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DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF OIL, GAS AND MINING

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June 12, 1997

TO: File 2

THRU: Daron Haddock, Permit Supervisor *DRH*

FROM: James D. Smith, Reclamation Specialist *JDS*

RE: Alkali Tract Significant Revision, Canyon Fuel Company, Soldier Canyon Mine, ACT/007/018-96-1, File 2, Carbon County, Utah

**SUMMARY**

Canyon Fuel Company submitted information for an addition to the Soldier Canyon Mine in 1996 and numerous deficiencies were identified. Revisions and corrections were submitted by Canyon Coal Company, the successor to Canyon Fuel Company, on March 4, 1997. Several deficiencies remained concerning baseline data that needed to be resolved, although none of the deficiencies were of a nature that would not have allowed the permit to be issued with stipulations. A second set of revisions and corrections was received by DOGM on May 15, 1997. There are still two potentially confusing details to be resolved in Table 7.24-1, but these should not hinder use of the plan to inspect the mining operation nor hinder enforcement of the Coal Mining Rules. Better, more legible copies of Exhibit 7.21-5 should be provided, although those in the Alkali Tract Significant Revision are usable.

**TECHNICAL ANALYSIS**

**ENVIRONMENTAL RESOURCE INFORMATION**

**GEOLOGIC RESOURCE INFORMATION**

Regulatory Reference: 30 CFR Sec. 784.22; R645-301-623, -301-724.

**Analysis:**

The Alkali Tract Significant Revision contains no additional information for Chapter 6 - Geology except that maps have been expanded to include the additional area. A summary of hydrogeology is included on pages 7-94 through 7-135 in the PHC determination. Geologic information in the existing MRP is sufficient to assist in: determining the probable hydrologic consequences of the operation upon the quality and quantity of surface and ground water in the permit and adjacent areas, including the extent to which surface- and ground-water monitoring is necessary; determining all potentially acid- or toxic-forming strata down to and including the stratum immediately below the coal seam to be mined; determining whether reclamation can be accomplished and whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area; and, preparing the subsidence control plan.

Geologic information in the Alkali Tract Significant Revision and in the currently approved MRP includes a description of the geology of the proposed permit and adjacent areas down to and including the deeper of either the stratum immediately below the lowest coal seam to be mined or any aquifer below the lowest coal seam to be mined which may be adversely impacted by mining. Geologic cross sections and maps of areal geology and coal seam thickness have been updated to include the Alkali Lease Addition. The geology map indicates strike-and-dip. It is suspected that spring 10 issues from a fracture, but alluvium obscures any surface expression of a fracture around the spring. There are apparently no mappable features of structural geology. The map showing the thickness of rock between the Rock Canyon and Gilson seams has been reduced to simply indicate where the interburden is more than or less than thirty feet; because thirty feet is a widely accepted limit for mining in overlying or underlying seams, this map is adequate for indicating areas where only one of the two seams can be mined.

In no portion of the Soldier Canyon Mine permit area, the Alkali Lease Addition, and adjacent areas are the strata down to the coal seam to be mined to be removed. The strata down to the coal seam to be mined are exposed at outcrops in and adjacent to these areas. No new samples have been collected and analyzed from test borings; drill cores; or fresh, unweathered, uncontaminated samples from rock outcrops for the Alkali Tract Significant Revision to the Soldier Canyon Mine MRP.

Collection, analysis, and description of additional geologic information has been determined not to be necessary to protect the hydrologic balance, to minimize or prevent subsidence, or to meet the performance standards.

**Findings:**

Geologic environmental resource information for the Alkali Tract Significant Revision to the Soldier Canyon Mine MRP is considered adequate to meet the requirements of this section.

**HYDROLOGIC RESOURCE INFORMATION**

**Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-720.**

A coal mine permit application has been submitted to the Utah Division of Oil, Gas, and Mining (DOG M) by Coastal States Energy Company for the Dugout Canyon Mine, to be located southeast of the current Soldier Creek mine permit area. The Dugout Canyon permit application includes roughly the area covered by a previous mine permit issued to Sunedco for the Sage Point/Dugout Canyon Mine. A CHIA is being prepared that will include the Soldier Canyon and Dugout Canyon Mines.

The Alkali Tract Significant Revision contains a new Chapter 7 on hydrology to replace Chapter 7 in the currently approved plan. It follows the same format as the current Chapter 7 but contains a large number of additions and revisions.

**Sampling and analysis**

**Analysis:**

Sampling and analysis is addressed on page 7-2, Section 7.23. This section states that analysis will be completed based on either "Standard Methods for the Examination of Water and Wastewater" or 40 CFR parts 136 and 434, when feasible. This statement in the Alkali Tract Significant Revision is not strictly true: except for tritium determination, methods to determine isotopic content of water are not covered by "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Tritium was determined at the University of Miami Tritium Laboratory using electrolytic enrichment and low level counting rather than the method in "Standard Methods for the Examination of Water and Wastewater". However, tritium data in the Alkali Tract Significant Revision are not used to determine water quality so do not fall under the requirements of R645-301-723.

Field measurements have been conducted with instruments calibrated according

to manufacturers recommendations.

