Grassland-Shrub), the runoff curve number of 72 is selected based on range land in fair condition, hydrologic soil group between B&C and forest land, thin stand, poor cover, no mulch hydrologic soil group between B&C.

Equation 7-6 is based upon the assumption $I_a = 0.2S$, where I_a is the initial abstraction from storm rainfall, defined as the rainfall which must fall before runoff begins, (i.e., to satisfy interception, evaporation and soil-water storage; therefore, determination of runoff from Equation 7-6 is valid only when P I_a or P 0.2S. No runoff can occur below this point.

Estimates of the peak discharge to be expected from various precipitation events were made using the unit hydrograph procedure developed by the US Soil Conservation Service 1972). Figure 7-2 shows a runoff hydrograph and the associated terminology.

A hyetograph of a single block of rainfall excess with duration D is shown in the upper portion of the figure. The lower portion of the figure contains the resultant runoff hydrograph. For runoff from excess rainfall, the area under the hydrograph curve and the area enclosed by the rainfall hyetograph represent the same volume of water (Q). The peak flow rate for the hydrograph is represented by "Q_p", while "t_p" represents the time to peak flow from the start of the hydrograph to "Q_p". The base time (t_b) is the duration of the hydrograph. The time from the center of mass of rainfall excess to the peak of the runoff hydrograph is the lag time (t_L).

The time of concentration (t_c), not shown on Figure 7-2, is defined as the time for flow from the hydraulically most remote point in a basin to reach the basin outlet.

Time to peak, t_p, is assumed to be a function of watershed lag (t_L) which is determined according to the equation:

$$t_L = \frac{(l^{0.8})(S+1)^{0.7}}{1900Y^{0.5}} \tag{7-8}$$

where t_L is the watershed lagtime in hours, l is the hydraulic length or the length of the main stream to the farthest divide in feet, "S" is as previously defined, and "Y" is the average watershed slope in percent. Values of "Y" were obtained by using methods outlined by Craig and Rankl (1977). The hydraulic length, *l*, was taken from an appropriate topographic map while "S" was determined from Equation 7-7 once the runoff curve number was estimated. According to the US Soil Conservation Service (1972), the watershed lag time is equal to $0.6t_C$ and the time of concentration (t_C) is equal to 1.5 t_p.

Combining these two expressions, it can be seen that:

$$t_p = 1.11\ t_L \tag{7-9}$$

where both variables are as previously defined.

The peak discharge constant used in the dimensionless unit hydrograph method is determined according to the equation:

$$q_p = \frac{484AQ}{t_p} \tag{7-10}$$

where "q_p" is the unit hydrograph peak flow rate in cubic feet per second, "A" is the drainage area in square miles, "Q" is the runoff volume in inches (as determined by Equation 7-6), "t_p" is as previously defined in hours, and 484 is a conversion factor. The rainfall distribution for the 24-hour storm duration was generated from the theoretical NOAA Type II storm distribution shown in Figure 7-3.

Dimensionless unit hydrographs are developed by simulating many natural unit hydrographs using the time to peak and the peak discharge constant. Haan (1970) proposed a dimensionless unit hydrograph based on the gamma function:

$$\frac{q(t)}{q_p} = \frac{rt \times e^{1-t/t_p} C_3 t_p}{t_p} \tag{7-11}$$

where "q(t)" is the hydrograph ordinate at time "t", "q_p" and "t_p" are as previously defined, and "C_3" is a parameter defined by:

$$Q = q_p t_p \left[\frac{e}{C_3 t_p} \right] C_3 t_p \times T(C_3 t_p) \tag{7-12}$$

where "Q" is the runoff volume (one inch for a unit hydrograph) and represents the gamma function.

Figure 7-4 shows how the shape of the hydrograph defined by equation 7-11 changes as "C_3t_p" changes. The higher the value of "C_3t_p", the sharper the peak of the hydrograph. The hydrograph for the disturbed area runoff of 0.75 inches was determined to have a shape with characteristics $t_L = 0.08$ hr., $t_p = 0.09$ hr., and $q_p = 20.1$ cfs. These results are associated with a "$C_3\ t_p$" factor of 3.0 or a "C_3" of 43. Similar evaluations were made for the hydrograph of Cottonwood and Side Canyon runoffs and are given in Table 7-7.

The dimensionless unit hydrograph method involves the development of a runoff hydrograph from a complex rainstorm. The storm is divided into blocks of uniform intensity of duration D. Values of D must be less than or equal to t_p. Practically, the selection of D as a multiple of t_p will ensure that the peak will be encountered. Rainfall excess is generated from the rainfall depths of duration D and the rainfall-runoff relationship expressed in equation 7-6. The rainfall excess from each increment D is then multiplied by the unit hydrograph ordinates to produce a component hydrograph. Each of the component hydrographs are then lagged by a time increment D and are concurrently summed to produce the synthetic runoff hydrograph. A more complete discussion of the unit hydrograph method can be found in Chow (1964) or Haan and Barfield (1977).

Following the determination of a given peak discharge, design sizes for culverts used for runoff diversions and conveyance were determined using methods derived by the US Soil Conservation Service (1972) and illustrated in Figure 7-5.

Sedimentation storage requirements were determined using a disturbed acreage factor of 0.05 ac-ft. of sediment per acre disturbed.

This factor was determined from the Universal Soil Loss Equation as defined by the Agricultural Research Service (ARS) at Purdue University[1]. The equation for soil loss A in tons/acre-year is:

$$A = R\,K\,L\,S\,C\,P$$

where "R" is the rainfall erosivity factor, "K" is the soil erodibility factor, "L" and "S" are slope length and gradient factors given as one variable.

1 *Wanielista, Martin P., Stormwater Management Quantity and Quality, Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, pp. 305-318, 1979.*

$LS = (X/72.6)^m (430 x^2 + 30x + 0.43)/6.57415$ with "X" being slope length, "m" a function of slope, and "x" the size of the slope angle, "C" is the cover factor, and "P" is the erosion-control practice factor.

Appropriate constants for each factor were obtained for the disturbed area from curves and tables given by the ARS. "R" for the Trail Mountain Mine region of Utah is 25. "K" for the loam to sandy loam soil texture class with > 4% organic matter content is 0.25. For a slope length of 250 feet, and average slope angle of 1.75° (since 17.5° = 0.3), and an "m" of 0.5 for gradients > 5%, "LS" is 13.6. The cover factor "C" is 1.0 for essentially no cover and practice factor is also 1.0 for no control measures presently. With these values "A" is 85 tons/acre-year. This soil type 1.0 ton per 0.95 yd^3 and converting to acre feet gives an annual soil loss factor of 0.050 acre feet per acre disturbed.

Open channel flow capacities were determined using the Manning equation. According to this method:

$$V = \frac{1.486 R^{0.67} S^{0.5}}{n} \tag{7-13}$$

where "V" is the velocity in feet per second, "n" is the Manning roughness coefficient, "R" is the hydraulic radius in feet, (defined as the area divided by the wetted perimeter), and "S" is the hydraulic slope, in feet per feet. Estimates of the roughness coefficient were determined from tabular information presented by the US Department of Transportation (1979). The velocity obtained by equation 7-13 was converted to a flow rate using the continuity equation which states that:

$$q = AV \tag{7-14}$$

where "q" is the discharge, in cubic feet per second; "A" is the cross-sectional area of flow in square feet; and "V" is velocity in feet per second. A maximum permissible velocity of 5 feet per second for unlined channels was assumed.

Those sections of diversion channels having velocities in excess of 5 feet per second were designed with rock riprap linings in accordance with methodologies presented by the US Department of Transportation (1975). In accordance with this methodology, the maximum permissible depth of flow for a channel lined with rock riprap is determined by:

$$d_{max} = \frac{63.5(D_{50})}{S_0} \tag{7-15}$$

where "d_{max}" is the maximum permissible depth of flow, in feet; "D_{50}" is the mean rock diameter (or the particle size gradation for which 50 percent of the mixture is finer by weight) in feet, 63.5 is the unit weight of water in pounds per cubic feet, and "S_o" is the channel slope, in feet per feet. The mean rock diameter (D_{50}) in each case was assumed from which the maximum permissible depth was determined. The channel configuration was then determined such that the maximum permissible depth at the design flow would not be exceeded.

7.2.3 Existing Surface Water Resources

This section of the report deals with the region in general and the Trail Mountain ~~mine plan~~ PHI area more specifically. Watershed and stream characteristics are both described.

7.2.3.1 Regional Surface Water Hydrology

The Trail Mountain Mine is located immediately adjacent to Cottonwood Creek, one of the major tributaries of the San Rafael River. Near Orangeville, Cottonwood Creek has had an annual flow of 70,700 acre-feet during the period of record that extends intermittently from 1909 through the present (US Geological Survey, 1984). Approximately 50 to 70 percent of stream flow in the mountain streams of the region occurs during May through July (Waddell et al., 1981). Stream flow during this late spring/early summer period is the result of snowmelt runoff.

Snowmelt is the primary source of water for the perennial streams in the San Rafael River Basin with summer precipitation usually producing little runoff (US Geological Survey, 1979). Ephemeral streams are also abundant in the San Rafael River Basin, existing primarily at lower elevations where evapotranspiration significantly exceeds precipitation.

Water use upstream from Castle Valley, the valley containing most of the agricultural land noted in Figure 7-6, is primarily for stockwatering and industrial purposes (coal mining and electrical power generation). Within Castle Valley agriculture and power production utilize nearly all of the inflowing water (Mundorff, 1972), with minimum flows in the gaged streams and rivers in the basin occasionally approaching zero. Storage reservoirs are common at higher elevations throughout the region. Transbasin diversions occur throughout the area.

The quality of water in Cottonwood Creek and other similar streams in the area varies significantly with distance downstream. Waddell et. al. (1981) found that concentrations of dissolved solids varied from 125 to 375 milligrams per liter in major streams in the region in reaches above major diversions to 1600 to 4025 milligrams per liter in reaches below major irrigation diversions and population centers. The major ions at the upper sites were calcium, magnesium, and bicarbonate, whereas sodium and sulfate were more dominant at the lower sites. They attributed the changes to (1) diversion of water containing low dissolved solids concentrations, (2) subsequent irrigation and return drainage from moderate to highly saline soils, (3) groundwater seepage, and (4) inflow of sewage and pollutants from population centers. Average annual sediment yields within the Cottonwood Creek drainage basin range from approximately 0.1 acre-feet per square mile in the headwaters area to about 3.0 acre-feet per square mile near the confluence with the San Rafael River (Waddell et al., 1981).

7.2.3.2 ~~Mine Plan~~ Potential Hydrologic Impact Area Watersheds and Streams, Stream Characteristics, and Watershed Characteristics

A portion of the Cottonwood Creek watershed receives drainage from the ~~mine plan~~ PHI area. Stream channels from the ~~mine plan~~ PHI area flow to the east toward the Cottonwood Canyon Creek and to the south toward Straight Canyon Creek, a tributary of Cottonwood Creek. Cottonwood Creek is a perennial stream.

The Cottonwood Canyon Creek is a major drainage system where evidence of glaciation exists. From the headwaters to Section 24, Township 17 South, Range 6 East, the canyon is characterized by U-shaped valleys with associated lateral and terminal moraine deposits. Lateral moraine deposits most commonly occur at the intersection with side canyons. Terminal moraine deposits occur at the northwest corner of Section 24 and from this point to near the confluence with Straight Canyon the canyon can be characterized as a V-shaped valley with little evidence of glaciation.

Based on data collected by PacifiCorp, Cottonwood Canyon Creek is an ephemeral stream from its headwaters to Section 24, Township 17 South, Range 6 East and intermittent from that point to its confluence with Cottonwood Creek at Straight Canyon. The stream becomes intermittent near the intersection of Roans Canyon just below the terminal moraine deposits discussed above. During drought conditions which have been experienced since 1985, flow in Cottonwood Canyon is limited to flow emanating from the Roans Canyon Spring located in Section 24 near the confluence with Roans Canyon. Prior to the drought, flow occurred along the entire reach of Cottonwood Canyon and had to be forged to access East Mountain at the Mill Canyon dugway located in Section 2.

Along with Roans Canyon Spring, another spring referred to as Cottonwood Spring (TM-23) is also associated with the alluvial (glacial) deposits. Cottonwood Spring is located in the canyon bottom within the area of terminal moraine deposits at an

elevation higher than that of Roans Spring. With normal precipitation, especially in the form of winter snowpack, runoff would saturate the alluvial deposits and a portion of groundwater would discharge at the location of Cottonwood Spring. During the period of the drought recharge to the alluvial deposits has been limited and the level of groundwater has been reduced to a point below the elevation of the Cottonwood Spring. To verify the extent of the alluvial deposits and to define the hydrologic characteristics, PacifiCorp conducted a hydrologic research project in 1992 which included a series of resistivity lines and the drilling of three surface sites (see Deer Creek/Cottonwood/Des-Bee-Dove Permit, Volume 9 - Appendix F for complete details). At each of the surface sites two wells were completed (except for CCCW-2, see Plate 6-2 for well locations); one in the alluvial deposits and one in the Spring Canyon member of the Star Point Sandstone Formation. Wells completed in the alluvial deposits will be utilized to compare the well hydrographs to those of Cottonwood Canyon Creek and the Star Point Sandstone. Monitoring data will be included in future Annual Hydrologic Monitoring Reports.

Surface water-quality data collected from Cottonwood Canyon Creek by PacifiCorp indicate that the dominant ions are: calcium, magnesium, and bicarbonate. Water quality and quantity data collected during the year are presented in the Annual Report. Total dissolved solids concentrations in the stream vary from about 250 to 300 milligrams per liter in the mine area, with the lower concentrations normally occurring during the high-flow season. Slight variations have been noted between stations located upstream and downstream from the permit area (SW-1, SW-2 and SW-3).

As expected, total suspended solids concentrations in Cottonwood Canyon Creek tend to vary inversely with the flow rate. Concentrations have varied during the period of record from less than 1 milligram per liter to greater than 1000 milligrams per liter.

Topography in the area is very rugged, with elevation varying from 6800 to over 9000 feet above sea level. Slopes within the ~~mine plan~~ PHI area vary from near vertical cliffs to less than 4 percent (2 degrees) on Trail Mountain. Major escarpments occur to the east and south of ~~the mine plan~~ this area.

7.2.4 Surface Water Development, Control and Diversion

Because of the remoteness and the limited amount of surface water in and adjacent to the ~~mine plan~~ PHI area, essentially no development of the surface water has occurred except from some possible stock watering. Cottonwood Creek water is used downstream for irrigation and for power generation. This section deals with the surface water supply in the area as well as the specific runoff and sedimentation control measures planned for the Trail Mountain Mine.

7.2.4.1 Water Supply

Surface water in the ~~mine plan~~ PHI and adjacent areas is utilized primarily for stock watering purposes. A listing of surface water rights within these ~~permit and adjacent~~ areas ~~is~~ are provided in Table 7-6. (Also see Appendix 7-8 Cottonwood Irrigation Shares.) A review of the files of the Utah Division of Water Rights indicated that additional rights have not been added to the area since that original submittal.

Flow Characteristics - According to Jeppson et al. (1968) the mean annual water yield for the ~~mine plan~~ PHI area is approximately 1.5 inches. Other hydrologic methods (described in Section 7.2.1) were used to determine the mean annual water yield to increase the confidence level of the estimate. According to Grunsky's Rule the mean annual water yield from the mine plan area is 2.0 inches. This was determined using an alpha value of 0.008/in. Water yield studies have found values of 0.007 to 0.009 for un-gaged areas with medium elevations, medium summer rainfall, medium temperature, medium soil, moderate slopes and east exposure. Gaged areas such as Black Mesa and Holbrook Creek, Colorado, and Black Hills,

South Dakota, which are similar to the Trail Mountain Mine site, have values ranging from 0.0068 to 0.0090.

According to Ol'deKop's formula (Sellars, 1965), the mean annual water yield from the mine plan area is 2.9 inches. The two methods utilize the information that mean annual precipitation and evapotranspiration over the ~~mine plan~~ PHI area are 16 to 19 inches, respectively (Jeppson et al., 1968).; therefore, estimates of the mean annual water yield from both Ol'deKop's and Grunsky's formulas compare favorably with the estimate from the Hydrologic Atlas of Utah prepared by Jeppson et al. (1968).

Monthly flows from Cottonwood Canyon Creek were computed as a percentage of annual flow for the water year 1979 (October 1978 to September 1979) to determine the seasonal distribution of flows for streams within ~~and adjacent to~~ the ~~mine plan~~ PHI area. The results are illustrated in Figure 7-7. Although actual monthly percentages will change, the distribution pattern of stream flow is characteristic of watersheds in the western highlands where the majority of annual water yield occurs in the spring and early summer as a result of snowmelt runoff.

Daily discharge measurements for the Cottonwood Canyon Creek were taken only during the three years 1979, 1980 and 1981. Within those years flow varied from 0 to 22 cfs with an average of 1.64 cfs. The average discharges for the respective three years of record were 0.87, 3.33 and 0.72 cfs. The USGS gauging station monitoring was discontinued in September 1981 (additional information on flow characteristics of Cottonwood Canyon Creek, review annual Hydrologic Reports).

