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State of Utah  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF OIL, GAS AND MINING

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June 28, 1995

John Pappas  
Sr. Environmental Engineer  
Cyprus Plateau Mining Corporation  
Star Point Mine  
P.O. Drawer PMC  
Price, Utah 84501

Re: Remaining Deficiencies for Crandall Canyon Reclamation, AMAX Coal Company, Castle Gate Mine, ACT/007/004-DO94A and 95D, Folder #3, Carbon County, Utah

Dear Mr. Pappas:

The Division has completed a review of the information you provided on April 20, 1995, in regard to reclamation of the Crandall Canyon area. The analysis is enclosed for your information and files. Please review it carefully. While a number of issues have been adequately addressed, you will note that there remain a number of deficiencies with the plan. You are still under obligation through Division Order 94A to correct the problems. We recognize that parts of the Crandall Canyon area are currently being considered for inclusion to the proposed Willow Creek Mine and encourage you to consider the importance of coordinating the two plans. The Division is anxious to bring this permitting process to a close. Please provide the required information by no later than August 15, 1995.

If you have any questions, please call me.

Sincerely,

A handwritten signature in cursive script that reads "Daron R. Haddock".

Daron R. Haddock  
Permit Supervisor

enclosure

cc: P. Grubaugh-Littig  
S. Falvey  
P. Baker  
W. Western

coverrand.cas

State of Utah  
Division of Oil, Gas and Mining  
Utah Coal Regulatory Program



Technical Analysis  
Castle Gate Mine  
Crandall Canyon  
ACT/007/004  
June 28, 1995

# TABLE OF CONTENTS

<b>TECHNICAL ANALYSIS</b> .....	1
<b>INTRODUCTION</b> .....	1
<b>SUMMARY OF OUTSTANDING DEFICIENCIES</b> .....	1
<b>ENVIRONMENTAL RESOURCE INFORMATION</b> .....	7
<b>VEGETATION RESOURCE INFORMATION</b> .....	7
<b>RECLAMATION PLAN</b> .....	9
<b>POSTMINING LAND USES</b> .....	9
<b>PROTECTION OF FISH, WILDLIFE, AND RELATED ENVIRONMENTAL VALUES</b>	11
<b>APPROXIMATE ORIGINAL CONTOUR RESTORATION</b> .....	13
<b>BACKFILLING AND GRADING</b> .....	14
<b>MINE OPENINGS</b> .....	16
<b>TOPSOIL AND SUBSOIL</b> .....	17
<b>ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES</b> .....	18
<b>HYDROLOGIC INFORMATION</b> .....	19
Water quality standards and effluent limitations. ....	20
Diversions. ....	20
Sedimentation ponds. ....	22
<b>REVEGETATION</b> .....	25
General requirements. ....	25

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

# TECHNICAL ANALYSIS

## INTRODUCTION

This Technical Analysis is conducted for the Crandall Canyon Mine for that portion of the plan related to the Division Order issued on August 19, 1994 (DO 94) items 3 through 6. The Permittee submitted this information on April 20, 1995. Additional requirements and comments beyond the scope of the Division Order were provided where possible. The bonding information from DO 94 number 7 was proposed to be submitted at this time but was not included.

The Price River Coal Company (original) permit issuance and technical analysis was completed for all portions of the mine other than the Crandall Canyon Area on May 24, 1984. The original permit issuance and technical analysis for the Crandall Canyon Area were completed February 19, 1982.

In the April 20, 1995, submittal, the Permittee proposes retaining portions of the operation west of pond 15 in the Castle Gate Mine permit. Portions of the surface facilities east of pond 15 would be transferred to the proposed Willow Creek Mine permit area. The Portion retained under the Willow Creek permit would not be reclaimed until determined to be unnecessary for mining operations.

The Permittee should consider potential problems with having the Crandall Canyon area under two separate permits. The site would be subject to two separate inspections, separate bonding requirements, and potential redisturbance of reclaimed areas if additional space is required for mining activities in the canyon.

The portion of the permit to be retained by Willow Creek has not been reviewed by the Division at this time to determine if it meets the requirements for the Operational phase under the Willow Creek permit application. Earlier reviews of recent submittals included a general review and determination of adequacy for pond designs and the general operational configuration for the facilities regarding their current use. Division Order deficiencies and Review for the Crandall Canyon area were based on the reclamation phase, as it was the intent of the mine to proceed with reclamation. Outstanding deficiencies in the plan in regard to the Division Order are the principle subject of this review.

The Permittee's proposal to retain the road, pads, culverts and other structures within the canyon are subject to alternate post mining land use requirements. However, the plan fails to address regulatory requirements associated with the retention of such facilities. Acceptance of the reclamation plan is based on the approval of the post-mining land use. A complete technical review cannot be achieved until the Division approves the proposed postmining land use change. The post mining land use change and the proposal to retain permanent structures may also require a variance from the approximate original contour.

## SUMMARY OF OUTSTANDING DEFICIENCIES

A summary of the major deficiencies found in this submittal is provided below. Upon finalization of the T.A., any outstanding deficiencies will be evaluated for compliance with the regulatory

**TECHNICAL ANALYSIS**

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requirements. Such deficiencies are currently conditioned to the requirements of the permit issued by the Division.

Accordingly, the Permittee must address those deficiencies as found within this Draft Technical Analysis and reiterated issues previously identified in DO 94 must be provided, prior to approval, in accordance with the requirements of:

Page

- R645-301-200 restated from DO 94 #2, demonstrate that adequate topsoil is available for the currently approved 6" final cover depth over the disturbed areas in Crandall Canyon. Mass balance calculations for topsoil as well as a discussion of the total acreage to receive topsoil and the volume of topsoil available within the disturbed area should be provided in the text of the plan. Any disturbed areas within the Crandall Canyon area or the access road area which will not receive topsoil as part of reclamation must be clearly delineated on the maps, and adequate reclamation treatments must be described for those areas in the plan. The Permittee must provide plans to show adequate soil/spoil preparation plans (i.e. deep ripping to 18-24 inches) prior to the application of borrow soils or hydroseeding. Testing of the regraded spoil for fertilization requirements (1 samples/2.5 acres) or other approvable methodology must be included in the reclamation plan. A field sampling program must be proposed and should be undertaken to determine the nature of the top four feet of material remaining in the location of the Crandall Canyon facilities after backfilling and grading to determine that the material is not acid/toxic forming. Spoil materials remaining on the site must be characterized for their acid/toxic forming potential. Testing parameters proposed should be in accordance with Division "Guidelines for Topsoil and Overburden Management". Any alternate plans or treatments regarding designs and demonstration of compliance with the requirements of this section for the Crandall Canyon area must also include any changes to other sections of the plan as such alternatives may necessitate. . . . . 18**
- R645-301-300.133.710 and R645-301-358, the Permittee has not demonstrated that revegetation, as required under the State Program, is feasible for the riparian areas that must be revegetated to a condition similar to the riparian reference area. The permittee must restore or enhance riparian areas using the best technology currently available to enhance fish and wildlife and related environmental values. . . . . 31**
- R645-301-301-358, provide a plan that meets the postmining land use for undeveloped lands. The ponds must be removed, or the permittee must demonstrated that these ponds provide wildlife enhancement and meets all applicable regulatory requirements for retention of a permanent Pond. . . . . 12**
- R645-301-321, provide a complete data set from the original Mariah vegetation report, or comparable data. If information describing the vegetation in the**

**TECHNICAL ANALYSIS**

disturbed area prior to disturbance is available, it should be included in the plan. . . . . 8

**R645-301-340**, the permittee must provide a mulching plan in Section 3.7 of Chapter 3 that is consistent with Chapter 9 per R645-301-121. Chapter 9 says no less than two tons per acre of straw or hay will be applied when straw or hay is used as mulch. Chapter 3 says only one ton per acre will be used. . . . . 30

**R645-301-353.140**, as required by R645-301-341, R645-301-353, and R645-301-356, the Permittee needs to propose erosion control success standards to show how they will comply with the biological protection performance standard of stabilizing the soils surface from erosion. . . . . 30

**R645-301-353**, the Permittee must provide a plan under which it is possible to meet diversity standards. In order to meet these standards, the Permittee needs to provide plans to establish conifers on north-facing slopes of Crandall Canyon. Diversity standards need to be applied to the leach field area and the slopes north of Shaft No, 1. . . . . 30

**R645-301-356**, the Permittee must identify the specific reference areas to be used to compare to each identified vegetative reclaimed area. . . . . 31

