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State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Michael O. Leavitt
Governor
Kathleen Clarke
Executive Director
Lowell P. Braxton
Division Director

1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, Utah 84114-5801
801-538-5340
801-359-3940 (Fax)
801-538-7223 (TDD)

Memorandum

To: FILE

Thru: Daron Haddock, Permit Supervisor *DRH*
Joseph Helfrich, Permit Supervisor

From: David Darby, Reclamation Specialist *DD*

DATE: December 18, 1998

RE: Amendment, Undermining Perennial Stream Channels in Box Canyon, SUFCO Mine, Canyon Fuels Company, LLC, ACT/041/002-98D, Sevier County, Utah

FILE #

SUMMARY

Canyon Fuels Company submitted Amendment 98D on May 18, 1998. The amendment proposes a change the current Mining and Reclamation Plan to include full extraction longwall mining beneath Box Canyon. The amendment changes the sequence of mining within the current permit area. The applicant proposes to develop longwall panels beneath the canyon and perennial stream.

Box Canyon is considered by the Forest Service and cattlemen as a significant source of flow for sustaining wildlife and cattle. Box Canyon also exhibits a unique ecosystem of plants and ancient cultural resources. Hikers to the canyon find it aesthetically pleasing and important as a resource to the area.

The application contained a report by Mayo and Associates, LC. (December 1997) identifying the probable impacts from longwall coal mining at the SUFCO Mine to the hydrologic balance of Box Canyon Creek. Also submitted is a report by Agapito Associates, Inc. (November 1997) describing the potential surface subsidence impacts from longwall mining under Box Canyon.

GEOLOGIC RESOURCE INFORMATION

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

Analysis:

A description of the geology is found in Chapter 6 in Volume 2 of the SUFCO Mine Plan. The MRP includes a geologic description which identifies the stratigraphic sequence. It also contains the operation plan which describes the monitoring and drilling activities.

All rock units within the SUFCO Mine property are sedimentary in origin. The exposed consolidated formations were deposited during the Cretaceous Period. Map 6.1 and Figure 6.1 depict the stratigraphy and extent of the formations on and adjacent to the minesite.

Plate 6-2 depicts a cross-section of the coal units at depth across the property from north to south. Upper Hiawatha and Lower Hiawatha coal seams are the minable coal seams on the permit area. Their extent or thickness over the area (isopach map) is not shown on a map, but identified in drill logs.

Potential subsidence limits are outlined in Chapter 5 in Plate 5-10 (MRP) and in Figure 22 of the Agipito Report for the current mine plan area. Figure 25 (Agipito Report) of the Amendment shows the predicted subsidence contours after mining under Box Canyon.

The Castlegate Sandstone lies above the coal bearing Blackhawk Formation. The thickness of the Castlegate Sandstone is approximately 200 feet at Box Canyon and 30 feet at the edge of the north boundary of the SUFCO Mine lease.

Coal and overburden isopach map were not submitted, however the thickness of the coal seam was obtained from drill hole log 89-16-1, west of and adjacent to Box Canyon. The coal height of the upper Hiawatha coal seam is approximately 3 feet. The lower Hiawatha seam is approximately 15 feet high and the overburden depth adjacent to creek approximately 830 feet.

Findings:

There is sufficient information presented by the applicant to make a finding of the potential effects of mining on Box Canyon. An overburden and coal isopach map for the lower Hiawatha Coal seam is preferred for better clarification across the property especially, if additional information has been discovered for the Pines Lease Track.

Both annual subsidence reports and the Agipito report identify

areas of previous subsidence over longwall panels. Subsidence is highly likely with expansion of the longwall panels beneath Box Canyon. Fracturing is also highly likely due to the pre-existing fracture pattern and the tensional stresses induced above the roadgates by sinking of the panels. The tensional stresses in this situation will run parallel with the canyon and likely take place along the canyon rims parallel to the canyon.

HYDROLOGIC RESOURCE INFORMATION

Analysis:

Sampling and analysis.

The applicant established stations along the Box Canyon drainage to monitor surface, groundwater and alluvial parameters. Figure 1, identifies the surface and ground water monitoring sites. Figure 5 and Table 1 of the Amendment portray the alluvial parameters. Table 2 and Figure 6 identify stream flow measurements from 1989 through 1996 at stations FS-109, FS-110 and FS-090.

The applicant indicated the highest points of flow in the channels in Figure 7 for the date of October 9, 1997. At the lowest station on the creek, FS-090, the flows appeared highest and ranged between 9.4 to 40.4 gallons per minute. Whereas, on a field visit August 11, 1998 flows in the creek were observed a couple thousand feet further up the drainage than is marked in Figure 7.

