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

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
James W. Carter
Division Director

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340
801-359-3940 (Fax)
801-538-5319 (TDD)

December 11, 1995

Mark Bailey, Area Manager
Bureau of Land Management
Price River Resource Area
125 South - 6th West
Price, Utah 84501

Re: Response to Division Order, ACT/015/009-DO-95A, Trail Mountain Mine, PacifiCorp, ACT/015/009-DO-95A, Folder #2, Emery County, Utah

Dear Mr. Bailey:

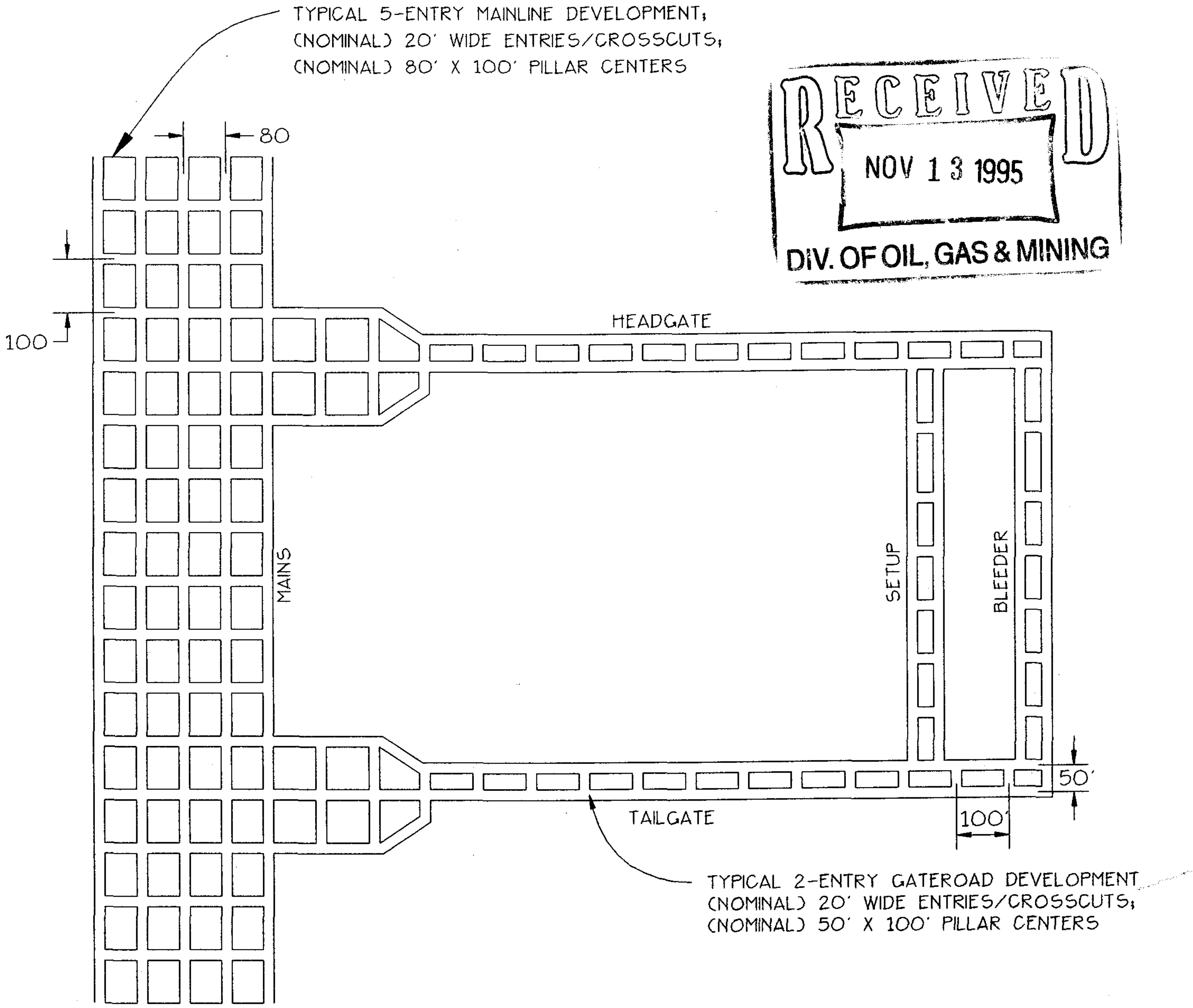
I am enclosing a response to a Division Order issued by the Division relative to issues in the Trail Mountain Mine mining and reclamation plan. Please review and notify the Division if you have any comments by January 19, 1995. 6

If you have any questions, please call me or Daron Haddock.

Sincerely,

Pamela Grubaugh-Littig
Permit Supervisor

Enclosure
cc: Alan Rabinoff, BLM, State Office
Janette S. Kaiser, Manti La Sal Forest Service
Mark Page, Water Rights, Price
Dave Ariotti, DEQ, Price
Bill Bates, DWR, Price



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DIV. OF OIL, GAS & MINING

FIGURE 3-4

TYPICAL MAIN ENTRY AND PANEL DEVELOPMENT AT THE TRAIL MOUNTAIN MINE

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.

Longwall 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~~ of tailgate 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.

