Attachment 2.05.3(3)-20
Pond 015
100YR-24HR Full Containment

TABLE 2.05.3(3)-15-1

THE DESIGN PARAMETERS OF POND 015 ARE AS FOLLOWS:

Watershed Area (Acres)	5.5
Curve Number	83.5
100 Yr 24 Hr Event Inches (NOAA)	3.0
Sediment Volume (Acre Feet)	0.04
100 Yr EventRunoff Volume (Acre Feet)	0.68
Total Volume Required (Acre Feet)	0.72
Peak Discharge in (CFS)	12.71
Peak Discharge Out (CFS)	0.0
Sediment trap Efficiency	NA
Peak Stage	NA
Primary Spillway Elevation	NONE
Emergency Spillway Elevation	NONE

Pond 015 is a pre-mine pond design to capture and contain without discharge, the 100-year 24-hour event over the worst case drainage area of 5.5 acres. This worst case drainage area is of both undisturbed areas between the diversion and collection ditches, and the topsoil stripping area immediately west of the pit. The drainage area for Pond 015 can be seen on Map 2.05.3(3)-15.

Pond 015 does not meet the criteria of 30 CFR 77.216(a) as it does not have an embankment greater than 20 feet in height, nor does it store 20 acre-ft or more of water behind a 5 foot embankment.

Run-off Volume

Pond 015 excavation has been designed to contain the 100-year 24-hour event with no discharge. The pond is completely incised, so there is no embankment that could fail. The excavated side slopes are 2H:1V. The run-off volume for the worst case drainage area is 0.68 acre-ft. This was determined using a combined curve number from the weighted average of the curve numbers of the undisturbed areas as well as the area ahead of the pit which has just had its topsoil stripped.

Runoff Curve Number and Runoff

Project: Pond015 By: B. Langenfeld Date: 05/11/09

1. Runoff Curve Number (CN)

Cover description	**CN**	**Area(Acre)**
Topsoil stripped	**89**	**2.745**
Grasses	**78**	**2.794**

CN (weighted): **83.5**

Total Area: **5.539 Acre**

2. Runoff

Return Period: **100-Year**

Rainfall, P: **3.00 in**

Runoff, Q: **1.4778 in**

Runoff Volume: **0.6821 Acre-Ft**

Sediment Volume

Sediment build up within the pond was determined using the Revised Universal Soil Loss Equation (RUSLE):

$A = R \times K \times LS \times C \times P$

A = soil loss in tons/year per acre

R = rainfall factor (from standard chart of area)

K = soil erodibility factor (function of site specific soil)
LS = length slope factor (from contour map & chart)
C = management factor dependent upon vegetation & mulch
P = erosion control practice factor

For the worst case drainage area that drains to Pond 015, the sediment load was determined to be 0.04 acre-ft over 3 years. The calculations of this volume follow.

R = 26

The rainfall factor is the product of rainfall energy times the maximum 30-minute intensity for a given rainstorm. It is considered as the erosive power of the rain for that particular area. A chart of "R" values for Colorado developed by the Transportation Research Board in 1980 shows that the "R" value for the entire Nucla area is 26.

K = 0.39 (NRCS soil type #14)

LS = 0.39

The effects of topography on soil erosion are determined by the dimensionless “L” and “S” factors, which account for both rill and interrill erosion. These factors have been considerably revised since the initial Universal Soil Loss Equation. The new RUSLE computer database for the combined “LS” factor is based on the soil’s ratio of rill to interrill erosion. For most western rangeland soils, the equations for low rill to interrill ratio are used. Table 1 (from ***Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation*** - US Department of Agriculture 1997) shows a chart based on these equations. From this chart (attached on page 6) the LS value was interpolated from between the 2.0% and 3.0% slopes at 1000 feet of horizontal distance.

