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

1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, Utah 84114-5801
(801) 538-5340 telephone
(801) 359-3940 fax
(801) 538-7223 TTY
www.nr.utah.gov

Michael O. Leavitt
Governor
Robert L. Morgan
Executive Director
Lowell P. Braxton
Division Director

October 18, 2002

TO: Internal File

THRU: Peter H. Hess, Sr. Reclamation Specialist/Engineer, Team Lead

FROM: Priscilla W. Burton, Sr. Reclamation Specialist/Soils

RE: Division Order, West Ridge Resources, Inc., West Ridge Mine, C/007/041-DO00A-6

SUMMARY:

Construction of the portal at the West Ridge Mine did not go according to plan when burned coal was encountered. The extensive highwall was not contemplated in the Mining and Reclamation Plan and the Division requested a modification to the reclamation plan.

The chronology of the Division Order is as follows:

Division Order		April 6, 2000
Initial Submittal	July 14, 2000	
Follow-up information	September 18, 2000	
Division Response		November 30, 2000
West Ridge Resources, Inc Response	March 16, 2000	
Follow-up information	July 2 & 14, 2001	
Division Response		September 21, 2001
Follow-up information	January 15, 2002	
Division Response		April 12, 2002
Follow-up information	August 15, 2002	
This Technical Analysis		October 10, 2002

The Permittee has provided the Division with one scenario for backfilling the highwall with angular rock fill to a slope of 40 degrees (less than 1.5h:1v. According to Agapito Associates, the regrading the site to a 30-degree slope would result in additional disturbance and re-alignment of the stream channel.

The reclamation plan presented for the 40-degree slope that includes an organic amendment, seeding, mulching, shrub, and tree transplants to try and achieve the 70% cover requirement for the slope.

The Permittee has changed course from the initial proposition dated June 2001 wherein the regraded slopes were to be comprised of clean, angular, well-graded durable rockfill with few fines. This proposal describes a 40-degree slope comprised of a rock drain and compacted fill separated by a non-woven geotextile layer.

The Permittee must identify the source of the fill and confirm that the characteristics of the fill meet the requirements described in Appendix 5-9. Missing information is requested from the 1998 Terracon Report.

TECHNICAL ANALYSIS:

GENERAL CONTENTS

PERMIT APPLICATION FORMAT AND CONTENTS

Regulatory Reference: 30 CFR 777.11; R645-301-120.

Analysis:

This August 15, 2002 submittal of Appendix 5-9 Agapito Report supercedes all previous versions of the Agapito Report.

The Table of Contents for the Appendices is up to date.

Terracon Consultants (1997) generated the shear strength values for the compacted fill. The Terracon Report is referenced in the Agapito Report. A **1998** Terracon Consultants Western Inc. report has been added to Appendix 5-9.

Findings:

The information provided meets the minimum clear and concise requirements of the Regulations.

REPORTING OF TECHNICAL DATA

Regulatory Reference: 30 CFR 777.13; R645-301-130.

Analysis:

The reclamation plan is based upon a report jointly produced by Agapito Associates, Inc. (AAI) and Mt. Nebo Scientific, entitled, "Stability Evaluation for the Proposed Reclaimed Slope at the Portal Excavation, West Ridge Mine, August 2002, Revision No. 3." AAI was responsible for slope stability and geotechnical design.

Laboratory data from soils investigations on the backfill was conducted in 2002 by Advanced Terra Testing, Inc. is included as Appendix A of the AAI report. The laboratory that is performing the analysis is identified on a fax transmittal form included in Appendix A of the Agapito report.

Terracon Consultants Western, Inc. is referenced in the AAI report as having conducted the soil engineering analyses in 1977 on the surficial residual soils and the compacted fill that comprises the bench at the base of the slope. The report was provided to the Division on August 15, 2002.

Mt. Nebo supplied the revegetation and erosion control methods. The three consultants have been listed by names and addresses in Appendix 1-6.

Findings:

The information meets the requirements for reporting of technical data.

ENVIRONMENTAL RESOURCE INFORMATION

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

SOILS RESOURCE INFORMATION

Regulatory Reference: 30 CFR 783.21; 30 CFR 817.22; 30 CFR 817.200(c); 30 CFR 823; R645-301-220; R645-301-411.