**Findings:**

The applicant has met the minimum requirements for surface-water sampling and analysis.

**Baseline information.**

**Ground water information.**

A description of the ground water system is found in section 7.24.1 beginning on page 7-3 of the Alkali Tract Significant Revision.

Culinary and sanitary water for the mine is hauled in by truck. Two water rights in Table 7.24-2 appear to involve past or current pumping of ground water from the subsurface. Water right 4124, located approximately one mile north of the northeast corner of the permit area in Section 28, T. 12 S., R. 12 E., was issued to Barnard Iriat for domestic, irrigation, and stockwatering use and a shallow well was installed near a cabin on the Iriat property. Water right 203, in Section 18, T 12 S., R. 12 E., was issued to California Portland Cement Company for industrial use and has been used by the Soldier Creek Mine for underground process water.

UG-1 and UG-2 were constructed for the investigation for the design of the UG ventilation shaft and have been abandoned. At least five wells have been drilled from within the Soldier Canyon Mine down to or through the Gilson seam to monitor water levels in the regional aquifer (Appendix 7-I, Soldier Canyon MRP). MW-1C, MW-1M, MW-2M, and MW-3M have been used to monitor water quality at the proposed waste rock disposal site that is no longer in the mine plan.

The current status of several wells is unclear. DM1, DM2, DM3, DM4, and 18-1 may have been mine water discharge points rather than wells. Exhibit 7.21-5 indicates DM1, DM2, DM3, DM4 have been destroyed at some time past. Accessibility and functionality of most in-mine wells is not discussed .

On pages 41, 54, and 62 of Appendix 7M, reference is made to the rapid loss of production capacity in wells #1 and #3. These are water supply wells at the Centennial Mine, located roughly six miles west of Soldier Canyon in Deadman Canyon. Location of these wells is shown on Figure 9 of Appendix 7M in the Alkali Tract Significant Revision.

The regional hydrology report begins on page 7-44. In this section Canyon Fuel Company discusses waters in the Book Cliffs to the Price River down to its confluence with the Green River. Much of the water data reported in this section comes from Waddell, 1981 (see MRP). Collection of water quality data in the area for purposes of coal mine permitting began in 1976. Baseline information on surface water includes data from Sunedco's Sage Point/Dugout Canyon MRP and SCCC's Soldier Canyon MRP. Location and elevation for monitoring stations used to gather baseline data on water quality and quantity are shown on Exhibit 7.21-5.

The head water of the Price River and Green River tend to have excellent water quality but deteriorate rapidly down stream. Geologically, shale areas contribute the greatest amount of sediment to the stream flow.

The life-of-mine (LOM) surface water hydrology is found beginning on page 7-46. Exhibit 7-46 shows the LOM area. The LOM area delineated on Exhibit 7-46 and the area of data collection by the Mayo and Associates report (Appendix 7M, Plate 1) are different. The original Mayo report does not include mining under the Coal Creek valley, but this has been covered by an addendum, dated March 1996.

Streams, lakes, ponds, and springs are shown on Exhibits 7.21-1 and 7.21-2. USGS topographic quadrangles show Soldier and Coal Creeks and several of their tributaries as perennial streams. Exhibits 7.21-1 and 7.21-2 make no distinction as to whether streams are perennial, intermittent or ephemeral.

Anderson Reservoir is located near the LOM area but no mining is to be done under or close to the reservoir. This is the only significant water body in the area.

The average precipitation in the LOM area is 12 to 16 inches.

Soldier Creek is addressed beginning on page 7-47; and Pine Creek on page 7-48. Coal Creek is discussed in an addendum to Appendix 7M. Data for Soldier Creek comes from a U.S. Geological Survey station (09313975) located just down stream from the mine's surface facilities, and from a station established by SC3 (G-1) upstream from the LOM area. The records for the USGS station found in Appendix 7-I, Table I-2. Soldier Creek between these two stations is perennial. Stations G-2 and G-3 were established by SC3 on Pine Creek to monitor water quantity and quality. The characteristic of this stream is intermittent to perennial. Data are included in Appendix 7-I, Table I-3.

Springs in the LOM area including the Alkali Tract are addressed beginning on page 7-50. A total of 24 spring have been identified within the LOM area. Locations and

The only water quality monitoring wells are the four located at the previously proposed waste rock disposal site. Locations are shown on Exhibit 7.21-1.

Exhibits 7.21-1 and 7.21-2 (p. 7-2) are referenced for information on surface and ground water occurrence and surface- and ground-water monitoring stations in and adjacent to the permit area.

Location and elevation for monitoring stations used to gather baseline data on water quality and quantity are shown Exhibit 7.21-5 in the Alkali Tract Significant Revision. This map was previously Exhibit 7.21-1. Wells SC-1, SC-8, and 18-1 are not on this map, but these may have been in-mine monitoring wells: this is not clear from information in the plan. Table 7.24-1 in the Alkali Tract Significant Revision lists locations and elevations of the twenty-four baseline and current springs located in the permit and adjacent areas, including the two new sites, 23 and 24.