**R645-301-358**, a demonstration that power poles meet raptor habitat requirements. The Permittee needs to determine which poles are currently being used or are needed for raptor habitat, and meet postmining land use requirements. Structures not suited to the postmining land use must be removed as required by **R645-301-541.300** . . . . . 13

**R645-301-400**, incorporate into the plan, information necessary to identify and justify the postmining or alternate post mining land uses within the Crandall Canyon area and justify the retention of any permanent structure according to the requirements of R645-301-400. Any changes to the post mining land use or proposal for retention of structures for facilities which are not currently part of the approved plan must be submitted in accordance with the requirements of R645-301-414 and meet the requirements of R645-301-400 and DO 94 #4, issued on August 19, 1994 . . . . . 11

**R645-301-413.210**, land areas which the Permittee uses to compare the premining uses of land to the postmining land use will have been properly managed. The comparisons of channel configuration to the area west of the disturbed area does not appear to constitute an area that was properly managed. . . . . 25

**R645-301-500 restated from DO 94 #5**, the permit application must include site specific plans that incorporate the design criteria for reclamation activities. These design criteria and plans shall include, but not to be limited to: phased reclamation treatments and designs throughout the permit liability period; designs for temporary and permanent surface features, including diversions, impoundments, sediment control structures, and other facilities which will

**TECHNICAL ANALYSIS**

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require construction throughout the reclamation process; specific plans and details for all permanent facilities to remain as part of or in conjunction with post mining land use, including roads, utilities, and structures; and maps and drawings which clearly show the areal and vertical extent of the existing facility areas and those areas throughout all phases of reclamation. Information within the Crandall Canyon Plan does not specifically address the above requirements for the elimination of all structures and facilities including the mine access road, culverts ponds, and pad area. Disturbed areas must be backfilled and graded to: achieve the approximate original contour; eliminate all highwalls, spoil piles, and depressions; achieve a postmining slope that does not exceed either the angle of repose or such lesser slope as is necessary to achieve a minimum long-term static safety factor of 1.3 and to prevent slides; minimize erosion and water pollution both on and off the site; and support the approved postmining land use. The backfilling and grading plan must include sufficient mass balance calculations to incorporate the amount of material required as backfill for the mine shafts if backfilling of the two mine shafts is proposed for reclamation. [ed.] Hydrologic impact regarding groundwater and potential effects on groundwater and stability of the backfilled material in the shafts must also be represented in the plan. . . . . 16

**R645-301-513, R645-301-551 and R645-301-631**, provide the Division with adequate information to make a finding which ensures long-term safety for the permanent seal. The Division requests a safety factor be determined for the designed seal. A prudent engineering design will have a safety factor of 2.5 or greater and is a standard employed by the Division for abandoned mines. The seals must be designed to prevent water contact with the steel so that the steel members will not rust. . . . . 17

**R645-301-527. Transportation Facilities**, classification of the leach field road as either a primary or secondary road as used by the current state and federal regulations. . . . . 19

**R645-301-700 restated from DO 94 #6**, the operational plan must be specific to the local hydrologic conditions and will contain steps to be taken during coal mining and reclamation operation though bond release. Hydrologic maps and supporting calculations for the Crandall Canyon facilities and the access road must be provided which show the surface hydrology and drainage and sediment control facilities to be used throughout all phases of operations and reclamation. The Permittee shall submit a reclamation plan for all phases of reclamation indicating how the relevant requirements for R645-301-730 through R645-301-760. will be met. The Permittee must correct the plan to include monitoring plans for ground water an surface water during reclamation through final bond release. These monitoring plans should reflect the requirement of R645-301-731.200, and must reflect the language of R645-301-731.212, R645-301-731.233, R645-301-731.214, and R645-301-731-224. . . . . 24

**TECHNICAL ANALYSIS**

Last revised - June 29, 1995

**R645-301-731**, a demonstration that the water quality monitoring plan is adequate to monitor for compliance with effluent limitations, and provide a PHC to cover the phases of reclamation and bond release. . . . . 24

**R645-301-733.220**, demonstrate that the retention of the ponds meets premining land use, or request a change in the post mining land use. The Permittee must demonstrate that the requirements of R645-301-733.220 (et. seq.) and applicable R645 requirements for permanent pond retention have been met. . . . . 25

**R645-301-742.110**, submit a design for BTCA methods to be employed in areas not reporting to the sediment pond. All disturbed area drainage must be clearly depicted on appropriate maps and identified with their respective sediment control measure. A disturbed area acreage calculation for each area and a description of the methods and elements used to comply with R645-301-724.110 must be submitted. . . . . 25

**R645-301-760 and R645-301-740**, provide the riprap gradation for the proposed channel designs in order to make a finding that the channels are designed to be stable. The Permittee's plan states that riprap gradation for the diversion channel is not provided because of the possibility that the final configuration of the channel may vary from the reclamation design. This statement must be removed in order to provide a clear and accurate plan that meets the requirements of R645-301-533 which says, "Backfill and grading design criteria must be described in the permit application." . . . . . 24

**R645-301-762.100 and R645-301-553.100 et. seq.**, provide disturbed area contouring drainage and channel reclamation designs that are backfilled and graded to achieve approximate original contour or restore natural drainage patterns. . . . . 24

**TECHNICAL ANALYSIS**

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## TECHNICAL ANALYSIS

Last revised - June 29, 1995

# ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR Sec. 783., et. al.

## VEGETATION RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.19; R645-301-320.

### Analysis:

Baseline vegetation information is found in Chapter 9, Appendix 9-1, of the existing mining and reclamation plan. Vegetation types in the disturbed area were mixed brush, conifer, grass-sage, riparian bottom, and previously disturbed. Three reference areas were established in Crandall Canyon. They are conifer, pinyon-juniper, and riparian bottom. The pinyon-juniper reference area would only be used for judging revegetation success in an area of Barn Canyon formerly proposed for disturbance. Additional reference areas that would be used for judging revegetation success in Crandall Canyon are the Castle Gate mixed brush and the Barn Canyon grass-sage reference areas.

The Crandall riparian reference area had vegetation cover of 47%. Dominant species included narrowleaf cottonwood, bluegrass, an aster, and some weedy plants. Some of the other woody plants were bigtooth maple, Gambel oak, snowberry, juniper, Douglas fir, and ponderosa pine. Thirty-six species were found in this reference area.

Vegetative cover in the Crandall conifer reference area was 74%, mostly from Douglas fir and ponderosa pine. Other frequently occurring plants included snowberry and perennial grasses. Twenty-three species were encountered in this reference area.

The Crandall pinyon-juniper reference area had 53% total vegetative cover comprised primarily of intermediate wheatgrass, western wheatgrass, pinyon, juniper, and curleaf mountain mahogany.

The two other reference areas proposed as standards for revegetation success are outside Crandall Canyon. The Castle Gate mixed brush and Barn Canyon grass-sage reference areas had 41 and 53% vegetative cover, respectively. Dominant species are typical for these vegetation communities, including *Agropyron* sp. (probably salina wild rye rather than a wheatgrass), sagebrush, Utah serviceberry, and fourwing saltbush.

The summary information in Appendix 9-1 is not complete and needs to be supplemented with the complete set of raw data. It is difficult to base a reclamation plan on a list of four or five dominant species. In addition, the Division normally requires sampling of areas proposed for disturbance before they are disturbed. This information may not exist, and it would be impossible to obtain it now. If it is available, however, it should be included in the plan.

### Findings:

## TECHNICAL ANALYSIS

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The permittee has failed to meet the requirements of R645-301-320. The permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-321**, provide a complete data set from the original Mariah vegetation report, or comparable data. If information describing the vegetation in the disturbed area prior to disturbance is available, it should be included in the plan.

## RECLAMATION PLAN

### POSTMINING LAND USES

Regulatory Reference: 30 CFR Sec. 784.15, 784.200, 785.16, 817.133; R645-301-412, -301-413, -301-414, -302-270, -302-271, -302-272, -302-273, -302-274, -302-275.

See: DO 94 #4, issued on August 19, 1994.

#### Analysis: Crandall Canyon

The Permittee proposes the post mining land use will be wildlife habitat and grazing according to the text on page 3.7-31. The Permittee has proposed the post mining land use also include a **potential** for recreation and residential use. The Permittee suggests this use is identified as a premining land use and indicates a request for alternative land use is not required.

The proposed changes to the plan in Section 3.7-4(7) state that historical studies indicate several structures were built in the canyon in conjunction with residential use. These structures were abandoned at the time of permit application (1980). Crandall Canyon had not been used for coal mining operations prior to development of the existing facilities. Prior to mining, the area did have some recreational use, as noted in the plan, for picnicking and hunting.