Analysis:

Soils in the vicinity of the highwall are listed on Map 2-2 as Midfork very stony fine sandy loam, 10 – 50% slopes. These soils are described in Appendix 2-2. Pit 14 was located in the immediate area of the highwall. In his January 15, 1997 Soil Resource Assessment, Mr. James Nyenhuis described the soils on the slopes of the highwall thusly:

It (the Midfork map unit) *is located primarily along the more densely vegetated south slope (north-facing slope) of the right fork drainage...Present vegetation is mainly Douglas-fir and snowberry. The average annual precipitation is 16 to 20 inches, and the average freeze-free period is 60 to 80 days.*

The M map unit is 75% Midfork, and 10% Rubbleland, 10% Commodore, and 5% Rock Outcrop. Midfork is deep to very deep, well drained. Effective rooting depth is 60 inches or more. Commodore is similar to Midfork but is shallow (<20 inches) to bedrock. Commodore was not sampled because it is a minor inclusion. Typically, the surface of Midfork is covered by an organic layer of twigs, leaves, and needles about 1.5 inches thick. The very dark grayish brown to brown "A" horizon is 5 – 7 inches thick and has gravelly to very stony fine sandy loam-to-loam texture. Total rock fragment content of the "A" horizon ranges from about 17 – 35% and can include about 10% gravel, 5 to 10% cobble or flagstone, and 2 – 15% stones and boulders.

The underlying subsoil layer is typically from about 7 to 18 inches in depth, and has very cobbly sandy loam-to-loam texture. Total rock fragment content of the subsoil ranges from about 7 to 40% and can include 5 to 15% gravel, 5 to 15% cobble or flagstone, and 1 to 15% stones and boulders. The substratum extends from the subsoil to a depth of 60 inches or more and has very gravelly to very stony sandy loam-to-loam texture. Total rock fragment content of the substratum ranges from about 35 to 40% and can include 10 to 15% gravel, 10 to 15% cobble or flagstone, and 10 to 20% stones or boulders. (Appendix 2-2, pp 14 - 15).

Soils from the highwall slope were salvaged to a depth of 18 inches. Mr. Nyenhuis indicated that below this depth, the rock fragment content exceeded 35 – 40% and 20% of that was large stones and boulders (Appendix 2-2, page 15).

Findings:

The information provided in the MRP adequately describes the pre-existing condition of the highwall.

OPERATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-230.

Analysis:

Removal and Storage

This submittal revises page 30 of Appendix 5-5 to indicate that there is no topsoil storage area in the left fork (ASCA Y has been eliminated). The area is dedicated to coal storage.

Map 2-2, Mine site Order 1 Soil Survey has been revised accordingly. Sample site locations have been retained on Map 2-2. (The commitment to sample the soil of the operations pad over the next five years is described in the Annual Report year 2000.)

Map 2-4, Topsoil Storage Area provides cross-sections and a profile of the topsoil stockpile, indicating that 7,613 cu yards of soil are presently stored in the topsoil storage area.

The As-Built maps submitted are adequate to satisfy the operations plan topsoil and subsoil requirements of the Regulations.

Topsoil Substitutes and Supplements

Borrow area soils have been identified on page 2-14 of the MRP and in Appendix 2-4. Map 2-4 locates the borrow soils and provides reclamation contours for the borrow site. The plan does not directly indicate that these soils will be used for topsoil, but no other source of topsoil is promoted.

Findings:

The information supplied does not meet the requirements of Reclamation Plan, Backfilling and Grading. Prior to approval, the Permittee must provide the following:

R645-301-233, The plan must clearly indicate the source of the substitute topsoil for the reclamation of the highwall.

RECLAMATION 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.