Table 7.24-1 in the Alkali Tract Significant Revision has not been changed to show that springs 3, 15, 18, and 21 will not be monitored under the Alkali Tract Significant Revision: those four springs are still marked as "current water monitoring sites". Their designation as "current water monitoring sites" in Table 7.24-1 is confusing and contrary to the Alkali Tract Significant Revision monitoring plan that is given in Table 7.31-1 and on pages 7-164 and 7-165.

Spring 5 is identified in Table 7.24-1 of the current MRP as being the same as site 55 of the Sage Point/Dugout Canyon Permit Application. However, this secondary identification has been changed in Table 7.24-1 of the Alkali Tract Significant Revision to read CC-55, which is an identification used in the EIS survey (Appendix 7N, page 4 and Plate 1; and 7M-C) for a man-made pond located approximately 1,500 feet downstream from the spring. Plate 1 in Appendix 7N identifies this pond as Spring 5. Although the consultant who prepared the report in Appendix 7N may have taken samples identified as Spring 5 from the pond, samples that have been taken by the operator and others appear to have come consistently from a pipe located above the pond (letter from Barry Barnum, May 14, 1997). The effects of past confusion appear limited and are probably inconsequential. To avoid future confusion, Table 7.24-1 should not show site CC-55 as another designation for Spring 5, but should instead indicate that site 55 from the Sage Point/Dugout Canyon Permit Application is one of the other, equivalent designations for this site.

Spring 10 has been identified in different studies as issuing from the Blackhawk, North Horn, and Price River Formations (pages 7-113 and 7-114). Plate 6.22-7 identifies the site of spring 10 as being in the middle of the North Horn Formation, but alluvium fills the valley

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bottom and obscures the bedrock. The uncertainty of the surface geology associated with this spring is acknowledged on page 7-114. Water chemistry and isotopic data indicate that the water is similar to water encountered deeper underground, in the mine. This suggests a deep source for the water flowing from spring 10, that it possibly flows several hundred feet upwards from the Blackhawk Formation along a fracture and mixes with recent surface water from Soldier Creek or with recently recharged, shallow ground water. There is no fracture mapped, but alluvium may be obscuring any surface expression of a fracture. Also, there is no identified source for an upward gradient from the Blackhawk Formation to the surface; such flow would be in opposition to the regional gradient described elsewhere in the Alkali Tract Significant Revision (i. e., page 58 Appendix 7M).

Baseline information on surface and ground water includes data from Sunedco's Sage Point/Dugout Canyon MRP and SCCC's Soldier Canyon MRP. Collection of water quality data in the area for purposes of coal mine permitting began in 1976. Additional data were collected by Mayo and Associates in 1995 for the Alkali Tract Significant Revision. Water quality data have been collected from streams, springs, mine sumps, in-mine discharges, and drill holes. Other sources of information on geology and hydrology of the area include USGS investigations and unpublished theses.

Appendix 7M, part of the Alkali Tract Significant Revision, is titled "Investigation of surface and ground water systems in the vicinity of the Soldier Canyon Mine, Carbon County, Utah" and was prepared by Mayo and Associates. This appendix contains a PHC determination for the Alkali and Dugout Creek Tracts and recommendations for surface- and ground-water monitoring. Included is a summary of discharge, temperature, solute composition, trace metal analysis, and dissolved oxygen data from several water quality studies. TSS, TDS, specific conductance corrected to 25 degrees C, pH, and total iron are reported for many samples.

Manganese concentrations are also reported, but concentrations for total manganese, required by statute, are not given in this appendix nor elsewhere in the Alkali Tract Significant Revision or Soldier Canyon Mine MRP. The currently approved MRP does not list total manganese concentration as a parameter to be determined, so neither baseline nor operational monitoring has included it. Determination of total manganese was recommended in the Mayo and Associates report in Appendix 7M and total manganese has been added to the surface- and ground-water monitoring parameters listed in Tables 7.31-3 and 7.31-4 in the Alkali Tract Significant Revision.

Appendix 7M includes data from as early as 1976 for springs 4, 5, 8, 10, 14, 15, 17, 18, 19, 20, 21, and 22 and for surface-water monitoring points G-1, G-2, G-3, G-4, and G-5.

Data for springs 1, 2, 3, 6, 9, 11, 12, 13, and 16 consist of one sample or observation at each site during the summer of 1976. Water quality analysis reports for springs 23 and 24, from May, September and October 1993, are in Appendix N. No data are included for spring 7, which has apparently never been monitored, and for surface-water monitoring points G-6 through G-10, which are new sites being proposed in the Alkali Tract Significant Revision. All of these sites are listed in Table 7.24-1. Appendix 7M also contains: data on spring discharges that are based on an unidentified 1982 USGS study and a 1993-1994 seep and spring survey by Environmental Industrial Services (EIS); data on water discharged from the UPDES points; and data on water from in-mine discharges.

Table 7 of Appendix 7M gives water level data for wells 5-1, 6-1, 10-2, and 32-1. Water levels in the monitoring wells have not varied seasonally. Water levels in well 5-1 declined ninety-two feet from 1987 to 1995, fifty-one feet of that decline occurring since late 1993, when the Sunnyside seam was mined in the area near the well bore. Well 10-2 declined only ten feet over the same period. There was a decline of twenty-nine feet in well 6-1 from 1990 to 1993, at which time the well was found to be blocked, probably from casing collapse. The water level in well 32-1 rose thirty-four feet from 1990 to 1995.

