0004

pro/043/001

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August 31, 1987

TO: File

FROM: Rick P. Summers, Reclamation Hydrologist RPS

RE: Replay to Response to Stipulations, Dated August 8, 1987, Summit No. 1 Coal Mine, Reclamation Plan, PRO/043/001, Summit County, Utah.

Summary

The applicant's response to our state Decision Package stipulations (received August 10, 1987) was reviewed for hydrology concerns (UMC 817.42-2 and 817.46-2). The following memo further substantiates the review team's position on these matters.

Body

UMC 817.42-2-RS

The intent of this stipulation was not to reclaim the existing sedimentation pond, rather it was to insure that sedimentation control strutures be placed between Chalk Creek and the reclaimed area during the reclamation period. The Division agrees that the existing sediment pond should remain.

UMC 817.46-2-RS

The Division has evaluated the expected sediment yield using USLE and feels our results are justifible and realistic. Apparently, two discrepancies exist between the applicant's submitted values and the values used in the technical analysis. First, the value used for K appears to be underestimated. The Division used a value of appx. 0.24 based upon the soils analysis report from USU provided in the permit application. Samples nos. 5 thru 8 indicate the soils in the area are predominantly loam with some sandy loam. Referring to Table 5.6 (enclosed) the recommended values range from 0.37 to 0.42. However, Table 5.5 (enclosed) indicates a value of 0.24 for fine sandy loam to sandy loam soils. Considering the local values given by Mr. Tim Watson (see HE-6 of the MRP) for our decision, it was decided to use the lower of the two referenced values (0.25).

The second discrepancy apparently lies with the choice of the C factor used. The applicant used a value of 0.004 based upon Table 5.A.4 (enclosed). The Division has determined that this chart is not the best information available for this site. The referenced table is for WOODLAND conditions and a footnote explains that litter cover must be two inches deep for 85 % of the watershed area. Field observations by the DOGM staff indicate these conditions do not exist. The Division feels a more applicable condition is described in Table 5.A.3 (enclosed). This table lists RANGELAND conditions for appreciable brush with 50 percent cover. It is felt this table is more appropriate for conditions in northern Utah. This table lists the value for C as 0.13. The Division used both the submitted values from the MRP and these tables for the determination of a CP factor of 0.01. It is felt that the Division selected values that are representative of the site without being unduly conservative.

It is recommended that the applicant contact myself or Kent Wheeler if questions arise.

jvb
cc: Sue Linner
Kent Wheeler

6000R-68

SOIL LOSS EVALUATION

SOIL LOSS IS CALCULATED USING THE METHODOLOGY DESCRIBED IN "APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS", B.J. BARFIELD, R.C. WARNER, CT HAAN, CHAPTER 5, 1981, FOR THE UNIVERSAL SOIL LOSS EQUATION. FOOTNOTES CITED ARE FOUND IN THIS REFERENCE.

WATER SHED (4)	AREA (AC) (4)	R (12)	K (13)	LS (14)	CP	TONS PER YR.
A	5.42	20	0.15	63.5 (17)	0.004 (16)	4.13
C+C'	12.87	20	0.20	9.0 (17)	1.0 (16)	463.32

TOTAL = 467.45 TON/YR

DESIGN LOSS: $\frac{(467.45\ T/YR)(3\ YR)(2000\ LB/T)}{100\ LB/FT^3\ (18)} = 28047\ CU\ FT$

$\frac{28047\ CU\ FT}{(43560\ CF/AC)(12.87\ AC)} = 0.050\ A\text{-}F/AC$ oh FOR 817.46(6)(2)

USE: 28,047 CF

(12) FIG. 5.3 $\tilde{=} R=30$; $R = 27\,P_{2,6}^{2.2}$ WHERE $P_{2,6} \tilde{=} 0.85$ (FIG 5.4) $\tilde{=} 19$ USE R=20

(13) PER TIM WATSON, SCS - COALVILLE UTAH, FOR MOUNTAIN GRAVELLY LOAM AT SUMMIT NO. 1 COAL MINE SITE. VALUE IS INCREASED BY [illegible]% FOR DISTURBED AREAS.

