Incoming C0150025

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Reviewers,

Here is my latest copy of the PHC from Alan Mayo.

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Revised Probable Hydrologic Consequences of Coal Mining in the Bear Canyon Mine, Wild Horse Ridge and Mohrland Permit Areas

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January 8, 2007

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PROBABLE HYDROLOGIC CONSEQUENCES OF MINING

This document describes the probable hydrologic consequences (PHC) of coal mining in the current Bear Canyon Mine permit area ("current permit area") and the permit expansion area, including the Mohrland area as described on page 1 of the June 25, 2001 report "Investigation of groundwater and surface-water systems in the C.W. Mining Company Federal Coal Leases and Fee Lands, Southern Gentry Mountain, Emery and Carbon Counties, Utah" by Mayo and Associates, LC. The distinction between these two areas is important because, groundwater systems in these areas are hydraulically isolated from each other by the Bear Canyon Fault. This PHC determination is required by R645-301-728 of the State of Utah Coal Mining Rules and appropriate subsections of the rules. This PHC determination is based on the data and information presented in Sections 1-8 of the 2001 report and is an addendum to the 2001 report. The hydrologic evaluation presented in Section 1-8 of the 2001 report also includes the Mohrland area.

1.1 Possible adverse impacts to the hydrologic balance (728.310)

1.1.1 Groundwater

In general, there are two mechanisms by which mining in the proposed permit area has the potential to adversely impact natural groundwater discharge rates from horizons overlying or underlying mine workings. The first mechanism is the direct interception and dewatering of groundwater contained either in perched systems in horizons directly overlying the mined or groundwater associated with faults or fractures. The second mechanism is the dewatering of perched groundwater higher in the stratigraphic section caused by interruption and deformation of strata above subsided areas. These mechanisms are discussed below.

Direct interception of perched groundwater

As described in Section 6.3, most water encountered in the workings of the Bear Canyon Mine in the current permit area discharges from inactive-flow perched groundwater systems. Waters in these systems are not in good hydraulic communication with the recharge and discharge areas. This is indicated by the radiocarbon ages of these waters (500-9,000 years), the lack of tritium in these waters, and the rapid decreases in discharge rate after a source of water is encountered (often days to weeks). Although a significant quantity of water has discharged from the large sandstone paleochannel encountered in the northern extent of the Blind Canyon Seam workings in the current permit area for a longer period of time, this inflow is nevertheless supported by an inactive-flow groundwater system. Discharge from this channel (measured at SBC-9 and SBC-10; Figure 10c and 10d) took longer to decrease because of the greater length of that particular channel. Both SBC-9 and SBC-10 are now inactive monitoring sites. Since 2002 all Mine 1 water, including discharge from the paleochannel reports to SBC-9A. Because measured discharge at SBC-9A has been as low as 3 gpm, it is likely that the discharge from the channel has essentially ceased.

Calculations of the steady-state flux of groundwater in this channel (Section 8.1) suggest that the natural pre-mining recharge and discharge rates for this channel is less than 2 gpm. The increasing radiocarbon age of water (Section 5.3) in this channel suggests that increased groundwater recharge to this channel due to dewatering of this channel is probably not occurring.

In both the current permit area and the permit expansion area, relatively few springs discharge from the stratigraphic horizons containing the mined coal seams or from horizons below the coal seams (Star Point Sandstone). If there were impacts due to water being encountered in the mined horizon, these are the springs that would be affected.

Springs in and adjacent to the proposed permit area which discharge from the lower Blackhawk Formation include SBC-7 in the current permit area, and 16-7-24-3 and SBC-17 in the permit expansion area. No springs discharge below mining horizons in the Mohrland Federal lease and private land area. It appears that SBC-7, which previously discharged near the Blind Canyon Seam portals, may have been affected by encountering water in the Blind Canyon Seam workings. As described in Section 4.2.1, this spring discharged about 18 gpm and did not display significant seasonal variation, varying by only about 1 gpm. SBC-7 went dry shortly after the sandstone channel in the northern extent of the Blind Canyon Seam workings was drained or depressurized, suggesting that some of the groundwater at SBC-7 was likely related to the groundwater in the sandstone channel.

