STATE OF COLORADO

Bill Owens, Governor
Douglas H. Benevento, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Located in Glendale, Colorado

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Colorado Department
of Public Health
and Environment

To J.W.
4-25-05

FACSIMILE
TRANSMITTAL

TO: Terry Brock

LICENSEE'S NAME: WRC

LICENSE #: —

FAX#: 1-301-415-3502

RE: Hecla Burrito

PAGES: 1 including cover sheet

ORIGINALS WILL BE MAILED.

Technical Person's Name

Environmental Protection Specialist
Radiation Management
Hazardous Materials Waste Management Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

Phone: 303/692-3300
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--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION DURITA LT STABILITY

BOUNDARY COORDINATES

4 Top Boundaries
8 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	10.00	90.00	12.00	1
2	90.00	12.00	198.00	33.50	1
3	198.00	33.50	216.00	37.00	2
4	216.00	37.00	320.00	37.50	2
5	198.00	33.50	320.00	33.50	1
6	210.00	31.50	320.00	31.50	3
7	210.00	31.50	230.00	11.00	1
8	230.00	11.00	320.00	11.00	1

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	114.0	127.0	500.0	20.0	.00	.0	1
2	121.0	130.0	500.0	20.0	.00	.0	1
3	92.0	111.0	200.0	29.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	10.00
2	90.00	12.00
3	216.00	37.00
4	320.00	37.50

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = .0 psf

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

4 Surfaces Initiate From Each Of 50 Points Equally Spaced Along The Ground Surface Between X = .00 ft. and X = 90.00 ft.

Each Surface Terminates Between X = 216.00 ft. and X = 320.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -30.0 And 1.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

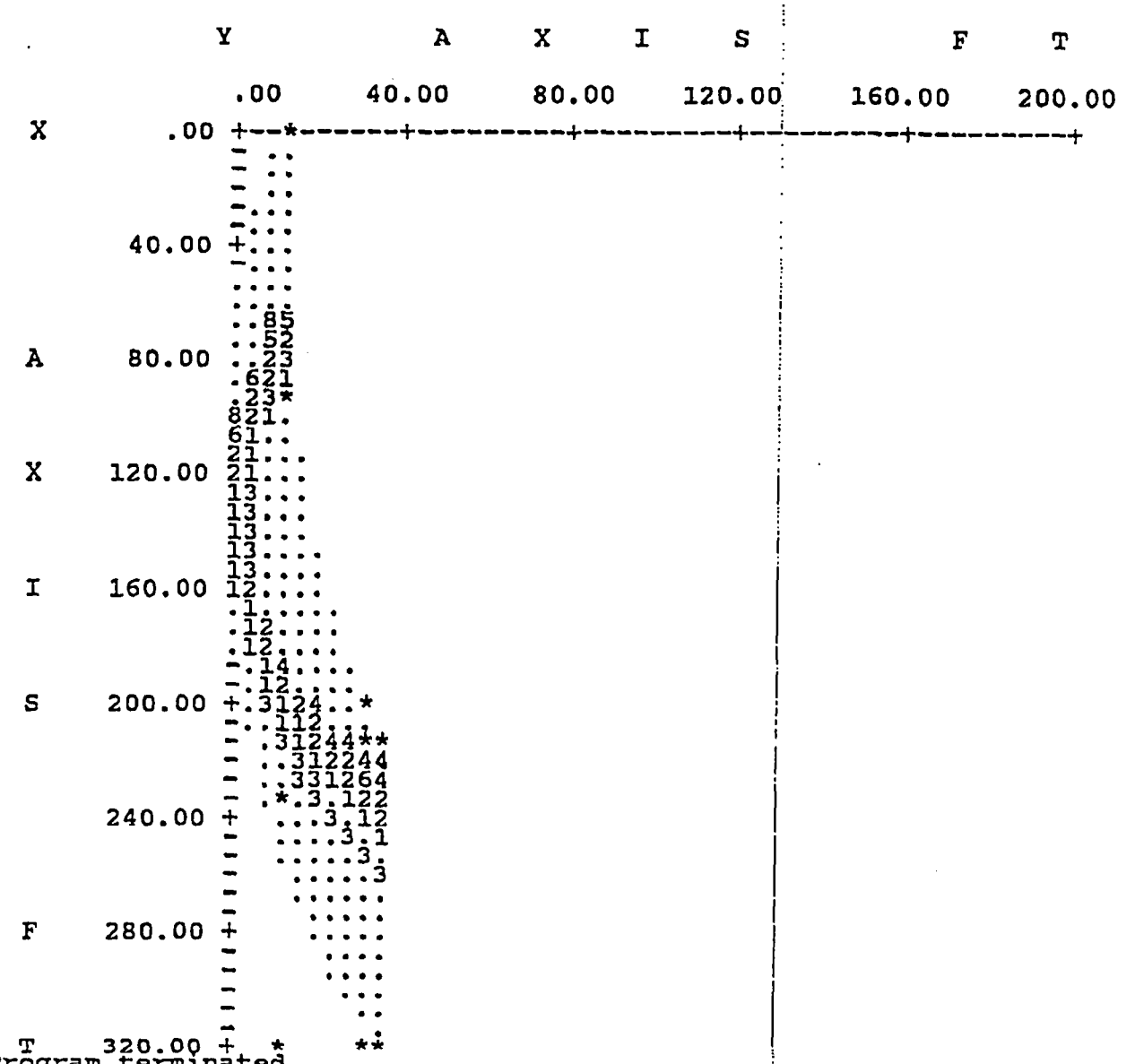
* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.16	11.96
2	92.83	10.16
3	97.55	8.51
4	102.32	7.02
5	107.14	5.68
6	112.00	4.51
7	116.89	3.49
8	121.82	2.63
9	126.77	1.93
10	131.74	1.39
11	136.73	1.01
12	141.72	.80
13	146.72	.74
14	151.72	.86
15	156.71	1.13
16	161.69	1.57
17	166.66	2.16
18	171.60	2.92
19	176.52	3.84
20	181.40	4.92
21	186.24	6.16
22	191.04	7.55
23	195.80	9.10
24	200.50	10.80
25	205.14	12.65
26	209.72	14.66
27	214.24	16.81
28	218.68	19.11
29	223.04	21.55
30	227.32	24.13
31	231.52	26.85
32	235.62	29.71
33	239.63	32.70
34	243.54	35.81
35	245.10	37.14

