0013

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INTERWEST MINING COMPANY

A Subsidiary of PacifiCorp

April 21, 1998

Mr. Steve McNeal
State of Utah
Department of Environmental Quality
Division of Water Quality - Permits and Compliance Section
288 North 1460 West
Salt Lake City, UT 84114-4870

#2
ACT/015/009

RE: **Requested Material to Address the Deficiencies of the PacifiCorp-Trail Mountain Mine UPDES Permit No. UT-0023728**

Dear Mr. McNeal:

Enclosed is the material requested by the Division of Water Quality to fulfill the deficiencies of UPDES Permit #UT-0023728. This packet includes:

1. Latitude and Longitude of outfall 002.
2. Discharge data for metals, cyanide and phenol collected within the last year, especially copper, lead, selenium, and zinc.
3. Information as required by the Colorado River Basin Salinity Control Forum Intercepted Groundwater Policy.
4. Signature of Responsible Corporate Official.
5. Summary of available recent receiving stream flow and water quality.

Item 5 is included with the information required by the Colorado River Basin Salinity Control Forum and is found in Appendix B.

Your consideration and approval of this permit renewal as well as the TDS conversion from a tonnage basis to a concentration limitation will be greatly appreciated. If you have any questions during your review of this packet, please feel free to contact Chuck Semborski at 435-687-4720 or Dennis Oakley at 435-687-4825.

Sincerely,

Rodger C. Fry
Exploration Administrator

cc: Blake Webster (IMC)
Chuck Semborski (EWMC)
Dennis Oakley (EWMC)
File

This section includes:

- Latitude and Longitude of Outfall 002.
- Discharge data for metals, cyanide and phenol collected within the last year, especially copper, lead, selenium and zinc.
- Signature of responsible corporate official.

EPA I.D. NUMBER (copy from Item 1 of Form 1)

OMB No. 2040-0086
Approval expires 7-31-88

Please print or type in the unshaded areas only.

FORM 2C NPDES

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (list)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (name)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
002	39	19	03	111	11	24.8	Cottonwood Canyon Creek

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined ***(e.g., for certain mining activities)***, provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO (list)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (list)	b. AVERAGE FLOW (include units)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	

OFFICIAL USE ONLY (effluent guidelines sub-categories)

CONTINUE ON REVERSE

EPA I.D. NUMBER (copy from Item 1 of Form 1)

Approved.
OMB No. 2040-0086
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CONTINUED FROM PAGE 2

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided. NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ YES *(list all such pollutants below)* ☐ NO *(go to Item VI-B)*

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
UT0023728	002

Form Approved.
OMB No. 2040-0086
Approval expires 7-31-88

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table *(all 7 pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						d. NO. OF ANALYSES	4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)			a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			ND						1	ug/L				
2M. Arsenic, Total (7440-38-2)	X			ND						1	ug/L				
3M. Beryllium, Total, 7440-41-7)	X			ND						1	ug/L				
4M. Cadmium, Total (7440-43-9)	X			ND						1	ug/L				
5M. Chromium, Total (7440-47-3)	X			ND						1	ug/L				
6M. Copper, Total (7440-50-8)	X			ND						1	ug/L				
7M. Lead, Total (7439-92-1)	X			ND						1	ug/L				
8M. Mercury, Total (7439-97-6)	X			ND						1	ug/L				
9M. Nickel, Total (7440-02-0)	X			8.2						1	ug/L				
10M. Selenium, Total (7782-49-2)	X			1						1	ug/L				
11M. Silver, Total (7440-22-4)			X												
12M. Thallium, Total (7440-28-0)	X			ND						1	ug/L				
13M. Zinc, Total (7440-66-6)			X												
14M. Cyanide, Total (57-12-5)	X			ND						1	ug/L				
15M. Phenols, Total			X												
DIOXIN															
2,3,7,8 Tetra chlorodibenzo P Dioxin (1764 01 6)				DESCRIBE RESULTS											

CONTINUE ON REVERSE

This section includes:

- Information as required by the Colorado River Basin Salinity Control Form Intercepted Groundwater Policy.
- Summary of available recent receiving stream flow and water quality (Appendix B of above report).

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Table of Contents

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1.0 Introduction

PacifiCorp has operated the Trail Mountain mines since 1992. The mine is located in the central Wasatch Plateau west of Huntington, Utah. PacifiCorp is currently planning to expand the Trail Mountain mine north and west to include the Trail Mountain Lease-By-Application (Trail Mountain LBA; Figure 1).

The scope of this report describes the topography, geology and hydrology of the Trail Mountain area within and around the mine. All aspects of these topics are completely reviewed as required by the *Intercepted Groundwater Policy for Implementation of the Colorado River Salinity Standards*. The information has been gathered from documents previously compiled for the Trail Mountain and East Mountain areas.

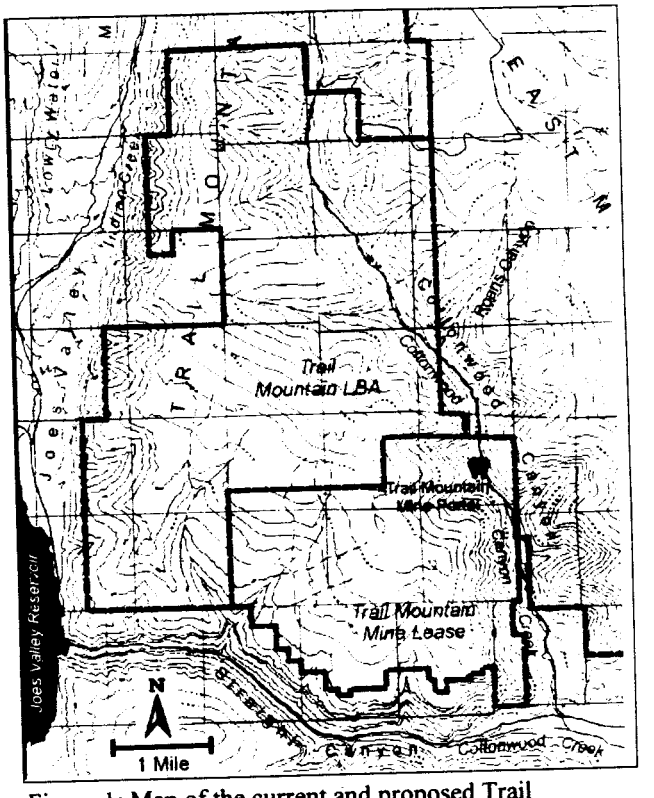

Figure 1: Map of the current and proposed Trail Mountain area and principle geographic features.

2.0 Topography

The topography of the PacifiCorp mines, including the Trail Mountain Mine, consists of narrow, flat-topped mesas surrounded by heavily vegetated slopes that extend to the precipitous cliffs of the eastern escarpment of the plateau. At the base of the plateau lies Castle Valley, which is developed on the Mancos Shale, and is naturally nearly devoid of vegetation. The Trail Mountain is separated from the surrounding area by the Joe's Valley to the west, Straight Canyon to the south, and Cottonwood Canyon to the east. Ground elevations range from approximately 6,800 feet near the base of the plateau in Castle Valley to over 10,600 feet immediately north of Trail Mountain (Mayo, 1997).

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3.0 Geology

The Wasatch Plateau coal field was formed along the western shoreline of the Cretaceous Seaway. Sediments deposited in the sea and costal 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 deltas, and strand-plain deposits. The Trail Mountain area is bounded by the eastern erosional escarpment of the Wasatch Plateau and on the west by the Joes Valley Fault System. The dip of the bedrock is controlled primarily by the Straight Canyon Syncline, which runs diagonally through the middle of the lease area, trending approximately north 50 ° east and plunging to the southwest (Figure 2). Bedrock located northwest of the syncline axis generally dips toward the southeast, whereas bedrock located southeast of the syncline axis dips toward the northwest. The dips of the rocks throughout the area are gentle, rarely exceeding 6°.

Figure 2: Geologic fault map of he Energy West lease area.

Most faults in the area trend north-south or northeast-southwest (Figure 2). The most significant is the Joes Valley Fault System, which extends more than 20 miles to the north and 40 miles to the south of the Joes Valley Reservoir dam, and has reported 2,300 feet of vertical displacement (Davis and Doelling, 1977). Joes Valley is a graben formed on the downthrown bock west of the fault; Trail Mountain forms the horst block east of the fault. Much of Joes Valley is filled with alluvium that is juxtaposed against the bedrock formations of Trail Mountain.

The Mill Fork and Roans Canyon Fault systems, which have much less displacement than the Joes Valley System, form narrow grabens in the central portion of Trail Mountain and in the northern

portion of East Mountain. The Mill Fork and Roans Canyon Fault systems roughly parallel the Straight Canyon Syncline (Figure 2) and appear to be scissor faults hinged near the center of Trail Mountain. At the hinge location there is essentially no vertical or horizontal displacement. Maximum displacement on these faults in the lease area is estimated to be 30 feet on the Mill Fork Fault, and 160 feet on the Roans Canyon Fault.