The Permit Application Package (PAP) also indicates, in Section 3.7-5(2)(3), the primary reason for leaving the features (roads, pads, diversions, etc.) is to enhance the postmining land use for livestock grazing and wildlife habitat. Because the permittee feels the retention of these structures will benefit the post mining land use, the permittee states in the plan that a request for an alternative land use is not required. However, the permittee further indicates the proposed permanent features meet the alternative land use criteria requirements enumerated in R645-301-413. Those criteria are stated in the plan as follows:

- There is a reasonable likelihood that the flat areas to remain in the reclamation plan will be used for livestock and wildlife grazing,
- The permanent features do not pose a hazard to the public health and safety (see section 3.7-5(3)(3) for Hilfiker stability),
- Water quality of the reclaimed area will be enhanced by leaving the ponds to collect eroded sediment,
- The use of these features to create the available flat pad areas and watering holes is both practical and reasonable,
- The permanent features and associated land use are in agreement with Carbon County land use policies,

## TECHNICAL ANALYSIS

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- Incorporation of these permanent features into the reclamation plan will not result in a delay to implementation of the reclamation plan, and
- Leaving the above-mentioned features as permanent is not a violation of Federal, State, or local laws.

The existing plan Section 3.7-5(1) (revised September 1991) states "These uses [residential recreational, and sheepherding] may have existed as long as fifty years ago and hold no true significance for the undeveloped state through natural succession". The Permittee states the pre-mining land use is primarily the undeveloped, un-managed land as described under **R645-100-200 Land Use**. The Division determined that the "Un-managed Land" definition accurately describes the pre-mining condition in the February 19, 1982 Technical Analysis and Permit Issuance for the Crandall Canyon area. The un-managed land is defined for previously developed lands "... if previously developed, that land has been allowed to return naturally to an undeveloped state". Supporting documentation comes from the Walker Report in Appendix 5-A. The Technical Analysis also indicates the postmining land use would be returned to the premining land use.

Consequently, incorporation of the road, and other facilities and structures into the postmining land use has a significant impact on potential land uses and constitute development of alternate land uses. Therefore, the Permittee's must include a proposal for a post mining land use to meet the requirements of R645-301-412.130.

Structures and facilities proposed to be left as part of the post-mining land use include, but are not limited to, the access road from Price Canyon to the Crandall canyon mine facilities area, pad areas associated with the current mine facilities area, impoundments currently being used for sediment control, culverts and engineered retaining walls used in the development of the roads and pads within the area.

In order for the Division to allow the retention of the above structures and facilities, a plan accomplishing reclamation to the approved postmining land use of un-developed must first be developed. If alternate postmining land uses, and enhancements to support other land uses are to be approved they must be compared to the premining land use reclamation plan to demonstrate a higher and better use. Additionally, bonding costs for the two alternate reclamation plans will need to be provided by the permittee in order for the Division to determine the amount of bond required in conjunction with approval of the plan. At a minimum, bonding will be required for a reclamation plan which can successfully accomplish reclamation to pre-mining land use conditions.

### **Findings:**

Information regarding postmining land use as required under the Division Order remains inadequate. Enhancements to the land use by allowing the retention of the mine access road and pads associated with the mine facilities constitute an alternate postmining land use. The Permittee must request a postmining land use change to meet the requirements of R645-301-412.130 and the requirements of this section.

The Permittee has failed to meet the requirements of R645-301-400 and DO 94 #4, issued on August 19, 1994. The permittee must provide the following, prior to approval, in accordance with the requirements of:

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

**R645-301-400**, incorporate into the plan, information necessary to identify and justify the postmining or alternate post mining land uses within the Crandall Canyon area and justify the retention of any permanent structure according to the requirements of R645-301-400. Any changes to the post mining land use or proposal for retention of structures for facilities which are not currently part of the approved plan must be submitted in accordance with the requirements of R645-301-414 and meet the requirements of R645-301-400 and DO 94 #4, issued on August 19, 1994 re-stated as follows:

**R645-301-400. restated from DO 94 #5, Land Use and Air Quality.** The Permittee must incorporate into the plan, identify and justify the postmining or alternate post mining land uses within the Crandall Canyon area and retention of any permanent structured according to the requirements of R645-301-400. Any changes, within the entire permit area, to the post mining land use or the retention of structures of facilities which are not currently part of the approved plan must be in accordance with the requirements of R645-301-414, which states:

"Interpretation of R645-301-412 and R645-301-413.100 through R645-301-413.334, R645-302-270, R645-302-271.100 through R645-302-271.400, R645-302-271.600, R645-302-271.800, and R645-302-271.900 for the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, Reclamation Plan: Postmining Land Use. The requirements of R645-301-412-130, for approval of an alternative postmining land use, may be met by requesting approval through the permit revision procedures of R645-303-220 rather than requesting such approval in the original permit application. The original permit application, however, must demonstrate that the land will be returned to its premining land-use capability (emphasis added) as required by R645-301-413.100. An application for permit revision of this type:

414.100. Must be submitted in accordance with the filing deadlines of R645-303-220;

414.200. Will constitutes a significant alteration from the mining operations contemplated by the original permit; and

414.300. Will be subject to the requirements of R645-300-120 through R645-300-155 and R645-300-200."

## PROTECTION OF FISH, WILDLIFE, AND RELATED ENVIRONMENTAL VALUES

Regulatory Reference: 30 CFR Sec. 817.97; R645-301-333, -301-342, -301-358.

### Analysis:

#### Fish and Wildlife Habitat

## TECHNICAL ANALYSIS

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Chapter 9 proposes microtopographic features, such as swales and rises, be created during regrading. Where rocks become available, the Permittee will construct rock piles. Snags and roosts will be constructed whenever materials become available. Wetland areas will be created where topography and hydrology lend themselves to their creation.

The Permittee indicates the sedimentation ponds, proposed for retention, provide habitat for waterfowl, fish, and amphibians. It is unlikely that fish inhabit either of the ponds. They are not large enough and do not have adequate shoreline cover to provide waterfowl nesting habitat. At most, they might be used as resting places for migrating birds. Tiger salamander larvae apparently live in Pond 014. Pond 014 may provide wildlife enhancement however, the Permittee has not demonstrated that it meets all applicable R645-regulations.

In Section 3.7-5(2)(2), the PAP says two water sources will allow the land owner to fence one of the ponds for cattle and allow the other to be used by wildlife. This statement is unclear. If cattle can access a pond, wildlife can also. If one pond is left unfenced for wildlife, livestock will also use it. The same enhanced vegetation created by leaving Pond 015 could be achieved with swales discussed in Chapter 9. The ponds are close enough to each other that there is no need for both ponds to remain after reclamation unless there is some other wildlife habitat enhancement feature associated with leaving both ponds.

A warm season water source in Crandall Canyon is very desirable for wildlife habitat enhancement. Current Division personnel have never seen pond 014 without water, and the vegetation near this pond is indicative of a continual water source. However, other regulatory requirements, such as an adequate stability demonstration, must also be met before the Permittee can leave the pond. Since it appears there is a seep or spring in this area, the Permittee could develop it into a small wetland area with enough free water to provide a wildlife water source.

In Section 3.7-5(3)(1), the application states that primary power poles will remain for raptor habitat. The Permittee needs to determine whether the power poles are being used by raptors. They may also need to be modified. If the poles are being used now, it would demonstrate that they meet the intended use and they could be retained for enhancement or post mining land use. Use would be evidenced by whitewash on the poles or regurgitated bones or portions of animal carcasses at the base. However, any poles not now being used are probably not needed for raptor habitat and should be removed. The Division of Wildlife Resources should be able to provide additional information about what modifications may be needed and which poles are in good locations.

### **Findings:**

The Permittee has failed to meet the requirements of R645-301-358. The permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-301-358**, provide a plan that meets the postmining land use for undeveloped lands. The ponds must be removed, or the permittee must demonstrated that these ponds provide wildlife enhancement and meets all applicable regulatory requirements for retention of a permanent Pond.

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

**R645-301-358**, a demonstration that power poles meet raptor habitat requirements. The Permittee needs to determine which poles are currently being used or are needed for raptor habitat, and meet postmining land use requirements. Structures not suited to the postmining land use must be removed as required by **R645-301-541.300**.

### APPROXIMATE ORIGINAL CONTOUR RESTORATION

Regulatory Reference: 30 CFR Sec. 784.15, 785.16, 817.102, 817.107, 817.133; R645-301-234, -301-270, -301-271, -301-412, -301-413, -301-512, -301-531, -301-533, -301-553, -301-536, -301-542, -301-731, -301-732, -301-733, -301-764.