C = 1.0

Since the topsoil-stripped area in advance of the pit has no cover, a 0% appreciable cover with no canopy was used for this factor. This is very conservative since roughly half of the drainage area is undisturbed ground that <u>does</u> have cover. The factor comes

from the *“C” Factors for Permanent Pasture and Rangeland EPA (1977)* table on page 7.

P = 1.0

This factor is only applicable when such practices such as contouring perpendicular to the slope or other similar practices are used. None of these items are applicable to the pre-mining case. Therefore, the “P” factor for both the pre-mine and mine cases is 1.0.

A = 26 x 0.39 x 0.39 x 1.0 x 1.0 = 3.95 tons/acre annually

Over a three year period, and across 5.5 acres, this gives a total sediment amount of 65.7 tons. At roughly one ton for every 27 cubic feet of soil, the total sediment if 1774.3 cubic feet. This is 0.04 acre-ft.

The combined run-off (0.68 acre-ft) and sediment volume (0.04 acre-ft) is 0.72 acre-ft. Pond 015 is designed to hold 0.95 acre-ft without discharge, roughly 25% larger than the amount required. The stage-storage report and graph are attached on pages 8 and 9 respectively.

The pond volumes were calculated from TIN surfaces in SurvCAD. Since the pond is temporary and has such a large safety factor for the 100 year event, no spillways are required.

Water stored in Pond 015 will either infiltrate into the ground or evaporate into the air. No discharge will take place at from Pond 015. The consumptive use of Pond 015 is covered under the existing water augmentation plans for the New Horizon Mine.

The plan view of the pond is shown on Map 2.05.3(3)-15

Values for topographic factor, LS, for low ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.5	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
1.0	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.17	0.17
2.0	0.20	0.20	0.20	0.20	0.20	0.21	0.23	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34	0.35
3.0	0.26	0.26	0.26	0.26	0.26	0.29	0.33	0.36	0.38	0.40	0.43	0.44	0.46	0.48	0.52	0.55	0.57
4.0	0.33	0.33	0.33	0.33	0.33	0.36	0.43	0.46	0.50	0.54	0.58	0.61	0.63	0.67	0.74	0.78	0.82
5.0	0.38	0.38	0.38	0.38	0.38	0.44	0.52	0.57	0.62	0.68	0.73	0.78	0.81	0.87	0.97	1.04	1.10
6.0	0.44	0.44	0.44	0.44	0.44	0.50	0.61	0.68	0.74	0.83	0.90	0.95	1.00	1.08	1.21	1.31	1.40
8.0	0.54	0.54	0.54	0.54	0.54	0.64	0.79	0.90	0.99	1.12	1.23	1.32	1.40	1.53	1.74	1.91	2.05
10.0	0.60	0.63	0.65	0.66	0.68	0.81	1.03	1.19	1.31	1.51	1.67	1.80	1.92	2.13	2.45	2.71	2.93
12.0	0.61	0.70	0.75	0.80	0.83	1.01	1.31	1.52	1.69	1.97	2.20	2.39	2.56	2.85	3.32	3.70	4.02
14.0	0.63	0.76	0.85	0.92	0.98	1.20	1.58	1.85	2.08	2.44	2.73	2.99	3.21	3.60	4.23	4.74	5.18
16.0	0.65	0.82	0.94	1.04	1.12	1.38	1.85	2.18	2.46	2.91	3.28	3.60	3.88	4.37	5.17	5.82	6.39
20.0	0.68	0.93	1.11	1.26	1.39	1.74	2.37	2.84	3.22	3.85	4.38	4.83	5.24	5.95	7.13	8.10	8.94
25.0	0.73	1.05	1.30	1.51	1.70	2.17	3.00	3.63	4.16	5.03	5.76	6.39	6.96	7.97	9.65	11.04	12.26
30.0	0.77	1.16	1.48	1.75	2.00	2.57	3.60	4.40	5.06	6.18	7.11	7.94	8.68	9.99	12.19	14.04	15.66
40.0	0.85	1.36	1.79	2.17	2.53	3.30	4.73	5.84	6.78	8.37	9.71	10.91	11.99	13.92	17.19	19.96	22.41
50.0	0.91	1.52	2.06	2.54	3.00	3.95	5.74	7.14	8.33	10.37	12.11	13.65	15.06	17.59	21.88	25.55	28.82
60.0	0.97	1.67	2.29	2.86	3.41	4.52	6.63	8.29	9.72	12.16	14.26	16.13	17.84	20.92	26.17	30.68	34.71