(14) $LS = \left(\frac{\lambda}{72.6}\right)^m \left(\frac{430\chi^2 + 30\chi + 0.43}{6.613}\right)$ WHERE λ = HYD. LENGTH (FT), $m = 0.5$ ($S > 5\%$ ALWAYS), χ = SIN (ANGLE OF SLOPE (DEG))

(15) TABLE 5.A.4 FOR 42.5% CANOPY AND 85% LITTER

(16) TABLE 5.A.1 FOR BARE SOIL (CONSERVATIVE)

(17) $\lambda_A = 725$, $\chi_A = \sin\left(\tan^{-1}\frac{61.1}{100}\right)$; $\lambda_{C\text{-}C'} \tilde{=} 1039$, $\chi_{C\text{-}C'} = \sin\left(\tan^{-1}\left(\frac{6420-6255}{1039}\right)\right)$ ← SLOPE OF $\lambda_{C\text{-}C'}$

Project - Net Erosion - Blackhawk TA

Date - 6-23-87

Reviewer KW

Gross Erosion

- Mine site divided into disturbed (C+C') and undisturbed (A) areas

AREA

A	5.56 acres
C+C'	12.63 acres

USLE Componates

Watershed	R	K ✓	LS	CP	T/A·Yr
A	20	0.25	64.67	0.01	3.23 T/A·Yr
C+C'	20	0.25	9.2	0.9	41.40 T/A·Yr

Volume of Sediment

Watershed	Area	Gross Erosion	Length of Accumulation	Conversion Factor	Gross Erosion
A	5.56 A	3.23 $\frac{T}{A \cdot Y}$	3 yr	$\frac{2000 \frac{lb}{T}}{1.5 (62.4 lb)}$	1,150 ft^3
C+C'	12.63 A	41.40 $\frac{T}{A \cdot Y}$	3 yr	$\frac{2000 \frac{lb}{T}}{1.5 (62.4 lb)}$	33516 ft^3

Total Gross Erosion 34,660 ft^3

SDR = 1

Net Erosion 34660 ft^3

OR 0.8 Acre-ft

Applicant values

WS	A	R	K	LS	CP	Ton/yr.
A	5.42	20	0.15	63.5	.004	4.13
C+C'	12.57	20	0.20	9.0	1.0	963.32

Pg HE-C - states K value increased by 20% for disturbed areas

2 not given

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Soil, Plant and Water
Analysis Laboratory

October 6, 1986

Richard Kopp
Summit Minerals, Inc.
221 West 2100 South
Salt Lake City, Ut 84115

Sample received September 11, 1986.

USU No.	Ident.	Texture*	Lime**	pH	mmhos /cm ECe	ppm P	K	Fe	Zn	NO_3-N	%>2mm
86-1606	#1A	SL	0	7.3	.3	20	137	15.6	4.3	3.7	9
86-1607	#1B	SL	0	7.0	.2	23	115	30.0	1.7	.8	16
86-1608	#2A	OM	0	6.7	.4	32	365	68.8	6.5	10.2	14
86-1609	#2B	SiL	0	6.8	.2	40	346	65.2	2.6	2.6	41
86-1610	#3A	SiL	0	6.7	.3	39	>400	52.8	4.5	3.1	15
86-1611	#3B	SiL	0	6.8	.3	35	378	46.2	2.4	2.0	12
86-1612	#4A	SiL	0	7.3	.6	37	295	22.4	3.8	20.1	20
86-1613	#4B	SiL	0	7.3	.3	32	255	30.4	3.5	4.7	15
86-1614	#5A	L	++	8.0	.5	15	92	11.1	3.6	1.7	34
86-1615	#5B	L	++	7.9	.5	14	67	13.5	1.3	1.1	60
86-1616	#6A	L	+	7.6	.5	21	86	25.4	4.0	4.5	46
86-1617	#6B	L	+	7.6	.5	25	88	19.8	2.6	2.9	49
86-1618	#7A	L	++	8.2	.5	13	63	8.3	.7	2.0	53
86-1619	#7B	L	++	8.3	.4	13	67	11.2	.6	2.5	64
86-1620	#8A	SL	++	8.1	.5	16	52	7.7	.7	7.9	63
86-1621	#8B	SL	++	8.2	.4	12	51	8.4	.6	2.9	62
86-1622	#9A	L	++	8.0	.5	12	116	7.4	.8	4.7	54
86-1623	#9B	L	++	8.2	.7	5.9	56	7.2	.5	4.8	38

*SL = Sandy Loam
OM = Organic Matter
SiL = Silty Loam
L = Loam
lwt

** 0 = no lime
+ = little lime
++ = alot of lime

K. Toren

Table 5.6 Typical subsoil K Values[1/] (SCS, 1978)

Subsoil Texture	Estimated K Value
Outwash Soils	
Sand	.17
Loamy Sand	.24
Sandy Loam	.43
Gravel, fine to mod. fine	.24
Gravel, med. to mod. coarse	.49
Lacrustrine Soils	
Silt loam and very fine sandy loam	.37
Silty clay loam	.28
Clay and silty clay	.28
Glacial till	
Loam, fine to mod. fine subsoil	.32
Loam, med. subsoil	.37
Clay loam	.32
Clay and silty clay	.28
Loess	.37
Residual	
Sandstone	.49
Siltstone, nonchannery	.43
Siltstone, channery	.32
Acid clay shale	.28
Calcareous clay shale or limestone residuum	.24

[1/] Note: These values are typical based only on textural information. Values for an actual soil can be considerably different due to different structure and infiltration.