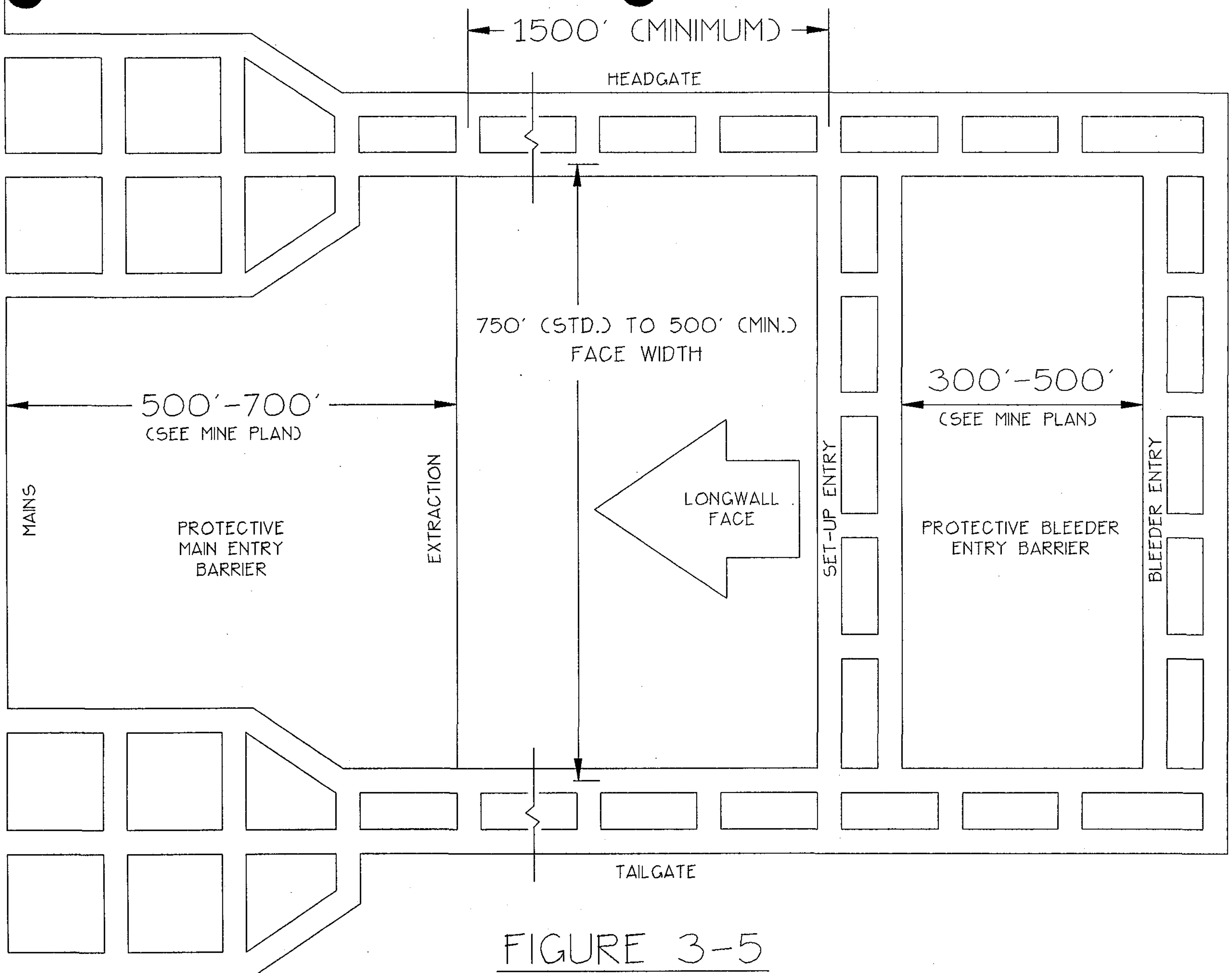


FIGURE 3-5

TYPICAL LONGWALL PANEL RETREAT AS USED AT THE TRAIL MOUNTAIN MINE

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.

Development of the fifth left mains and third west mains will continue. The ~~panels~~ gateroads east off the fifth left mains will be driven west to east and the ~~panels~~ gateroads west off the fifth left mains will be driven east to west. Panel sequence for extraction will be second east to fifth east, ~~and thirteenth~~ twelfth right to ~~first~~ ninth right and sixth right to first right.

3.3.1.5 RETREAT MINING

Panel extraction will commence once the fifth left mains are developed below the second east panel and the second east tailgate, headgate ~~are~~ and bleeders are completed.

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 perennial 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~~ 11, Geotechnical.

3.3.2.1 PROTECTION OF OIL AND GAS WELLS

Presently no oil or gas wells exist on the property. 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 BOUNDARIES

Property 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'~~ 1100' south of the ~~forth~~ belt 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 amount of coal recoverable from the Trail Mountain property is approximately ~~20,167,382~~ 21,234,002 tons. Table 3-1 shows the breakdown of coal recovery. Plate 3-3 shows the 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 approximately 60%.

The maximum amount of economically recoverable coal will be extracted except for 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).~~ To ensure the integrity of mine entries associated with the active underground workings of the Trail Mountain Mine, protective solid coal barriers are designed and left in place. These protective coal barriers are classified within three (3) separate categories; property boundary barriers, main entry barriers and bleeder barriers.

Property Boundary Barriers

All external property boundaries are protected, where feasible, by a 50 ft. (minimum) solid coal "buffer" barrier to ensure the effects of mining are contained within Trail Mountain Mine's current property boundaries.

Main Entry Barriers

Main entry barriers are designed to protect long-term mine entries from excessive abutment pressures of the retreating longwall. Design of these barriers is based on; (1) intended duration of use, (2) depth of cover in the area, (3) geologic conditions present and (4) historical performance of similar sized barriers in similar conditions. These barriers range from 500 to 700 feet in solid coal thickness between the projected longwall panel extraction location and the main entries they protect.

Bleeder Entry Barriers

Bleeder entry barriers are designed to ensure the long-term stability of the longwall panel bleeder system. Design of these barriers is based on; (1) intended duration of use, (2) depth of cover in the area, (3) geologic conditions present and (4) historical performance of similar sized barriers in similar conditions. These barriers range from 300 to 500 feet in solid coal thickness between the longwall setup entries and gateroads and the bleeder entries they protect.

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 area. 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 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 area have been surveyed and are

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.

