

## INTRODUCTION

The Subsidence Control Plan contained herein for Federal Coal Leases Salt Lake 062648 and Salt Lake 050655 addresses specifically those items that are required by UMC 784.20 on pages 90-91 and UMC 817.121-.126 on pages 229-231 of the "Regulations Pertaining to Surface Effects of Underground Coal Mining Activities (including regulations for coal exploration), Final Rules of the Utah Board and Division of Oil, Gas and Mining," dated 9-20-82.

This plan is an amendment to the original application filed on December 17, 1980, by Genwal Coal Company, Inc. and the SUBSIDENCE CONTROL PLAN FOR GENWAL COAL COMPANY, INC. as prepared by David A. Skidmore and L.G. Manwaring of COAL SYSTEMS, INC. on August 28, 1981. The format of the approved COAL SYSTEMS report will be used with the conclusions based upon the results of the recent drilling which was obtained in April 1985. The original application was submitted pursuant to the following: Title 40, Chapter 10, Utah Code annotated 1943, as amended, the "Cooperative Agreement between the United States Department of Interior and the State of Utah"; the Surface Mining Control and Reclamation Act (P.L. 95-87); and all regulations promulgated under those Acts affecting mining operation conducted in the State of Utah.

Since the original submittal, several operational and construction modifications have been submitted to satisfy regulatory compliance requirements.

## MINING - GENERAL

### History

The mine will be installed in an area of old works in the Hiawantha seam. Coal was produced from this operation during the period 1940 through 1955 and was sold locally for domestic use.

Certain sections of the mine will be reopened so that water sump, ventilation and coal haulage facilities can be reestablished. Item XII-2 in the Appendix illustrates the manner in which the old workings were modified and repaired in order to bring them into compliance with modern regulations and the overall mining plans of Genwal Coal Company.

Where necessary, the workings were widened to accommodate a 42-inch coal haulage conveyor and proper supports will be placed in areas of questionable roof control.

There is no way to monitor the effects of subsidence from the old workings. Item XII-2 indicates the preferred location of the intake, return and conveyor entries.

### Future Mining

The mining operation will access only the Hiawantha seam by drifting into the seam from the coal outcrop as the recently completed drilling indicates no areas of mineable coal in the upper seams. The portal area for the Hiawantha seam will have three entries: one intake ventilation entry which will also serve as a haulage route, one neutral coal haulage conveyor entry and one return airway. The portal access area for the mine will have the necessary surface support items such as a fan, conveyor belt drive, power, etc.

The following description of the general mining sequence will apply to the Hiawantha seam. No development is anticipated in any of the upper seams as they are too thin to be economically recoverable. The projected mining plan for the Hiawantha seam is illustrated on Item XII-2 and as presented below:

1. Portal area excavated.
2. Actual portals established.
3. Permanent fan installation for exhaust ventilation.
4. North Mains developed.
5. North Mains completed to intersection with planned First West Mains.
6. First West Mains developed.

7. First West Mains completed.
8. Development of First South Panel off First West Mains.
9. Pillar recovery of First South Panel.
10. First South Panel sealed.
11. Development of Second South Panel off First West Mains.
12. Pillar recovery of Second South Panel.
13. Second South Panel sealed.
14. Pillar recovery of barrier pillars and First West Mains.
15. Pillar recovery of barrier pillars and North Mains.
16. Portal of mine sealed.

#### Pillar Recovery Plan

The proposed pillar recovery plan currently under review by MSHA, DOGM and the USFS was designed by Genwal employees with the aid of MSHA Technical Support in Denver and information in a technical report COAL PILLAR SIZING, GENWAL MINE prepared by Mr. Dan W. Guy of Blackhawk Engineering Co. on 10/1/84. The proposed pillar plan is preferred because of the inherent safety feature that a solid rib of coal will be on the miner operators right at all times as the actual mining takes place.

The purpose of the Blackhawk Engineering Report was to evaluate the use of 60' x 60' centers on the entries and rooms as shown in the Appendix as Item XII-2. The major assumptions used in the analysis were an average coal compressive strength of 1400 psi, a mining height of 6 feet, an entry width of 20 feet, an overburden pressure gradient of 1 psi per foot of depth and a minimum acceptable safety factor of 1.3 in the panel areas. The conclusions of this report state that the remaining 40 foot square pillars will have a safety factor of 1.39 or greater in areas with less than 1000' of cover which is acceptable for short term entries. A copy of this report can be found in the Appendix as Item XII-5.

During secondary mining, half of the coal pillar is removed by taking four cuts across the side or across the front of the pillar as shown in the submitted Pillaring Plan which is currently under review by MSHA. A copy of the Pillaring Plan can be found in the Appendix as Item XII-6. No bolting will be required after the panels have been developed and all additional roof support will be provided by timbers spaced on 5 foot centers. Controlled caving is anticipated once half the pillar has been removed and all personnel are clear of the area.