Discharge data from springs 16-7-24-3 and SBC-17 are limited, and it is not known if these springs have a relatively constant discharge rate that might indicate that they are supported by an inactive-flow groundwater system. Nevertheless, they discharge from a sandstone horizon directly above the Blind Canyon Seam. These springs discharge near the surface trace of the Bear Canyon Fault and may be related to this structure. If these springs are not associated with the Bear Canyon Fault but instead discharge from perched systems in the Blackhawk Formation, there is the potential that the flow paths of the groundwater system supporting these springs may be intercepted by mining in the permit expansion area. Because the discharge from these springs (about 5 gpm) is small relative to the base flow in Bear Creek (about 50 gpm), the disruption of flow from these springs would not greatly affect the hydrologic balance of Bear Creek.

Springs that discharge from horizons below the mined coal seam in the current permit area include the Panther Sandstone springs (Big Bear, Birch, Defa #1, and Defa #2). Some or all of the water discharging from the Panther Sandstone springs has antiquity, suggesting a possible relationship with waters encountered by mine workings. However, as discussed extensively in Section 8.0, these springs are hydraulically isolated from the groundwater that has been encountered in the Bear Canyon Mine. Hence, we do not anticipate any impacts from mining activities in the current permit area, the Wild horse Ridge lease area or the Mohrland Federal lease area. to Panther Sandstone springs.

Impacts to Big Bear Spring or other groundwater resources in the current permit area due to mining in the permit expansion area are not expected. These areas are separated by the Bear Canyon Fault which likely prevents hydraulic communication from between the west and east side of the fault. That there is a hydraulic disconnect is indicated by the following:

1. The vertical offset of the Bear Canyon Fault is approximately 230 feet. It has been our experience that faults with large displacements in the Blackhawk Formation, Star Point Sandstone, and Mancos Shale are almost always filled with relatively impermeable fault gouge because of abundant shale and mudstone. This suggests that the plane of the Bear Canyon Fault is filled with fault gouge. Where the Bear Canyon Fault is exposed near the headwaters of Bear Canyon, extensive fault gouge is visible. Fault gouge is generally not capable of transmitting water as demonstrated by the lack of water in the gouge of the Blind Canyon Fault where encountered by the Bear Canyon Mine (MRP, Appendix 7-J, p. 78).

   If the Bear Canyon Fault is filled with gouge, then the fault is a barrier to flow vertically down the fault, laterally along the fault, or perpendicularly across the fault. While, the fault plane itself may not support groundwater or groundwater flow, fault-associated fractures on either side of the fault may support groundwater flow. Consequently, any water-bearing fractures east of the Bear Canyon Fault are not in hydraulic communication with fractures west of the fault that may be supporting groundwater flow to Big Bear Spring.

2. Groundwater recharge to the Panther Sandstone likely occurs where the Panther Sandstone is exposed at or near the surface and the little water recharges the Panther Sandstone from overlying horizons (Section 6.3). Along the Bear Canyon Fault,

adjacent to the Wild Horse Ridge and Mohrland areas, the Panther Sandstone is juxtaposed against the Blackhawk Formation, because of 230 feet of vertical movement along the Bear Canyon Fault. Consequently there can be no direct hydraulic communication between the Panther Sandstone west of the Bear Canyon Fault where Big Bear Spring is located and the Panther Sandstone east of the fault in Wild Horse Ridge and Mohrland areas.

3. The rocks in the Wild Horse Ridge and Mohrland areas dip to the southeast. Thus, groundwater in bedrock formations in these areas would naturally flow to the southeast, away from the Bear Canyon Fault and away from Big Bear Spring.

