HOMESTAKE MINING COMPANY
P.O. BOX 98
GRANTS, NEW MEXICO 87020
(505) 287-4456

June 30, 1997

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U.S. Nuclear Regulatory Commission
Division of Waste Management, MST-7-J-9
Attn. Mr. Joseph J. Holonich, Chief
High Level Waste and Uranium
Recovery Projects Branch
11555 Rockville Pike
Rockville, MD 20850

Re: **Docket No. 40-8903**
License No. SUA-1471
Evaluation of Field Measurements on Rock Cover for LTP

Dear Mr. Holonich:

In response to a request by Mr. Ken Hooks, Homestake Mining Company of California (HMC) respectively submits the attached report titled "Evaluation of Field Measurements on Rock Cover of Large Tailings Impoundment" prepared by HMC's geo-technical consultant Mr. Alan Kuhn. The information in Mr. Kuhn's report was requested to provide additional calculation data to answer some remaining questions from Mr. Ted Johnson resulting from a March 31, 1997 site visit by Mr. Hooks and Mr. Johnson to inspect the erosion protection rock for the outslopes of the large tailings pile.

For additional reference, I have made a package of relevant information which includes the following: 1) a map showing the approximate rock sample data locations, 2) a copy of the Appendix C from the 10/93 revision of the Homestake Grants Reclamation Plan, 3) the Laboratory Control Test Summary for the erosion protection rock, Table 4.5.13C from the Knight Piésold Quality Control report, 4) a copy of HMC's November 1, 1996 Quantitative Review of Outslope Rock report to the NRC (without pictures and maps) and 5) a copy of the April 22, 1997 NRC site inspection report.

I hope the contained information will satisfy any remaining questions concerning the placement of the rock on the outslopes of the Grants large tailings pile. If you have any additional questions regarding this information please contact me at the Grants site, 505-287-4456. Thank you.

Sincerely,

HOMESTAKE MINING COMPANY OF CALIFORNIA

NL05 1/1

Roy R. Cellan
Corporate Manager, Reclamation

cc: Mr. Ken Hooks, Project Manager
Mr. Ted Johnson, Surface Water Hydrologist
Mr. C. Cain, NRC, Arlington, TX
Mr. Harold Barnes, Director EHSGA, SFO

AK GeoConsult, Inc. Geotechnical and Geoenvironmental Engineering
13?12 Manitoba Drive, NE Albuquerque, NM 87111-2955 505 275 8410 Fax 505 298 9839

June 3, 1997

Mr. Roy Cellan
Homestake Mining Company
P.O. Box 98
Grants, NM 87020

EVALUATION OF FIELD MEASUREMENTS ON ROCK COVER OF LARGE TAILING IMPOUNDMENT, HOMESTAKE GRANTS PROJECT

Dear Roy:

At your request I have reviewed your letter report of 11/1/96 to the USNRC regarding the field measurements made at five locations on the large impoundment outslope rock cover. You requested that I respond to Mr. Ted Johnson's request to perform an evaluation of those field measurements to determine if the rock meets the necessary erosion protection parameters as contained in the 10/93 revision of the reclamation plan.

The attached table entitled *EVALUATION OF ROCK COVER MEASUREMENTS AS REPORTED BY HMC ON 11/1/96* summarizes my review and evaluation. As discussed with Mr. Johnson (telcon, 4/4/97), I assumed initially that the rock cover at each measured location consisted of one layer of rock, the thickness of which would then represent the d_{100} of rock at that location. Using the design relationships between d_{100} and d_{50}, as described in the reclamation plan Appendix C, I calculated the maximum, minimum, and average d_{50} values that would correspond to each d_{100}. The minimum d_{50} is the value used in the determination of rock sizes needed to protect against PMP runoff, and the smallest d_{50}min value based on the field measurements is 4.2 inches at sample location #1 (shaded number in attached table).

Several *size* and *thickness* criteria are used to design a rock cover or to evaluate an existing cover. If the rock is to meet the design requirements for <u>size</u>, *the smallest d_{50}min must be at least as large as the largest d_{50}min required for outslope protection.* The calculated design values (d_{50}min) for various outslope sections are contained in Calculation C10.1A.1 of Appendix C of the reclamation plan, 10/93 revision, a copy of which is attached. The largest of these d_{50}min values and, therefore, the smallest d_{50}min that will meet the size criteria, is 4.2 inches, so the required d_{50}min is exactly equal, coincidentally, to the smallest d_{50}min based on the field measurements of cover thickness. Therefore, the rock at all five measurement locations meets or exceeds the required d_{50}min value of 4.2 inches.

Homestake Mining Company
Grants Reclamation Site

Evaluation of Field Measurements on Rock Cover of Large Tailing Impoundment

by

Dr. Alan Kuhn

June 3, 1997

Rock cover *thickness* is a function of rock size - the average cover thickness should be at least equal to the design d_{100} or be 1.71 times the d_{50} min. To examine cover thickness vs d_{50}min, the measured cover thickness was divided by the design d_{50}min of 4.2 inches. The results are shown in column H of the attached table and are labeled as "equivalent no. of layers of design d_{50}min rock". The average is well above 2.0 and the smallest value is 1.7. This may be viewed as a way to compare a single layer of the rock cover as placed to multiple layers of rock cover made up of only d_{50}min rock.

The basis for the foregoing comparisons and analysis is the same as that for the design of the rock cover and is described in detail in the reclamation plan, 10/93 revision, Appendix C10. Both the design and this analysis followed the methods and recommendations of NUREG/CR-4620, NUREG/CR-4651 and the USNRC *Final Staff Technical Position on Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites*. Specifically, for the outslope rock cover the Stephenson Method was used to determine the rock size needed for protection of slopes steeper than 0.1 gradient (outslopes are up to 0.2 gradient). The method uses the following equation to determine the minimum d_{50} in inches:

$$d_{50} = [(q^*(\tan SA)^{7/6} * p^{1/6})/(Cs^* g^{1/2} * ((1-p)^*(G-1)^*(\cos SA)^*(\tan FA-\tan SA))^{5/3}]^{2/3} * 12$$

where:

q = unit discharge, cfs/ft = C*i*a
SA = slope angle, radians = 0.1974 for 5:1 slope
p = rock cover porosity = 0.45
Cs = Stephenson factor = 0.27 for blasted and crushed basalt
g = gravitational acceleration = 32.2 ft/sec/sec
G = specific gravity of the rock = 2.57
FA = friction angle of rock, radians = 0.6981

and

C = runoff coefficient = 0.8; i = rainfall intensity in inches/hr; and a = unit area in acres

For any given slope angle and rock source, all factors of this equation are constants except for the discharge, *q*, and its factors *i* and *a*, both of which are functions of the flow path length. In preparing the reclamation plan, the design configuration of the reclaimed tailing pile was examined to determine the range of flow paths that will produce discharge to the tops of the outslopes. Ten such flow paths on the large pile were analyzed, as illustrated on Figure C10.2 (attached) in Appendix C10. Using a spreadsheet format to display the

variables and the results, I calculated the rock sizes (d_{50}) needed to protect the outslopes, as shown in Calculation C10.1A.1. The entries in the column captioned "d50 for S>0.1, inches", seventh column from the right side of the table, are the required sizes calculated by the Stephenson method. Note that the columns to the right of that column are parameters and results of the Safety Factors method of determining rock sizes for the pile top (slopes < 0.1 gradient) and are not relevant to this discussion.

Not surprisingly, the largest rock (4.2 inches) is required for the outslope portion of the longest flow path, "West" on Figure C10.2 and Calculation C10.1A.1. This became the design rock size for all outslopes of the large pile, regardless of the fact that this size is needed only for a small percentage of the total outslope surface. Consequently, an additional margin of conservatism in rock sizing has been applied over most of the outslope surface.

In preparing this response to the NRC question, it was not necessary to generate new design calculations of rock size because the referenced field measurements fall within the range of sizes already calculated for the PMP runoff event. The measured rock locations indicate that rock cover *thickness* meets or exceeds the thickness required by the design criteria based on the methods described above; and by these same methods the rock *sizes*, although not included in the field measurements, appear to meet the design criteria.

It should be noted that some additional conservatism was built into the rock sizing by the fact that the rock gradations and sizes changed (were reduced) from the original calculations to the 10/93 revision because of a change in the HMR 55 hydrometeorological parameters. These changes slightly reduced the intensities and total rainfall of the PMP, and when combined with the effect of modifications in the regrading design of the impoundment, they resulted in a reduction of the d_{50}min from 4.7 inches to 4.2 inches. However, by the time this revision was adopted the rock order had been placed, so it was decided to keep the order unchanged and to use the oversized rock. Therefore, most of outslope cover has two additional levels of conservatism not required by the USNRC.

Please contact me if you have any questions.