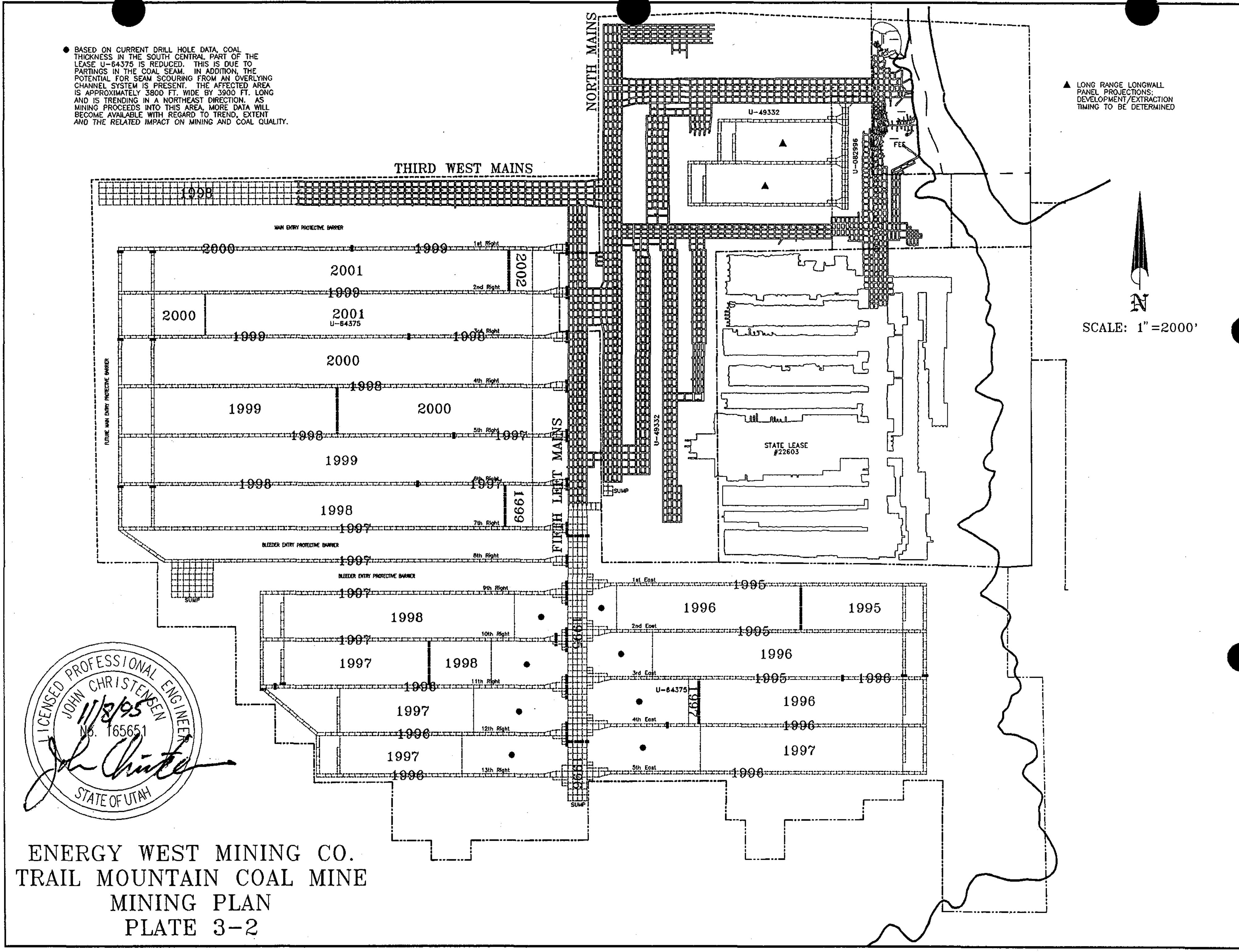
3.4.9 WASTE DISPOSAL

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



ENERGY WEST MINING CO.
TRAIL MOUNTAIN COAL MINE
MINING PLAN
PLATE 3-2

APPENDIX 7-10

PROBABLE HYDROLOGICAL

CONSEQUENCE DETERMINATION (PHC)

PROBABLE HYDROLOGIC CONSEQUENCES OF MINING AT THE TRAIL MOUNTAIN MINE, EMERY COUNTY, UTAH

Prepared for

TRAIL MOUNTAIN COAL COMPANY
Orangeville, Utah

Prepared by

EARTHFAX ENGINEERING, INC.
Salt Lake City, Utah

Modified with Additional Data Collected by Acro Coal & PacifiCorp

November 1995

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PROBABLE HYDROLOGIC CONSEQUENCES OF MINING AT THE TRAIL MOUNTAIN MINE, EMERY COUNTY, UTAH

1.0 INTRODUCTION

The purpose of this document is to present an assessment of the probable hydrologic consequences of the Trail Mountain mining operation. Where appropriate, the potential cumulative impacts of Tract 1 (Lease U-082996 and State 22603), Tract 2 (Lease U-49332) and from Lease UTU-64375. will be addressed.

This document is divided into five sections, including this introduction. Section 2.0 presents probable groundwater impacts and proposed groundwater monitoring plans. A similar discussion of surface water is provided in Section 3.0. Conclusions and references are listed in Sections 4.0 and 5.0, respectively.

2.0 GROUNDWATER

2.1 Probable Impacts

2.1.1 Background Information. Information presented in Chapters 6 and 7 of the PAP indicates that groundwater in the mine plan and adjacent areas occurs within the Blackhawk Formation (the coal-bearing formation) and the underlying Star Point Sandstone. These two formations are jointly considered an aquifer in the region (Lines, 1985).

According to Doelling (1972), the Blackhawk Formation consists of interbedded layers of sandstone, siltstone, shale, and coal, all of marine origin. The Star Point Sandstone consists of massive medium- to fine-grained sandstone with minor interbedded layers of shale and siltstone near its base. The Star Point also interfingers locally with the Blackhawk in the vicinity of the mine (Lines, 1985).