EXAMPLE PROBLEM 5.5

A soil series is analyzed both physically and mineralogically. The results are shown below. Estimate the erodibility of the surface soil and subsoil using the Wischmeier *et al.* nomograph and the Roth *et al.* nomograph.

Singer *et al.* (1978) investigated engineering properties of soil as they affect erodibility and found that the rate of erosion was highly related to the critical tractive force of soils. The data presented were too limited to predict K values, but hold promise for relating K to measurable soil properties.

Essentially no information is available on the K of exposed spoil material or for topsoil that has been reconstructed. At the present, it will be necessary to estimate K using either the Wischmeier *et al.* erodibility nomograph or the Romkens *et al.* (1975, 1977) equation. Research is presently underway to determine K values for these materials.

The USDA (SCS, 1978) has developed K values as a function of soil texture. Tables 5.5 and 5.6 can be used for approximate erosivity estimates of topsoil and exposed subsoil materials, respectively.

Estimates of K have been made by the Soil Conservation Service based on experience and soil classification for subsoils for most areas of the United States. Local and state SCS offices should be consulted for further information.

Table 5.5 Typical topsoil K Values[1/] (SCS, 1978).

Surface Layer Texture	Estimated K Value
Clay, clay loam, loam, silty clay	.32
Fine sandy loam, loamy very fine sand, sandy loam	.24
Loamy fine sand, loamy sand	.17
Sand	.15
Silt loam, silty clay loam, very fine sandy loam	.37

1/ Note: These values are typical based only on textural information. Values for an actual soil can be considerably different due to different structure and infiltration.

angeland, Idle Land,

ntacts the Surface

ent Ground Cover

0	60	80	95-100
10	.042	.013	.003
15	.090	.043	.011
09	.038	.012	.003
3	.082	.041	.011
07	.035	.012	.003
1	.075	.039	.011
06	.031	.011	.003
09	.067	.038	.011
9	.040	.013	.003
4	.085	.042	.011
85	.038	.012	.003
3	.081	.041	.011
8	.036	.012	.003
2	.077	.040	.011
0	.041	.013	.003
4	.087	.042	.011
9	.040	.013	.003
4	.085	.042	.011
9	.039	.012	.003
3	.083	.041	.011

mulch or vegetation, and
d refers to land with un-
ive years. Also to be used
harvested less than three

face: m = meters.
iew by canopy in a verti-

mpacted duff or litter at

nts (as weeds with little
residue.

Table 5.A.4. C Factors for Undisturbed Woodland.[4]

Effective Canopy[1]. % of Area	Forest Litter[2]. % of Area	C_s[3]. Factor
100-75	100-90	.0001-.001
70-40	85-75	.002-.004
35-20	70-40	.003-.009

1. When effective canopy is less than 20%, the area will be considered as grassland or idle land for estimating soil loss. Where woodlands are being harvested or grazed, use Table 5.6.
2. Forest litter is assumed to be at least two inches deep over the percent ground surface area covered.
3. The range in C values is due in part to the range in the percent area covered. In addition the percent of effective canopy and its height has an effect. Low canopy is effective in reducing raindrop impact and in lowering the C factor. High canopy, over 13 meters, is not effective in reducing raindrop impact and will have no effect on the C value.
4. Soil Conservation Service (1977).

Table 5.A.3. C Factors for Permanent Pasture, Rangeland, Idle Land, and Grazed Woodland.[1,5]

Vegetal Canopy			Cover that Contacts the Surface					
Type and Height of Raised Canopy[2]	Canopy Cover[3]	Type[4]	Percent Ground Cover					
	%		0	20	40	60	80	95-100
No appreciable canopy		G	.45	.20	.10	.042	.013	.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush (0.5 m fall ht.)	25	G	.36	.17	.09	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.06	.031	.011	.003
		W	.17	.12	.09	.067	.038	.011
Appreciable brush or bushes (2 m fall ht.)	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees but no appreciable low brush (4 m fall ht.)	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

1. All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists. Idle land refers to land with undisturbed profiles for at least a period of three consecutive years. Also to be used for burned forest land and forest land that has been harvested less than three years ago.
2. Average fall height of waterdrops from canopy to soil surface: m = meters.
3. Portion of total area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).
4. G: Cover at surface is grass, grasslike plants, decaying compacted duff or litter at least 2 inches deep.

   W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral root network near the surface), and/or undecayed residue.
5. Soil Conservation Service (1977).

Tabl

Effective Canopy[1] % of Area
100-75
70-40
35-20

1. When effective c or idle land for grazed, use Table
2. Forest litter is a surface area cove
3. The range in C addition the perc is effective in re canopy, over 13 no effect on the
4. Soil Conservation