Rio Algom Mining LLC

August 1, 2007

ADDRESSEE ONLY
Mr. Tom McLaughlin, Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop T-8F5
Washington, DC 20555

Subject: **License SUA-1473, Docket 40-8905**
Pond 2 Cell Design Plan Revision

Dear Mr. McLaughlin,

Please find attached to this letter Rio Algom Mining LLC's (RAML) revisions to the design for the waste disposal cell that will be constructed upon closed tailings pond 2 for the purposes of final disposal of the lined evaporation pond sediments located at Section 4 and Pond 9.

Please contact Terry Fletcher at 505 287 8851, extension 11 if you have questions or wish to discuss this matter.

Regards,

Peter Luthiger
Manager, Radiation Safety
and Environmental Affairs

Attachment: As stated

xc: T. Fletcher
D. Gillen (NRC)
T. Johnson (NRC)
R. Pleiness (DOE)
File

RIO ALGOM MINING LLC
AMBROSIA LAKE FACILITY

License SUA-1473 Docket 40-8905

Pond 2 Cell Design Plan Revisions

August 1, 2007

ADDITIONS/CHANGES TO REVISION 1 RECLAMATION PLAN TAILINGS CELL 2, Dated May 2007

Rio Algom Mining LLC (RAML) is submitting these additions and/or changes to Revision 1 of the *Reclamation Plan for Disposal of Pond Sediments and Ancillary Materials, Tailings Cell 2 Expansion*. Revision 1 of the plan was submitted to the Nuclear Regulatory Commission (NRC) in May, 2007. These amendments were developed based on subsequent comments and discussions with NRC on the revised Reclamation Plan. Amendments to the revised plan are listed below:

Section 4, page 5 – Subsection 4.3.2

The reference to laboratory testing should be Appendix A-2 (Geotechnical Investigations – 2004) instead of Appendix B-1 (Rock Quality Testing). Replace page with new Section 4 page 5.

Section 4, page 20 – Subsection 4.5.8 (Summary)

Please place supplemental information (attached), which is referenced in settlement monitoring discussion, at the end of Appendix C-2 (Settlement Calculations).

Section 7.3.1 – Section 7.3.4, Erosion Protection

Add Table 7.4 (Erosion Protection Rock Gradations) following page 17, Section 7. Gradations of the various sizes of erosion protection rock as shown in this table will be used for construction. Previously proposed gradations have been removed from the design drawings (Figure 7.7 through Figure 7.21) and the revised drawings are included in this report. These rock gradations have been revised to meet minimum D_{50} size per surface water hydrologic calculations.

Section 9, page 14 – Subsection 9.3 (Cover Design)

Add reference calculation of frost depth (attached) to Appendix C as Appendix C-6 (Frost Depth). Replace page with new Section 9 page 14.

Section 10, page 4 – Subsection 10.5 (Erosion Protection Material)

In first bullet, start of third sentence: "If deemed necessary" has been deleted and sentence reworded. Replace page with new Section 10 page 4.

Section 10, page 5 – Subsection 10.5 (Erosion Protection Material) under Source Quality Assurance

Please add to section the "Description of Acceptable Rock."

Section 10, page 6 – Subsection 10.5 (Erosion Protection Material) under On-Site Quality Assurance

Please add to section the "Rock Placement Procedures."

Revised Drawings

Revised drawings are included with this submittal. Revisions consisted of correcting a typographical error on 7.2 and removing the gradation tables from the drawings.

REVISED PAGES

Table 4.2
Shear Wave Velocity Determinations
Rio Algom Mining Company LLC

Location	Test Interval (m)	Maximum Velocity (m/s)	Minimum Velocity (m/s)	Average Velocity (m/s)
CPT-7	1.8-6.6	300	200	244
CPT-12	1.7-7.65	342	190	258
CPT-22	1.8-20.8	382	160	251

4.3.2 Laboratory Testing

A laboratory testing program was conducted to determine the properties of the Section 4 sediments, dike soils, and combinations of the two mixed materials. These tests included index tests, shear strength tests, and compaction tests on mixtures of sediments and natural soils. The results of this testing program are shown in Appendix A-2 (Geotechnical Investigations – 2004).

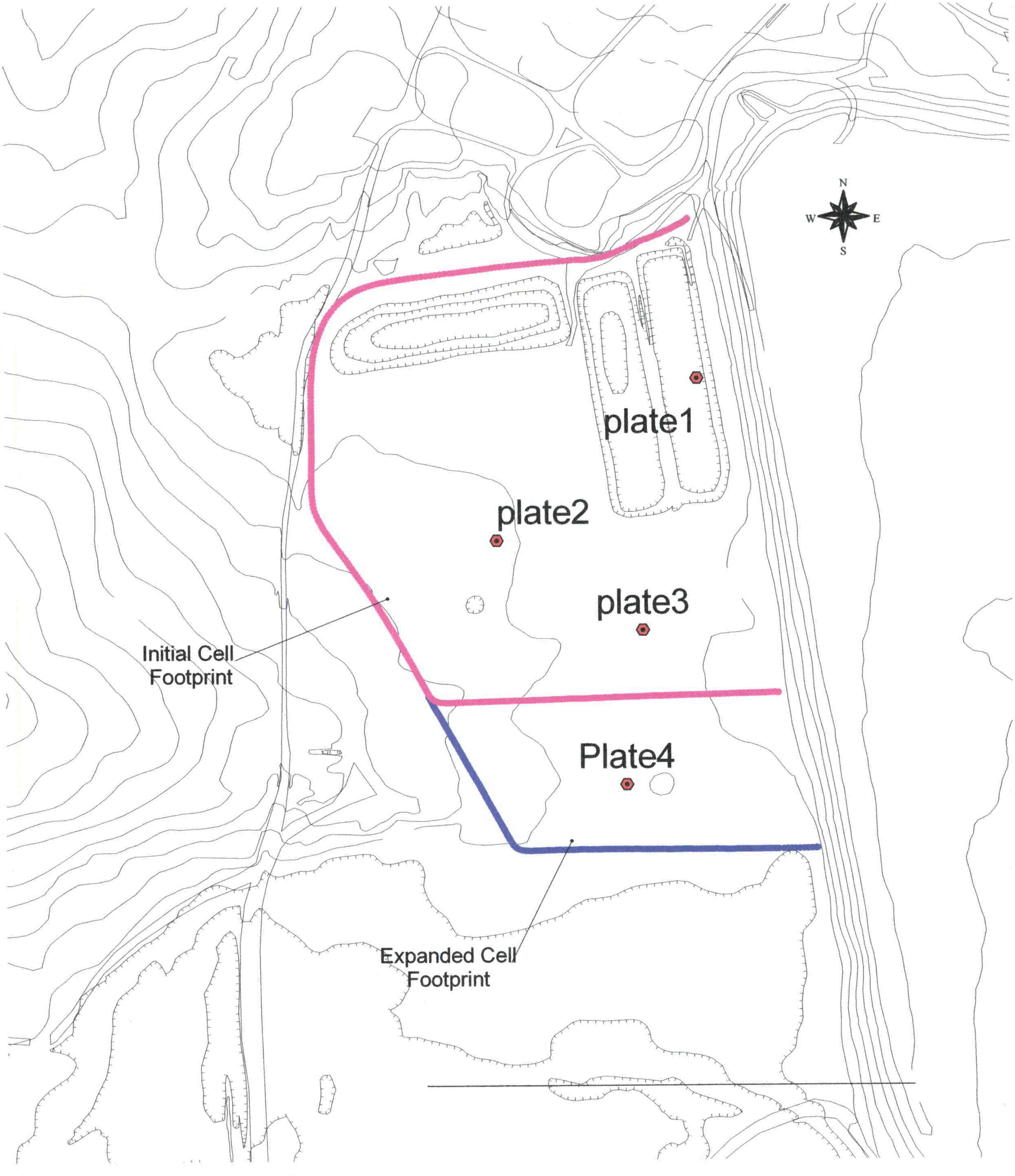
4.4 SUBSURFACE CONDITIONS

The results of the geotechnical investigations show that beneath the existing reclamation cover, mill tailings consisting of silty sands to sands, and sandy silts in various layers and mixtures extend to a maximum depth of 65 feet below the existing surfaces. Clayey silts to sandy clays (slimes) are intermixed with these materials at various locations. A generalized subsurface cross sections beneath the proposed Cell 2 expansion are shown in Figures 4.2 through 4.7.

The eastern subsurface boundary of the new repository is the common dike area between Pond 1 and Pond 2. The western embankment of Tailings Cell 1 will form the eastern abutment of Cell 2. The beach deposits formed from spigoting from this common dike between Ponds 1 and 2 are represented by CPT borings 4 and 9 on the east side of the project area. CPT boring 4 consists entirely of granular materials to the terminal depth of 31.7 feet. A water table was encountered in the CPT boring at 30.0 feet. CPT boring 9 consists of 2.5 feet of slimes directly below the 3 feet of reclamation cover. Below this depth, tailings