4. Two springs, 16-7-24-3 and SBC-17, discharge from the Blackhawk Formation immediately east of the Bear Canyon Fault in Bear Canyon. A third spring, SBC-14, discharges from the Spring Canyon Sandstone near the location of the proposed portals for the Wild Horse Ridge expansion. All three of these waters have elevated TDS contents relative to Big Bear Spring or water encountered in the Bear Canyon Mine. These waters also have unusual chemical compositions with magnesium and sulfate being the dominant ions compared to Big Bear Spring water in which calcium and bicarbonate dominate (Section 5.2.2). These chemical data suggest that there is no hydraulic communication between the area east and the area west of the Bear Canyon Fault.

One spring, SBC-14, discharges from a horizon located below the mined coal seams in the Wild Horse area. This spring discharges from the Spring Canyon Sandstone in the right fork of Bear Canyon. As noted in Section 4.1.6, discharge from SBC-14 fluctuates from 0.5 to 15 gpm, suggesting that this spring is supported by a local, shallow groundwater system in good communication with the surface. The discharge fluctuations measured in this spring suggest nearly all of the discharge from SBC-14 is not supported by groundwater that flows for some great distance through fractures associated with the Bear Canyon Fault. (Discharge from such a groundwater system would tend to have a more constant discharge rate.) Thus, this spring should not be impacted if groundwater associated with the Bear Canyon Fault or groundwater associated with perched horizons in the Blackhawk Formation is encountered in mine workings in the permit expansion area.

We do not expect any additional large groundwater inflows to either the Blind Canyon Seam or Tank Seam workings in the current permit area.

When coal mining recommences in the Hiawatha Seam workings, there is a potential for water to up well from the Spring Canyon Sandstone where the elevation of the coal seam is below the elevation of the potentiometric surface of the Spring Canyon Sandstone. In the Mohrland Complex (Blackhawk, Mohrland, Hiawatha, and King mines), located immediately north of the Mohrland area, historical inflows as great as 100 gpm were reported when the Bear Canyon Fault was intercepted. In the Bear Canyon Mine inflows were typically less than 5 gpm and dried up shortly after initial encounter. Inflow rates in the Mohrland area are anticipated to be small, only a few gpm, because it is anticipated that the Bear Canyon Fault will not be intercepted by the proposed mining except to access Leas U-46484. Based on historical inflows in the Bear Canyon Mine from crossing the Bear Canyon Fault, groundwater inflows should be minimal (i.e., only a few gpm) and should dry us shortly after being encountered.

We do not anticipate that partial dewatering of the Spring Canyon Sandstone will be a significant adverse impact to the hydrologic balance because 1) water in the Spring Canyon Sandstone has antiquity (Section 5.3) indicating that groundwater flow in the sandstone is not active and 2) there are no discernable discharges from the Spring Canyon Sandstone (except the small seep BP-1).

Mine workings in the permit expansion area will likely not encounter any large groundwater inflows. As in the current permit area, large inflows will only occur if mining encounters a large water-bearing sandstone paleochannel. The location of such features is not readily predictable, but in the existing mine area, channels have only been encountered in the Blind Canyon Seam. No mining will take place in the Blind Canyon Seam within the Mohrland Mine lease/private area. We anticipate that if a large water-bearing sandstone channel is encountered, groundwater discharging from the channel will have antiquity and not be part of an active flow system that supports discernable discharge to the surface.

Direct interception of water associated with faults

Although groundwater is not associated with the Bear Canyon Fault in the current permit area, it is not known if this feature will be the source of groundwater inflows when approached from the east. Although we expect that water associated with the Bear Canyon Fault may be part of an inactive groundwater flow system, we recommend that if any water is encountered an evaluation be made at that time to confirm this supposition.