Water levels measured in monitoring wells in the Soldier Canyon Mine area do not show evidence of a consistent piezometric surface. However, wells in areas east of the Soldier Canyon Mine indicate a mappable piezometric surface in the Castlegate Sandstone. In the Sage Point/Dugout Canyon Mine MRP it was concluded that in the area covered by that MRP, regional ground water movement is north to northwest with a gradient estimated to be slightly less than the dip of the strata. The regional water table is above the coal seams in at least part of the area to be mined. Average linear velocity is apparently less than 10 feet/year.

Well 10-2 is screened in the Castlegate Sandstone. Well 5-1 is perforated over two intervals, at both the Sunnyside and Rock Canyon coal seams of the Blackhawk Formation. Wells 6-1 is continuously perforated over a 200-foot interval that includes the Sunnyside seam. Well 32-1 is perforated over a fifty-foot section immediately above the Sunnyside seam. Wells 6-1 and 32-1 are approximately one mile apart.

Water levels in Well 5-1 started dropping after the well was perforated in 1979. A slug test in 1982 raised the water levels again, but by 1987 levels were close to pre-test levels and continued to drop slowly. Water levels started dropping more rapidly in 1993 when mining began nearby. Even with the long history of declining water levels, the water level is still approximately 1100 feet above the first perforated zone and water-level measurements appear to be simply measuring the slow infiltration of drilling fluid or slug-test fluid into the coal seam, rather than potentiometric head of ground water in the coal seams and adjacent rock. Canyon

Fuel Company feels this well is not providing worthwhile data and should be dropped from the quarterly monitoring schedule.

Well 6-1 has recently experienced casing failure or blockage (p. 7-30), yet is proposed as one of three wells to be monitored under the Alkali Tract Significant Revision (Table 7.31-1, p. 7-157) if the blockage can be removed or bypassed. Wells 10-2 and 32-1 are the other two wells to be monitored.

On the second page of Table 7.24-1 in the current MRP, water level monitoring wells 5-1, 6-1, 10-2, and 32-1 are marked as currently monitored for water levels. In Tables 7.24-1 and 7.31-1 in the Alkali Tract Significant Revision, 5-1 is no longer listed as one of the wells to be monitored. However, Exhibit 7.21-1 in the Alkali Tract Significant Revision still shows well 5-1 as one of the wells to be monitored, in addition to 6-1, 10-2, and 32-1.

Locations of wells SC-1, SC-8, and 18-1, listed in Table 7.24-1, are not shown on Exhibit 7.21-5. Other than being listed in Table 7.24-1, there is no information on these three wells. Well 11-2 is listed in Tables 7.24-1 and 7.24-4 and discussed briefly on page 71 in Appendix 7M as a recommended water monitoring well for the Dugout Canyon Mine, but there is no other information on well 11-2 in the Alkali Tract Significant Revision. On Exhibit 7.21-5 wells DM 1, 2, 3, and 4 are described as having been destroyed by ventilation shaft construction. Their destruction is not mentioned in the text or in Table 7.24-1.

Rocks in the permit and adjacent area are described in the Alkali Tract Significant Revision. They are dominantly sandstones, siltstones, and shales of marine and continental origin. Although all these can be water-bearing, sandstone is the principle water-bearing rock. Sandstone bodies are generally lenticular and discontinuous, separated and surrounded by low permeability shale and mudstones. Aquifers in these sandstones are poorly understood and difficult to quantify.

The volume of ground water stored within the rocks above the Gilson seam in the Soldier Canyon Mine area is estimated to be 677,000 acre-feet (p. 7-28). Discharge by springs in the Soldier Canyon Mine area (250 acre-feet/year) and underflow moving out of the Soldier Canyon Mine area (500 acre-feet/year) are estimated on page 7-33. Inflows of water are common at working faces within the mine. Flows, at times large flows, occur from some fractures intercepted by mining. These inflows are consistent with the characterization of the Blackhawk Formation being saturated in most areas. Inflows at mining faces generally stop flowing within a few days and flows from fractures tend to diminish substantially over time, indicating either perched conditions or low recharge rates. Consumption, evaporation, and discharge volumes for 1985 - 1991 are on page 7-153. Recharge is estimated to be 758 acre-feet

per year (p. 7-64) and proposed mining activities are expected to intercept an average of 460 acre-feet of ground water per year. Ground water recharge, consumption, and storage estimates on pages 7-28, 7-33, and 7-64 and in Table 7.24-3 (page 7-19) have been updated to include the Alkali Tract Significant Revision.

Unconfined ground water occurs in alluvial deposits along canyon bottoms. These deposits are generally thin and small in areal extent. Water in alluvium will generally move towards the axis of the canyon and down gradient along the axis.