Analysis:

Backfilling and Grading On Steep Slopes

The following information from Revision No. 3 of the Agapito Associates, Inc. (AAI) and Mt. Nebo Scientific, entitled, "Stability Evaluation for the Proposed Reclaimed Slope at the Portal Excavation, West Ridge Mine, August 2002, Revision No. 3." (hereafter referred to as Appendix 5-9) pertains to the backfill:

- The 40-degree reclaimed slope installed with 95% modified Proctor compaction and the geosynthetic drain in place will have a static safety factor of 1.3.
- The rock fill drain will consist of clean, angular rock fill of the specifications outlined in Table 4 of Appendix 5-9.
- A geosynthetic composite drain will be placed against 30% of the portal cut slope. The geosynthetic will have an internal angle of friction equal to 18 degrees. A few design parameters for the geosynthetic composite are included in Figure 10 of Appendix 5-9.
- A non-woven geotextile filter fabric will separate the rock fill drain and the overlying backfill.
- "Mohr-Coloumb shear strength parameters for the backfill material were defined by laboratory testing conducted for this evaluation (Table 2)." (Section 2.3 of Appendix 5-9).
- "Laboratory testing was prescribed for the backfill material because the performance of the reclaimed slope will depend primarily on the shear strength of the backfill material." (Section 2.3, Appendix 5-9).
- **The backfill has yet to be identified by the Permittee (page 6, letter from Agapito Associates to Pam Grubaugh-Littig dated August 14, 2002).**

The backfill material has a USCS classification of GC-GM (silty clayey gravel with sand). The material is approximately 50% gravel, 28% sand, 25% fines, (page 6, Appendix A of Appendix 5-9). Table 2 of Appendix 5- 9 reports the backfill to have a plasticity index of 6.5, a saturated weight of 121.6 pcf, a moist cohesion of 771.7 psf and internal angle of friction of 38.4 degrees based upon the Advanced Terra Testing (2002) study. (AAI indicates that the use of the saturated weight provides a more conservative model as the greater weight drives the slope to instability.)

The figure used for the internal angle of friction is described as the post-peak friction angle. In the last review of Appendix 5-9, the Division requested an explanation of the post – peak friction angle. Agapito Associates Inc (AAI) have explained on page 8 of Appendix 5-9 that the coarse-grained material chosen for the backfill continues to gain strength after initial shearing, because coarse particles in the material rotate, "causing the sample to dilate and increase shearing resistance." AAI indicate, "Post-peak shear strengths are typically used in slope evaluation because the conservative assumption is made that the material has already undergone peak shearing."

The stress/strain graph for the backfill material is shown on page 3 of Appendix 5-9. The graph indicates that there is no peak shear, but that the material is displaced steadily as force is increased. The internal angle of friction (Phi) was derived from the point on the stress/strain curve where the stress no longer increases as illustrated on page 4 of Appendix A of Appendix 5-9.

Appendix 5-9 has received the scrutiny and stamp of a professional engineer, Francis S. Kendorski, Principal and Vice-President of Agapito Associates Inc. The signature was not dated, however.

Terracon Consultants Western Inc (TCWI) reported on the geotechnical characteristics of the compacted fill and the surficial soils above the highwall in January **1998**. The surficial soils are described as silty sand with gravel (Section 2.1 Appendix 5-9) and as having a Unified Soil Classification of GC-GM (Table 3, Appendix 5-9).

AAI relied upon a **1997** Terracon Report to obtain mean values for both the compacted fill and the surficial soils (Section 2.3.2 of Appendix 5-9). The mean values were the same for both soils: 121.6 pcf saturated weight, 347.5 psf cohesion, and 31.5 internal angle of friction.

In the **1998** TCWI report, the only soils with a unified soil classification of silty sand with gravel (GC-CM) were the soils of the borrow site sample no. 5. Sample results for Borrow Site No. 5 are not outlined in Table 1 of the 1998 TCWI. Therefore, the Division could not verify the friction angle and cohesion of the compacted fill and residual soil.

Other borrow sites in the 1998 Terracon Report are classified as CL-ML. It is imperative that the soil classification being used is that reported by AAI as noted in Section 6.0 of Appendix 5-9.