The Pleasant Valley fault System, which extends for 20 miles north of the lease area, is located along the eastern edge of East Mountain (Figure 2). In the lease area, displacement is less than 150 feet.

Near surface joints sets trending northeast-southwest, and northwest-southeast are common in the lease area. Lineament and drainage trace analysis suggest that the major trunk streams in the lease and adjacent area follow a regional northwest-southeast trend and that these drainages follow fracture or joint systems (Peters and Speirer, 1986).

Formations exposed in the Trail Mountain region range from Tertiary to Upper Cretaceous and are described below. In descending order, these formations are the: Flagstaff Limestone, North Horn, Price River Formation, Castlegate Sandstone, Blackhawk Formation, Star Point Sandstone, and Mancos Shale (Figure 3).

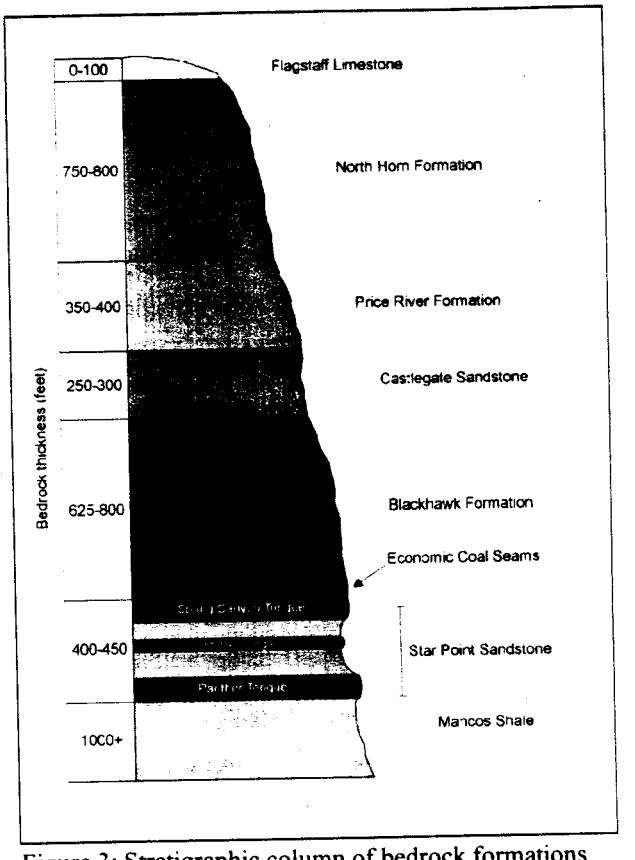

Figure 3: Stratigraphic column of bedrock formations in the mine lease area.

3.1 Description of Stratigraphy (Mayo, 1977)

3.1.1 Flagstaff Limestone (Tertiary Age)

The Flagstaff Limestone, which caps the uppermost portions of the Wasatch Plateau, is the youngest of the bedrock formations exposed in the Trail Mountain lease area (Figure 3). It typically forms a prominent white cliff on the top of the plateau. A thickness of 105 feet was measured on the Trail Mountain.

The Flagstaff Limestone consists of carbonates, marls and some thin sandstone stringers deposited in lacustrine, and alluvial plain depositional environments (Garner and Morris, 1996). It primarily consists of light- to medium-gray limestone containing abundant secondary fractures produced during uplift and sub-aerial exposure. Thin beds of shale and volcanic ash are present in some locations.

3.1.2 *North Horn Formation (Tertiary-Cretaceous Age)*

The North Horn Formation is the caprock of much of East and Trail Mountains where the Flagstaff Limestone has been eroded away. Exposures of the North Horn Formation form purple, red, or brown colored slopes. In the Trail Mountain area the thickness ranges from 750 to 800 feet and increases to the west.

The North Horn Formation was deposited in an alluvial-plain/suspended-load fluvial channel environment. In such environments, layers of mud are more abundant than sands, which occur in sandstone channels. The sandstone channels are generally isolated from each other both laterally and vertically by mud-rich overbank and interfluvial rocks (Galloway, 1977). In the area the formation consists primarily of shale with discontinuous sandstone channels, minor lenses of limestone, and conglomerate. Highly bentonitic mudstones, which swell when wetted, are common in the lower two-thirds of the formation.

3.1.3 Price River Formation (Cretaceous Age)

The Price River Formation typically forms a steep, receding slope above the Castlegate Sandstone with alternating ridges and slopes resulting from the interbedding of resistant sandstones with less resistant shales and claystones. In the lease area the formation is 350 to 400 feet thick.

The Price River Formation was deposited from mixed-laid fluvial channel systems having sandstone/mudstone ratios intermediate between bed-load and suspended-load channel systems. Sandstones and mudstones occur in about equal proportions. Points bars that develop in this type of system are larger than those in suspended-load channel systems. Mudstone drapes created during low flow stages of the active fluvial system separate the sandstones from each other both horizontally and vertically.

3.1.4 Castlegate Sandstone (Cretaceous Age)

The Castlegate Sandstone has a distinctive cliff forming habit and typically forms a resistant cliff above the underlying, less resistant Blackhawk Formation. The thickness of the Castle Gate Sandstone ranges from 250 to 300 feet in the lease area.

The formation was deposited from bed-load fluvial channel systems. The Castlegate Sandstone is made up of coarse-grained, often conglomeratic, fluvial sandstone with some thin interbeds of siltstone and claystone, especially toward the base of the unit. Sandstone dominates over mudstone and individual sand channels may be thin, wide, or interpenetrating. Although the primary porosity is high, the existence of mudstone drapes and pervasive carbonate and silica cement greatly reduces the overall porosity.

3.1.5 Blackhawk Formation (Cretaceous Age)

The Blackhawk Formation generally forms a steep, irregular slope between the cliffs of the underlying Star Point Sandstone and the overlying Castlegate Sandstone.

The formation consists of an upper non-marine, suspended-load fluvial portion and a lower marine shoreface and non-marine foreshore portion. Massive, cliff-forming units are common in the upper portion, and thinner-bedded, slope-forming units are common in the lower portion. The thickness of the Blackhawk Formation ranges from 625 to 800 feet and generally thickens to the northeast. Most of the thicker coal seams occur in the lower 150 feet of the Blackhawk Formation.

The upper portion of the Blackhawk Formation was deposited in an alluvial-plain/suspended-load fluvial channel environment. In these delta and flood-plain environments, layers of mud are more abundant than channel sands. Sandstone channels are generally isolated from each other both laterally and vertically by mud-rich overbank and interfluvial rocks (Galloway, 1977). The upper portion of the Blackhawk Formation also contains some thin carbonaceous shale layers and thin coal seams which are not of economic interest.

The lower portion of the Blackhawk formation contains the minable coal deposits and consists of more thinly bedded sandstone and shale layers (Johnson, 1978). The coal-bearing units of the lower Blackhawk Formation overlie and are laterally juxtaposed to marine shoreface sandstones of the Blackhawk Formation and Star Point Sandstone. On a large scale, these sandstone bodies are laterally continuous but terminate abruptly into the mud- and organic-rich backshore faces in a landward direction (Van Wagoner and others, 1990). However, individual rock layers are

lenticular and discontinuous with abundant shaley interbeds. The fine- to medium-grained sandstones occur as thin- to massively- bedded paleochannel deposits. The paleochannels increase in frequency, thickness, and lateral extent upward in the formation. There is also a vertical repetition of erosional scours within the upper sandstones (Marley and others, 1997).

The PacifiCorp mine workings are within the Hiawatha and Blind canyon coal seams. In most locations the Hiawatha seam lies directly on top of the Star Point Sandstone. In some locations, a 0-15 foot thick shaley lagoonal deposit is present between the Hiawatha seam and the top of the Star Point Sandstone. The Blind Canyon seam lies approximately 80 feet above the Hiawatha seam. In the Wasatch Plateau, large areas of the Blackhawk Formation have been baked by natural burning of the coal near the surface. These reddish clinker layers are generally more resistant and form steeper slopes than adjacent unburned layers.

3.1.6 Star Point Sandstone (Cretaceous)

The Star Point Sandstone, which is present throughout the area, forms massive cliffs where exposed at the surface. The sandstone was deposited as marine shoreface blanket sands which are laterally continuous, but thin seaward (east). Landward (west), these sandstones terminate abruptly into the mud- and organic-rich backshore facies. Because many of the organic-rich facies have been converted to minable quality coal, locally the Star Point Sandstone has immediate contact with coal seams. Elsewhere, sandstone bodies of the Star Point Sandstone are overlain and underlain by lower shoreface and open marine shales of the Mancos Formation. What this means is that the marine shoreface sandstones are three dimensionally encased by low-permeability marine shales and fine-grained carbonaceous backshore coal-bearing facies.