Circle Center At X = 145.8 ; Y = 154.5 and Radius, 153.7

*** 1.613 ***



Stop - Program terminated.

C>

CALCULATION C2

-----*****! RADON !*****-----

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RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

DURITA SITE - ADDITIONAL COVER NEEDED USING C MATERIAL

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS

17'

THICKNESS	521	cm
POROSITY	.52	
CALCULATED MASS DENSITY	1.272	g cm^-3
MEASURED RADIUM ACTIVITY	432	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.32	
CALCULATED SOURCE TERM CONCENTRATION	7.101D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	16.2	%
MOISTURE SATURATION FRACTION	.396	
CALCULATED DIFFUSION COEFFICIENT	2.118D-02	cm^2 s^-1

LAYER 2 PRESENT COVER

2.5'

THICKNESS	76	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	10.36	%
MOISTURE SATURATION FRACTION	.422	
CALCULATED DIFFUSION COEFFICIENT	1.583D-02	cm^2 s^-1

LAYER 3 ADDITIONAL COVER WITH "C" MATERIAL

THICKNESS	60	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.77	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	9.98	%
MOISTURE SATURATION FRACTION	.552	
CALCULATED DIFFUSION COEFFICIENT	7.858D-03	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 3.687D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.210D+02	1.350D+02	2.150D+05
2	7.600D+01	4.260D+01	1.063D+05
3	8.493D+01	2.001D+01	0.000D+00

= 1.79 ft.

CALCULATION C3

----------*****! RADON !*****----------

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RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

EVAPORATION POND COVER

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 POND SALTS

THICKNESS	183	cm
POROSITY	.35	
MEASURED MASS DENSITY	1.51	g cm^-3
MEASURED RADIUM ACTIVITY	13.22	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.406	
CALCULATED SOURCE TERM CONCENTRATION	4.863D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.259	
CALCULATED DIFFUSION COEFFICIENT	2.809D-02	cm^2 s^-1

LAYER 2 COVER

THICKNESS	60	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.77	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	9.98	%
MOISTURE SATURATION FRACTION	.552	
CALCULATED DIFFUSION COEFFICIENT	7.858D-03	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 1.531D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	1.830D+02	1.531D+01	1.089D-02
2	0.000D+00	1.531D+01	0.000D+00