#### Analysis:

The objectives of backfilling and grading should be designed to meet the Approximate Original Contour so that the area "closely resembles the general surface configuration of the land prior to mining" and "blends and complements the drainage pattern of the surrounding terrain".

The Permittee has not demonstrated that backfilling and grading operations will:

- 1) Minimize off-site effects;

The Permittee states that in general, leaving the Hilfiker walls in place will minimize the disturbance to the area, reduce the areal extent of erodible slopes and minimize erosion and subsequent sediment loading to the stream. The Permittee has not provided a demonstration to support this argument. The areal extent over time may in-fact be increased due to failure of the Hilfiker retaining wall and create a potential for slumping of the fill material. In order to demonstrate that off-sites effects are minimized a comparison of the potential effects from the land returned to its premining land-use capability to the proposed postmining land use capability would be necessary. The Permittee has not demonstrated the land can be returned to the premining land-use capability as required by R645-301-413.100.

- 2) Achieve a final surface configuration which closely resembles the general surface configuration of the land prior to mining;

Final post mining slope grades shall not exceed approximate pre-mining slope grades. The Permittee suggests that slopes that remain will be flatter than the angle of repose of the material and 2:1. However this is related to regraded areas and not the proposed remaining cut-slopes and Hilfiker walls. Slopes in these areas are greater than 2:1. A demonstration that these slopes have not exceeded premining configuration was not presented.

- 3) Provide a subsurface foundation for a vegetative cover capable of stabilizing the surface from erosion and;

## TECHNICAL ANALYSIS

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The retention of the Hilfiker (Welded Wire Walls) as a permanent structure would not aid in providing a surface cover capable of stabilizing the surface from erosion as this structure degrades over time. The assessment report states "As the walls approach the end of their useful service life, gradual deterioration will begin. Because "failure of MSE walls is a very gradual process, at what ever time this occurs, the progression will be evident. Slumping and eventual tension failure of the reinforcement will likely occur. Free-standing slopes will be very steep and will gradually slump to roughly a two horizontal to one vertical slope. It is not expected that such slopes will ravel back and affect the existing ponds at the site. This gradual process will allow the construction of any necessary remedial measures".

The Hilfiker wall is adjacent to the existing realigned stream channel. It does not appear the analysis has considered potential undercutting of the toe following failure. Thus, increasing the potential for a less gradual failure. Assuming the final configuration to a two to one slope is accurate a potential to disrupt the existing pond 014 is evident. The minimum embankment width is 19 feet and the Hilfiker wall perpendicular to this point is 25 feet (field measurements). A slope this steep probably does not provide a subsurface foundation for a vegetative cover adequate to stabilize the surface from erosion.

#### 4) Support the approved postmining land use

The Permittee states the AOC requirements will be met based on the assumption that the ponds and Hilfiker wall will be retained. The Division has found no justification for retaining the proposed features, as they do not meet the postmining land use. The Permittee's proposed reclamation would require a variance in alternate Postmining Land use and a may need approval for AOC variance.

#### **Findings:**

Findings regarding AOC cannot be determined adequate until such time as the issues related to postmining land use are corrected in the plan.

## **BACKFILLING AND GRADING**

Regulatory Reference: 30 CFR Sec. 785.15, 817.102, 817.107; R645-301-234, -301-537, -301-552, -301-553, -302-230, -302-231, -302-232, -302-233.

See: Division Order 94 #5, issued on August 19, 1994.

#### **Analysis:**

The Permittee proposes the retention of the following structures: Hilfiker retaining wall and corresponding flat pad areas; road P-1; road A-1; leach field and leachfield piping; existing main stream channel alignment; numerous culverts; Pond 014 and Pond 015.

Proposed Backfilling and grading associated with Phase I reclamation will be confined to the removal of culverts CCC-5 and CCC-25, sealing of CCC-6 and reworking of drainage diversions,

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

CCD-5, CCD-7A and CCD-7B (renamed CCRD-5 and CCRD-7), to direct water to the main channel (CCRD-23D). In addition, a minimum of 2 feet of soil will be placed over the tank support footings once the tank support stem walls are demolished. Cut slopes next to road A-1 will remain since the road will not be reclaimed. Cut slopes next to the main channel west of the Phase I boundary would also remain since the channel is proposed to remain in its present configuration. Slopes formed during Phase I reclamation earthwork will be significantly flatter than the angle of repose of the graded soil, and flatter than 2:1. However, existing cut slopes are at greater than 2:1. The volume of earthwork associated with Phase I is summarized in Table 3.7-10.

The primary objective of the proposed backfilling and grading plan associated with Phase II reclamation is to cover the permanent seals of shafts No. 1 and No. 2. No backfill will be placed in the shafts. In addition, drainage diversions CCRD-20-, CCRD-21 and CCRD-22 are proposed to be constructed to rout runoff east along the south side of the facilities pad to the undisturbed stream channel. Culverts CCC-10 and CCC-13 are proposed to be removed. CCC-11 and CCC-12 are proposed to be sealed at both ends and abandoned in place since removal would sacrifice the integrity of the Hilfiker retaining wall system. Cut-slopes south of the pad area are proposed to remain to maximize the availability of the pad. Cut-slopes associated with the main stream diversion are also proposed to remain since the stream alignment will not be altered. The Permittee states the regraded areas will be graded to drain. This conflicts with the proposal to retain a berm at the perimeter of the pad area.

The Permittee's proposal does not meet the pre-mining land use "Un-developed lands" See: "POSTMINING LAND USES" section of this Technical Analysis. The proposed grading plan requires a change in the post-mining land use and a may require a request for Variance from Approximate Original Contour.

Since retention of the pad is incompatible with the premining land use and would require a change in post-mining land use, the cut slopes associated with the pad and the stream channel should be backfilled and graded to approximate the premining configuration. With removal of the Hilfiker culverts CCC-9, CCC-11 and CCC-12 can be removed rather than sealed. Sealing culverts is usually not a procedure used for final reclamation. When removing the culvert creates problem the proper procedure is to backfill them. Culverts can and do corrode overtime and collapse, which causes subsidence piping and increased erosion.

If the Permittee proposes a land use change a demonstration that the Hilfiker wall will meet the stability requirements is necessary. The Hilfiker wall was determined to have a service life of forty to fifty years with maintenance requirements. When the Hilfiker wall eventually deteriorates the slopes will slump. The slope angle of the material will be the approximate angle of repose. Since the safety factor of slopes at the angle of repose by definition is 1 they will not meet the requirements for having a safety factor of at least 1.3. The report of the Hilfiker wall indicates the slumped slopes will eventually stabilize to a 2H:1V slope. On June 7, 1995 Sharon Falvey, of the Division, visited the site. She found that in some areas the angle between the toe of the Hilfiker wall and Pond 014 was greater than 2H:1V. When failure does occur, the pond's embankments would be destroyed. If the Hilfiker walls are requested to be retained the permittee must demonstrate the requirements of R645-301-301-512-260 can be met. It should be noted that the estimated life of 50 years does not promote long-term stability.

## TECHNICAL ANALYSIS

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### Findings:

The Permittee has failed to meet the requirements of R645-301-500 and DO 94 #5. Division Order 94 #5, issued on August 19, 1994 is re-stated: the permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-500 restated from DO 94 #5**, the permit application must include site specific plans that incorporate the design criteria for reclamation activities. These design criteria and plans shall include, but not to be limited to: phased reclamation treatments and designs throughout the permit liability period; designs for temporary and permanent surface features, including diversions, impoundments, sediment control structures, and other facilities which will require construction throughout the reclamation process; specific plans and details for all permanent facilities to remain as part of or in conjunction with post mining land use, including roads, utilities, and structures; and maps and drawings which clearly show the areal and vertical extent of the existing facility areas and those areas throughout all phases of reclamation. Information within the Crandall Canyon Plan does not specifically address the above requirements for the elimination of all structures and facilities including the mine access road, culverts ponds, and pad area. Disturbed areas must be backfilled and graded to: achieve the approximate original contour; eliminate all highwalls, spoil piles, and depressions; achieve a postmining slope that does not exceed either the angle of repose or such lesser slope as is necessary to achieve a minimum long-term static safety factor of 1.3 and to prevent slides; minimize erosion and water pollution both on and off the site; and support the approved postmining land use. The backfilling and grading plan must include sufficient mass balance calculations to incorporate the amount of material required as backfill for the mine shafts if backfilling of the two mine shafts is proposed for reclamation. [ed.] Hydrologic impact regarding groundwater and potential effects on groundwater and stability of the backfilled material in the shafts must also be represented in the plan.