Lines (1985) tested core samples of the Blackhawk Formation and the Star Point Sandstone taken from a drill hole located approximately 1.5 miles west of the western Tract 2 boundary. Analysis results are presented in Table 2-1. According to the results, the sandstone units within the Blackhawk Formation are five to six orders of magnitude more permeable than the shale and siltstone units. The Star Point Sandstone is one to two times more permeable than the sandstone units of the Blackhawk Formation.

Aquifer tests were conducted by Lines (1985) on selected wells in the vicinity of the Trail Mountain Mine. Due to the low yield of most bedrock in the area, the tests could only be performed as recovery tests following pumping at rates of 5 to 10 gallons per minute for periods less than 5 hours. Nonetheless, the data are useful in determining approximate hydraulic characteristics of bedrock in the mine vicinity.

Based on the transmissivity and thickness data presented by Lines (1985) a hydraulic conductivity of 1.1x10-2 feet per day was calculated for a well completed in the Blackhawk Formation and the Star Point Sandstone in Section 24,Township 17 South, Range 6 East, approximately one-quarter mile north of the Tract 1 permit area. Another test was conducted in a well completed in the Blackhawk-Star Point aquifer in Section 27,Township 17 South, Range 6 East, about 1.5 miles west of the Tract 2 area (the same well from which core was obtained to determine the laboratory hydraulic conductivities provided in Table 2-1). Results of the test indicated a hydraulic conductivity of 1.4x10-2 feet per day. Both of these values compare favorably with the laboratory results reported in Table 2-1.

Table 2-1. Results of laboratory analyses of selected core samples (from Lines, 1985).

[Determinations by Core Laboratories, Inc., Dallas, Texas]

Lithology: Sh, shale; Slt, siltstone; Ss, sandstone; f, fine grained; m, medium grained.
Hydraulic conductivity: I, impermeable to water even at a pressure of 5,000 pounds per square inch.

Geologic unit	Lithology	Depth below land surface (feet)	Porosity (percent)	Hydraulic conductivity (feet per day)	
				Horizontal	Vertical
Blackhawk Formation	Ss, f	1,521	14	1.5×10^{-2}	3.7×10^{-3}
	Slt	1,545	3	9.3×10^{-8}	1.2×10^{-7}
	Sh	1,786	2	I	I
	Ss, f	1,792	14	1.1×10^{-2}	3.9×10^{-3}
	Sh	2,170	4	1.1×10^{-8}	---
	Slt	2,265	2	2.0×10^{-7}	2.2×10^{-6}
Star Point Sandstone	Ss, m	2,466	17	3.1×10^{-2}	1.1×10^{-2}
	Ss, m	2,493	11	1.5×10^{-2}	6.6×10^{-3}

Lines (1985) also reported the results of a constant-drawdown and recovery test conducted in a since-abandoned flowing well located in Straight Canyon (Section 4, Township 18 South, Range 6 East) approximately 2.5 miles east-southeast of the southeast corner of the proposed Tract 2 permit area. This well was located near the center of the Straight Canyon Syncline immediately east of the Joes Valley Fault in an area of suspected fracturing (Lines, 1985). The hydraulic conductivity of the Blackhawk-Star Point aquifer at this location (as determined from the measured transmissivity and the thickness) was calculated to be 1.6x10-1 foot per day, approximately one order of magnitude more permeable than the unfractured Blackhawk-Star Point aquifer as determined from previously mentioned laboratory and field tests. Lines (1985) attributed the relatively high value to fracturing.

In addition to the studies conducted by the U.S.G.S., 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 artisan 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. The transmissivity of the Star Point aquifer at this location (as determined from the measured permeability and the thickness) was calculated to be 2.46x10-2 foot per minute (or 35.4 feet per day), which is within the range of data collected by Lines (1985) . Piezometric data collected from TM-3 will be reported in the Annual Hydrologic Monitoring Report (see Appendix 7 for monitoring schedule and frequency).

No major fractures that might increase the permeability of the Blackhawk-Star Point aquifer are known to exist within the mine plan and adjacent areas (see Section 6.4.2). Thus, based on the remaining laboratory and field tests, this aquifer is assumed to have a hydraulic conductivity ranging from about 0.01 to 0.03 feet per day.

Data presented in the PAP (as developed initially by Lines, 1985 and modified using local data from the mine area) indicate that the flow of groundwater in the Blackhawk-Star Point aquifer is primarily to the south-southwest toward Straight Canyon. The hydraulic gradient within this aquifer varies in the eastern portion of the permit area from about 0.029 to 0.055 feet per foot, averaging 0.039 feet per foot. In the western portion of the permit area the hydraulic gradient ranges from about 0.046 to 0.061 feet per foot, averaging 0.048 feet per foot.

2.1.2 Potential Dewatering Impacts. Potential inflows to underground workings at the Trail Mountain Mine were determined from modeling studies conducted by Lines (1985) using a three-dimensional finite-difference model developed by McDonald and Harbaugh (1984). Lines (1985) considered the mine inflow and drawdown estimates determined as a result of these modeling studies to be *more reliable than those that could be made with other more simplified analytical techniques*. In light of the fact that rigorous analytical techniques that apply to the local conditions are not available (Freeze and Cherry, 1979), the results of Lines' modeling efforts are considered adequate for inflow and drawdown estimation.

Lines assumed that the Blackhawk-Star Point aquifer could be simulated with three layers (two in the Blackhawk and one in the Star Point) and that the aquifer was isotropic and infinite in areal extent. Drawdown effects were modeled for various mine widths, mine lengths, premining hydraulic gradients, and hydraulic conductivities.

Figure 2-1 shows the effect of mine size on expected inflow rates as determined by Lines (1985). Results presented in this figure are based on hydraulic conductivities of 0.01 feet per day for the Blackhawk Formation and 0.02 feet per day for the Star Point Sandstone. These values are very similar to the laboratory hydraulic conductivities reported by Lines (1985) for sandstone units within the Blackhawk Formation and for the Star Point Sandstone, respectively. They are also similar to the hydraulic conductivities calculated in Section 2.1.1 for the Blackhawk-Star Point aquifer from transmissivity and thickness data reported by Lines (1985) from local aquifer tests. Thus, the results are considered representative of local conditions.

