Figure 525.120a

SUBSIDENCE PREDICTION – MINING WATTIS SEAM

Moved to the Confidential Permit Information Binder
Figure 525.120b

SUBSIDENCE PREDICTION – MINING WATTIS AND THIRD SEAMS

Moved to the Confidential Permit Information Binder
SILT FENCE

FLOW

BOUND BALES PLACE ON THE CONTOUR

STRAW-BALE DIKE

Source: Barfield et al. (1981)

FIGURE 542.200a. SILT FENCE AND STRAW-BALE DIKE SCHEMATICS
June 16, 1992

Mr. Ben Grimes
Cyprus-Plateau Mining Corporation
P. O. Drawer PMC
Price, Utah 84501

Dear Mr. Grimes:

Re: Approval of Division Order ACT/007/006-DQ-92A, Cyprus Plateau Mining Corporation, Star Point Mine, ACT/007/006-DQ-92A, Folder #1, Carbon County, Utah

All of the permit deficiencies outlined in Division Order DO-92A have been corrected. Please submit eight copies (with page numbers noted) for insertion into the plan by June 30, 1992. Thank you.

Sincerely,

[Signature]
Pamela Grbaugh-Litong
Permit Supervisor

INTEGRATED EFFECTIVE: MAY 27, 1998
Utah Division Oil, Gas and Mining
AFFIDAVIT OF PUBLICATION

I, Dan Stockburger, on oath, say that I am the Publisher of the Sun Advocate, a twice-weekly newspaper of general circulation, published at Price, State and County aforesaid, and that a certain notice, a true copy of which is hereto attached, was published in the full issue of such newspaper for consecutive issues, and that the first publication was on the 14th day of April, 1992, and that the last publication of such notice was in the issue such newspaper dated the day of 19....

Subscribed and sworn to before me this 14th day of April, 1992.

Notary Public

My Commission expires January 10, 1995
Residing at Price, Utah
Publication fee, $13.60

NOTICE OF PUBLIC MEETING

Cyprus Plateau Mining Corporation announces that a public meeting, in accordance with Utah Mining Regulation R645-105-234.200, is scheduled for 12:00 P.M., April 28, 1992 at the Days Inn, Price, Utah. The meeting is to provide opportunity for any member of the public to comment if they feel the Cyprus Plateau Mining operations adjacent to Carbon County public road 290 affects their interests. Carbon County public road 290 passes through the Cyprus Plateau Mining operations near the old town of Wattis in Sections 8, 9, 10, 16 and 17, Township 15S Range 8 East, Salt Lake Base and Meridian. Anyone interested in attending this meeting should contact Lowell Braxton at the Utah Division of Oil, Gas and Mining at 335 West North Temple, 3 Traid Center, Suite 350, Salt Lake City, Utah 84180-1203 before 4:00 P.M. on Monday April 20, 1992. If no requests to make comments are received before this time, the meeting will be canceled.

Published in the Sun Advocate April 14, 1992.

INCORPORATED EFFECTIVE: MAY 27 1998
FAX TRANSMITTAL
MOAB DISTRICT OFFICE
PRICE AREA HEADQUARTERS

TO:       T. M. Hurst

FROM:     Stephen Falk

SUBJECT:  Castle Valley Ridge Coal Lease Tract R2P2 approval

NUMBER OF PAGES: 3
(Including cover sheet)

DATE:     3/6/97

TIME:     9:00 a.m.

FAX MACHINE NO.

COMMENTS:

INCORPORATED EFFECTIVE: MAY 27 1998

FILE: GOV 1.6.3 BLM

C. J. Puppess (OCTOBER 1991)
Mr. Richard Holbrook  
Senior Project Manager  
Office of Surface Mining  
1020 15th Street  
Denver, Colorado 80202

Re: Resource Recovery and Protection Plan (R2P2) for Federal Coal Lease U-64263

The Bureau of Land Management (BLM) has reviewed the R2P2 submitted by Cyprus Plateau Mining Company (PMC) on September 9, 1991 for Federal coal lease UTU-64263. This correspondence provides our findings and recommendations regarding the R2P2.

Federal coal lease UTU-64263 was issued to Cyprus Western Coal Company on April 1, 1990 involving 1987.46 acres. During the leasing process, the area was referred to as the Castle Valley Ridge Tract. On July 10, 1991, the lease was modified by the addition of 50 acres to allow mining and prevent the bypass of Federal coal. The entire 2,037.46 acres is within the Manti-La Sal National Forest.