Findings:

The information supplied does not meet the requirements of Reclamation Plan, Backfilling and Grading. Prior to approval, the Permittee must provide the following:

R645-301-553.100, 1) The Permittee must clear up the confusion over what material was tested for shear strength parameters to be represented as backfill in Table 2 of Appendix 5-9. 2) Provide the results of laboratory tests confirming the shear strength parameters described for the compacted fill and surficial residual soils, Site S-5 of the 1998 Terracon Report. 3) Have the Professional Engineer date the signature on the stamp.

TOPSOIL AND SUBSOIL

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

Analysis:

Redistribution

The following information pertains to the substitute topsoil [from Revision No. 3 of the Agapito Associates Report (Appendix 5-9)]:

- The backfill material has a USCS classification of GC-GM (silty clayey gravel with sand). The material is approximately 50% gravel, 28% sand, 25% fines, (page 6, Appendix A of Appendix 5-9).
- The backfill material will be compacted in lifts, but "mechanical compaction will not be effective near the outside of the slope because the backfill material will not be confined laterally. This will result in a zone of weakly compacted backfill material that is expected to comprise an adequate rooting zone."
- The slope will be roughened using a combination of backhoe and hand tools to leave pocks with a depth of 12 – 18 inches and between 2 – 4 feet wide.
- Boulders will be embedded into the fill for water retention and microhabitat.
- An application of slow release 6-3-1 Biosol fertilizer at 1500 lbs/ac (Section 3.2 Appendix 5.9).
- The mix described in Table 5 of the AAI report will be hydro-seeded.
- The seeded slope will be mulched at a rate of 3500 lbs/ac with a bonded fiber matrix such as EcoAegis or SoilGuard.
- Diverter logs may be used parallel to the contour.
- Containerized shrub and trees will be planted.

Findings:

The information supplied does not meet the requirements of Reclamation Plan, Topsoil Subsoil. Prior to approval, the Permittee must provide the following:

R645-301-233.100, 1) The Permittee must identify the source of the backfill material which will become the rooting zone as described on page 10 of the Agapito Associates, Inc. (AAI) and Mt. Nebo Scientific, entitled, "Stability Evaluation for the Proposed Reclaimed Slope at the Portal Excavation, West Ridge Mine, August 2002, Revision No. 3." 2) The Permittee must provide the Division with information on the chemical characteristics of the material as recommended by the Table 6 of the Division's 1988 Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining.

R645-301-242.120, Appendix 5-9 should include (1) a determination of the level of compaction at a depth of two to four feet in native ground on an adjacent undisturbed, vegetated slope and (2) an analysis of whether this existing level of compaction can be duplicated on the regraded slope at a depth of two to four feet while still maintaining stability.

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.

Analysis:

Revegetation: General Requirements

The permittee proposes to reclaim the highwall area to a 40°-slope angle. The undisturbed slope above the highwall has a 32°-slope angle. The Permittee plans to construct the 40°-slope according to the designs outlined in Appendix 5-9:

- Compact the slope to a 95 percent compaction standard.
- The outside edge of the slope will be less compacted and will be the rooting zone.
- An irregular surface will be created by pocking with a track hoe and creating basins 12-18 inches in depth and 2 - 4 feet in diameter.
- Boulders will be incorporated into the fill at a frequency of 1 per 100 sq ft.
- Rocks less than 6" diameter will be scattered on the surface.
- Biosol fertilizer will be applied at the rate of 1500 pounds per acre.
- The slope will be hydro-seeded with the seed mixture shown in Table 5.
- The surface mulched with a bonded fiber matrix material at a rate of 3,500 lbs/ac or at the manufacturer's recommended rate.
- Containerized woody plants will be planted at the rate of 2,500 plants per acre or one plant every 4.27 foot.
- Five to six foot highballed and burlaped conifer trees will be transplanted at a rate of 145 per acre irregularly on the slope.
- Diverter logs will be used, if needed, for erosion control.

The information provided meets the Division's standard for roughness as detailed at: ftp://dogm.nr.state.ut.us/PUB/MINES/Coal_Related/RecMan/Reclamation_Manual.pdf.

Examples of sites, near the angle of repose, successfully reclaimed and revegetated with 68 percent vegetative cover were presented in the application.

The information presented does not ensure that the surface will be loosened to a four-foot depth to provide for proper root growth. This question has been addressed under Reclamation Plan, Topsoil & Subsoil Redistribution.