According to Figure 7-3 of the PAP, the projected mine workings will have a maximum length of 12,000 feet. Figure 2-2 was prepared from Figure 2-1 using this mine length, showing potential mine inflows for various mine widths and two premining hydraulic gradients.

Comparing Figure 7-3 of the PAP with Figure 7-1 of the PAP and Figure 5 of Lines (1985), the maximum width of the potentially saturated projected mine workings will be 12,000 feet. Utilizing a premining hydraulic gradient of 0.041 feet per foot as being most representative of local conditions, Figure 2-2 indicates a potential steady-state inflow of approximately 80 gallons per minute. Using a premining hydraulic gradient of 0.065 feet per foot to represent a worst case scenario, Figure 2.2 indicates a potential steady-state inflow of about 170 gallons per minute. Inflow rates are likely to be more near the lower end of the range except perhaps in the western portion of the permit area where hydraulic gradients are steeper and heads are greater.

If areas of significant fracturing are encountered in the saturated portion of the mine workings, inflows to the mine would increase; however, as noted previously, no significant fracturing that would result in increased inflows above the predicted range is known to exist in the mine area.

Future mining within the Trail Mountain Mine (beyond Tract 2 LeaseUTU-64373) could conceivably extend approximately 8000 feet to the west of Tract 2 and 4000 feet south of tracts 1 and 2. Mining to the south should not significantly increase potential inflows to the mine workings since much of this area is unsaturated (based on a comparison of Figure 7-1 of the PAP with Figure 5 of Lines, 1985); however, mining to the west would continue into the saturated zone, thus increasing potential mine inflows. By extrapolation of the curves in Figure 2-2, increasing the width of the mine from 6000 to 14,000 feet should increase inflows by less than 25 gallons per minute under either premining hydraulic gradient condition.

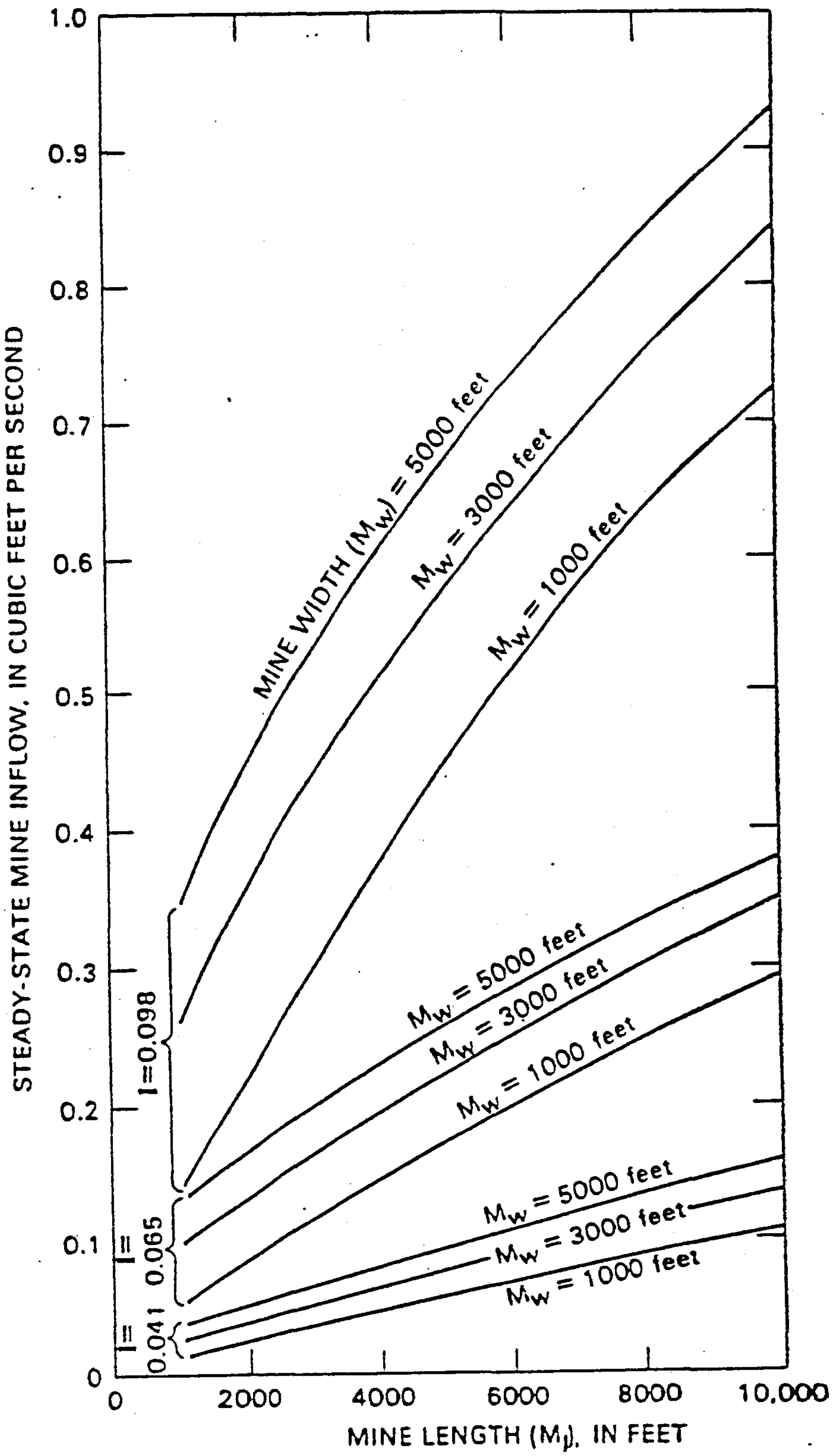


Figure 2-1. Effect of mine size and premining hydraulic gradient on mine inflow (from Lines, 1985).