Underground development of coal on this lease is merely an extension of an existing operation and will not require construction of new surface facilities for access or coal processing. However, it is necessary to drive three rock slopes to the surface near the Little Park Stream to provide ventilation and escapeway portals. Development will involve longwall mining methods in one minable seam.

Deficiencies in the R2P2 were resolved directly with the company and it is now complete and technically accurate. The BLM has determined that the R2P2 is in compliance with the Mineral Leasing Act of 1920, as amended, the lease terms and conditions, and will achieve maximum economic recovery of Federal coal.

The BLM is extremely concerned that failure to approve the permit revision involving the subject lease by October 1, 1991 will result in the bypass of the Federal coal on the 50 acre modification.
If you have any questions, please contact Gary Johnson in the Price Coal Office at (801) 637-4584.

Sincerely yours,

/\ W. WILLIAM C. STRINGER

Assistant District Manager
Mineral Resources

cc:
U-065c, Price Coal Office
U-921, Utah State Office
Utah Division of Oil, Gas, and Mining
335 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
Cyprus Plateau Mining Company
P. O. Drawer PMC
Price, Utah 84501

BNorthrup: caf: 9/19/91 Minerals Disk A: PLAT.MPR
March 20, 1981

Memorandum

To: Regional Director, USGS, Denver

From: District Mining Supervisor, USGS-CD
Salt Lake City

Subject: Plateau Mining Company, Star Point Mines, Carbon County, Utah, Mining and Reclamation Plan

The subject plan consisting of five volumes and transmitted with your letter dated March 2, 1981, was received in this office on March 9, 1981. This plan is a permanent program submission (CSP) and has been reviewed for completeness relative to USGS-CD responsibilities under Federal regulations 30 CFR 211.10 (c) dated May 17, 1976, as amended August 22, 1978, and pursuant to the cooperative agreement between our offices. The following are our comments:

1. Several areas that indicate minable thicknesses of coal are not shown as being mined. Plans to mine these areas or the reasons for not mining these areas should be included as part of the plan. The areas of concern are listed below:

   a. Plate 3-4C, Hiawatha seam, northern part of Federal lease U-13097 and the southwestern corner of Federal lease SI-031286.

   b. Plate 3-45, Middle seam, southwest corner of Federal lease SI-031286.

2. Final abandonment of mine openings and for underground works will require an onsite inspection with the G3 and a formal submission of a sealing procedure to the G3 for approval.

3. Interburden isopach map(s) are not required by 30 CFR 211.10 (c) dated May 17, 1976, as amended August 22, 1978; however, if the company has or is planning interburden isopachs for the Plateau mines it is requested that copies be furnished the USGS-CD. This type of information is required to document areas of coal of minable thickness which can or cannot be recovered.
Except for the above we have determined the submission to be complete and technically adequate for our administration of the associated federal coal leases.

Since the submission is essentially complete the GS will agree that the permit application can be processed and that the additional information required can be required as a stipulation in the approval of the lease.

Jackson W. Hoffitt

cc: Denver Plateau Mining Co./ Mine Plan File
Memorandum

To: Regional Director, Office of Surface Mining, Denver, Colorado

From: District Mining Supervisor, Minerals Management Service, Salt Lake City, Utah

Subject: Plateau Mining Company, Star Point Mines, Carbon County, Utah, Underground Mining and Reclamation Plan

April 1, 1982

The one-volume supplement to the subject plan which was transmitted to this office with your form letter dated March 23, 1982, has been reviewed as requested for completeness and technical adequacy relating to the responsibilities of the Minerals Management Service. We have determined that this volume, which is the reply to the special stipulations of the approved subject plan dated January 21, 1982, is compatible with the requirements of the 30 CFR 211 regulations and for our administration of the associated Federal coal leases. Maximum economic recovery, as determined in the seven-volume approved plan, will not be affected by enforcement of these special stipulations.

[Signature]

For Jackson W. Moffitt
CERTIFIED MAIL - RETURN RECEIPT REQUESTED
Certification No. 0502

Mr. Robert Lauman
Chief of Technical Services
Cyprus-PLateau Mining Co.
P. O. Box PMC
Price, Utah 84501

Subject: Diligence Status for the Starpoint Logical Mining Unit (LMU)

Dear Mr. Lauman:

The purpose of this letter is to establish the diligence status of the Starpoint LMU and to notify you of a slight adjustment in the LMU recoverable reserves.