The sequence of pillar extraction is shown within the Pillar Recovery Plan. The pillars may be removed from either the right or left hand side as long as the row is pulled in its entirety

from one direction. It is anticipated that this method of pillar removal will yield an overall recovery factor of near 70%.

### SUBSIDENCE CONTROL PLAN

#### Geology

The coal seam to be mined on the Genwal leases occur in the lower part of the Blackhawk Formation. The Formation is comprised of approximately 1000 feet of gray carbonaceous shales, siltstones, coals and interbedded sandstones of late Cretaceous Age. The Star Point Sandstone, a massive cliff forming 700 to 900 foot thick sandstone unit, underlies the Blackhawk Formation and its top serves as a useful lithologic landmark in the area.

The formations in the area dip gently (1-3 degrees) westward off the west flank of the San Rafael Swell. The regional structure is broken by several north-south trending, high angle normal faults which offset the rocks from less than 10 feet to 250 feet or more.

The Hiawantha seam is the only seam to be mined on the leases with an average thickness of 6 feet. The coal within the permit area is a high volatile bituminous type. The seam will be entered into at an elevation of 7895 feet. The old works in the Hiawantha seam are accessible and it appears that the immediate roof is a competent laminated to massive sandstone interrupted by an occasional shale-siltstone lens varying in thickness from approximately 6 inches to 2 feet. Falls of roof in the old works are confined to the siltstone lenses and where observed are usually at intersections of rooms and entries. Falls are generally over the width of the opening extending rib to rib.

The floor of the coal seam grades from a clayey shale less than 1 foot thick to laminated sandstone, as observed in the old Hiawantha works.

#### Overburden

The term "subsidence" applies to the deformation or movement in the overburden two or more mine entry heights above the immediate mine roof. The overburden thickness ranges from zero at the outcrop to over 1000 feet. The strength of the overburden is typical of the late Cretaceous sediments that are mined in Eastern Utah and Western Colorado.

It is accepted practice in this area to use two sources of information for subsidence evaluation. The sources are: 1) "Some

Engineering Geologic Factors Controlling Coal Mine Subsidence in Utah and Colorado", Geological Survey Professional Paper 969, by C. Richard Dunrud, 1976, and (2) "SME Mining Engineering Handbook", Volume 1, by Arthur B. Cummins and Ivan A. Given, 1973.

The conclusions based upon the above source material are tempered by some on site review and actual experience based on similar mining conditions in late Cretaceous overburdens with similar thicknesses and strengths.

Regarding those surface areas within the leases, the topographic map Item XII-3 in the Appendix indicates the relatively steep sloping sides of Crandall Canyon which contains Crandall Canyon Creek. There is little or no talus slope and rock outcrops are abundant.

#### Surface Features

The Statement of Fact found as Item XII-1 in the Appendix confirms that there are no man made structures inside the property boundary that would require subsidence control planning. The accompanying photo, Item XII-7 in the Appendix, and Items XII-2 and XII-3 of the area also confirm Mr. Wollen's conclusions.

Furthermore, there appears to be no springs or creeks on the proposed permit area. However, Crandall Creek is located within 200 feet horizontally and about 120 feet vertically from the boundary line of the property. Item XII-3 indicates the relative position of Crandall Creek to the lease boundary.

There are no plans to backfill any area of the mine with waste material in order to reduce subsidence.

Crandall Creek comes no closer than 205 feet to the lease boundary as shown on Figure 1 and on Item XII-3 which occurs in the southwest corner. Calculations and the results shown on Figures 1 and 2 indicate that the subsidence will occur no closer than 200 feet from the centerline of Crandall Creek using a 30 degree angle of draw and a 50 foot barrier pillar along the southern boundary. An angle of draw equal to 69 degrees or greater is required before the area within 40 feet of Crandall Creek becomes subject to any possible subsidence. This magnitude of draw angle in shale and sandstone formations is unrealistic.

#### Calculations

The main objectives of this plan are to delineate the areas

FIGURE 1.

