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

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March 25, 1997

TO: File

THRU: Joseph C. Helfrich, Supervisor

FROM: Robert Davidson, Soils Reclamation Specialist

RE: Technical Analysis of Hardscrabble Reclamation Plan, Castle Gate Mine, Amax Coal Company, PRO/007/004-96F, Folder #2, Carbon County, Utah

SUMMARY:

Amax Coal Company submitted to the Division on May 1, 1996, proposed changes for the reclamation design of Hardscrabble Canyon. A Technical Analysis from the Division followed which resulted in a resubmittal of the MRP in November 1996. The following TA provides the review of the resubmittal Reclamation Plan.

TECHNICAL ANALYSIS:

RECLAMATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-240.

Analysis:

The remaining 20 acres scheduled for reclamation in Hardscrabble Canyon were disturbed by mining prior to the enactment of SMCRA. As a result, no topsoil was salvaged from the site. The existing soil and overburden material at the site will be used as substitute topsoil. Several studies have been performed to assess the usefulness of these materials for reclamation purposes. Both the 1990 and 1995 soil investigations were conducted to evaluate the physical and chemical characteristics of the soil materials according to the Division's

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guidelines for topsoil and overburden¹. In addition, the 1995 soil investigation was conducted to locate areas of buried coal debris that would likely be encountered during reclamation. Descriptions of the soils and coal debris were made using trenches, soil pits and soil borings at varying depths.

Generally, overburden samples have a loam to sandy loam texture, possess a weak, sub-angular to granular structure, and have a pH in the range of 7.4 to 8.6. Coal samples range from loamy sand to sandy loam in texture, and are generally loose to single grained with a pH range from 7.5 to 8.0. Overburden and coal samples meet the requirements of the DOGM for toxicity and acid-forming potential. Boron concentration does not exceed 5 mg/kg in any sample with only 2 samples in excess of 3 mg/kg. Selenium is rarely above the method of detection (0.02 mg/kg) limit for the hot water extraction procedure with only three samples HC-COMP-3 (0.02 mg/kg), HC-COMP-6 (0.04 mg/kg) and HC-COMP-12 (0.02 mg/kg) exceeding the detection limit. In terms of surface acidity potential, all samples meet DOGM's limit of -5 tons CaCO₃ per 1000 tons material. Coal samples have a higher acid potential with their neutralization capacity 4 times greater than their total sulfur acidity. The composite loam sample HC-COMP-8 has elevated sodicity with a sodium adsorption ratio (SAR) of 15.7 exceeding DOGM's SAR limit of 12 for fine textured soils. DOGM's guidelines require that in soils with unacceptable SAR values, exchangeable sodium percentage (ESP) is needed to verify a true sodicity problem. By traditional classification, soils with an ESP greater than 15% having an electrical conductivity less than 4 are classified as sodic soils².

With the exception of overburden between 30 and 72" in HC-3, and 18 and 48" in HC-5 (Sample HC-COMP-8 has high SAR values), soil material encountered in the 1995 sampling has the potential for use as alternate topsoil within Hardscrabble Canyon. However, the use of identified overburden suitable as substitute topsoil may produce water limiting conditions for regenerating vegetation since the overburden has a weak soil structure and is essentially void of organic matter. To mitigate against the drought nature of the overburden, AMAX proposes that hay and/or straw mulch, or suitable substitute with high organic matter content, be incorporated into the upper layers of soil thus improving aeration and water holding capacity of the overburden material. The plan further notes that care should be taken during the mulching process to avoid compaction of the upper regions of the soil. Loam soils, with elevated sodium levels, even concentrations well below the Division's minimum requirements,

¹Leatherwood, J., and Duce, D., 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining.

²Terminology Committee, *Glossary of Soil Science Terms*, Soil Science Society of America, Madison, Wisconsin, 1973.

are prone to aggregate slaking. Aggregate slaking increases bulk density of the soil and may cause reductions in hydraulic conductivity. Compaction would exacerbate this condition by further reducing the micro-pore space of the soil.

Based on the results of the 1995 soil sampling and the types of material found within the excavations and borings, approximately 20,270 yd³ of substitute topsoil may be available for use as appropriate growth media. The total area to be reclaimed in Hardscrabble Canyon is approximately 869,122 ft². The volume of salvaged soil will allow approximately 9 inches of soil cover over the reclaimed areas with the exception of road R-1 and the reclamation channels. The postmining land use for Hardscrabble Canyon is grazing and wildlife.

Alternate sediment control measures (ASCMS) will be implemented during reclamation to reduce erosion of the soil growth media. These ASCMS will include the following and are discussed below:

1. Ripping of the regraded surface prior to placement of growth media,
2. Contour furrowing,
3. Incorporation of hay and/or straw mulch into the growth media,
4. Deep gouging of the growth media,
5. Seeding and fertilizing the prepared soil,
6. Addition of more mulch following seeding, and
7. Physically or chemically anchoring the final mulch layer.

