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

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January 23, 1998

Vicky Bailey
Horizon Coal Company
P.O. Box 599
Helper, Utah 84526

Re: N97-26-7-1, Channel Configuration, Horizon Coal Company, Horizon Mine, ACT/007/020-97G-1, Folder #2, Carbon County, Utah

Dear Ms. Bailey:

This submittal incorporates changes associated with the changes to the county road and resulting stream re-alignment changes to the existing plan.

Analysis:

The channel at the outlet of UC-1 was impacted during two consecutive storm events in August of 1997 which resulted in erosion downstream of the culvert. Recently the county re-constructed the creek downstream of the disturbed area. The permitted design was initially constructed to tie into the channel which had different characteristics than the one which presently exists.

The magnitude of the events occurring in 1997 indicates a need to increase the riprap and rock check dam design requirements to be stable. The velocity resulting from the flow equal to the maximum channel capacity above and below the site should be used to design the riprap and rock check dams in the lower Jewkes Creek section re-constructed with the county road re-alignment.

The information submitted did not increase the riprap and rock check dam requirements to provide increased stability as is warranted in perennial systems. The information provided meets minimum regulatory requirements except for:

- Page 7-63 indicates the downstream channel capacity of Jewkes creek is 38.7 cfs not the 33 cfs used in the calculations on the design sheet for "Jewkes Creek Realignment - Maximum slope", page 18c.

The following were identified as concerns regarding the adequacy of riprap with

proposed designs for Jewkes Creek:

- **The D_{50} riprap design results in a safety factor less than one**. The Hydraulic Engineering Circular No. 11, **Use of Riprap for Bank Protection,** Searcy (1967) was used to design the riprap. The methods used in this design result in a safety factor less than 1 according to the Colorado State University (CSU) design criteria. According to C.T, Haan, B.J. Barfield, and J.C. Hayes, 1994, Design Hydrology and Sedimentology for Small Catchments, "The CSU procedure is the most theoretically complete and conservative of the three procedures [Federal Highway Administration (Norman, 1975), Soil Conservation Service (1979) Engineering Field Manual, and Colorado State University (Stevens and Simons, 1971, Simons and Senturk, 1977, 1992)]".

- **Prior to the deposition of sedimentation the slope is increased and the check dams may have to withstand greater flow velocities**. The estimate for appropriate gradation and distribution for a dam of 3.3 ft height according to and a peak flow of 35.3 cfs with a D_{50} around 7.2 inches which is close to the 6 inch D_{50} estimated for the proposed design with a 2 foot height according to the design, criteria identified in Heede, 1976 "Gully Development and Control" . However, the design for the maximum velocity against the riprap in the check dam did not consider the period prior to sedimentation build up. The check dam will be roughly 1.5 feet from the base of the channel to the spillway. The maximum capacity of flow against the check dam at this height is approximately 65 cfs with an approximate 6 fps velocity against the stone.

- **The riprap sizing result from Abt et. al. resulted in reduced velocity and a smaller D_{50} than would result using the standard equation for Manning's n.** The applicant uses Abt et. al. (1987) to estimate Manning's n. According to C.T, Haan, B.J. Barfield, and J.C. Hayes, 1994, Design Hydrology and Sedimentology for Small Catchments, Abt et. al. (1987), this procedure has not been officially adopted but, for the conditions tested it appeared to better describe Manning's n.

Findings:

Because added stability in design is warranted in perennial systems, design criteria are specified according to **R645-301-742.324.**

R645-301-742.324. 1) Design the Jewkes Creek channel riprap and the riprap key at the transition area to the steep gradient to withstand the velocities for the maximum downstream channel capacity as identified on page 7-63, wherein, the plan indicates the

downstream channel capacity of Jewkes creek is 38.7 cfs. and,
2) Design the riprap to have a safety factor of 1.3 assuming a combination of rounded and angular riprap is used using the Colorado State University Procedure (Stevens and Simons, 1971, Simons and Senturk, 1977, 1992) for forces on the channel bank as well as the channel bed. Adjust the riprap gradation and other design criteria as necessary. It is recommended that the D_{50} for check dams be adjusted for the potentially larger flow that could be retained behind the dam prior to sediment deposition.

Recommendation:

The recommendations under the findings section above should be incorporated into design and constructed in the field.

The abatement time has been extended to allow for the submittal of revised abatement plans. Please address the remaining deficiency by February 6, 1998.

If you have any questions, please call.

Sincerely,

Joseph C. Helfrich
Permit Supervisor

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Enclosure
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