Water rights are listed in Table 7.24-2 and mapped on Map 7.21-2. Water rights information includes quantity, usage, source, and location. Seasonal use and quantity vary significantly over the year. There is little use of spring or surface flows during the winter, but stockwatering consumes considerable water during the summer. Two water rights listed in Table 7.24-2 appear to involve past or current pumping of ground water from the subsurface. Water right 4124, located approximately one mile north of the northeast corner of the permit area in Section 28, T. 12 S., R. 12 E., was issued to Barnard Iriat for domestic, irrigation, and stockwatering use and a shallow well was installed near a cabin on the Iriat property. Water right 203, in Section 18, T 12 S., R. 12 E., was issued to California Portland Cement Company for industrial use and has been used by the Soldier Creek Mine for underground process water. Possible impacts of mining on water use will probably be limited to interactions between surface water and ground water.

#### **Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements for baseline ground water resource information.

#### **Surface-water information**

#### **Analysis:**

Surface-water baseline information is addressed in Section 7.24.2 on pages 7-43 to 7-51. This section is predominantly information for the original permit application but has been revised as part of the Alkali Lease amendment. Additional data were collected by Mayo and Associates in 1995 for the Alkali Tract Significant Revision.

The proposed life of mine (LOM) area shown on Exhibit 7.21-1 contains 6,770 acres of the Soldier Creek watershed according to the text on page 7-46.

information about the springs can be found in Table 7.24-1. Six of the springs, shown on Exhibit 7.21-1, will be monitored. Sections 7.28 and 7.31.2 provide details about the monitoring plan.

**Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements for baseline surface water resource information.

**Probable hydrologic consequences determination**

**Analysis:**

The PHC determination is found in section 7.28 beginning on page 7-75. A report by Mayo and Associates, including a partial PHC determination, can be found in Appendix 7M. Pages 7-84 to 7-142 are dedicated to groundwater systems while pages 7-143 and 7-144 cover stream flows. Acid and toxic forming materials are discussed in Section 7.28.32 on page 7-145. A discussion of impacts of mining and reclamation operations begin on page 7-145, Section 7.28.33. Conclusions are drawn on page 7-152, Section 7.28.34.

Previous assessments of probable hydrologic consequences to the quantity and quality of ground water were based on 1) determining likely directions of ground water flow; 2) identifying locations of potential contaminant sources; and, 3) examining likely responses of the ground water systems to contamination. The Alkali Tract Significant Revision has added analyses of 4) solute and isotopic composition of surface and ground water data; 5) surface and ground water discharge data; and, 6) a re-evaluation of geologic data to determine surface and ground water interactions.

The PHC determination is based on baseline hydrologic, geologic, and other information collected for the Soldier Canyon Mine and the Alkali Tract Significant Revision. The area of investigation for the PHC determination extends from the uppermost pediment areas of the Mancos Shale on the south (base of the Book Cliffs) to the headwaters of the principal drainages on the north (base of the Roan Cliffs), and extends from the Coal Creek drainage on the west to the Pace Canyon drainage on the east. These features are shown on Figures 7.28-1 and 7.28-3.

The PHC contains determinations that adverse impacts to the hydrologic balance will not occur and mining will not affect ground water discharge or solute composition of any spring. Toxic-forming materials that are present in mine discharge water have remained within

discharge limits. Discharge waters have historically been alkaline and there are adequate carbonate minerals to neutralize potentially available acid. Monitoring of discharges from the mine indicate that sediment control measures are effective in controlling sediment yield from currently disturbed areas, and there will be no additional disturbed areas associated with the Alkali Tract.

The PHC thoroughly addresses the groundwater resources and systems; however, the surface-water resources are skimmed over without much analysis as to the existing resources or the effects that mining in the Soldier Canyon Mine, including the Alkali Tract, will have on those resources. The PHC does address springs and seeps as part of the groundwater systems but streamflow in Soldier Creek and Coal Creek and their tributaries is minimalized in the discussion except for a statement that much of the summer flow in Soldier Creek is due to mine effluent. The potential negative effect from this increased stream flow is passed over without analysis.

**Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements for probable hydrologic consequences information.

**Ground-water monitoring plan**

The ground-water monitoring plan is based upon the PHC determination and the analysis of all baseline hydrologic, geologic, and other information in the Alkali Tract Significant Revision and current Soldier Canyon Mine MRP. Soldier Creek Coal Company interprets this information (page Appendix 7M-70) as indicating that:

- 1) Ground water systems in the Flagstaff and North Horn Formations operate independently of the ground water system in the Blackhawk Formation;
- 2) Temporal variability of flow in springs issuing from the Flagstaff and North Horn Formations is due to annual variations in precipitation; and,
- 3) Mining will not affect ground water systems in the Flagstaff and North Horn Formations.

Table 7.24-1 lists twenty-four spring monitoring sites, including two new ones, and data from most of these sites are in the appendices. Only six spring monitoring sites are shown on Exhibit 7.21-1.

Recommended monitoring locations are listed in Table 7.31-1 (page 7-157) and shown on Exhibit 7.21-1. Table 7.31-2 outlines the recommended protocol for field and laboratory measurements, and Table 7.31-3 lists the recommended parameters for ground water quality monitoring. Purpose of the water quality monitoring program is to verify the three assumptions given above, to identify potential impacts of coal mining operations on the hydrologic balance, and to provide information to the Utah Division of Water Quality if impacts to water sources occur (pages 7-155 and Appendix 7M-70).