Findings:

The information provided meets the revegetation requirements of the regulations.

STABILIZATION OF SURFACE AREAS

Regulatory Reference: 30 CFR Sec. 817.95; R645-301-244.

Analysis:

Figure 4 of the Agapito Associates report Revision No. 3 in Appendix 5-9 illustrates the components of the geotechnical model for the reclaimed slope.

According to the report, infiltration into the surface of the fill will be limited by the steepness of the slope (40%), (Introduction to Appendix 5-9). Section 3.1 describes the following:

- A rooting zone will be formed by the weakly compacted material on the outslope of the fill.
- The slope will be gouged as a means to trap sediment and collect moisture. Gouges will be approximately 12-18 inches deep and 2 - 4 feet wide.
- Boulders (1 per 100 sq ft) will be used to add additional surface roughening and erosion protection.
- Smaller rocks (6-inch minus) will be scattered on the surface.
- After seeding, the slope will be mulched with a bonded fiber matrix at a rate of 3,500 lbs/ac (or as recommended).
- Diverter logs might be placed parallel with the contours of the slope.
- Figure 5 shows a cross section of the slope roughening techniques to be employed.

Findings:

The information provided meets the requirements of the regulations for applying the best technology available to stabilize surface areas.

EXPERIMENTAL PRACTICES MINING

Regulatory Reference: 30 CFR Sec. 785.13; R645-302-210, -302-211, -302-212, -302-213, -302-214, -302-215, -302-216, -302-217, -302-218.

Analysis:

The Division is of the opinion that the successful revegetation of the site takes precedence over the experimental practice. If necessary to achieve a stable and revegetated site, the experimental practice area could be reduced in size.

One of the important design criteria mentioned in the introduction to Revision No. 3 of the Agapito Report (Appendix 5-9) was to fix the toe at the lower bench in accordance with the planned reclamation for the area below the slope.

In the last Technical Analysis dated April 12, 2002, the Permittee was asked to demonstrate to the Division that restoration of the highwall to a 40 degree slope and retention of the experimental practice would result in a site that was at least as environmentally sound as the alternative of eliminating the experimental practice and reducing the slope of the backfill and replacing topsoil.

A full exploration of the stability of the 30-degree slope was not offered, but the argument was made that a lesser slope would alter the stream channel and require additional disturbance to the south facing slope of the right fork of C Canyon to retain the same stream gradient as presently exists (letter from Mr. Jim Cremeens, Senior Engineer with Agapito Associates Inc. to Pam Grubaugh-Littig dated August 14, 2002).

The engineering consultants have declared that backfilling the highwall to the original contour will be stable if a source of fill is identified having the characteristics described by the Agapito report and given the strict implementation of the Agapito compaction requirements (see disclaimer on page 18 of the report).

Findings:

The stability of the slope described by the Agapito Associates, Inc. (AAI) and Mt. Nebo Scientific, entitled, "Stability Evaluation for the Proposed Reclaimed Slope at the Portal Excavation, West Ridge Mine, August 2002, Revision No. 3." depends upon the characteristics of the fill used during slope construction. Prior to approval and in accordance with:

R645-302- 212.300 and R645-302-214, The Permittee must identify a source of fill meeting the requirements of the Agapito Associates, Inc. (AAI) and Mt. Nebo Scientific, entitled, "Stability Evaluation for the Proposed Reclaimed Slope at the Portal Excavation, West Ridge Mine, August 2002, Revision No. 3".

RECOMMENDATIONS:

The Permittee has provided the Division with one scenario for backfilling the highwall with angular rock fill to a slope of 40 degrees (less than 1.5h:1v). The Permittee declined to evaluate an alternative scenario of a lesser-angled backfilled slope (encroaching upon the experimental practice) because a lesser slope would disturb a larger area and change the gradient of the stream.

Ultimately, the Division is required to make a Finding whether the continued existence of the experimental practice is environmentally sound. At present, the information presented in support of the forty-degree slope is not complete. The source of the fill material, that has the properties described by the Agapito Report and which will become the topsoil, must be stated.