Surface Water Quality - Three surface water sites (referred to as SW-1, SW-2 and SW-3 in Plate 7-2) have been sampled since 1979. Table 7-3 contains a list of the water quality parameters analyzed along with the results of the chemical analyses of surface water samples collected at these three sites. As illustrated in Plate 7-2, SW-1

is located approximately one mile above the mine, SW-2 is located immediately below all mine surface facilities, and SW-3 is located approximately 2 miles below the mine near the confluence of Cottonwood Canyon Creek and Straight Canyon. Additional water quality data have been collected by the USGS at a gaging station on the Cottonwood Canyon Creek located in the SE1/4NE1/4, Section 36, T17S, R6E. This data is compiled and reported in Table 7-4. This station was discontinued in 1981; however, an additional monitoring station, SW-3, was added by the applicant to monitor Cottonwood Creek below the permit area. Results from all the monitoring stations are summarized in the Annual Report.

As depicted in Tables 7-3 and 7-4 surface waters of the ~~mine plan~~ PHI area are of a mixed chemical type (Calcium-magnesium, bicarbonate) and seasonally vary from a stronger magnesium-bicarbonate to a stronger calcium-bicarbonate. A sample collected by the USGS in November 1978 was a calcium-bicarbonate type; whereas, those collected in July and September of 1979 were of a stronger magnesium-bicarbonate type.

Total dissolved solids concentrations varied from 226 to 976 milligrams per liter at stations SW-1, SW-2, USGS gaging station, and SW-3. Measurements were taken during all periods of the year, therefore, this range represents both high and low TDS values to be expected during low and high flow periods of the year. From April to June, when stream discharges are highest due to direct snowmelt, a diluting effect usually occurs in surface waters, resulting in a lower total dissolved solids concentrations. Later in the year as flow decreases and the majority of the flow is derived from groundwater, the dilution effect becomes less pronounced and total dissolved solids concentrations increase.

Suspended solids concentrations during the inventory period were found to vary from less than 0.5 milligrams per liter to 5024 milligrams per liter in Cottonwood Canyon

Creek. It is known that suspended solids concentrations tend to vary somewhat proportionately with flow rate (Vaughn Hansen Associates, 1979); therefore, during the snowmelt runoff period, suspended solids concentrations are expected to be generally higher than values from low flow periods. The Utah Division of Health has classified Cottonwood Creek within the ~~mine plan~~ permit and adjacent areas as 1C - protected for domestic purposes with prior treatment by standard complete treatment processes, 2B- Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water, 3A - protected for cold water species of game fish and other cold water aquatic life, and 4 - protected for agricultural uses including irrigation of crops and stockwatering. Table 7-5 contains the numerical water quality standards applicable to the various classifications. Few samples collected by personnel of either Beaver Creek Coal Company or the USGS were noted to exceed the chemical standards. One sample collected at the USGS gaging Station contained a lead concentration of 0.13 milligrams per liter in excess of the standard set in all ~~three~~ four applicable state classifications for the waters of Cottonwood Creek.

Water Rights - Surface water rights within and adjacent to the ~~mine plan~~ PHI area have been obtained from the Utah Division of Water Rights and are presented in Table 7-6 and Plate 7-4. In conjunction with the location and permit number, other information included is owner, source of supply, quantity of right, purpose of use, and period of use. As indicated on Table 7-6, the majority of rights in the area are for stockwatering, with only a minor percentage allotted to irrigation.

7.2.4.2 Sedimentation Control Structures and Diversions

One sedimentation pond with corresponding runoff control facilities is constructed to provide sediment control for the Trail Mountain Mine. The layout of the

sedimentation control plan, including pond location, pond drainage area boundary, ditches and berms, are illustrated on Plate 7-5.

A sedimentation pond exists on site. Specific design details for the sedimentation pond and channels conveying runoff to the pond are described in this section. All conveyance facilities associated with the runoff control plan have been constructed.

Conveyance Facilities Design - The sedimentation pond is sized to contain runoff from the areas draining onto the mine site. As shown in Plate 7-5, no diversion ditches for undisturbed area runoff are proposed. Only runoff from the side canyon above the operation will be bypassed through a culvert. The side canyon culvert was designed to pass runoff from the 10-year, 24-hour storm (2.4 inches). As stated earlier, Miller et al. (1973) gives values for precipitation. Their Figure 27 indicates a 10-year, 24-hour storm precipitation isopluvial at the mine site of 2.4 inches.

A diversion culvert and curb and gutter system conveys runoff from the disturbed area to the sedimentation pond. The culvert and gutter system were designed to pass runoff from the 10-year, 24-hour storm [2.4 inches - from Miller et al. (1973), Figure 27 as above]. The diversion culverts for Cottonwood Creek were designed and sized by the U.S. Forest Service and the Division of Oil, Gas and Mining to pass runoff from the 50 year, 24-hour storm [3.2 inches - from Miller et al. (1973), Figure 39, page 41]. The culvert was extended 300 feet upstream in the fall of 1990.
(See Appendix 7-3 for Culvert Specifications.)
(See Appendix 7-13 for Culvert Extension Details.)

Diversion with riprap has a higher roughness coefficient. Peak flows and peak flow design related information for the diversion ditch and culverts are contained in Table 7-7.

The soil conservation service equation for calculation of watershed lag times (t_L) was used in this analysis:

$$t_L = \frac{(l^{0.8})(S+1)^{0.7}}{1900Y^{0.5}} \quad \text{and} \quad S = \frac{1000}{CN} - 10$$

Where l = the hydraulic length (ft)

Y = the average water shed slope (%)

S = the storage at saturation

CN = curve number

The drainage basin characteristics are given in Table 7-7 along with the resultant: T_L values: canyon = $(6375)^{0.8}$ $(2.5 + 1)^{0.7}/1900$ $(49.12)^{0.5}$ = 0.2.

Drainage areas for the side canyon 48-inch culvert and Cottonwood Canyon 66-inch culvert are shown on Plate 7-6. Drainage areas for the disturbed and undisturbed drainage to the sediment pond are shown on Plate 7-5. It should be noted that diversion culvert designs for Cottonwood Canyon were originally developed by the U.S. Forest Service and subsequently verified by Vaughn Hansen and Associates as shown in Appendix 7-3. As indicated, the culvert was originally designed with a capacity of 535 cfs, based on the USFS design flood of 450 cfs and the Vaughn Hansen and Associates design flood of 510 cfs. The culvert was extended in 1990, and the design was verified for the 510 cfs flow as shown in Appendix 7-13.

The design flood includes <u>all</u> of the Cottonwood Canyon runoff, down to and including the side drainage and the three culvert inlets from the opposite side of the highway, as shown on Plates 3-1, 7-5 and 7-6.

Design criteria and calculation results for sizes and flows in the diversion system at maximum discharge are presented in Table 7-8. Also contained in Table 7-8 is the required mean rock diameter (D_{50}) for cross sections (with velocities in excess of five feet per second) which would require a rock riprap lining; however, the maximum flow does not result in velocities significantly larger than 5 fps on the non-metal surfaces.

Two other minor inlets to the sediment pond exist at this time. The first inlet is from a small road and pad area at the top of the switchback above the pond. It drains into a vegetated ditch and enters the pond at the point where the dam meets the ~~highwall~~ hillside. The second inlet is from a 24-inch culvert which picks up a small amount of road drainage below the gate. The culvert was installed in 1988 to catch runoff below the gate which may contain dust or mud carried onto the highway by the haul trucks. A third minor inlet was the 4" mine water discharge line. The 4" discharge line located in the 2nd portal south of ROM belt portal was optionally used to channel mine water discharge through the sediment pond in lieu of discharging directly to Cottonwood Creek. Due to increased volume of flow from the shift in mining from the east to west side of the mine, a replacement 8" line now discharges mine water to the 100,000 gallon storage tank. From the storage tank, water can be discharged to an existing 48" culvert as discussed in section 7.2.4.2. ~~pg 3-37~~. Inflows to the 8" line vary according to routing as well as volume of water to be discharged. The existing 4" line is disconnected within the mine but remains in place on the surface for emergency backup measures and can be easily reconnected if needed. All inlets are shown on Plates 3-1 and 7-5. Design criteria and sizing are shown in Table 7-8.

"BTCA" Areas - It should be noted that two small areas of disturbance do not drain to the pond. The first "BTCA" area consists of approximately 0.21 acres located just south of the sediment pond. The calculated runoff from this area is 0.013 acre feet,

based on the 0.21 acres and a 10-year, 24-hour event. The area is vegetated, and all drainage from the site passes through straw bales, the approved sediment control measure. The realigned stream channel is entirely protected with large (approved size) riprap. Riprap will be maintained at this site until bond release or earlier release by the Division. The straw bales or other sediment control measures, approved by the Division, will be maintained at the site until vegetation is determined adequate by the Division. Adequacy will be based on comparison of the site with the riparian reference area.

The second "BTCA" area consists of approximately ~~0.028 acres located above the water treatment plant. The area, which drains to the creek, is an outslope of the pad area and cannot be drained to the sediment pond. The outslope BTCA area is vegetated, and all drainage from the site passes through a silt fence as a final treatment. Silt fences will be maintained at this site until vegetation is deemed adequate by the Division, by comparison with the riparian reference area, or until bond release~~ 0.04 acres located on the northern extent of the parking lot. The area, which drains to Cottonwood Creek, is an outslope of the parking lot and cannot be diverted to the pond. The BTCA is riprapped with rock to control erosion and vegetated which filters sediment. This area will be maintained until bond release (see Plate 7-11 for Typical Sediment Control Measures). Runoff from the area for a 10-year, 24-hour event is calculated to be ~~0.002~~ 0.004 acre feet.

The above described "BTCA" areas are shown on Plates 3-1 and 7-5. It should be noted that these areas are included in the total disturbed area for the site (~~9.85~~ 10.39 acres) but are not included in the runoff calculations for disturbed area draining to the pond (9.45 acres) shown on Table 7-9 since they do not drain into the pond.

Sedimentation Pond Design - As mentioned previously, one sedimentation pond is constructed to provide sediment control for the surface facilities of the Trail

Mountain Mine. The sedimentation pond was designed to contain sediment storage volume from 0.05 acre-feet of sediment per acre to disturbed area. Sediment will be cleaned out at 60 percent of the sediment storage level. Sediment yield for the 9.61 acre disturbed area will be 0.47 acre-feet. (Note: 0.16 acres of disturbed area on the new ventilation portal access road drain into the mine, not to the pond).

Spillway capacity requirements for the sedimentation pond were based on runoff from the 25-year, 24-hour storm (2.9 inches). Table 7-9 contains the volume and spillway capacity requirements for the pond as well as additional design related information.

The sedimentation pond will be inspected quarterly, and a copy of the inspection report will be kept at the ~~mine site~~ main office. A certified annual inspection report will also be done yearly, with a copy kept at the mine site and one sent to the Division with the Annual Report for the property. The above inspections will be performed in accordance with requirements of R645-301-514.330 and R645-301-514.310, respectively.

The pond design details for the sedimentation pond are illustrated on Plates 7-7 and 7-8 with the stage-capacity curve for the pond given in Figure 7-9. The sedimentation pond consists of a sediment storage pool, a dead pool, and a runoff control pool equal to the inflow volume from a 10-year, 24-hour storm (2.4 inches). A dewatering device is placed in the pond to draw the pond level down to the bottom of the runoff control pool in anticipation of a future runoff event. The Utah Division of ~~Health~~ Environmental Quality requires that no dewatering device be placed within three feet of the top of the sediment cleanout level (60 percent); therefore, a dead storage pool has been created in order to meet the requirements of both agencies. The proposed principal and emergency spillway system consists of a corrugated metal riser and conduit with an anti-vortex device, trash rack, and anti-seep collars.

Utilizing Equation 7-16, which defines orifice flow, the discharge capacity of the riser-conduit combination with a diameter of 48 inches was found adequate in passing the peak inflow resulting from the 25-year, 24-hour storm (see Figure 7-10).

Orifice flow occurs when the flow is restricted by the opening and can be determined as;

$$q = CA\,(2gH)^{1/2} \qquad (7\text{-}16)$$

where q is as previously defined; C is a coefficient dependent upon the orifice geometry (0.6 in this case); A is the cross sectional area of the opening, in square feet; g is the gravitational constant (32.2 feet per second squared); and H is the head above the orifice inlet, in feet. The orifices considered are the riser inlet and the inlet of the conduit leading from the riser through the pond embankment.

The total embankment height was obtained by adding the stage at full storage capacity, the head of water over the spillway under design flow conditions, the required freeboard height (1.0 feet), and a five percent settlement allowance. The embankment top width will not be less than (H + 35)/5 where H is the height of the embankment, in feet. Table 7-10 summarizes the design specifications for the sedimentation pond.

The sedimentation pond is constructed between the excavated slope of the old pond and a new embankment constructed over the ~~proposed~~ 66-inch culvert. The excavated slope of the old pond was approximately equal to 1.06H:1V. To obtain the necessary pond storage capacity, the remaining inside slopes of the pond was designed at 2h:1V. The pond is lined with 18 inches of a 10:1 mixture of the embankment material and bentonite, respectively, to prevent seepage and piping.

The dewatering device consists of a 12-inch corrugated metal riser and an 8-inch conduit drainline, antivortex device, trash rack, and anti-seep collars. The anti-vortex also acts as a skimming device by not allowing water to be pulled directly from the surface of the pond. A water control gate valve is located at the end of the 8-inch diameter corrugated metal conduit within the 48-inch spillway within the pond embankment to allow efficient water release.

This was necessitated by the facts that:

1) The water control gate valve must be installed in the manhole/spillway to allow access to the valve;

2) The location of the riser does not allow access to the gate if placed at the extreme inlet;

3) Gates were apparently not available which could be attached between two culverts in a watertight manner; and

4) It was desirable to allow access to the control gate for maintenance purposes.

The control gate operator mechanism is located above the spillway cover. Access to the gate for maintenance can be made via a ladder or rebar rungs which have been welded to the spillway side. A walkway has been installed to allow access to the control gate for purposes of dewatering and inspection. Sufficient space must be available in the pond to completely detain the runoff resulting from the 10-year, 24-hour storm. At the same time, sufficient settling time must be allowed in order to meet applicable effluent standards in the discharged water. It is therefore suggested that water in the pond be released through the dewatering device after 14 days unless there is a good probability of occurrence of a runoff producing storm prior to that time, under which condition the water should be released before the storm occurrence. This would allow sufficient time for all but the fine clay and colloidal particles to settle (U.S. Environmental Protection Agency, 1976).

Anti-seep collars have been used based on methods outlined by the U.S. Environmental Protection Agency (1976). Figure 7-11 outlines details of the proposed anti-seep collars with spacing requirements shown Plate 7-7.

Riprap was placed in the inlet channels and below the outlet conduit of the pond to dissipate energy and reduce erosion potential. Riprap ~~shall also be~~ was placed on the inside slope of the pond embankment to a width of five feet on both sides of the spillway and dewatering device up the full height of the embankment to protect the embankment from erosion.

The outlet culvert from the pond discharges onto the riprap protection on the main channel as described in Appendix 7-3.

Sediment Disposal Plans - Federal and State regulations require that sediment, which has accumulated in the pond, be removed when 60 percent of the design sediment storage volume has been filled. The point at which cleanout becomes necessary is 11.2 feet below the top of the riser and can be measured directly with a tape. Sediment removed from the pond will be temporarily stored within the drainage basin to the pond. Removed sediment is disposed of at the Cottonwood Waste Rock Facility.

The procedure for sedimentation pond cleaning is as follows:

1. Decanting of the pond water:
   a. Discharge through the primary spillway, according to UPDES requirements, and/or;
   b. Pumping the water behind abandoned, sealed mine workings, and/or;
   c. Hauling to the Cottonwood Waste Rock Storage Facility's sedimentation pond.

2. Sediment disposal at the Cottonwood Waste Rock Facility.

3. Division's "Title V Coal Program Policy for Disposal of Sediment Pond Waste" guideline will be followed for sediment samples and testing.

4. Division will be contacted at the beginning of the sludge transport process.

Pond Reclamation - The disturbed area of the pond has been seeded with the interim (contemporaneous) seed mix. Permanent reclamation of the pond is discussed under Section 7.4.

7.2.5 Effect of Mining on the Surface Water Hydrologic Balance

As has been previously mentioned, the occurrence and quality of water in any region is highly controlled by geology. Section 7.1.3.1 Regional Groundwater Hydrology of this chapter describes in detail the influence geology has on the hydrologic regime. Major drainages conveying runoff away from the ~~permit~~ PHI area are Cottonwood Canyon Creek and Straight Canyon. With the exception of the very headwater regions of these drainage basins, mining and, therefore, subsidence will not occur beneath the major stream channels of these canyons. In the majority of cases, cracking due to subsidence is not anticipated to extend to the surface; therefore, surface runoff patterns will not be significantly affected. Data collected by PacifiCorp over a ~~ten~~twenty-year period on the East Mountain ~~permit~~ PHI and adjacent areas concerning subsidence and surface drainages has not detected any surface stream impacts. Consequently, subsidence should not cause significant impacts to the surface water system.