********* CALCULATION C4 *********

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HYDROLOGIC PARAMETERS AND EQUATIONS USED FOR SITE RUNOFF AND EROSION PROTECTION CALCULATIONS

DESIGN STORM PRECIPITATION — see Figure 11 for rainfall tabulations and plot

1-HR LOCAL PMP
8.4 inches unadjusted for elevation above 5000 ft (Fig. 4.5, HMR 49)
7.8 inches adjusted for ave. elev. of 6454 in west watershed
8.4 - (8.4 x (6454-5000)/1000 x 0.05) (Section 4.3.2, HMR 49)

RUNOFF PARAMETERS

C, runoff coeff. 0.6 for sloping terrain (10-15% along channels), forested shale/sandstone
0.7 for sloping site surfaces, 0.5 for site surfaces of <.01 grade
(Table 4.6, NUREG/CR-4620)

n, Manning coeff.,
channels, upstream watersheds = 0.05 (Tables 4.2, 4.3; NUREG/CR-4620)
diversion in soil = 0.030 (Tables 4.2, 4.3; NUREG/CR-4620)
of soil cover 0.020 (Tables 4.2, 4.3; NUREG/CR-4620)
of rock cover n=0.0456(d50 x S)^0.159 (Eqn. 4.8, NUREG/CR-4651)

Ta, alloweble shear stress, in psf, of:
alluvial sand = 0.02 for SP with d75 < 0.05" or 1.27mm (USDA Ag. Handbook 667, Table 3.3)
sandy clay, SC = Tab * Ce^2 = 0.09504 psf, USDA Handbook #667, p.56
where Tab = 0.066 psf for PI= 18.2 and Ce = 1.2 for void ratio = 0.437

F, flow concentration factor, assumed to be 3 (worst case)

ROCK RIPRAP/COVER PARAMETERS

P, rock cover porosity = 0.44 (Table B.1, NUREG/CR-4651)
G, rock spec. gravity = 2.60 based on tests on San Miguel river rock (see App.D)
Cs, Stephenson factor = 0.25 for rounded river cobbles (p. 48, NUREG/CR-4620)
FA, friction angle of large rock = 38 degrees, 0.6632 radians (Figure 4.8, NUREG/CR-4620)
of 1 to 10" rock 35 degrees, 0.6109 radians

SLOPE AND GRADIENT PARAMETERS

SA, slope angle (design values)
pile top, max. 2 degrees, 0.0349 radians
outslope 11.31 degrees, 0.1974 radians
channel banks 11.31 degrees, 0.1974 radians
N, stability number for particles on plane bed = 21*y*s/(G-1)*d50 (Stevens et al, 1976)
B, angle between gravity vector along slope and particle movement vector on slope
= arctan(N*tanFA / (2*sinSA)) (Eqn 4.23, NUREG/CR 4620)
N', stability number for particles on slope = (N/2)*(1+sinB) for horizontal flow
(Stevens et al, 1976)
Ss, critical slope (limiting value for erosional stability) = ((65*Ta^(5/3))/(i*L*F*n))^(6/7)

EQUATIONS OF FLOW

q, unit discharge = C*i*a

Q, total runoff = C*i*A for peak discharge from area A, = V*A in channel with flow section area A and velocity V

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

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

SIZING OF ROCK FOR EROSION PROTECTION

d50, mean rock diameter (per rationale of NRC Staff Technical Position on Erosion Protection...)
For slopes with gradients < 0.1 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 rock on slope with horizontal flow
SF = cos SA * tan FA / (N'*tan FA + sin SA * cos B)

CHANNEL DESIGN ANALYSIS EQUATIONS

Q = AV = wh * (1.486/n)*R^.67*S^.5 where w = channel width, h = water water depth
R = hydraulic radius = wh/(w+2h), S = hydraulic gradient - channel gradient
A(R)^2/3 = (Qn)/(1.486*S^1/2)