Groundwater that may be associated with the Bear Canyon Fault was encountered in the Hiawatha Complex approximately 5 miles north of the Bear Canyon Mine. Based on inflows from the Bear Canyon Fault in the Hiawatha Complex, the maximum anticipated inflow from the Bear Canyon Fault in the Hiawatha Mine will be 100 gpm. However, fault intercepts in the Tank, Blind Canyon, Hiawatha Seams in the Bear Canyon Mine, suggests that the Bear Canyon Fault does not convey water from the Hiawatha area to the Bear Canyon area. Water encountered in the Hiawatha Complex, which now discharges from the Mohrland Portal, has a radiocarbon age in excess of 9,000 years, which is considerably older than water in either Big Bear Spring or the Bear Canyon Mine (Section 5.3). Thus, water inflows to the Bear Canyon Mine or water discharging from Big Bear Spring is not the same water that is associated with the Bear Canyon Fault in the Hiawatha Complex. What this means is that if water associated with the Bear Canyon Fault is encountered in the permit expansion area, it likely will not impact any significant groundwater resource in either the current permit area or the permit expansion area.

Subsidence-related fracturing and deformation

The second method whereby natural groundwater discharge rates may be adversely affected results from interruption and deformation of strata above subsided areas. Removal of coal during second mining causes the strata immediately above the mined horizon to cave. Above the zone of caving, bedrock fractures in response to subsidence. The height of the fracturing zone can be related to mining height. A relationship applied at some western coal mines is that subsidence fractures propagate upward to approximately 30 times the height of the extracted coal (Kadnuck, 1994). Rock strata above the fracture zone commonly bend rather than fracture. Near-surface fractures, which are the result of tension at the land surface associated with differential subsidence, commonly extend less than 100 feet below the surface.

In the current permit area, mining has occurred in three seams, the Hiawatha, Blind Canyon, and Tank Seams. At the Bear Canyon Mine second mining occurred in the Blind Canyon Seam prior to mining in the overlying Tank Seam. This unconventional mining sequence (i.e. extraction of the lower seam first) provides a unique opportunity to evaluate the integrity of the strata overlying second mined areas at a height of about 250 feet above the Blind Canyon Seam. Mine personnel report (C. Reynolds, Personal Communication, 1999) that the Tank Seam was intact and that vertical fractures did not extend as high as the Tank Seam. Some existing fractures were opened or loosened. Subsided areas at this height above the Blind Canyon Seam did experience bending as demonstrated by increased aperture along horizontal bedding planes. What this means is that fracturing propagates upward considerably less than 250 feet. That fracturing does not propagate upward further is likely a result of the presence of massive sandstones in the Blackhawk Formation.

The effects of second mining in the Tank Seam cannot be as intimately ascertained. Second mining in the Hiawatha, Blind Canyon and the Tank Seams will cause fracturing to propagate upward from the Tank Seam to a greater height than fractures would extend if mining occurred in the Tank Seam alone. However, because of the ameliorating effect of the thick interburden between the Hiawatha, Blind Canyon and Tank Seams, it is unlikely that the height of fracturing above areas of multiple seam removal will be significantly greater than the height of fracturing above second mined areas in the Tank Seam alone. Thus, we do not expect fracturing to extend more than about 300 feet above the Tank Seam.

In the Wild Horse Ridge permit expansion area second mining will occur in the Blind Canyon and Tank Seams. In the Mohrland permit expansion area second mining will also occur in the Hiawatha and Tank Seams.

In the current permit area and permit expansion area, no springs have been identified which discharge from the upper Blackhawk Formation or the Castlegate Sandstone, and only two springs discharge from the Price River Formation. Thus, the bulk of the groundwater resources in the area are found in the North Horn Formation and the Flagstaff Limestone. All of the springs with significant discharges identified in the Flagstaff Limestone and North Horn Formation are separated from the Tank Seam by more than 1,000 feet of overburden

(Plate 6-10 of the Bear Canyon Mine MRP). In the Mohrland area all springs are separated from the Tank Seam by more than 1,000 feet of overburden. Thus, the groundwater systems from which these springs discharge are well above the zone of potential impact from subsidence fractures that propagate upward from the mine. Abundant clay and mudstone in the North Horn Formation aids the quick healing of any subsidence-related fractures that do occur. Therefore, the potential for these springs to be impacted as a result of mining-related activities is minimal. This is important because Mohrland area springs SBC-16, 16A, 16B, 18, and 21 provide base flow to the left fork of Fish Creek.