Figures 9 through 12 show views of bedding planes and fractures in the CastleGate Sandstone (member of the Price River Formation) which supply groundwater (seeps and springs) to the creek. The seeps and springs supply and create an unique environment for ferns and mosses as well as other riparian vegetation in the canyon.

Baseline information.

There appears to be no designated water rights established in Box Canyon for diversion. Muddy Creek Irrigation Company has the rights to 244 cfs in Muddy Creek. Flows from Box Canyon flow into Muddy Creek. The Forest Service claims the need to sustain flows in Box Canyon for livestock and wildlife watering.

The applicant differentiated mining under Box Canyon with mining under Miller Creek and Burnout Creek. Some pertinent factors were pointed out that distinguish Box Canyon from other minesites

where impacts occurred as a result of mining. Only one coal seam is proposed for mining. Overburden thickness is over 800 feet. There is no extensive faulting in Box Canyon. The applicant also concluded that tension fractures tend to heal over time.

Some information in the application indicate there could be substantial impacts to the water resources in Box Canyon from subsidence. The highly fractured Castlegate Sandstone has been shown to sustain tension fractures when other areas were mined. The arrangement of longwall panels in the Box Canyon area are parallel with the stream channel. Tension fractures will also run parallel with the creek and have a high potential of intersecting the stream channel in the vicinity of the confluence with Upper Left Fork (See Figure 21 Agipito Report).

Ground-water information.

There are a large number of springs that issue from the base of the Castlegate Sandstone in Box Canyon. The creek in Box Canyon is a continuous gaining stream throughout the amendment area. The Mayo Report suggests that solute, isotopic and discharge data indicate groundwater recharge to Box Canyon is in hydraulic communication with the surface and not recharged through the overlying Price River Formation.

The Mayo Report also suggests that near surface groundwater systems are not in communication with groundwater encountered during mining. Data compiled by Mayo and Associates (1997) demonstrate the composition of in-mine waters have a radiocarbon ages of 7,000 to 20,000 years and contain no tritium, whereas surface waters exhibit isotopic ages far less in age.

Surface-water information.

The applicant has established surface monitoring sites along the stream in Box Canyon to measure flow and water quality. Discharge data was collected and presented in Table 2 and Figure 6 (Mayo Report).

Baseline cumulative impact area information.

Cultural resources, vegetation, subsidence and hydrologic (surface and groundwater flow and chemistry) have been supplied in respective reports for the amendment. There appears to be sufficient information provided to make a determination of potential impacts.

The applicant identified the probable impacts to the hydrologic

balance in Mayo's report beginning on page 34. The report specifies that groundwater interception from mining is not anticipated the response of water monitoring wells Well 89-20-2W and a lack of tritium in the gob water.

Modeling

Two thoughts of groundwater flow and interception were proposed. Groundwater model has been presented based on solute composition and isotopic data. As stated earlier, the applicant predicts that no interception of surface water or water above the Castlegate Sandstone will be to be captured and taken into the mine.

Surface water that may be intercepted from subsidence fracturing will be transmitted and stored in fractures. The well cemented Castlegate Sandstone will prevent sandstone from receiving or transmitting water increasing the flux of water through the bedrock. The magnitude of flow will depend on the saturation of rock underneath the canyon and the geometry of the tension cracks.

Cracks that form in the bottom of the creek may cause recharge to bedrock underlying the canyon at the direct expense of water in Box Canyon.

Alternative water source information.

The applicant has not proposed an alternate water source, but has identified the low percentage of loss to the flow of Muddy Creek of 15 gpm if flow is lost. The applicant has also identified mitigation measures to restore flows in the event they are lost or diminished. The applicant has proposed to fill cracks with bentonite grout in the event natural sediments do not seal the fractures which may occur as a result of subsidence.

Findings:

The applicant has supplied sufficient information to make a determination of potential hydrologic impacts to the Box Canyon area as a result of proposed longwall mining.

Information provided about monitoring wells concluded no impacts. However, an evaluation of the well information suggests that the well information is inconclusive. In fact other than US-77-8, which is shallow and stabilized, because it abuts a barrier pillar, the other wells US-80-4 and 89-20-2W show a decline in water levels and the reestablished flows do not necessarily depict the no impact scenario.

The applicant proposed a disconnection between the groundwater sources of the Castlegate Sandstone and the water generated in the mine. Isotopic information was presented for the basis of this claim. Locations where isotopic samples was not presented.

Based on existing subsidence information, the subsidence potential for the area and fracturing is high.

The alignment of the panels over the west fork of Box Canyon Creek reveals that the gateroads align parallel to the creek and some of the cliffs that supply recharge to the creek. The pre-existing fracture pattern coupled with the expected subsidence can magnify the potential for groundwater interception to the creek. Fractures opening parallel with the creek can transmit flow away from the creek down stream, leaving the stream and riparian vegetation desiccated.