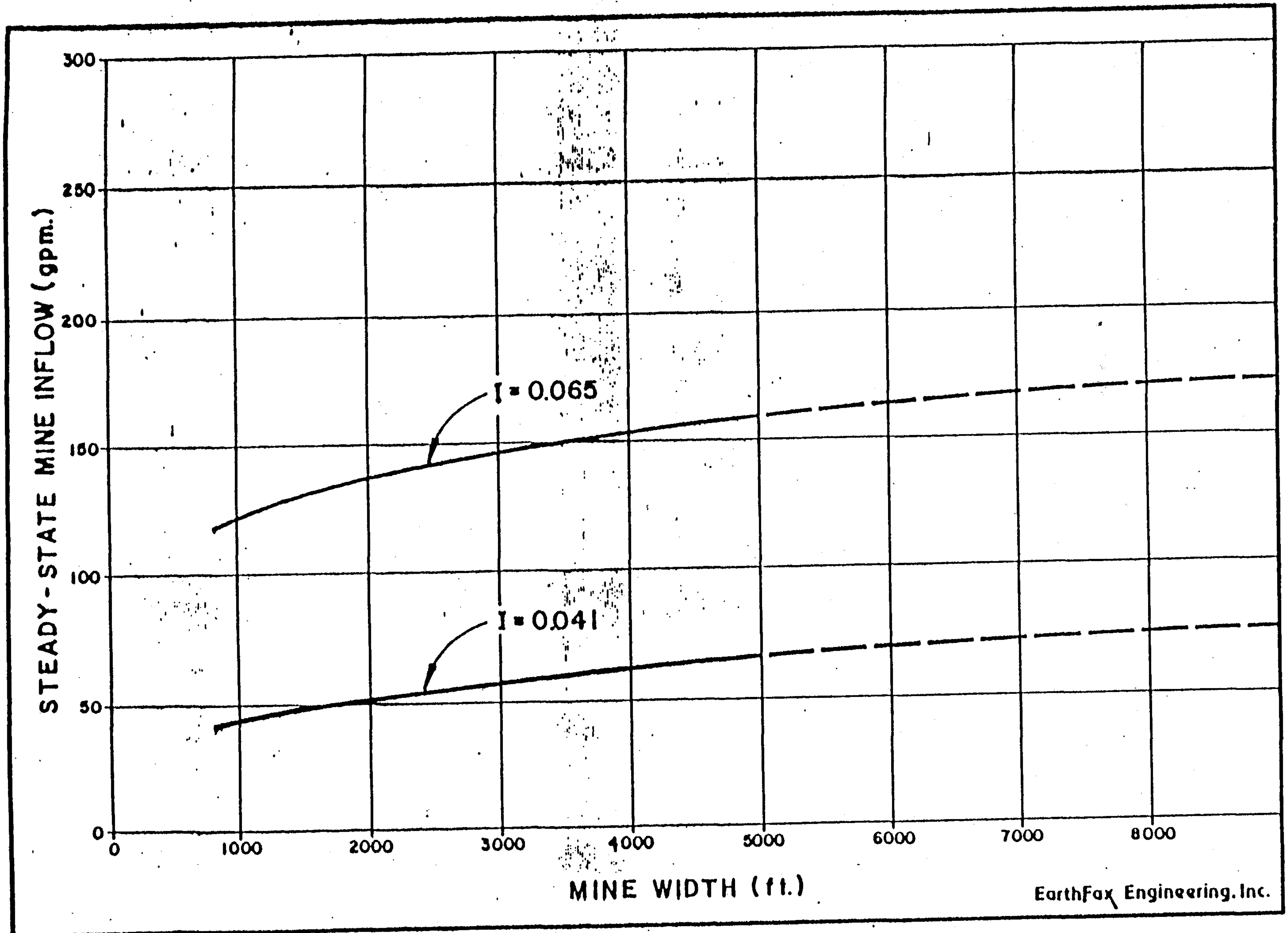


Figure 2-2. Effect of mine width on steady-state inflow for a mine length of 9000 feet.

As noted in Section 7.1.3.2 of the PAP, in-mine water requirements are projected to amount to approximately 250 gallons per minute during mining operations. As a result, water that naturally flows into the mine workings will probably all be used underground except potentially when mine workings are concentrated near the western portion of the permit area. Thus, during most of the mining period, the need for pumping mine water to the surface will be eliminated. Similarly, the use of water that flows into the mine to satisfy underground requirements will preclude the need to pump that quantity of water from Cottonwood Creek.

