T E C H N I C A L M E M O R A N D U M

Utah Coal Regulatory Program

November 28, 2005

TO: Internal File

THRU: Wayne Western, Environmental Scientist/Engineering, Team Lead

FROM: Steve Fluke, Reclamation Hydrogeologist

RE: Division Order 4.6-00, West Ridge Resources, Inc., West Ridge, C/0070041, Task ID #2233

SUMMARY:

West Ridge Resources, Inc. submitted a response to deficiencies of their proposed highwall reclamation plan on April 29, 2005. The submittal (assigned Task ID #2233 by the Division) includes Appendix 5-9, Alternate Highwall Reclamation Plan, which describes the reduction of the slope of the reclaimed highwall area and the re-alignment of the original streambed. The area being discussed is included in an Experimental Practice dealing with reclamation. As part of the Experimental Practice, the original streambed surface was left intact and marked with flagging and geotextile fabric. The intent at reclamation is to uncover the original streambed and surrounding area and have very little alteration or additional reclamation of the streambed because it should be relatively undisturbed. Appendix 5-9 modifies this plan (hydrologically) by re-aligning a 500-foot section of the streambed.

This review is for the hydrologic aspects of the alternate highwall reclamation plan submittal (Task ID #2233). The Division requires additional hydrologic information prior to recommending the proposed Appendix 5-9 for incorporation into the currently approved Mining and Reclamation Plan (MRP).

TECHNICAL ANALYSIS:

RECLAMATION PLAN

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.

Analysis:

Hydrologic Reclamation Plan

The application does not meet the Hydrologic Information of the Hydrologic Reclamation Plan as provided in R645-301-761. Appendix 5-9 presents an alternate highwall reclamation plan that includes a reconstruction design for 500 feet of the main stream channel in C Canyon designated as RC-GG. Because RC-GG is a permanent diversion of an intermittent stream, the channel design must be adequate to contain the peak flow of a 100-year, 6-hour precipitation event. The proposed design for RC-GG is for trapezoidal channel that allows for the first 350 feet of the channel to be unlined with some potential for encountering bedrock to create a natural armor. The last 150 feet of the proposed design allows for a rip-rap channel. Dam structures are proposed approximately ever 100 feet for the length of the channel design. Channel flow calculations and figures showing channel profiles are presented in the appendix.

In general, the RC-GG channel reconstruction design is acceptable. However, there are several issues with the design as presented in Appendix 5-9 of the submittal that need to be modified as described below.

1) The average slope of the channel reconstruction design is presented in the text as the same as the original/restored channel average slope of 6.4%. The average slopes of the first 350 feet (upstream) and final 150 feet of the channel reconstruction are 5.71% and 9.33%, respectively, as presented in the text and on Plate 3 of Appendix 5-9. However, the reconstruction design allows for an overall straightening of the channel that would increase the average slope. Based on the slopes of the 50-foot sections of the channels as presented in Plate 3, the average slope of the channel reconstruction should be 6.8%.

2) As outlined on page 10 of Appendix 7-4 and referenced in both “Applied Hydrology and Sedimentology for Disturbed Areas” (Barfield, Warner & Haan, 1983), and “Design Hydrology and Sedimentology for Small Catchments” (Haan, Barfield, Hayes, 1994) the

limiting velocity for unlined channels is 6.0 fps. The natural channel outlined a velocity of 7.7 fps, however that assumed the natural sinuosity and armoring of the channel. Based on information provided in Appendix 5-9, the first 350 feet (upstream portion) of the channel reconstruction exceeds the limiting velocity of an unlined channel. Appendix 5-9 needs to provide a channel reconstruction design that will either allow for the installation of armor where calculated flow velocities are greater than 6.0 fps, or allow for the installation of additional dam or drop structures to reduce the velocity below 6.0 fps. Supporting calculations should be appropriate for the proposed velocity control structures.

3) The text in the Hydrologic Design section of Appendix 5-9 states that bedrock will likely be encountered to provide natural armor on the lesser-sloped and non-riprapped portion of the channel. The plan should discuss how the bedrock will affect the designs use of riprap and dams or drop structures, and that the final design is contingent upon the bedrock encountered.