********* CALCULATION C5 *********

ORIGINAL (PRE-1977) SITE SURFACE-WATER CHANNEL GRADIENTS

	Channel Elev.	Segment Length l	Segment Slope s	Cum. Length L	Ave. S for L S	
WEST CHANNEL	5620	(starting point for analysis)				
	5610	285	0.035	285	0.035	
	5600	345	0.029	630	0.032	
	5598	40	0.050	670	0.033	property fence
	5590	250	0.032	920	0.033	
	5580	420	0.024	1340	0.030	
	5570	360	0.028	1700	0.029	
	5566	140	0.029	1840	0.029	West/ Mid channels merged
	5560	220	0.027	2060	0.029	
	5550	500	0.020	2560	0.0273	0.0264 below 5610
MID 1 CHANNEL	5620	(starting point for analysis)				
	5610	300	0.033	300	0.033	
	5603	215	0.033	515	0.033	property fence
	5600	45	0.067	560	0.036	
	5590	270	0.037	830	0.036	
	5585.5	95	0.047	925	0.037	Mid 1/ Mid 2 confluence
MID 2 CHANNEL	5614	(starting point for analysis)				
	5610	100	0.040	100	0.040	
	5600	390	0.026	490	0.029	property fence
	5590	280	0.036	770	0.031	
	5585.5	150	0.030	920	0.031	Mid 1/ Mid 2 confluence
	5580	230	0.024	1150	0.030	
	5570	350	0.029	1500	0.029	
	5566	100	0.040	1600	0.030	Mid /West confluence
EAST 1 CHANNEL	5620					
	5610	300	0.033	300	0.033	
	5602	195	0.041	495	0.036	property fence
	5600	25	0.080	520	0.038	
	5590	360	0.028	880	0.034	
	5580	235	0.043	1115	0.036	
	5570	365	0.027	1480	0.034	
	5560	200	0.050	1680	0.036	
	5557	70	0.043	1750	0.036	East 1 /East 2 confluence
	5550	260	0.027	2010	0.035	
EAST 2 CHANNEL	5630					
	5620	155	0.065	155	0.065	
	5610	185	0.054	340	0.059	
	5607	70	0.043	410	0.056	property fence
	5600	155	0.045	565	0.053	
	5590	225	0.044	790	0.051	
	5580	225	0.044	1015	0.049	
	5570	175	0.057	1190	0.050	
	5560	250	0.040	1440	0.049	
	5557	100	0.030	1540	0.047	East 1 /East 2 confluence

PRESENT (PRE-RECLAMATION) SITE SURFACE-WATER CHANNEL GRADIENTS

	Channel Elev.	Segment Length l	Segment Slope s	Cum. Length L	Ave. S for L S	Delta vs Original s	Delta vs Original S
WEST CHANNEL	5620	(starting point for analysis)					
	5610	425	0.024	425	0.024	-0.012	-0.012
	5600	520	0.019	945	0.021	-0.010	-0.011
	5590	270	0.037	1215	0.025	0.005	-0.008
	5585	90	0.056	1305	0.027		
	5580	220	0.023	1525	0.026	-0.001	-0.004
	5570	370	0.027	1895	0.026	-0.001	-0.003
	5560	440	0.023	2335	0.026	-0.005	-0.003
	5550	420	0.024	2755	0.025	0.004	-0.002
MID 1 CHANNEL	5620	(starting point for analysis)					
	5610	300	0.033	300	0.033	0.000	0.000
	5600	200	0.050	500	0.040	-0.017	0.004
	(joins West channel at ~elev. 5600)						
MID 2 CHANNEL	5620	(starting point for analysis)					
	5610	250	0.040	250	0.040	0.000	0.000
	5600	430	0.023	680	0.029	-0.002	0.001
	5590	205	0.049	885	0.034	0.013	0.003
	5585	175	0.029	1060	0.033	-0.001	0.002
	(joins WEST channel)						
EAST CHANNEL	5630						
	5620	400	0.025	400	0.025	NA	NA
	5610	250	0.040	650	0.031	0.007	-0.003
	5600	220	0.045	870	0.034	-0.035	-0.004
	5590	290	0.034	1160	0.034	0.007	0.000
	5580	230	0.043	1390	0.036	0.001	0.000
	5570	160	0.063	1550	0.039	0.035	0.005
	5560	270	0.037	1820	0.038	-0.013	0.003
	5557	40	0.075	1860	0.039	0.032	0.003
	5550	315	0.022	2175	0.037	-0.005	0.002