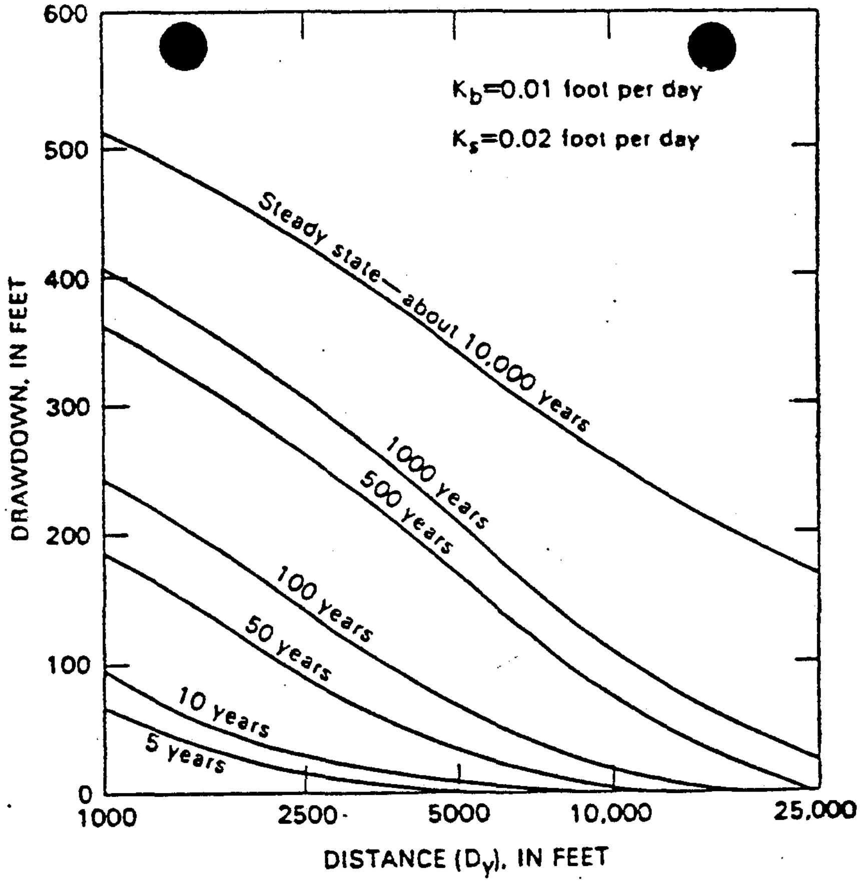
Lines (1985) modeled potential drawdown due to mine dewatering for a hypothetical mine with a length of 10,000 feet, a width of 1000 feet, and a premining hydraulic gradient of 0.065 feet per foot. Curves developed from these modeling results are presented in Figure 203 for hydraulic conductivities of 0.01 and 0.02 feet per day for the Blackhawk Formation and Star Point Sandstone, respectively. Since the premining hydraulic gradient used to develop these curves is generally greater than the gradient in the mine area, the impacts predicted using these curves will be conservatively high.

Since the Trail Mountain Mine will be wider than 1000 feet, actual drawdowns near the center of the mine will be greater than predicted by Figure 2-3 (due to the law of superposition); however, the curves are reliable in predicting the maximum extent of drawdown effects near the mine since superposition does not affect the outer limit of the impact. Under a worst-case condition (i.e., all water encountered in the mine is pumped to the surface), data presented in Figure 2-3 indicate that, after 50 years of mining and accompanying dewatering (a probable maximum period of mining), the cone of depression resulting from dewatering can be expected to extend about two miles from the mine in the direction of the mine length (Dy) and five miles from the mine in the direction of the mine width (Dx). These effects will be most noticeable to the north and west of the mine since the Blackhawk Formation is typically unsaturated to the east and south.

Unless subsidence fractures extend vertically to overlying perched aquifers, inflow to the mine workings will be derived totally from the Blackhawk-Star Point aquifer. According to Lines (1985), only perched groundwater systems exist above the Blackhawk Formation. Thus, springs in overlying formations are not hydraulically connected to the Blackhawk and will not be impacted by mine inflows.

Data presented in Chapter 7 of the PAP (Appendix 7-1) and by Lines (1985) indicate that only three springs issue from the Blackhawk Formation within the zone of potential influence from dewatering. No other seeps or springs issuing from the Blackhawk Formation have been noted in the area adjacent to the mine plan area.

Spring TM-23 - Cottonwood Spring (discussed in the PAP) is located in the canyon bottom and is associated with the alluvial (glacial) deposits. With normal prepcitation, especially in the form of winter snowpack, runoff will saturate the alluvial deposits and a portion of groundwater would discharge at the location of Cottonwood Spring. During periods of drought, recharge to the alluvial deposits will be limited and the level of groundwater will be reduced to a point below the elevation of the Cottonwood Spring.



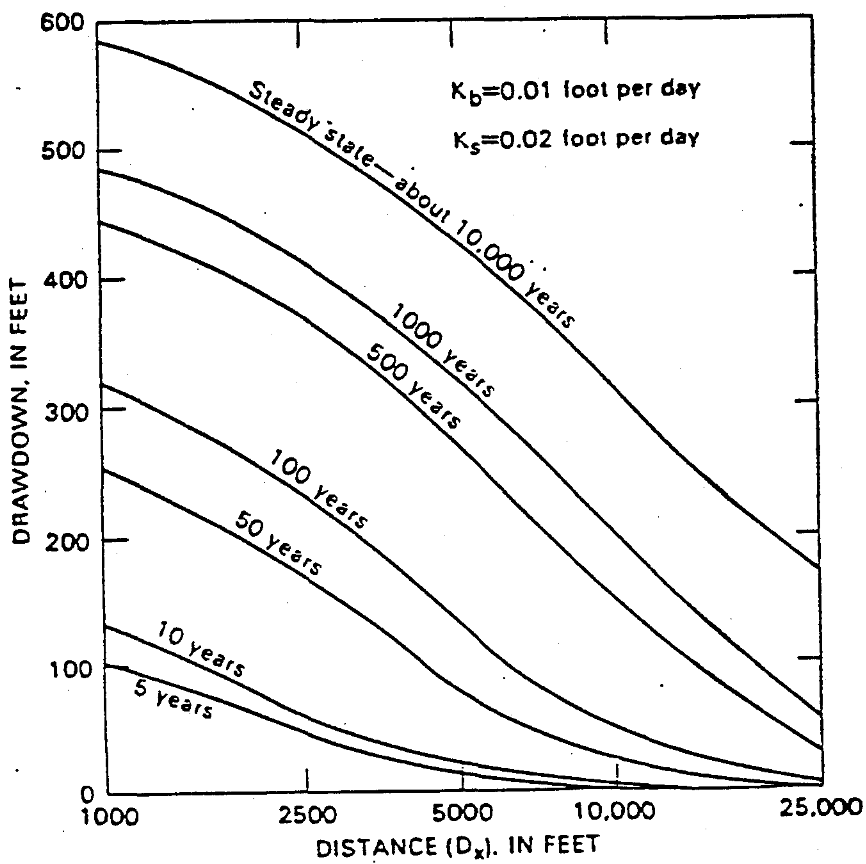


Figure 2-3. Effect of mine size and time on drawdown in the Blackhawk-Satr Point aquifer (from Lines, 1985).