4) More information regarding efforts to make riprap portions of the channel appear natural is needed in the plan.

Sediment Control Measures

Section 4.2 of Appendix 7-4 of the MRP, Reclaimed Area Drainage Control, identifies the primary sediment control as extreme-roughening or "gouging" of the surface with the a backhoe. Prior to removal of sediment ponds, a series of four (4) silt fences will be installed across the main drainage channel. These silt fences will remain as final treatment for runoff from the reclaimed site until Phase II Bond requirements are met.

The re-alignment of the channel assumes there will be little soil development – potentially there will be more of an issue working with existing bedrock in the stream channel. At the Division's request, portions of the re-aligned stream channel with greater than 2-feet of soil development will be armored. This will be consistent with the armoring of the highwall toe, and should keep the flow within the designed channel.

Findings:

The information provided does not adequately address the minimum requirements of the Reclamation Plan – Hydrologic Information section of the regulations. The following must be addressed in accordance with:

R645-301-742.310, .320, The Permittee must modify the stream reconstruction plan presented in Appendix 5-9 as described below.

1) The average slope of the channel reconstruction design is presented in the text as the same as the original/restored channel average slope of 6.4%. The average slopes of the first 350 feet (upstream) and final 150 feet of the channel reconstruction are 5.71% and 9.33%, respectively, as presented in the text and on Plate 3 of Appendix 5-9. However, the reconstruction design allows for an overall straightening of the channel that would increase the average slope. Based on the slopes of the 50-foot sections of the channels as presented in Plate 3, the average slope of the channel reconstruction should be 6.8%.

2) As outlined on page 10 of Appendix 7-4 and referenced in both "Applied Hydrology and Sedimentology for Disturbed Areas" (Barfield, Warner & Haan, 1983), and "Design Hydrology and Sedimentology for Small Catchments" (Haan, Barfield, Hayes, 1994) the limiting velocity for unlined channels is 6.0 fps. The natural channel outlined a velocity of 7.7 fps, however that assumed the natural sinuosity and armoring of the channel. Based on information provided in Appendix 5-9, the first 350 feet (upstream portion) of the channel reconstruction exceeds the limiting velocity of an unlined channel. Appendix 5-9 needs to provide a channel reconstruction design that will either allow for the installation of armor where calculated flow velocities are greater than 6.0 fps, or allow for the installation of additional dam or drop structures to reduce the velocity below 6.0 fps. Supporting calculations should be appropriate for the proposed velocity control structures.

3) The text in the Hydrologic Design section of Appendix 5-9 states that bedrock will likely be encountered to provide natural armor on the lesser-sloped and non-riprapped portion of the channel. The plan should discuss how the bedrock will affect the designs use of riprap and dams or drop structures, and that the final design is contingent upon the bedrock encountered.

4) More information regarding efforts to make riprap portions of the channel appear natural is needed in the plan.

MAPS, PLANS, AND CROSS SECTIONS OF RECLAMATION OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-323, -301-512, -301-521, -301-542, -301-632, -301-731.

Analysis:

Reclamation Backfilling And Grading Maps

Plates 1 through 5 of Appendix 5-9 present the RC-GG channel relocation, reclaimed channel and highwall cross-sections, original and reclaimed channel profiles, reclamation contours, and area types. Figures 3, 4, and 5 present cross sections of the trapezoidal channel reconstruction, rock drop structures, and rip-rap channel reconstruction. The plates and figures must be updated where necessary to reflect the design modification requested by the Division.

Findings:

The information provided does not adequately address the Reclamation Plan – Maps, Plans, and Cross Sections of Reclamation Operations section of the regulations. The following needs to be addressed in accordance with:

R645-310-731.720, -760, The Permittee needs to update plates and figures of Appendix 5-9 where necessary to reflect the design modification requested by the Division.

RECOMMENDATIONS:

Incorporation into the existing MRP is not recommended until the deficiencies cited above are adequately addressed.

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