Ripping the fill surface prior to soil placement will help promote a smooth fill: soil boundary interface that will encourage both root penetration and water infiltration. This smooth interface is especially critical on reclaimed compacted fill slopes to help retain soil and prevent sloughing of the soil surface.

Following placement of the soil growth media, an organic mulch will be incorporated into the soil at a rate of 2 tons/acre by either plowing along the contour, deep gouging, or a combination of these two methods. The soil surface will be gouged to an approximate 12 to 18 inch depth using the bucket of a trackhoe. Deep gouging will thus extend below the 9 inch thickness of the growth media. However, the 1995 soil investigation shows that the soil materials which will be used for backfilling in the canyon are neither acid nor toxic-forming. Therefore, if these materials are exposed, they will not create revegetation concerns. With time, wind and water transport of adjacent soil material will cover exposed fill.

Approximately 25 pounds of nitrogen and 50 pounds of phosphorus will be applied per acre of reclaimed area. The nitrogen will be a slow-release form (i.e., urea), while the phosphorus will be in the form of phosphate (P₂O₅).

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Following seeding, an additional 2 tons/acre of straw mulch will be spread over the seeded area by mechanical blowers or hand spreading. This final mulch will either be crimped with the trackhoe bucket or sprayed with a tackifier.

Stability analyses in the No. 4 Mine canyon indicate that fill slopes as steep as 39° (1.2H:1V) will be stable with a static safety factor exceeding 1.3H:1V, provided that the fill is properly placed and compacted during construction. These stability analyses are considered representative of all slopes to be reclaimed within Hardscrabble Canyon. It is noted that reclamation slopes have been designed to be concave in cross section and not exceed a slope of 2H:1V. Slopes shown to be steeper than 2H:1V are natural rock outcrops that will be retained following reclamation. To the extent possible, using the reasonably-available material, existing cut slopes will be backfilled during reclamation operations, however, given the extent of pre-SMCRA disturbances in the canyon, some cut slopes will likely remain following reclamation. Pertaining to reclaimed cut slopes and other steep reclaimed slopes, deep gouging and/or straw mulch are not sufficient alone to protect the soil surface from erosion on steep slopes (\geq 2H:1V) before and after seeding. In addition to deep gouging and mulching, erosion control materials are needed on surface slopes at 25° (2 H: 1 V) and steeper to protect the soil material from erosion. These materials may include erosion control matting, blankets, tackifiers, etc.

Coal debris and acid- and/or toxic-forming material exposed or excavated during reclamation grading will be removed, if possible, and used as backfill against highwall, cut slopes, or as backfill in existing sedimentation ponds. Were these materials are found and cannot be effectively removed, the area will be over excavated with the over-excavated material used as backfill. The plan states that all coal debris and acid- and/or toxic-forming material will then be covered by a minimum of four feet of overburden material. *However, the analytical section (Appendix 3.3M, Overburden and Coal Evaluation, April 1, 1996, Section 5-1 Coal Disposal) states that "based upon the nontoxic/non-acidic nature of the coal, the depth of cover placed on coal and mixed coal waste will be determined by the amount of overburden and alternative growth media available on site." The plan prevails and the consultant report in Appendix 3.3M is a recommendation only. As discussed in the analytical appendix 3.3M, section 4.0 Analytical results, coal samples range from loamy sand to sandy loam in texture, and are generally loose to single grained. Because of the water limiting conditions of coal and coal-waste material, vegetation regeneration is severely restricted. In addition, coal and coal-waste material is flammable. Therefore, the Division requires that all coal, and inextricably mixed coal waste and overburden, will be buried under a cover of 4 feet of overburden. In the event that inadequate overburden exists and the operator wants to use less than four feet of cover, the operator must specifically request a variance to the four foot cover requirement.*

Findings:

Information provided in the proposed amendment is not considered adequate to meet the

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requirements of this section. Prior to approval, the permittee must provide the following in accordance with:

R645-301-553.260. The Division requires that all coal, and inextricably mixed coal waste and overburden, will be buried under a minimum cover of 4 feet of overburden. The analytical section (Appendix 3.3M, Overburden and Coal Evaluation, April 1, 1996, Section 5-1 Coal Disposal) states that "based upon the nontoxic/non-acidic nature of the coal, the depth of cover placed on coal and mixed coal waste will be determined by the amount of overburden and alternative growth media available on site." The MRP needs to acknowledge and clarify this contradiction concerning fill depth over coal waste material while reaffirming the commitment to cover all coal waste with four feet of cover. In the event that inadequate overburden exists and the operator wants to use less than four feet of cover, the operator must specifically request a variance to the four foot cover requirement.

RECOMMENDATION:

Prior to approval, the requirements of R645-301-553.260 must be provided as outlined above.

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