Yours truly,

Alan K. Kuhn

Alan K. Kuhn, PhD, PE

AKK/kmk
attachments

EVALUATION OF ROCK COVER MEASUREMENTS AS REPORTED BY HMC ON 11/1/96

A	B	C	D	E	F	G	H
ID	AREA	DEPTH	EQUIVALENT d_{100}	EQUIVALENT d_{50} RANGE			EQUIVALENT NO. OF LAYERS OF
				max $=d_{100}/1.29$	min= $d_{100}/1.71$	ave= $d_{100}/1.5$	
	ft^2	ft	inches	inches	inches	inches	DESIGN d_{50}min ROCK
1	72	0.6	7.2	5.7	4.2	4.8	1.7
2	47.6	0.7	8.4	6.7	4.9	5.6	2.0
3	26.6	0.9	10.8	8.6	6.3	7.2	2.6
4	41.3	0.8	9.6	7.6	5.6	6.4	2.3
5	14.1	1.3	15.6	12.4	9.1	10.4	3.7
DESIGN VALUES				5.4	4.7		

Average Specific Gravity of rock is 2.57

Average Unit Weight of rock is 160.4 pcf

EXPLANATION

Column	
A,B,C	From Table 1, HMC letter report of 11/1/96
D	The largest possible rock size (d_{100}) at the measured location, equaling the rock layer thickness (Column C), converted to inches.
E	The max d_{50} that would be associated with the d_{100} (column D) if the design relationships between d_{100} and d_{50} were maintained.
F	The min d_{50} that would be associated with the d_{100} (column D) if the design relationships between d_{100} and d_{50} were maintained.
G	The average d_{50} that would be associated with the d_{100} (column D) if the design relationships between d_{100} and d_{50} were maintained.
H	The number of d_{50}min-thick layers represented by the measured layer thickness, =Column D/ 4.2.

CALCULATION C10.1A.1 - ROCK SIZES FOR EROSION PROTECTION OF LARGE IMPOUNDMENT FROM RAINFALL AND RUNOFF OF 1-HR LOCAL PMP

HMCEROPR.WK3 a611120
Revised 10/93

SLOPE ELEMENT Fig.C10.2	ELEMENT LENGTH L	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc hours	RAINFALL WITHIN tc (1)	i in/hr	q cfs/ft (2)	y ft (2)	v fps (2)	Critical slope, Ss ft/ft	d50 for S>0.1 inches	d50 for S<0.1 inches	Parameters for flow on top of rock: n for d50 (3)	y	v	Ss	Safety Factor
east top	483	679	667	0.0248	1.42	0.06	2.40	38.18	0.34	0.12	2.83	0.00033		1.00	0.025	0.14	2.46	0.02671	1.73
east os	450	667	590	0.1711	9.71	0.09	3.50	38.38	0.65	0.10	6.59	0.00035	3.52						
SE top	506	679	667.5	0.0227	1.30	0.07	2.90	43.01	0.40	0.14	2.95	0.00029		1.00	0.025	0.15	2.58	0.02346	1.69
SE os	550	667.5	590	0.1409	8.02	0.10	3.80	36.87	0.77	0.12	6.63	0.00030	3.93						
S1 top	810	679	667	0.0197	1.13	0.08	3.10	37.66	0.42	0.15	2.89	0.00027		1.00	0.024	0.16	2.56	0.02284	1.84
S1 os	400	667	590	0.1925	10.90	0.11	4.00	37.37	0.69	0.10	6.99	0.00039	3.67						
S2 top	650	679	664	0.0231	1.32	0.08	3.10	38.13	0.45	0.15	3.12	0.00026		1.00	0.025	0.17	2.73	0.02054	1.55
S2 os	420	664	585	0.1881	10.65	0.11	4.00	37.32	0.74	0.10	7.12	0.00038	3.83						
S3 top	700	679	660	0.0271	1.55	0.08	3.10	38.34	0.49	0.15	3.38	0.00024		1.00	0.026	0.17	2.91	0.01913	1.30
S3 os	400	660	582	0.1950	11.03	0.11	4.00	37.93	0.77	0.11	7.31	0.00039	3.93						
S4 top	700	679	660	0.0271	1.55	0.08	3.10	38.34	0.49	0.15	3.38	0.00024		1.00	0.026	0.17	2.91	0.01913	1.30
S4 os	400	660	580	0.2000	11.31	0.11	4.00	38.02	0.77	0.10	7.37	0.00039	3.93						
7 apron	10	580	579.9	0.0100	0.57	0.11	4.00	36.46	0.78	0.26	3.01	0.00951	3.95						
S5 top	673	674	660	0.0208	1.19	0.09	3.50	40.27	0.50	0.16	3.13	0.00024		1.00	0.025	0.18	2.77	0.01967	1.60
S5 os	400	660	580	0.2000	11.31	0.11	4.00	35.95	0.76	0.10	7.33	0.00041	3.89						
West top	1034	672	660	0.0116	0.66	0.15	5.10	33.68	0.64	0.22	2.91	0.00019		1.00	0.022	0.24	2.71	0.01718	2.21
West os	371	660	588	0.1941	10.98	0.17	5.50	31.48	0.85	0.11	7.60	0.00049	4.20						
N1 top	750	679	660	0.0253	1.45	0.09	3.50	39.97	0.55	0.16	3.46	0.00022		1.00	0.025	0.18	3.00	0.01757	1.29
N1 os	360	660	590	0.1944	11.00	0.11	4.00	36.28	0.79	0.11	7.37	0.00044	3.99						
SW top	790	669.5	660	0.0120	0.69	0.12	4.40	36.24	0.52	0.19	2.72	0.00023		1.00	0.023	0.21	2.53	0.02023	2.41
SW os	416	660	586	0.1779	10.09	0.15	5.10	34.53	0.79	0.11	7.18	0.00041	3.99						

Notes

(1) from graph of rainfall vs duration, Figure C10.1

(2) for soils surfaces without (before application of) rock cover

(3) $n=0.0456(d50 \times S)^{0.159}$

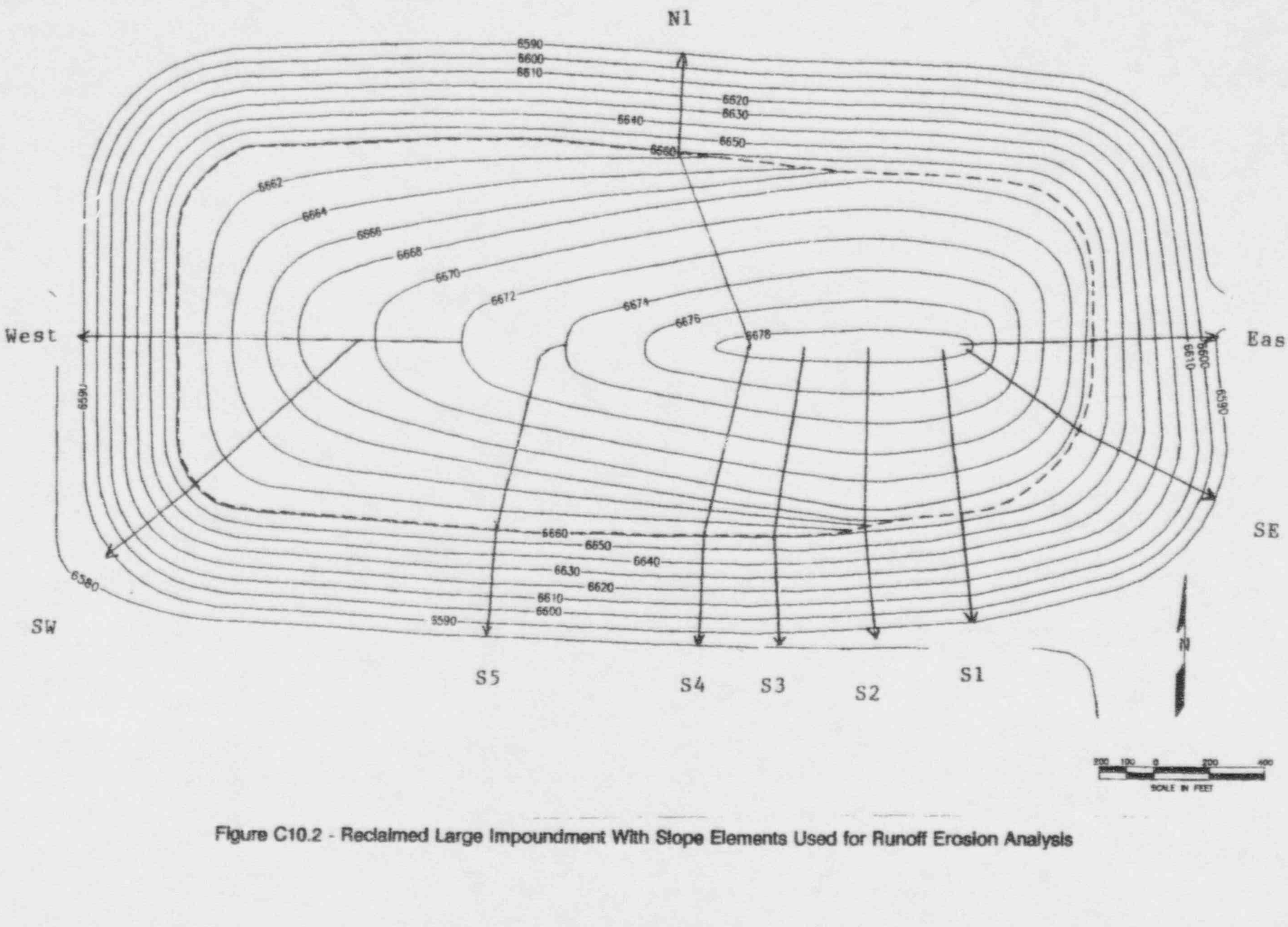


Figure C10.2 - Reclaimed Large Impoundment With Slope Elements Used for Runoff Erosion Analysis