The Star Point Sandstone thins eastward and emerges with the underlying Masuk Member of the Mancos Shale. Three prominent tongues of the Star Point Sandstone interfinger with the Mancos Shale. These three sandstone members, from top to bottom, are the Spring Canyon, Storrs, and Panther Sandstones. In the lease area, the Spring Canyon tongue is approximately 100 feet thick, lies about 80 feet above the Storrs tongue, and consist of massive, fine- to medium-grained sandstone. The Storrs tongue lies about 120 feet above the Panther tongue and consists of 50 feet of soft, friable sandstone. The basal Panther tongue is approximately 100 feet thick and consists of massive, cross-bedded delta front sandstones.

3.1.7 Masuk Member of the Mancos Shale (Cretaceous Age)

The marine Masuk Member of the Mancos Shale was deposited in an open marine environment. The rock is highly erodible calcareous, gypsiferous, and carbonaceous dark gray shale. It is

continuously exposed along the eastern edge of the Wasatch Plateau. The Masuk Member is approximately 1,300 feet thick. Westward thinning wedges of the Masuk interfinger with tongues of the Star Point Sandstone. Castle Valley, to the east of the PacifiCorp mines is developed on the Mancos Shale.

4.0 Hydrology

The principal factor controlling the occurrence and availability of groundwater in any area is geology. 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, artisan, and perched conditions. Water table conditions exist primarily in shallow alluvial deposits along larger perennial streams and in relatively flat lying sedimentary rocks. Artisan 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..

PacifiCorp has monitored significant groundwater inflows into each of its mines since 1979. Groundwater encountered within mine openings occurs by three main mechanisms. These mechanisms include: 1) drainage from overlying sandstone channels which are penetrated by roof-bolts and by vertical boring, or which are exposed during mining, 2) interception of water bearing faults and major fracture systems which transmit water from either overlying or underlying horizons, and 3) upward leakage from the underlying Spring Canyon Member of the Star Point Sandstone.

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 a sump to Cottonwood Creek, with an option of routing the discharge through the sediment pond if necessary. This discharge point is approved under the current UPDES Discharge Permit and is fitted with a flow meter for accurate quantity measurement. Intercepted groundwater is monitored, quantified and reported annually in the Hydrologic Monitoring Report.

As has been noted, the occurrence and quality of groundwater in any region is highly controlled by geology. It is believed that the Straight Canyon Syncline may influence the groundwater hydrology in the northwester corner of the permit area. The axis of the syncline, plunging NE-SW at approximately 3.5°, passes just to the northwest of the current permit boundary and through the LBA. It is visible at the outcrop at the Joes Valley dam. The syncline is a prominent feature and could provide a conduit for groundwater migration from NE-SW. Increased amounts of intercepted groundwater can be expected as mining approaches the syncline axis. Rather than rapid inundation which can occur along fault zones, a gradual increase in the amount of groundwater entering the mine should be anticipated as mining proceeds downdip below the potentiometric surface toward the syncline axis.

5.0 Chemical Quality Intercepted Groundwater

Since the commencement of mining by PacifiCorp, hydrology data has been collected within and around the Trail Mountain Mine. This data includes in-mine, spring and surface water samples to determine the effects of mining on water quality. The following sections evaluate the water quality of these areas from the data collected from 1997. Historical data provide similar trends.

5.1 In-Mine

Water quality samples have been collected from seepages within the Trail Mountain Mine to determine the groundwater hydrologic conditions within the Blackhawk Formation and Star Point Sandstone in which the coal-bearing zone is located. The sample location map of Figure 4, shows the locations of all sampling points within the Trail Mountain mine. Stiff diagrams have been added to the figure to show the quality composition of the intercepted groundwater.

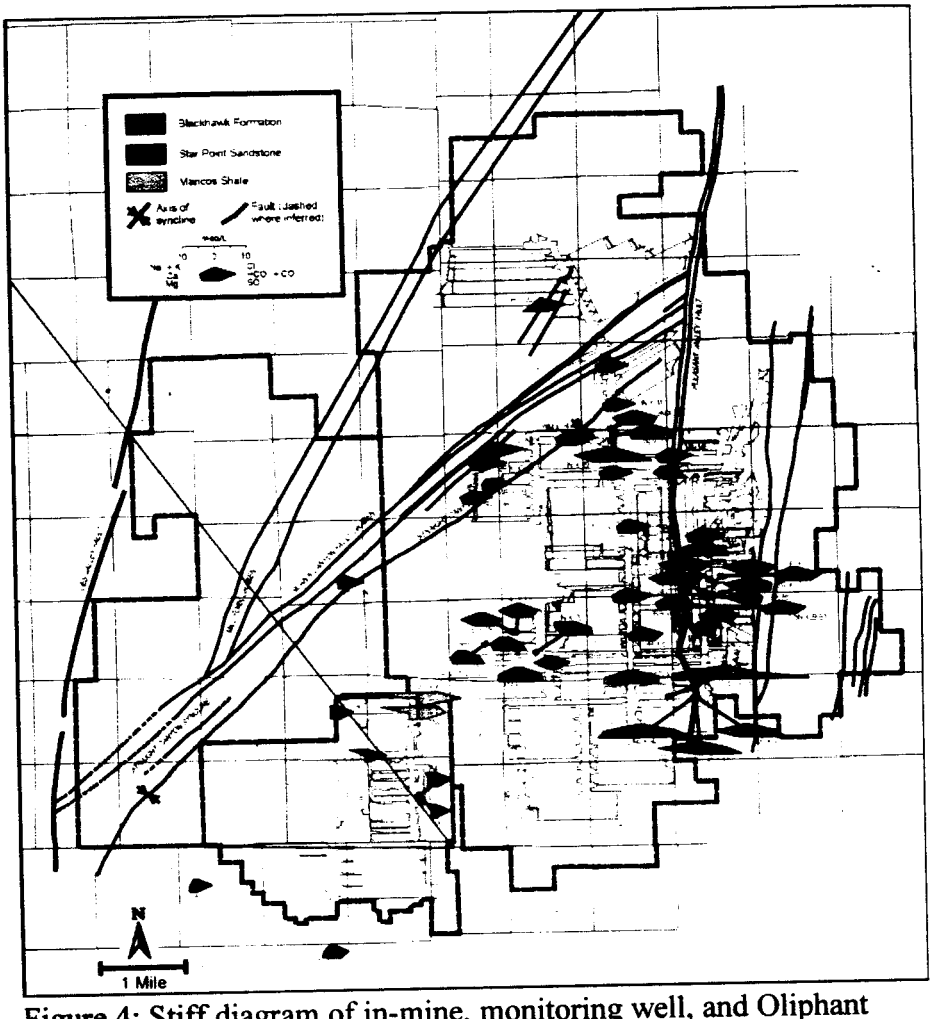

Figure 4: Stiff diagram of in-mine, monitoring well, and Oliphant Mine (T-18) waters.

The analysis of the chemical constituents intercepted within the Trail Mountain mine are identified in Table 2. The locations were listed because of there water producing capabilities. These samples tend to have consistent levels of TDS at each location within the mine; however, TDS concentrations from one location to the next are highly variable. TDS generally ranges from approximately 700 to 1600 mg/L, depending on the location from where sample is taken.

Table 1. Sampling of TDS at various locations within the Trail Mountain Mine.

Location	Date Sampled	TDS (mg/L)
9th Right XC-75	July 18, 1997	890
"	July 21, 1997	880
"	July 22, 1997	890
9th Right XC-70	July 18. 1997	1560
"	July 21, 1997	1570
"	July 22, 1997	1560
UG-3	March, 1997	320
"	June, 1997	300
"	September, 1997	300
"	December, 1997	310

The samples taken from the 9th Right locations are specific of the Star Point Sandstone. Table 1 shows how TDS differs from location to location. TDS at XC-75 is measured at 890 mg/L, while 500 feet to the east, TDS increased 680 mg/L to 1560 mg/L. Samples taken from UG-3 are specific to the Blackhawk Formation. These samples also show consistent TDS values measured throughout 1997.

Average TDS and loading of mine water discharge was calculated using DMR reporting data from 1997. Intercepted groundwater was discharged only in the latter half of the year from the Trail Mountain Mine. Discharge increased as mining progressed to the west, towards the Straight Canyon Syncline. The average TDS (Appendix A) of the samples taken were 954.50 mg/L. This gave a loading value of 1,529.06 lbs/day or 24.94 tons/month. Although the discharge is under the daily loading limit of one ton per day or 350 tons per year, it is anticipated that discharge will steadily increase and compliance will be increasingly difficult to

maintain. It is thus, recommended that the current UPDES (permit # UT-040003) be converted from a General to a Site Specific/Individual Permit to allow intercepted groundwater to be discharged based on the Total Dissolved Solids instead of the current tonnage limit. Table 2 below displays the salt loading that would occur at various flows.

Table 2: Loading calculation of lbs/day using flow vs. TDS.