7.2.5.1 Quantity

As mentioned earlier in the report, the major drainage carrying runoff away from the mine facility area is Cottonwood Canyon Creek. All surface facilities are located adjacent to Cottonwood Canyon Creek, and surface runoff from disturbed areas is passed through the sedimentation pond prior to discharging in the creek.

Water ~~made~~ intercepted within the mine is either; 1) used within the mine and; therefore, retained within the groundwater hydrologic system, or 2) is discharged into Cottonwood Canyon Creek. Discharge from the mine will vary depending on localized mining conditions. Underground sumps are installed for storage, settling and recirculation of water. When the sumps become full, water is pumped outside, either to the sediment pond for additional settling or directly to the creek if the quality meets effluent standards. Discharge quantity and quality will be reported in the Annual Hydrologic Reports.

7.2.5.2 Quality

The quality of flow from the headwaters of the San Rafael River Basin is excellent; however, the quality rapidly deteriorates downstream as streams cross shale formations and receive irrigation return flows from Mancos derived soils. The impact of mining on this system will be quite limited.

The existence of runoff and sediment control structures should minimize the potential for degradation of the quality of stream waters due to runoff from disturbed areas of the Trail Mountain Mine.

7.2.6 Mitigation and Control Plans

Runoff from all disturbed areas will be passed through sediment control facilities with the exception of ~~one~~ two small "BTCA" areas as discussed in Section 7.2.4.2. Any discharge from facilities will be monitored in accordance with UPDES permit standards and State and Federal regulations. The effects of the mining operation on the surface water system will be analyzed through the surface water monitoring plan described in the next section. In the unlikely event that monitoring shows that the surface water system is being adversely affected by mining activities, additional steps will be taken to rectify the situation in consultation with State and Federal regulatory agencies.

7.2.7 Surface Water Monitoring Plan

An ongoing hydrologic monitoring program will be conducted at each of the stations shown in Plate 7-2 and as described in Appendix 7-1. Stations have been established to monitor water quality and quantity above and below the ~~mine plan~~ permit area~~s~~. Monitoring parameters will be in accordance with Table 7-2a in Appendix 7-1. Monitoring schedule and reporting will be in accordance with Appendix 7-1.

7.2.7.1 Baseline Monitoring

All surface water monitoring stations are presently on operational status. Baseline will be conducted every fifth year and compared to historical data.

7.2.7.2 Operational Monitoring

All surface water monitoring stations will be monitored quarterly for flow (when flowing) to delineate seasonal variation and correlate discharge with changes in water quality. The water quality parameters and sampling frequency will be as listed in Appendix 7-1. All surface monitoring stations will be monitored quarterly for water quality. Results of all water quality data will be submitted quarterly and summarized in the Annual Report as described in Appendix 7-1.

7.2.7.3 Postmining Monitoring

Representative surface water stations will be monitored biannually during high and low flow conditions. The representative stations will be determined with the aid and approval of the Utah State Division of Oil, Gas and Mining. Duration of monitoring and parameter selection will be as per DOGM guidelines listed in Appendix 7-1.

7.3 ALLUVIAL VALLEY FLOOR DETERMINATION

Utah regulations (R645-302-320) require that the presence of alluvial valley floors in or adjacent to the mine permit area be identified. The regulations (R645-100-200) define an alluvial valley floor as "unconsolidated stream-laid deposits holding streams with water availability sufficient for

subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by un-concentrated runoff or slope wash together with talus, or other mass-movement accumulations, and windblown deposits". The existence of an alluvial valley floor is, therefore, determined to exist if:

1) Unconsolidated stream-laid deposits holding streams are present, and

2) There is sufficient water to support agricultural activities as evidenced by:
   a) The existence of flood irrigation in the area in question or its historical use;
   b) The capability of an area to be flood irrigated, based on stream-flow water yield, soils, water quality, topography, and regional practices; or
   c) Subirrigation of the lands in question, derived from the groundwater system of the valley floor.

7.3.1 Scope

The purpose of this ~~document~~ section is to examine the potential existence of alluvial valley floors in and adjacent to the areas to be affected by surface operations associated with the Trail Mountain Mine, an underground coal mine located ten miles northwest of Orangeville, Emery County, Utah.

This section is divided into three parts. First, a general description of the surface operations and site disturbances associated with the Trail Mountain Mine is presented. Next, a discussion of geomorphic and irrigability characteristics and the water quality and availability of Cottonwood Canyon drainages as a possible alluvial valley floor are presented. Finally, the conclusions of the alluvial valley floor determination are summarized.

7.3.2 Site Description

Surface facilities associated with the Trail Mountain Mine ~~plan~~ permit area consist of the portal area located in Cottonwood Canyon. ~~and an~~ The ~~access~~ paved road ~~up~~ in Cottonwood Canyon accessing the mine facility is the jurisdiction of the Emery County Special Services District #1.

The climate of the general area is semi-arid and continental. Mean monthly temperatures range from about 8° F to the mid-70's. Temperatures in the region tend to be inversely related to elevation. Average annual precipitation is approximately 16 inches. Seventy percent of the annual precipitation falls during the winter as snow with most of the remainder coming as summer thunderstorms.

7.3.3 Alluvial Valley Floor Characteristic

The various criteria for determining the existence of an alluvial valley floor are examined in relation to the Trail Mountain Mine ~~plan~~ permit and adjacent areas.

7.3.3.1 Geomorphic Criteria

Alluvial deposits in and adjacent to the mine permit area are shown on Plate 7-9. Plate 7-9 shows the extent of the alluvium as presented by Doelling (1972) and shows that the alluvium is found primarily along ~~Lower Cottonwood Creek and~~ at the mouth of the Cottonwood Canyon Creek. Only very narrow bands of alluvium are found along the Cottonwood Canyon Creek above the canyon mouths.

7.3.3.2 Water Quality and Availability

The potential for flood and subirrigation are now evaluated in conjunction with the alluvial valley floor determination.

Flood Irrigation - Flood irrigation near the mine ~~plan~~ permit area is currently, and has historically been, confined to the alluvial areas of Lower Cottonwood Creek. Water is diverted at the mouth of the Cottonwood Canyon Creek to irrigate fields on the alluvium.

No flood irrigation has historically been practiced on the narrow alluvium land upstream in the canyon opening to lower Cottonwood Creek. A reconnaissance survey of the surrounding region indicates that flood irrigation is also absent in other areas of similar hydrologic, geologic, and biotic characteristics. The historic lack of

flood irrigation in these steep, narrow canyons suggests that such activities are not feasible in the region. In addition, the topography is very steep and consequently not conducive to agricultural activities.

Cottonwood Canyon Creek water quality is good. A detailed review of the surface water quality has been presented previously in this report.

Subirrigation - Some subirrigation of vegetation does occur on the alluvial valley floors shown in Plate 7-9. The subirrigated species, mainly cottonwoods and willows, are found along the channels of Cottonwood Creek suggesting that subirrigation is confined to the channel areas where the water table is near the surface.

7.3.4 Alluvial Valley Floor Identification

Based on the foregoing reconnaissance analysis, the canyon of Cottonwood Canyon Creek cannot be considered an alluvial valley floor due to the lack of area for supporting an agriculturally useful crop. The valley floor of Lower Cottonwood Creek, however, can be classified as an alluvial valley floor due to the presence of both flood irrigation and limited subirrigation on the alluvium. The flood or subirrigated alluvial areas are located over two miles from the mine permit area and are used for pasture and hay production.

7.3.5 Potential Impacts to the Alluvial Valley Floors

Plate 7-9 shows that the Trail Mountain Mine ~~plan~~ permit area is over two miles from the alluvial valley floor at Cottonwood Creek. Little potential exists for the mine operation to impact the alluvial valley floor. Access to the mine is by existing county road across a minimal amount of alluvial area. All surface disturbances in the portal area will be protected by sediment control facilities and will be designed and constructed according to the Utah Coal Regulations in an environmentally sound manner.

The hydrologic monitoring program will help determine the actual impact of surface activities and aid in selecting mitigating measures, if necessary. However, it is PacifiCorp's position that the Trail Mountain Mine and associated activities will have no significant hydrologic impacts to the alluvial valley. Details concerning this monitoring program are outlined in a previous section of this report.

7.4 CLIMATOLOGICAL INFORMATION

PacifiCorp operates a network of weather stations, including two at low elevations (Hunter and Huntington power plants) and two at high elevations (Electric Lake and East Mountain).

7.4.1 Precipitation

The climate of the permit, adjacent, and PHI areas has been described by the U.S. Geological Survey, which states that it is semi-arid to subhumid and precipitation generally increases with altitude. The average annual precipitation ranges from about ten (10) inches in the lowest parts of the ~~permit~~ areas (southeast) to more than twenty-five (25) inches in the highest parts (northwest). PacifiCorp's weather station, located in Section 26, Township 17 South, Range 7 East, has provided data which shows that the summer precipitation in the form of thundershowers averages about the same as the winter precipitation in the form of snowfall. Because much of the summer precipitation runs off without infiltration, the winter precipitation has the greatest impact on groundwater.

Precipitation amounts have been and will continue to be recorded at the Hunter and Huntington power plants, at Electric Lake Dam, and on East Mountain. Precipitation data can be found in the annual Hydrologic Monitoring Report (Table 7-12 for East Mountain data).

7.4.2 Temperatures

Air temperatures vary considerably both diurnally and annually throughout the ~~permit~~ region ~~area~~. Midsummer daytime temperatures in lower areas commonly exceed 100° F, and midwinter nighttime temperatures throughout the area commonly are well below 0° F. The summer temperatures are accompanied by large evaporation rates. Although not recorded, there probably also is significant

sublimation of the winter snowpack, particularly in the higher plateaus which are unprotected from dry winds common to the region. Temperature information is collected at the ~~UP&L~~ PacifiCorp weather stations at each power plant, at Electric Lake, and on East Mountain. These data will continue to be included in the annual Hydrologic Monitoring Report (see Table 7-12 for East Mountain data).

7.4.3 Winds

The winds in the area are generally variable. The wind rose presented in Figure 7-13 displays the variability for the Meetinghouse Ridge area for January to December 1978.

7.5 RECLAMATION HYDROLOGY

7.5.1 General

Reclamation hydrology will take place in two phases. Phase I reclamation will consist of removal of all diversions and the majority of the culverts, restoration of the main and side canyon channels, and redirection of the reclaimed area runoff to the sediment pond. Phase II reclamation will consist of the removal of the sediment pond and all remaining culverts after revegetation standards have been reached.

It is proposed to use a 2-Phase reclamation program with a sediment pond remaining through Phase I because of the close proximity of the site to an intermittent stream and the resulting difficulty in controlling both runoff and sediment by other means. Another advantage to this approach is that by leaving some culverts in place, access is provided for required maintenance by equipment.

The following sections will describe each of the major hydrologic items involved in reclamation, along with details on design, operation and final disposition.

7.5.2 Cottonwood Canyon Channel

During Phase I of the reclamation, the 66-inch culvert that presently carries the main canyon drainage beneath the site will be removed. The 96-inch to 66-inch transition and trash rack will be relocated to a point just above the sediment pond, as shown on Plate 3-12. The stream channel will be reconstructed through the property, down to the new culvert inlet near the pond.

It is expected that the reconstructed channel will be on bedrock and, for that reason, it was proposed that only the channel sides be protected by riprap. Since the bottom conditions are unknown, PacifiCorp will commit to placement of appropriately sized riprap and filter blanket on the channel side and bottom, unless the bottom turns out to be on bedrock.

Riprap, filter blanket and flow designs and calculations are detailed in Appendices 7-3 and 7-4. Design criteria are summarized in Table 7-11 in this Chapter. See Plate 3-12 for structure locations. The reclaimed main channel slope is projected to be a consistent 6% as shown in Table 7-11 and on Plates 3-12 and 3-12A.

The reclaimed area runoff will be prevented from reaching the restored channel by installation of an earthen berm on the reclamation side of the channel. The berm will direct disturbed runoff to the sedimentation pond. A typical section of the restored channel (and berm) is shown on Figure 7-12.

When the revegetation standards have been met, the second phase of reclamation will begin. It will consist of removal of the sedimentation pond and all remaining culvert sections. The remaining channel area will be restored as in Phase I, and all newly disturbed areas will be reseeded. Additional sediment and/or erosion controls, such as strawbales, silt fence, berms, etc., will be installed if necessary to protect the restored channel and stream.

During reconstruction of the main channel, it is proposed to divert the Cottonwood Canyon Creek flow around the minesite. This will be accomplished by installation of a small, temporary dam in the

channel with a pump diverting the flow into a flexible culvert (or other conveyance structure), which will discharge either back into the culvert below or into the channel below the pond.

7.5.3 Side Canyon Channel

During Phase I of the reclamation, the 48-inch culvert will be removed from the side channel down to its confluence with the restored main channel. The side channel will also be restored and riprapped as described in Appendix 7-3. At the intersection of the side and main channels, 40 feet of 48-inch culvert will be left in place in the side channel. The inlet section and trash rack will also be installed at this location. The reclaimed area will be separated from the restored channels by installation of an earthen berm on the reclamation side of the channels, providing for reclaimed area drainage to the north of the side canyon to flow over the culverted area and to the sediment pond. During Phase II, the remaining 48-inch culvert will be removed along with the sediment pond and remaining main channel culverts when revegetation standards have been met. The remaining disturbed area will then be reseeded in accordance with the plan.

Design parameters are summarized in Table 7-11 of this Chapter. Riprap, filter blanket and flow designs and calculations are detailed in Appendices 7-3 and 7-4. A typical section of the restored side channel is shown in Figure 7-12, and the overall plan and structure locations are shown on Plates 3-5 and 3-6.

7.5.4 Sedimentation Pond

The sedimentation pond will remain in place during Phase I of reclamation. There will be no change in pond size, operation or configuration. The reclaimed area runoff will be directed to the pond at the existing inlet location by earthen berms as described in the previous sections. Runoff area will be less than the operational design area by the amount of area involved in the channel restoration; therefore, the pond capacity is more than adequate to contain the reclaimed area runoff from a 10-year, 24 hour event.

The sedimentation pond will continue to be operated, maintained and inspected, as required, until such time as it can be removed.

When revegetation standards have been reached on the reclamation, the sedimentation pond and all remaining culverts will be removed. Any sediment removed from the pond will be hauled to the Cottonwood Waste Rock Facility for disposal. The main channel will be restored through the former pond area, and all remaining disturbed areas will be reseeded.

Pond design details can be found in Section 7.2.4.2 of this Chapter. Structure locations for Phases I and II of reclamation are shown in Plates 3-5 and 3-6.

7.4.5 Post-Mining Water Monitoring

Upon completion of Phase I of the reclamation, all water monitoring locations with the exception of the UPDES sampling point for the sediment pond discharge will enter reclamation status. Post-mining monitoring will take place at the locations and frequencies described in Appendix 7-1. The UPDES (pond discharge) point will continue to be monitored in accordance with requirements of the permit until such time as the permit is cancelled and/or the pond is removed.

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Table 7-1
Results of Groundwater Quality Analyses

	Belt Entry 24+00 1-Jun-79	Belt Entry 24+00 Jul-79	Station #134 6-Sep-79	Intake #4 29 & 35 Oct-79	Entry #4 31+00 1-Nov-79	Station #114 1st Right 27-Nov-79	Station #138 1st Left 32+40 27-Dec-79	Entry #1 South Section 31-Jan-80	Entry #2 32+00 25-Feb-80	Entry #2 1st Right 5+00 27-Mar-80	Entry #4 West Section 8+50 Jun-80	Belt Entry 24+00 Jul-80	Entry #2 West Section 11+70 Aug-80	Entry #3 West Section Sep-80	Entry #3 West Section 17+50 3-Oct-80	South Section 34+75 24-Nov-80
Conductivity, mmhos/cm	780	330	320	1000	630	1850	700	480	430	490	470	780	520	785	1200	490
pH, Units	7.62	7.22	7.6	7.6	7.75	6.2	3.2*	7.85	8	8.6	7.8	7.62	7.8	8	2.6*	7.6
Iron (Disolved), mg/L	0.25	0.17	0.02	0.025	0.1	0.125	0.13	0.122	0.06	0.035	0.059	0.25	0.22	0.017	0.096	0.12
Iron (Total), mg/L	0.31	0.17	0.11	0.115	0.136	0.33	0.385	0.15	0.11	0.157	0.13	0.31	0.26	0.16	0.169	0.15
Manganese, mg/L	0.009	0.009	0													
Oil & Grease, mg/L	0.009	0.009	0.009	0.01	0.01	0.01	0.012	0.015	0.01	0.014	0.013	0.009	0.01	0.01	0.005	0.005
Sulfate, mg/L	52	710	<1.0	320	410	540	370	26	21	<1.0	<1.0	52	6	4.5	<0.1	<1.0
Suspended Solids, mg/L	320	3	2	1	1	<0.1	1.5	1.5	3.5	5	5	320	5	9	8	7
Total Dissolved Solids, mg/L	500	2700	420	857	406	1200	560	336	280	320	310	500	364	550	840	320

On one location in the mine was known to product a sufficient groundwater flow (approximately one gal. per day) to suggest sampling. These locations was identified as UG-1 on Figure 6-9. Over 30 samples from this site have been analyzed during the 1979 - 1983 period. The lowest pH was 6.8 and most are above 7.5. Alkalinities are also high, generally above 240 mg/L as $CaCO_3$ which indicates a large pH burrering capacity. (See Annual Reports for Water Monitoring Data). Other samples from misc. sites in the mine show similar results. *The low pH samples in Table 7-1 are either erroneous or else samples of small stagnant pools, not representative of any significant water generated with the mine.