Additional Reference Item

No. 1

Homestake Mining Company
Grants Reclamation Site

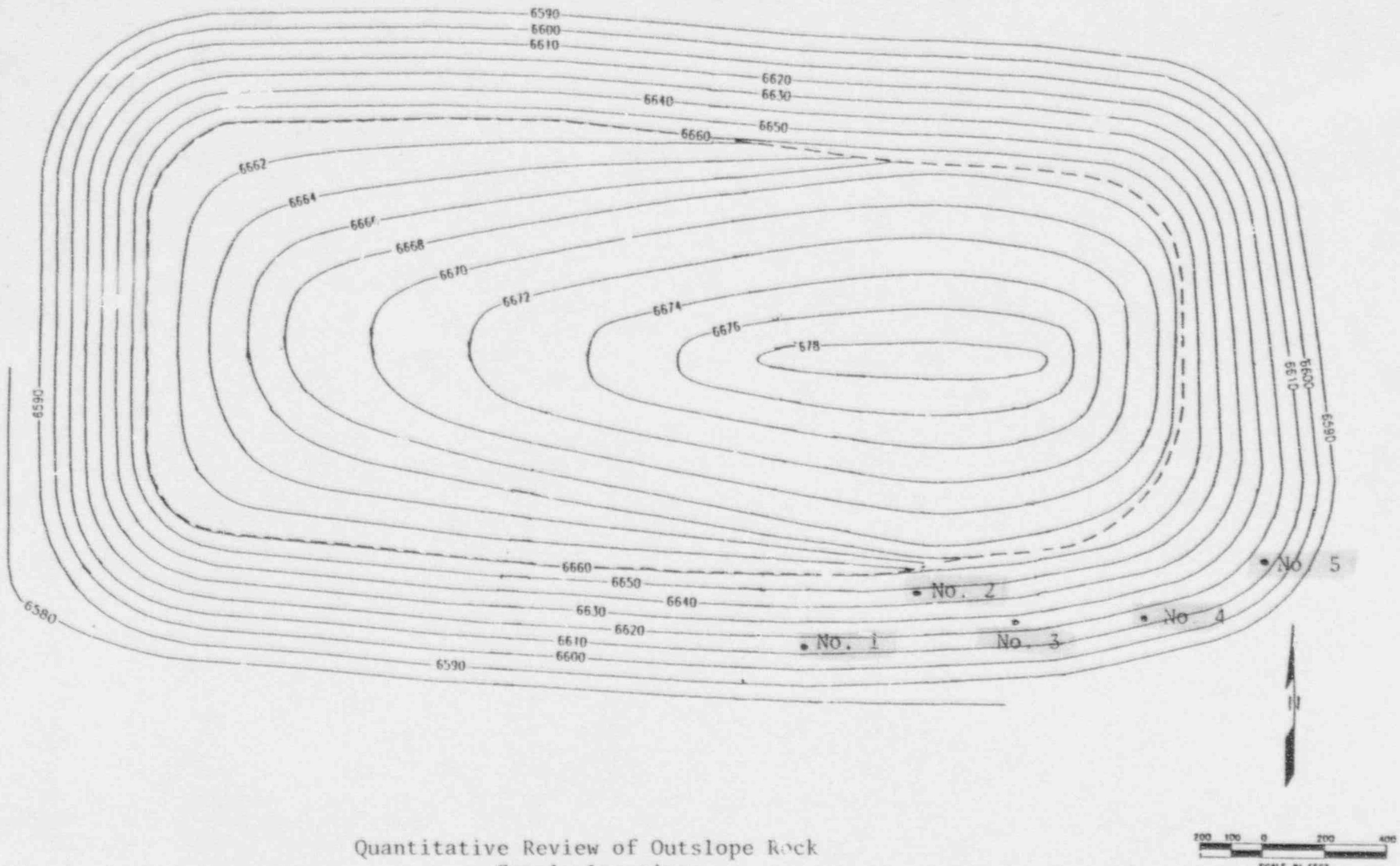
Map

Rock Sample Locations

From

Quantitative Review of Outslope Rock

June 17, 1996



Quantitative Review of Outslope Rock
Sample Locations

6/17/96

Additional Reference Item

No. 2

Homestake Mining Company
Grants Reclamation Site

Appendix C
Volume 2

Homestake Mining Company
Reclamation Plan
Revision 10/93

October 1993

APPENDIX C10 (Rev. 10/93) - ROCK SIZES FOR EROSION PROTECTION

PARAMETERS USED FOR SITE RUNOFF AND EROSION PROTECTION CALCULATIONS

1-HR LOCAL PMP 10.58 inches unadjusted for elevation above 5000 ft (Plate VIc, HMR 55A)
1-HR LOCAL PMP 9.94 inches adjusted for ave. elev. of 6600 on pile (Fig. 14.3, HMR 55A)

C, runoff coeff. 0.8 from pile surfaces (NRC-directed value)
0.7 from other site surfaces (upper end of range for gravel, Table 4.6, NUREG/CR-4620)

Manning coeff., n,
of soil cover 0.020 (Table 4.2, NUREG/CR-4620)
of rock cover n=0.0456(d50 x S)^0.159 (Eqn. 4.8, NUREG/CR-4651)

allowable shear stress, Ta, in psf, of:
alluvial sand = 0.02 for SP with d75= 0.27 mm = 0.0106 in.
gravel = 0.425 for GP with d75= 26.9 mm 1.06 in. (USDA Ag. Handbook 667, Table 3.3)
rock = 0.4*d75 = 0.4*1.25*d50 = 0.5*d50

flow concentration factor, F = 3 assumed based on vegetation over 30 % or less of area

Stephenson factor, Cs = 0.27 for blasted/ crushed basalt (p. 48, NUREG/CR-4620)

rock cover porosity, P = 0.45 (Table 8.1, NUREG/CR-4651)

rock spec. gravity, G = 2.57 based on average of 27 tests of samples from 0-50' depth (Rev. 10/93) (see Appendix D)

slope angle, SA (design values)
pile top varies up to about 8.0 degrees
outslope 11.31 degrees, 0.1974 radians

friction angle
of rock, FA = 40 degrees, 0.6981 radians (Figure 4.8, NUREG/CR-4620)

EQUATIONS

tc, time of concentration = 0.00013*(L^0.77/S^0.385)

i, rainfall intensity = PMP depth * %PMP * 60/tc = rainfall depth/tc (rainfall depth from HMR 55A, Fig.12.10 and Table 12.4; reproduced on Figure C10.1 of this appendix)

q, unit discharge = C*i*a

Q, total runoff = C*i*A

y, max. flow depth = (q*n/1.486*S^.5)^0.6

v, max. flow velocity = (1.486/n)*y^.667*S^.5

Ss, critical slope (limiting value for erosional stability) = ((65*Ta^(5/3))/(i*L*F*n))^(6/7)

d50, mean rock diameter (per rationale of NRC Staff Technical Position on Erosion Protection...)
by Safety Factors Method, Safety Factor, SF = (cos SA)*(tan FA)/((21*y*S/(G-1)*d50)*(tan FA)+sin SA) For slopes with gradients < 0.1
by Stephenson Method, d50 = [(q*(tan SA)^7/6*P^1/6)/(Cs*g^.5*((1-P)*(G-1)*(cosSA)*(tanFA-tanSA))^1.667]^.667*12 For slopes with gradients < 0.1

CALCULATION C10.1A.1 - ROCK SIZES FOR EROSION PROTECTION OF LARGE IMPOUNDMENT FROM RAINFALL AND RUNOFF OF 1-HR LOCAL PMRevised 10/93 HMCEROPR.WK3 a61.t120

SLOPE ELEMENT Fig.C10.2	ELEMENT LENGTH L	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc hours	RAINFALL WITHIN tc (1)	i in/hr	q cfs/ft (2)	y ft (2)	v fps (2)	Critical slope, Ss ft/ft	d50 for S>0.1 inches	d50 for S<0.1 inches	Parameters for flow on top of rock: n for d50 (3)	y	v	Ss	Safety Factor
east top	483	679	667	0.0248	1.42	0.06	2.40	38.18	0.34	0.12	2.83	0.00033							
east os	450	667	590	0.1711	9.71	0.09	3.50	38.38	0.65	0.10	6.59	0.00035	3.52	1.00	0.025	0.14	2.46	0.02671	1.73
SE top	506	679	667.5	0.0227	1.30	0.07	2.90	43.01	0.40	0.14	2.95	0.00029							
SE os	550	667.5	590	0.1409	8.02	0.10	3.80	36.87	0.77	0.12	6.63	0.00030	3.93	1.00	0.025	0.15	2.58	0.02346	1.69
S1 top	610	679	667	0.0197	1.13	0.08	3.10	37.66	0.42	0.15	2.89	0.00027							
S1 os	400	667	590	0.1925	10.90	0.11	4.00	37.37	0.69	0.10	6.99	0.00039	3.67	1.00	0.024	0.16	2.56	0.02284	1.84
S2 top	650	679	664	0.0231	1.32	0.08	3.10	38.13	0.45	0.15	3.12	0.00026							
S2 os	420	664	585	0.1881	10.65	0.11	4.00	37.32	0.74	0.10	7.12	0.00038	3.83	1.00	0.025	0.17	2.73	0.02094	1.55
S3 top	700	679	660	0.0271	1.55	0.08	3.10	38.34	0.49	0.15	3.38	0.00024							
S3 os	400	660	582	0.1950	11.03	0.11	4.00	37.93	0.77	0.11	7.31	0.00039	3.93	1.00	0.026	0.17	2.91	0.01913	1.30
S4 top	700	679	660	0.0271	1.55	0.08	3.10	38.34	0.49	0.15	3.38	0.00024							
S4 os	400	660	580	0.2000	11.31	0.11	4.00	38.02	0.77	0.10	7.37	0.00039	3.93	1.00	0.026	0.17	2.91	0.01913	1.30
7 apron	10	580	579.9	0.0100	0.57	0.11	4.00	36.46	0.78	0.26	3.01	0.00951	3.95						
S5 top	673	674	660	0.0208	1.19	0.09	3.50	40.27	0.50	0.16	3.13	0.00024							
S5 os	400	660	580	0.2000	11.31	0.11	4.00	35.95	0.76	0.10	7.33	0.00041	3.89	1.00	0.025	0.18	2.77	0.01967	1.60
West top	1034	672	660	0.0116	0.66	0.15	5.10	33.68	0.64	0.22	2.91	0.00019							
West os	371	660	588	0.1941	10.98	0.17	5.50	31.48	0.85	0.11	7.60	0.00049	4.20	1.00	0.022	0.24	2.71	0.01718	2.21
N1 top	750	679	660	0.0253	1.45	0.09	3.50	39.97	0.55	0.16	3.46	0.00022							
N1 os	360	660	590	0.1944	11.00	0.11	4.00	36.28	0.79	0.11	7.37	0.00044	3.99	1.00	0.025	0.18	3.00	0.01757	1.29
SW top	790	669.5	660	0.0120	0.69	0.12	4.40	36.24	0.52	0.19	2.72	0.00023							
SW os	416	660	586	0.1779	10.09	0.15	5.10	34.53	0.79	0.11	7.18	0.00041	3.99	1.00	0.023	0.21	2.53	0.02023	2.41