TDS \ GPM	100	200	300	400	500	600	700	800	900	1000
500	602	1204	1806	2408	3010	3612	4213	4815	5417	6019
1000	1204	2408	3612	4815	6019	7223	8427	9631	10835	12038
1500	1806	3612	5417	7223	9029	10835	12640	14446	16252	18058
2000	2408	4815	7223	9631	12038	14446	16854	1926[illegible]	21669	24077

From the above Table, it is evident that when TDS remains constant, salt loading increases proportionally as flow increases. Even with a drinking water quality of 500 parts TDS, effluent limitations of 1 ton/day is surpassed when mine discharge exceeds 330 gal./min. The quality of the water discharged is not compromised, only the quantity is increased.

5.2 Surface Springs

The springs within and adjacent to the mine plan area 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 previously mentioned, the North Horn Formation consists of varied 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. In other words, water encountered from springs are from different origin then the water encountered underground.

5.3 Surface Streams

A portion of the Cottonwood Creek watershed receives drainage from the mine plan area. Stream channels from the mine plan 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. Figure 5 shows the drainage basins of the Trail Mountain and East Mountain areas.

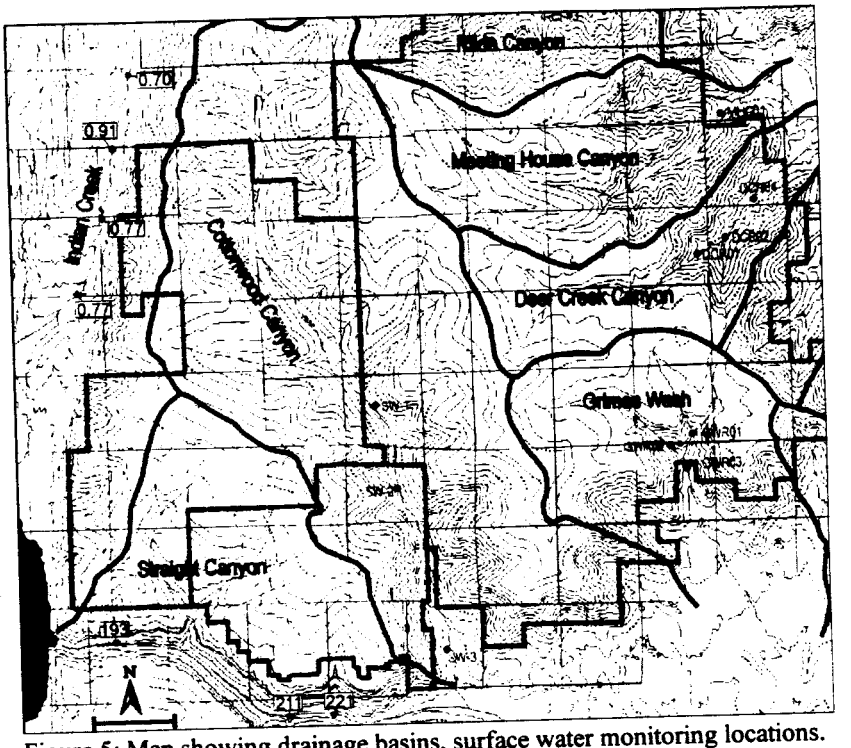

Figure 5: Map showing drainage basins, surface water monitoring locations.

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. In normal precipitation years with ample snowpack, runoff saturates alluvial deposits and discharges from the Cottonwood Spring. The Cottonwood Spring is (TM-23) located at a higher elevation than the Roans Canyon Spring.

Surface water-quality data collected from Cottonwood Canyon Creek by PacifiCorp indicate that the dominant ions are: calcium, magnesium, and bicarbonate. Total dissolved solids concentrations in the stream historically vary from about 300 to 1000 milligrams per liter in the mine area, with lower concentrations normally occurring during the high-flow season.

PacifiCorp established permanent sampling sites in the Cottonwood Canyon Creek in order to tract water quality of the creek. These sites are labeled SW-1, SW-2, and SW-3. SW-1 is located above the point of mine discharge. Site SW-2 is located at the Trail Mountain Mine immediately below the point of mine discharge. And site SW-3 is located farther down the creek above the confluence of the Cottonwood Creek. Refer to Figure 5 for the locations of these permanent sampling sites.

Quality data was collected from these sites in both 1996 (no mine discharge) and 1997 (mine discharge from May through December) and is found in Appendix B. Average TDS in 1996 for SW-1, SW-2, and SW-3, was 446.25 mg/L, 680.67 mg/L, and 852.25 mg/L respectively. When compared to data collected in 1997, we find that the TDS concentration actually dropped at the three sites to 350 mg/L, 650 mg/L, and 797.50 mg/L. The TDS of the mine discharge during this time period averaged 954.50 mg/L. This suggests that mine discharge had little effect to the TDS concentration of the creek. The influence of the geologic formations from SW-1 to SW-3 is believed to control the TDS concentration in the creek rather than the mine discharge.

A mass balance calculation was conducted on the Cottonwood Canyon Creek between the TDS contributions of the mine discharge and SW-1. This was conducted to further justify that mine discharge has minimal effects on salt loading of the creek. The calculation is found in Appendix B. Using the 1997 average, it was found that the TDS concentration immediately below the mine is 662.42 mg/L. This value correlates very well with 1996 values when there was no mine water discharged into the Cottonwood Canyon Creek.

6.0 Conclusion

Based on the sampling history of the Trail Mountain mine, the quality of the intercepted groundwater is fairly consistent, ranging in values from 300 mg/L to 1600 mg/L, depending on the location the sample was taken. Discharge from the mine into the Cottonwood Canyon Creek imitates these values, thus, suggesting that no additional salt is accumulated during transport from source to discharge point. Intercepted mine waters correspond very well to the TDS values achieved from the surface waters.

With the anticipation of intercepting increased quantities of groundwater as mine production extends further west, compliance with the UPDES (Permit #UT-040003-002) will/has become increasingly difficult if not impossible. Thus, it is essential that the current UPDES permit be converted from a General to Site Specific/Individual permit to allow intercepted groundwater to be discharged based on the concentration of the Total Dissolved Solids instead of the current tonnage limit.

This conversion was justified by examining the TDS concentration of the Cottonwood Canyon Creek during times when mine water was discharged and when not discharged. It was found that the mine discharge had little effect on the TDS concentration of the creek using the water quality parameters recorded in 1996 and 1997. Also, a mass balance was conducted using the data from the mine discharge and sampling site SW-1 as sources. It was concluded that the TDS concentration remained consistent with concentrations achieved when there was no mine discharge.

PacifiCorp, therefore, recommends that the TDS limitation be set to a level that is compatible with the TDS of the intercepted groundwater. This limitation should be set at 75% of the maximum, or 1200 mg/L. This adjustment in the TDS level will allow for discharge of water intercepted by mining without violating the UPDES permit.

References

Davis and Doelling H.H., 1972. Utah Geological and Mineralogical Survey Bulletin 112.

Garner, A. and Morris, T.H., 1996. Outcrop Study of the Lower Green River Formation for Reservoir Characteristics and Hydrocarbon Production Enhancement in the Altamont-Bluebell Field, Unital Basin, Utah: Utah Geological Survey, Miscellaneous Publications.

Galloway, W.E., 1977. Catahoula Formation of Texas Coastal Plain: Depositional systems, Compositions, Structural development, Groundwater Flow History, and Uranium Distribution: Bureau of Economic Geology, University of Texas- Austin, Report Investigation Number 87.

Johnson, J.L., 1978. Stratigraphy of the Coal-Bearing Blackhawk Formation on North Horn Mountain, Wasatch Plateau, Utah: Utah Geology, v. 5, no. 1, p. 57-77.

Lines, C.G., 1985. The Ground Water System and Possible Effects of Underground Coal Mining in the Trail Mountain Area, Central Utah. USGS Water Supply Paper 2259, p. 32.

Marely, W.E. and others, 1979 Coal Accumulation in Upper Cretaceous Marginal Deltaic Environments of the Blackhawk Formation and Star Point Sandstone, Emery, Utah. Utah Geo. v. 6, no. 2.

Mayo, Alan L. and others., 1997. Investigation of Surface and Groundwater Systems in the PacifiCorp Lease Area, East and Trail Mountains, Emery County, Utah. 20 October, 1997 Mayo and Associates, LC.

Peters, D.C. and Speirer, R.A., 1986. A Case History of Computer-Aided Lineament Analysis for Ground Control Planning, Paper Proceedings of 5th Conference on Ground Control in Mining, WV University, Morgantown, WV, p. 191-205.

Spieker, E.M., 1931. The Wasatch Plateau Coal Field. USGS Bulletin 819.

VanWagoner, J.C. and others, 1990. Siliciclastic Sequence Stratigraphy in Well Logs, Cores, and Outcrops: Concepts for High-resolution Correlation of Time and Facies: American Association of Petroleum Geologist, Methods in Exploration Series, no. 7, p. 55.