Section 7 of the Mineral Leasing Act of 1920 (MLA), as amended subjects all Federal coal leases and approved LMU's issued after August 4, 1976 to diligent development and continued operation requirements. The Starpoint LMU was approved effective December 22, 1986 (date of submission) and became subject to diligence requirements on that date. The diligent development period for this LMU begins December 22, 1986.

In order to satisfy the diligent development requirement, commercial quantities (1 percent of the recoverable reserves) must be produced from an LMU within 10 years after it became subject to diligence. Once diligent development is achieved, commercial quantities must be produced every year thereafter to maintain continued operation either for the year in question or beginning in the third continued operation year (COY) on the basis of a three year total.

The total LMU recoverable reserves at the time of approval includes the recoverable coal reserves from Federal lands and non-Federal lands. The non-Federal recoverable reserves used were those reserves existing at the time of LMU application. For those leases subject to lease-specific diligence requirements (issued, modified or readjusted after August 4, 1976) the recoverable reserves used will be those reserves on the date the lease became subject to diligence. For those leases not subject to lease-specific diligence requirements the recoverable reserves used will be those in existence at the time of LMU application.
In reviewing the reserve and production figures from the Starpoint LMU, the Bureau of Land Management (BLM) has found some arithmetic errors (incorrect production figures). The result of these findings change the LMU recoverable reserves, as of the approval date, to 34,460,129 tons from 34,482,485 tons, as stated in the LMU stipulations. Therefore, the commercial quantities amount for the Starpoint LMU becomes 344,601 tons versus 344,825 tons, as stated in the LMU stipulations.

Federal coal lease SL-031286 was modified September 14, 1982 and became subject to lease-specific diligence on that date. From that time up to the LMU approval 4,001,085 tons of coal were produced. Federal coal lease U-37045 was issued on April 1, 1980 and became subject to lease-specific diligence on that date. From April 1, 1980 to December 22, 1986 there have been 1,654,321 tons of coal produced. Therefore, as of December 22, 1986 5,655,406 tons of coal have been credited to the Starpoint LMU diligent development requirements. This exceeds the commercial quantity requirement of 344,601 tons, required to meet diligent development. The Starpoint LMU entered continued operation at the beginning of the next royalty reporting period following the effective date of approval (January 1, 1987). The Continued Operation Year (COY) is defined as January 1st to December 31st.

Commercial quantities of 344,601 tons must be produced every year thereafter to maintain continued operation either for the year in question or beginning in the third COY on the basis of a 3-year total. The 3-year total involves the year in question plus the two immediately preceding years.

Continued operation can also be satisfied by payment of advance royalty equivalent to the commercial quantities production shortage, which is only owed on the Federal LMU recoverable reserves prorated against the total LMU recoverable coal reserves. This production shortage is based on the year in question or the 3-year total, whichever is less.

A lessee must apply to pay advance royalty within 30 days from the beginning of the continued operation if no production is planned. If production is planned, but falls short of the commercial quantities, the lessee must apply to pay advance royalty prior to the end of the continued operation year.

TABLE-1 depicts the continued operation status of the Starpoint LMU. To date, the LMU has maintained continued operation requirements for COY-1 and COY-2. The Starpoint LMU is currently in COY-3.
### TABLE-1
CONTINUED OPERATION STATUS
OF
STARPOINT LMU

<table>
<thead>
<tr>
<th>COY</th>
<th>PROD REQUIR.</th>
<th>PROD SHORT.</th>
<th>PROD REQUIR.</th>
<th>PROD SHORT.</th>
<th>PROD REQUIR.</th>
<th>PROD SHORT.</th>
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<td>(1/1/87-12/31/87)</td>
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<td>2</td>
<td>1,717,493</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>?</td>
<td>344,601</td>
<td>?</td>
<td>?</td>
<td>1,033,804</td>
<td>?</td>
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<tr>
<td>(1/1/89-12/31/89)</td>
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<td></td>
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</tr>
</tbody>
</table>

Since the formation of the Starpoint LMU the lease-specific diligent development and continued operation requirements for the Federal coal leases included in the LMU are superceded by the LMU continued operation requirements. Lease-specific requirements will run concurrently with the LMU requirements and will resume if the LMU is ever dissolved.

Please contact Brent Northrup, Chief of Solid Minerals, at (801) 259-6111 if you have any questions regarding the diligence status of the Starpoint LMU.