********* CALCULATION C6 *********

PMP/PMF EVENT HYDROLOGIC ANALYSIS

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WATERSHED ELEMENT	ELEMENT LENGTH L	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc hours	RAINFALL WITHIN tc (1)	i in/hr	Runoff Area, A acres(2)	Q cfs	PMF Flood Plain Width ft b	Gradient ft/ft s	Trial Depth, ft Sn/1.49S^.5	y	A(R)^.67	Velocity fps v	Shear Stress Peak psf Tp	Allow psf Ta
CENTRAL CHANNEL DRAINAGE																		
West	14500	7306	5601	0.1176	6.71	0.47	6.85	14.44	494.0	4280	100	0.020	611	3.03	612	14.13	3.78	0.09504
Mid 1	3950	6070	5601	0.1187	6.77	0.17	4.70	27.07	32.5	528	23	0.033	59	1.85	58	12.41	3.81	0.09504
Combined West and Mid 1 Channel									526.5	4808	200	0.025	610	1.95	602	12.33	3.08	0.09504
Mid 2	6900	6505	5601	0.1310	7.46	0.26	5.85	22.78	122.0	1667	30	0.018	251	3.92	251	14.18	4.40	0.09504
Combined West, Mid 1 and Mid 2 Channels (Central Channel)									648.5	6475	300	0.027	796	1.80	794	11.99	3.03	0.09504
Central including runoff from tributaries and channel surfaces (See Calc. C7)																		
Sta. 0+00, Start of diversion, to 5+22									494.0	4280	50	0.028	516	4.31	516	19.86	7.53	0.09504
5+22, West/Mid 1 channels junction, to 6+78									526.5	4808	110	0.028	580	2.76	580	15.84	4.82	0.09504
6+78, South edge of site, to 9+79									653.5	6663	300	0.022	907	1.96	915	11.33	2.69	0.09504
9+79 to 13+25, Between LT202 & LT 203									674.8	7264	300	0.022	989	2.05	986	11.81	2.81	0.09504
13+25 to 15+43									693.3	7729	310	0.025	987	2.00	978	12.47	3.12	0.09504
15+43 to 22+43, at NE corner of plant area									712.0	8263	310	0.015	1362	2.43	1351	10.97	2.27	0.09504
22+43 to 26+43									754.0	9209	370	0.015	1518	2.33	1507	10.68	2.18	0.09504
EAST																		
Upstream Watershed	9150	6660	5610	0.1148	6.55	0.34	6.40	19.05	155.7	1780								
East including runoff from tributaries and channel surfaces																		
Sta. 0+00 to 2+05, south edge of site									155.7	1780	100	0.0500	161	1.35	162	13.18	4.21	0.09504
2+05 to 4+62									160.5	1897	100	0.0350	205	1.55	204	12.24	3.39	0.09504
4+62 to 7+12									170.9	2227	100	0.0350	240	1.71	240	13.02	3.73	0.09504
7+12 to 10+89, NE corner of LT203									179.4	2446	100	0.0350	264	1.82	265	13.44	3.97	0.09504
10+89 to 14+82, NE corner of ore prep area									189.9	2714	250	0.0350	293	1.11	296	9.78	2.42	0.09504
14+82 to 20+92, SE corner of evap. pond area									202.0	3031	300	0.0200	433	1.25	433	8.08	1.56	0.09504
20+92 to NE corner of site									213.1	3803	300	0.0200	543	1.42	535	8.93	1.77	0.09504