The applicant's plan for mitigation, by using a bentonite slurry, to fill fractures, if all fractures can be identified, may do more harm than good some bentonite should leak into the stream.

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.

Analysis:

Affected Area Boundary Maps

SUFCO submitted maps in Figures 1 and 2 (Mayo Report) depicting the location and extent of the permit to be modified. The applicant plans to extend longwall panels 13 left 4 east and 14 left 4 east. The panels were not proposed for full development during the initial permit application. The figures show the panels (panels 13 left 4 east and 14 left 4 east) will be extended in length under Box Canyon to equal the length of Panel 12 left 4 east and abut the border of the lease area. No additional mining is proposed outside the current lease area.

Coal Resource and Geologic Information Maps

Maps 5-7 and 5-8 identify mining areas in the Hiawatha Coal Seam and Lower Hiawatha Coal seam. Figure 2 of the amendment also identifies proposed mine changes.

Cultural Resource Maps

Cultural resource maps are submitted in the updated Amendment submittal, Appendix 4-2. Maps 3 through 13 identify resource sites and are marked ~~Confidential~~.

Existing Structures and Facilities Maps

Plate 5-5 shows the existing surface and subsurface facilities and features. A runoff catch pond is the only feature shown in the vicinity of Box Canyon.

Existing Surface Configuration Maps

Several Plates in the MRP are based on the 1/24,000 USGS topographic map. They identify the topography of the mine permit area, including the topography Box Canyon. Box Canyon trends north for several miles. The head of the canyon lies in the north east corner of the permit area. Box Canyon forks approximately 2.5 miles from the headwaters. The east fork of Box Canyon lies northeast of the permit area and trends northwest. Both canyons are approximately the same in length. The ridges adjacent to the canyons exhibit low relief because of the resistant surface of the Price River Formation.

Mine Workings Maps

Figure 2 of the Amendment shows the Present Mine Plan and Proposed Mine Plan, showing panels 12 Left 4 East,. Plate 5-7 identifies the mining sequence for the Hiawatha Coal Seam. Mining is currently taking place in Panel 12 Left 4 East. Panels 13 Left 4 East and 14 Left 4 East are planned for mining in years 1999 and 2000.

Monitoring Sampling Location Maps

Hydrologic monitoring and sampling sites are identified in Figure 1 (Mayo Report) and cultural resource sites are identified on location Map 3 (Appendix 5-10, confidential filing).

Permit Area Boundary Maps

The permit area boundary is identified in several maps and

reports of the amendment.

Surface and Subsurface Ownership Maps

Surface water and groundwater rights are identified on Plate 7-2 in the MRP. No water rights are shown in Box Canyon.

Subsurface Water Resource Maps

A description of the subsurface water resources is provided in the Mayo Report. A description and conceptual model of the relationship between the surface flow and groundwater flow adjacent to Box Canyon is provided in Figure 13 of the report.

Findings

A review of the mine plan and amendment indicate that there is no overburden isopachs maps and no cross-sections through the property proposed in the amendment.

OPERATION PLAN

MINING OPERATIONS AND FACILITIES

Regulatory Reference: 30 CFR Sec. 784.2, 784.11; R645-301-231, -301-526, -301-528.

Analysis:

General

There are no new facilities associated with the amendment. The amendment proposes only to expand longwall mining panels beneath Box Canyon, an area previously omitted because the surface features a perennial stream, springs and high value riparian habitat.

Type and Method of Mining Operations

Continuous and longwall mining methods are employed at the SUFCO. Longwall mining in adjacent panels have incurred surface subsidence up to four feet. Some spreading of natural fractures has taken place. It is expected that similar mining in the Box Canyon area will involve subsidence and fracture spreading.

Facilities and Structures

There are no mine related facilities or structures proposed for the amendment area at this time.

Findings

The applicant has supplied sufficient information to make a findings of the potential impacts of mining beneath Box Canyon, that the proposed mining method have a high potential of fracturing the Castlegate aquifer, dewatering and damaging the current hydrologic balance.

Conclusion and Recommendations

This amendment is not recommended for approval because of the high subsidence and fracturing potential for irreversable impacts to the hydrologic balance. There exists a high degree for the operations intercepting groundwater flows to Box Canyon Creek and diverting them away from their natural underground flow pattern to seeps and springs along canyon walls. Fracturing created by subsidence could likely dewater the perennial stream and desiccate the riparian vegetation.

If mining is allowed in this area, it should be restricted to room and pillar, first mining only. This form of mining would allow a more gradual and uniform settling of the surface, which would give the natural healing process more time.