U.S. Geological Survey Water Data Report. UT-79-1, UT-80-1, UT-81-1.

Appendices

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Appendix A
Summary of Trail Mountain Mine Water Discharge Data
Water Quality Analysis Reports of UT-040003-002

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Appendix B
Sample Location Data of the Cottonwood Canyon Creek for the Years 1996 and 1997
Mass Balance Calculations

Energy West Mining Co.
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Huntington, UT 84528

1996

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

1997

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Appendix A
Summary of Trail Mountain Mine Water Discharge Data
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Appendix B
Sample Location Data of the Cottonwood Canyon Creek for the Years 1996 and 1997
Mass Balance Calculations

Energy West Mining Co.
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1996

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

1997

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Appendix A
Summary of Trail Mountain Mine Water Discharge Data
Water Quality Analysis Reports of UT-040003-002

Trail Mountain Mine Discharge Data

1997

Date	TDS (mg/L)	Flow (gpm)	Loading (lbs/day)	Tons/Month
Dec-97	940	161	1821.89	27.33
Nov-97	930	246	2754.15	41.31
Oct-97	1020	157	1927.83	28.92
Sep-97				
Aug-97	920	120	1329.04	19.94
Jul-97	940	120	1357.93	20.37
Jun-97	977	100	1176.15	17.64
May-97				
Apr-97				
Mar-97				
Feb-97				
Jan-97				
Average	954.50	150.67	1727.83	25.92

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FAX: (801) 653-2436

July 1, 1997

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

Sample identification by
PACIFICORP FIELD OFFICE

Trail Mountain Mine Discharge
UPDES UG-040003-002

Rec'd 1130 hr.
Sampled 0900 hr.

Kind of sample reported to us Water

Sample taken at

Sample taken by Energy West/M.D.

Date sampled June 2, 1997

Date received June 2, 1997

FIELD MEASUREMENTS

pH	8.27
DO	8.0
Flow	100 gpm
Conductivity	1259
Temperature	16.0°C

NOTE:Dissolved metals filtered at lab!

Analysis report no. 59-17218

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	<10	10	mg/l as $CaCO_3$	D1067-92	06-10-1997 0730 SW
Alkalinity, Bicarbonate	601	5	mg/l as HCO_3	SM2320-B	06-04-1997 1000 RJ
Alkalinity, Carbonate	6	5	mg/l as CO_3	SM2320-B	06-04-1997 1000 RJ
Alkalinity, Total	502	5	mg/l as $CaCO_3$	EPA 310.1	06-04-1997 1000 RJ
Anions	15.4	----	meq/l	---------	06-26-1997 1800 RJ
Calcium, Dissolved	34	1	mg/l	EPA 215.1	06-19-1997 1115 MK
Cations	15.6	----	meq/l	---------	06-26-1997 1800 RJ
Chloride	31	1	mg/l	SM4500-Cl-B	06-26-1997 0810 RJ
Conductivity	1421	1	umhos/cm	SM2510-B	06-10-1997 1200 SW
Hardness, Total	175	----	mg/l as $CaCO_3$	SM2340-B	06-26-1997 1800 RJ
Iron, Total	1.4	0.1	mg/l	EPA 236.1	06-19-1997 0900 MK
Iron, Dissolved	0.3	0.1	mg/l	EPA 236.1	06-19-1997 0900 MK
Magnesium, Dissolved	22	1	mg/l	EPA 242.1	06-19-1997 1130 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	06-19-1997 0915 MK
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	06-19-1997 0915 MK
Oil & Grease	<2	2	mg/l	SM5520-B	06-11-1997 0700 JC
pH	8.37	----	pH units	EPA 150.1	06-02-1997 1140 RJ
Potassium, Dissolved	5	1	mg/l	EPA 258.1	06-19-1997 0945 MK
Sodium, Dissolved	274	5	mg/l	EPA 273.1	06-19-1997 1030 MK
Solids, Settleable	<0.5	0.5	ml/l	EPA 160.5	06-02-1997 1230 JC
Solids, Total Dissolved	920	10	mg/l	EPA 160.1	06-05-1997 0700 JC
Solids, Total Suspended	73	5	mg/l	EPA 160.2	06-05-1997 0700 JC
Sulfate	217	83	mg/l	EPA 375.4	06-24-1997 0830 RJ
Cation/Anion Balance	0.4	----	%		06-26-1997 1800 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

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July 10, 1997

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

PACIFICORP
JUL 10 1997
FIELD OFFICE

Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN MINE DISCHARGE
UPDES UG-0400003-002

Kind of sample reported to us Water

Rec'd 1440 hr.
Sampled 1345 hr.

Sample taken at

Sample taken by Energy West/Mike

Date sampled June 13, 1997

Date received June 13, 1997

FIELD MEASUREMENTS

pH	8.45
DO	8.7
Flow	100 gpm
Conductivity	1250
Temperature	16.3°C

NOTE:Dissolved metals filtered at lab!

Analysis report no. 59-17316

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	<10	10	mg/l as $CaCO_3$	D1067-92	06-23-1997 0900 RJ
Alkalinity, Bicarbonate	602	5	mg/l as HCO_3	SM2320-B	06-16-1997 1700 RJ
Alkalinity, Carbonate	14	5	mg/l as CO_3	SM2320-B	06-16-1997 1700 RJ
Alkalinity, Total	517	5	mg/l as $CaCO_3$	EPA 310.1	06-16-1997 1700 RJ
Anions	16.9	----	meq/l	---------	07-08-1997 1600 RJ
Calcium, Dissolved	42	1	mg/l	EPA 215.1	07-08-1997 1045 MK
Cations	17.2	----	meq/l	---------	07-08-1997 1600 RJ
Chloride	39	1	mg/l	SM4500-Cl-B	07-02-1997 0730 RJ
Conductivity	1530	1	umhos/cm	SM2510-B	06-30-1997 0340 RJ
Hardness, Total	204	----	mg/l as $CaCO_3$	SM2340-B	07-08-1997 1600 RJ
Iron, Total	1.3	0.1	mg/l	EPA 236.1	07-08-1997 0800 MK
Iron, Dissolved	0.4	0.1	mg/l	EPA 236.1	07-08-1997 0800 MK
Magnesium, Dissolved	24	1	mg/l	EPA 242.1	07-08-1997 1100 MK
Manganese, Total	0.2	0.1	mg/l	EPA 243.1	07-08-1997 0830 MK
Manganese, Dissolved	0.1	0.1	mg/l	EPA 243.1	07-08-1997 0830 MK
Oil & Grease	7	2	mg/l	SM5520-B	06-18-1997 0800 JC
pH	8.48	----	pH units	EPA 150.1	06-14-1997 1020 RJ
Potassium, Dissolved	5	1	mg/l	EPA 258.1	07-08-1997 0900 MK
Sodium, Dissolved	299	5	mg/l	EPA 273.1	07-08-1997 0930 MK
Solids, Settleable	<0.5	0.5	ml/l	EPA 160.5	06-14-1997 1000 RJ
Solids, Total Dissolved	1020	10	mg/l	EPA 160.1	06-19-1997 0900 JC
Solids, Total Suspended	46	5	mg/l	EPA 160.2	06-16-1997 0700 JC
Sulfate	263	83	mg/l	EPA 375.4	07-02-1997 0715 JC
Cation/Anion Balance	0.9	----	%		07-08-1997 1600 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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July 2, 1997

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN DISCHARGE

Kind of sample reported to us Water

Rec'd 1230 hr.
Sampled 1800 hr.

Sample taken at

FIELD MEASUREMENTS
Flow 100 gpm

Sample taken by Energy West/Delivered for C.S.

Date sampled June 15, 1997

Date received June 16, 1997

Analysis report no. 59-17317

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	1.2	0.1	mg/l	EPA 236.1	06-19-1997 0900 MK
Solids, Total Dissolved	990	10	mg/l	EPA 160.1	06-19-1997 0900 JC
Solids, Total Suspended	13	5	mg/l	EPA 160.2	06-19-1997 0900 JC

PACIFICORP
JUL - 3 1997
FIELD OFFICE

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

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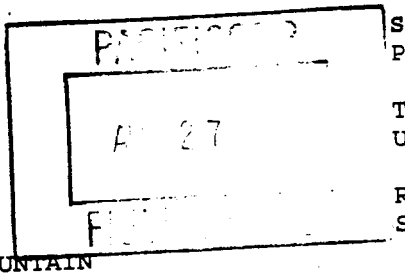
August 27, 1997

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528



Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN MINE DISCHARGE
UPDES UG-040003-002

Kind of sample reported to us Water

Rec'd 1010 hr.
Sampled 0858 hr.

Sample taken at TRAIL MOUNTAIN

Sample taken by ENERGY WEST/MBD

Date sampled July 23, 1997

Date received July 23, 1997

FIELD MEASUREMENTS

pH	8.09
DO	5.9
Flow	180 gpm
Conductivity	1279
Temperature	16.5°C

NOTE:DISSOLVED METALS FILTERED AT LAB!