### MINE OPENINGS

Regulatory Reference: 30 CFR Sec. 817.13, 817.14, 817.15; R645-301-513, -301-529, -301-551, -301-631, -301-748, -301-765, -301-748.

### Analysis:

The proposed sealing plan for the two shafts in Crandall Canyon is presented in Appendix 3.7M. The sealing plan consists of placing 6 inch thick concrete slabs over the top of the shaft openings. These seals are presently in place at the minesite and are intended to be temporary to allow easy access in the event that mining operations resume. These seals appear to meet MSHA guidelines for temporary seals.

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

The Permittee proposes to permanently seal the mine during reclamation Phase II at Shaft No. 1 and Shaft No. 2. Each seal will consist of a reinforced concrete slab anchored to the shaft collar. Three Slabs will be used to seal Shaft No. 1, two for the air intake openings, and one for the hoist opening. A single concrete cap will form the seal of Shaft No. 2. The permanent seals have been structurally engineered by Construction Survey Resources under the assumption that the existing temporary seals will be removed. Calculations for the designed permanent seal, are contained in Appendix 3.7N. The slabs will then be covered with a minimum of 2 feet of soil.

While backfilling is the preferred method of shaft seal, the Division will allow seals when backfilling is not practical. Shaft sealing, rather than backfilling of deep shafts, is a common practice in many areas. Since this shaft is approximately 1,600 feet deep, backfilling may not be deemed practicable.

While these caps may function and meet MSHA guidelines for temporary seals, the proposed designs were not demonstrated to be adequate for a permanent seal. These designs do not provide calculations for a safety factor for the permanent seals. A safety factor of 2.5 or greater is generally considered a prudent engineering design for the permanent seals. Additionally, the drawings for the permanent seal show that the I-beams will be exposed. Moisture from inside the mine which comes in contact with exposed steel will cause the steel to eventually rust and lose its strength. Rusting steel also expands and causes concrete spalling. The Permittee has not provided protection of the steel from exposure to water. All steel must be protected from contact with water in order to prevent rust formation.

### Findings:

The Permittee has failed to meet the requirements of R645-301-500. The permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-513, R645-301-551 and R645-301-631**, provide the Division with adequate information to make a finding which ensures long-term safety for the permanent seal. The Division requests a safety factor be determined for the designed seal. A prudent engineering design will have a safety factor of 2.5 or greater and is a standard employed by the Division for abandoned mines. The seals must be designed to prevent water contact with the steel so that the steel members will not rust.

### TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-232, -301-233, -301-234, -301-242, -301-243.

See: Division Order 94 #2, issued on August 19, 1994.

### Analysis:

## TECHNICAL ANALYSIS

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Review of the Topsoil requirements is determined unnecessary until the Permittee fulfills the backfill and grading requirements of R645-301-513.500.

### Findings:

A determination of adequacy for topsoil and subsoil requirements can not be made until the backfilling and grading plan is determined adequate. See: **"BACKFILLING AND GRADING"** in this TA.

Division Order 94 #2, issued on August 19, 1994 is re-stated: the Permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-200 restated from DO 94 #2**, demonstrate that adequate topsoil is available for the currently approved 6" final cover depth over the disturbed areas in Crandall Canyon. Mass balance calculations for topsoil as well as a discussion of the total acreage to receive topsoil and the volume of topsoil available within the disturbed area should be provided in the text of the plan. Any disturbed areas within the Crandall Canyon area or the access road area which will not receive topsoil as part of reclamation must be clearly delineated on the maps, and adequate reclamation treatments must be described for those areas in the plan. The Permittee must provide plans to show adequate soil/spoil preparation plans (i.e. deep ripping to 18-24 inches) prior to the application of borrow soils or hydroseeding. Testing of the regraded spoil for fertilization requirements (1 samples/2.5 acres) or other approvable methodology must be included in the reclamation plan. A field sampling program must be proposed and should be undertaken to determine the nature of the top four feet of material remaining in the location of the Crandall Canyon facilities after backfilling and grading to determine that the material is not acid/toxic forming. Spoil materials remaining on the site must be characterized for their acid/toxic forming potential. Testing parameters proposed should be in accordance with Division "Guidelines for Topsoil and Overburden Management". Any alternate plans or treatments regarding designs and demonstration of compliance with the requirements of this section for the Crandall Canyon area must also include any changes to other sections of the plan as such alternatives may necessitate.

## ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES

Regulatory Reference: 30 CFR Sec. 701.5, 784.24, 817.150, 817.151; R645-100-200, -301-513, -301-521, -301-527, -301-534, -301-537, -301-732.

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

### Analysis:

The main access road (P-1) is proposed to remain as a permanent road (in its configuration prior to reclamation) from the state highway to the west edge of the lower facilities area. Road A-1, starts at the Phase I/Phase II reclamation boundary and accesses the leach field, and is proposed to be retained as a Class III road. The road will connect to the pre-existing jeep road west of the disturbed area. For a road to be retained it must be approved for the postmining land use and shall be classified as a primary road. The road must be designed, constructed and maintained in accordance with the requirements for primary roads and in consideration of the approved postmining land use.

Both the main access road (P-1) and the leach field access road (A-1), follows the general alignment of the premining jeep road. The Permittee indicate the roads were improved, and the grades, fills, and cuts associated with the improved road are not significantly different from those features of the premining road. Consequently, the permittee suggests, the road meets the approximate original contour requirements.

The Culverts left to control runoff in the vicinity of the road are listed in Table 3.7-14.

The retention of the existing roads are considered a change from the premining land use as the road which existed was an unimproved/abandoned jeep road. Road A-1 and P-1 were widened and re-surfaced. Retention of the road in this condition may require an alternate postmining land use as an abandoned road existed prior to mining. Design of the road should be in line with the post mining land use.

### Findings:

The Permittee has failed to meet the requirements of R645-301-527 and DO 94 #5. See: Division Order 94 #5, issued on August 19, 1994. The permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-527. Transportation Facilities,** classification of the leach field road as either a primary or secondary road as used by the current state and federal regulations.

## HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57;  
R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725,  
-301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

See: Division Order 94 #2, issued on August 19, 1994.

**Analysis:**

**Water quality standards and effluent limitations.**

The Permittee states Phase III monitoring will be characterized by establishment of vegetation and compliance with R645-301-880.320 as it relates to water quality, in section 3.7 page 30. However, the Permittee has not demonstrated that the water quality monitoring plan is adequate to monitor for compliance with effluent limitations, and has not provided a PHC to cover the phases of reclamation and bond release.

**Diversions.**

**Phase I**

The Permittee proposes Culverts CCC-5, CCC-6, and CCC-25 be removed or sealed. The road Leach Field and Pond 015 are proposed to be retained as permanent structures.

**Phase II**

The Permittee proposes Culverts CCC-13, and CCC-28, be removed and replaced by stable reclamation channels. Culverts CCC-9 and CCC-11, and CCC-12 will be sealed and abandoned. Culvert CC-10 will be removed.

The Permittee has indicated that culverts CCCC-9, CCC-11 and CCC-12 will be sealed at both ends and abandoned in-place since their removal would sacrifice the integrity of the Hilfiker retaining wall system. The Permittee indicates the upper 20 feet of the culverts will be crushed and backfilled. However, these culverts are greater than 200 feet long and have 84", 48", and 48 " diameters, respectively. This size culvert over time will decay and lead to piping and or subsidence over the pipe. It is also proposed the outlets be sealed by cutting them back 8 inches from the face of the wall and filled with rock. The exposed rock will be mortared in place except between the rocks at the base of the culvert to allow water to escape.

The Permittee has not demonstrated the Hilfiker wall is compatible with the postmining land use. In the case where the Hilfiker is demonstrated to be commensurate with the postmining land use, and meets all appropriate R645 requirements, the culvert may be plugged through the portion under the Hilfiker up to the point where the construction activities are demonstrated to de-stabilize the structure. If the Permittee receives approval for a variance of approximate original contour, and the Hilfiker is determined to be an approved structure the closure of these culverts would need to be addressed further.

The Permittee states that riprap gradation for the diversion channel is not provided because the final configuration of the channel may vary from the reclamation design. This statement must be removed in order to provide a clear and accurate plan that meets the requirements of R645-301-533 " backfill and grading design criteria must be described in the permit application". According to the performance standards of R645-301-750 major adjustments in grade would constitute a change in the permit and require Division approval. It is understood that some minor field changes may be

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

necessary. If a significant variation is expected to occur, the Permittee should be reconsidering the details of the grading design. The Permittee must provide the riprap gradation for the proposed channel designs or a finding that the Permittee has designed a stable channel and provided a clear and accurate permit can not be made.