Note: UG-1 was rendered inaccessible in 1988. A new underground monitoring site, UG-2, has since been selected for monitoring.

02/15/1990

Table 7-2
Runoff Curve Numbers for Hydrologic Soil-Cover Complexes
(Antecedent moisture condition II, and Ia - 0.2S)

Cover			Hydrologic Soil Group			
Land Use	Treatment or Practice	Hydrologic Condition	A	B	C	D
Fallow	Straight Row	-----	77	86	91	94
Row Crops	"	Poor	72	81	88	91
		Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	"	Good	65	75	82	86
	" and Terraced	Poor	66	74	80	82
	" and Terraced	Good	62	71	78	81
Small Grain	Straight Row	Poor	65	76	84	88
	"	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
	"	Good	61	73	81	84
	" and Terraced	Poor	61	72	79	82
	" and Terraced	Good	59	70	78	81
Close-seeded Legumes[1] or Rotation Meadow	Straight Row	Poor	66	77	85	89
	"	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	"	Good	55	69	78	83
	" and Terraced	Poor	63	73	80	83
	" and Terraced	Good	51	67	76	80
Pasture or Range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	"	Fair	25	59	75	83
	"	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		-----	59	74	82	86
Roads (dirt)[2]		-----	72	82	87	89
(hard surface)[2]		-----	74	84	90	92
Industrial Area		-----	81	88	91	93

[1] Close-drilled or broadcast
[2] Including right-of-way

Table 7-3
COTTONWOOD CANYON CREEK WATER QUALITY *
SW-1

SAMPLE DATES	ACIDITY	ALKALINITY BICARBONATE	CALCIUM	CARBONATE	CHLORIDE	CONDUCTIVITY (umhos/cm)	HARDNESS	IRON TOTAL	IRON DISSOLVED	MAGNESIUM	MANGANESE	OIL & GREASE	PH (units)	POTASSIUM	SODIUM	SULFATE	TSS	TDS
HISTORICAL 1977-2008																		
MIN	0.0	231	6.0	0.0	0.7	380.0	210.00	0.00	0.0	2	0.0	0.50	7.1	1.0	6.0	20.0	1	226
MAX	27.0	442	152.3	20.0	27.0	1026.0	541.0	15.90	0.4	78	1.3	358.00	8.7	21.0	60.0	238.7	1298	690
MEAN	5.7	337	67.1	5.6	12.5	690.7	343.1	0.82	0.1	40	0.1	11.10	8.0	2.8	20.2	75.8	65	386.8
No. of Analysis	46	91	90	21	91	52	58	81	19	91	64	41	86	87	90	91	81	91

* Quality parameters are reported as mg/l unless otherwise noted.

** Data: Database input restricted to values greater then laboratory minimum detection limit.

Table 7-4. USGS Water Quality Data at USGS Gaging Station on Cottonwood Creek above Straight Canyon, near Orangeville, Utah.

Date	Oct 21 1978	Nov 19 1978	Jun 13 1979	Jul 16 1979	Aug 05 1979	Sep 15 1979
Time	1130	1030	1430	1830	1630	1615
Stream Flow, cfs	.33	.57	3.3	.94	.54	.32
Specific Conductance, umhos/cm	530	570	470	540	560	560
pH	8.7	8.9	7.8	8.8	8.7	8.6
Temperature, C^o	8.5	.0	17.0	17.0	19.5	13.5
Oxygen (Dissolved), mg/l	9.1	11.2	---	7.4	7.0	8.2
Coliform (Fecal), cols. 100 ml	---	K13	---	---	24	---
Streptococci (Fecal), cols. 100 ml	---	81	---	---	2000	---
Hardness as CaCO3, mg/l	300	300	---	250	280	270
Hardness as CaCO3 (Noncarbonate), mg/l	30	16	---	17	50.	40
Calcium (Dissolved), mg/l	54	55	---	39	40	42
Magnesium as Mg (Dissolved), mg/l	39	39	---	38	44	41
Sodium (Dissolved), mg/l	14	13	---	18	20	16
Sodium (Percent)	9	9	---	13	13	24
Sodium Absorption Ratio	.4	.3	---	.5	.5	.4
Sodium Potassium as Na (Dissolved), mg/l	---	---	---	20	26	18
Potassium as K (Dissolved), mg/l	2.9	1.9	---	2.1	6.1	2.3
Bicarbonate as HCO3, mg/l	280	310	---	260	260	260
Carbonate as CO3, mg/l	24	18	---	14	10	10
Alkalinity as CaCO3, mg/l	270	284	---	240	230	230
Carbon Dioxide as CO2 (Dissolved), mg/l	1.0	.7	---	.7	.9	1.1
Sulfate as SO4 (Dissolved), mg/l	49	44	---	56	61	60
Chloride as Cl (Dissolved), mg/l	10	9.0	---	8.9	11	9.1
Fluoride as F (Dissolved), mg/l	---	.1	---	---	.2	---
Silica as SIO2 (Dissolved), mg/l	6.9	6.9	---	6.5	6.7	6.8
Solids (Dissolved), tons per ac/ft	.46	.47	---	.42	.45	.43
Nitrate as N (Dissolved), mg/l	---	.31	---	---	.08	---
Nitrite as NO2 (Dissolved), mg/l	---	.00	---	---	.00	---
Nitrogen NO2 + NO3 as N (Dissolved), mg/l	---	.31	---	---	.08	---
Ammonia as N (Dissolved), mg/l	---	.02	---	---	.01	---
Organic Nitrogen as N (Dissolved), mg/l	---	.22	---	---	.13	---
Organic Ammonia as N (Total), mg/l	---	.22	---	---	.18	---
Organic Nitrogen NH4 (Total Suspended), mg/l	---	.00	---	---	.04	---
Ammonia + Organic Nitrogen (Dissolved), mg/l	---	.24	---	---	.14	---
Phosphorus as P (Total), mg/l	---	.010	---	---	.010	---
Phosphorus Ortho as P (Dissolved), mg/l	---	.00	---	---	.00	---
Phosphate Ortho as PO4 (Dissolved), mg/l	---	.00	---	---	.00	---
Boron as B (Dissolved), ug/l	---	50	---	---	60	---
Organic Carbon as C (Dissolved), mg/l	---	1.5	---	---	2.0	---
Organic Carbon as C (Total Suspended), mg/l	---	---	---	---	.1	---
Phenols, ug/l	---	3	---	---	0	---
Oil & Grease (Total), mg/l	---	0	---	---	0	---
Arsenic as As (Dissolved), ug/l	---	1	---	---	1	---
Chromium as Cr (Dissolved), ug/l	---	0	---	---	0	---
Iron as Fe (Dissolved), ug/l	---	10	---	---	0	---
Lead as Pb (Dissolved), ug/l	---	130	---	---	0	---
Lithium as Li (Dissolved), ug/l	---	10	---	---	20	---
Manganese as Mn (Dissolved), ug/l	---	2	---	---	1	---
Selenium as Se (Dissolved), ug/l	---	1	---	---	1	---
Strontrium as Sr (Dissolved), ug/l	---	320	---	---	370	---
Zinc as Zn (Dissolved), ug/l	---	3	---	---	3	---
Solids Sum of Constituents (Dissolved), mg/l	338	342	---	311	328	315
Solids (Dissolved), tons/day	.30	.53	---	.79	.48	.27

Table 7-5

Utah Division of Health numerical standards for water in the state.

Constituent	CLASSES											
	Domestic Source			Recreation & Aesthetics		Aquatic Wildlife				Agri-culture	Indus-try	Special
	1A	1B	1C	2A	2B	3A	3B	3C	3D	4	5	6
Bacteriological (No./100 ml)												
(30-day Geometric Mean)												
Maximum Total Coliforms	1	50	5,000	1,000	5,000	*	*		*	*		
Maximum Fecal Coliforms	*	*	2,000	200	2,000	*	*		*	*		
Physical												
Total Dissolved Gasses	*	*	*	*	*	(b)	(b)		*	*		
Minimum DO (mg/l) (a)	*	*	5.5	5.5	5.5	6.0	5.5		5.5	*		
Maximum Temperature	*	*	*	*	*	20°C	27°C		*	*		
Maximum Temp. Change	*	*	*	*	*	2°C	4°C		*	*		
pH	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0		6.5-9.0	6.5-9.0		
Turbidity increase (c)	*	*	*	10 NTU	10 NTU	10 NTU	10 NTU		15 NTU	*		
Chemical (Maximum mg/l)												
Arsenic, dissolved	.05	.05	.05	*	*	*	*	STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS (SEE APPENDIX D)	*	.1	STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS	STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS
Barium, dissolved	1	1	1	*	*	*	*		*	*		
Cadmium, dissolved	.010	.010	.010	*	*	.0004(d)	.004(d)		*	.01		
Chromium, dissolved	.05	.05	.05	*	*	.10	.10		.10	.10		
Copper, dissolved	*	*	*	*	*	.01	.01		*	.2		
Cyanide	*	*	*	*	*	.005	.005		*	*		
Iron, dissolved	*	*	*	*	*	1.0	1.0		1.0	*		
Lead, dissolved	.05	.05	.05	*	*	.05	.05		*	.1		
Mercury, total	.002	.002	.002	*	*	.00005	.00005		.00005	*		
Phenol	*	*	*	*	*	.01	.01		*	*		
Selenium, dissolved	.01	.01	.01	*	*	.05	.05		*	.05		
Silver, dissolved	.05	.05	.05	*	*	.01	.01		*	*		
Zinc, dissolved	*	*	*	*	*	.05	.05		*	*		
NH_3 as N (un-ionized)	*	*	*	*	*	.02	.02		*	*		
Chlorine	*	*	*	*	*	.002	.01		*	*		
Fluoride, dissolved (e)	1.4-2.4	1.4-2.4	1.4-2.4	*	*	*	*		*	*		
NO_3 as N	10	10	10									
Boron, dissolved	*	*	*	*	*	*	*		*	.75		
H_2S	*	*	*	*	*	.002	.002		*	*		
TDS (f)	*	*	*	*	*	*	*		*	1200		
Radiological (Maximum pCi/l)												
Gross Alpha	15	15	15	*	*	15(g)	15(g)		15(g)	15(g)		
Radium 226, 228 combined	5	5	5	*	*	*	*		*	*		
Strontium 90	8	8	8	*	*	*	*		*	*		
Tritium	20,000	20,000	20,000	*	*	*	*		*	*		
Pesticides (Maximum ug/l)												
Endrin	.2	.2	.2	*	*	.004	.004		.004	*		
Lindane	4	4	4	*	*	.01	.01		.01	*		
Methoxychlor	100	100	100	*	*	.03	.03		.03	*		
Toxaphene	5	5	5	*	*	.005	.005		.005	*		
2, 4-D	100	100	100	*	*	*	*		*	*		
2, 4, 5-TP	10	10	10	*	*	*	*		*	*		
Pollution Indicators (g)												
Gross Beta (pCi/l)	50	50	50	*	*	50	50		50	50		
BOD (mg/l)	*	*	5	5	5	5	5		5	5		
NO_3 as N (mg/l)				4	4	4	4		*	*		
PO_4 as P (mg/l)(h)	*	*	*	.05	.05	.05	.05		*	*		

Insufficient evidence to warrant the establishment of numerical standard. Limits assigned on case-by-case basis.

(a) These limits are not applicable to lower water levels in deep impoundments.

(b) Not to exceed 110% of saturation.

(c) For Classes 2A, 2B, 3A, and 3B at background levels of 100 NTUs or greater, a 10% increase limit will be used instead of the numeric values listed. For Class 3D at background levels of 150 NTUs or greater, a 10% increase limit will be used instead of the numeric value listed. Short term variances may be considered on a case-by-case basis.

(d) Limit shall be increased threefold if $CaCO_3$ hardness in water exceeds 150 mg/l.

(e) Maximum concentration varies according to the daily maximum mean air temperature.

Temp. °C	mg/l
12.0 and below	2.4
12.1 to 14.6	2.2
14.7 to 17.6	2.0
17.7 to 21.4	1.8
21.5 to 26.2	1.6
26.3 to 32.5	1.4

(f) Total dissolved solids (TDS) limit may be adjusted on a case-by-case basis.

(g) Investigations should be conducted to develop more information where these pollution indicator levels are exceeded.

(h) PO_4 as P(mg/l) limit for lakes and reservoirs shall be .025.

Table 7-6
Surface Water Rights in the Vicinity of the Trail Mountain Mine

Source	Claim No.	Owner	Use	Period	
Straight Canyon	93-702	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Straight Canyon	93-703	Hunter Investment Group	Stockwatering	June 21 - Sept. 20	
Straight Canyon	93-704	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Cottonwood Creek	93-708	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Cottonwood Creek	93-709	Trail Mountain Coal LDT	Mining/Industry	Jan. 1 - Dec. 31	(See Appendix)
Cottonwood Creek	93-710	State Institutional Trust Lands Administration	Stockwatering	June 6 - Sept. 30	
Cottonwood Creek	93-711	DOI Bureau of Land Management	Stockwatering	Jan. 1 - Dec. 31	
Cottonwood Creek	93-715	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Trail Mountain	93-718	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Roans Canyon	93-719	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Roans Canyon	93-720	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
	93-721	USDA Forest Service	Stockwatering	June 1 - Oct. 15	
Straight Canyon	93-800	DOI Bureau of Land Management	Stockwatering	Jan.1 - Dec. 31	
Straight Canyon	93-802	Jessie James Peacock	Stockwatering	Jan. 1 - Dec. 31	
Straight Canyon	93-803	Jessie James Peacock	Stockwatering	Jan. 1 - Dec. 31	
Cottonwood Creek	93-1087	Jessie James Peacock	Stockwatering	Jan. 1 - Dec. 31	
Cottonwood Creek	93-1088	Jessie James Peacock	Irrigation	April 1 - Oct. 31	0.5 cfs
Cottonwood Creek	93-1088	Jessie James Peacock	Stockwatering	Jan. 1 - Dec. 31	0.25 cfs

Table 7-7
Peak Flows and Peak Flow Design Related Information for Diversion Ditches and Culverts

Structure	Disturbed Area (ac)	Undisturbed Area (ac)	Total Area (mi2)	Weighted CN	Design Storm (in)	S (in)	Runnoff (Q) (in)	Hydraulic Length (ft)	Average Watershed Slope (%)	Watershed Lag (hr)	tc (hr)	Δ D (hr)	49/A(Q)^1/2	C,c	Peak Flow (q) (cfs)
Cottonwood Canyon Culvert		11,969	10.7	57	3.2	7.54	0.31	40,000	36.5	1.74	2.09	1	1341.3	3.7	510
Side Canyon Culvert		366	0.57	80	2.4	2.5	0.82	6,375	49.12	0.199	0.22	0.04	1032	0.83	80.1
***Sediment Pond Diversion**	9.27	22.82	0.05	78.5	2.4	2.74	0.75	2,200	8	0.22					22.56

* SCS - TR55 Method

Table 7-8 - continued

Channel Flow Calculation
Culvert from Road

Bed Slope	=	0.02	
Manning's N	=	0.024	
Bottom Width	=	0.01	feet
Channel Side Slope	=	1	
Flow Depth	=	0.4196697	feet
Cross Sectional Area	=	0.1803193	square feet
Wetted Perimeter	=	1.197005	feet
Hydraulic Radius	=	0.1506421	feet
Discharge	=	0.45	cubic feet/sec
Velocity	=	2.495573	feet/sec

Table 7.9

Sediment Pond Storage and Spillway Capacity Requirements

Variable		
Disturbed Area	acres	9.45
Undisturbed Area	acres	26.61
Total Area (A)	mi^2	0.56
Weighted Curve Number (Disturbed Area)		78.5
Weighted Curve Number (Undisturbed Area)		72.0
S	inches	2.74
25-year, 24-hour Precip. (P)	inches	2.9
25-year, 24-hour Runoff (Q). - Disturbed	inches	1.22
25-year, 24-hour Runoff (Q). - Undisturbed	inches	0.75
Hydraulic Length (L)	feet	2200
Average Watershed Slope (Y)	%	8.0
Time of Concentration (T_c)	hours	0.37
25-year, 24-hour Peak Inflow	cfs	36.46
10-year, 24-hour Precip.	inches	2.4
10-year, 24-hour Runoff - Disturbed	inches	0.75
10-year, 24-hour Runoff - Undisturbed	inches	0.48
10-year, 24-hour Runoff	ac-ft	1.65
Sediment Storage Requirements	ac-ft	0.47
Pond Storage Requirements	ac-ft	2.12