ADDITIONAL SETTLEMENT DATA

Tailings Cell 2
Settlement Plate Locations

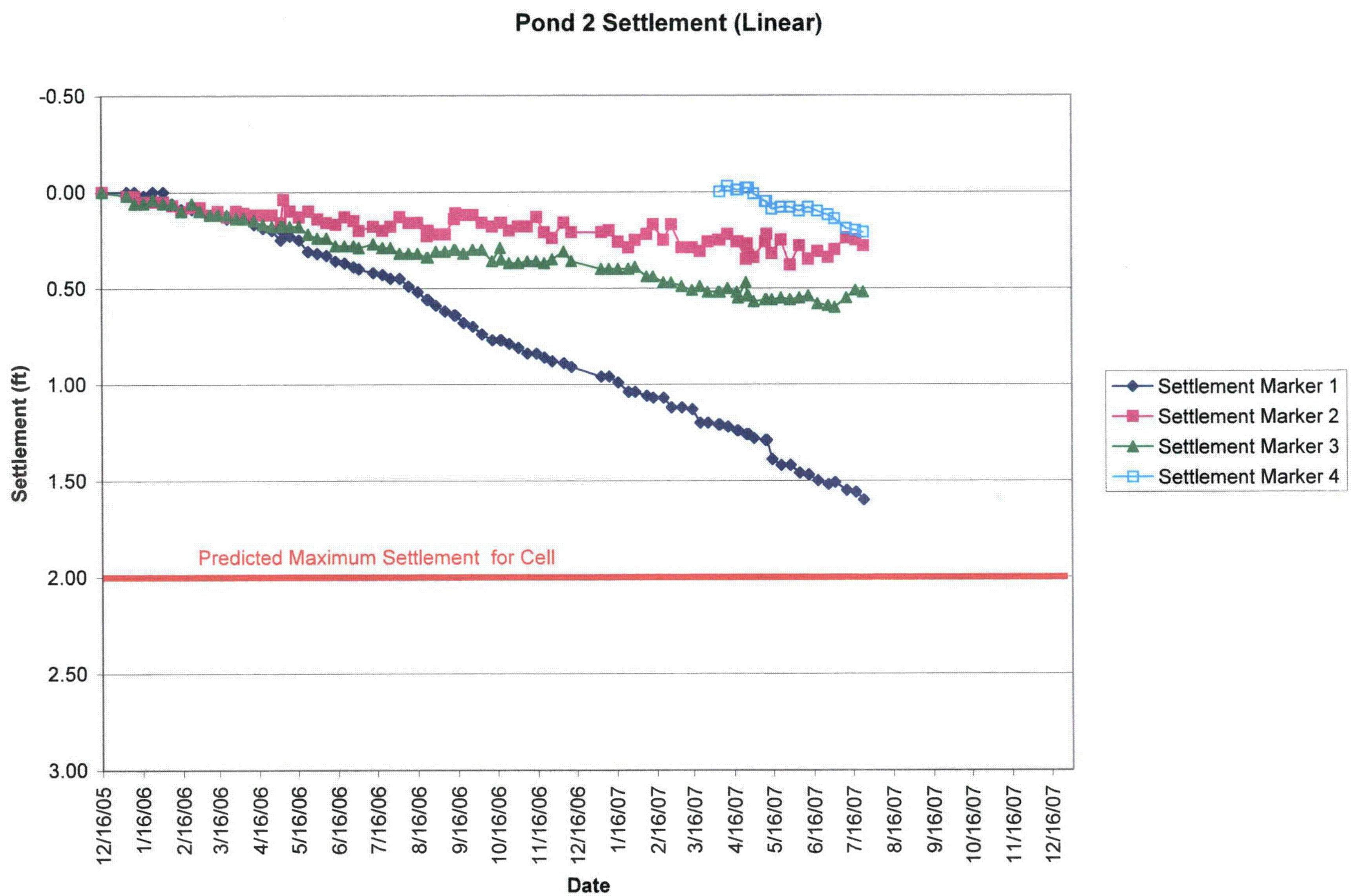


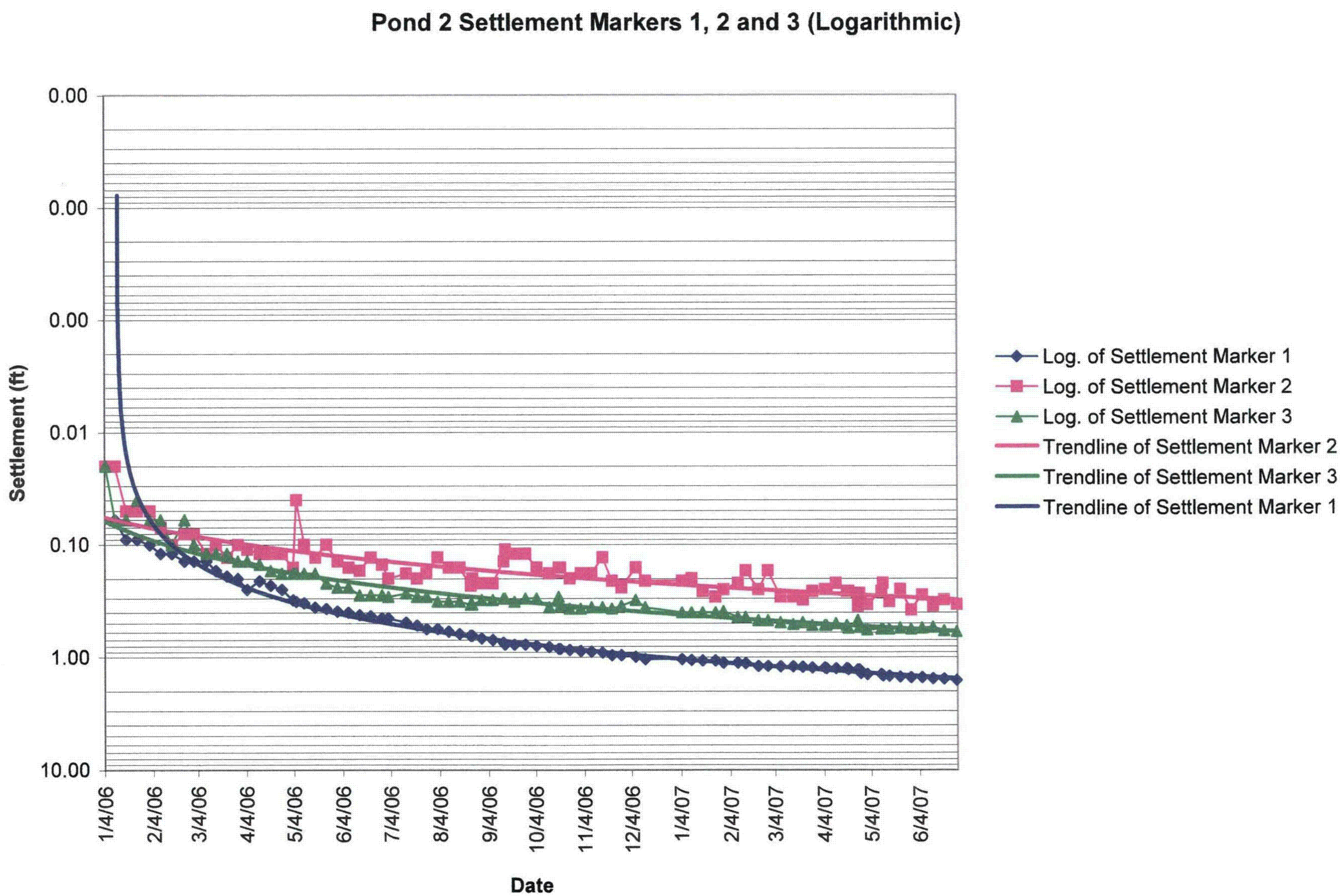
Pond 2 Settlement Plates Summary Table

Initial Elevation (ft)	Plate No. 1 6,994.93		Plate No. 2 6,998.85		Plate No. 3 6,995.84		Plate No. 4 6,993.63	
Date	Elevation (ft)	Settlement (ft)	Elevation (ft)	Settlement (ft)	Elevation (ft)	Settlement (ft)	Elevation (ft)	Settlement (ft)
12/16/05	6,994.93	0.00	6,998.85	0.00	6,995.84	0.00		
1/4/06	6,994.93	0.00	6,998.83	0.02	6,995.82	0.02		
1/10/06	6,994.94	0.00	6,998.83	0.02	6,995.78	0.06		
1/17/06	6,994.91	0.02	6,998.80	0.05	6,995.78	0.06		
1/24/06	6,994.93	0.00	6,998.80	0.05	6,995.80	0.04		
2/1/06	6,994.93	0.00	6,998.80	0.05	6,995.78	0.06		
2/8/06	6,994.87	0.06	6,998.78	0.07	6,995.78	0.06		
2/15/06	6,994.84	0.09	6,998.75	0.10	6,995.74	0.10		
2/23/06	6,994.84	0.09	6,998.77	0.08	6,995.78	0.06		
3/1/06	6,994.83	0.10	6,998.77	0.08	6,995.74	0.10		
3/9/06	6,994.81	0.12	6,998.73	0.12	6,995.72	0.12		
3/15/06	6,994.81	0.12	6,998.75	0.10	6,995.72	0.12		
3/22/06	6,994.79	0.14	6,998.72	0.13	6,995.72	0.12		
3/29/06	6,994.79	0.14	6,998.75	0.10	6,995.70	0.14		
4/4/06	6,994.79	0.14	6,998.74	0.11	6,995.70	0.14		
4/12/06	6,994.76	0.17	6,998.73	0.12	6,995.69	0.15		
4/19/06	6,994.74	0.19	6,998.73	0.12	6,995.67	0.17		
4/26/06	6,994.73	0.20	6,998.73	0.12	6,995.66	0.18		
5/3/06	6,994.68	0.25	6,998.69	0.16	6,995.66	0.18		
5/5/06	6,994.72	0.21	6,998.81	0.04	6,995.66	0.18		
5/10/06	6,994.70	0.23	6,998.75	0.10	6,995.66	0.18		
5/17/06	6,994.68	0.25	6,998.72	0.13	6,995.66	0.18		
5/24/06	6,994.62	0.31	6,998.75	0.10	6,995.62	0.22		
5/31/06	6,994.61	0.32	6,998.71	0.14	6,995.60	0.24		
6/7/06	6,994.60	0.33	6,998.69	0.16	6,995.60	0.24		
6/14/06	6,994.57	0.36	6,998.68	0.17	6,995.56	0.28		
6/21/06	6,994.56	0.37	6,998.72	0.13	6,995.56	0.28		
6/28/06	6,994.54	0.39	6,998.70	0.15	6,995.56	0.28		
7/2/06	6,994.53	0.40	6,998.65	0.20	6,995.55	0.29		
7/13/06	6,994.51	0.42	6,998.67	0.18	6,995.57	0.27		
7/20/06	6,994.50	0.43	6,998.65	0.20	6,995.55	0.29		
7/26/06	6,994.48	0.45	6,998.67	0.18	6,995.55	0.29		
8/2/06	6,994.48	0.45	6,998.72	0.13	6,995.52	0.32		
8/9/06	6,994.44	0.49	6,998.69	0.16	6,995.52	0.32		
8/16/06	6,994.41	0.52	6,998.69	0.16	6,995.52	0.32		
8/23/06	6,994.37	0.56	6,998.62	0.23	6,995.50	0.34		
8/24/06	6,994.37	0.56	6,998.65	0.20	6,995.50	0.34		
8/30/06	6,994.34	0.59	6,998.63	0.22	6,995.53	0.31		
9/6/06	6,994.31	0.62	6,998.63	0.22	6,995.53	0.31		
9/13/06	6,994.29	0.64	6,998.71	0.14	6,995.54	0.30		
9/14/06	6,994.29	0.64	6,998.74	0.11	6,995.54	0.30		
9/20/06	6,994.25	0.68	6,998.73	0.12	6,995.52	0.32		
9/27/06	6,994.23	0.70	6,998.73	0.12	6,995.54	0.30		
10/4/06	6,994.19	0.74	6,998.69	0.16	6,995.54	0.30		
10/12/06	6,994.16	0.77	6,998.67	0.18	6,995.48	0.36		
10/18/06	6,994.16	0.77	6,998.69	0.16	6,995.55	0.29		
10/19/06	6,994.16	0.77	6,998.69	0.16	6,995.49	0.35		
10/25/06	6,994.14	0.79	6,998.65	0.20	6,995.47	0.37		
11/1/06	6,994.12	0.81	6,998.67	0.18	6,995.47	0.37		
11/8/06	6,994.09	0.84	6,998.67	0.18	6,995.48	0.36		
11/15/06	6,994.09	0.84	6,998.72	0.13	6,995.48	0.36		
11/21/06	6,994.07	0.86	6,998.64	0.21	6,995.47	0.37		
11/27/06	6,994.05	0.88	6,998.61	0.24	6,995.49	0.35		
12/6/06	6,994.04	0.89	6,998.69	0.16	6,995.53	0.31		
12/12/06	6,994.02	0.91	6,998.64	0.21	6,995.48	0.36		
1/4/07	6,993.97	0.96	6998.64	0.21	6,995.44	0.40		
1/10/07	6,993.97	0.96	6998.65	0.20	6,995.44	0.40		
1/17/07	6,993.94	0.99	6998.59	0.26	6,995.44	0.40		
1/25/07	6,993.89	1.04	6998.56	0.29	6,995.44	0.40		
1/30/07	6,993.89	1.04	6998.60	0.25	6,995.45	0.39		
2/8/07	6,993.87	1.06	6998.63	0.22	6,995.40	0.44		
2/13/07	6,993.86	1.07	6998.68	0.17	6,995.40	0.44		
2/21/07	6,993.86	1.07	6998.60	0.25	6,995.37	0.47		