Notes:
(1) from graph of rainfall vs duration, Figure C10.1
(2) for soils surfaces without (before application of) rock cover
(3) n=0.0456(d50 x S)^0.159

CALCULATION C10.1B.1 - ROCK SIZES NEEDED FOR EROSION PROTECTION OF SMALL IMPOUNDMENT FROM RAINFALL AND RUNOFF OF 1-HR LOCAL PMP HMCEROPR.WK3

SLOPE ELEMENT Fig.C10.3	ELEMENT LENGTH L	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc hours	RAINFALL WITHIN tc (1)	i in/hr	q cfs/ft (2)	y ft (2)	v fps (2)	Critical slope, Ss ft/ft	d50 for S>0.1, inches	d50 for S<0.1, inches	Parameters for flow on top of rock sur: n for d50 (3)	y	v	Ss	Safety Factor
North top	90	606	605	0.0111	0.64	0.02	2.5	106.38	0.18	0.10	1.71	0.00058							
North os	124	605	580	0.2016	11.40	0.03	2.5	74.95	0.35	0.06	5.36	0.00059	2.30	1.00	0.022	0.11	1.60	0.05228	4.80
SW top	1293	606	595.5	0.0081	0.47	0.21	6.1	29.56	0.70	0.26	2.71	0.00018							
SW os	152	595.5	570	0.1678	9.52	0.22	6.2	28.34	0.78	0.11	7.02	0.00115	3.96	1.00	0.021	0.27	2.62	0.01666	2.79

Notes:
(1) from graph of rainfall vs duration, Figure C10.1
(2) for soils surfaces without (before application of) rock cover
(3) n=0.0456(d50 x S)^0.159

SUMMARY OF ROCK QUALITY SCORING --- HOMESTAKE'S MALPAIS BASALT QUARRY SITE (NE 1/4, 28/T12N/R10W)

Sample Number	Rock Type (1 = igneous) (2 = limestone) (3 = sandstone)	Specific Gravity g/cc	Absorption %	Sulfate Soundness % loss	LA Abrasion % loss	Schmidt Hammer SRU	Tensile Strength psi	
		Weighting Factor (WF)/ Test Value (TV) / Score for:						
AVERAGES FOR ALL TESTED SAMPLES								
	Numbers of Samples Tested =	27	27	27	15	17	18	
	TV =	2.57	1.81	0.79	26.2	39.7	1059	
	Score =	8.51	3.37	9.87	2.49	5.01	8.26	
	Rating =	74.95	6.75	108.57	2.49	15.0	82.59	ROCK SOURCE COMPOSITE
	Maximum possible rating (MPR)=	90	20	110	10	30	100	RATING, %, USING ALL ROCK FROM 0' TO 50' =
	Rating in % MPR =	83.28	33.74	98.70	24.90	50.10	82.59	80.7
AVERAGES FOR ALL SAMPLES BELOW HIGHLY VESICULAR ZONE (0'--5')								ROCK BELOW ~5'
	Numbers of Samples Tested =	22	22	22	14	16	17	
	TV =	2.60	1.66	0.75	27.71	40.20	1074	
	Score =	9.50	3.66	9.86	2.09	5.07	8.34	
	Rating =	83.48	7.32	108.44	2.09	15.22	83.41	ROCK SOURCE COMPOSITE
	Maximum possible rating (MPR)=	90	20	110	10	30	100	RATING, %, USING ONLY ROCK FROM 5' TO 50' =
	Rating in % MPR =	92.75	36.60	98.58	20.92	50.73	83.4	83.3

FIGURE C10.1

DEPTH VS DURATION FOR 1-HR LOCAL PMP

HOMESTAKE GRANTS OPERATION, NEW MEXICO

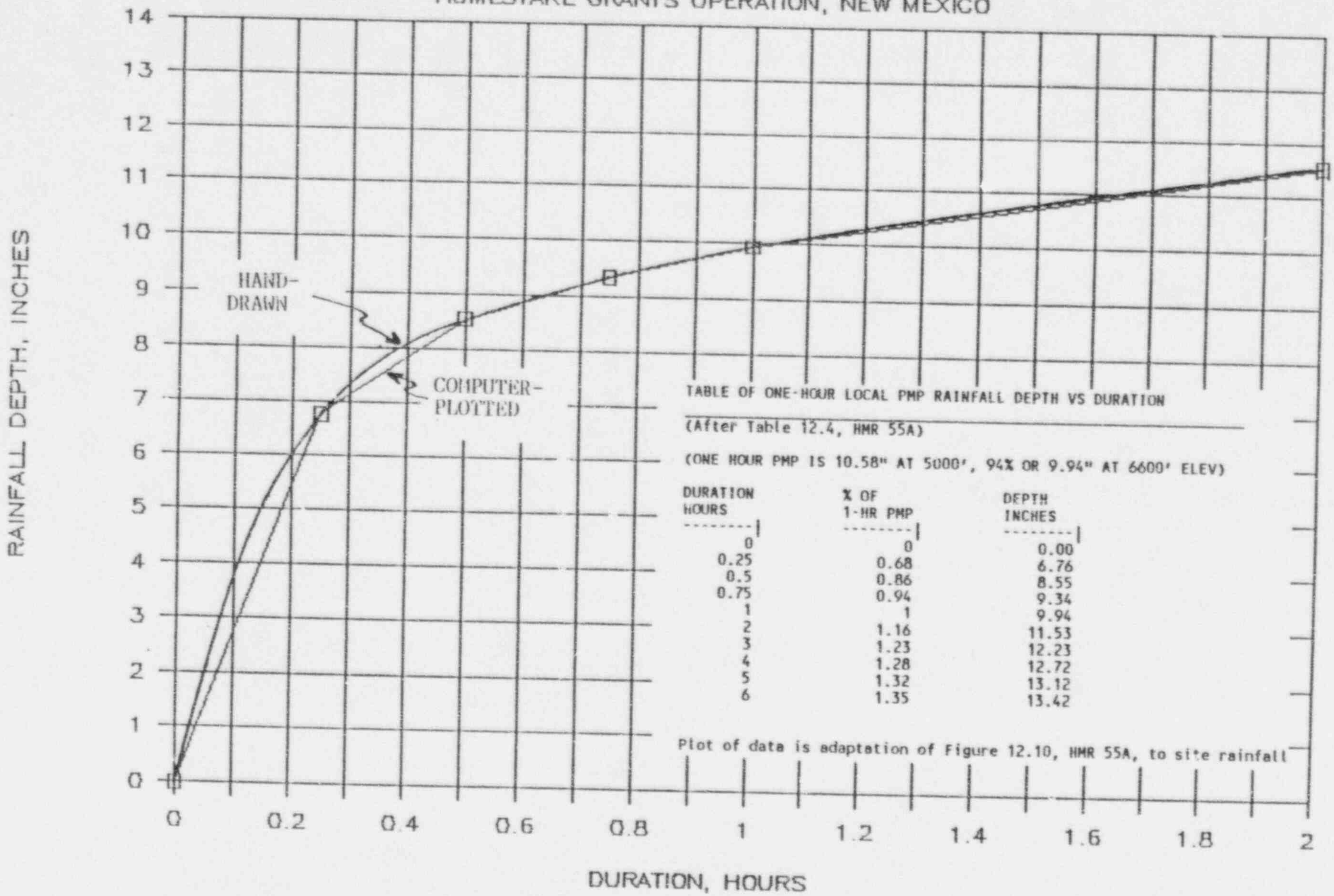


TABLE OF ONE-HOUR LOCAL PMP RAINFALL DEPTH VS DURATION

(After Table 12.4, HMR 55A)

(ONE HOUR PMP IS 10.58" AT 5000', 94% OR 9.94" AT 6600' ELEV)

DURATION HOURS	% OF 1-HR PMP	DEPTH INCHES
0	0	0.00
0.25	0.68	6.76
0.5	0.86	8.55
0.75	0.94	9.34
1	1	9.94
2	1.16	11.53
3	1.23	12.23
4	1.28	12.72
5	1.32	13.12
6	1.35	13.42