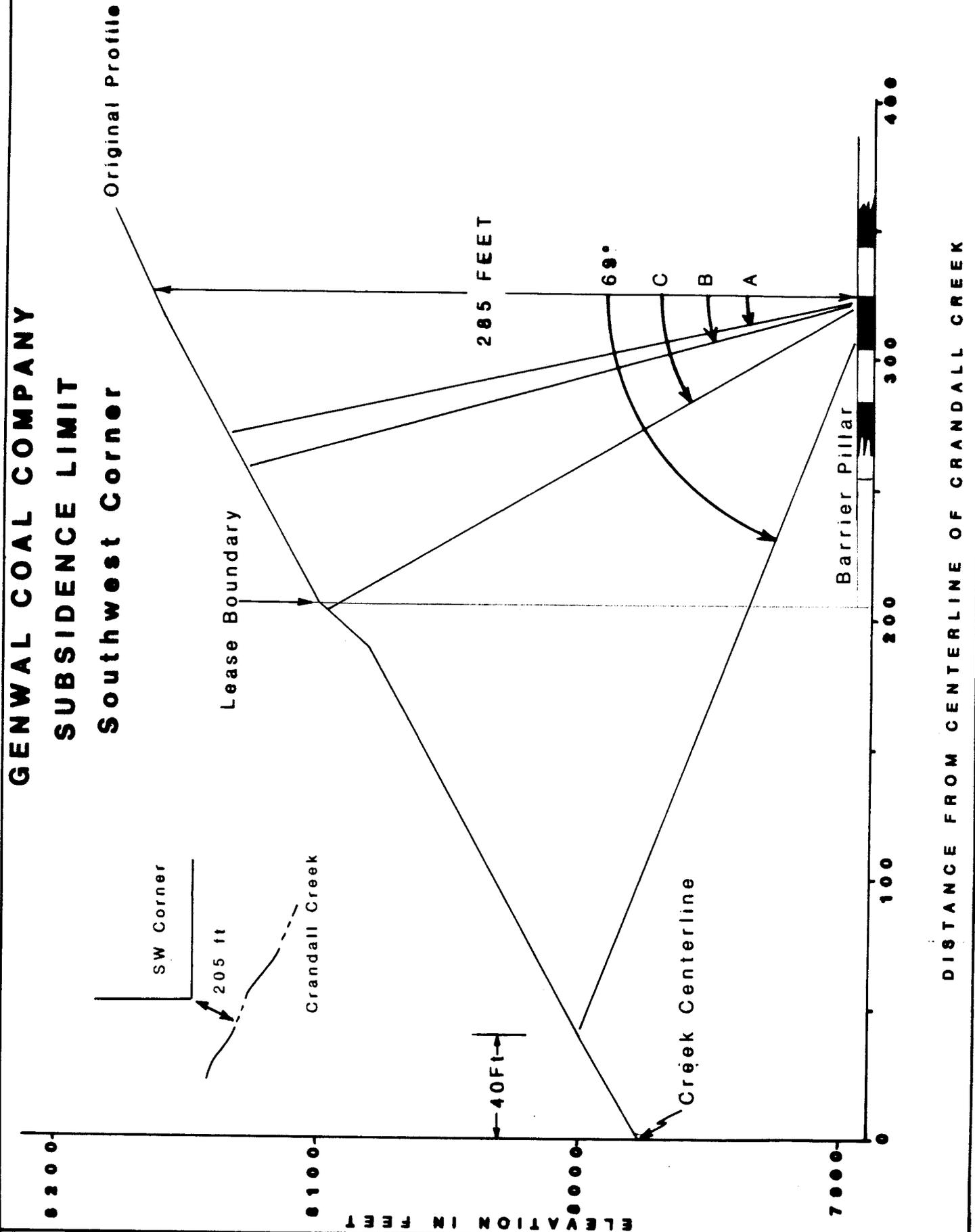


FIGURE 2

Definitions for Figure 1.

A. This angle is equal to 12 degrees and is the complement of the break line angle. This angle also corresponds to the area shown in the plan view Item XII-4 labelled as area "A"..

B. Angle "B" is equal to 15.5 degrees and represents the maximum break line found at the Geneva Mine, Utah as discussed in the USGS Professional Paper 969 on pages 4 and 34. It is felt that some form of deformation will take place in this area. Item XII-4 indicates this area with the letter "B".

C. Angle "C" represents that area where light to moderate subsidence will be experienced. This also represents the expected extent of the subsidence. Item XII-4 denotes this area with the letter "C" which is equal to the angle of draw, being 30 degrees, multiplied by the overburden depth less the effect of sloping topography.

D. This area will experience little or no subsidence.

within the lease and adjacent lands that may be affected by subsidence and to determine the extent of the disturbance as shown in the Appendix as Item XII-4.

Significant guiding design criteria are as follows:

1. A 50 foot barrier pillar will be maintained on the lease directly adjoining the southern boundary and an approximate 100 foot barrier along the northern boundary.
2. Research indicates that a 30 degree positive limit "draw angle" should be used to project maximum extent of subsidence in the Eastern Utah/Western Colorado coal mining region as shown on Figures 1 and 2.
3. The area most likely to experience the maximum amount of subsidence is in the area of greatest coal thickness, which is 7 feet on the existing leases.