1.1.2 Surface water

The mine plan for the current permit area and the Wild Horse Ridge permit expansion area has been designed to prevent subsidence of Bear Creek, the right fork of Bear Creek, or the Left Fork of Fish Creek. Thus, these perennial drainages should not be directly affected by mining. However, the hydrologic balance of these systems would be impacted if groundwater discharge that provided base flow for these systems were impacted. As noted in the previous section, impacts to the groundwater discharge rates are not expected.

The hydrologic balance of Bear Creek below the mine discharge point will be affected by the addition of mine water to the creek. This impact is discussed in Section 9.5.

In the Mohrland Mine lease/private area no impacts are expected from undermining stream or drainage channels due to the depth of overburden. Previous mining in Mines #1 and #2 support this idea. In Mine #1 full coal extraction was followed by mining in the overlying Mine #2. Despite the fact that only 200 feet of overburden separated Mines #1 and #2, the Mine #2 coal seam and roof were intact when mining commenced in Mine #2.

1.2 Presence of acid-forming or toxic-forming materials (728.320)

Information on acid- and toxic-forming materials is contained in Appendix 6-C of the MRP. Evaluation of these data using *Guidelines for Management of Topsoil and Overburden* (Table 2; Leatherwood and Duce, 1988) revealed that there have been no poor or unacceptable (acid- or toxic-forming) materials encountered in the permit area. Coal and rock strata in the permit expansion area are expected to be identical to those encountered in the current permit area. However, if any acid- and/or toxic-forming materials are discovered in waste rock in the future, these materials will be disposed of in accordance with the requirements of R645-301-731.300 and as outlined in Chapter 3 of the MRP.

Western coal mines commonly contain sulfide minerals, which, when exposed to air and water, oxidize and release H^+ ions (acid). The sulfide mineral pyrite (FeS_2) has been identified in the Bear Canyon Mine. Although pyrite oxidation does occur, acidic mine drainage does not. Acid derived from pyrite oxidation is readily consumed by dissolution of carbonate minerals, which are pervasive throughout the rocks in the vicinity of the Bear Canyon Mine. Iron liberated during pyrite oxidation is readily precipitated as iron-hydroxide and is not observed in the mine discharge water.

1.3 Impact of coal mining on sediment yield from disturbed areas (728.331)

The sediment load of streams can be impacted by increased sediment yield from disturbed areas and from subsided landscape above mine workings. Sediment control measures for existing and proposed disturbed areas are described in 7.2.7 and 7.2.8 of the MRP. It is expected that the installation and maintenance of these sediment control structures will prevent any adverse impacts to the sediment load of streams. Also of particular concern is spring SBC-14 which discharges immediately below the proposed portal area in the right fork of Bear Canyon. This spring supports a small riparian area in the canyon. The portal facilities, culverts, and sediment control structures have been specifically designed to prevent impacts from sediment yield to this spring and riparian area.

Subsidence can result in either increased or decreased sediment loading of ephemeral and intermittent streams. Differential subsidence can locally increase stream gradients, causing higher flow velocities in the stream channel and greater sediment loading. However, this impact would likely be localized and short-lived. If there is sufficient water in the drainage, the increased erosion of easily eroded sediments will rapidly bring the channel to equilibrium with the stream. If the altered substrate in the channel is not easily eroded, there will be no increase in sediment loading of the stream. The sediment load of ephemeral and intermittent streams would be decreased where subsidence causes water to be impounded. Here, sediment would be deposited in the subsidence-induced depressions in the stream channel. This occurrence would also be short-lived because sediment deposition in the depressions would gradually bring the channel into equilibrium with the stream.

