United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Moab District
P. O. Box 970
Moab, Utah 84532

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DIVISION OF
OIL GAS & MINING

Mr. George A. Morris
Forest Supervisor
Manti-La Sal National Forest
599 West Price River Drive
Price, Utah 84501

Dear Mr. Morris:

Based on your written request of November 22, 1991, this letter provides our comments concerning the approved resource recovery and protection plan (R2P2) for the Skyline Mines and the protection of the Burnout Creek drainage area. This request was generated when the Forest Service recently determined that Burnout Creek is perennial up to the forks and may be perennial for an unknown distance above the forks.

The lease terms and conditions require that underground mining operations shall be conducted in such a manner so as to prevent surface subsidence that would damage or alter the flow of perennial streams; except in specifically approved locations. As a result, the Bureau of Land Management (BLM) is responsible for reviewing the approved R2P2 and providing an assessment of the anticipated impacts that underground mining would have on the surface of the Burnout Creek drainage area.

Under the Burnout Creek drainage area, there are 4 minable coal seams. In descending order these minable coal seams are the Upper O'Connor, Lower O'Connor B, Lower O'Connor A, and Flat Canyon. Longwall development is currently approved for the three upper coal seams but the BLM has identified additional minable reserves in the lowest coal seam and has required Utah Fuel Company to submit a proposed R2P2 for these additional reserves. Blocks of longwall panels are delineated for the upper two coal seams which essentially underlie the entire Burnout Creek drainage area except where full extraction is restricted under the gas pipeline. Blocks of longwall panels are delineated for the lower two coal seams which only partially underlie the Burnout Creek drainage area. In general, the sequence of mining coal seams is from top to bottom with longwall panels superimposed and aligned in a northwest direction. Mining will begin in the northeast portion of the longwall blocks and continue sequentially toward the southwest. The time frame for longwall development under the Burnout Creek drainage area for each coal seam is as follows:

Upper O'Connor Seam - 1991 thru 1995
Lower O'Connor B Seam - 1999 thru 2008
Lower O'Connor A Seam - 2004 thru 2005
Flat Canyon Seam - 2006 thru 2008

In order to assess the impacts to the Burnout Creek drainage area from multiple seam longwall mining, we have reviewed all the available subsidence information. Subsidence effects from longwall mining are documented in a number of studies conducted in the region and other areas in the Western United States; but, only one study was found which dealt with subsidence effects from multiple seam longwall mining. Additionally, there are some general reports involving longwall mining in the West and the potential effects on surface hydrological resources; but, no specific detailed studies

are available on the impacts of longwall mining on streams in the West. This information provides accepted subsidence parameters and potential impacts to streams applicable to the Skyline Mine. Site specific subsidence information generated from the Skyline Mine was also utilized.

Subsidence is usually coincident with mining and is transmitted rapidly from the workings to the surface. Once subsidence has begun it will progress with the direction of mining and continue until after the last longwall panel in the block is complete. The total subsided area will include the surface area above the extracted longwall block plus an additional area determined by an angle of draw. Final subsidence contours, for a large block of longwall panels extracted from a single coal seam, will resemble a broad irregularly shaped trough with maximum subsidence occurring towards the center of the longwall block. Maximum subsidence is always less than the mining height because of bulking of the overburden strata.

In most cases, a narrow subsidence trough will form with the initial longwall panel. A stream flowing across the narrow subsidence trough formed over a single longwall panel could potentially be disrupted temporarily by settlement, changes in slope over a short distance, and surface cracks. But as the longwall face passes the ground will stabilize and many cracks may close up or heal as the surface goes into compression behind the face. All these ground changes can occur progressively along the stream channel as subsequent longwall panels are mined until a broad subsidence trough forms and mining ceases.

A broad subsidence trough with a smooth profile minimizes disruption to the surface. It is produced by mining a large block of longwall panels at an even rate which results in uniform gradual subsidence. One potential impact to streams crossing the final subsidence trough is a change in the original surface slope. Depending on the original topography, an increase or decrease in the surface slope could have an affect on the flow of the stream.

The major effect of multiple seam longwall mining is to increase the maximum subsidence but the angle of draw is not changed appreciably where longwall blocks in each coal seam are superimposed. Where a longwall block in an underlying coal seam extends beyond a longwall block in an overlying coal seam the subsidence area will expand in accordance with the extended area. Subsidence will resume in the same manner described for a single coal seam as extraction of each underlying coal seam is undertaken. Extraction of each additional coal seam will increase subsidence with maximum subsidence occurring toward the center of the largest amount of longwall block overlap.