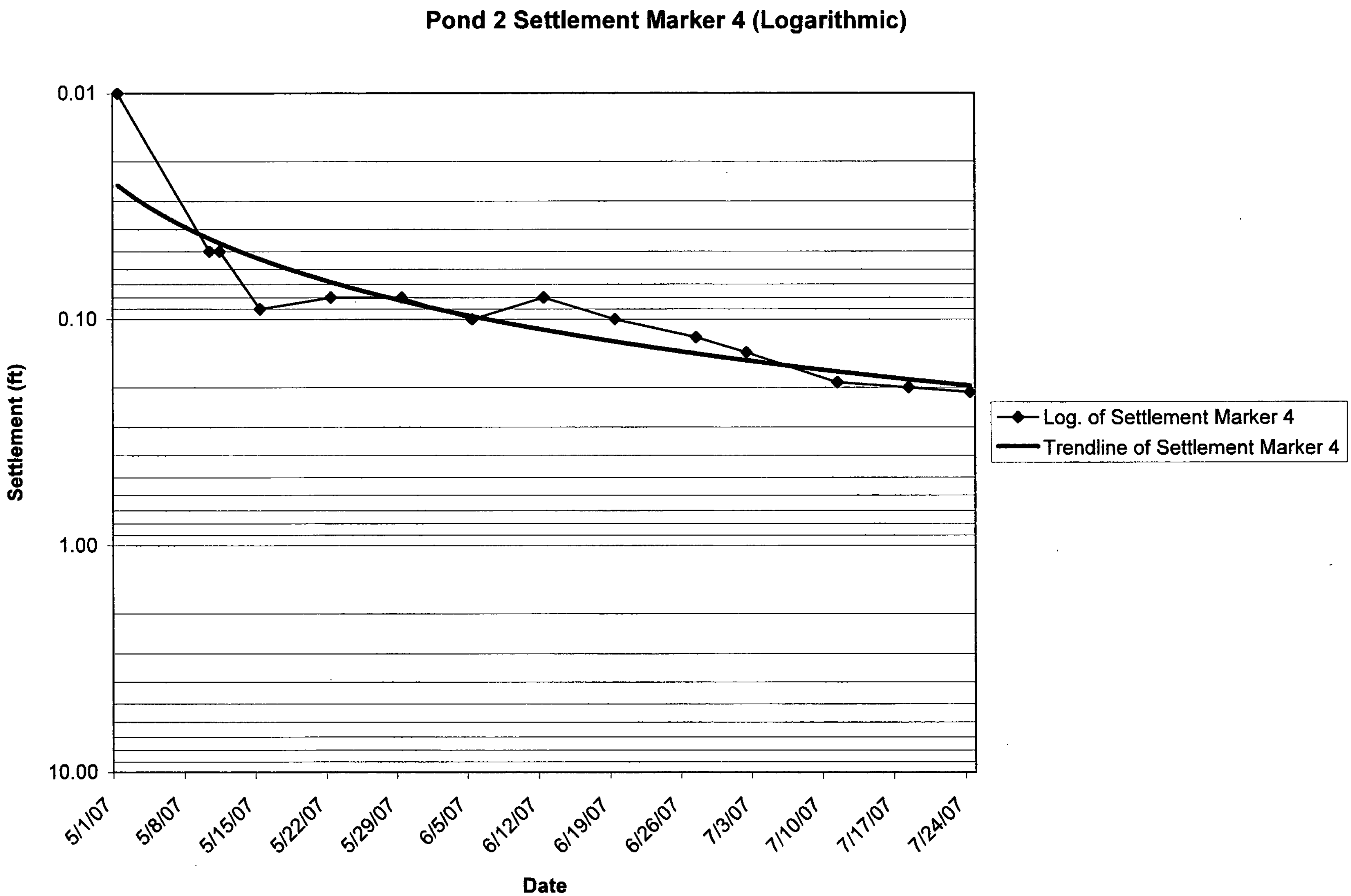
Initial Elevation (ft)	Plate No. 1 6,994.93		Plate No. 2 6,998.85		Plate No. 3 6,995.84		Plate No. 4 6,993.63	
Date	Elevation (ft)	Settlement (ft)	Elevation (ft)	Settlement (ft)	Elevation (ft)	Settlement (ft)	Elevation (ft)	Settlement (ft)
2/27/07	6,993.81	1.12	6998.68	0.17	6,995.37	0.47		
3/7/07	6,993.81	1.12	6998.56	0.29	6,995.35	0.49		
3/15/07	6,993.80	1.13	6998.56	0.29	6,995.33	0.51		
3/21/07	6,993.73	1.20	6998.54	0.31	6,995.35	0.49		
3/27/07	6,993.73	1.20	6998.59	0.26	6,995.32	0.52		
4/4/07	6,993.72	1.21	6998.60	0.25	6,995.32	0.52		
4/5/07	6,993.72	1.21	6998.60	0.25	6,995.32	0.52	6,993.63	0.00
4/11/07	6,993.71	1.22	6998.63	0.22	6,995.34	0.50	6,993.66	-0.03
4/18/07	6,993.69	1.24	6998.59	0.26	6,995.32	0.52	6,993.64	-0.01
4/19/07	6,993.69	1.24	6998.59	0.26	6,995.29	0.55	6,993.64	-0.01
4/25/07	6,993.67	1.26	6998.50	0.35	6,995.37	0.47	6,993.65	-0.02
4/26/07	6,993.67	1.26	6998.58	0.27	6,995.30	0.54	6,993.65	-0.02
4/27/07	6,993.67	1.26	6998.52	0.33	6,995.30	0.54	6,993.65	-0.02
5/1/07	6,993.65	1.28	6998.51	0.34	6,995.27	0.57	6,993.62	0.01
5/10/07	6,993.64	1.29	6998.59	0.26	6,995.28	0.56	6,993.58	0.05
5/11/07	6,993.64	1.29	6998.63	0.22	6,995.28	0.56	6,993.58	0.05
5/15/07	**6993.54 ***	**1.39**	6998.53	0.32	6,995.28	0.56	6,993.54	0.09
5/22/07	6,993.51	1.42	6998.60	0.25	6,995.29	0.55	6,993.55	0.08
5/29/07	6,993.51	1.42	6998.47	0.38	6,995.28	0.56	6,993.55	0.08
6/5/07	6,993.47	1.46	6998.57	0.28	6,995.29	0.55	6,993.53	0.10
6/12/07	6,993.46	1.47	6998.50	0.35	6,995.30	0.54	6,993.55	0.08
6/19/07	6,993.43	1.50	6998.54	0.31	6,995.26	0.58	6,993.53	0.10
6/27/07	6,993.41	1.52	6998.51	0.34	6,995.25	0.59	6,993.51	0.12
7/2/07	6,993.42	1.51	6998.55	0.30	6,995.24	0.60	6,993.49	0.14
7/11/07	6,993.38	1.55	6998.61	0.24	6,995.29	0.55	6,993.44	0.19
7/18/07	6,993.37	1.56	6998.60	0.25	6,995.33	0.51	6,993.43	0.20
7/24/07	6,993.33	1.60	6998.57	0.28	6,995.32	0.52	6,993.42	0.21

* Settlement marker #1 was hit by the 815 Compactor and was reset - as a result of the impact the plate dropped 0.10'


Pond 2 Settlement (Linear)
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
3.00
Settlement (ft)
Predicted Maximum Settlement for Cell
12/16/05
1/16/06
2/16/06
3/16/06
4/16/06
5/16/06
6/16/06
7/16/06
8/16/06
9/16/06
10/16/06
11/16/06
12/16/06
1/16/07
2/16/07
3/16/07
4/16/07
5/16/07
6/16/07
7/16/07
8/16/07
9/16/07
10/16/07
11/16/07
12/16/07
Date
Settlement Marker 1
Settlement Marker 2
Settlement Marker 3
Settlement Marker 4



Pond 2 Settlement Markers 1, 2 and 3 (Logarithmic)
Settlement (ft)
0.00
0.00
0.00
0.01
0.10
1.00
10.00
1/4/06
2/4/06
3/4/06
4/4/06
5/4/06
6/4/06
7/4/06
8/4/06
9/4/06
10/4/06
11/4/06
12/4/06
1/4/07
2/4/07
3/4/07
4/4/07
5/4/07
6/4/07
Date
Log. of Settlement Marker 1
Log. of Settlement Marker 2
Log. of Settlement Marker 3
Trendline of Settlement Marker 2
Trendline of Settlement Marker 3
Trendline of Settlement Marker 1


Pond 2 Settlement Marker 4 (Logarithmic)
Settlement (ft)
0.01
0.10
1.00
10.00
5/1/07
5/8/07
5/15/07
5/22/07
5/29/07
6/5/07
6/12/07
6/19/07
6/26/07
7/3/07
7/10/07
7/17/07
7/24/07
Date
Log. of Settlement Marker 4
Trendline of Settlement Marker 4

ROCK GRADATIONS

TABLE 7.4

U.S. Standard Sieve Size (Nominal) (Square Openings)	Percent Passing (by weight)
Rock Size D_{50} = 1" (Nominal)	
3-inch	100
2-inch	70-100
1-inch	25-55
3/4-inch	15-40
1/2-inch	0-25
Rock Size D_{50} = 3.2"	
6-inch	100
5-inch	78-100
4-inch	35-100
3-inch	10-40
2-inch	0-20
Rock Size D_{50} = 7.8"	
12-inch	100
9-inch	45-70
6-inch	5-20
4-inch	0-5
Rock Size D_{50} = 9.2"	
15-inch	100
12-inch	70-90
9-inch	20-45
6-inch	0-10

SETTLEMENT DATA

To-date over 2 million cubic yards blended sediment/berm soils have been hauled and placed at the Tailings 2 Cell expansion at a mix ratio of 1:1.25 pond sediments to soil, which is a less concentrated mix than the design assumptions. Considering also that the flux is principally generated from ingrowth of thorium-230, this cover design is believed to be extremely conservative.

Materials to construct the frost protection layer will be from the same borrow area and similar materials as the radon barrier. They will be compacted to 90% Standard Proctor dry density at a moisture content required to meet the density. The Modified Berggren formula was used to determine the freeze/thaw depth using meteorological data from San Mateo, New Mexico, which is about six miles south of the Ambrosia Lake site. For the analyses (see Appendix C-6, Frost Depth Calculation), it was assumed that the erosion protection rock cover over the frost protection layer would be in-filled with windblown sand for additional frost protection. Additionally, a one-foot thick frost protection layer had previously been approved in an NRC Technical Evaluation Report on a letter dated February 7, 1994 for Quivira Mining Company for radon covers of Impoundments 1 and 2.

APPENDIX C-6

CALCULATION OF FROST DEPTH
AND
SUPPORTING DATA

JOB NO. 4690046 JOB TITLE ______ DATE 5/2/07 BY JMM

SUBJECT FROST DEPTH CHECKED ______ SHEET 1 OF 14

SEE ATTACHED FOR MODIFIED BERGGREN METHOD FOR EQUATIONS AND PARAMETER DEFINITION.

λ COEFFICIENT - FIGURE 1 calculated from μ (Fusion Parameter and α (Thermal Ratio)

(1) $\mu = (T_f - T_s)\left(\frac{C}{L}\right)$ $T_f - T_s = n(FI)/d$ (FROM TABLE 3)

$= .9(231° \text{ DAYS}/76 \text{ DAYS}) = .9(3°) = 2.7°$

C for

(2) $= \gamma_d(0.17 + [.75\,w])$ where γ_d = Dry Density

w = Moisture Content

$= 96\,\text{pcf}(0.17 + [0.75)(.17)]$

$= 28.6\ \text{BTU}/ft^3$ (AMEC PROCTOR CURVE - MANCOS SHALE @ 90%)

(3) $L = \left(144\ \frac{\text{BTU}}{\text{lb}}\right) w\ \gamma_d$

$= (144)(.17)(96) = 2350\ \text{BTU}/ft^3$

(4) $\mu = (2.7)\left(\frac{28.5}{2350}\right) = 0.033$

(5) $\alpha = \frac{(\bar{T} - T_F)\,d}{n\,FI} = \frac{(48° - 32°)\,76}{.9(231)} = 5.85$

FROM FIG. 1

$\lambda\,(@\ \mu = 0.033, \alpha = 5.85) = 0.62$

JOB NO. ______ JOB TITLE ______ DATE ______ BY ______

SUBJECT ______ CHECKED ______ SHEET 2 OF 14

K_{AVG} (SILT + CLAY) For γ_d = 96 pcf, 17% (-2% OMC)

FROM FIG. 1

$K_{FROZEN} = 0.7$

$K_{UNFROZEN} = 0.6$

$\Big\}\ K_{AVG} = 0.65$

$$X = \lambda \left(\frac{48\ K_{AVG}\ n FI}{L} \right)^{1/2} \qquad (6)$$

$$= .62 \left[\frac{48(.65)\ .9\ (231)}{231} \right]^{1/2}$$

$X = 1.03$ FT

Frost Protection layer of processed Mancos Shale compacted @ 90% STND Proctor, -2% OMC (96 pcF @ 17%). Frost Penetration of 1 ft. plus minimum 3 inches of rock ($D_{50} = 1''$) on Topslope, more on sideslopes.

∴ Adequate for protection of radon barrier layer.

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Modified Berggren Formula for Estimating Freeze/Thaw Depth

The modified Berggren formula was developed in the early 1950s to address the shortcomings of the Stefan formula. The modified Berggren formula assumes that the soil is a semi-infinite mass with uniform properties and existing initially at a uniform temperature (T_I). It is further assumed that surface temperature is suddenly changed from T_I to T_S (below freezing). The modified Berggren formula is simply the Stefan formula corrected for the effects of temperature changes in the soil mass:

$$x = \lambda\sqrt{\frac{48k_{avg}nFI}{L}}$$

6

where:

x = depth of freeze or thaw, (ft))

λ = dimensionless coefficient which takes into consideration the effect of temperature changes in the soil mass (i.e., a fudge factor). Corrects the Stefan formula for the neglected effects of volumetric heats (accounts for "sensible heat" changes)

k_{avg} = thermal conductivity of soil, average of frozen and unfrozen (BTU/hr • ft • °F)

n = conversion factor for air freezing (or thawing) index to surface freezing (or thawing) index

FI = air freezing index (°F • days)

TI = air thawing index (°F • days)

L = latent heat (BTU/ft^3)

Determination of λ

λ can be determined by chart (see Figure 1) based on inputs of α (thermal ratio) and μ (fusion parameter).

λ = f (FI (or TI), mean annual air or ground temperature, thermal properties of soil)

= f(μ,α) and can be read from Figure 1

4

μ = fusion parameter $= \left(T_f - T_s\right)\left(\frac{C}{L}\right)$

C = average volumetric heat capacity of a soil (BTU/ft^3 • °F)

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L = latent heat (BTU/ft^3)

$|T_f - T_s|$ = surface freezing (or thawing) index, nFI (or nTI) divided by length of freezing (or thawing) season. Represents temperature differential between average surface temperature and 32 °F taken over the entire freeze (or thaw) season.

1 $= \frac{nFI}{d}$ or $\frac{nTI}{d}$

d = length of freezing or thawing duration. For example, if the winter freezing season is December through February, then the duration of freezing (d) equals about 90 days.

T_f = 32 °F

T_s = average surface temperature for the freezing (or thawing) period

5 α = thermal ratio $= \left|\frac{\bar{T} - T_f}{T_f - T_s}\right| = \bar{T} - T_F \left(\frac{nFI}{d}\right)$

$\bar{T}$ = average annual air or ground temperature

$|\bar{T} - T_f|$ = represents the amount that the mean annual temperature exceeds (or is less than) the freezing point of the soil moisture (assumed to be 32 °F).