********* CALCULATION C7 *********

TRIBUTARY-AREA SURFACE WATER DISCHARGES FROM PMP WITHIN THE SITE

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B180.0253

CHANNEL/ TRIBUTARY AREA	ELEMENT LENGTH L ft	ELEMENT WIDTH W ft	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc (minimum is 0.042) hours	RAINFALL WITHIN tc (1) inches	i in/hr	Runoff Area, A acres(2)	PMF Runoff from A Q cfs	Unit Discharge q cfs/ft
CENTRAL/												
Floodplain Surface Between LT 202,203	510	530	5601	5587	0.0275	1.57	0.06	2.25	35.67	6.21	155	0.29
Floodplain Surface East of LT 201	590	530	5587	5571	0.0271	1.55	0.07	2.60	36.67	7.18	184	0.35
M1 - ore area	155 ave	500	5585	5579	0.0387	2.22	0.042	1.73	41.19	1.78	51	0.10
Hill SW	455 max.	420 ave.	5669	5570	0.2176	12.28	0.042	1.73	41.19	4.39	127	0.30
Plant area	340	835 ave.	5572	5557 ave.	0.0441	2.53	0.042	1.73	41.19	6.52	188	0.23
Floodplain Surface East of Plant Area	525 median	530	5571	5557	0.0267	1.53	0.07	2.00	30.66	4.87	105	0.20
Hill NW1	515 median	n/a	5669	5560	0.2117	11.95	0.042	1.73	41.19	1.67	48	
Hill NW2	515 median	n/a	5669	5560	0.2117	11.95	0.042	1.73	41.19	1.19	34	
Hill NE1	470	n/a	5669	5560	0.2319	13.06	0.042	1.73	41.19	1.14	33	
West half cover on Evap. ponds	440	415	5562	5540	0.0500	2.86	0.042	1.73	41.19	3.62	104	0.25
NW quadrant	1600	n/a	5557	5514	0.0269	1.54	0.15	4.80	31.29	38.4	841	
EAST/												
Floodplain East of LT203	600	170 ave.	5607.3	5586	0.0355	2.03	0.06	2.25	34.75	2.34	57	0.33
Trib. East 1	500 max.	n/a	5692	5586	0.2120	11.97	0.042	1.73	41.19	3.3	95	
M2 - ore area east to east fence line	850	n/a	5592	5560	0.0376	2.16	0.08	3.00	36.24	10.56	268	
Trib. East 2	1200	n/a	5617	5540	0.0642	3.67	0.09	3.25	36.96	8.47	219	
Hill SE	375 median	n/a	5669	5560	0.2907	16.21	0.042	1.73	41.19	4.62	133	
Floodplain East of hill	700	n/a	5585	5550	0.0500	2.86	0.06	2.25	35.21	7.44	183	
Hill NE2	470 median	n/a	5669	5560	0.2319	13.06	0.042	1.73	41.19	1.55	45	
East half cover on Evap. ponds	440	370	5562	5540	0.0500	2.86	0.042	1.73	41.19	3.72	107	0.29
Floodplain East of EP cover	440	460	5559	5530	0.0659	3.77	0.08	5.00	60.84	4.28	290	0.63
Trib. East 3	600	100	5540	5530	0.0167	0.95	0.09	3.25	37.51	1.58	331	3.31

********* CALCULATION C8 *********

DIVERSION CHANNEL LINE, GRADE, AND DIMENSION CONTROL - CENTRAL CHANNEL

START POINT COORD.	FROM STATION	TO STATION	SEGMENT PLAN FORM	CENTER AND RADIUS	CURVE ANGLE degrees	WIDTH feet	LENGTH feet	GRADIENT	ELEVATION START	ELEVATION END
E46508 N34333	0+00	6+78	st.line	n/a	n/a	10	678	0.030	5620.0	5599.7
E47121 N34620	6+78	9+79	circ. curve	E47008 N34861 266'	64.8	10	300.8	0.030	5599.7	5590.6
E47274 N34861	9+79	13+25	st. line	n/a	n/a	10	346	0.029	5590.6	5580.6
E47274 N35207	13+25	15+43	circ. curve	E46722 N35207 552'	22.6	10	218	0.029	5580.6	5574.3
E47232 N35419	15+43	22+43	st. line	n/a	n/a	10	700	0.027	5574.3	5555.4
E46963 N36065	22+43	26+43	circ. curve	E46534 N35887 464.3'	49.3	10	400	0.020	5555.4	5547.4