Wells 10-2 and 32-1 are recommended to be maintained as monitoring wells. Well 6-1 is recommended to be maintained as a monitoring wells if the blockage in the casing can be removed or opened. These wells will be monitored for water levels only.

Soldier Creek Coal Company recommends that Well 5-1 no longer be monitored routinely because this well appears to be simply monitoring the slow infiltration of drilling fluid and slug-test water into the coal seam. Recent, more rapid declines of the water level in 5-1 correlate with mining of the Sunnyside seam in the area near the well bore. The four wells at the former waste rock disposal site are no longer to be monitored.

Springs 4, 5, 8, 10, 23 (CC-36), and 24 (CC-40) will be monitored quarterly for flow and field parameters. The water quality sampling schedule is presented in Tables 7.31-1 and 7.31-2. Semi-annual operational laboratory measurements of spring water quality are to be done once during a wetter-than-normal year and once during a drier-than-normal year. Routine operational water-quality will be determined quarterly using field measurements only.

The proposed monitoring plan eliminates four springs issuing from the Flagstaff Formation (3, 15, 18, and 21) from the current monitoring plan but adds 23 (CC-36), and 24 (CC-40), which issue from the Flagstaff Formation in or adjacent to the Alkali Tract. A footnote on Table 7.21-1 indicates data for springs 23 (CC-36) and 24 (CC-40) are in Appendix 7N: there are two analysis reports for CC-36 and three for CC-40, all from May through September 1993.

Monitoring of springs 3, 15, 18, and 21, which issue from the Flagstaff Limestone, is to be discontinued. According to Table 7.31-1, monitoring of springs 4 and 8, which also issue from the Flagstaff Limestone, will be discontinued one year following the end of mining in the vicinity of the spring in the same area. Justifications for discontinuing monitoring at these sites are discussed on page 7-165: chemical characteristics are well established; baseline and operational data strongly suggest that mining does not affect water quality in the Flagstaff and North Horn; and ground water systems in the Flagstaff and North Horn are not connected with the systems in the Blackhawk.

Total iron, dissolved iron, total manganese, and dissolved manganese will be determined for ground water samples from springs during the third quarter only, supposedly because spring flow during that quarter is the least effected by precipitation and runoff and therefore is most representative of actual ground water conditions. Water quality parameters in Table 7.31-3 match those in the May 23, 1995, DOGM directive except for total alkalinity and total hardness: pH's are high and dissolved metals low in the vicinity of the Soldier Canyon Mine so total hardness and alkalinity are not critical water quality parameters.

**Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements for the baseline ground-water monitoring plan.

**Surface-water monitoring plan.**

The surface-water monitoring plan is based upon the PHC determination and the analysis of all baseline hydrologic, geologic, and other information in the Alkali Tract Significant Revision and current Soldier Canyon Mine MRP.

Monitoring locations proposed by the Alkali Tract Significant Revision are listed in Table 7.24-1 and shown on Exhibit 7.21-1. Sites G-1, G-2, and G-5 are currently monitored and G-6, G-7, G-8, and G-9 are new sites. Site G-1 is not shown on the new Exhibit 7.21-1 in the Alkali Tract Significant Revision because it will not be monitored under the Alkali Tract Significant Revision. This site is too far upstream of the mine to provide a good a comparison in evaluating effects of mine water discharges into Soldier Creek. Information from site G-6, which is situated closer to the disturbed area than G-1, should more accurately indicate the condition of surface water entering the disturbed area.

Sites G-3 and G-4 were monitored up to 1986 and 1985 respectively. G-3 and G-4 are not to be monitored under the Alkali Tract Significant Revision so are not shown on Exhibit 7.21-1 of the Alkali Tract Significant Revision. However, comparing Exhibit 7.21-1 from the Alkali Tract Significant Revision with that from the current Soldier Creek Mine MRP it appears that the new site G-7 is at approximately the same location on Soldier Creek as G-4, and Table 7.24-1 of the Alkali Tract Significant Revision gives the same elevation and approximate location for these two sites. Comparison of the current and new versions of Exhibit 7.21-1 also indicates that the old site G-3 and the new site G-9 are also at approximately the same location on Pine Creek, but the location descriptions and elevations for G-3 and G-9 in Table 7.24-1 of

the Alkali Tract Significant Revision indicate G-3 probably was closer to the confluence with Soldier Creek than G-9. Along with G-7 and G-9, site G-8 is intended to permit evaluation of impacts from coal mining on Pine Creek and the relationship between the Blackhawk Formation and creek flow. G-7, G-8, and G-9 are intended to be temporary.

Monitoring of G-2 will cease one year following the end of active mining in the vicinity of this site. Monitoring of Soldier Creek at G-5, just downstream of the permit boundary, will continue. Site G-10 has been added to monitor surface flow from the Alkali Tract.

**Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements for the baseline surface-water monitoring plan.

**MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION**

**Regulatory Reference: 30 CFR Sec. 783.24, 783.25; R645-301-323, -301-411, -301-521, -301-622, -301-722, -301-731.**

Cross sections, maps, and plans included in the Alkali Tract Significant Revision as required by this section have been prepared by, or under the direction of, and certified by a qualified, registered, professional engineer.