Southwest Corner

Tangent  $30 \times 279$  feet of overburden = 161.1 feet (use 160)  
No radius was drawn on Item XII-4 as a result of the work on Figures 1 and 2 showing the maximum limit of subsidence occurring at the lease boundary due to the surface topography. No additional barrier pillars will be required to protect Grandall Creek.

Northwest Corner

Tangent  $30 \times 930$  feet of overburden = 536.9 feet (use 535)  
A radius of 535 feet from 40 feet within the northwest corner was used to inscribe an arc which defines the limit for possible subsidence.

Northeast Corner

Tangent  $30 \times 580$  feet overburden = 334.9 feet (use 335)  
A radius of 335 feet from 20 feet within the northeast corner was used to inscribe an arc which defines the limit for possible subsidence.

Southeast Corner

The coal outcrops near this corner, but for simplicity sake, the boundary line of the lease was extended to this corner and made to follow the south boundary line of the lease to the W1/4 corner of Section 5. Here again the overburden increases sufficiently to extend the permit area beyond the lease boundary.

Amount of Subsidence

Maximum surface subsidence anticipated will amount to

approximately 90% of the seam thickness. Refer to Item XII-2 for the areas of maximum subsidence of approximately 6.3 feet.

#### DESCRIPTION OF PERMIT AREA

Item XII-4 was constructed from the previous calculations to define the expected aerial extent of possible subsidence for the Crandall Canyon Mine. The largest magnitude of subsidence anticipated is 6.3 feet at a point 40 feet east of the section line between Sections 5 and 6 and 1522 feet south of the section line between Sections 32 and 5. The average coal height across the property is 6 feet and the average vertical displacement should be less than 5.4 feet.

The unusual configuration of the area of possible subsidence on Item XII-4 is the result of calculations based on the thickness of the Hiawantha Seam and the depth of overburden at the lease boundary. The larger radius in the northwest corner is due to the thicker overburden in this area.

The legal descriptions of Federal Leases Salt Lake 062648 and Salt Lake 050655 are the SW1/4NW1/4 Section 5 and SE1/4NE1/4 Section 6, Township 16 South, Range 7 East of the Salt Lake Base Meridian encompassing 80 acres more or less.

Item XII-4 indicates the approximate location of each subsidence monitoring monument or station. Those monuments designated with the letter "D" are to be placed outside of the projected disturbed areas and therefore will be unaffected by any subsidence. These monuments may also be used as the datum monuments for the other monuments.

Those monuments prefixed with the letter "C" should show slight indications of subsidence. These movements may be relatively small, in the order of 0.7 feet.

Those monuments with the prefix "L" will be the indicators of rapid subsidence in areas of 400 feet to 800 feet of overburden. Movement at those stations should be noticed within two to three months after caving begins in the Hiawantha Seam. This time may be reduced if the overburden is thinner or increased if thicker.

The subsidence monitoring will be performed as discussed in the meeting held on May 10, 1985 in Salt Lake City with Messrs. Wayne Hedberg and Lowell Braxton representing the Division of Oil, Gas and Mining and Messrs. Andrew King and Leonard Witkowski

representing Genwal Coal. Subsidence monitoring stations labelled D-1, D-2, D-3, C-1, C-2 and L-1 as shown on Item XII-4 will be installed before any secondary recovery begins. Vertical as well as horizontal control will be established on these six stations. The US Forest Service in the mean time is preparing an aerial monitoring system for Genwal's review and possible acceptance. The US Forest Service method has been acceptable for other permittees in Utah. Based upon the estimated costs of the aerial photography versus field surveying the means of monitoring will be determined. If the USFS plan is adopted it will be sent to DOGM as a modification for approval. If the USFS plan is not adopted by Genwal before August 1, 1985 the remaining monitoring points will be installed and the following plan will remain in effect.

The monitoring sequence should begin with the stations prefixed with "L" as soon as the pillaring begins and should be monitored at no less than three week intervals until movement is detected and recorded if access is available. Thereafter, monitoring every quarter should be sufficient. After the second quarter, monitoring should begin on all "C" stations within the panel's immediate vicinity. Once the mining is completed or there is no longer any indication of horizontal or vertical movement in the "C" or "L" series of stations, the monitoring of the "D" stations should begin, and should continue until it can be determined with certainty that no further movement will occur.

As the mining plan is developed and before the retreat mining is to begin, the monuments should be placed in the proper position as recommended in this plan. The following information should then be forwarded to the proper authority:

1. A complete list of monuments with beginning horizontal and vertical coordinates.
2. A current map of the underground workings with areas delineated as to where the second mining will begin.
3. The date when second mining will commence and terminate.
4. The date of movement occurrence.
5. The total subsidence observed at each station.

APPENDIX