Springs (D-18-6) 4bbc-S1 and (D-18-6) 5abd-S1 (both discussed by Lines, 1985) issue in the bottom of Straight Canyon immediately downstream from Joes Valley Reservoir. These springs also contribute to the base flow of Cottonwood Creek via Straight Canyon. Lines (1985) reported that the flow of the former spring has been less than 2 gallons per minute during the period of observation. The latter spring had measured discharge rates of 180 and 200 gallons per minute during two observations in 1982.

Since other springs in the mine plan and adjacent areas are located above the regional water table, the primary impact from mine dewatering will probably be a decrease in the flow of Cottonwood Creek (diverting water either from one of the indicated springs or from diffuse inflow to Cottonwood Creek and Straight Canyon). Based on an average annual flow of Cottonwood Creek near Orangeville of 70,700 acre feet (see Section 7.2.2.1 of the PAP), the potential annual flow reduction of Cottonwood Creek (80 to 170 gallons per minute) is approximately 0.2 to 0.4 percent of the average flow (assuming none of the inflowing water is used underground). These flow changes will decrease the amount of water available for downstream irritation, stock watering, and wildlife usage.

2.1.3 Potential Subsidence Impacts. The maximum area of the potential surface expression of subsidence due to mining in the is presented in Figure 7-1 of the PAP. Nine springs exist within this area. Data presented in Appendix 7-1 of the PAP documents the geologic occurrence of each spring. All of the springs emanate from the North Horn Formation except T-14 (17-25-1) which issues from the Price River Formation.

Springs within and surrounding the mine plan area 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 and adjacent area. As shown, only a limited number of springs/seeps was 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 (Volume 9 Hydrologic Section, East Mountain Permit Area) and the Bureau of Mines (IC 9405 Response of Springs to Longwall Coal Mining at the Deer Creek and Cottonwood Mines, Wasatch Plateau, UT) 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.

As was previously discussed, no significant impacts to the groundwater system are expected from the mining operation. The groundwater monitoring plan (discussed in Chapter 7) 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 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.

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).

According to data presented by Lines (1985), water quality is similar in all aquifers in the Trail Mountain area. Thus, subsidence should not degrade the quality of groundwater. Some improvement of groundwater quality may even occur since flow rates through the bedrock would increase and residence time in the bedrock would decrease, thereby decreasing dissolution and lowering the dissolved concentrations of various constituents below current concentrations.

2.2 Groundwater Monitoring Plan

A groundwater monitoring plan has been developed for the Trail Mountain permit area and adjacent areas which includes monitoring of selected springs, in-mine sources and monitoring wells. Details of this plan can be found in Appendix 7-1 of the PAP.

3.0 SURFACE WATER

3.1 Probable Impacts

3.1.1 Background Information. According to Chapter 7 of the PAP the Trail Mountain Mine is located within the Cottonwood Creek watershed. Cottonwood Creek has had an average annual flow of 70,700 acre feet, approximately 60 percent of which occurs as snowmelt runoff during May through July . The quality of water in Cottonwood Creek is good near the mine with total dissolved solids concentrations generally less than 400 milligrams per liter.

The permit area is drained entirely by ephemeral and intermittent streams. Watersheds tend to be steep and well vegetated.

3.1.2 Potential Water Quality Impacts. Existing runoff and sediment control facilities were designed in accordance with applicable Division regulations and are maintained to minimize sediment concentrations from the surface facilities to Cottonwood Creek.

3.1.3 Potential Water Quantity Impacts. Water for in-mine use is from underground sources. As the mine workings expand to the west (into the saturated zone), intercepted water in excess of mine requirements will either be stored in sealed areas or discharged according to the stipulations listed in the UPDES permit (see Appendix 7-11).

Projected in-mine water requirements are 250 gallons per minute when the mine is fully developed. Assuming a 195-day work year, this quantity amounts to approximately 180 acre feet per year and represents 0.2 percent of the average annual flow of Cottonwood Creek. A reduction in the flow of the stream would decrease the amount of water available for downstream irrigation, stock watering, and wildlife usage.

3.2 Surface Water Monitoring Plan

A surface water monitoring plan has been previously submitted to the Division by PacifiCorp. Details of this plan can be found in Appendix 7 of the PAP.

4.0 CONCLUSIONS

The following conclusions have been presented in this document in relation to potential hydrologic impacts from mining at the Trail Mountain Mine.

- Inflow of water to the underground workings at the Trail Canyon Mine are expected to range between 80 and 170 gallons per minute. Inflows are predicted to be lowest in the eastern portion of the mine and highest to the west, where hydraulic gradients are steeper and heads are greater. Inflow to the mine workings will be derived primarily from the Blackhawk Formation.

- Expansion of the mine workings into Lease UTU-64375 would increase inflows to the mine by less than 10 gallons per minute.

- Most water encountered underground will be used underground during mining.

- The cone of depression resulting from mine dewatering will extend a maximum of two miles north and south of the mine and five miles east and west of the mine. The effects will be most noticeable to the north and west where the bedrock is saturated.

- The primary potential impact due to a drawdown of the potentiometric surface near the mine is a decrease in the base flow of Cottonwood Creek. The maximum potential decrease in the average annual flow of Cottonwood Creek near Orangeville is 0.2 to 0.4 percent.

- Due to the limited number of springs in the immediate vicinity of the mine, subsidence is predicted to have little impact on local spring flow.

- No adverse impacts to surface or groundwater quality are anticipated as a result of mining at the Trail Mountain Mine.

- Water for in-mine use is from underground sources. As the mine workings expand to the west (into the saturated zone), intercepted water in excess of mine requirements will either be stored in sealed areas or discharged according to the stipulations listed in the UPDES permit Projected in-mine water requirements are 250 gallons per minute when the mine is fully developed. Assuming a 195-day work year, this quantity amounts to approximately 180 acre feet per year and represents 0.2 percent of the average annual flow of Cottonwood Creek.

5.0 REFERENCES

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