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- c_{rock} = 0.17 BTU/lb • °F (soil minerals)

- Volumetric specific heat relationship (C)
  - Unfrozen soil

    $$C_u = \gamma_d\left(0.17 + \frac{w}{100}\right)$$

  - Frozen soil

    $$C_u = \gamma_d\left(0.17 + \frac{0.5w}{100}\right)$$

$C = \gamma_d \left(0.17 + .75 w\right)$ ②

Example

Calculated values for a gravel with γ_d = 130 lb/ft and w = 5%:

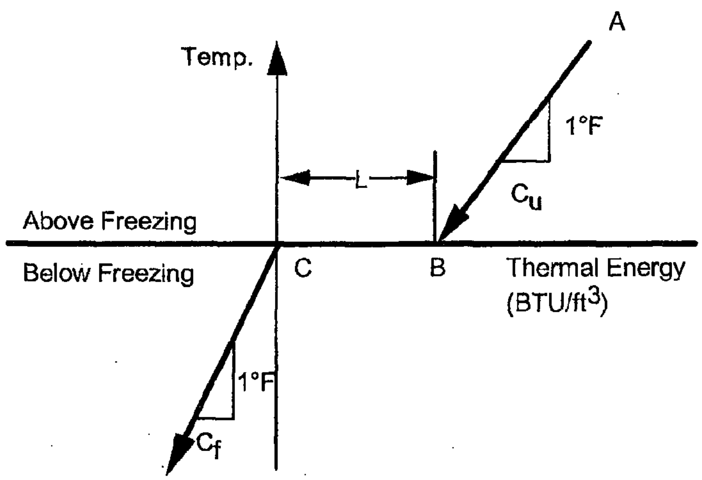
C_u = 130 (0.17 + 5/100) = 28.6 BTU/ft^3 • °F

C_f = 130 (0.17 + (0.5) (5/100)) = 25.4 BTU/ft^3 • °F

C_{avg} = 130 (0.17 + (0.75) (5/100)) = 27.0 BTU/ft^3 • °F

Latent Heat(L)

All objects have energy (heat). A portion of this thermal energy (stored heat) is released when the object cools. The sketch below represents a volume of soil with some moisture as it freezes:



As water freezes, thermal energy equal to L is released while the temperature of the soil remains nearly constant. Thus, the latent heat is the energy required to transform 1 lb of a pure substance from one phase to another at constant temperature. Further, 1 lb. of water gives off 144 BTU as it freezes. The latent heat of a soil can be represented by:

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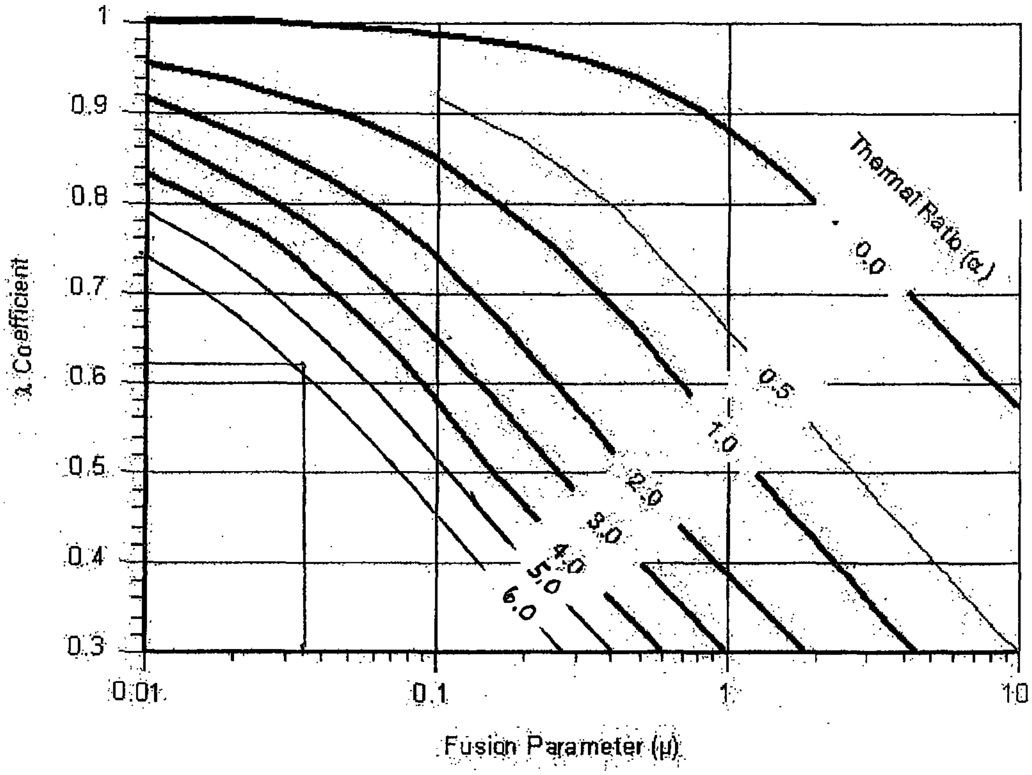

Figure 1: λ Coefficient in the Modified Berggren Formula

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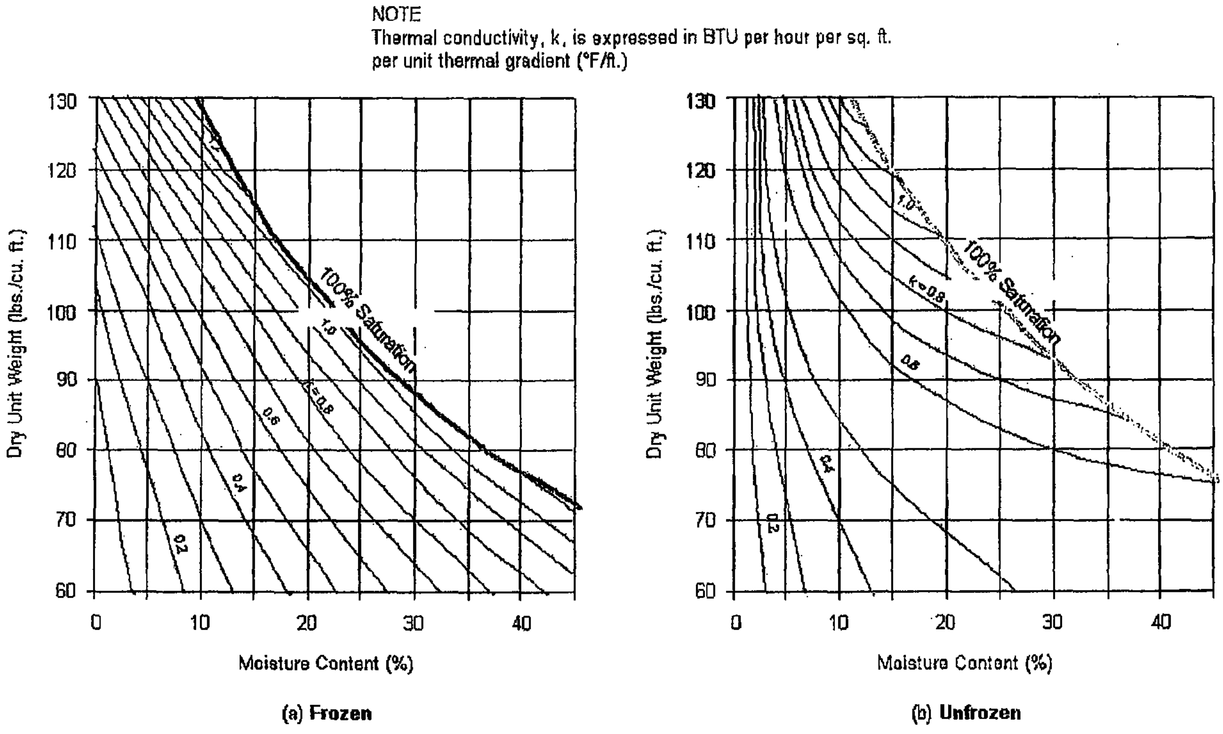

Figure 1: Average Thermal Conductivity for Silt and Clay Soils, Frozen and Unfrozen (redrawn from Kersten, 1949 and Air Force, 1966)

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$$L = \frac{\left(144\frac{BTU}{lb}\right)(w)(\gamma_d)}{100}$$

3

An embankment material with w = 5% and γ_d = 140 lb/ft^3,

$$L = \frac{\left(144\frac{BTU}{lb}\right)(5)(140\ {}^{lb}/_{ft^3})}{100} \cong 1000\ {}^{BTU}/_{ft^3}$$

Freezing and Thawing Indices

Depth of freezing and thawing depends in part on the magnitude and duration of the temperature differential below or above freezing (32 °F) at the ground surface. The freezing or thawing index is therefore given by the summation of the degree-days for a freezing or thawing season.

Washington State Freezing Index Maps

Washington State Frost Depth Maps

Calculations for Freezing Index (FI) or Thawing Index (TI)

$$\sum(\bar{T} - 32^\circ F)$$

where: $\bar{T}$ = mean daily temperature

= $0.5(T_1 + T_2)$

T_1 = maximum daily air temperature

T_2 = minimum daily air temperature

Example FI/TI Calculations

Day	Maximum	Minimum	Average	Degree Days per Day	Cumulative Degree Days
1	29	1	15	-17	-17

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2	9	-11	-1	-33	-50
3	10	-8	1	-31	-81
4	15	-1	7	-25	-106
5	30	16	23	-9	-115
6	38	30	34	+2	-113
7	30	18	24	-8	-121

Notes:

1. Assume Day 1 start of freezing season. The negative sign in this case indicates freezing degree-days (normally omitted).
2. For the purpose of assessing spring load restrictions, use 29 °F in lieu of 32 °F. This accounts for the "dark" bituminous surface

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Air and Surface Indexes

Normally, data are only available for air freezing and thawing indexes (≅ 1 meter in air above ground). However there is still a need to establish potential heat flow at the air-ground interface. No simple correlation exists between air and surface indexes. Differences between air and surface temperatures are influenced by:

- latitude
- cloud cover
- time of year
- wind speed
- surface characteristics
- subsurface thermal properties
- surface slope and orientation

However, designers generally use "n-factor" for purposes of correlation.

n-Factor for Freezing Conditions

"n" increases with increases in latitude and wind speed. Snow covered surfaces reflect large portion of incoming solar radiation with a resulting larger surface freezing index.

$$n = \frac{surface\ freezing\ index}{air\ freezing\ index}$$

Table 3: Typical "n" Values for Freezing Conditions

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Surface Type	"n"
Snow	1.0
Pavements free of snow and ice	0.9
Sand and gravel	0.9
Turf	0.5

TABLE 3

n VALUE

n-Factor for Thawing Conditions

"n" decreases with increases in latitude and wind speed.

$$n = \frac{surface\ thawing\ index}{air\ thawing\ index}$$

Table 3: Typical "n" Values for Thawing Conditions

Surface Type	"n"
Sand and gravel	2.0
Turf	1.0

Design Freezing and Thawing Indexes

For design purposes, generally use freezing (or thawing) index based on three coldest winters (or warmest summers) in last 30 years of record. If not available, use air-freezing index for the coldest winter in last 10 years.

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SAN MATEO, NEW MEXICO (297918)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1918 to 2/29/1988

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	40.6	44.6	51.6	60.9	70.7	81.0	83.1	79.6	73.1	62.9	50.9	41.4	61.7
Average Min. Temperature (F)	16.0	19.1	25.2	30.7	40.5	50.0	55.3	53.3	46.5	35.9	25.3	17.0	34.6
Average Total Precipitation (in.)	0.34	0.28	0.37	0.31	0.48	0.48	1.68	2.11	1.12	0.76	0.45	0.28	8.66
Average Total SnowFall (in.)	2.2	1.5	1.1	0.0	0.2	0.0	0.0	0.0	0.0	0.2	1.4	3.1	9.7
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 30.1% Min. Temp.: 31.1% Precipitation: 42.3% Snowfall: 27.1% Snow Depth: 26%
Check Station Metadata or Metadata graphics for more detail about data completeness.

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NO. OF DAYS -32°F = 76 days (DAY 337 through 46)

AVE. ANNUAL TEMP. = $(61.7^\circ + 34.6^\circ)/2$ = 48°

TOTAL No. OF DEGREE DAYS (-32°F) = 231 DEG. DAYS

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SAN MATEO, NEW MEXICO

30 Year Daily Temperature and Precipitation Summary

STATION 297918 AVERAGES FROM AVAILABLE YEARS IN PERIOD 1961 TO 1990 .