An escarpment failure study conducted by (add reference) identified the Left Fork of fish Creek as an area that may be impacted by subsidence. The modeling activity included: 1) the identification or potential instability areas along cliff faces and 2) modeling of potential failure along selected cliff face transects. Two areas within the lease boundaries and a third area outside the lease boundary were modeled for potential cliff face failure. In all areas the study found that escarpment failure would not present a hazardous condition. Locations of the cross-sections (transect lines) of the modeled areas are shown on Plate 5.3 of the Bear Canyon Mining and Reclamation Plan. The areas and potential impacts are summarized below.

Section	Distance to Stream	Maximum Rock Fall Distance
C-C'	2,600 ft	950 feet
D-D'	1,980 ft	650 ft
E-E'	450 ft	450 ft (rock hit bottom of canyon)

Section C-C'

This section is located on Wild Horse Ridge against the left fork of Fish Creek near the southeast end of Federal Lease U-38727. The cross-section was selected where the escarpments are the largest and the slope is the steepest. The model predicts that escarpment failure will occur, but the falling rocks will not reach the stream channel. Therefore no water related impacts would occur.

Section D-D'

The section is located on Wild Horse Ridge against the left fork of Fish Creek near the northeast end of Federal Lease U-38727. This section represents the transition area where subsidence contours transition between the cliff face and the upland slope. Modeled escarpment failure debris will not reach the stream channel, thus not stream impact will occur.

Section E-E'

This section is located at the upper end of the right fork of Fish Creek between the two stream segments of Federal Lease U-61049. Here Fish Creek flows through a box canyon and the escarpment failure will impact the streambed. Because stream flows are minimal in this area, typically 10-30 gpm, water quality impacts, primarily sediment loading, will be minimal and short term.

1.4 Impacts to acidity, TDS, and other important water quality parameters (728.332)

There is the potential for surface water and groundwater quality to be affected by mining operations. Potential impacts to the acidity of surface waters and groundwaters resulting from acid mine drainage were discussed in Section 9.2, and the potential impacts of increased suspended solids were discussed in Section 9.3. Other potential impacts from coal mining activity include increasing the concentration of total dissolved solids (TDS) and specific solutes in streams that receive mine discharge water.

As discussed in Section 9.2, pyrite oxidation, which has the potential to cause acid mine drainage, does occur in the mine environment. However, the ubiquitous presence of carbonate minerals in the permit area results in the rapid neutralization of produced acid. Therefore, acid mine drainage does not occur. Toxic forming minerals are generally not found in the permit area. Thus, the potential for detrimental impacts to groundwater or surface-water systems as a result of the discharge or seepage of mine discharge water to the surface is minimal. In fact, the quality of water discharged from the Bear Canyon Mine portals is generally better than that of the receiving water (Bear Creek). Bear Creek above the mine discharge (BC-1) has an average TDS concentration of 544 mg/l, while the mine discharge water (NPDES-004) averages 364 mg/l. The mean sulfate concentration of Bear Creek water is 263 mg/l, while the sulfate concentration of the mine discharge water is less than one fifth as great (51 mg/l).

The practice of using rock dust for the suppression of coal dust in a mine may potentially impact the groundwater flowing through the mine by dissolution of the rock dust constituents into the water. Currently, only limestone or dolomite rock dust is used for dust suppression purposes in the Bear Canyon Mine and this practice is expected to continue during mining in the permit expansion area. Hence, it is doubtful that rock dust usage will adversely impact groundwater quality.

Hydrocarbons (in the form of fuels, greases, and oils) are stored and used in the current permit area and will be used in the permit expansion area. Groundwater contamination could result from spillage of hydrocarbon products during maintenance of equipment during operations, filling of storage tanks and vehicle tanks, or from tank leakage due to the rupture of tanks. The probable future extent of the contamination caused by diesel and oil spillage is expected to be minimal for three reasons:

1. No underground storage tanks will exist in the permit expansion area;
2. Spillage during filling of the storage or vehicle tanks will be minimized to avoid loss of an economically valuable product;
3. The 1997 SPCC Plan provides for (and C.W. Mining has implemented) inspection and operation measures to minimize the extent of contamination resulting from the use of hydrocarbons at the site.