The berms and super-elevated channels are not appropriate drainage measures for reclamation purposes. Appropriate grading should be employed to eliminate burms and sup-elevated drainages. Berms shown to be retained in Phase I, and Phase II reclamation must be removed for final reclamation.

### Stream Channel Diversion

The Permittee has stated that the area north of the main channel diversion, west of Pond 015, is requested to be retained so that it may be used for grazing and it could potentially be used for residential development. The Permittee has not demonstrated the proposed configuration meets the postmining land use. However, the premining configuration would actually increase forage for wildland and grazing use. The area adjacent to the channel, as it existed prior to mining, provides a greater potential for increased forage through locating the adjacent riparian area at an elevation where water storage and retention is increased and provides access to plant roots.

The Permittee has suggested the realignment of the channel down the center of the canyon would place the channel closer to the two shafts increasing the potential for interception of the surface runoff by mine channel shafts, and re-alignment would involve routing the channel on fill. Although, maintaining the water away from the shaft is necessary downstream of Pond 015, no shafts are present in the Phase I (Pond 015 and west of the pond) reclamation area. Additionally, grading could occur to protect the sealed shaft(s), and have a more centrally located channel in other portions of the stream while avoiding routing water over fill material.

It also appears the Permittee has not located the channel at the north end of the site so as to maintain a long-term diversion away from the shaft. This drainage is located upstream of the shaft. The grade flattens at the upstream elevation. Since the channel slope decreases in this area the sediments would tend to accumulate potentially filling the drainage and spilling outside the designed channel toward the sealed shaft.

### Geomorphology and Stream Characteristics

The majority of the Crandall Canyon stream channel is located in the Price River formation with upper portions of the watershed in the Northhorn formation. The topography west of Shaft no. 1 is characterized by steep canyon side slopes and a relatively broad canyon bottom. The permittee suggest that relative to the drainage flows of the geologic past, the recent flows are relatively small. The main stream meanders on top and erodes slowly through unconsolidated materials that were deposited previously during high flow high energy events. These conditions have resulted in various configurations of stream alignments along the base of the canyon.

Although the description of earlier geologic flows is generally accurate, the current configuration resulting in the various stream alignments along the base of the canyon has degraded from a relatively stable channel configuration. This degradation potentially occurred from a combination of uses occurring in the canyon. These changes may be in response to a combination

## TECHNICAL ANALYSIS

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of the following: grazing pressures; a function of impacts from the road; a lowering of the channel grade in the re-aligned channel section; and the 1983 floods as well as other possibilities. According to R645-301-413.210. The premining uses of land to which the postmining land use is compared will be those uses which the land previously supported, if the land has not been previously mined and has been properly managed. The comparisons of channel configuration to the area west of the disturbed area does not appear to constitute an area that was properly managed.

The Permittee provides cross-sections within the exiting disturbed area and areas upstream of the site. The Permittee indicates the operational channel configuration is similar to the existing "undisturbed" and the pre mining configuration to the west of the permit area. The Permittee has not provided cross-sections for comparison of the pre-mining configuration.

Exhibits 3.7-7B were used to determine approximate valley slopes for disturbed and "undisturbed" reaches of Crandall Creek as follows:

The lower pad (Pond 014 to Pond 015) have a slope of approximately 0.053 ft/ft

The upper pad (West of Pond 015) has an approximate slope of 0.062 ft/ft.

The "undisturbed" area west of the LP gas tanks to the lower end of the leach pad are has an approximate slope of 0.082 ft/ft.

The "undisturbed" north fork of the drainage above the leach pad is approximately 0.14 ft/ft while the main fork (along the road) is approximately 0.125 ft/ft.

The Permittee has compared reaches with a steeper gradient than the reach to be reclaimed. Channel gradient and channel geology affects the channel configuration.

If the Permittee wishes to compare the existing channels, the downstream configuration appears to have relatively increased stability and may represent a configuration that is a closer match of the undisturbed or "potential" configuration (some impact from the upstream area is likely to have occurred in this section). The Permittee should use historical information, photography and the premining land configuration maps to demonstrate approximate original contour.

Drainage gradients to the south and west of the pad area are designed to drain southwest to meet the designed channel and then flows northeast. This area is not graded to drain in a manner similar to premining conditions. CCRD-24 similarly does not blend into the premining land configuration.

### **Sedimentation ponds.**

#### **Phase II**

The Permittee proposes Pond 015 will be retained to collect sediment and provide a benefit to wildlife. The proposed reasoning for retention of these ponds is to replace the two small ponds existing prior to mining.

Both Ponds are located in different positions from the premining location. The Permittee states that Pond 014 is either spring fed, or is lined with a low permeability material, because it contains water throughout the year, and that Pond 015 contains water after snowmelt and after a

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

significant storm. According to the Permittee, the two water sources will allow the landowner to fence one of the ponds for cattle and allow wildlife to access the other pond.

The general description of season of availability in the ponds is accurate. Pond 014 is most likely spring fed as there is evidence of seepage from the face of the Hilfiker wall below the pond. The most convincing evidence pertains to the presence of a moss like vegetation on the west face of the wall. This pond retains water year-round but does not appear to receive a large enough volume of water from runoff to sustain this pond over the has high evaporative rates during summer. Therefore, it is believed this seep would remain whether or not the pond is retained.

Assuming that the Permittee proposes both a change in post mining land use and a variance from approximate original contour. The following would need to be addressed.

The Permittee has not demonstrated that the requirements of R645-301-733.220 (et.seq.) have been met. For example: the Permittee must demonstrated the size and configuration of the proposed impoundment is adequate for its intended purposes. Access and timing of the proposed use must be addressed. If used for wildlife, a description of the wildlife to be managed should be identified. The time of the year these wildlife are present and the necessity for water use at this time should be discussed. Additionally the proposed configuration should be demonstrated to be adequate for access for the intended use.

An adequate number of water quality samples must be obtained from the pond water during all proposed seasons of use to demonstrate that the quality of impounded water will be suitable on a permanent basis for its intended use, and to show that after reclamation it will meet applicable state and federal water quality standards.

The following excerpts were obtained from the Hilfiker (welded wire wall) review in Appendix 3.7 L (observed under snow covered conditions) and were excerpted from the conclusions; "...the walls as they presently stand (with improvements noted) have a service life of at least forty to fifty years. Some occasional light maintenance of the type described herein may be necessary if other sections of the wall face compress to the point of exposing the internal fill". The noted improvement includes "... cut out the affected portions and regrade the channel bank to a flatter slope." In the western and central portions of wall "A" the following degradation was noted "...the weight of the walls over time (due largely to moisture infiltration) has caused the partial collapse..." The document indicates the weak portions are minimal and the structure, if properly maintained, is expected to last 50 years.

The Permittee has included stability analysis for the ponds based on the existing configuration. This stability analysis accounts for the existing configuration, including a Hilfiker adjacent to the existing stream channel diversion. It does not appear the analysis has considered potential undercutting of the toe following failure. Thus, increasing the potential for a less gradual failure. Assuming the estimate of a final configuration of a two to one slope is accurate, a potential to disrupt the existing pond 014 is evident. The minimum embankment width is 19 feet and the Hilfiker wall perpendicular to this point is 25 feet (field measurements). A two to one slope would most certainly affect the existing pond at this point.

One piezometric surface has been identified. Although the methodology presented may be adequate for the operational pond a number of stability and design factors have not been accounted

## TECHNICAL ANALYSIS

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for during the reclaimed life of the pond including: the degradation of the Hilfiker wall over time; the presence of the stream below the wall and thus a second potential piezometric surface; the stability of the earth face without a competent Hilfiker wall.

### Findings:

The Permittee has not provided disturbed area contouring drainage and channel reclamation designs that are backfilled and graded to achieve approximate original contour or restore natural drainage patterns (R645-301-553.100 et. seq. and R645-301-762.100). The Permittee has failed to meet the requirements of R645-301-700 and DO 94 #6.

Division Order 94 #6, issued on August 19, 1994 is re-stated: the Permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-700 restated from DO 94 #6**, the operational plan must be specific to the local hydrologic conditions and will contain steps to be taken during coal mining and reclamation operation though bond release. Hydrologic maps and supporting calculations for the Crandall Canyon facilities and the access road must be provided which show the surface hydrology and drainage and sediment control facilities to be used throughout all phases of operations and reclamation. The Permittee shall submit a reclamation plan for all phases of reclamation indicating how the relevant requirements for R645-301-730 through R645-301-760. will be met. The Permittee must correct the plan to include monitoring plans for ground water an surface water during reclamation through final bond release. These monitoring plans should reflect the requirement of R645-301-731.200, and must reflect the language of R645-301-731.212, R645-301-731.233, R645-301-731.214, and R645-301-731-224.