DOY	MON	DY	TMAX	#YRS	TMIN	#YRS	PRECIP	#YRS	SD MAX	SD MIN
1	1	1	39.4	20.	14.7	21.	0.005	21.	7.336	8.523
2	1	2	39.4	20.	14.7	21.	0.005	20.	7.344	8.574
3	1	3	39.4	20.	14.7	21.	0.006	20.	7.423	8.603
4	1	4	39.4	20.	14.7	21.	0.009	20.	7.502	8.643
5	1	5	39.4	20.	14.8	21.	0.011	20.	7.620	8.653
6	1	6	39.3	20.	14.8	21.	0.011	20.	7.712	8.641
7	1	7	39.3	20.	14.8	21.	0.011	20.	7.742	8.687
8	1	8	39.3	20.	14.9	21.	0.011	20.	7.757	8.777
9	1	9	39.4	20.	15.0	21.	0.010	20.	7.889	8.788
10	1	10	39.5	19.	15.1	20.	0.010	20.	7.952	8.828
11	1	11	39.6	20.	15.2	21.	0.010	21.	7.927	8.769
12	1	12	39.7	20.	15.3	21.	0.009	21.	7.843	8.747
13	1	13	39.8	19.	15.4	21.	0.009	21.	7.840	8.738
14	1	14	40.0	19.	15.6	21.	0.009	21.	7.861	8.761
15	1	15	40.3	19.	15.9	21.	0.009	21.	7.857	8.792
16	1	16	40.5	19.	16.1	21.	0.009	21.	7.927	8.794
17	1	17	40.8	19.	16.3	21.	0.009	21.	7.977	8.782
18	1	18	40.9	19.	16.4	21.	0.010	21.	8.055	8.769
19	1	19	41.0	19.	16.7	21.	0.010	21.	8.060	8.688
20	1	20	41.1	19.	16.9	21.	0.010	21.	8.071	8.566
21	1	21	41.3	19.	17.0	21.	0.010	21.	8.110	8.355
22	1	22	41.4	19.	17.2	21.	0.010	21.	8.132	8.185
23	1	23	41.6	19.	17.3	21.	0.010	21.	8.216	8.123
24	1	24	41.7	19.	17.3	21.	0.010	21.	8.315	8.179
25	1	25	41.7	19.	17.4	20.	0.010	21.	8.336	8.148
26	1	26	41.8	19.	17.4	20.	0.010	21.	8.376	8.120
27	1	27	41.9	19.	17.5	20.	0.010	21.	8.388	8.158
28	1	28	41.9	19.	17.6	20.	0.010	21.	8.400	8.141
29	1	29	42.1	20.	17.7	20.	0.010	21.	8.416	8.090
30	1	30	42.2	20.	17.8	21.	0.010	21.	8.444	8.028
31	1	31	42.3	20.	17.9	21.	0.010	21.	8.451	7.984
32	2	1	42.3	21.	17.9	22.	0.009	22.	8.320	7.972
33	2	2	42.4	21.	17.9	22.	0.007	22.	8.223	7.818
34	2	3	42.5	21.	18.1	22.	0.005	22.	8.143	7.750
35	2	4	42.7	21.	18.1	22.	0.005	22.	8.115	7.761
36	2	5	42.9	21.	18.2	22.	0.007	22.	8.103	7.687
37	2	6	43.0	21.	18.3	22.	0.007	22.	8.186	7.572
38	2	7	43.2	21.	18.4	22.	0.008	22.	8.173	7.551
39	2	8	43.3	21.	18.5	22.	0.008	22.	8.204	7.564
40	2	9	43.4	21.	18.5	22.	0.008	21.	8.255	7.577
41	2	10	43.6	21.	18.6	22.	0.008	22.	8.303	7.541
42	2	11	43.9	21.	18.7	22.	0.008	22.	8.302	7.485
43	2	12	44.1	21.	18.9	22.	0.008	22.	8.362	7.434
44	2	13	44.2	21.	18.9	22.	0.008	22.	8.384	7.437
45	2	14	44.5	21.	19.1	22.	0.009	22.	8.351	7.357
46	2	15	44.9	21.	19.4	22.	0.009	22.	8.327	7.263
47	2	16	45.2	21.	19.7	22.	0.008	22.	8.322	7.198
48	2	17	45.6	21.	20.0	22.	0.009	22.	8.307	7.180
49	2	18	45.9	21.	20.2	22.	0.009	22.	8.319	7.203
50	2	19	46.1	21.	20.4	22.	0.008	22.	8.298	7.178
51	2	20	46.4	21.	20.5	22.	0.009	22.	8.289	7.171

AVE. Deg. (-32°F)
5.0°
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0

135.5° Days

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292	10	18	61.9	22.	35.0	22.	0.026	22.	6.970	6.619	
293	10	19	61.5	22.	34.6	22.	0.027	22.	7.011	6.658	
294	10	20	61.1	22.	34.2	22.	0.026	22.	7.045	6.672	
295	10	21	60.7	22.	33.8	22.	0.026	22.	7.084	6.688	
296	10	22	60.4	22.	33.5	22.	0.024	22.	7.143	6.626	
297	10	23	60.0	22.	33.2	22.	0.024	22.	7.250	6.640	
298	10	24	59.6	22.	32.8	22.	0.028	22.	7.380	6.631	
299	10	25	59.2	22.	32.5	22.	0.028	22.	7.399	6.601	
300	10	26	58.9	22.	32.2	22.	0.027	22.	7.440	6.577	
301	10	27	58.6	22.	31.8	22.	0.024	22.	7.435	6.512	
302	10	28	58.2	22.	31.5	22.	0.024	22.	7.433	6.475	
303	10	29	57.9	22.	31.2	22.	0.023	22.	7.479	6.441	
304	10	30	57.6	22.	31.0	22.	0.024	22.	7.576	6.389	
305	10	31	57.3	20.	30.8	20.	0.024	22.	7.563	6.449	
306	11	1	57.0	20.	30.6	20.	0.024	22.	7.591	6.424	
307	11	2	56.6	20.	30.3	21.	0.022	22.	7.645	6.420	
308	11	3	56.2	19.	29.9	21.	0.022	22.	7.676	6.414	
309	11	4	55.7	19.	29.5	21.	0.022	22.	7.759	6.493	
310	11	5	55.3	19.	29.2	21.	0.021	22.	7.795	6.582	
311	11	6	54.9	19.	28.8	21.	0.019	22.	7.848	6.662	
312	11	7	54.6	21.	28.4	21.	0.019	21.	7.837	6.748	
313	11	8	54.2	21.	28.1	21.	0.018	22.	7.748	6.777	
314	11	9	53.7	19.	27.8	21.	0.018	22.	7.797	6.769	
315	11	10	53.4	19.	27.4	21.	0.017	22.	7.770	6.780	
316	11	11	53.0	18.	27.1	20.	0.017	22.	7.691	6.842	
317	11	12	52.6	19.	26.8	20.	0.017	22.	7.651	6.795	
318	11	13	52.1	19.	26.3	20.	0.018	22.	7.661	6.819	
319	11	14	51.6	20.	26.0	20.	0.018	22.	7.613	6.845	
320	11	15	51.2	19.	25.5	21.	0.018	22.	7.640	6.890	
321	11	16	50.7	19.	25.1	21.	0.017	22.	7.704	6.927	
322	11	17	50.3	19.	24.7	21.	0.015	22.	7.718	6.970	
323	11	18	49.9	20.	24.3	21.	0.015	22.	7.743	6.990	
324	11	19	49.6	20.	24.0	21.	0.014	22.	7.798	7.023	
325	11	20	49.3	20.	23.7	21.	0.014	22.	7.832	7.191	
326	11	21	48.9	20.	23.3	21.	0.014	22.	7.920	7.349	
327	11	22	48.5	20.	23.0	21.	0.011	22.	7.914	7.455	
328	11	23	48.1	20.	22.6	21.	0.010	22.	8.025	7.513	
329	11	24	47.7	20.	22.4	20.	0.010	22.	8.025	7.620	
330	11	25	47.2	18.	22.1	20.	0.009	22.	8.037	7.743	
331	11	26	46.8	18.	21.7	21.	0.009	22.	8.139	7.817	
332	11	27	46.3	19.	21.4	21.	0.010	22.	8.224	7.933	
333	11	28	45.9	20.	20.9	21.	0.009	22.	8.190	7.949	
334	11	29	45.5	21.	20.6	20.	0.011	22.	8.162	7.914	
335	11	30	45.1	20.	20.3	19.	0.011	22.	8.141	7.884	AVE. DEG (-32°)
336	12	1	44.7	19.	19.9	22.	0.011	22.	8.118	7.834	+0.3
→ 337	12	2	44.3	18.	19.6	22.	0.011	22.	8.160	7.853	0
338	12	3	44.1	18.	19.4	22.	0.011	22.	8.107	7.818	-0.25
339	12	4	43.8	18.	19.1	22.	0.011	22.	8.078	7.767	
340	12	5	43.6	18.	19.0	22.	0.011	22.	8.055	7.687	-0.5
341	12	6	43.4	18.	18.8	22.	0.011	22.	8.071	7.689	↓
342	12	7	43.2	18.	18.6	22.	0.011	22.	8.131	7.658	-1.0
343	12	8	43.0	18.	18.4	22.	0.011	22.	8.113	7.686	↓
344	12	9	42.8	18.	18.2	22.	0.011	22.	8.141	7.712	-1.5
345	12	10	42.6	18.	17.9	22.	0.011	22.	8.101	7.718	↓ 23° Days
346	12	11	42.3	18.	17.7	22.	0.011	22.	8.043	7.721	-2.0
347	12	12	42.2	19.	17.6	22.	0.010	22.	8.010	7.617	
348	12	13	42.0	19.	17.4	21.	0.010	22.	8.023	7.592	
349	12	14	41.9	19.	17.3	22.	0.010	21.	8.037	7.557	↓
350	12	15	41.8	19.	17.3	22.	0.010	22.	8.082	7.575	-2.5
351	12	16	41.6	19.	17.1	22.	0.010	22.	8.083	7.638	↓

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											AVE. DEG (-32°F)	
352	12	17	41.3	18.	16.9	22.	0.010	22.	8.101	7.650	-3.0	
353	12	18	41.0	18.	16.6	22.	0.010	22.	8.087	7.707		
354	12	19	40.5	18.	16.3	22.	0.010	22.	8.041	7.673	-3.5	
355	12	20	40.3	18.	16.1	22.	0.010	22.	7.964	7.638		
356	12	21	40.1	19.	15.7	22.	0.010	22.	7.977	7.701	-4.0	
357	12	22	39.9	19.	15.5	22.	0.010	22.	7.912	7.837		
358	12	23	39.7	19.	15.3	22.	0.010	22.	7.876	8.023	-4.5	
359	12	24	39.5	19.	15.1	22.	0.010	22.	7.836	8.172		72.5° DAYS
360	12	25	39.3	19.	15.0	22.	0.010	22.	7.716	8.293		
361	12	26	39.2	19.	14.8	22.	0.010	21.	7.591	8.254	-5.0	
362	12	27	39.2	19.	14.8	22.	0.009	22.	7.539	8.308		
363	12	28	39.2	19.	14.8	22.	0.005	22.	7.509	8.333		
364	12	29	39.3	19.	14.7	22.	0.005	21.	7.482	8.420		
365	12	30	39.4	19.	14.7	22.	0.005	22.	7.436	8.456		
366	12	31	39.4	18.	14.7	21.	0.005	22.	7.330	8.480		

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TOTAL DEG. DAYS = 135.5° + 23 + 72.5 = 231° DAYS

EROSION PROTECTION MATERIAL

- Materials are adjusted for moisture and compacted to at least 90 percent of standard Proctor dry density (ASTM method D-698) at a moisture content necessary to achieve compaction.
- A Standard Proctor Density Curve is developed for each 10,000 cubic yards of material placed or for each change in apparent soil type.
- A minimum of one Atterberg Limits Test (ASTM method D-4318) and one Gradation Analysis are performed for each 10,000 cubic yards of material placed or an apparent change in soil type. Alluvium soils will have at least 30 percent passing the number 200 sieve and have the soil classification as stated above.
- In-place density testing is performed at a rate of at least one test per 1,000 cubic yards placed. Testing will be performed by ASTM method D-1556 "Standard Test Method for Density of Soil by the Sand-Cone Method". Test frequency may be reduced to 2,500 cubic yards for each material type if in-place density testing indicates that during 20 successive tests, a minimum of 90 percent of the tests meets project specifications. Retests are not included in the 20 successive in-place density tests.
- Daily field observations are performed to verify that material conforms to specifications and to monitor construction quality progress.

10.5 EROSION PROTECTION MATERIAL

- The rock for use as erosion protection material will be evaluated for suitability prior to placement. Gradation analyses will be performed for every 10,000 cubic yards placed along with other laboratory tests to determine the "score" of these materials by NUREG guidance methods.
- The placement of erosion protection material will be monitored to verify that the required thickness has been placed on the completed cell.

DESCRIPTION OF ACCEPTABLE ROCK

Description of Acceptable Rock (Section 10.5 – Source Quality Assurance))

Acceptable erosion protection rock from the Tinaja quarry is from the San Andreas Formation (Permian age), specifically the unit comprised of a massive, grayish white, dolomitic limestone. At the quarry, this unit is overlain by a tan, clay-rich carbonate layer (overburden) that varies in thickness from 0 to 10 feet along the north face of pit that is being mined. There are enough reserves in the pit to continue producing acceptable rock for Rio Algom from this portion of the quarry. The tan, clay-rich overburden layer will be removed and segregated prior to drilling and blasting the rock that will be used for erosion protection at Rio Algom. The contact separating the overburden layer from the more massive limestone is readily apparent and will be monitored by quarry personnel during removal. The dolomitic limestone (petrographic analyses) unit that is found in the north face of the Tinaja quarry is approximately 70 feet thick and is being mined in two benches for safety considerations. The limestone has widely spaced fractures and stands unsupported on vertical faces at the quarry. Underlying the massive limestone is a brown to tan, sandstone/siltstone (Glorieta Sandstone). This rock unit is not used for any economic purposes by the quarry and forms the floor of the quarry operation.

After drilling and blasting of the limestone unit, quarry personnel in all handling operations for production (stockpiling, crushing, loading, etc.) will monitor and segregate rock that is not the grayish-white limestone for use as erosion protection rock at Rio Algom Ambrosia Lake site. Rock from either the overburden layer (tan, clay-rich carbonate) or the floor of the quarry (brown to tan sandstone/siltstone) is unacceptable for use as erosion protection rock.