There are no transformers in the current or expanded mine permit areas that contain polychlorinated biphenyls (PCBs). No surface roads capable of handling large volume and or heavy truck traffic will be constructed in the permit expansion area. All roads will be constructed and maintained in such a manner that the approved design standards are met throughout the life of the entire transportation system (see Chapter 3 of the MRP). This fact reduces the potential for hydrocarbon spills. Salting of some roads within the lease area occurs during the winter months. Road salt is applied sparingly to minimize water quality impacts to nearby surface-water and groundwater systems. The impacts resulting from road salting in the permit area are expected to be minimal.

The springs that discharge above the mined horizons on Gentry Mountain are related to shallow, active zone groundwater systems. These springs, which include but are not limited to SBC 12, 15, 16, 18, 20, 21, and 22, and SCC-1, 2, 5, 6, and 7, are not in hydraulic communication with groundwater systems that will be encountered in the mine. We anticipate no detrimental impacts to water quality to these springs as a result of mining activities. Indeed, it is difficult to imagine a mechanism whereby the water quality of springs that discharge above the mined horizon may be significantly impacted by mining operations.

Groundwater systems from which the springs on Gentry Mountain discharge are not related to the groundwater systems encountered in the mine. The water quality characteristics at each of these springs have been well documented. Generally, the concentrations of individual solute parameters have not changed significantly over time (Appendix A).

1.5 Flooding or streamflow alteration (728.333)

Flooding is a potential consequence of mine water discharge. Mine water discharge is a significant addition to the baseflow of Bear Creek (Figures 19e and 19f). During low-flow conditions, the continuous addition of sediment free mine discharge water to Bear Creek may increase the erosion potential in the stream channel. The channel substrate below the mine discharge is located on the Mancos Shale, which is highly erodable. However, the amount of water discharged from the Bear Canyon Mine is relatively small, averaging about 130 gpm with a historic maximum of about 320 gpm. This relatively small quantity can be accommodated in the inner, relatively stable portion of the channel. Significant bank erosion is, therefore, unlikely. The stream gradient in this reach of Bear Creek, approximately 6%, suggests that in general this area has relatively low erosion potential.

Localized flooding can occur due to increased overland runoff from disturbed areas. Runoff control structures and sediment ponds minimize local flooding. The proposed surface disturbance in the right fork of Bear Canyon has been specifically designed to prevent flooding of the discharge area of spring SBC-14 or riparian areas supported by this discharge. The mine plan for the current permit area and the permit expansion area has been designed to prevent subsidence of Bear Creek, the right fork of Bear Creek, or the Left Fork of Fish Creek. Thus no stream alteration is anticipated in these perennial and intermittent drainages. In ephemeral drainages, differential subsidence may cause some alterations of stream channels. Possible changes are described above in Section 9.3.

In mine water from the Mohrland expansion will be discharged from the existing Mohrland Portal (SCC-3). The portal currently discharges about 250 gpm, although historical flows have exceeded 700 gpm. During the initial phase of mining approximately 200 gpm of this discharge will be used for in mine process water. As mining progresses in situ mine water will be used as process water and Mohrland Portal discharges will increase. Assuming excess in mine discharge will be similar to that in the Bear Canyon Mine, the discharge rate from the Mohrland Portal may ultimately increase by about 50 -100 gpm creating a maximum flow of 350 gpm based on the current best available data.

1.6 Groundwater and surface-water availability (728.334)

As described in Section 9.1 there are no expected impacts to the hydrologic balance of either groundwater or surface water systems. Therefore, there are no probable impacts to groundwater or surface water supply. There are no water supply wells in the permit area that could be damaged by subsidence. As described in Sections 8.1 and 8.2, mining has not nor should not affect the groundwater systems that support Big Bear and Birch springs. Thus, we expect that Big Bear and Birch springs will continue to be available for culinary use.

1.7 Contamination, diminution, or interruption of water sources (728.340)

Based on the information presented in this document, we anticipate that there should be no contamination, diminution, or interruption of water sources.