**R645-301-731**, a demonstration that the water quality monitoring plan is adequate to monitor for compliance with effluent limitations, and provide a PHC to cover the phases of reclamation and bond release.

**R645-301-762.100 and R645-301-553.100 et. seq.** provide disturbed area contouring drainage and channel reclamation designs that are backfilled and graded to achieve approximate original contour or restore natural drainage patterns.

**R645-301-760 and R645-301-740**, provide the riprap gradation for the proposed channel designs in order to make a finding that the channels are designed to be stable. The Permittee's plan states that riprap gradation for the diversion channel is not provided because of the possibility that the final configuration of the channel may vary from the reclamation design. This statement must be removed in order to provide a clear and accurate plan that meets the requirements of R645-301-533 which says, "Backfill and grading design criteria must be described in the permit application."

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

**R645-301-413.210**, land areas which the Permittee uses to compare the premining uses of land to the postmining land use will have been properly managed. The comparisons of channel configuration to the area west of the disturbed area does not appear to constitute an area that was properly managed.

**R645-301-742.110**, submit a design for BTCA methods to be employed in areas not reporting to the sediment pond. All disturbed area drainage must be clearly depicted on appropriate maps and identified with their respective sediment control measure. A disturbed area acreage calculation for each area and a description of the methods and elements used to comply with R645-301-724.110 must be submitted.

**R645-301-733.220**, demonstrate that the retention of the ponds meets premining land use, or request a change in the post mining land use. The Permittee must demonstrate that the requirements of R645-301-733.220 (et. seq.) and applicable R645 requirements for permanent pond retention have been met.

## REVEGETATION

Regulatory Reference: 30 CFR Sec. 785.18, 817.111, 817.113, 817.114, 817.116; R645-301-244, -301-353, -301-354, -301-355, -301-356, -302-280, -302-281, -302-282, -302-283, -302-284.

See: Division Order 94 #3, issued on August 19, 1994.

### Analysis:

#### General requirements.

The Division Order specifically requires seedbed preparation plans. Prior to spreading topsoil, all regraded areas will be scarified by deep ripping. Topsoil will be spread in one lift and will be disced. Chapter 9 says wildlife habitat will be created by development of microtopographic features, such as swales and rises. Seeding will commence immediately after seedbed preparation to minimize the potential for erosion.

Discing tends to leave a relatively smooth surface. Probably the most consistently successful surface preparation technique used in Utah is surface roughening. The best techniques for both vegetation establishment and erosion control are to gouge or pit the surface irregularly. When finished, the area may look somewhat like a ski slope with moguls. These gouges trap nearly all precipitation and keep it in the area being revegetated. In the Division's experience, this also reduces runoff, erosion, and sedimentation. The Crandall Canyon area receives enough precipitation that it is probably impossible to say revegetation is not feasible without using this technique; however, it is highly recommended.

## TECHNICAL ANALYSIS

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Planting will typically occur after October 15 and before the ground freezes. When necessary, spring planting may occur between March 15 and May 15. Drainages will be planted in April when possible. Unusually favorable weather conditions or compliance requirements may necessitate planting at other times.

The planting times discussed in Chapter 9 are standard for Utah. Spring seeding is not recommended but is sometimes necessary. Where it is necessary, it should be done as early as possible; May is usually too late (except in 1995).

According to the current Chapter 9, areas disturbed after May 1978 will be planted with species lists 2 and 3. North-facing slopes will receive transplants.

It is assumed that the north-facing slopes mentioned in Chapter 9 refer to north-facing slopes in Crandall Canyon where conifers should be planted. Species list 2 should be amended to include conifers to be planted in these areas (north-facing slopes only, not the entire Crandall Canyon area). Recommended species and rates are 300 per acre of Douglas fir, 200 per acre ponderosa pine, and 100 per acre white fir. Assuming a mortality rate of 20%, this would give 480 trees per acre. Although this is less than the density in the reference area, the reference area probably has a higher density than the area can properly support. Also, tree density in the reference area included a relatively small tree, juniper.

The Permittee has recently proposed changing its species lists in Chapter 9, and the proposal was recommended for approval. The new species list 5 would be used for areas within 20 feet of reclamation channels. The proposed Crandall Canyon reclamation plan says species list 5 will be used within 20 feet of reclamation channels CCRD-23A, CCRD-23B, and CCRD-23C. Exhibit 3.7-12 contains a footnote with this same comment. Species list 5 is very similar to species list 3, but cottonwoods and willows would be optional. Cottonwoods and willows should be planted in Crandall Canyon. However, as discussed in the "Revegetation Success Standards" section below, it is not expected that a riparian community could be established using the proposed reclamation plan.

The Permittee proposes to seed the Hilfiker walls by doubling the rate of tackifier application for both the seed and mulch mixes to improve adhesion. Seed from species list 2 would be used to seed the Hilfiker walls. The hydroseed slurry would be applied through a nozzle at the end of a hose, and the hose would be held within six feet of the wall to ensure seed penetration. Fertilizer would be applied at a minimum rate of 200 pounds per acre.

The proposed reclamation channels with Hilfiker on a side do not have side slopes within twenty feet conducive to seeding with species list 5. The Hilfiker walls are all within twenty feet of the reclamation channels and should, therefore, be seeded with the seed from species list 5. However, since the Hilfiker walls have few or no riparian characteristics, species list 2 is appropriate if the Hilfiker walls are left. The regulations require riparian areas to be restored or enhanced, so it will be necessary to provide slopes configurations conducive to establishing a riparian community.

Nearly all of the species in the planting mixtures are native to the area. Non-native species are legumes that increase microbial activity and add nitrogen. The Division of Wildlife Resources reviewed the species lists and had no comment about those that would be used in Crandall Canyon. The species meet the requirements of R645-301-342 and R645-301-350.

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

Seed would be mixed with a small amount of wood fiber mulch and water to form a slurry, and this would be applied to the reclaimed area with a hydroseeder. The balance of the mulch, together with fertilizer and tackifier, would then be applied. Chapter 9 says seed and fertilizer will not be mixed in the hydroseeder. The total amount of mulch used will be 2000 pounds per acre.

In areas inaccessible to the hydroseeder, seed will be broadcast by mechanical means. These areas will be mulched with 2000 pounds per acre of straw, and the mulch will be anchored with nylon or other suitable netting. This plan conflicts with Chapter 9 which says native hay or straw will be applied at a rate of no less than two tons per acre. The higher rate has been shown to reduce erosion and increase seedling establishment better than one ton per acre.

Mechanical broadcasting or broadcasting combined with drilling is preferred over hydroseeding. Hydroseeding tends to leave "shadows" of unseeded areas. Also, several studies have shown straw or hay mulch to be more effective at controlling erosion and increasing seedling establishment than hydraulically-applied wood fiber. Nevertheless, with the exception of the riparian areas, revegetation is still considered feasible using the proposed techniques.

Chapter 9 discusses irrigation and pest and disease control. No irrigation is planned, but transplants will be watered on a case-by-case basis to minimize drought kill. No pest or disease control measures are anticipated to be necessary, but a plan will be developed in coordination with Carbon County Weed and Pest if needed. This plan would also be approved by the Division.

### Revegetation Success Standards

The revegetation success standards will be the Crandall conifer, Crandall riparian bottom, Castle Gate mixed brush, and Barn Canyon sage-grass reference areas. The amendment application says these revegetation standards will apply to all areas that are reclaimed within the disturbed area boundary except the leach field and the north-facing slopes south of Shaft No. 1. It also says the leach field could be used if the canyon is designated for residential development, and planting additional woody vegetation to increase diversity would not be desirable because of possible root penetration.

The north-facing slopes south of Shaft No. 1 were vegetated with conifer prior to mine development. The application says the proposed reclamation topography for the area is relatively flat, so these areas will not include north-facing slopes that can be vegetated with conifers.

Residential development is considered a "potential" postmining land use. The application does not officially propose that this be a designated land use, and the Permittee has not fulfilled the requirements to change the land use. Therefore, the plan must indicate how the approved land use in the plan will be achieved. The PAP is contradictory whether the proposed post-mining land use is undeveloped land, wildlife habitat, grazing, or some combination of these. In any case, residential is not a proposed or approved postmining land use, and the Permittee must achieve the diversity success standards for the leach field area. If the use is changed at some time in the future, there would still need to be a diversity success standard.

