0025

Dianne
cc: Ron Daniels
Jim Smith
Orig mine file

United States Department of the Interior

OFFICE OF SURFACE MINING
Reclamation and Enforcement
BROOKS TOWERS
1020 15TH STREET
DENVER, COLORADO 80202

JUL 2 0 1984

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DIVISION OF OIL
GAS & MINING

Mr. William McQuay
Utah Power & Light Company
1407 West North Temple Street
P. O. Box 899
Salt Lake City, Utah 84110

Dear Mr. McQuay:

In response to your recent request for clarification of Permit UT 007, 5/84 Condition Number 1 in the Wilberg mine permit, we have prepared the enclosed explanation. It addresses the difficulties associated with your proposed riprap design, together with guidance regarding a more acceptable design equation. Submittal of your response to Permit Condition Number 1 is extended to August 6, 1984.

If you have any questions about the enclosed clarification, please contact either Lou Hamm or Walter Swain at 303-844-3806. Lou is now serving as OSM's Project Leader for both the Wilberg and Deer Creek Mines.

Sincerely,

Allen D. Klein
Administrator
Western Technical Center

Enclosure

cc: Dianne Nielson, DOGM
Mary Boucek, DOGM

ACT/015/019
#2

Clarification of Wilberg Mine Condition No. 1

Your riprap size determination was based on the following equations:

$$T_{max} = 5D_{50} \qquad (1)$$
$$T_0 = C\ 62.4\ d\ S \qquad (2)$$

where,

T_{max} (Tau_{max}) = the maximum shear stress that the riprap can sustain in pounds/sq.ft.
T_0 (Tau_0) = the actual shear stress on the channel in pounds/sq.ft.
D_{50} = the mean riprap diameter in feet
d = the flow depth in feet
S = the channel slope (ft/ft)
62.4 = the unit weight of water in pounds/cu.ft.
C = the channel shape coefficient (see Table 1)

Two constraints are associated with the use of equations 1 and 2. They are:

1. T_{max} should be less than 15 pounds/sq.ft.

2. The maximum riprap size, d_{max}, should not exceed approximately 1/3 of the channel width.

Both constraints limit the mean riprap diameter to three feet for the channel conditions at the Wilberg site. By combining equations 1 and 2 with the Manning equation, the following equation is obtained:

$$D_{50} = 9.8\ C\ (nq)^{0.6}\ S\ 0.7 \qquad (3)$$

where the additional variables are:

n is the Mannings roughness coefficient
q is the discharge per unit width of channel

It can be seen from equation 3 that with the riprap diameter fixed and the roughness and flow conditions established, the slope of the channel is the only variable that can be adjusted to meet riprap stability requirements.

Equation 3 can be used to establish criteria for maximum slope conditions along the channel reach. The difference between the actual slope conditions and the maximum allowable slope will be the fall that will have to be incorporated into the channel profile. The fall will take place over natural ledges along the channel profile or should be excavated in bedrock during channel restoration.

Table 1. Channel shape coefficients for sides of trapezoidal shaped channel with 2:1 side slopes

Bottom width/depth	C
1.0	1.3
2.2	1.2
4.3	1.1
>6.3	1.0

Standard Reference

Anderson, A. G., A. S. Paintal, and J. T. Davenport. 1970. Tentative design procedure for riprap lined channels. University of Minnesota, National Cooperative Highway Research Program Report 108. Highway Research Board.