Based on these parameters and the approved R2P2, subsidence should occur soon after the mining begins in the first longwall panel in the northeast portion of the longwall block for the Upper O'Connor Seam. Subsidence should follow the mining and continue towards the southwest with each consecutive longwall panel. After extraction of this coal seam is complete, the subsidence area should resemble the perimeter of this longwall block and maximum subsidence should include the head of the north fork of Burnout Creek. Extraction of the Lower O'Connor B Seam should expand the subsidence area to include this more extensive longwall block and subsidence will increase with the extraction of each additional coal seam. The area of maximum subsidence, resulting from the extraction of all coal seams, should still include the head of the north fork of Burnout Creek.

Mining has already started in the northeast portion of the longwall block in the Upper O'Connor Seam. Four longwall panels are completed and production is currently occurring in the 5th longwall panel (under the upper reaches of the north fork of Burnout Creek). Monitoring stations indicate that the subsidence trough is developing as expected. For the first longwall panel, subsidence was recorded within weeks after the longwall face passed the

monitoring stations. Maximum subsidence detected so far is about 60 percent of the seam height with an angle of draw less than 20 degrees. According to field investigations reported by Skyline Mine personnel, the main surface effects noted are surface cracks which formed in shallow overburden between 200 and 400 feet above the first two longwall panels. They formed parallel to the south facing slopes in the colluvium above the panels. Several of these surface cracks were reported as 200 feet long, 1 foot wide, with a 1 foot scarp. Numerous other surface cracks opened about 1 to 3 inches and were 30 to 50 feet in length. One of these minor cracks appeared across a flowing stream. Follow up field investigation revealed that most of the minor cracks had disappeared within a few months and the major cracks were rapidly healing. The minor crack crossing the stream did not interrupt flow and had filled in with sediment and completely disappeared. No surface cracks were observed where mining was conducted with greater than 400 feet of overburden.

One concern raised by surface cracks is the potential risk of intercepting stream flow and diverting it underground. This impact is considered unlikely for the Burnout Creek drainage area because of the overburden and the nature of the surface material. The overburden in this area for the Upper O'Connor Seam is between 600 and 1000 feet and, from the data compiled so far, surface cracks are not likely to occur where the overburden is greater than 400 feet. Greater overburden would certainly minimize the possibility and severity of surface cracks since it is generally accepted that the greater the overburden the less the surface effects. If cracks were to occur, the most likely place is along the slopes of the drainage where data shows that the unconsolidated colluvium is favorable for healing naturally in a short period of time. In the event that a minor surface crack formed across a stream, it is expected to fill rapidly with alluvial material and disappear. The potential for a surface crack to divert water underground prior to healing is further limited by the characteristics of the underlying Blackhawk Formation which consists of interbedded claystone, siltstone, and sandstone. Although this material may fracture at the surface, the fractures are prone to heal because of the expanding nature of the clay contained. Additionally, this material is not conducive for receiving an influx of surface water because the claystone and siltstone have a low permeability and the higher permeability sandstones are lenticular and pinch out in a short distance.

Due to the existing steep gradient of Burnout Creek and the broad subsidence trough anticipated under the existing mining plan, minimal change in the flow of Burnout Creek is expected even with total extraction of all the coal seams. For example, from our estimations the gradient would at worst change from about 400 feet per mile to about 370 feet per mile between the head of the north fork of Burnout Creek, where maximum subsidence (up to 30 feet) is expected, to about one mile downstream, where the edge of the subsidence trough is expected. This minor change in gradient should not significantly affect the flow of the stream. Potential impacts to the stream gradient are further minimized because the sequence of mining will induce subsidence in the upstream high gradient areas before proceeding downstream toward lower gradient areas.

Although our analysis indicates that mining operations should not damage or alter the flow of the perennial stream, the variables involved make it impossible to make this determination with absolute certainty. Some short term interruptions could occur but no long term effects are anticipated. As a result, we conclude that mining operations should continue under the approved R2P2 for the Upper O'Connor Seam contingent on careful subsidence monitoring of the Burnout Creek drainage area by Utah Fuel Company. Any surface impacts identified should be promptly and carefully analyzed by the BLM and the Forest Service to determine whether they could negatively affect the flow of the perennial stream and whether further longwall mining will occur under the drainage area.

If you have any questions or concerns, please contact Brent Northrup at (801) 259-6111.

Sincerely,

/s/ Roger Zortman

District Manager

cc:
U-921, Utah State Office
State of Utah
Division of Oil, Gas and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203