Plot of data is adaptation of Figure 12.10, HMR 55A, to site rainfall

FIGURE C10.1

Calculation C10.2 - Revised 10/93
****

OVERSIZING FOR HIGHLY VESICULAR ROCK WITH RATING < 80
HOMESTAKE'S MALPAIS BASALT QUARRY SITE (NE 1/4, 28/T12N/R10W)

ROCKSCOR.WK3
AA1.A070

Sample Number	Rock Type (1 = igneous) (2 = limestone) (3 = sandstone)		Weighting Factor (WF)/ Test Value (TV) / Score for: Specific Gravity(SSD) g/cc	Absorption %	Sulfate Soundness % loss	LA Abrasion % loss	Schmidt Hammer SRU	Tensile Strength psi	TOTALS	COMPOSITE RATING FOR SAMPLE, %
10/1'-6'	1	WF =	9	2	11					
		TV =	2.392	2.6	1.3					
		Score =	2.84	1.8	9.9					
		Rating =	25.56	3.6	108.35					
		Max. Possible =	90	20	110				137.5 220	62.5
11/0'-4'	1	WF =	9	2	11					
		TV =	2.398	2.1	0.6					
		Score =	2.96	2.8	10.0					
		Rating =	26.64	5.6	110					
		Max. Possible =	90	20	110				142.2 220	64.7
12/0'-5'	1	WF =	9	2	11					
		TV =	2.393	2.9	1.30					
		Score =	2.86	1.2	9.9					
		Rating =	25.74	2.4	108.35					
		Max. Possible =	90	20	110				136.5 220	62.0
13/0'-5'	1	WF =	9	2	11					
		TV =	2.390	2.7	1.2					
		Score =	2.8	1.6	9.9					
		Rating =	25.2	3.2	108.9					
		Max. Possible =	90	20	110				137.3 220	62.4
X+Y+Z	1	WF =	9	2	11	[illegible]				
		TV =	2.581	2.083	1.5	33.[illegible]				
		Score =	6.62	2.8	9.7	0.0				
		Rating =	59.58	5.7	107.09	0.00				
		Max. Possible =	90	20	110	10			172.3 230	74.9
X	1	WF =					3	10		
		TV =					54.60	940		
		Score =					6.9	7.7		
		Rating =					20.76	76.5		
		Max. Possible =					30	100	97.3 130	74.8
Y	1	WF =					3	10		
		TV =					49.80	720		
		Score =					6.4	6.3		
		Rating =					19.2	63.3		
		Max. Possible =					30	100	82.5 130	63.4
Z	1	WF =					3	10		
		TV =					52.90	900		
		Score =					6.8	7.4		
		Rating =					20.53	74.1		
		Max. Possible =					30	100	94.6 130	72.8

% OVERSIZING (80-AVE.) = 12.8 FOR AVERAGE RATING OF 67.2

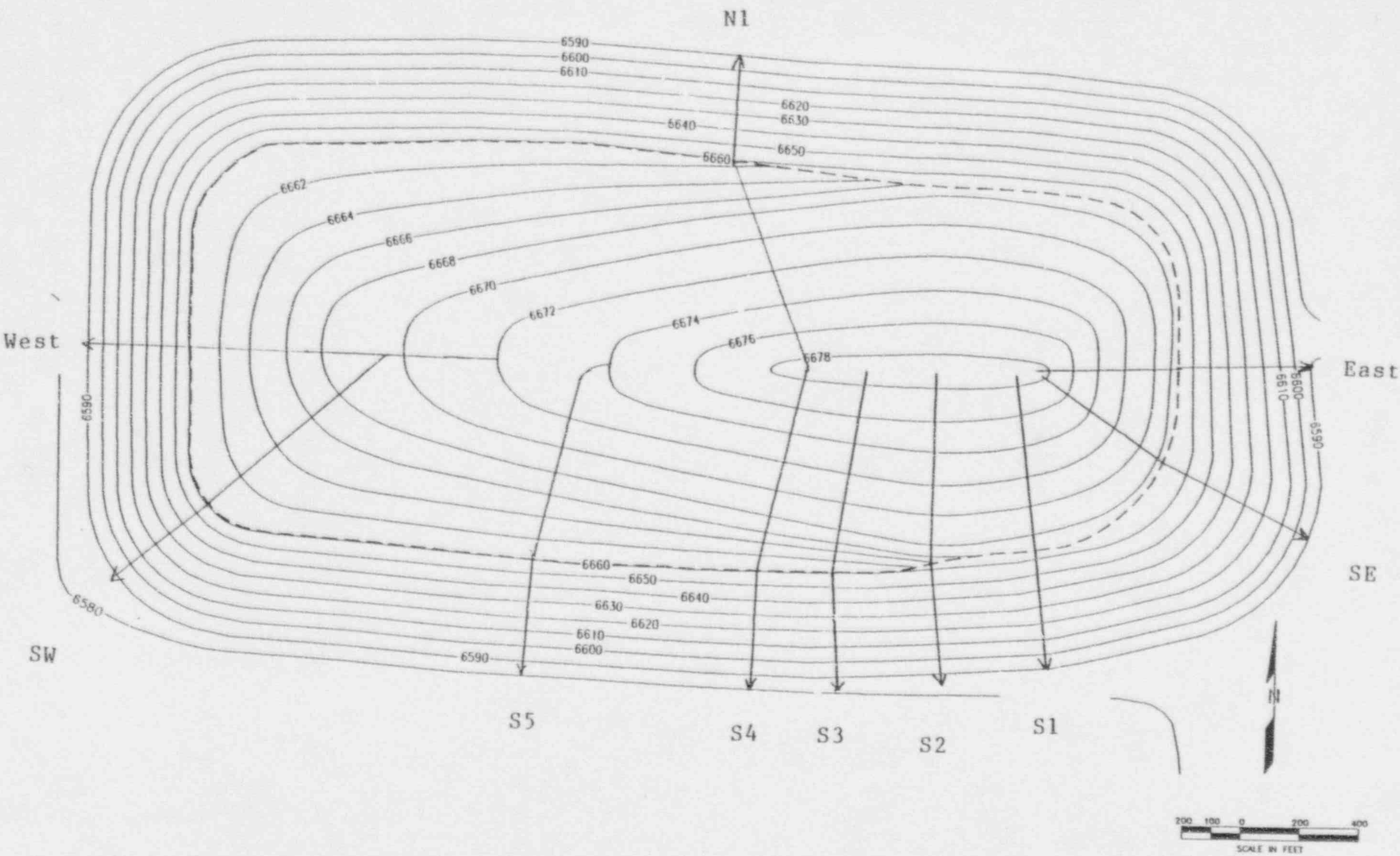


Figure C10.2 - Reclaimed Large Impoundment With Slope Elements Used for Runoff Erosion Analysis

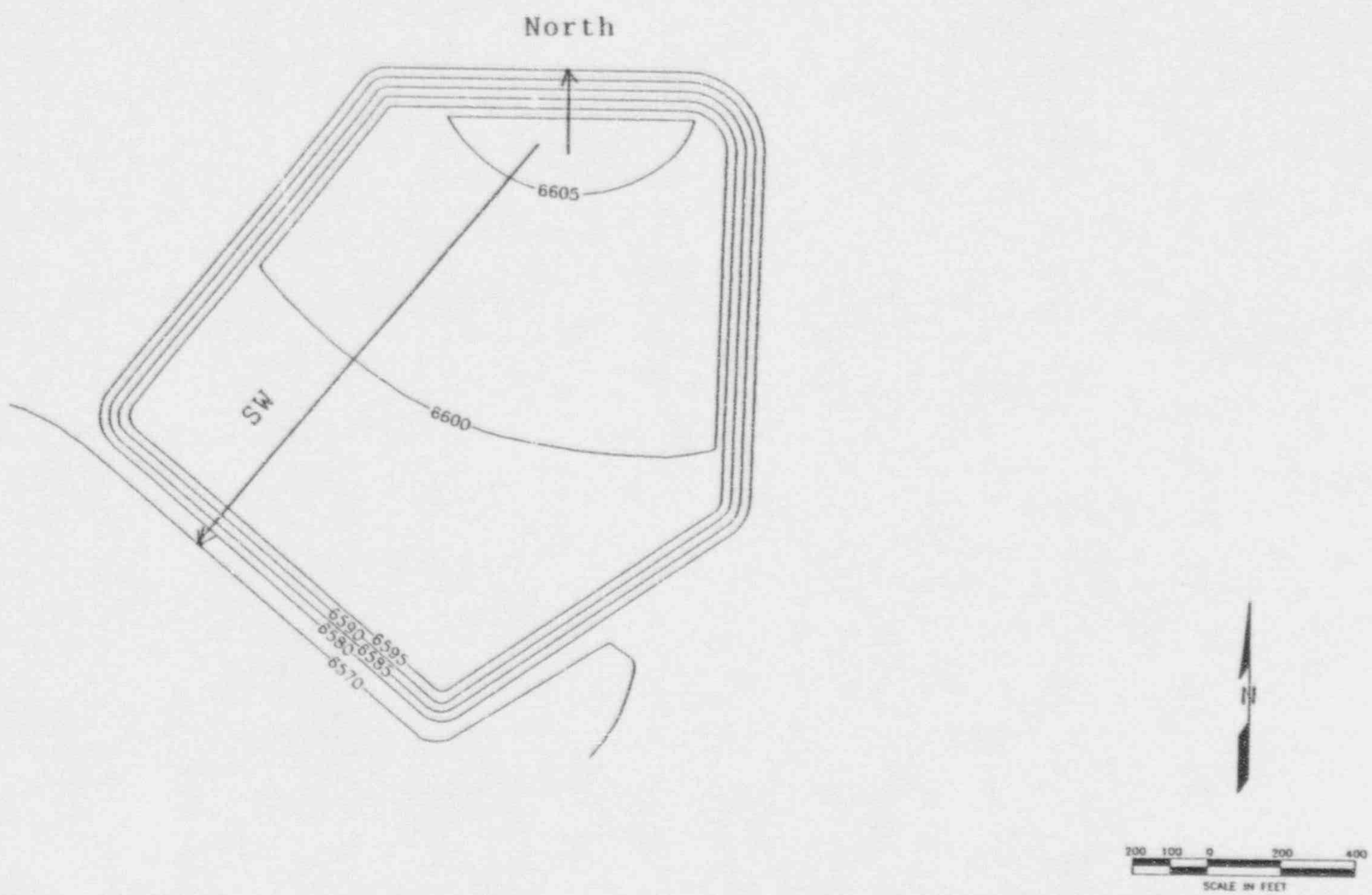


Figure C10.3 - Reclaimed Small Impoundment With Slope Elements Used for Runoff Erosion Analysis