Table 7.10

Sediment Pond Storage and Spillway Capacity Requirements

Sediment Storage Volume	ac-ft	0.47
Runoff Storage Volume	ac-ft	1.65
Total Storage Volume - Design Volume	ac-ft	2.12
Embankment Height at Design Volume	feet	14.50
Spillway Capacity	cfs	36.50
Spillway Diameter	inches	48.00
Head Above Spillway Crest as Design Discharge	feet	0.80
Required Freeboard	feet	1.00
Required Total Embankment Height	feet	16.00
Actual Embankment Height of Existing Pond	feet	17.00
Total Width	feet	11 - 13

Table 7-11

Design Criteria
Reclamation Hydrology

Location		Main Channel	Side Channel	Sediment Pond Inlet
Undisturbed Drainage Area	acre	11,969	366	14.7
Disturbed Drainage Area	acre	****	****	2.4
Precipitation 10yr/24hr	inches	****	****	8.8
Precipitation 100yr/24hr	inches	3.80	3.80	****
Flow	cfs	710.00	160.00	20.10
Slope	%	0.06	0.08	0.065
Bottom Width	feet	7.00	2.00	0.010
Side Slope	H:V	2:1	2:1	2:1
Manning's N		0.04	0.04	0.04
Velocity	fps	15.02	11.67	6.24
Flow Depth	feet	3.42	2.16	1.27
Area Required	sq. ft.	47.28	13.71	3.22
Min. Structure Area	sq. ft.	72.00	24.00	4.00
Rip-rap Required	Y/N	Y	Y	N

Table 7-11 - continued

Channel Flow Calculation
Main Channel

Bed Slope	=	0.06	
Manning's N	=	0.04	
Bottom Width	=	7	feet
Channel Side Slope	=	0.5	
Flow Depth	=	3.417295	feet
Cross Sectional Area	=	47.27688	square feet
Wetted Perimeter	=	22.28261	feet
Hydraulic Radius	=	2.121694	feet
Discharge	=	710	cubic feet/sec
Velocity	=	15.01791	feet/sec

Table 7-11 - continued

Channel Flow Calculation
Side Channel

Bed Slope	=	0.08	
Manning's N	=	0.04	
Bottom Width	=	2	feet
Channel Side Slope	=	0.5	
Flow Depth	=	2.165701	feet
Cross Sectional Area	=	13.71192	square feet
Wetted Perimeter	=	11.68531	feet
Hydraulic Radius	=	1.173432	feet
Discharge	=	160	cubic feet/sec
Velocity	=	11.66868	feet/sec

Table 7-11 - continued

Channel Flow Calculation
Sediment Pond Inlet

Bed Slope	=	0.06	
Manning's N	=	0.04	
Bottom Width	=	0.01	feet
Channel Side Slope	=	0.5	
Flow Depth	=	1.266117	feet
Cross Sectional Area	=	3.218768	square feet
Wetted Perimeter	=	5.67225	feet
Hydraulic Radius	=	0.5674588	feet
Discharge	=	20.1	cubic feet/sec
Velocity	=	6.244627	feet/sec

Table 7-12

ENERGY WEST MINING COMPANY
EAST MOUNTAIN PRECIPITATION
HISTORICAL COMPARISON

MONTH	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002 MIN	MEAN	MAX	ST DEV
OCT	1.28	1.93	0.38	0.76	3.27	1.15	1.57	2.77	0.61	0.28	0.48	0.49	1.57	2.23	1.86	0.18	1.50	0.24	3.01	0.04	3.48	0.11	0.04	1.33	3.48	1.06
NOV	0.39	0.53	2.90	2.43	0.97	2.38	0.39	1.91	0.43	0.39	0.26	1.07	0.57	1.12	1.42	0.46	1.63	0.84	1.08	0.05	0.62	0.40	0.05	1.01	2.90	0.77
DEC	0.05	0.97	1.39	2.42	1.67	0.87	0.16	1.29	1.56	0.16	0.66	0.07	1.53	0.14	0.65	0.64	1.66	0.23	0.00	0.28	0.39	0.18	0.00	0.77	2.42	0.68
JAN	0.29	3.22	1.30	0.27	0.49	0.30	1.37	1.42	1.00	0.74	0.34	0.61	4.10	0.32	1.37	1.39	2.49	0.97	0.75	0.48	1.96	0.03	0.03	1.15	4.10	1.00
FEB	0.52	0.14	1.81	0.65	0.59	2.10	1.37	0.00	0.68	2.08	0.39	1.73	2.34	1.35	0.66	1.18	1.56	3.34	0.34	3.27	1.21	0.19	0.00	1.25	3.34	0.93
MAR	2.77	1.67	1.98	1.22	1.77	1.43	1.65	0.99	1.03	1.75	2.34	2.39	2.01	0.34	0.79	2.23	0.00	0.71	0.07	1.56	1.03	0.10	0.00	1.36	2.77	0.78
APR	0.64	0.00	0.92	0.50	1.35	1.05	1.16	2.08	0.26	1.03	0.59	0.56	0.33	2.65	3.75	0.21	0.40	0.81	2.82	0.15	1.12	0.16	0.00	1.02	3.75	0.96
MAY	0.87	0.45	0.71	0.22	1.73	0.38	1.77	1.03	0.47	0.26	1.83	2.19	0.72	0.36	2.29	1.14	0.91	0.37	0.36	0.72	1.39	0.00	0.00	0.92	2.29	0.66
JUN	0.11	0.09	0.61	1.18	0.28	0.53	0.58	0.81	0.43	0.67	0.21	0.95	0.19	0.39	1.19	0.30	0.15	0.04	1.21	0.59	0.19	0.06	0.04	0.49	1.21	0.37
JUL	0.57	1.86	1.27	1.90	2.47	0.87	2.49	0.45	1.19	0.88	1.01	0.85	0.04	0.10	0.34	0.58	0.15	0.78	2.08	0.03	0.58	0.26	0.03	0.94	2.49	0.75
AUG	0.85	1.10	4.83	2.33	0.12	2.24	1.16	0.96	2.44	1.03	1.48	0.48	0.82	0.83	1.52	0.35	1.30	0.57	2.24	2.03	1.09	0.69	0.12	1.38	4.83	1.00
SEP	2.55	2.61	1.62	0.64	2.31	1.63	0.06	0.91	0.49	1.62	3.11	0.35	0.14	1.49	0.62	3.46	2.43	2.16	0.78	0.96	0.12	4.15	0.06	1.55	4.15	1.14
TOTAL	10.90	14.57	19.71	14.53	17.02	14.92	13.73	14.62	10.59	10.90	12.69	11.74	14.37	11.33	16.46	12.12	11.75	11.05	14.73	10.16	13.17	6.34	6.34	13.06	19.71	2.76

EAST MOUNTAIN TEMPERATURES - HISTORICAL SUMMARY

October Summary	HIGH	LOW
AVG.	49.57	33.03
MAX.	78.16	55.78
MIN.	11.60	4.29

November Summary	HIGH	LOW
AVG.	35.84	23.14
MAX.	61.57	54.71
MIN.	6.59	-4.76

December Summary	HIGH	LOW
AVG.	29.36	15.25
MAX.	62.49	45.00
MIN.	-2.64	-17.61

January Summary	HIGH	LOW
AVG.	31.02	16.63
MAX.	63.21	53.81
MIN.	1.95	-15.19

February Summary	HIGH	LOW
AVG.	33.22	17.25
MAX.	57.21	39.99
MIN.	-2.26	-14.75

March Summary	HIGH	LOW
AVG.	40.03	21.80
MAX.	70.86	49.75
MIN.	7.39	-6.63

April Summary	HIGH	LOW
AVG.	47.50	27.90
MAX.	77.22	52.90
MIN.	12.70	-0.34

May Summary	HIGH	LOW
AVG.	57.61	36.75
MAX.	89.03	64.32
MIN.	15.79	1.77

June Summary	HIGH	LOW
AVG.	68.64	46.18
MAX.	92.62	74.12
MIN.	27.73	13.09

July Summary	HIGH	LOW
AVG.	76.19	53.73
MAX.	96.00	72.01
MIN.	48.47	20.39

Annual Summary	HIGH	LOW
AVG.	73.53	52.44
MAX.	94.90	73.39
MIN.	35.77	31.85

September Summary	HIGH	LOW
AVG.	63.54	43.49
MAX.	85.62	64.98
MIN.	31.60	17.55

HISTORICAL SUMMARY - 1981 through 2000		
PARAMETER	DATE	TEMP
AVERAGE HIGH	NA	50.50
MAXIMUM HIGH	07/13/02	96.00
AVG. MAX. HIGH	NA	77.41
MINIMUM HIGH	12/22/91	-2.64
AVG. MIN. HIGH	NA	16.23
AVERAGE LOW	NA	32.30
MAXIMUM LOW	06/28/93	74.12
AVG. MAX. LOW	NA	58.40
MINIMUM LOW	12/22/90	-17.61
AVG. MIN. LOW	NA	2.47

Table 13
Watershed Hydrograph - recreated from STORM®

Project Title	Trail Mountain Area 1A
Inflow into Structure	#1
Structure Type	Null

Watershed Data for Watershed #1

Curve Number	=	95	
Area	=	0.2	acres
Hydraulic Length	=	320	feet
Elevation Change	=	8	feet
Concentration Time	=	0.03	hours
Concentration Time Type	=	SCS Upland	
Unit Hydrograph Type	=	Disturbed	
Total Area	=	0.2	acres

Storm Data

Total Precipitation	=	2.2	inches
Storm Type	=	SCS 6 hr design storm	
Peak Discharge	=	0.15	cfs
Discharge Volume	=	0.02	ac-ft

Time (hr)	Rainfall (in)	Hydrograph (cfs)	Time (hr)	Rainfall (in)	Hydrograph (cfs)
0.00	0.0000	0.000	0.20	0.028	0.000
0.40	0.0280	0.000	0.60	0.035	0.000
0.80	0.0420	0.001	1.00	0.042	0.003
1.20	0.0470	0.006	1.40	0.047	0.009
1.60	0.0650	0.015	1.80	0.308	0.023
2.00	0.0840	0.028	2.20	0.327	0.115
2.40	0.0327	0.145	2.60	0.208	0.106
2.80	0.0088	0.051	3.00	0.088	0.043
3.20	0.0700	0.036	3.40	0.070	0.035
3.60	0.0590	0.030	3.80	0.048	0.025
4.00	0.0480	0.024	4.20	0.043	0.022
4.40	0.0430	0.022	4.60	0.039	0.020
4.80	0.0350	0.018	5.00	0.035	0.018
5.20	0.0320	0.016	5.40	0.032	0.016
5.60	0.0330	0.017	5.80	0.035	0.018
6.00	0.0350	0.018	6.20	0.000	0.003
6.40	0.0000	0.000			

Table 13 - continued
Watershed Hydrograph - recreated from STORM®

Project Title	Trail Mountain Area 1B
Inflow into Structure	#1
Structure Type	Null

Watershed Data for Watershed #1

Curve Number	=	98	
Area	=	0.2	acres
Hydraulic Length	=	140	feet
Elevation Change	=	1	feet
Concentration Time	=	0.02	hours
Concentration Time Type	=	SCS Upland	
Unit Hydrograph Type	=	Disturbed	
Total Area	=	0.2	acres

Storm Data

Total Precipitation	=	2.2	inches
Storm Type	=	SCS 6 hr design storm	
Peak Discharge	=	0.2	cfs
Discharge Volume	=	0.03	ac-ft

Time (hr)	Rainfall (in)	Hydrograph (cfs)	Time (hr)	Rainfall (in)	Hydrograph (cfs)
0.00	0.0000	0.000	0.20	0.028	0.000
0.40	0.0280	0.001	0.60	0.035	0.005
0.80	0.0420	0.011	1.00	0.042	0.015
1.20	0.0470	0.020	1.40	0.047	0.022
1.60	0.0650	0.032	1.80	0.308	0.044
2.00	0.0840	0.048	2.20	0.327	0.176
2.40	0.0327	0.204	2.60	0.208	0.143
2.80	0.0088	0.067	3.00	0.088	0.056
3.20	0.0700	0.047	3.40	0.070	0.045
3.60	0.0590	0.039	3.80	0.048	0.032
4.00	0.0480	0.031	4.20	0.043	0.028
4.40	0.0430	0.028	4.60	0.039	0.026
4.80	0.0350	0.023	5.00	0.035	0.023
5.20	0.0320	0.021	5.40	0.032	0.020
5.60	0.0330	0.021	5.80	0.035	0.022
6.00	0.0350	0.023	6.20	0.000	0.003
6.40	0.0000	0.000			

Table 13 - continued
Watershed Hydrograph - recreated from STORM®

Project Title	Trail Mountain Area 1C
Inflow into Structure	#1
Structure Type	Null

Watershed Data for Watershed #1

Curve Number	=	77	
Area	=	1.6	acres
Hydraulic Length	=	513	feet
Elevation Change	=	52	feet
Concentration Time	=	0.06	hours
Concentration Time Type	=	SCS Upland	
Unit Hydrograph Type	=	Forrested	
Total Area	=	1.6	acres

Storm Data

Total Precipitation	=	2.2	inches
Storm Type	=	SCS 6 hr design storm	
Peak Discharge	=	0.31	cfs
Discharge Volume	=	0.07	ac-ft

Time (hr)	Rainfall (in)	Hydrograph (cfs)	Time (hr)	Rainfall (in)	Hydrograph (cfs)
0.00	0.0000	0.000	0.20	0.028	0.000
0.40	0.0280	0.000	0.60	0.035	0.000
0.80	0.0420	0.000	1.00	0.042	0.000
1.20	0.0470	0.000	1.40	0.047	0.000
1.60	0.0650	0.000	1.80	0.308	0.000
2.00	0.0840	0.000	2.20	0.327	0.047
2.40	0.0327	0.226	2.60	0.208	0.313
2.80	0.0088	0.255	3.00	0.088	0.244
3.20	0.0700	0.242	3.40	0.070	0.247
3.60	0.0590	0.241	3.80	0.048	0.225
4.00	0.0480	0.217	4.20	0.043	0.204
4.40	0.0430	0.194	4.60	0.039	0.180
4.80	0.0350	0.165	5.00	0.035	0.158
5.20	0.0320	0.149	5.40	0.032	0.143
5.60	0.0330	0.143	5.80	0.035	0.146
6.00	0.0350	0.147	6.20	0.000	0.091
6.40	0.0000	0.060	6.60	0.000	0.048
6.80	0.0000	0.037	7.00	0.000	0.028
7.20	0.0000	0.020	7.40	0.000	0.014
7.60	0.0000	0.009	7.80	0.000	0.004
8.00	0.0000	0.002	8.00	0.000	0.000
8.40	0.0000	0.000	8.20	0.000	

Table 13 - continued
Watershed Hydrograph - recreated from STORM®

Project Title	Trail Mountain Area 4
Inflow into Structure	#1
Structure Type	Null

Watershed Data for Watershed #1

Curve Number	=	95	
Area	=	0.1	acres
Hydraulic Length	=	109	feet
Elevation Change	=	52	feet
Concentration Time	=	3.5	hours
Concentration Time Type	=	SCS Upland	
Unit Hydrograph Type	=	Disturbed	
Total Area	=	0.1	acres

Storm Data

Total Precipitation	=	2.2	inches
Storm Type	=	SCS 6 hr design storm	
Peak Discharge	=	0.007	cfs
Discharge Volume	=	0.02	ac-ft

Time (hr)	Rainfall (in)	Hydrograph (cfs)	Time (hr)	Rainfall (in)	Hydrograph (cfs)
0.00	0.0000	0.000	0.20	0.028	0.000
0.40	0.0280	0.000	0.60	0.035	0.000
0.80	0.0420	0.000	1.00	0.042	0.002
1.20	0.0470	0.003	1.40	0.047	0.004
1.60	0.0650	0.007	1.80	0.308	0.011
2.00	0.0840	0.013	2.20	0.327	0.056
2.40	0.0327	0.071	2.60	0.208	0.051
2.80	0.0088	0.024	3.00	0.088	0.021
3.20	0.0700	0.017	3.40	0.070	0.017
3.60	0.0590	0.015	3.80	0.048	0.012
4.00	0.0480	0.012	4.20	0.043	0.011
4.40	0.0430	0.010	4.60	0.039	0.010
4.80	0.0350	0.009	5.00	0.035	0.009
5.20	0.0320	0.008	5.40	0.032	0.008
5.60	0.0330	0.008	5.80	0.035	0.009
6.00	0.0350	0.009	6.20	0.000	0.001
6.40	0.0000	0.000			

Table 14
Circular Channel analysis & Design
Solved with Manning's Equation

Open Channel - Uniform Flow

Worksheet Name	Trail Mountain Pipe #1
Comment	Trail Mountain Culvert #1 (inflows 1A, 1B, 1C)

Solve for Actual Depth

Given Input Data

Diameter	1.00	feet
Slope	0.06	ft/ft
Manning's N	0.025	
discharge	0.66	cfs

Computed Results

Depth	0.26	feet
Velocity	4.12	fps
Flow Area	0.16	sq. ft.
Critical Depth	0.34	ft
Critical Slope	0.0208	ft/ft
Percent Full	25.77	%
Full Capacity	4.54	cfs
QMAX @ .94D	4.88	cfs