PMF FLOOD PLAIN LINE, GRADE, AND DIMENSION CONTROL - CENTRAL FLOOD PLAIN

STATION (1)	SEGMENT LENGTH feet	OFFSET FROM CHANNEL CENTERLINE TO BANK, FT LEFT	RIGHT	TOTAL WIDTH feet	MIN. DEPTH feet	GRADIENT	MAX ELEV AT TOE OF BANK	MIN.ELEV. AT TOP OF BANK FOR PMF Q	MIN.ELEV. AT TOP OF BANK FOR CH ELEV
0+00		30	20	50	4.31		5620.25	5624.6	5624.6
	600					0.028			
6+00		55	55	110	4.31		5603.5		
	78					0.028			
6+78		65	75	140	2.76		5601.3	5604.0	5603.1
	412 (2)					0.022			
9+79		50	250	300	2.05		5592.2	5594.3	5594.2
	346					0.022			
13+25		50	250	300	2.00		5584.6	5586.6	5584.1
	256 (2)					0.025			
15+43		50	260	310	2.00		5578.2	5580.2	5577.8
	700					0.025			
22+43		50	260	310	2.43		5560.7	5563.1	5559.4
	482 (2)					0.015			
26+43		100	270	370	2.43		5553.5	5555.9	5551.7

NOTES: 1) Stationing is along centerline of channel (not flood plain)
2) Segment length is calculated using average of radii at start and end of segment in formula for length of circular arc.

DIVERSION CHANNEL LINE, GRADE, AND DIMENSION CONTROL - EAST CHANNEL

START POINT COORD.	FROM STATION	TO STATION	SEGMENT PLAN FORM	CENTER AND RADIUS	CURVE ANGLE degrees	WIDTH feet	LENGTH feet	GRADIENT	ELEVATION START	ELEVATION END
E48295 N34473	0+00	2+05	circ. curve	E48470 N34473 175'	67	10	204.6	0.06	5620.0	5607.7
E48390 N34634	2+05	4+62	circ. curve	E48316 N34837 220'	67	10	257.3	0.05	5607.7	5594.9
E48536 N34837	4+62	7+12	straight line	n/a	n/a	10	250.0	0.035	5594.9	5586.1
E48536 N35087	7+12	10+89	circ. curve	E48099 N35087 437'	49.5	10	377.5	0.035	5586.1	5572.9
E48383 N35419	10+89	14+82	circ. curve	E48545 N35609 250'	90	10	392.7	0.033	5572.9	5559.9
OR										
ALTERNATE DESIGN END SEGMENT										
E48383 N35419	10+89	12+91	circ. curve	E48502 N35560 185'	62.5	10	201.8	0.037	5572.9	5565.4

PMF FLOOD PLAIN LINE, GRADE, AND DIMENSION CONTROL - EAST FLOOD PLAIN

STATION (1)	SEGMENT LENGTH feet	OFFSET FROM CHANNEL CENTERLINE TO BANK, FT LEFT	OFFSET FROM CHANNEL CENTERLINE TO BANK, FT RIGHT	TOTAL WIDTH feet	MIN. DEPTH feet	GRADIENT	MAX ELEV AT TOE OF BANK	MIN.ELEV. AT TOP OF BANK FOR PMF Q	MIN.ELEV. AT TOP OF BANK FOR CH ELEV
0+00		70	30	100	1.35		5620.7	5622.1	5621.9
	225 (2)					0.050			
2+05		70	30	100	1.55		5609.5	5611.0	5609.8
	227 (2)					0.035			
4+62		90	20	100	1.71		5601.5	5603.2	5597.1
	250					0.035			
7+12		105	25	100	1.71		5592.8	5594.5	5588.3
	431 (2)					0.035			
10+89		65	100	250	1.71		5577.7	5579.4	5575.9
	351 (2)					0.035			
14+82		115	85	300	1.82		5565.4	5567.2	5563.3
	520					0.020			
20+92		n/a	n/a	300	1.25		5555.0		

Alternate channel-end segment does not affect flood plain past 10+89

NOTES: 1) Stationing is along centerline of channel (not flood plain)
2) Segment length is calculated using average of radii at start and end of segment in formula for length of circular arc.

********** CALCULATION C9 **********

CALCULATION OF DEPTH OF SCOUR AT TOE OF FLOOD PLAIN BANKS DUE TO PMF FLOW

scourdur.wk3
a1.170

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

Estimates of scour depth made by methods described in Ref.1 using PMF flood parameters