Calculation C10.3 Revised 10/93
****

ROCK COVER GRADATIONS - BOTH IMPOUNDMENTS
HOMESTAKE GRANTS TAILING RECLAMATION

Area Covered	Design d50 inches	d50 Range minimum	d50 Range maximum	d100 Range minimum	d100 Range maximum	d25 Range minimum	d25 Range maximum
Top	1	1	1.1	1.3	1.7	0.7	1.0
Top using HVB (1)	1.128	1.128	1.3	1.4	1.9	0.8	1.2
Outslope	4.7	4.7	5.4	5.9	8.0	3.3	5.3
Riprap, Toe	4.7	4.7	5.4	5.9	8.0	3.3	5.3

(1) HVB = highly vesicular basalt, from upper 4-6 feet of flow

Gradation criteria, per NUREG/CR-4620, p.53, are:

Design d50 - see calculation c10.1
d50 minimum = design d50
d50 maximum = d100 maximum/1.5
d100 minimum = d50 minimum x 1.26
d100 maximum = d50 minimum x 1.71
d25 minimum = d50 minimum x 0.7
d25 maximum < d50 maximum

****
Calculation C10.4
****

ROCK SIZE FOR OUTSLOPE RIPRAP AND TOE SCOUR PROTECTION

Sizes must be sufficient to resist local boundary shear caused by San Mateo PMF overbank flows along outslope toe. Left overbank velocities (VLOB), channel velocities (VCH) and average water surface gradients (S) at analytical cross sections (Figures 11, 12) from HEC-2 calculation of 1/29/88 (see Appendix C8) are:

Section	VLOB fps	VCH fps	S
Z	1.8	2.33	0.000449
A	*	4.01	0.0028
B	*	7.25	0.0031
C	0.76	4.94	0.0014
D	4.66	8.78	0.0076
E	*	4.08	0.0019

* VLOB calculated as 0.00 by HEC-2, VCH value used for VLOB

1) Allowable shear, Ta

Assuming all soil within top 10' of alluvium is sand (conservative),

From D'Appolonia, 1980, and HMC, 1986, grain size analyses of 23 alluvial sand samples, d75= 0.268 mm = 0.010 in. ave.

Ta = 0.02 psf (USDA Handbook 667, Table 3.3)

2) Peak shear, Tmax = 62.4Sy

depth, y, cannot be taken from HEC-2 because left bank elev. is higher than peak water elev. at A, B, and E, so calculate using VLOB:

y =((VLOB x n)/(1.486 x S^0.5))^1.5
where: n=0.020 (see cover sheet)

Section	y ft.	Tmax. psf	
Z	1.22	0.03	> Ta
A	1.03	0.18	> Ta
B	2.32	0.45	> Ta
C	0.14	0.01	< Ta
D	0.61	0.29	> Ta
E	1.41	0.17	> Ta

All sections except C would have erosion; therefore, entire length of west and north outslopes will be protected with riprap and scour protection

3) Riprap size needed, d50

Tmax = 0.04(unit wt rock - unit wt water)d50 x (1- (sin^2 bank slope/sin^2 angle of repose))^0.5

= 0.04 (1.51 x 62.4) d50 x (1- sin^2(11.3)/sin^2(40))^0.5

d50 = 0.13 feet, = 1.50 inches

APPENDIX C.11 - CALCULATION OF DEPTH OF SCOUR AT TOE OF LARGE IMPOUNDMENT DUE TO PMF ON SAN MATEO CREEK

===

References:

1) Pemberton, E.L., and J.M. Lara, 1984, "Computing Degradation and Local Scour", Technical Guideline for Bureau of Reclamation

2) HEC-2 Output for San Mateo Creek, 1988, Canonie Environmental

Estimates of scour depth made by five methods described in Ref.1 using flood parameters from Ref. 2. Estimates made for section B-B' (see Fig. 11 in text) where velocities should be highest.

1) ds = depth of scour = K*q^0.24 (p.32, Ref. 1)

K = 2.45
q = Q/T
where:
Q = 169800 cfs, peak PMF discharge (Ref.2)
T = top width of section B-B' = 2600 ft. (Fig.12 of text)

q = 65.31 cfs/ft

ds = 6.68 ft

2) ds = 0.25 * dm (eqn. 26, Ref. 1)
dm = mean water depth at design discharge = 0.47(Q/f)^0.333

f = Lacey silt factor = 1.76 (Dm)^.5
Dm = mean grain size of bed material = 0.20mm (Table 3 of text)

dm = 28.07 ft.
ds = 7.02 ft.

3) ds = 0.6 * dfo (eqn 27, Ref. 1)
dfo = qf^0.666/Fbo^0.333
qf = unit discharge = 65.31 cfs/ft (see #1 above)
Fbo = zero bed factor, Fig. 9, Ref. 1, for Dm, = 1.0 ft/s^2

dfo = 16.17
ds = 9.70 ft.

4) ds = 0.25 * dma (p.37, Ref. 1)
dma = channel cross section area / water surface width = A/T
= 23485 ft^2 / 2600 ft = 9.03 ft

ds = 2.26 ft

5) ds = dma * ((Vm/Vc)-1) (p. 38, Ref. 1)
dma = 9.03 ft. (see #4 above)
Vm = mean velocity = Q/A = 7.23 fps
Vc = competent mean velocity = 3.0 fps (Fig. 12, Ref. 1)

ds = 12.74 ft

AVERAGE OF ABOVE, ds ave. = 7.68 ft.

Additional Reference Item

No. 3

Homestake Mining Company
Grants Reclamation Site

Laboratory Control Test Summary
Erosion Protection Rock
Table 4.5.13C
Knight Piésold's Quality Control Report

January 17, 1996

TABLE 4.5.13C
LABORATORY CONTROL TEST SUMMARY - EROSION PROTECTION

MATERIAL Erosion Protection (EP - # - C)
AREA Tailing Facility Reclamation

Date	Sample No.	Specific Gravity			L.A. Abrasion*	Absorption*	Soundness*	Gradation Analysis - % Passing											
								Large Gradation						Small Gradation					
		Gs	App	Gssd	(% loss)	(%)	(% loss)	9"	8"	7"	6"	5"	4"	3"	2"	1.5"	1.25"	1"	0.75"
Specifications							max												
							min												
05/08/94	1	2.51	2.69	2.58	30.8	2.5	0.8							100.0	100.0	68.6	44.6	10.7	0.8
05/13/94	2													100.0	100.0	93.0	70.1	41.3	12.2
05/18/94	2A													100.0	100.0	82.6	52.0	10.9	2.1
05/18/94	3													100.0	100.0	93.7	61.8	25.3	5.9
05/18/94	4													100.0	100.0	86.9	56.0	24.1	4.4
05/19/94	5	2.54	2.64	2.58	29.5	1.5	2.4							100.0	100.0	88.1	53.9	21.9	6.1
06/01/94	6	2.56	2.72	2.62	32.8	2.3	1.2							100.0	100.0	85.4	52.5	21.0	5.2
08/15/94	7	2.69	2.84	2.74	NA	1.9	7.0							100.0	100.0	81.9	54.2	23.6	5.3
08/19/94	8	2.67	2.82	2.73	NA	1.9	7.2							100.0	100.0	89.7	58.6	27.8	2.2
09/24/94	9	2.66	2.79	2.70	NA	1.7	7.9							100.0	100.0	75.5	50.3	31.4	11.0
10/14/94	10	2.67	2.77	2.71	NA	1.4	9.5	100.0	93.7	74.7	47.5	23.3	8.9						
10/16/94	11							100.0	93.4	74.6	47.4	22.4	9.2						
10/20/94	12	2.67	2.77	2.71	NA	1.4	7.0	100.0	93.4	75.5	45.2	15.5	5.4						
10/25/94	13	2.65	2.78	2.70	NA	1.8	8.7	100.0	94.8	76.6	47.9	18.8	5.8						
10/27/94	14							100.0	93.1	71.9	41.5	15.5	4.4						
10/30/94	15	2.67	2.77	2.71	NA	1.4	9.5	100.0	94.4	72.8	41.9	15.6	4.5						
11/01/94	16							100.0	93.2	72.5	42.0	15.6	4.3						
11/03/94	17	2.65	2.76	2.69	NA	1.5	9.5	100.0	93.1	73.3	43.4	17.1	4.9						
11/05/94	18	2.48	2.59	2.52	NA	1.7	4.4	100.0	93.9	74.7	45.5	18.7	4.6						
11/08/94	19							100.0	93.0	74.9	47.3	22.0	9.2						
11/12/94	20	2.62	2.70	2.65	NA	1.1	9.8	100.0	94.3	75.3	40.2	17.7	5.5						
11/28/94	21							100.0	93.9	73.3	49.6	22.4	6.1						
12/01/94	22	2.58	2.71	2.63	NA	1.8	5.1	100.0	90.5	77.1	48.6	24.5	9.2						
12/04/94	23							100.0	96.6	78.7	50.5	21.6	6.7						
12/05/94	24	2.51	2.66	2.57	NA	2.2	11.8							100.0	100.0	77.5	55.6	29.4	10.8
12/07/94	25													100.0	100.0	79.5	59.5	27.3	11.0
12/08/94	26	2.58	2.70	2.62	NA	1.8	4.1	100.0	96.6	78.7	50.8	21.9	7.0						
12/10/94	27	2.58	2.75	2.64	NA	2.4	10.4							100.0	100.0	78.5	57.2	29.0	6.0
12/13/94	28	2.52	2.66	2.57	NA	2.1	3.9							100.0	100.0	84.5	59.5	30.7	9.4
12/14/94	29							100.0	96.6	81.1	53.7	30.2	9.7						
12/15/94	30	2.58	2.81	2.66	NA	3.2	5.0							100.0	100.0	82.2	57.6	31.0	6.8
12/19/94	31													100.0	100.0	69.6	52.8	26.3	9.2
12/20/94	32	2.17	2.39	2.26	NA	4.1	10.7	100.0	94.0	79.7	52.5	19.7	5.5						