Analysis report no. 59-17520

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	22	10	mg/l as $CaCO_3$	D1067-92	07-28-1997 1030 SC
Alkalinity, Bicarbonate	596	5	mg/l as HCO_3	SM2320-B	07-30-1997 0730 SC
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	07-30-1997 0730 SC
Alkalinity, Total	489	5	mg/l as $CaCO_3$	EPA 310.1	07-30-1997 0730 SC
Anions	15.4	----	meq/l	---------	08-25-1997 0920 MK
Calcium, Dissolved	49	1	mg/l	EPA 215.1	08-21-1997 1330 MK
Cations	16.6	----	meq/l	---------	08-25-1997 0920 RJ
Chloride	36	1	mg/l	SM4500-Cl-B	08-01-1997 1010 SC
Conductivity	1463	1	umhos/cm	SM2510-B	08-11-1997 0800 JC
Hardness, Total	217	----	mg/l as $CaCO_3$	SM2340-B	08-25-1997 0920 RJ
Iron, Total	1.4	0.1	mg/l	EPA 236.1	08-13-1997 0800 MK
Iron, Dissolved	0.3	0.1	mg/l	EPA 236.1	08-13-1997 0800 MK
Magnesium, Dissolved	23	1	mg/l	EPA 242.1	08-21-1997 1345 MK
Manganese, Total	0.1	0.1	mg/l	EPA 243.1	08-13-1997 0815 MK
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	08-13-1997 0815 MK
Oil & Grease	<2	2	mg/l	SM5520-B	08-04-1997 0700 JC
pH	8.07	----	pH units	EPA 150.1	07-23-1997 0900 MK
Potassium, Dissolved	3	1	mg/l	EPA 258.1	08-13-1997 0845 MK
Sodium, Dissolved	281	1	mg/l	EPA 273.1	08-21-1997 0900 MK
Solids, Settleable	<0.5	0.5	ml/l	EPA 160.5	07-23-1997 1030 MK
Solids, Total Dissolved	940	10	mg/l	EPA 160.1	07-28-1997 0700 JC
Solids, Total Suspended	14	5	mg/l	EPA 160.2	07-28-1997 0700 JC
Sulfate	277	50	mg/l	EPA 375.4	08-08-1997 0830 SC
Cation/Anion Balance	3.9	----	%		08-25-1997 0920 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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FAX: (801) 653-2436

September 17, 1997

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

Rec'd CEW Sep 22

Kind of sample reported to us WATER

Sample taken at TRAIL MOUNTAIN

Sample taken by ENERGY WEST/MBD

Date sampled August 28, 1997

Date received August 28, 1997

Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN
MINE DISCHARGE
UPDES UG-040003-002
Rec'd 0745 hr.
Sampled 0700 hr.

FIELD MEASUREMENTS

pH	8.51
DO	5.9
Flow	180 GPM
Conductivity	1280
Temperature	16.9°C

Dissolved metals filtered @ lab!

Analysis report no. 59-17671

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	<10	10	mg/l as $CaCO_3$	D1067-92	09-10-1997 0900
Alkalinity, Bicarbonate	688	5	mg/l as HCO_3	SM2320-B	09-05-1997 0600
Alkalinity, Carbonate	12	5	mg/l as CO_3	SM2320-B	09-05-1997 0600
Alkalinity, Total	583	5	mg/l as $CaCO_3$	EPA 310.1	09-05-1997 0600
Anions	16.5	----	meq/l	---------	09-16-1997 0700
Calcium, Dissolved	20	1	mg/l	EPA 215.1	09-09-1997 1100
Cations	16.9	----	meq/l	---------	09-16-1997 1400
Chloride	37	10	mg/l	SM4500-Cl-B	09-05-1997 0800
Conductivity	1473	1	umhos/cm	SM2510-B	09-16-1997 1200
Hardness, Total	936	----	mg/l as $CaCO_3$	SM2340-B	09-16-1997 1400
Iron, Total	1.2	0.1	mg/l	EPA 236.1	09-09-1997 0900
Iron, Dissolved	0.3	0.1	mg/l	EPA 236.1	09-09-1997 0900
Magnesium, Dissolved	17	1	mg/l	EPA 242.1	09-09-1997 1115
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	09-09-1997 0915
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	09-09-1997 0915
Oil & Grease	2	2	mg/l	SM5520-B	09-04-1997 0700
pH	8.49	----	pH units	EPA 150.1	08-28-1997 1420
Potassium, Dissolved	5	1	mg/l	EPA 258.1	09-09-1997 0945
Sodium, Dissolved	330	2	mg/l	EPA 273.1	09-09-1997 1000
Solids, Settleable	<0.5	0.5	ml/l	EPA 160.5	08-28-1997 1300
Solids, Total Dissolved	920	10	mg/l	EPA 160.1	09-02-1997 0700
Solids, Total Suspended	42	5	mg/l	EPA 160.2	09-02-1997 0700
Sulfate	182	83	mg/l	EPA 375.4	09-04-1997 0900
Cation Anion Balance	1.1	----	%		09-16-1997 1400

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

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FAX: (801) 653-2436

November 11, 1997

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN
MINE DISCHARGE UPDES UG-04003-002
Rec'd 1530 hr.
Sampled 0723 hr.

Kind of sample reported to us Water

Sample taken at Trail Mountain

Sample taken by Energy West/MBD

Date sampled October 28, 1997

Date received October 28, 1997

FIELD MEASUREMENTS

pH	8.94
DO	6.5
Flow	400 gpm
Conductivity	1313
Temperature	12.6°C

NOTE: Dissolved metals filtered at lab
NOTE: TSS expired when analyzed

Analysis report no. 59-18012

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	<10	10	mg/l as $CaCO_3$	D1067-92	11-10-1997 0900 SC
Alkalinity, Bicarbonate	775	5	mg/l as HCO_3	SM2320-B	11-03-1997 0900 SC
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	11-03-1997 0900 SC
Alkalinity, Total	635	5	mg/l as $CaCO_3$	EPA 310.1	11-03-1997 0900 SC
Anions	17.3	----	meq/l	---------	11-11-1997 1000 FC
Calcium, Dissolved	20	1	mg/l	EPA 215.1	11-07-1997 0845 MW
Cations	16.4	----	meq/l	---------	11-11-1997 1000 FC
Chloride	29	1	mg/l	SM4500-Cl-B	11-04-1997 1230 SC
Conductivity	1529	1	umhos/cm	SM2510-B	10-28-1997 2215 MW
Hardness, Total	116	----	mg/l as $CaCO_3$	SM2340-B	11-11-1997 1000 FC
Iron, Total	1.0	0.1	mg/l	EPA 236.1	11-07-1997 0700 MW
Iron, Dissolved	0.4	0.1	mg/l	EPA 236.1	11-07-1997 0700 MW
Magnesium, Dissolved	16	1	mg/l	EPA 242.1	11-07-1997 0900 MW
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	11-07-1997 0715 MW
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	11-07-1997 0715 MW
Oil & Grease	<2	2	mg/l	SM5520-B	10-31-1997 0700 SC
pH	8.28	----	pH units	EPA 150.1	10-28-1997 2145 MW
Potassium, Dissolved	5	1	mg/l	EPA 258.1	11-07-1997 0745 MW
Sodium, Dissolved	321	5	mg/l	EPA 273.1	11-07-1997 0800 MW
Solids, Settleable	<0.5	0.5	ml/l	EPA 160.5	10-28-1997 1745 MW
Solids, Total Dissolved	1020	10	mg/l	EPA 160.1	10-29-1997 0700 SC
Solids, Total Suspended	14	5	mg/l	EPA 160.2	11-04-1997 0900 FC
Sulfate	183	50	mg/l	EPA 375.4	10-29-1997 1400 SC
Ion Anion Balance	-2.7	----	%		11-11-1997 1000 FC

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

MEMBER ACIL

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306

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P.O. BOX 1020
HUNTINGTON, UT 84528
TEL: (801) 653-2311
FAX: (801) 653-2436

December 11, 199

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN
MINE DISCHARGE
UPDES UG-040003-002
Rec'd 1430 hr.
Sampled 1251 hr.