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Haestad Methods. Inc., 37 Brookside Rd, Waterbury, CT 06708

Table 14 - continued
Circular Channel analysis & Design
Solved with Manning's Equation

Open Channel - Uniform Flow

Worksheet Name	Trail Mountain Pipe #4
Comment	Trail Mountain CMP #4 (inflows 1A, 1B, 1C, & 4)

Solve for Actual Depth

Given Input Data

Diameter	1.00	feet
Slope	0.067	ft/ft
Manning's N	0.025	
discharge	0.73	cfs

Computed Results

Depth	0.26	feet
Velocity	4.41	fps
Flow Area	0.17	sq. ft.
Critical Depth	0.36	ft
Critical Slope	0.0209	ft/ft
Percent Full	26.37	%
Full Capacity	4.8	cfs
QMAX @ .94D	5.16	cfs

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Table 14 - continued
Circular Channel analysis & Design
Solved with Manning's Equation

Open Channel - Uniform Flow

Worksheet Name	Trail Mountain Pipe #5
Comment	Trail Mountain Temporary Pipe #5

Solve for Actual Depth

Given Input Data

Diameter	0.50	feet
Slope	0.058	ft/ft
Manning's N	0.016	
discharge	0.41	cfs

Computed Results

Depth	0.21	feet
Velocity	5.19	fps
Flow Area	0.08	sq. ft.
Critical Depth	0.33	ft
Critical Slope	0.014	ft/ft
Percent Full	42.33	%
Full Capacity	1.1	cfs
QMAX @ .94D	1.18	cfs

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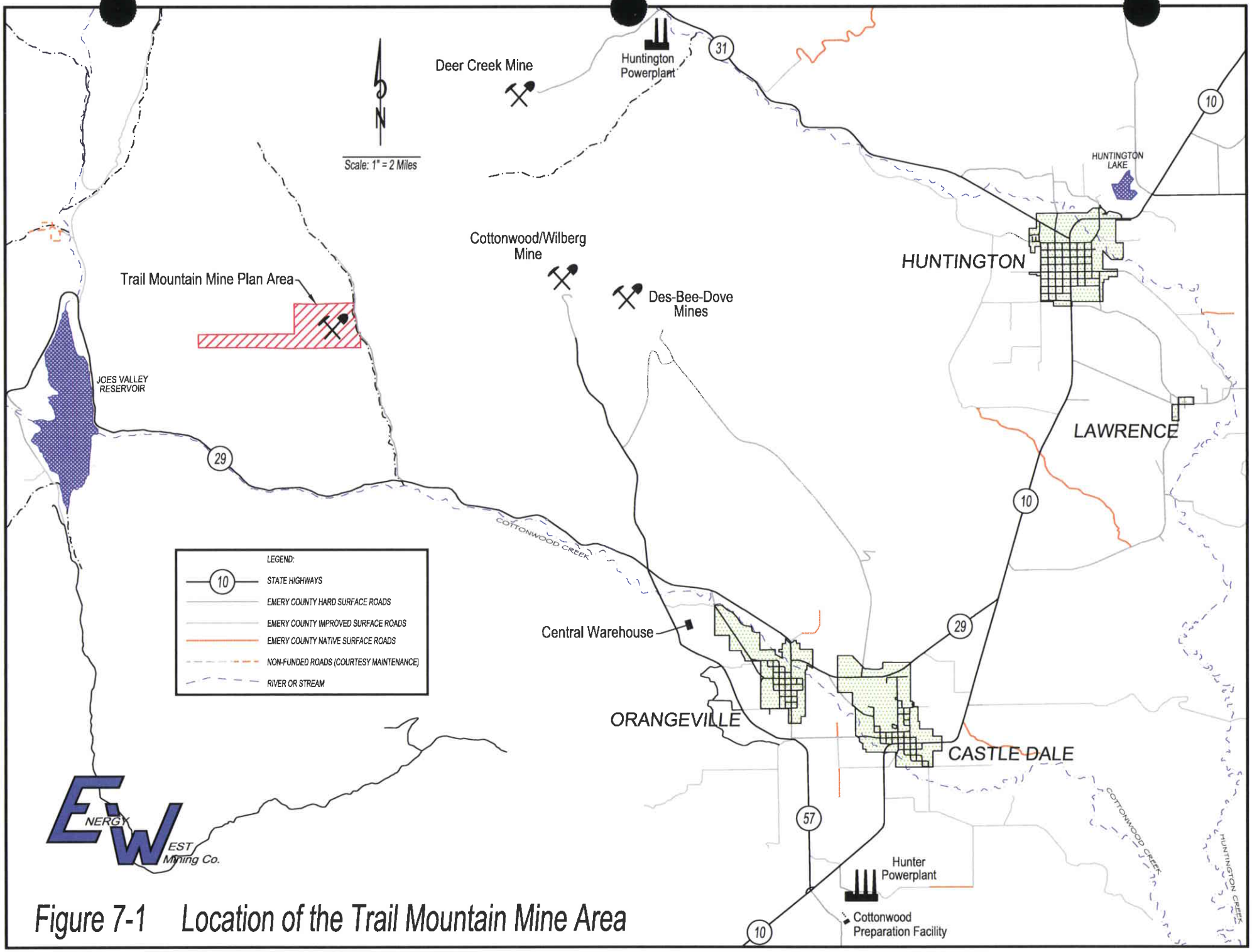


Figure 7-1 Location of the Trail Mountain Mine Area

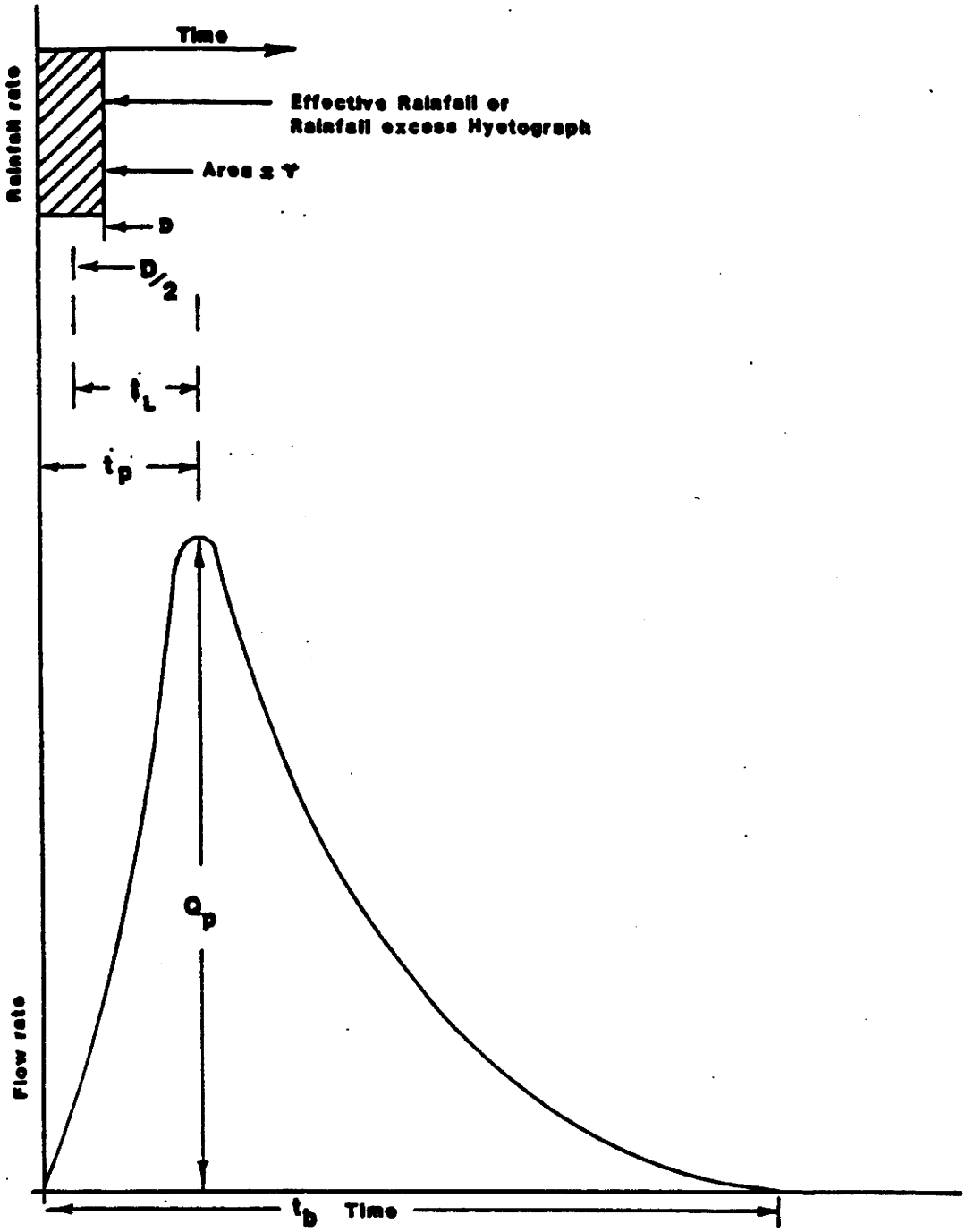


FIGURE 7-2 Hydrograph Terminology

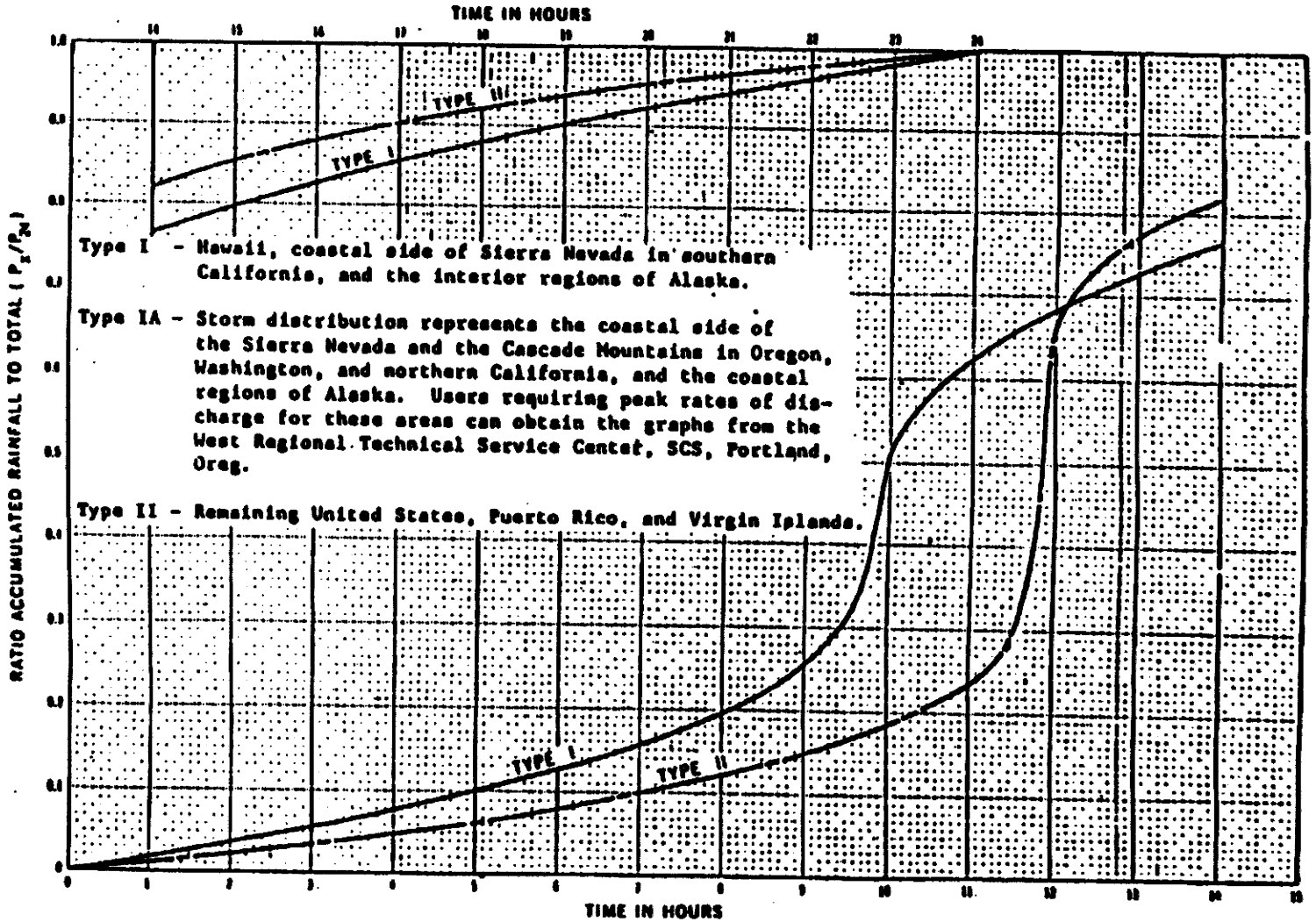


FIGURE 7-3 Twenty-four-hour rainfall distributions (from Kent, 1973).