Although the area north of Shaft No. 1 may have had a conifer vegetation type before the area was disturbed, it is not absolutely necessary to compare it to the conifer reference area for

**TECHNICAL ANALYSIS**

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judging revegetation success. It might be compared to the mixed brush reference area instead. No matter which reference area is used, there must be a success standard.

The application does not exactly discuss which reference area will be compared with each disturbed area for judging revegetation success. Table 3.3 in Appendix 9-1 shows that the leach field area will be compared with the Barn Canyon grass-sage, the Castle Gate mixed brush, and the Crandall conifer reference areas, and that the shaft site will be compared with the Castle Gate mixed brush, the Crandall conifer, and the Crandall riparian bottom reference areas. However, this table does not show where each reference areas will be compared with the disturbed areas.

With the exception of erosion control, Chapter 9 includes methods for judging the diversity, seasonality, and other characteristics of reestablished vegetation as required by R645-301-353 and R645-301-356. Absolute cover will be used to compute the Motyka Index. This index will then be used to compare reclaimed and undisturbed areas. Cover, production, and stocking, as applicable, will need to meet the requirements of R645-301-356.100 and R645-301-356.200.

According to Section 3.7 of the current mining and reclamation plan, the postmining land use for the Crandall Canyon area is undeveloped land. This is different from a wildlife or rangeland grazing postmining land use mainly in the degree of management it receives. Because the postmining land use is not wildlife, no specific woody plant density standard for success is being established. However, the Permittee will still need to meet diversity requirements which will necessarily include establishment of trees and shrubs.

Chapter 9 says some erosion is natural as part of a functioning hydrogeomorphologic system, but it will be controlled if it becomes or threatens to become disruptive of the postmining land use or inconsistent with erosional activities typical of the local area. It says suitable methods of measuring erosion will be developed in consultation with the Division and will be employed upon approval.

The Permittee needs to propose erosion control success standards and specific methods of measuring erosion. This is becoming urgent for reclaimed areas of the Castle Gate Mine, such as Goose Island and Sowbelly Gulch. The Permittee is required to demonstrate that reestablished vegetation is controlling erosion, but, without a specific and approved method, the measurements will probably be overlooked. Even if the Permittee does make erosion measurements, the Division will at some point review the adequacy of the methods. If the methods or standards are not approved, bond release could be delayed.

The Division is required to make a finding that reclamation as required by the State Program can be accomplished according to information given in the permit application. R645-301-321 requires the application to have adequate information for the Division to make this finding. Revegetation according to the reclamation plan is feasible in most disturbed areas of Crandall Canyon. Most slopes are not extraordinarily steep although the Permittee does propose to leave some cut slopes. The Hilfiker walls themselves would probably have minimal vegetative cover; however, their areal extent is very limited. The area where the Permittee cannot achieve the revegetation success standards is in and adjacent to the stream channels.

It is impossible to tell from the vegetation maps exactly how wide the riparian areas were prior to disturbance. The narrowest part of the riparian area below the disturbance is about 50 feet;

## TECHNICAL ANALYSIS

Last revised - June 29, 1995

it is about 100 feet wide immediately below the disturbed area. Above the disturbed area, there is very little riparian area because the stream channel is eroded into the alluvium next to the adjacent mixed brush and conifer communities. However, as discussed below, even if the channel through the disturbed area was in a degraded condition prior to mining, the regulations require the Permittee to enhance these areas where practicable. Also, the designated success standard is the riparian reference area.

The cross sections shown on Exhibit 3.7-7D show the stream channel through the disturbed area varying in width from about 12 to possibly as much as 25 feet. Side slopes both with Hilfiker and in some of the cut slopes are nearly vertical. This basically leaves an area to be revegetated to a riparian community one-fourth or less the width of the riparian area immediately below the disturbed area.

Using the proposed reclamation plan, the Permittee cannot restore a riparian community of the same extent as apparently existed prior to mining. The application says species list 2 (for riparian areas) will be planted within 20 feet of each side of the channel for a total of 40 feet width. Cottonwoods and other riparian species may become established to a limited extent in the channel, but the channel, as built, is designed more as a water conveyance structure than for habitat. Riparian species present in the reference area and species list 2 would not survive in the more xeric habitats above the cut slopes and Hilfiker walls.

R645-301-358.400 requires the Permittee to avoid disturbances to, enhance where practicable, restore, or replace, wetlands and riparian vegetation along rivers and streams. Coal mining and reclamation operations must also avoid disturbances to, enhance where practicable, or restore, habitats of unusually high value for fish and wildlife. Riparian areas are considered critical wildlife habitat.

In summary, the Permittee needs to restore and/or enhance riparian habitat along Crandall Creek for the following reasons:

1. Without changing the stream channel configuration, it is impossible to establish a riparian community equal in extent to what probably existed prior to mining. A riparian community reference area is the standard for revegetation success for these areas, and this standard cannot be achieved using the proposed plan.
2. Riparian areas are considered critical wildlife habitat that need to be restored and/or enhanced where practicable. Whether the channel through the disturbed area was in a degraded or pristine condition prior to mining, the Permittee should present plans that would restore the area to a condition similar to the reference area or better if possible.

The application contains arguments that retention of the flat pad areas and the Hilfiker walls offers benefits to the postmining land use. The facilities area could be graded to eliminate much of the pad area, but the resulting topography would be characterized by significantly steeper slopes near the main stream channel. The application says soil erosion would be increased, plant production would be adversely affected, and there would be a corresponding negative impact to the postmining land uses of wildlife habitat and grazing.

## TECHNICAL ANALYSIS

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Properly-managed riparian areas are very productive vegetation communities. Considering the number of weedy species present in the Crandall Canyon riparian reference area, it is not in ideal condition and was probably overgrazed in the historical past. Nevertheless, productivity for this reference area, as shown in Table 3.8 of Appendix 9-1, was 2500-3000 pounds per acre. Productivity for other reference areas to be used in Crandall Canyon was 650-700 and 200-300 pounds per acre for the Castle Gate mixed brush and Crandall conifer reference areas, respectively. (The plan does not show productivity in the Barn Canyon grass-sage reference area.) Restoring a productive riparian area would more than offset production losses caused by steeper slopes in a few areas.

Erosion could, theoretically, increase slightly where the Permittee would grade slopes toward the channel. However, the revegetation success standards allow relatively little bare ground. The Crandall conifer reference area had 6% bare ground, the Castle Gate mixed brush reference area had 24% bare ground, and the Barn Canyon grass-sage reference area had only 1% bare ground. This small amount of bare ground does not allow very much erosion. Also, vegetation in flat areas near the creek should filter out most sediment that does erode.

Leaving the Hilfiker walls and the channel in its current configuration does not offer benefits to postmining land uses discussed in the application. A good quality riparian area is far more compatible with wildlife and grazing uses than the narrow, steep-sloped, riprapped channel. The creek becomes accessible for watering, it creates greater habitat diversity, and there is increased vegetation production. For residential or recreation postmining land uses, a stream with good ground cover, cottonwoods and ponderosa pines, and associated wildlife is much more aesthetically pleasing than an engineered channel with Hilfiker walls.

### Findings:

The Permittee has failed to meet the requirements of R645-301-340 and-353 and all requirements of Division Order 94 #3, issued on August 19, 1994. The Permittee must provide the following, prior to approval, in accordance with the requirements of:

**R645-301-340**, the permittee must provide a mulching plan in Section 3.7 of Chapter 3 that is consistent with Chapter 9 per R645-301-121. Chapter 9 says no less than two tons per acre of straw or hay will be applied when straw or hay is used as mulch. Chapter 3 says only one ton per acre will be used.

**R645-301-353**, the Permittee must provide a plan under which it is possible to meet diversity standards. In order to meet these standards, the Permittee needs to provide plans to establish conifers on north-facing slopes of Crandall Canyon. Diversity standards need to be applied to the leach field area and the slopes north of Shaft No, 1.

**R645-301-353.140**, as required by R645-301-341, R645-301-353, and R645-301-356, the Permittee needs to propose erosion control success standards to show how they will comply with the biological protection performance standard of stabilizing the soils surface from erosion.

**TECHNICAL ANALYSIS**

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Last revised - June 29, 1995

**R645-301-356**, the Permittee must identify the specific reference areas to be used to compare to each identified vegetative reclaimed area.

**R645-301-300.133.710 and R645-301-358**, the Permittee has not demonstrated that revegetation, as required under the State Program, is feasible for the riparian areas that must be revegetated to a condition similar to the riparian reference area. The permittee must restore or enhance riparian areas using the best technology currently available to enhance fish and wildlife and related environmental values.

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