ROCK PLACEMENT PROCEDURES

ROCK PLACEMENT PROCEDURES FOR EROSION PROTECTION

General Guidelines for Rock Placement

In general, proper placement is created by providing a relatively uniform thickness of rock at a specified gradation. The following are general guidelines that should be used in conjunction with specific placement criteria to achieve adequate placement of rock riprap layers:

A. The various riprap sizes should be placed in layer thicknesses according to that specified on the associated design drawings. In general, these specified thicknesses are based on a minimum layer thickness being at least 1.5 to 2 times the D_{50} rock size.

B. Where the D_{50} size is eight inches or more, the placement procedures should include a certain amount of individual rock placement (using specialized equipment or hand labor) to ensure that proper thicknesses and areal coverage are achieved. Where the D_{50} size is less than 8 inches and the layer thickness exceeds two times the average rock size, dumping and spreading by heavy equipment will generally be the only procedures necessary to achieve adequate rock placement.

C. After the start of construction of the various erosion protection layers, test sections of the proper thickness and gradation will be constructed for layers with 3.2", 7.8", and 9.2" D_{50} size rock. This test section should be visually examined, and contractor personnel should become familiar with the visual properties of this section; that is, the acceptable section should be used as visual guidance of proper placement and should be used to evaluate future riprap placement. The test section should be tested to determine its gradation and rock weight-unit volume that will be achieved in future rock placement activities.

D. Riprap materials shall be reasonably well-graded within the limits presented in Table 7-4. The sizes are specified in terms of square openings of-U.S. Standard Sieves or by the Nominal Sizes of the Materials. The Contractor reserves the right of inspection while the samples are being taken.

Placement and Compaction

A. Erosion protection materials shall be handled, loaded, transported, stockpiled, and placed in a manner that avoids nonconformance with specifications due to segregation and degradation, including materials moved to and from stockpiles.

B. Subgrade preparation shall be as specified in Specifications. In addition, the subgrade (frost protection layer) shall be prepared so that it will adequately support the rock placement equipment. Care will be exercised to eliminate the potential damage due to rutting of the subgrade during rock placement activities. Any rutting or deviations to the subgrade surface shall be repaired prior to the resumption of rock placing activities. Also, in order to prevent rock migration into the subgrade layer, rock shall not be placed on frozen or saturated subgrade.

C. Where the required bedding material thickness is six inches or less, the bedding material shall be spread and compacted in one layer.

D. Placing of material by methods that will tend to segregate particle sizes within the layer will not be permitted.

E. Dumped riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the bedding material. The larger stones shall be well- distributed throughout the mass. The finished riprap shall be free from pockets of small stones and clusters of larger stones. Placing stone by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement that will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand may be required to the extent necessary to obtain a well-keyed and reasonably well-graded distribution of stone sizes as specified above. Larger riprap may require individual placement by equipment. Hand arrangement will be required only to the extent necessary to secure acceptable results. Stones shall be selected and positioned so as to produce an essentially solid, densely placed face of rock with all stones firmly wedged in place. Any stones that are not firmly wedged shall be adjusted and additional selected stones inserted or existing stones replaced, so as to achieve a solid interlock

F. For riprap placed by clam-shell or similar equipment, hand arrangement will be required only to the extent necessary to secure the results specified herein. Stones shall be selected individually and positioned manually under experienced supervision so as to produce an essentially solid layer with all stones firmly wedged in place. Any stones that are not firmly wedged, in the opinion of the Contractor, shall be adjusted by crow-bars or similar tools and additional selected stones inserted, or existing stones replaced, so as to achieve solid interlock.

G. Each layer of riprap shall be track-walked by two passes of a Caterpillar D6 bulldozer or equal unless otherwise approved by the Contractor. Riprap shall be spread in a manner that will achieve full coverage and a uniformly distributed well-keyed, densely- placed layer.

H. Construction equipment other than spreading and compaction equipment shall not be allowed to move over the placed riprap material and bedding material layers except at equipment crossovers as designated by the Contractor. Fill materials shall be placed temporarily at equipment crossovers to prevent degradation of placed riprap materials. Each crossover shall be cleaned of all contaminating materials and approved by the Contractor before additional materials are placed in these areas. Other construction equipment may move over placed riprap and bedding layers. The Contractor may restrict such traffic to minimize damage to completed layers. Areas of riprap and bedding layers damaged by construction equipment shall be restored to meet the requirements of the Specifications.

Acceptability of Rock Placement

A. The material placed meets the gradation requirements specified.

B. The in-place thickness of riprap material shall be between 90 percent and 125 percent of the thickness shown. Local irregularities not exceeding the thickness limits above will be permitted provided that such irregularities do not form noticeable mounds, ridges, swales or depressions that in the opinion of the Contractor could cause concentrations of surface runoff or form ponds or gullies. Riprap layer thickness will be directly measured on a specified grid to determine that minimum thickness requirements are met. A specified area is determined on top of the riprap layer. The rock within the grid is removed to the top of the bedding layer (when appropriate).

C. Materials segregated or not placed according to the above requirements shall be regraded or adjusted, or removed and replaced using appropriate equipment, to conform with the limits given above.

D. Materials not meeting the requirements of this Section shall be removed and placed with specified materials. Rejected materials shall be disposed of at designated disposal Sites. Materials not meeting the grading requirements shall be reprocessed or discarded. The Contractor may require modification of the processing and grading operations to ensure that the specified grading requirements are met.

Erosion Protection Materials Testing

A. The bedding material and each type of riprap shall be tested by a commercial testing laboratory during production in accordance with several tests utilized in the scoring process. These tests include the following:

Specific Gravity (SSD)	ASTM C-127
Absorption	ASTM C-127
Soundness (5 cycles)	ASTM C-88
Abrasion (100 revolutions)	ASTM C-131
Schmidt Rebound Hardness	ISRM Method

B. Each type of riprap and bedding material shall be tested for gradation in accordance with ASTM C-117 and ASTM C-136, as applicable. Test results shall be in accordance with the Design Specifications.

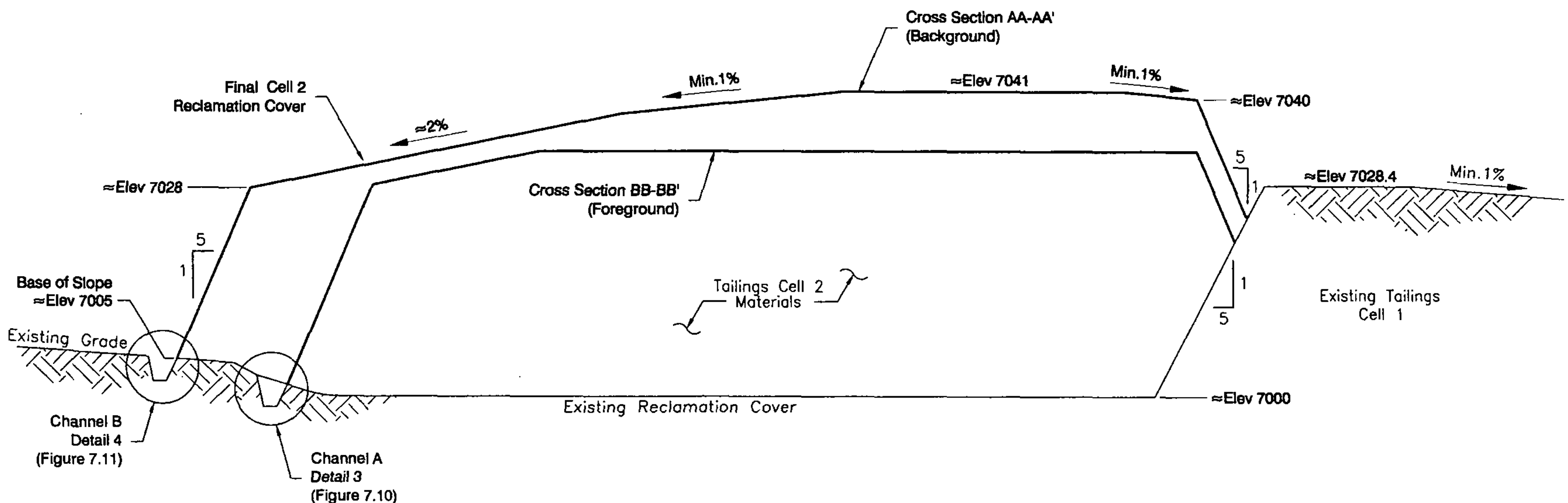
C. Bedding material and each type of riprap material shall be tested at a minimum frequency of one test for each 10,000 cubic yards or fraction thereof produced or placed.

D. At least one petrographic examination shall be made for each rock type used for erosion protection materials. Testing shall be performed in accordance with ASTM C-295-90.

Inspections

Daily visual inspections shall be performed to verify that quality-related activities are performed in accordance with requirements. Daily visual inspections performed by qualified and certified inspection personnel shall be accomplished during execution of the various work activities to verity compliance to the above-listed criteria.

REVISED DRAWINGS



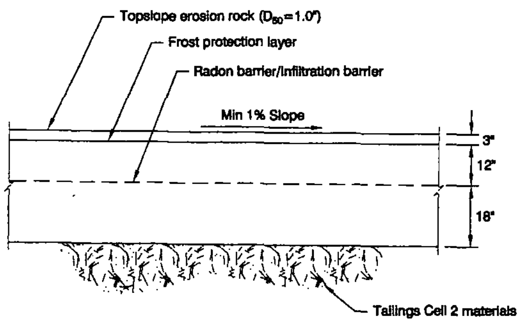
Cross Section AA–AA' (Background)
Cross Section BB–BB' (Foreground)
Tailings Cell 2
Option A

APPROX. HORIZONTAL SCALE: 1"=150'
APPROX. VERTICAL SCALE: 1" = 15'

Construction Notes:

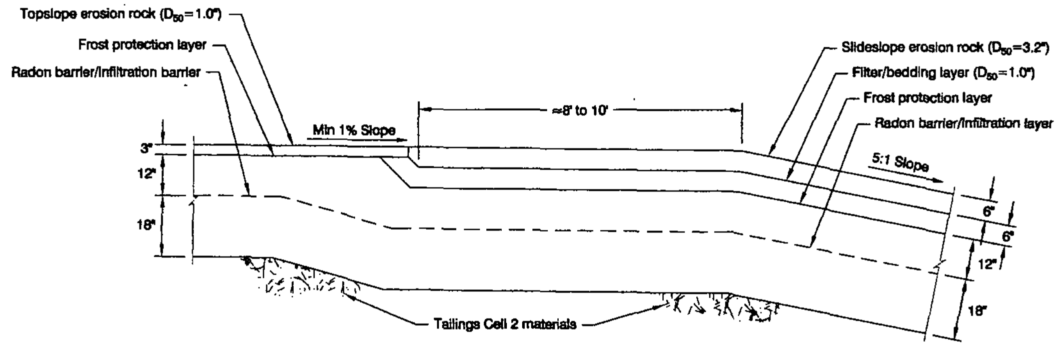
1. All incidental rainfall occurring on the East Slope of tailings Cell 2 will flow to the interface drainage channel between Cells 1 and 2 as shown. No incident rainfall from any portion of Cell 2 drains onto Cell 1.