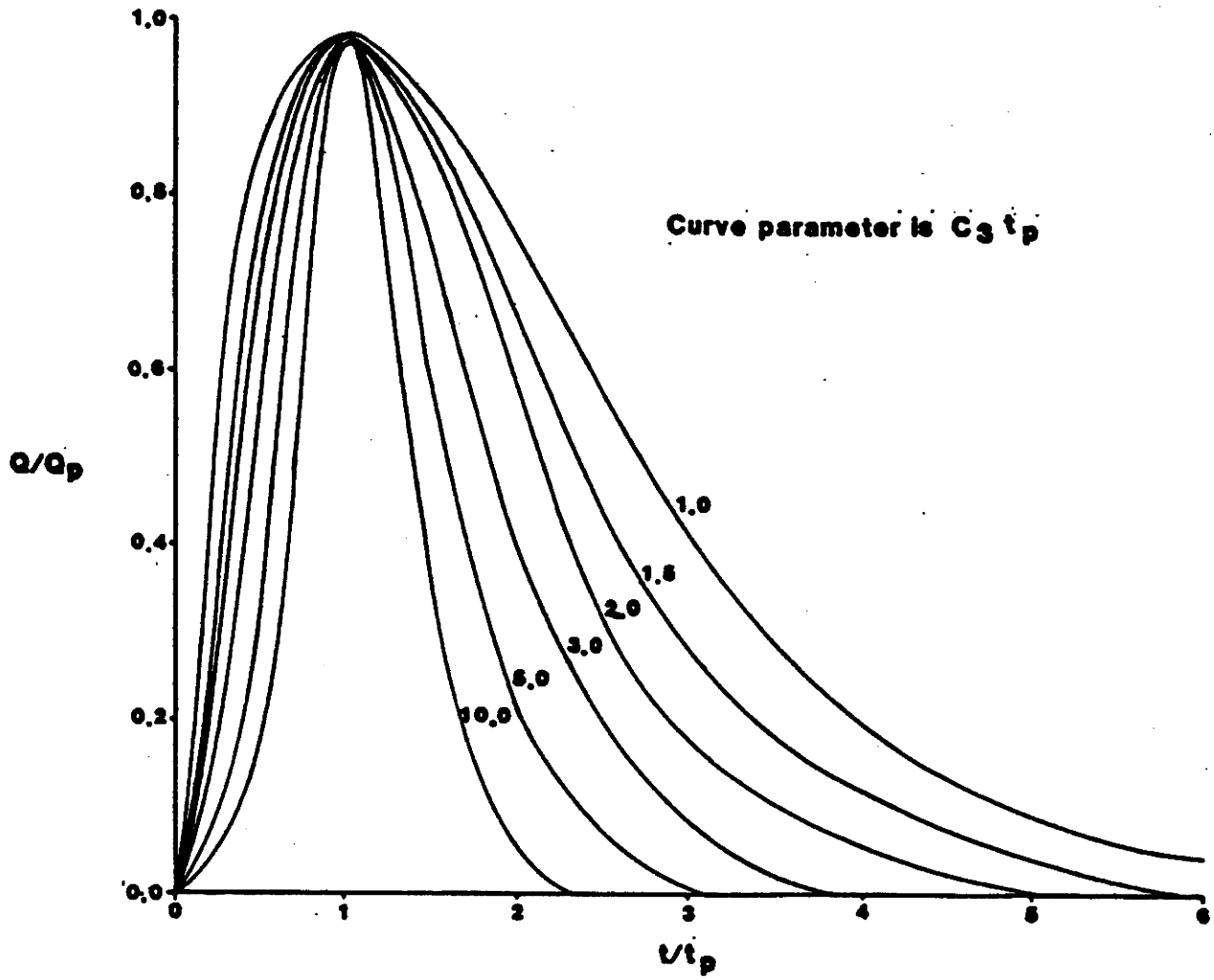


FIGURE 7-4 Variation of hydrograph shape with $C_3 t_p$

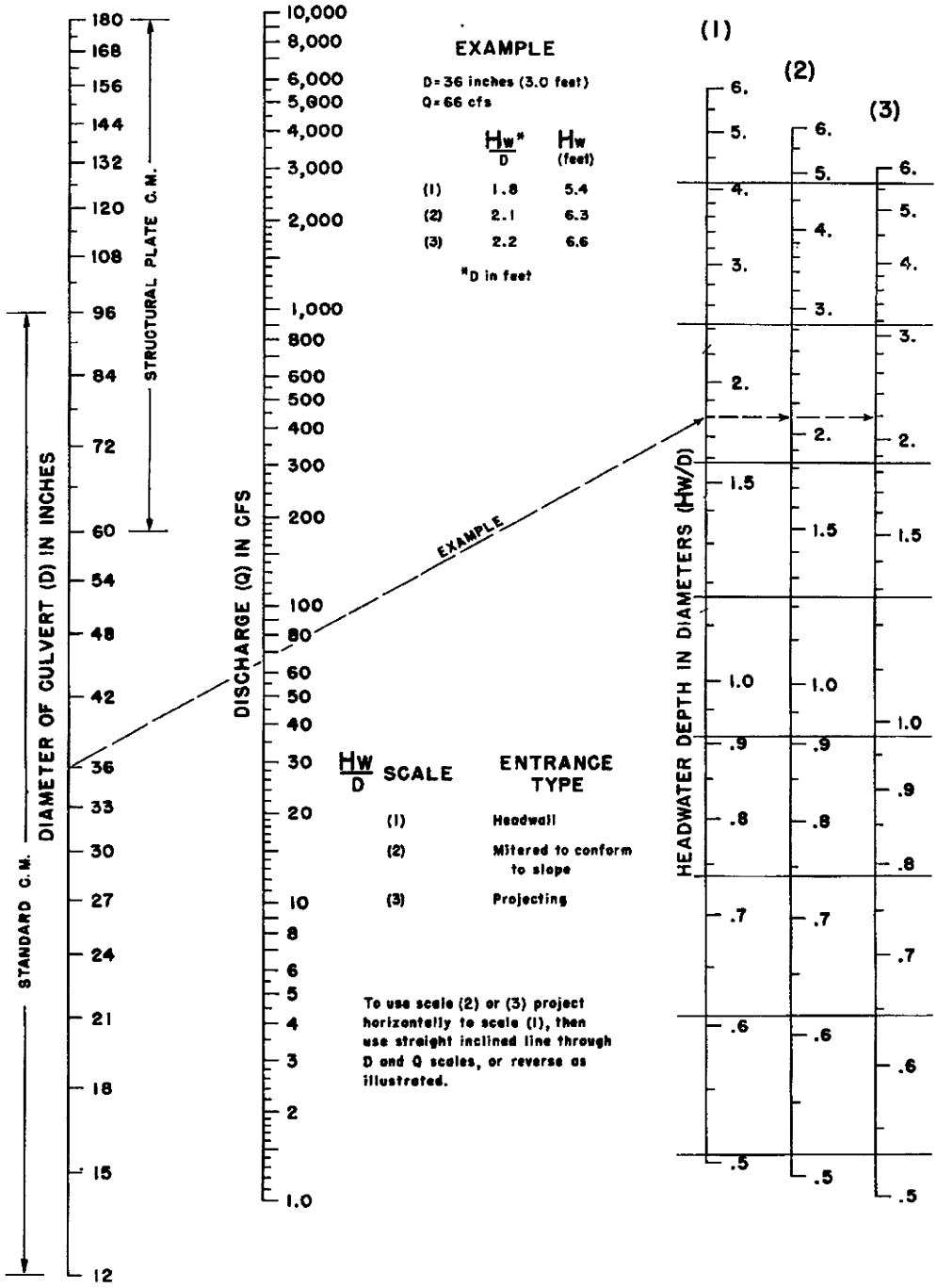


Figure 7-5: Headwater depth for corrugated metal pipe culverts with inlet control (U.S. Soil Conservation Service, 1972).

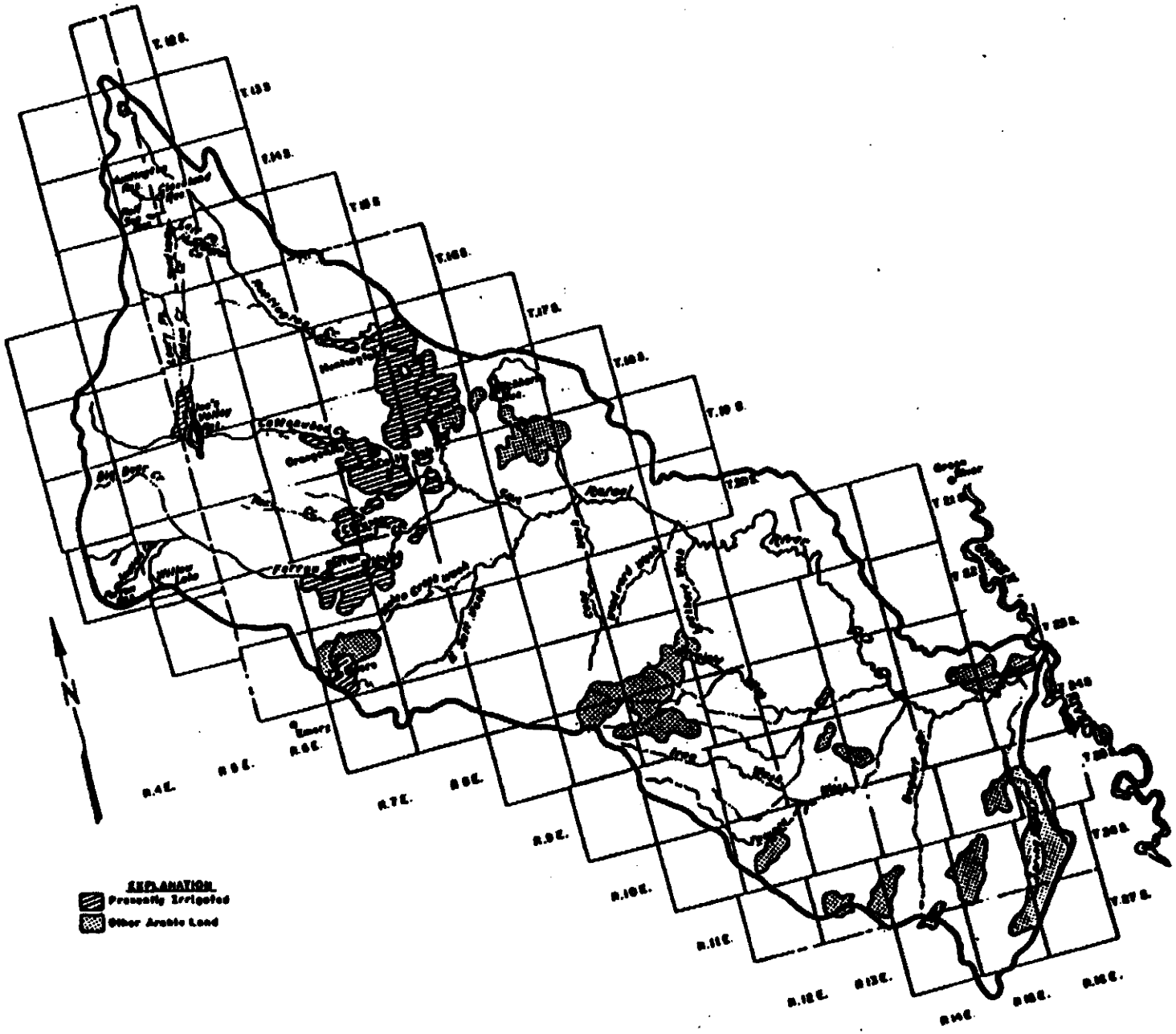


FIGURE 7-6 San Rafael River Basin (taken from Utah Division of Water Resources 1976)

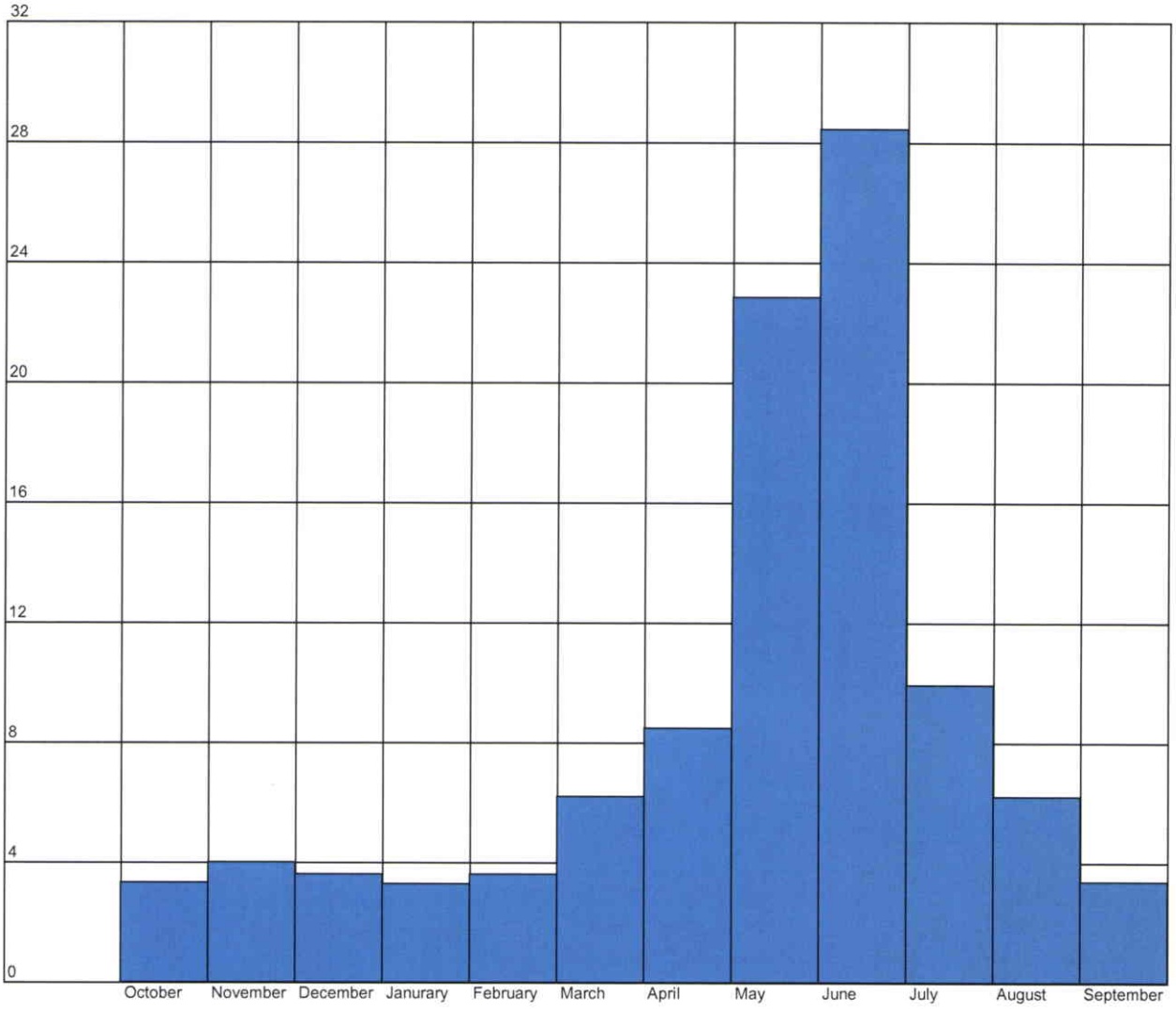
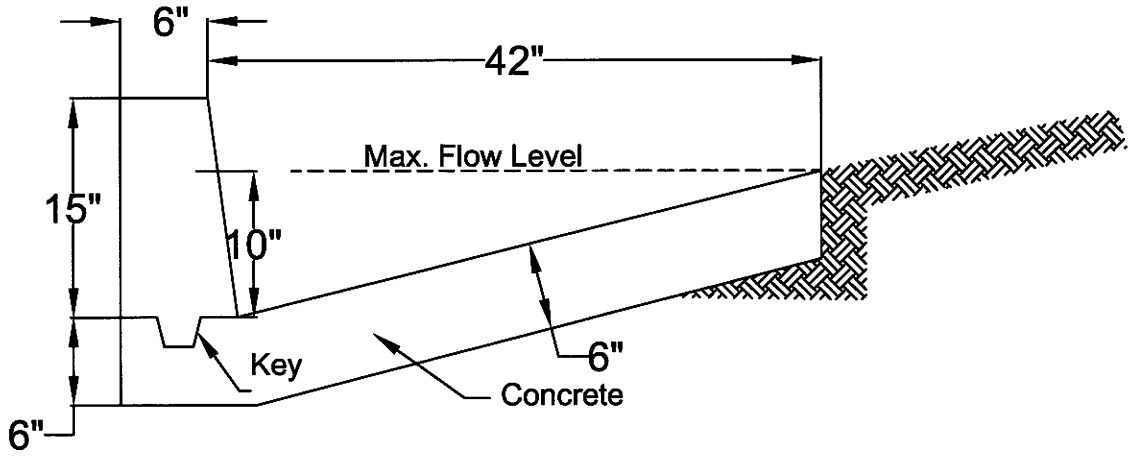
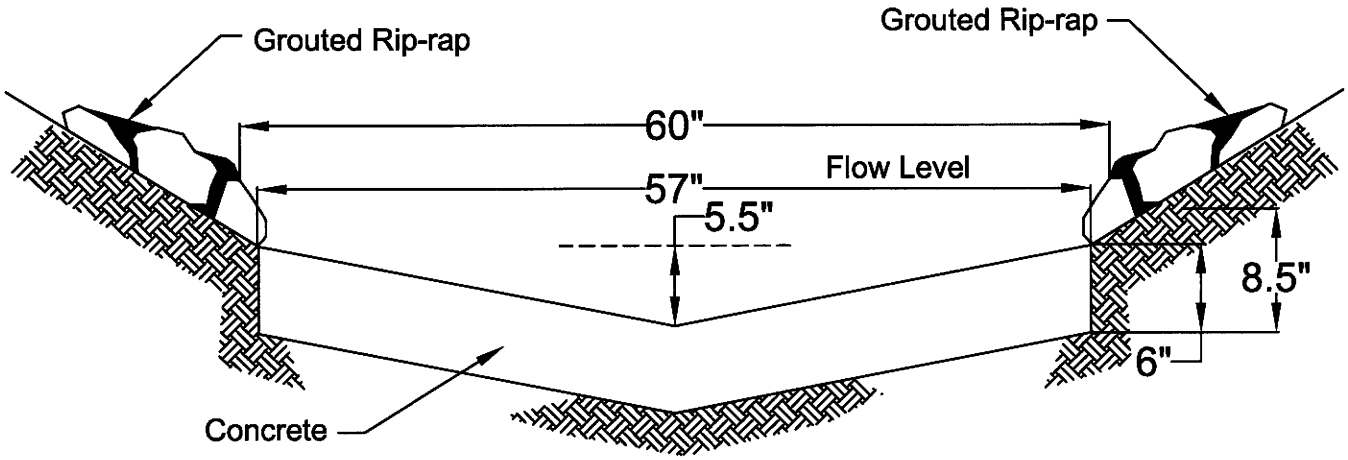


Figure 7-7: Monthly distribution of flows for Cottonwood Creek above Stright Canyon for the water year 1979 (October 1978 to September 1979). (from Water Resources Data for Utah. Part 1: Surface Water Records, 1979 USGS gaging Station 09324200)

Figure 7-8
Typical Sections of Curb/Gutter Diversion
Trail Mountain Mine



Curb/Gutter
(Upper Section)
1" = 1'



Curb/Gutter
(Lower Section)
1" = 1'

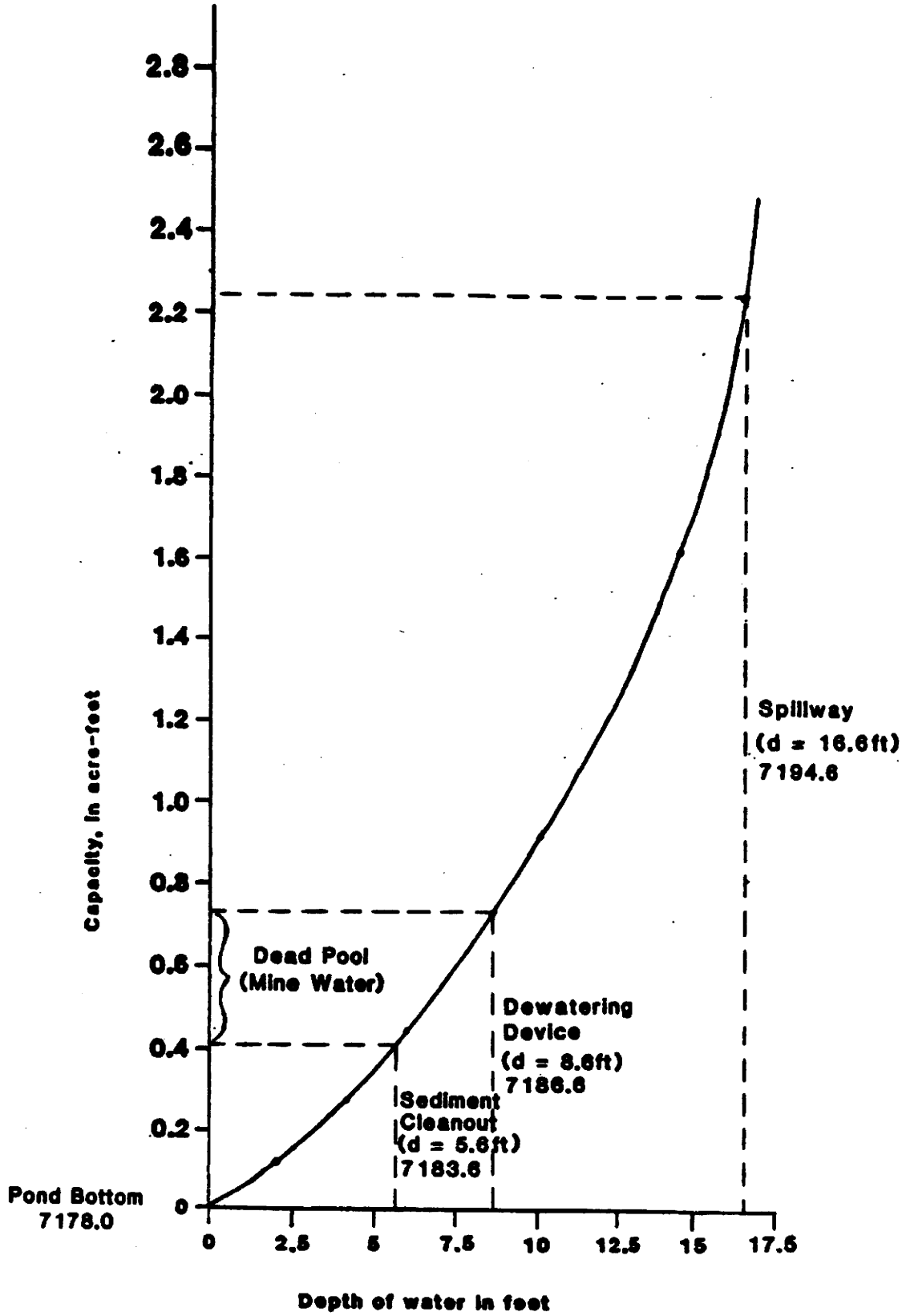


FIGURE 7-9 Stage-capacity curve for Sedimentation Pond.