**Coal Resource and Geologic Information Maps**

**Analysis:**

Geologic information in the Alkali Tract Significant Revision and in the currently approved MRP includes geologic cross sections and maps of areal geology and coal seam thickness that have been updated to include the Alkali Lease Addition. The geology map indicates strike-and-dip. It is suspected that spring 10 issues from a fracture, but alluvium obscures any surface expression of a fracture around the spring. There are apparently no mappable features of structural geology. The map showing the thickness of rock between the Rock Canyon and Gilson seams has been reduced to simply indicate where the interburden is

more than or less than thirty feet; because thirty feet is a widely accepted limit for mining in overlying or underlying seams, this map is adequate for indicating areas where only one of the two seams can be mined.

**Findings:**

The Alkali Tract Significant Revision meets the minimum requirements for coal resource and geologic information maps.

**Monitoring Sampling Location Maps**

**Analysis:**

It appears that no new test borings or core samplings have been done for the Alkali Tract Significant Revision. Information on elevation and locations of test borings and core samplings is not included in the Alkali Tract Significant Revision. This information should be in the current Soldier Canyon Mine MRP. Operational water monitoring and sampling location are shown on Exhibit 7.21-1. Location and elevation for monitoring stations used to gather baseline data on water quality and quantity are shown Exhibit 7.21-5 in the Alkali Tract Significant Revision.

**Findings:**

The Alkali Tract Significant Revision meets the minimum requirements for subsurface water resource sampling location maps.

**Subsurface Water Resource Maps**

**Analysis:**

No new maps of subsurface water resources are included in the Alkali Tract Significant Revision.

**Findings:**

Subsurface water resource maps meet the minimum requirements of this section.

## **Well Maps**

### **Analysis:**

There are no gas and oil wells within the proposed permit area. There are three natural gas exploration wells approximately one-half to one mile north of the Soldier Canyon Mine permit area that are not shown on maps in the Alkali Tract Significant Revision. On pages 54 and 62 of Appendix 7M, reference is made to the rapid loss of production capacity in water production wells #1 and #3, two wells located to the west, near the portal of the Centennial Mine. Two water rights in Table 7.24-2 appear to involve past or current pumping of ground water from the subsurface. Water right 4124, located approximately one mile north of the northeast corner of the permit area in Section 28, T. 12 S., R. 12 E., was issued to Barnard Iriat for domestic, irrigation, and stockwatering use and a shallow well was installed near a cabin on the Iriat property. Water right 203, in Section 18, T 12 S., R. 12 E., was issued to California Portland Cement Company for industrial use and has been used by the Soldier Creek Mine for underground process water.

### **Findings:**

The Alkali Tract Significant Revision meets the minimum requirements of this section.

## **OPERATION PLAN**

### **OPERATIONAL HYDROLOGIC INFORMATION**

**Regulatory Reference:** 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

### **Surface-water monitoring**

#### **Analysis:**

Table 7.31-2 outlines the recommended protocol for field and laboratory

measurements, and Table 7.31-4 lists the recommended parameters for surface water quality monitoring. The purpose for the surface water quality monitoring program is 1) to further evaluate the potential for hydrologic connection between the Blackhawk Formation and streams; and 2) to continue monitoring the effects of coal mine discharge waters on Soldier Creek (page Appendix 7M-69).

The surface-water monitoring plan begins on page 7-165 of the application. Stream monitoring locations are found on Drawing 7.21-1. Three stations are monitored on Soldier Creek, but SC3 proposes to drop monitoring at station G-1, north of the permit area, because it is located too far upstream to allow evaluations of the mine water discharge. They will also request removal of G-2, to the East, at a later time. This would leave G-5 as the only surface-water monitoring site on Soldier Creek according to the text on page 7-166 of the mine MRP. This site is located down stream from the mine and would not have any reference to upstream water.

Site G-10 has been added to monitor surface flow from the Alkali Tract. Sites G-3 and G-4 were monitored up to 1986 and 1985 respectively. G-3 and G-4 are not to be monitored under the Alkali Tract Significant Revision so are not shown on Exhibit 7.21-1 of the Alkali Tract Significant Revision. However, comparing Exhibit 7.21-1 from the Alkali Tract Significant Revision with that from the current Soldier Creek Mine MRP it appears that the new site G-7 is at approximately the same location on Soldier Creek as G-4, and Table 7.24-1 of the Alkali Tract Significant Revision gives the same elevation and approximate location for these two sites. Comparison of the current and new versions of Exhibit 7.21-1 also indicates that the old G-3 and the new G-9 are also at approximately the same location on Pine Creek, but the location descriptions and elevations for G-3 and G-9 in Table 7.24-1 of the Alkali Tract Significant Revision indicate G-3 probably was closer to the confluence with Soldier Creek than G-9. Along with G-7 and G-9, site G-8 is intended to permit evaluation of impacts from coal mining on Pine Creek and the relationship between the Blackhawk Formation and creek flow. G-7, G-8, and G-9 are intended to be temporary.