CROSS SECTION DETAILS (1 of 5) RECLAMATION COVER – OPTION A TAILINGS CELL 2 EXPANSION AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO	TETRA TECH
PROJECT No. 4690046-100 / DRAWING BY: EJS 8/1/07	FIGURE 7.2
FILE NAME: RioAlgom 7-1A.DWG / REVIEWED BY: COS	



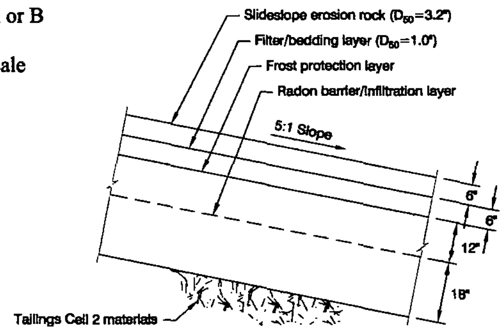
DETAIL 8
(Figures 7.3 and 7.6)
TOPSLOPE RECLAMATION COVER
AND EROSION PROTECTION
OPTION A or B

Not to Scale



DETAIL 9
(Figures 7.3 and 7.6)
CREST RECLAMATION COVER
AND EROSION PROTECTION
OPTION A or B

Not to Scale



DETAIL 10
(Figures 7.3 and 7.6)
SIDE SLOPE RECLAMATION COVER
AND EROSION PROTECTION
OPTION A or B

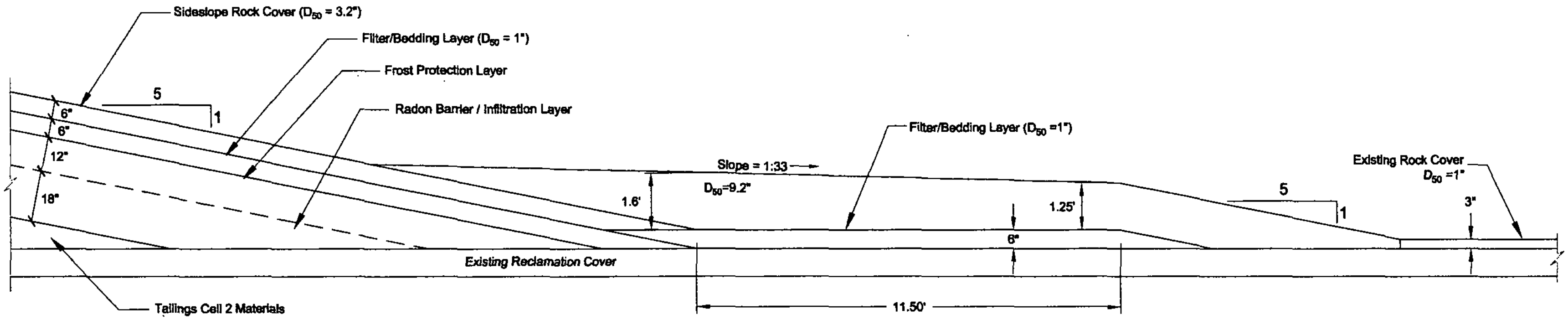
Not to Scale

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.
2. The erosion protection for the topslope of Pond 2 shall be constructed of a rock diameter d_{50}=1.0" conforming to the gradation as presented on Table 7.4.
3. The sideslope erosion protection of Pond 2 shall be constructed of a rock diameter D_{50}=3.2" and shall be placed on a minimum 6" thick filter/bedding layer, and conform to the gradation as presented on Table 7.4.
4. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the slope. The filter/bedding layer shall extend the full slope length. Filter/bedding material shall be spread and compacted in one layer, and be constructed of a rock diameter of D_{50}=1.0" conforming to the gradation as presented on Table 7.4.
5. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.
6. Match D_{50}=1.0" rock (topslope) with D_{50}=3.2" rock (sideslope) at crest transition.
7. Maintain minimum thickness of erosion protection and cover layers at crest transition.
8. Tailings Cell 2 materials to be placed in maximum 6" compacted lifts and compacted to 90% standard proctor density ±3% optimum moisture content.
9. Radon barrier/Infiltration layer to be placed in maximum 6" compacted lifts and compacted to 95% standard proctor density ±2% optimum moisture content.
10. Frost protection layer to be placed in maximum 6" compacted lifts and compacted to 90% standard proctor density at moisture content necessary to achieve required minimum compaction.

RECLAMATION COVER AND EROSION PROTECTION DETAILS TAILINGS CELL 2, OPTIONS A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: EJS 8/1/07	FIGURE 7.7
FILE NAME: RilAlgom Details.DWG	REVIEWED BY: COS	

DETAIL 1 (SEE FIGURE 7.3 AND 7.6)
TAILINGS CELL 2 EROSION PROTECTION
CATCHMENT 1 OR 1B APRON
TYPICAL SECTION



NOT TO SCALE

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization,* U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.

2. The erosion protection apron width was designed based on NUREG recommendations in conjunction with local storm run off parameters and calculations. Per NUREG methods, the required rock size for the apron with a local storm PMF is equal to a D_{50}= 8.8". To minimize rock types required to complete erosion protection systems at the site, the rock size detailed in this apron is similar to the rock size used in other design tasks at the site, D_{50}=9.2".

3. Erosion protection aprons shall be sloped to the downstream edge with a minimum slope of two percent or at a slope that matches the slope of the natural ground, should it be steeper than two percent.

4. Erosion protection apron excavations shall be constructed with 2H:1V slopes to permit placement of the filter materials as shown above.

5. The erosion protection apron shall be constructed of a rock diameter D_{50}=9.2" conforming to the gradation as presented on Table 7.4.

6. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. Filter/bedding materials shall be spread and compacted in one layer.

7. The apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50} = 1", conforming to the gradation as presented on Table 7.4.

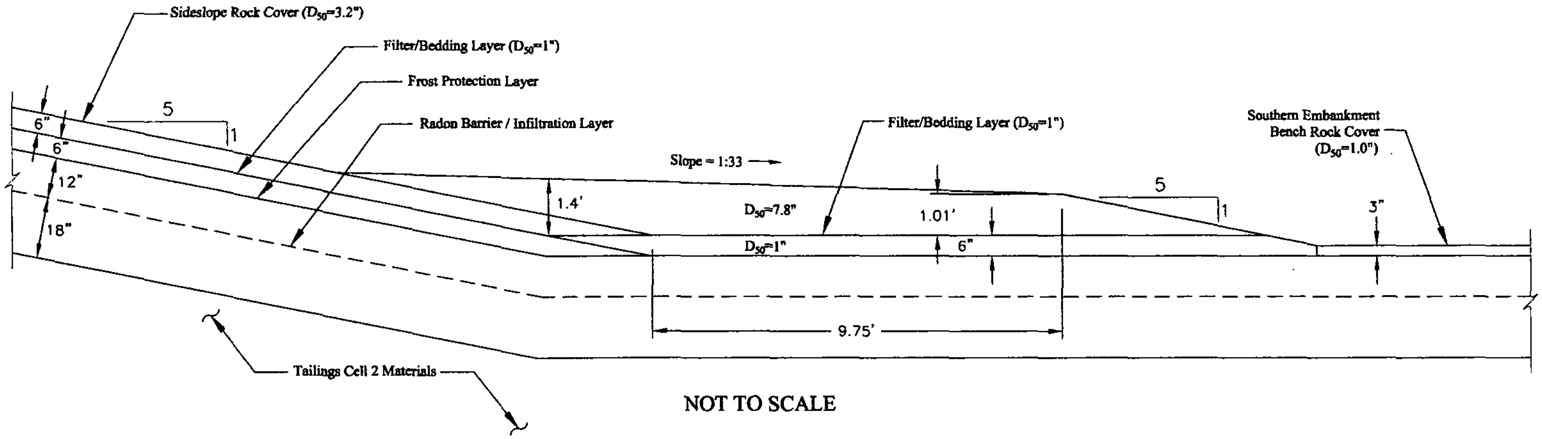
8. Gradation test results for erosion protection rock will be reviewed per the specified *gradation bands of the rock size and will also* be checked against the minimum D_{50} for the specified rock size.

9. The erosion protection apron shall be constructed continuously along the southern base of Catchment 1 (Option A) or Catchment 1B (Option B) of Tailings Cell 2 to the limits shown on Figure 7.1.A or 7.1.B respectfully.

10. The erosion protection apron shall be constructed level throughout to prevent longitudinal flows within the apron. The erosion protection apron shall be constructed such that flow from the embankment will flow perpendicular to the apron and onto the existing grade where it will drain away from the erosion protection apron.

DETAIL 1 TAILINGS CELL 2 EROSION PROTECTION CATCHMENT 1(OPTION A) OR 1B(OPTION B) AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07	FIGURE 7.8
FILE NAME: New Fig7.8-Detail 1.dwg	REVIEWED BY: JMM	

DETAIL 2
(Figure 7.6)
TAILINGS CELL 2 EROSION PROTECTION
CATCHMENT 1A
TYPICAL SECTION



NOT TO SCALE

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with *Appendix F of Design of Erosion Protection for Long-Term Stabilization,* U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.

2. The erosion protection apron width was designed based on NUREG recommendations in conjunction with local storm run off parameters and calculations. Per NUREG methods, the required rock size for the apron with a local storm PMF is equal to a D_{50}= 6.8". To minimize rock types required to complete erosion protection systems at the site, the rock size detailed in this apron is similar to the rock size used in other design tasks at the site, D_{50}=9.2".

3. The erosion protection apron shall be constructed of a rock diameter D_{50}=9.2" *conforming to the gradation as presented on* Table 7.4.

4. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. Filter/bedding materials shall be spread and compacted in one layer.

5. The apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50}=1", conforming to the gradation as presented on Table 7.4.

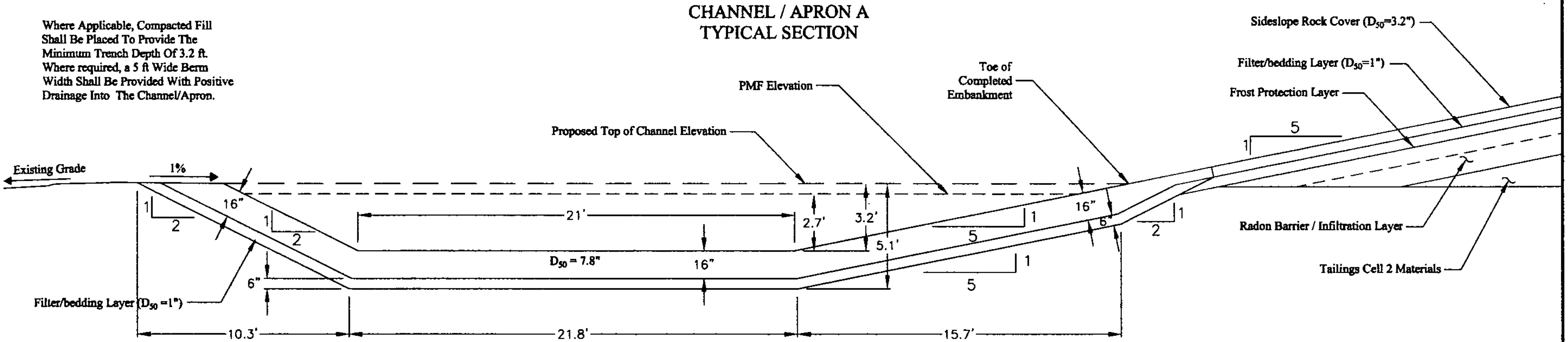
6. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.

7. *The erosion protection apron* shall be constructed continuously along the southern base of Catchment 1A (Option B) of Tailings Cell 2 to the limits shown on Figure 7.1.B.

8. The erosion protection apron shall be constructed level throughout to prevent longitudinal flows within the apron. The erosion protection apron shall be constructed such that flow from the embankment will flow perpendicular to the apron and onto the southern embankment bench of Tailings Cell 2 where it will drain away from the erosion protection apron.

DETAIL 2 TAILINGS CELL 2 EROSION PROTECTION CATCHMENT 1A – OPTION B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: EJS 8/1/07	FIGURE 7.9
FILE NAME: RioAlgom 7-9.DWG	REVIEWED BY: COS	

DETAIL 3
(Figures 7.2 and 7.5)
TAILINGS CELL 2 EROSION PROTECTION
CHANNEL / APRON A
TYPICAL SECTION



NOT TO SCALE

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.
2. The bottom of the channel/apron shall be constructed flat from side slope to side slope to prevent concentrated flows.
3. Where applicable, compacted fill may be placed on the exterior to construct an embankment that will provide the minimum 3.2 ft of depth for the channel/apron. The fill required to construct the embankment shall consist of material excavated from within the channel/apron trench. The fill shall be compacted to a minimum of 90% of maximum density as determined by ASTM D-698 and within +/- 3% of optimum moisture content. Each lift of fill shall not exceed a loose thickness of 10 inches. The embankment shall maintain the 5H:1V slope on its interior and a 2H:1V slope on the exterior. The embankment shall have a crest width of not less than 5 ft.
4. The exterior slope of the channel/apron shall be constructed with 2H:1V slopes. The interior slope shall match the constructed embankment slope, approximately 5H:1V.
5. The channel/apron excavation shall be constructed with bottoms free of loose debris, vegetation and muddy surfaces. When required, soft material shall be removed and replaced with approved material compacted to a minimum of 90% of maximum density as determined by ASTM D-698 and within +/- 3% of optimum moisture content
6. The channel/apron shall be covered with a minimum of 16" of D_{50} =7.8" rock. The rock shall be extended up the side slopes to the existing grade on the exterior and interlock with the existing interior rock placed on the Cell 2 embankment slope as shown above.
7. The channel/apron erosion protection rock shall be constructed of a rock diameter D_{50} =7.8" conforming to the gradation as presented on Table 7.4.
8. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.
9. The erosion protection bedding/filter layer shall be placed at a minimum thickness of 6" along the length of the channel/apron. Filter/bedding materials shall be spread and compacted in one layer.
10. The channel/apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50} =1" conforming to the gradation as presented on Table 7.4.