Sincerely yours,

[Signature]

District Manager

cc:  
U-066, Price River Resource Area  
U-921, Utah State Office

---

INTEGRATED EFFECTIVE:
MAY 27 1998

Utah Division Oil, Gas and Mining
May 31, 1991

Mr. Ben Grimes
Cyprus Plateau Mining Company
P. O. Drawer PMC
Price, UT 84501

RE: Subsidence Predictions - Little Park Stream

Dear Mr. Grimes:

This letter report with attachments was prepared to address subsidence potential near Little Park Mains. Figure 1 presents the proposed mining geometry, location of the Little Park Stream and overburden thickness isopachs. Known faulting in this area is also shown in this figure.

For discussion purposes, I have divided this letter into 1) Subsidence Mechanisms, 2) Stream Protection Zone, 3) Mains Overburden Stability, and 4) Subsidence Profile.

1) Subsidence Mechanisms

Surface subsidence occurs as a result of downward rock mass movement caused by the closure and collapse of underground openings. Two major mechanisms of surface subsidence are associated with mining — sinkhole and trough.

a) Sinkhole Subsidence

This type of subsidence, also called "chimney" subsidence, is characterized by marked surface fracturing and sinking. It results from sudden or intermittent collapse of the overburden roof in localized areas and it can be from several feet to tens of feet in diameter. A "chimney" or "plug" of broken rock develops from the mine level to the surface. Figure 2 shows a typical cross sectional view.

Extensive experience from room-and-pillar coal mines indicates that sinkhole subsidence occurs mostly in overburden less than 180 ft thick as illustrated in Figure 3 for CPMC's Old Workings. This is supported by considerable experience from abandoned coal mines in the USA as follows:

i) Pittsburgh Coal Seam:

Subsidence over abandoned coal mines in the Pittsburgh coal seam was studied by Bruhn, et al (1978). Overburden rocks consist of typical sedimentary strata associated with coal—mostly sandstone and shales. Figure 4 summarizes the results of the study for both sinkhole and trough subsidence modes. The frequency of subsidence events is shown as a function of the overburden depth for a total of 354 cases. This data shows that approximately 95% of the events occurred at depths of 150 ft or less.
ii) Hanna Mining District:

The Hanna Basin in Wyoming is a major coal-producing region which was mined exclusively by underground mining methods from 1868 to 1937. Presently, most of the production is from strip mines. Overburden rocks consist of a wide variety of conglomeratic sandstones, siltstones, claystones and shales. Mining heights varied from 9 ft to 18 ft. Kafkakis (1987) evaluated sinkhole subsidence in this coal field which included more than 300 cases. Figure 5 summarizes the results of the study in terms of the probability of sinkhole subsidence versus overburden depth. There is only a 2% probability of occurrence for depths of 160 ft or more. This probability increases significantly at lower depths, such as 60 ft where the probability of the occurrence increases to 40%.

iii) Colorado Front Range Mining District:

Coal was mined along the Colorado Front Range from the 1860’s to 1970’s in many mines. A large variety of sedimentary strata occurs above these mines with the majority of the rock consisting of sandstones and claystones. Matheson and Bliss (1986) reviewed the Colorado Front Range sinkhole subsidence. Figure 6 summarizes the results for the Colorado Springs coal field in terms of probability of sinkhole subsidence versus overburden depth. In this area, there is only a 2% probability of occurrence at depths of 90 ft or more. For the whole of the Colorado Front Range district, this study found that sinkhole surface subsidence occurred more frequently in flat laying room-and-pillar areas when the overburden depth/mining height ratio was 10 or less.

In conclusion, the above case study experience shows that the potential for sinkhole subsidence is negligible above the mains, except in the area near the outcrop. The potential for long-term sinkhole subsidence in this area can be minimized by geologic studies and secondary support allocation or backfilling. Geologic studies should focus on detecting faults and shear zones, forming a suitable slip line for overburden collapse.

b) Trough Subsidence

Trough subsidence is characterized by the formation of a basin, usually without continuous fracturing from the mine to the surface, and with much less surface fracturing than the sinkhole subsidence. This form of subsidence is elliptical in plane view and occurs over large areas, typically from hundreds to thousands of feet in breadth.

Figure 7 shows a typical cross section of trough subsidence where three zones are usually present (Maleki, 1986):

- **Zone I**: Caved zone from the immediate roof with a height approximately equal to 30 ft.
- **Zone II**: Fissured zone can extend at least 300 to 400 ft above the seam.
- **Zone III**: Deformation zone from the top of the fractured zone to the surface.
The angle of draw defines the boundaries between the edges of the underground openings and the limit of surface subsidence.

Caving induces fractures in Zone II due to shear and bending forces. In Zone III, fracturing is minimal as the rock mass deflects forming a basin or trough at the surface. Cracks develop at the surface but these are shallow and usually not more than 50 ft in depth. Figure 7 also shows the zones of lateral tension (expansion) and compression which form at the surface.