Kind of sample reported to us Water

Sample taken at Trail Mountain

Sample taken by Energy West/MBD

Date sampled November 13, 1997

Date received November 13, 1997

FIELD MEASUREMENTS

pH	8.92
DO	5.8
Flow	200 GPM
Conductivity	1384
Temperature	13.6°C

NOTE: DISSOLVED METALS FILTERED AT LAB

Analysis report no. 59-18087

Parameter	Result	MRL	Units		Method	Analyzed Date/Time/Analyst	
Acidity	<10	10	mg/l	as $CaCO_3$	D1067-92	11-19-1997 1300	SC
Alkalinity, Bicarbonate	747	5	mg/l	as HCO_3	SM2320-B	11-17-1997 1130	SC
Alkalinity, Carbonate	<5	5	mg/l	as CO_3	SM2320-B	11-17-1997 1130	SC
Alkalinity, Total	612	5	mg/l	as $CaCO_3$	EPA 310.1	11-17-1997 1130	SC
Anions	17.9	----	meq/l		---------	12-11-1997 1100	RJ
Calcium, Dissolved	23	1	mg/l		EPA 215.1	11-17-1997 2300	MK
Cations	16.5	----	meq/l		---------	12-11-1997 1100	RJ
Chloride	35	1	mg/l		SM4500-Cl-B	11-19-1997 0930	SC
Conductivity	1541	1	umhos/cm		SM2510-B	11-14-1997 1700	MK
Hardness, Total	127	----	mg/l	as $CaCO_3$	SM2340-B	12-11-1997 1100	RJ
Iron, Total	1.0	0.1	mg/l		EPA 236.1	11-17-1997 2000	MK
Iron, Dissolved	0.4	0.1	mg/l		EPA 236.1	11-17-1997 2000	MK
Magnesium, Dissolved	17	1	mg/l		EPA 242.1	11-18-1997 1200	MK
Manganese, Total	<0.1	0.1	mg/l		EPA 243.1	11-17-1997 2100	MK
Manganese, Dissolved	<0.1	0.1	mg/l		EPA 243.1	11-17-1997 2100	MK
Oil & Grease	<2	2	mg/l		SM5520-B	11-18-1997 0700	SC
pH	8.23	----	pH units		EPA 150.1	11-13-1997 1500	SC
Potassium, Dissolved	5	1	mg/l		EPA 258.1	11-17-1997 2130	MK
Sodium, Dissolved	318	5	mg/l		EPA 273.1	11-17-1997 2200	MK
Solids, Settleable	<0.5	0.5	ml/l		EPA 160.5	11-14-1997 1615	MK
Solids, Total Dissolved	930	10	mg/l		EPA 160.1	11-20-1997 0700	SC
Solids, Total Suspended	19	5	mg/l		EPA 160.2	11-20-1997 0700	SC
Sulfate	224	125	mg/l		EPA 375.4	12-10-1997 1230	SC
Cation/Anion Balance	-4.0	----	%			12-11-1997 1100	RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout
Huntington Laboratory RJ

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FAX: (801) 653-2436

January 2, 1998

PACIFICORP FIELD OFFICE
P.O. Box 1005
Huntington UT 84528

Sample identification by
PACIFICORP FIELD OFFICE

TRAIL MOUNTAIN
MINE DISCHARGE
UPDES UG 040003-002

Rec'd 0945 hr.
Sampled 0819 hr.

Kind of sample reported to us Water

Sample taken at Trail Mountain

Sample taken by Energy West/MBD

Date sampled December 16, 1997

Date received December 16, 1997

FIELD MEASUREMENTS

pH	8.88
Flow	100 GPM
Conductivity	1290
Temperature	13°C

NOTE: Dissolved metals filtered at lab

Analysis report no. 59-18165

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	<10	10	mg/l as $CaCO_3$	D1067-92	12-23-1997 0900 RJ
Alkalinity, Bicarbonate	781	5	mg/l as HCO_3	SM2320-B	12-18-1997 1200 JC
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	12-18-1997 1200 JC
Alkalinity, Total	640	5	mg/l as $CaCO_3$	EPA 310.1	12-18-1997 1200 JC
Anions	16.7	----	meq/l	---------	01-02-1998 0930 RJ
Calcium, Dissolved	20	1	mg/l	EPA 215.1	12-18-1997 1400 MK
Cations	17.5	----	meq/l	---------	01-02-1998 0930 RJ
Chloride	10	1	mg/l	SM4500-Cl-B	12-23-1997 1030 JC
Conductivity	1497	1	umhos/cm	SM2510-B	12-24-1997 1200 RJ
Hardness, Total	116	----	mg/l as $CaCO_3$	SM2340-B	01-02-1998 0930 RJ
Iron, Total	1.0	0.1	mg/l	EPA 236.1	12-18-1997 1200 MK
Iron, Dissolved	0.4	0.1	mg/l	EPA 236.1	12-18-1997 1200 MK
Magnesium, Dissolved	16	1	mg/l	EPA 242.1	12-18-1997 1415 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	12-18-1997 1215 MK
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	12-18-1997 1215 MK
Oil & Grease	<2	2	mg/l	SM5520-B	12-19-1997 0700 JC
pH	8.22	----	pH units	EPA 150.1	12-16-1998 1000 MK
Potassium, Dissolved	5	1	mg/l	EPA 258.1	12-18-1997 1300 MK
Sodium, Dissolved	345	5	mg/l	EPA 273.1	12-18-1997 1315 MK
Solids, Settleable	<0.5	0.5	ml/l	EPA 160.5	12-16-1997 1000 MK
Solids, Total Dissolved	940	10	mg/l	EPA 160.1	12-16-1997 0700 JC
Solids, Total Suspended	15	5	mg/l	EPA 160.2	12-16-1997 0700 JC
Sulfate	173	125	mg/l	EPA 375.4	12-30-1997 0900 JC
Cation/Anion Balance	2.2	----	%		01-02-1998 0930 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory

MEMBER ACIL

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Appendix B
Sample Location Data of the Cottonwood Canyon Creek for the Years 1996 and 1997
Mass Balance Calculations

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

1996

Water Quality Report: Operational

20-Apr-98

LOCATION GROUP: TMSURF

LOCATION: SW-1 HISTORICAL DATA FOR DATE: 19960101 THROUGH 19961231

PARAMETER	MAXIMUM	MINIMUM	AVERAGE	# ANALYSES	SUM
BICARB:	413	288	376	4	1504
CALCIUM:	77	63	69.75	4	279
CARBONATE:	12	12	12	1	12
CHLORIDE:	18	9	14.75	4	59
CONDUCT:	822	537	728.5	4	2914
DISS_OXY:	10.9	7.6	8.9	3	26.7
FLOW:	800	6.67	207.42	4	829.67
HARDNESS:	425	293	376.5	4	1506
IRON_TOT:	0.7	0.1	0.4	2	0.8
IRON_DISS:				0	
MAGNESIUM:	56	33	49	4	196
MANG_DISS:				0	
MANGANESE:				0	
OIL_GREASE:				0	
PH:	8.35	8	8.185	4	32.74
POTASSIUM:	2	1	1.65	4	6.6
SET_SOLIDS:				0	
SODIUM:	23	12	20	4	80
SULFATE:	108	29	78.25	4	313
SUSPENDED:	36	36	36	1	36
TEMP_WATE	19.5	1.7	10.85	4	43.4
TDS:	518	308	446.25	4	1785
DEPTH:				0	

Water Quality Report: Operational

20-Apr-98

LOCATION GROUP: TMSURF

LOCATION: SW-2 HISTORICAL DATA FOR DATE: 19960101 THROUGH 19961231

PARAMETER	MAXIMUM	MINIMUM	AVERAGE	# ANALYSES	SUM
BICARB:	454	233	347.67	3	1043
CALCIUM:	73	65	69.333	3	208
CARBONATE:	41	16	25.333	3	76
CHLORIDE:	128	12	56.667	3	170
CONDUCT:	1709	563	1043	3	3129
DISS_OXY:	10.9	7.3	9.1	2	18.2
FLOW:	850	2	295.67	3	887
HARDNESS:	631	323	462	3	1386
IRON_TOT:	1.3	0.4	0.85	2	1.7
IRON_DISS:				0	
MAGNESIUM:	109	39	70	3	210
MANG_DISS:				0	
MANGANESE:				0	
OIL_GREASE:				0	
PH:	8.63	8.13	8.4467	3	25.34
POTASSIUM:	24	2	9.5667	3	28.7
SET_SOLIDS:				0	
SODIUM:	158	14	68.667	3	206
SULFATE:	254	44	151.67	3	455
SUSPENDED:	78	20	49	2	98
TEMP_WATE	18.3	5.5	12.4	3	37.2
TDS:	1170	332	680.67	3	2042
DEPTH:				0	

Water Quality Report: Operational

20-Apr-98

LOCATION GROUP: TMSURF

LOCATION: SW-3 HISTORICAL DATA FOR DATE: 19960101 THROUGH 19961231

PARAMETER	MAXIMUM	MINIMUM	AVERAGE	# ANALYSES	SUM
BICARB:	452	265	385.25	4	1541
CALCIUM:	111	55	91.25	4	365
CARBONATE:	20	20	20	1	20
CHLORIDE:	78	20	56.25	4	225
CONDUCT:	1491	651	1237.3	4	4949
DISS_OXY:	10.7	7	9.1	3	27.3
FLOW:	1000	10	261.25	4	1045
HARDNESS:	652	327	563.25	4	2253
IRON_TOT:	0.6	0.6	0.6	1	0.6
IRON_DISS:				0	
MAGNESIUM:	95	46	81.5	4	326
MANG_DISS:				0	
MANGANESE:				0	
OIL_GREASE:	3	3	3	1	3
PH:	8.51	8.03	8.25	4	33
POTASSIUM:	4	2	3.05	4	12.2
SET_SOLIDS:				0	
SODIUM:	100	25	78	4	312
SULFATE:	398	100	267.25	4	1069
SUSPENDED:	38	38	38	1	38
TEMP_WATE	19.9	1.6	12.85	4	51.4
TDS:	1052	400	852.25	4	3409
DEPTH:				0	