[1]Such as for rangeland and other consolidated soil conditions with cover (applicable to thawing soil where both interrill and rill erosion are significant).

"C" Factors for Permenant Pasture and Rangeland
(EPA, 1977)

Vegetative Canopy			Cover That Contacts the Surface 1/						
Type and Height of Raised Canopy 2/	Canopy Cover 3/	Type 4/	Percent Ground Cover						
			0	10	20	40	60	80	95-100
No appreciable canopy		G	1.0	.45	.20	.10	.042	.013	.003
		W	1.0	.45	.24	.15	.090	.043	.011
Canopy of tall forbs	25	G	1.0	.36	.17	.09	.038	.012	.003
or short brush		W	1.0	.36	.20	.13	.082	.041	.011
(0.5 m fall ht.)	50	G	1.0	.26	.13	.07	.035	.012	.003
		W	1.0	.26	.16	.11	.075	.039	.011
	75	G	1.0	.17	.10	.06	.031	.011	.003
		W	1.0	.17	.12	.07	.067	.038	.011
Appreciable brush	25	G	1.0	.40	.18	.09	.040	.013	.003
or brushes		W	1.0	.40	.22	.14	.085	.042	.011
(2 m fall ht.)	50	G	1.0	.34	.16	.085	.038	.012	.003
		W	1.0	.34	.19	.13	.081	.041	.011
	75	G	1.0	.28	.14	.08	.036	.012	.003
		W	1.0	.28	.17	.12	.077	.040	.011
Trees but no appreciable	25	G	1.0	.42	.19	.10	.041	.013	.003
low brush		W	1.0	.42	.23	.14	.087	.042	.011
(4 m fall ht.)	50	G	1.0	.39	.18	.09	.040	.013	.003
		W	1.0	.39	.21	.14	.085	.042	.011
	75	G	1.0	.36	.17	.09	.039	.012	.003

1/ All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists.