Trough subsidence often occurs without major damage to groundwater or surface features. This has been well illustrated both in the U. S. and Europe. Subsidence resulting from potash mining operations in the Permian Basin near Carlsbad, New Mexico has occurred without rupturing a large aquifer 250 to 400 ft below the surface and without causing mine inflows (Pierson, 1965). Approximately 7 ft of subsidence was obtained from potash mining at a depth of 1000 ft without significant damage to highways and county roads. In European coal mining districts, subsidence has occurred as a normal part of mining operations for many years. Canal locks, bridges, roads and buildings have been lowered without significant structural damage — a 400 year old church in Germany was lowered 21 ft without collapsing (Peele, 1950).

2) **Stream Protection Zone**

U. S. Bureau of Mines has proposed guidelines for mining under major bodies of water (Babcock and Hooker, 1977). These guidelines (Figure 8) were applied to the Little Park Stream resulting in a protection zone as shown in Figure 1. The mains were positioned to the north of the protection zone to avoid stream crossing at shallow depth of cover. Note that these guidelines are very conservative, attempting to prevent safety hazard to humans and facilities as a result of destruction of dams, etc. For the Little Park Stream, there is minimum safety hazard involved and thus development mining can be carried out under the protection zone provided that there is no major faulting in the area.

3) **Mains Overburden**

A four-entry mains is proposed for the Little Park Stream area as shown in Figure 1. To minimize subsidence potential over the mains, pillar dimensions were designed to minimize potential for pillar failure (Table 1). In addition, the existing geophysical log for hole CVR-2 was checked to assess roof stability. Table 2 shows the roof lithology, suggesting minimal potential for pillar punching and plug subsidence. Shear failure and slip may occur along faults and shear zones (if any) and thus it is important to conduct a geological study consisting of surface mapping and core testing. Based on a review of results, support requirements can be finalized to ensure long-term stability over the mains.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pillar Stability</th>
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<tbody>
<tr>
<td><strong>Pillar Dimension (ft by ft)</strong></td>
<td><strong>Entry Span (ft)</strong></td>
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<td>60 by 80</td>
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*Using tributary area load and maximum cover of 800 ft
Table 2  Roof Lithology CVR-2

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<th>Unit</th>
<th>Thickness (ft)</th>
<th>Lithology</th>
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<td>6</td>
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<td>10,000</td>
</tr>
</tbody>
</table>

* extrapolated from existing block

4)  Subsidence Profile

National Coal Board’s Subsidence Engineering Handbook was used to calculate the subsidence profile along Section A-A’ upon completion of longwall mining. In these calculations, a subsidence factor of 0.75 (ratio of maximum subsidence to mining height) was used based on the subsidence monitoring over the first longwall block. Angle of draw of 35° was used to account for the possibility of faulting in the area.

The surface subsidence profile is shown in Figure 9. The maximum estimated subsidence is 5.3 ft in the longwall, as a result of trough subsidence. Subsidence is insignificant over the mains and under the stream.

I enjoyed working with you. Please give me a call if you have any questions regarding this report.

Sincerely,

Hamid Maleki
Senior Associate

HM:nm
References


Figure 1  Overburden Thickness Contours, Proposed Mining Geometry and Stream Location Map
Figure 3  Histogram Frequency Diagram of Sinkhole Formation vs Depth of Cover at
PMC (Maleki, 1986)

MEAN = 76.00
STANDARD DEVIATION = 45.45
Figure 4

Frequency of Subsidence Event vs Depth of Overburden for Abandoned Coal Mines in the Pittsburgh Seam (Bruhn, et al, 1978)

Legend:
- All sites where overburden thickness is known (239)
- Sites where diameter and depth of subsidence feature is also known (133)

Note:
Overburden thicknesses are nominal values for the respective sites. The maximum overburden thickness at any site is 450 feet. (site 1200.)
Figure 5  Relationship Between Probability of Sinkhole Subsidence and Overburden Depth for the Colorado Springs Coal Field (Matheson and Bliss, 1986)
Figure 6  Relationship Between Probability of Sinkhole Subsidence and Overburden Depth for the Hanna Mining District (Karfakis, 1987)
Figure 7  Schematic Presentation of Caving Progress and Trough Subsidence (Maleki, 1986)
Figure 8  Safety Zone for Mining Under Bodies of Water (Babcock and Hooker, 1977)
Figure 9  Overburden Thickness Subsidence Profile Along Section A-A'