Canyon Fuel Company has not conducted any monitoring of Coal Creek. According to some maps, this creek flows through the proposed permit area. Though there are no surface facilities proposed in that area, underground mining could effect the water quantity and quality of this stream.

**Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements for surface-water monitoring during mine operations.

### **Ground-water monitoring**

Ground-water monitoring data will be submitted quarterly to DOGM, within ninety days of the end of the quarter. When the analysis of any water sample indicates noncompliance with the permit conditions, the operator will notify DOGM, within five days if UPDES permit conditions are exceeded (p. 7-162).

Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of ground water onsite and offsite will be properly installed, maintained, and operated and shall be removed by the operator when no longer needed.

The ground-water monitoring plan is based upon the PHC determination and the analysis of all baseline hydrologic, geologic, and other information in the Alkali Tract Significant Revision and current Soldier Canyon Mine MRP. Soldier Creek Coal Company interprets this information (page Appendix 7M-70) as indicating that:

- 1) Ground water systems in the Flagstaff and North Horn Formations operate independently of the ground water system in the Blackhawk Formation;
- 2) Temporal variability of flow in springs issuing from the Flagstaff and North Horn Formations is due to annual variations in precipitation; and,
- 3) Mining will not affect ground water systems in the Flagstaff and North Horn Formations.

Table 7.24-1 lists twenty-four spring monitoring sites, including two new ones, and data from most of these sites are in the appendices. Only six spring monitoring sites are shown on Exhibit 7.21-1.

Recommended operational monitoring locations are listed in Table 7.31-1 (page 7-157) and shown on Exhibit 7.21-1. Table 7.31-2 outlines the recommended protocol for field and laboratory measurements, and Table 7.31-3 lists the recommended parameters for ground water quality monitoring. Purpose of the water quality monitoring program is to verify the three assumptions given above, to identify potential impacts of coal mining operations on the hydrologic balance, and to provide information to the Utah Division of Water Quality if impacts to water sources occur (pages 7-155 and Appendix 7M-70).

Wells 10-2 and 32-1 are recommended to be maintained as monitoring wells. Well 6-1 is recommended to be maintained as a monitoring wells if the blockage in the casing

can be removed or opened. These wells will be monitored for water levels only. Soldier Creek Coal Company recommends that Well 5-1 no longer be monitored routinely because this well appears to be simply monitoring the slow infiltration of drilling fluid and slug-test water into the coal seam; however, recent, more rapid declines of the water level correlate with mining activities nearby. The four wells at the former waste rock disposal site are no longer to be monitored.

Springs 4, 5, 8, 10, 23 (CC-36), and 24 (CC-40) will be monitored quarterly for flow and field parameters, but monitoring of springs 4 and 8 will be discontinued one year following the end of mining in the vicinity of the spring. Monitoring of springs 3, 15, 18, and 21, which are monitored under the current ground-water monitoring plan and which issue from the Flagstaff Limestone, is to be discontinued. Monitoring of springs 23 (CC-36), and 24 (CC-40), which issue from the Flagstaff Formation in or adjacent to the Alkali Tract, is to be added. Springs 23 and 24 are not monitored under the current MRP. A footnote on Table 7.21-1 indicates data for springs 23 (CC-36) and 24 (CC-40) are in Appendix 7N: there are two analysis reports for CC-36 and three for CC-40, all from May through September 1993.

The water quality sampling schedule is presented in Tables 7.31-1 and 7.31-2. Semi-annual operational laboratory measurements of spring water quality are to be done once during a wetter-than-normal year and once during a drier-than-normal year at springs 5, 10, 23, and 24. Routine operational water-quality will be determined quarterly using field measurements only.

Total iron, dissolved iron, total manganese, and dissolved manganese will be determined for ground water samples from springs during the third quarter only, supposedly because spring flow during that quarter is the least effected by precipitation and runoff and therefore is most representative of actual ground water conditions. Water quality parameters in Table 7.31-3 match those in the May 23, 1995 DOGM directive except for total alkalinity and total hardness: pH's are high and dissolved metals low in the vicinity of the Soldier Canyon Mine so total hardness and alkalinity are not a critical water quality parameters.

One of the stated purposes of the ground-water monitoring program is to verify that mining will not affect ground water systems in the Flagstaff and North Horn Formations. Justifications for discontinuing monitoring at these six sites are discussed on page 7-165: chemical characteristics are well established; baseline and operational data strongly suggest that mining does not affect water quality in the Flagstaff and North Horn; and ground water systems in the Flagstaff and North Horn are not connected with the systems in the Blackhawk.

**Findings:**

Information in the Alkali Tract Significant Revision is considered adequate to meet the minimum requirements on operational ground-water monitoring.

**MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS**

**Regulatory Reference: 30 CFR Sec. 784.23; R645-301-512, -301-521, -301-542, -301-632, -301-731, -302-323.**

**Monitoring and Sampling Location Maps**

**Analysis:**

Exhibit 7.21-1 shows locations of operational surface- and ground-water monitoring sites.

**Findings:**

The Alkali Tract Significant Revision meets the minimum requirements for information on operational monitoring and sampling location maps and plans.

**RECOMMENDATION**

The Alkali Tract Significant Revision is considered adequate to meet the requirements of the Coal Mining Rules.