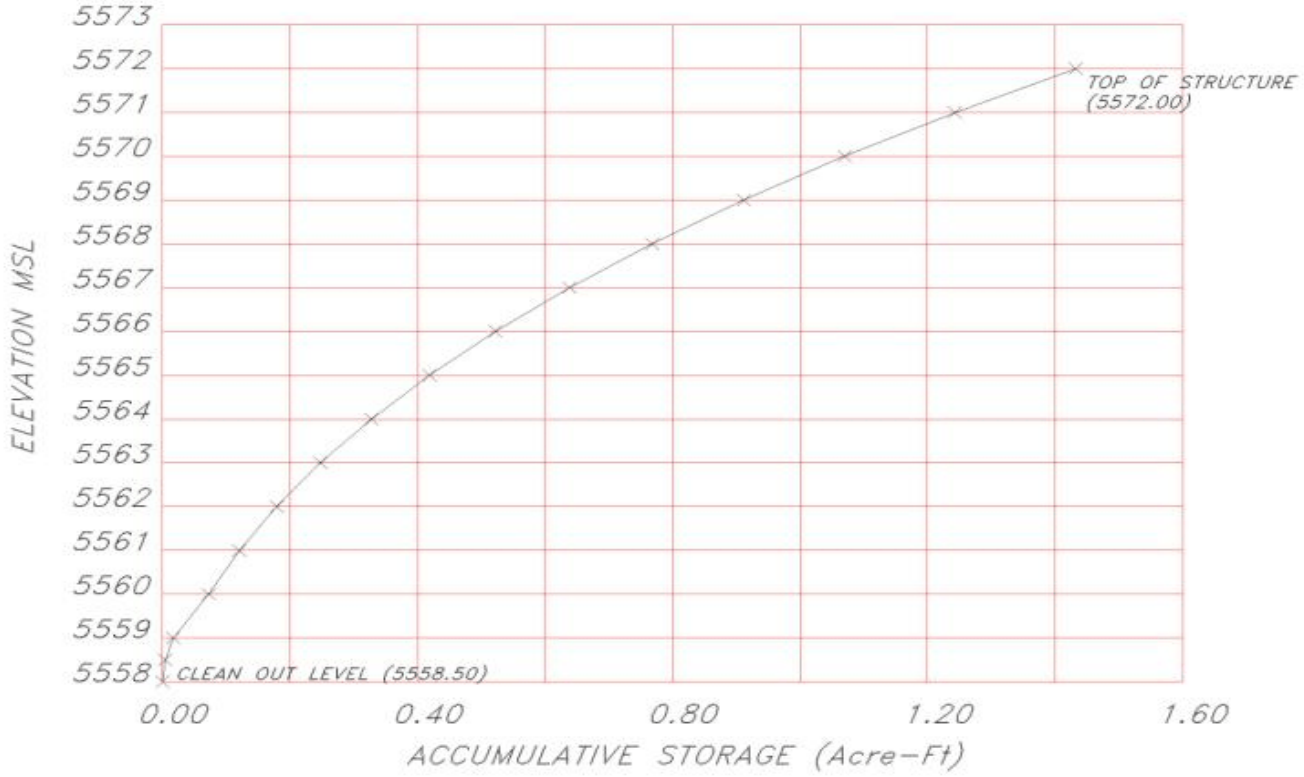
2/ Average fall height of waterdrops from canopy to soil surface: m=meters.

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.

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

STAGE STORAGE CURVE
POND 015



STORAGE VOLUME COMPUTATIONS

POND 015

ELEV. (ft)	WIDTH (ft)	LENGTH (ft)	AREA (ac)	AVG. AREA (ac)	INTERVAL (ft)	STORAGE (ac-ft)	ACC. STORAGE (ac-ft)	STAGE INTERVAL (ft)
5558.00	N/A	N/A	0.0000					
5558.50	N/A	N/A	0.0170	0.0085	0.50	0.0042	0.0042	0.50
5559.00	N/A	N/A	0.0340	0.0255	0.50	0.0127	0.0170	1.00
5560.00	N/A	N/A	0.0434	0.0387	1.00	0.0387	0.0726	2.00
5561.00	N/A	N/A	0.0531	0.0482	1.00	0.0482	0.1208	3.00
5562.00	N/A	N/A	0.0632	0.0582	1.00	0.0582	0.1790	4.00
5563.00	N/A	N/A	0.0742	0.0687	1.00	0.0687	0.2477	5.00
5564.00	N/A	N/A	0.0854	0.0798	1.00	0.0798	0.3275	6.00
5565.00	N/A	N/A	0.0970	0.0912	1.00	0.0912	0.4187	7.00
5566.00	N/A	N/A	0.1100	0.1035	1.00	0.1035	0.5222	8.00
5567.00	N/A	N/A	0.1226	0.1163	1.00	0.1163	0.6385	9.00
5568.00	N/A	N/A	0.1368	0.1297	1.00	0.1297	0.7681	10.00
5569.00	N/A	N/A	0.1508	0.1438	1.00	0.1438	0.9119	11.00
5570.00	N/A	N/A	0.1652	0.1580	1.00	0.1580	1.0699	12.00
5571.00	N/A	N/A	0.1810	0.1731	1.00	0.1731	1.2431	13.00
5572.00	N/A	N/A	0.1974	0.1892	1.00	0.1892	1.4323	14.00