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

1997

Water Quality Report: Operational

20-Apr-98

LOCATION GROUP: TMSURF

LOCATION: SW-1 HISTORICAL DATA FOR DATE: 19970101 THROUGH 19971231

PARAMETER	MAXIMUM	MINIMUM	AVERAGE	# ANALYSES	SUM
BICARB:	422	304	346.5	4	1386
CALCIUM:	77	54	60.75	4	243
CARBONATE:	5	5	5	1	5
CHLORIDE:	22	8	14	4	56
CONDUCT:	802	528	614.75	4	2459
DISS_OXY:	7.7	7.1	7.4	2	14.8
FLOW:	250	11	94	4	376
HARDNESS:	419	246	300	4	1200
IRON_TOT:	1	0.2	0.6667	3	2
IRON_DISS:				0	
MAGNESIUM:	55	27	36	4	144
MANG_DISS:				0	
MANGANESE:				0	
OIL_GREASE:				0	
PH:	8.47	8.12	8.23	4	32.92
POTASSIUM:	2	1	1.6667	3	5
SET_SOLIDS:				0	
SODIUM:	23	9	13.25	4	53
SULFATE:	110	32	58.5	4	234
SUSPENDED:	78	6	43	3	129
TEMP_WATE	12.1	1.8	7.775	4	31.1
TDS:	500	300	350	4	1400
DEPTH:				0	

PACIFICORP
TECHNICAL SERVICES - HYDROLOGIC MONITORING

COTTONWOOD CANYON CREEK FLOW & QUALITY

SW-1

	<----------		Field Measurements			------>		
Date	Time	emp. (oC	Flow GPM	pH	Cond. (uS)	Dis. Oxygen	Weather	Comments
1/31/97	1045		INACCESSIBLE				clear30's	
2-31-97	1132		5				clear20's	
3/10/97	1115	9.1	11	8.08	723	7.7	clear50's	
4/7/97	1238		60				pc40's	
5/27/97	1140		750				clear50's	
6/23/97	759	8.1	250	8.41	480	NA	clear60's	
7/23/97	918		200				cloudy70's	
8/25/97	1230		60				clear80's	
9/8/97	956	12.1	80	8.27	484	7.1	clear70's	
10/14/97	952		60				clear50's	
11/21/97	1050		30				pc30's	
12/5/97	1117	1.8	35	8.55	535	8	cloudy20's	
		Average	140.09					

Water Quality Report: Operational

20-Apr-98

LOCATION GROUP: TMSURF

LOCATION: SW-2 HISTORICAL DATA FOR DATE: 19970101 THROUGH 19971231

PARAMETER	MAXIMUM	MINIMUM	AVERAGE	# ANALYSES	SUM
BICARB:	606	308	444.5	4	1778
CALCIUM:	69	29	50.5	4	202
CARBONATE:	85	85	85	1	85
CHLORIDE:	179	10	79.75	4	319
CONDUCT:	1344	531	1067	4	4268
DISS_OXY:	8.4	6.6	7.5	2	15
FLOW:	280	18	157	4	628
HARDNESS:	460	151	287.5	4	1150
IRON_TOT:	1.4	0.4	0.825	4	3.3
IRON_DISS:	0.2	0.1	0.15	2	0.3
MAGNESIUM:	65	19	38	4	152
MANG_DISS:	0.3	0.3	0.3	1	0.3
MANGANESE:	0.1	0.1	0.1	1	0.1
OIL_GREASE:	39	39	39	1	39
PH:	8.64	8.44	8.5325	4	34.13
POTASSIUM:	4	1	2.75	4	11
SET_SOLIDS:				0	
SODIUM:	221	11	124.75	4	499
SULFATE:	153	35	118.25	4	473
SUSPENDED:	148	10	62.75	4	251
TEMP_WATE	16	4.5	8.5	4	34
TDS:	840	310	650	4	2600
DEPTH:				0	

PACIFICORP
TECHNICAL SERVICES - HYDROLOGIC MONITORING

COTTONWOOD CANYON CREEK FLOW & QUALITY

SW-2

	<----------		Field Measurements			---------->		
Date	Time	emp. (oC	Flow GPM	pH	Cond. (uS)	Dis. Oxygen	Weather	Comments
1/31/97	1050		DRY				clear30's	
2-31-97	1140		10				clear20's	
3/10/97	1128	4.6	18	8.48	1217	8.4	clear50's	
4/7/97	1247		65				pc40's	
5/27/97	1219		750				clear50's	
6/23/97	834	8.9	250	8.5	479	NA	clear60's	
7/23/97	923		400				cloudy70's	
8/25/97	1235		460				clear80's	
9/8/97	1044	16	280	8.72	1024	6.6	clear70's	
10/14/97	1018		90				clear50's	
11/21/97	1100		200				pc30's	
12/5/97	1130	4.5	80	8.92	1101	7.9	cloudy20's	
		Average	236.64					

Water Quality Report: Operational

20-Apr-98

LOCATION GROUP: TMSURF

LOCATION: SW-3 HISTORICAL DATA FOR DATE: 19970101 THROUGH 19971231

PARAMETER	MAXIMUM	MINIMUM	AVERAGE	# ANALYSES	SUM
BICARB:	569	350	479.25	4	1917
CALCIUM:	115	32	56.75	4	227
CARBONATE:	18	10	14	2	28
CHLORIDE:	95	22	48.25	4	193
CONDUCT:	1595	795	1224.3	4	4897
DISS_OXY:	8.2	6.7	7.45	2	14.9
FLOW:	400	6.67	215.42	4	861.67
HARDNESS:	687	181	329	4	1316
IRON_TOT:	1.1	0.5	0.9	3	2.7
IRON_DISS:	0.2	0.1	0.1667	3	0.5
MAGNESIUM:	97	24	45.5	4	182
MANG_DISS:	0.2	0.2	0.2	1	0.2
MANGANESE:	0.1	0.1	0.1	1	0.1
OIL_GREASE:	28	28	28	1	28
PH:	8.62	8.22	8.465	4	33.86
POTASSIUM:	4	2	3.5	4	14
SET_SOLIDS:				0	
SODIUM:	220	67	152.5	4	610
SULFATE:	438	121	228	4	912
SUSPENDED:	114	11	77.667	3	233
TEMP_WATE	16.6	1.6	9.9	4	39.6
TDS:	1130	490	797.5	4	3190
DEPTH:				0	

PACIFICORP
TECHNICAL SERVICES - HYDROLOGIC MONITORING

COTTONWOOD CANYON CREEK FLOW & QUALITY

SW-3

	<----------		Field Measurements ---			------>		
Date	Time	emp. (oC	Flow GPM	pH	Cond. (uS)	Dis. Oxygen	Weather	Comments
1/31/97	1300		5				clear30's	
2-31-97	1210		5				clear20's	
3/10/97	1150	9.9	6.67	8.32	1386	8.2	clear50's	
4/7/97	1336		10				pc40's	
5/27/97	1232		1000				clear50's	
6/23/97	922	11.6	400	8.55	710	NA	clear60's	
7/23/97	937		500				cloudy70's	
8/25/97	1248		450				clear80's	
9/8/97	1103	16.6	280	8.66	1071	6.7	clear70's	
10/14/97	1018		150				clear50's	
11/21/97	1120		180				pc30's	
12/5/97	1148	1.6	175	8.7	1177	8.2	cloudy20's	
		Average	263.47					

Mass Balance

Cottonwood Canyon Creek (SW-1)

TDS
350 mg/L

Flow (Q_1)
140.09 gpm

Loading (W_1)
589.20 lbs/day

Mine Discharge (UT04003-002)

TDS
954.3 mg/L

Flow (Q_2)
150.67 gpm

Loading (W_2)
1727.83 lbs/day

$W_1 + W_2 = W_T$

$W_T = (589.20 + 1727.83)$ lbs/day = 2317.03 lbs/day = 1.61 lbs/min.

$Q_1 + Q_2 = Q_T = (140.09 + 150.67)$ gpm = 290.76 gpm

$$\frac{1.61\ lbs/day}{290.76\ gpm} = 5.53 \times 10^{-3}\ lbs/gal$$

$$(5.53 \times 10^{-3}\ lbs/gal)\left(\frac{1\ gal}{3.79\ L}\right)\left(\frac{453.6\ grams}{1\ lb.}\right)\left(\frac{1000\ mg}{grams}\right)$$

= 662.42 mg/L (TDS concentration immediately below the mine)