TABLE 4.5.13C
LABORATORY CONTROL TEST SUMMARY - EROSION PROTECTION

MATERIAL Erosion Protection (EP - # - C)
AREA Tailing Facility Reclamation

Date	Sample No.	Specific Gravity			L.A. Abrasion*	Absorption*	Soundness*	Gradation Analysis - % Passing											
								Large Gradation						Small Gradation					
		Gs	App	Gssd	(% loss)	(%)	(% loss)	9"	8"	7"	6"	5"	4"	3"	2"	1.5"	1.25"	1"	0.75"
Specifications							max												
							min												
12/21/94	33	2.12	2.51	2.27	NA	7.3	8.4							100.0	100.0	69.7	55.7	25.8	9.8
12/27/94	34							100.0	92.7	75.9	54.0	17.3	4.9						
12/31/94	35	2.31	2.40	2.35	NA	1.6	10.8	100.0	95.5	81.0	57.3	23.9	10.5						
01/06/95	36							100.0	93.9	74.8	48.9	24.9	10.2						
01/10/95	37	2.31	2.51	2.39	NA	3.5	13.3	100.0	94.1	74.5	50.9	24.8	9.2						
01/11/95	38													100.0	100.0	78.7	53.2	28.0	12.4
01/13/95	39	2.31	2.51	2.40	NA	3.2	11.4							100.0	100.0	74.8	48.3	21.0	9.7
01/15/95	40							100.0	87.3	74.2	43.1	27.8	10.0						
01/18/95	41													100.0	100.0	85.9	61.9	30.1	5.9
01/22/95	42							100.0	92.2	74.8	49.0	19.3	8.5						
01/28/95	43	2.45	2.61	2.51	NA	2.4	10.6	100.0	94.2	72.1	48.0	26.7	8.5						
01/31/95	44							100.0	88.3	74.9	61.5	37.8	10.0						
02/16/95	45							100.0	82.3	65.5	47.9	19.1	8.4						
02/21/95	46	2.49	2.64	2.55	NA	2.3	13.4	97.1	81.0	44.4	24.4	8.0	2.1						
02/24/95	46A							100.0	93.6	75.3	54.5	34.6	3.7						
02/26/95	47							100.0	89.8	73.4	43.1	20.7	6.9						
03/26/95	48	2.70	2.75	2.72	NA	0.6	0.3	100.0	96.1	83.8	53.4	23.0	4.7						
04/16/95	49							100.0	97.0	87.0	44.0	22.0	5.2						
07/26/95	50	2.52	2.66	2.57	NA	2.1	0.7	99.8	95.9	79.8	55.3	34.0	15.0						
08/19/95	51							100.0	--	66.1	48.3	27.0	11.8						
08/26/95	52	2.388	2.538	2.447	NA	2.47	7.2	100.0	--	63.3	39.7	24.2	9.1						
07/18/95	53	2.51	2.64	2.56	NA	1.9	0.9	100.0	--	75.5	53.3	32.1	14.6						
07/19/95	54	2.39	2.53	2.45	NA	2.4	0.5	100.0	--	77.8	47.2	26.4	7.4						
07/30/95	54A							100.0	94.9	75.5	49.8	27.7	11.4						
07/20/95	55							100.0	--	78.6	46.0	31.1	13.9						
07/25/95	56	2.395	2.537	2.451	NA	2.33	8.8	100.0	93.0	79.8	54.7	26.5	11.0						
07/31/95	57							100.0	90.4	72.4	53.4	22.0	9.6						
07/20/95	58													100.0	100.0	75.5	45.2	26.5	10.3
07/23/95	59	2.46	2.61	2.52	NA	2.3	6.5							100.0	100.0	74.1	48.4	27.8	14.2
07/27/95	60	2.64	2.79	2.69	NA	2.1	4.9							100.0	100.0	71.4	39.9	19.4	5.0
08/01/95	61	2.47	2.61	2.52	NA	2.2	4.8	100.0	91.5	72.3	47.1	25.6	10.5						
08/03/95	62							100.0	--	76.6	56.8	36.1	17.5						
08/05/95	63	2.54	2.66	2.59	NA	1.7	6.3	100.0	--	75.5	55.2	30.7	11.3						

TABLE 4.5.13C
LABORATORY CONTROL TEST SUMMARY - EROSION PROTECTION

MATERIAL Erosion Protection (EP - # - C)
AREA Tailing Facility Reclamation

Date	Sample No.	Specific Gravity Gs	Specific Gravity App	Specific Gravity Gssd	L.A. Abrasion* (% loss)	Absorption* (%)	Soundness* (% loss)	Gradation Analysis - % Passing: Large Gradation 9"	8"	7"	6"	5"	4"	Small Gradation 3"	2"	1.5"	1.25"	1"	0.75"
Specifications							max												
							min												
08/06/95	64	2.58	2.728	2.634	NA	2.11	10.3							100.0	100.0	87.4	55.1	35.0	20.0
08/07/95	65							100.0	92.3	65.5	43.0	25.0	9.3						
08/11/95	66	2.374	2.537	2.438	NA	2.71	5.9	98.7	92.2	73.9	51.8	28.8	12.9						
08/08/95	67													100.0	100.0	80.9	55.0	31.1	10.7
08/12/95	68	2.561	2.722	2.620	NA	2.3	10.7							100.0	100.0	78.0	56.6	33.3	15.0
08/14/95	69													100.0	100.0	82.1	54.3	19.6	11.2
08/18/95	70	2.381	2.539	2.443	NA	2.61	6.0							100.0	100.0	82.1	48.7	21.4	5.3
09/01/95	71							100.0	--	73.1	56.8	34.9	19.7	100.0	100.0	73.1	56.8	34.9	19.7
08/25/95	72													100.0	100.0	85.3	60.0	33.1	16.9
09/05/95	73	2.641	2.700	2.662	NA	0.83	11.0							100.0	100.0	73.4	46.1	21.1	5.5
09/11/95	74													100.0	100.0	77.1	51.8	23.4	6.1
09/10/95	75	2.548	2.693	2.602	NA	2.11	6.5	100.0	--	73.3	51.0	33.3	14.7						
09/16/95	76							100.0	--	88.2	62.0	31.7	15.8						
09/19/95	77	2.388	2.519	2.440	NA	2.18	6.2	100.0	--	86.0	56.6	28.9	9.5						
09/14/95	78	2.658	2.792	2.706	NA	1.80	10.6							100.0	100.0	77.9	50.6	26.4	6.4
09/17/95	79	2.650	2.791	2.700	NA	1.91	10.8							100.0	100.0	74.7	53.5	24.4	7.2
09/28/95	80							98.0	--	82.0	46.3	28.2	13.8						
10/01/95	81	2.506	2.648	2.559	NA	2.14	5.6	100.0	--	71.3	45.9	27.8	11.3						
10/08/95	82							99.1	--	66.4	46.2	21.8	8.9						
10/15/95	83	2.404	2.538	2.457	NA	2.2	7.8	100.0	--	88.2	61.9	32.3	13.6						
11/16/95	84													100.0	100.0	87.3	57.9	25.5	4.3
11/16/95	85													100.0	100.0	82.6	46.9	25.0	7.0

Comments: All testing completed in accordance with standard ASTM procedures.
* = Testing performed by Vinyard & Associates, Inc.
NA = Not analyzed at the request of A.K. GeoConsult, Inc.