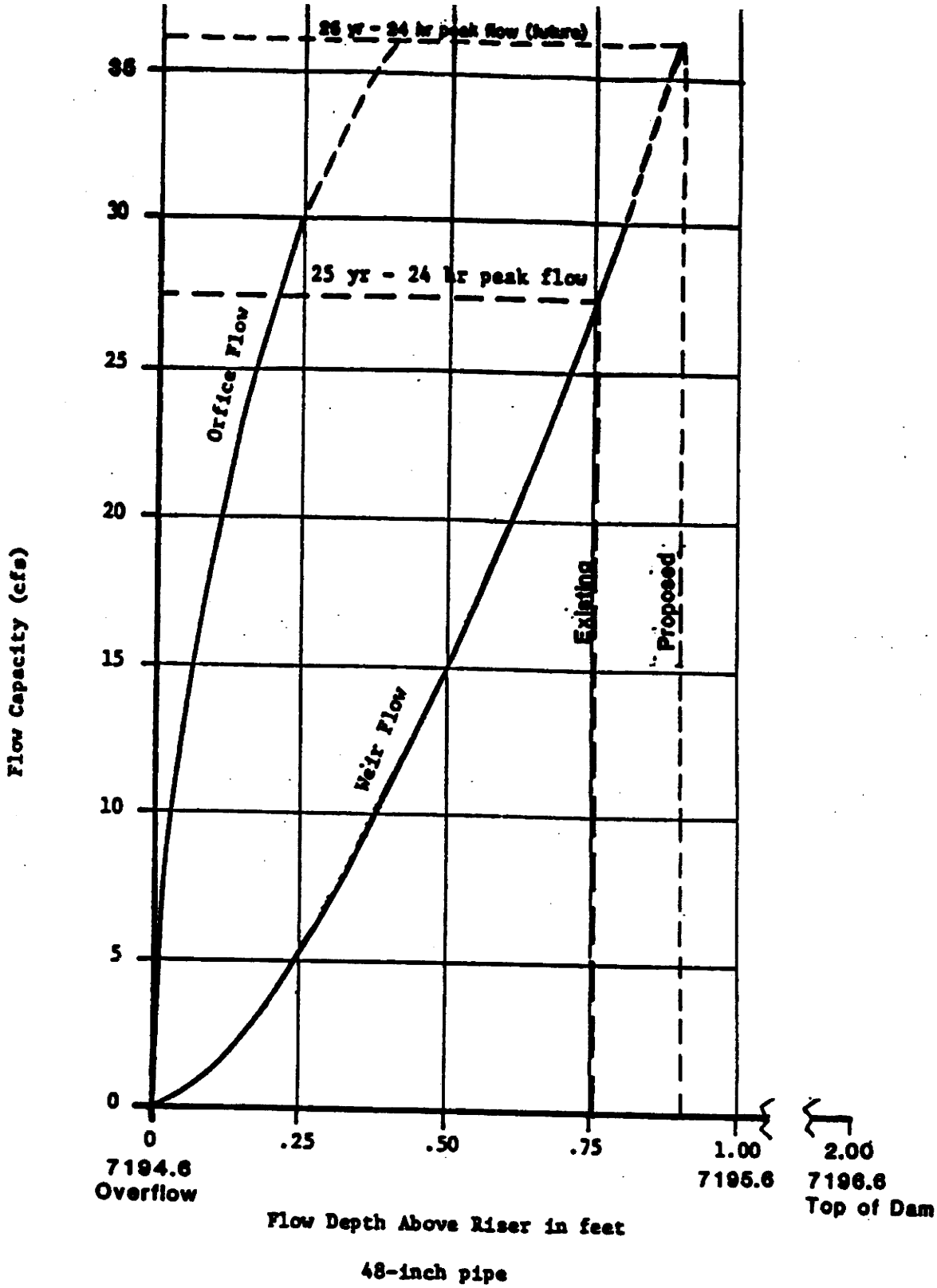
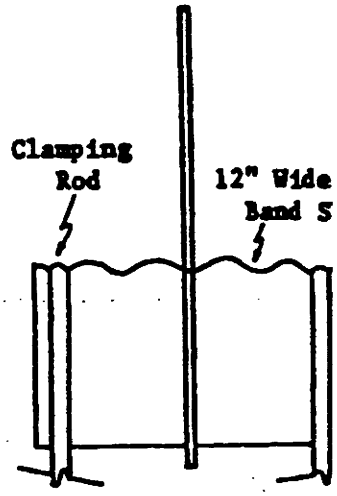


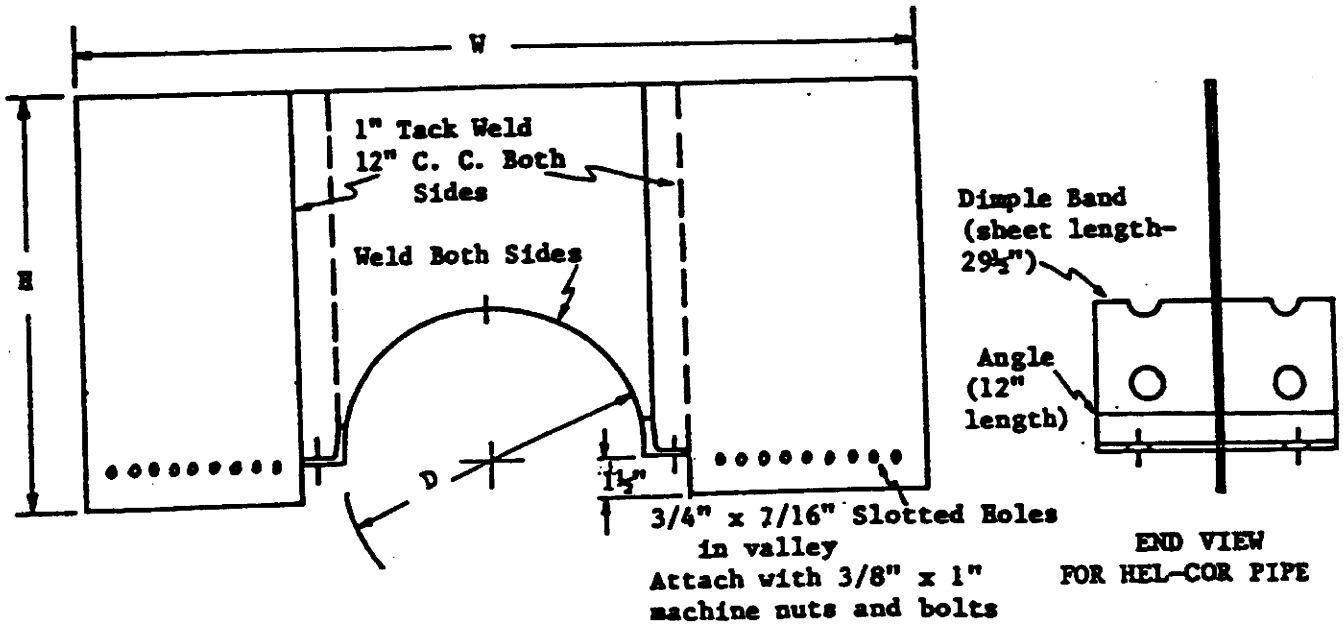
FIGURE 7-10
Stage-discharge curves for the 48-inch spillway riser and conduit.

Size of Anti-Seep Collars

	Spillway	Dewatering Device
Metal Gauge	14	14
Width, inches	72	36
Height, inches	38	20



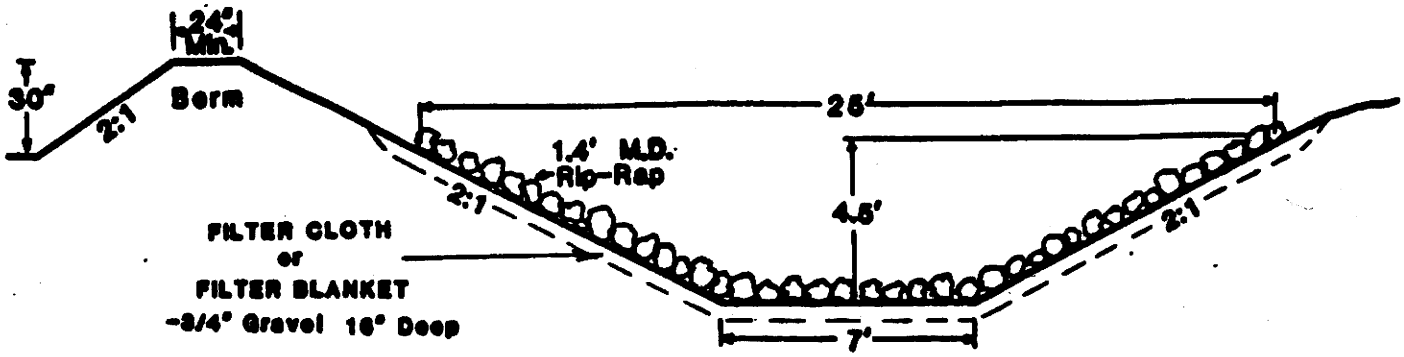
END VIEW
FOR ANNULAR PIPE



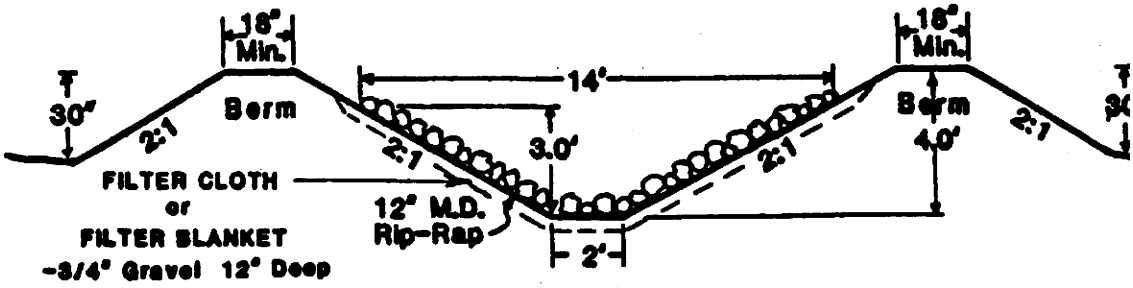
END VIEW
FOR HEL-COR PIPE

ONE HALF SHOWN - OTHER HALF IDENTICAL

FIGURE 7-11 Armco Corrugated Metal Anti-Seep Collar.



Main Channel - Typical Reclaimed Section

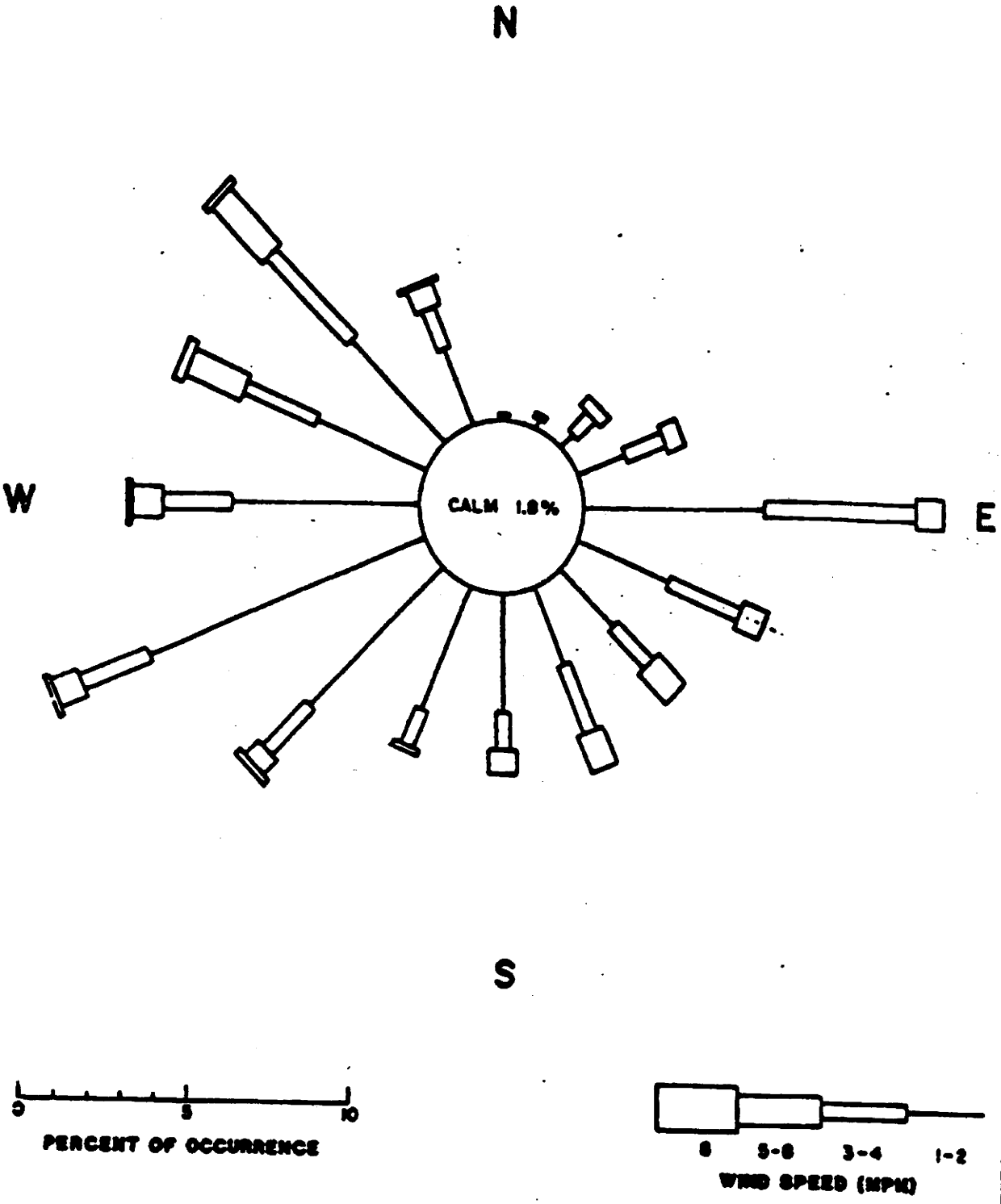


Side Channel - Typical Reclaimed Section

FIGURE 7-12

ENERGY WEST MINING CO.		
Typical Reclaimed Channels		
Prepared: D.W. Guy	Scale: 1" = 5'	
Department: ENG.	Date: 12/21/90	
Drawn by: K.S.F.	Figure 7-20	

FIGURE 7-13



MEETINGHOUSE RIDGE JAN.-DEC. 1978

ALL TIMES