CHANNEL/ FLOOD PLAIN STATION	FLOW RATE Q cfs	PEAK DEPTH y ft	BOTTOM WIDTH Wb ft	MEAN SIZE OF BED MATERIAL Dm, mm(1)	LACEY BED FACTOR Z (2)	ZERO BED FACTOR Fbo (3)	SCOUR DEPTH, ft. ds1	ds2	ds3	AVERAGE ds
CENTRAL FLOOD PLAIN										
0+00 to 5+22	4280	4.31	50	0.015	0.25	2.8	7.1	3.2	8.3	6.2
5+22 to 6+78	4808	2.76	110	0.015	0.25	2.8	6.1	3.3	5.3	4.9
6+78 to 9+79	6663	1.96	300	0.015	0.75	2.8	5.2	11.0	3.4	6.5
9+79 to 13+25	7264	2.05	300	0.015	0.25	2.8	5.3	3.8	3.6	4.2
13+25 to 15+43	7663	2.00	310	0.015	0.50	2.8	5.3	7.7	3.6	5.5
15+43 to 22+43	8263	2.43	310	0.015	0.25	2.8	5.4	3.9	3.8	4.4
22+43 to 26+43	9209	2.33	370	0.015	0.50	2.8	5.3	8.2	3.6	5.7
EAST FLOOD PLAIN										
0+00 to 2+05	1780	1.35	100	0.015	0.75	2.8	4.9	7.1	2.9	5.0
2+05 to 4+62	1897	1.55	100	0.015	0.75	2.8	5.0	7.3	3.0	5.1
4+62 to 7+12	2227	1.71	100	0.015	0.25	2.8	5.2	2.6	3.4	3.7
7+12 to 10+89	2446	1.82	100	0.015	0.50	2.8	5.3	5.3	3.6	4.7
10+89 to 14+82	2714	1.11	250	0.015	0.75	2.8	4.3	8.2	2.1	4.9
14+82 to 20+92	3031	1.25	300	0.015	0.25	2.8	4.3	2.8	2.0	3.0

NOTES:
1) Mean size of bed material based on grain size analyses of soil samples from C and E test pits. See Appendix D
2) Bed factor Z for Lacey method is 0.25 for straight reach, 0.50 for moderate bend , 0.75 for severe bend; 0.6 for Blench method (Table 7 of reference).
3) Zero bed factor determined from Figure 9 of reference.
4) unit discharge q = Q/Wb

Scour Depth equations from reference, "Computing Degradation and Local Scour", US BuRec Technical Guideline, 1984

ds1 = 2.45*q^0.24, Field Measurements method, Eqn. 24

ds2 = Z*0.47*(Q/(1.76*Dm^0.5))^0.333, Lacey method, Eqns.26 and 29

ds3 = 0.6*((q^0.667)/(fbo^0.333)), Blench method, Eqns.27 and 30

********* CALCULATION C10 *********

PMF EROSION PROTECTION ANALYSIS

hyddur.wk3
cc2.cn50

FLOOD PLAIN SEGMENT	RIPRAP SIZING Flood Plain Banks: Rock Size inches d50	Bank Slope, grade	N	B	N'	Safety Factor SF
CENTRAL						
Sta. 0+00, Start of diversion, to 5+22	18.3	0.5	1.04	1.12	0.99	1.00
5+22, West/Mid 1 channels junction, to 6+78	11.7	0.5	1.04	1.12	0.99	1.00
6+78, South edge of site, to 9+79	6.9	0.5	0.98	1.55	0.98	1.01
9+79 to 13+25, Between LT202 & LT 203	7.2	0.5	0.99	1.55	0.99	1.00
13+25 to 15+43	8.0	0.5	0.98	1.55	0.98	1.01
15+43 to 22+43, at NE corner of plant area	5.8	0.5	0.99	1.55	0.99	1.00
22+43 to 26+43	5.6	0.5	0.98	1.55	0.98	1.01
EAST						
Sta. 0+00 to 2+05, south edge of site	10.2	0.5	1.04	1.12	0.99	1.00
2+05 to 4+62	8.2	0.5	1.04	1.12	0.99	1.00
4+62 to 7+12	9.1	0.5	1.04	1.12	0.98	1.01
7+12 to 10+89, NE corner of LT203	9.6	0.5	1.05	1.12	0.99	1.00
10+89 to 14+82, NE corner of ore prep area	5.9	0.5	1.04	1.12	0.99	1.00
14+82 to 20+92, SE corner evap. pond area	3.8	0.5	1.04	1.12	0.98	1.01
20+92 to NE corner of site	4.3	0.5	1.04	1.12	0.99	1.00

See Calc. C4 for equations, C6 for parameters used is this calculation.