Knight Piésold LLC Consulting Engineers and Environmental Scientists	*Client* **Homestake Mining Company**	*Project* **Grants Reclamation Project** **Project No. 1306A**

Additional Reference Item

No. 4

Homestake Mining Company
Grants Reclamation Site

Quantitative Review of Outslope Rock
A Report Submitted to the NRC

November 1, 1996

HOMESTAKE MINING COMPANY
P.O. BOX 98
GRANTS, NEW MEXICO 87020
(505) 287-4456

CERTIFIED MAIL NO.: P 369 600 953

November 1, 1996

Mr. Joseph J. Holonich, Branch Chief
U.S. Nuclear Regulatory Commission
Division of Waste Management, MST-7J9
High Level Waste and Uranium Recovery Project Branch
11555 Rockville Pike
Rockville, MD 20852

RE: Docket No. 40-8903
License No. SUA-1471
Quantitative Review of Outslope Rock

Dear Mr. Holonich:

At the request of Mr. Ted Johnson, personnel from Homestake Mining Company, Grants Reclamation site, conducted a quantitative review of the erosion protection rock placed on the outslope of the large tailings pile at the Grants site.

The purpose of the review, based on a visual inspection of the outslopes, was to identify areas where the rock density may appear to have a low in-place density or be inconsistent with respect of rest of the placed rock. Rock in-place density would be defined in pounds of rock per cubic foot in-place for a given area.

The entire rock covered outslope of the large tailing pile was inspected. During the inspection four areas were identified that appeared to have significant bedding material near the surface of the rock, thereby giving the areas the appearance of having a lower rock in-place density. A fifth area that had previously passed a visual inspection was chosen to be used as a test control area.

The attached testing procedure was used during the quantitative review at all five test sites. In addition, control photographs were taken during the various steps of the review process at each of the test sites.

The quantitative review of the four test areas and resulting test data show that the in-place density of the outslope rock of these areas are consistent with the test data from the control area and should therefore, be consistent over the entire outslope area. The data in Table 1 lists the results from the testing process. The enclosed set of photographs is a photographic sequence of one test area showing the testing steps in progress. Photographic records were

taken during the testing of the other four areas but have not been included with this report. The photographs are available for review if it becomes necessary.

I hope the enclosed data is sufficient to answer all of Mr. Johnsons questions relative to rock placement density. If you or your staff have any additional questions related to this subject please contract me at the Grants project site.

Sincerely,

HOMESTAKE MINING COMPANY OF CALIFORNIA

Roy R. Cellan
Corporate Manager, Reclamation

Enclosures

xc: enclosures - C. Cain, NRC

Homestake Mining Company of California
Grants Project

Quantitative Review of Outslope Rock

Equipment: 10 plastic buckets
1 hanging scale-100 pound capacity
2 8-foot by 10-foot tarps
spray paint
camera and film
tripod to allow for weighting rock
square point shovel
marking pen and poster board
tape measure
pencil and paper to record results

Procedure:

1) By visual inspection, identify a site on the outslope of large tailings pile where rock is visually less than 10-inches in depth and greater than 2-foot by 2-foot in surface dimensions. Label site utilizing marker and poster board. Place label near site and photograph site before any work begins. Record location, date and reviewer.

2) Paint boundary of site. Take photograph with label in picture. Measure surface area of site with at least 3 measurements in each direction. Remove all rock down to and including within the bedding. Weigh any rock above 0.5 inch diameter and is within the painted boundary. If more than 50% of a rock is within paint boundary line then rock will be weighed and should be placed in a bucket. If less than 50% of a rock is within the paint line do not weigh rock. Record size of site and weight of each bucket of rock weighed.

3) Setup tripod with hanging scale suspended from tripod. Weigh each plastic bucket and record tare weight on bucket.

4) Check bedding for rock that could have been pushed into bedding. Smooth bedding after checking for buried rock. Photograph results.

5) Replace rock evenly on site and photograph. Measure thickness of rock.

6) Calculate volume and density of rock. Prepare estimated location on outslope of each evaluation location.

Homestake Mining Company of California
Grants Project

Table 1 - Quantitative Review of Outslope Rock

I.D.	DATE	AREA (ft^2)	DEPTH (ft)	VOLUME (ft^3)	TOTAL WEIGHT (lbs)	DENSITY OF ROCK (#/cf)
1	6/17/96	72.0	0.6	43.2	2656	61
2	6/17/96	47.6	0.7	33.3	2102	63
3	6/17/96	26.6	0.9	23.9	1644	69
4	6/17/96	41.3	0.8	33.0	2104	64
5 (control)	6/17/96	14.1	1.3	18.3	1136	62

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Homestake Mining Company
Grants Project

Quantitative Review of Outslope Rock

Photographs of Test Area No. 1

- Picture No. 1 - Undisturbed test area No. 1, prior to testing;
- Picture No. 2 - Test area outlined with the green line;
- Picture No. 3 - Rock removal from the test area;
- Picture No. 4 - Weighing the rock removed from the test area;
- Picture No. 5 - Preparation of bed before replacement of the rock;
- Picture No. 6 - Test area no. 1 rock replacement completed;

Additional Reference Item

No. 5

April 22, 1997

NRC Inspection Report
40-8903/97201

RECEIVED APR 2 8 1997

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 22, 1997

Mr. Roy R. Cellan
Homestake Mining Company
P.O.Box 98
Grants, New Mexico 87020

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION INSPECTION REPORT 40-8903/97201

Dear Mr. Cellan:

On March 31, 1997, the U.S. Nuclear Regulatory Commission completed an inspection of the Homestake Mining Company (HMC) Grants Uranium Mill site located in Cibola County, New Mexico. The enclosed report presents the results of that inspection.

The inspection examined activities conducted under the license as they relate to surface water hydrology and erosion protection. The inspection consisted of observation of completed site reclamation activities and interviews with HMC personnel.

No violations or deviations were identified; therefore, no response to this letter is required. However, as discussed in the inspection report, the staff expects that additional information will be provided by HMC to justify the adequacy of the in-place riprap layers.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Should you have any questions concerning this inspection, please contact Ken Hooks, the NRC Project Manager and inspection team leader, at (301) 415-7777.

Sincerely,

Charles L. Cain

Charles L. Cain, Acting Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 40-8903
License No. SUA-1471

Enclosure:
NRC Inspection Report
40-8903/97201

cc: J. Virgona, DOE-Grand Junction
R. Ohrbom, New Mexico Environment Dept.

ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF WASTE MANAGEMENT

Report No.:	40-8903/97201
License No.:	SUA-1471
Docket No.:	40-8903
Licensee:	Homestake Mining Company (HMC)
Facility:	Grants Mill
Location:	Cibola County, New Mexico
Date:	March 31, 1997
Inspectors:	Kenneth R. Hooks, Project Manager and Team Leader, Division of Waste Management, Uranium Recovery Branch (DWM/URB) Daniel S. Rom, Geotechnical Engineer, DWM/URB T. L. (Ted) Johnson, Surface Water Hydrologist, DWM/URB
Approved By:	Charles L. Cain, Acting Chief Uranium Recovery Branch Division of Waste Management

Attachments:

Attachment 1: Partial List of Persons Contacted
List of Items Opened, Closed, and Discussed
List of Acronyms

9704250196 3pp

Report Details

On-Site Construction (88001)

Inspection Scope

Inspectors conducted a routine, announced inspection of the licensee's placement and repair of erosion protection rock. The staff examined areas of the main tailings pile outslope rock placement for areas of segregation or inadequate thickness, such as those identified during inspection 40-8903/95201, November 30, 1995, as possibly not meeting construction specifications. Some outslope areas were repaired by HMC and subsequently examined during inspection 40-8903/96-01, February 5-7, 1996, and some were determined to be acceptable. At this time, riprap placement had not been completed, and there were several areas that needed further rock placement. The adequacy of the repairs and the inplace density of the rock were documented in HMC's letter of November 1, 1996 "Quantitative Review of Outslope Rock."

Observations and Findings

The additional areas of riprap that were placed or repaired after February 1996 needed to be examined to determine that rock placement was acceptable and met all applicable license requirements. This inspection also provided inspectors with sufficient information to evaluate the validity of the licensee's procedures for measuring inplace rock density.

The inspectors walked several areas of the outslope and inspected those locations where test pits had been excavated to measure the inplace density of the rock. The inspection indicated that some areas of the outslope still appeared questionable and that layer thicknesses, in those areas chosen to perform the inplace density tests, may not meet specifications. Various reasons for these problems include: (1) deposition of wind-blown soils into the riprap layer; (2) inadequate layer thickness; or (3) inadequate rock size.

The inspectors discussed with HMC possible methods for demonstrating the adequacy of the questionable areas. First, HMC could perform hydraulic calculations to determine if the installed riprap (despite the questionable layer thickness and rock size) is adequate, based on evaluation of original design flow rates and the average inplace rock size. Alternatively, HMC could perform additional testing to demonstrate that adequate rock has been placed.

Conclusions

Visual inspection of the outslope erosion protection rock on the main tailings pile identified areas which may not meet specifications. HMC committed to provide additional calculations to the NRC to justify the existing rock placement, or perform additional tests to demonstrate compliance with specification requirements.

EXIT MEETING SUMMARY

An exit meeting was conducted at the conclusion of the inspection on March 31, 1997. During this meeting, the inspectors reviewed the scope and findings of the inspection. The licensee did not identify, as proprietary, any information provided to, or reviewed by, the inspectors.

Attachment 1

PARTIAL LIST OF PERSONS CONTACTED

Licensee

R. Cellan, HMC

ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None were opened in this report.

Closed

None

Discussed

None

LIST OF ACRONYMS USED

HMC	Homestake Mining Company
DWM	Division of Waste Management
URB	Uranium Recovery Branch