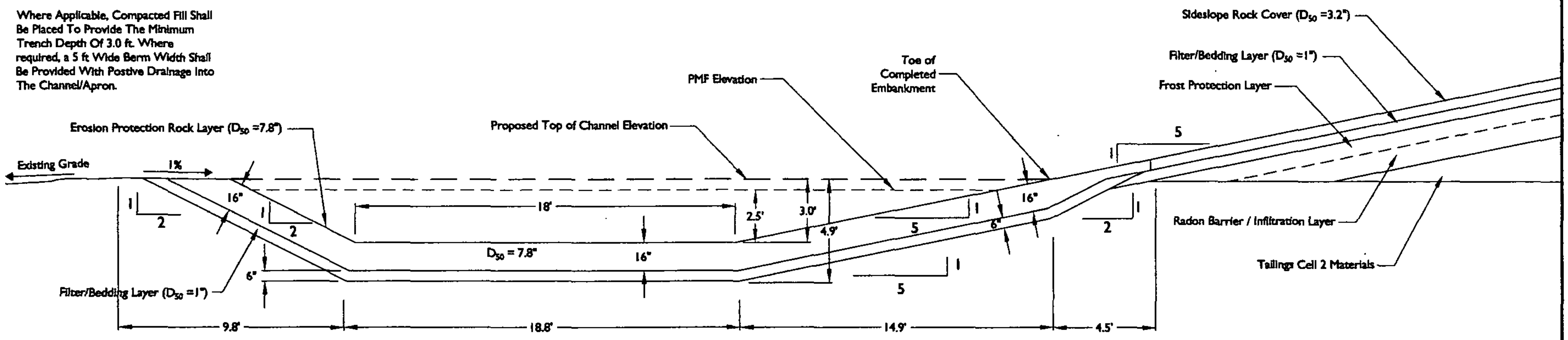
DETAIL 3
TAILINGS CELL 2 EROSION PROTECTION
CHANNEL/APRON A – OPTION A OR B
AMBROSIA LAKE MILL
RIO ALGOM MINING LLC
GRANTS, NEW MEXICO

TETRA TECH

PROJECT No. 4690046-100	DRAWING BY: EJS 8/1/07
FILE NAME: RioAlgom 7-10.DWG	REVIEWED BY: COS

FIGURE 7.10

DETAIL 4 (FIGURE 7.2 AND 7.5)
TAILINGS CELL 2 EROSION PROTECTION
CHANNEL / APRON B
TYPICAL SECTION



NOT TO SCALE

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG -1623 Final Report.

2. The bottom of the channel/apron shall be constructed flat from side slope to side slope to prevent concentrated flows.

3. Where applicable, compacted fill may be placed on the exterior to construct an embankment that will provide the minimum 3.0 ft of depth for the channel/apron. The fill required to construct the embankment shall consist of material excavated from within the channel/apron trench. The fill shall be compacted to a minimum of 90% of maximum density as determined by ASTM D-698 and within +/- 3% of optimum moisture content. Each lift of fill shall not exceed a loose thickness of 10 inches. The embankment shall maintain the 5H:1V slope on its interior and a 2H:1V slope on the exterior. When required, the embankment shall have a crest width of not less than 5 ft.

4. The exterior slope of the channel/apron shall be constructed with 2H:1V slopes. The interior slope shall match the constructed embankment slope, approximately 5H:1V.

5. The channel/apron excavation shall be constructed with bottoms free of loose debris, vegetation and muddy surfaces. When required, soft material shall be removed and replaced with approved material compacted to a minimum of 90% of maximum density as determined by ASTM D-698 and within +/- 3% of optimum moisture content

6. The channel/apron shall be covered with a minimum thickness of 16" of D_{50} =7.8" rock. The rock shall be extended up the side slopes to the existing grade on the exterior and interlock with the existing interior rock placed on the Cell 2 embankment slope as shown above.

7. The channel/apron erosion protection rock shall be constructed of a rock diameter D_{50} =7.8" conforming to the gradation as presented on Table 7.4.

8. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the channel/apron. The filter/bedding material shall extend up the 2H:1V side slopes and end flush with the existing ground elevation. Filter/bedding materials shall be spread and compacted in one layer

9. The channel/apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50}=1" conforming to the gradation as presented on Table 7.4.

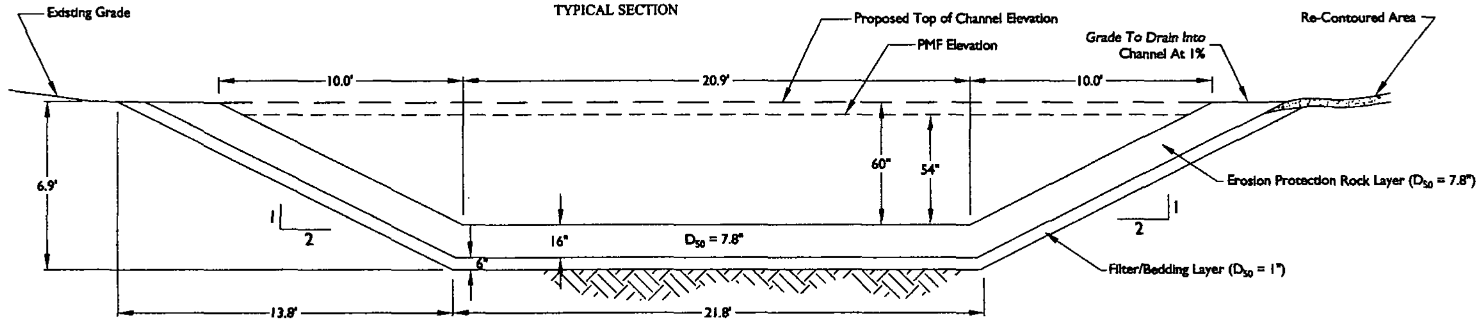
DETAIL 4
TAILINGS 2 EROSION PROTECTION
CHANNEL/APRON B – OPTION A OR B
AMBROSIA LAKE MILL
RIO ALGOM MINING LLC
GRANTS, NEW MEXICO

TETRA TECH

PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07
FILE NAME: NewFig 7.11-Detail4.dwg	REVIEWED BY: JMM

FIGURE 7.11

CROSS SECTION H-H' (FIGURE 7.1.A AND 7.1.B)
TAILINGS CELL 2 EROSION PROTECTION
CHANNEL / APRON C
TYPICAL SECTION



SCALE: 1 in = 5 ft

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG -1623 Final Report.

2. The bottom of the channel/apron shall be constructed flat from side slope to side slope to prevent concentrated flows.

3. Where applicable, compacted fill may be placed on the exterior to construct an embankment that will provide the minimum 5.0 ft of depth for the channel/apron. The fill required to construct the embankment shall consist of material excavated from within the channel/apron trench. The fill shall be compacted to a minimum of 90% of maximum density as determined by ASTM D-698 and within +/- 3% of optimum moisture content. Each lift of fill shall not exceed a loose thickness of 10 inches. When required, the embankment shall have a crest width of not less than 5 ft.

4. The sideslopes of the channel/apron shall be constructed with 2H:1V slopes.

5. The channel/apron excavation shall be constructed with bottoms free of loose debris, vegetation and muddy surfaces. When required, soft material shall be removed and replaced with approved material compacted to a minimum of 90% of maximum density as determined by ASTM D-698 and within +/- 3% of optimum moisture content

6. The channel/apron shall be covered with a minimum thickness of 16" of D_{50} =7.8" rock. The rock shall be extended up the side slopes to the existing grade on the exterior and interlock with the existing interior rock placed on the Cell 2 embankment slope as shown above.

7. The channel/apron erosion protection rock shall be constructed of a rock diameter D_{50} =7.8" conforming to the gradation as presented on Table 7.4.

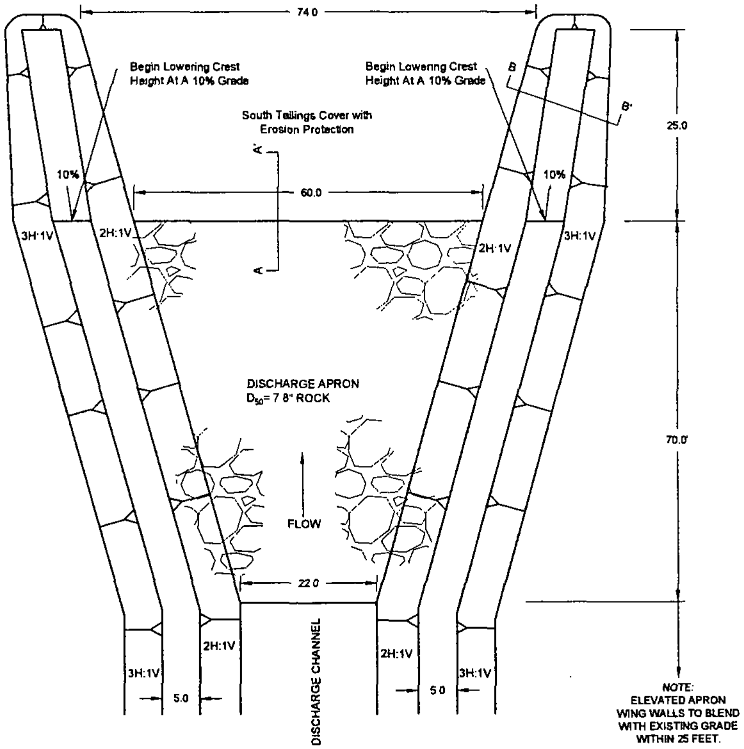
8. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the channel/apron. Filter/bedding materials shall be spread and compacted in one layer.

9. The channel/apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50} =1" conforming to the gradation as presented on Table 7.4.

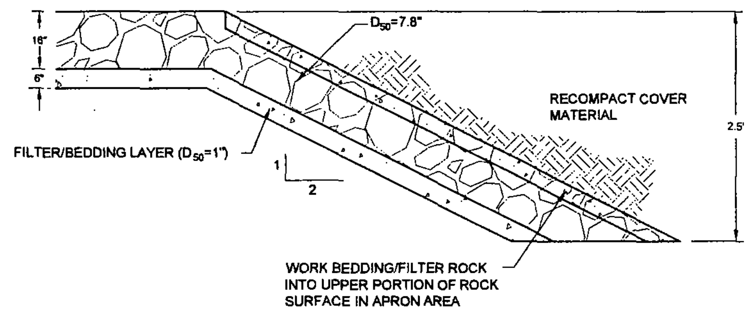
10. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.

CROSS SECTION H-H' TAILINGS CELL 2 EROSION PROTECTION CHANNEL/APRON C – OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07	FIGURE 7.12
FILE NAME: NewFig 7.12-CrossSectionH.dwg	REVIEWED BY: JMM	

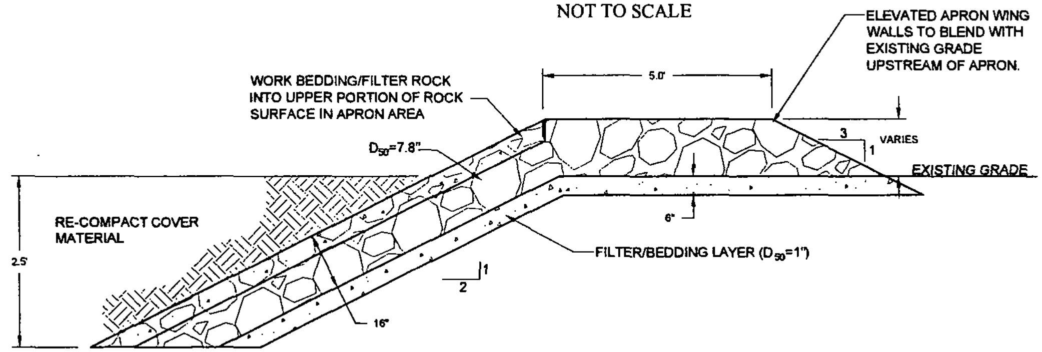
DISCHARGE APRON PLAN VIEW
CHANNEL A
(FIGURE 7.1.A OR 7.1.B)



DISCHARGE APRON TOE
SECTION A-A' (FIGURE 7.13)
NOT TO SCALE



DISCHARGE APRON WING WALL
SECTION B-B' (FIGURE 7.13)
NOT TO SCALE

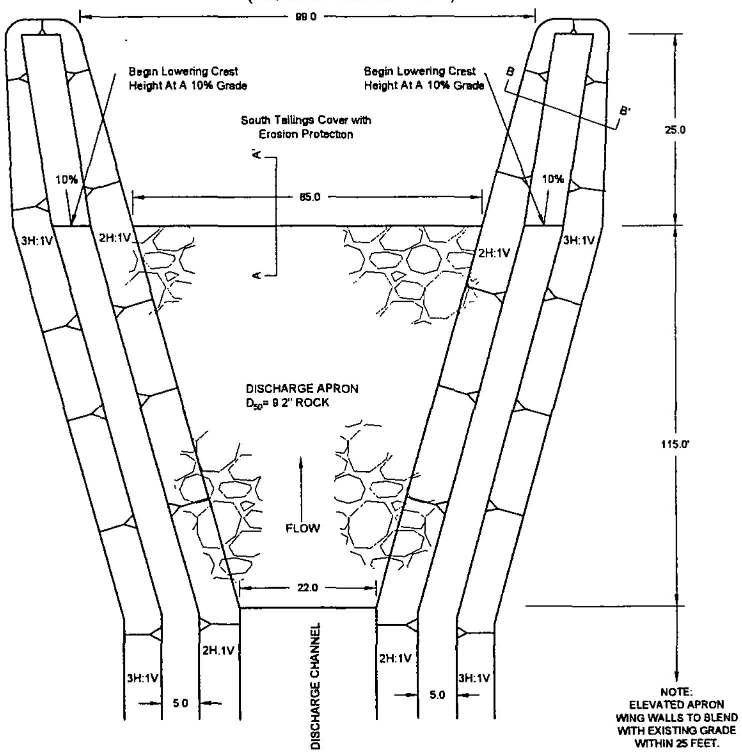


CONSTRUCTION NOTES:

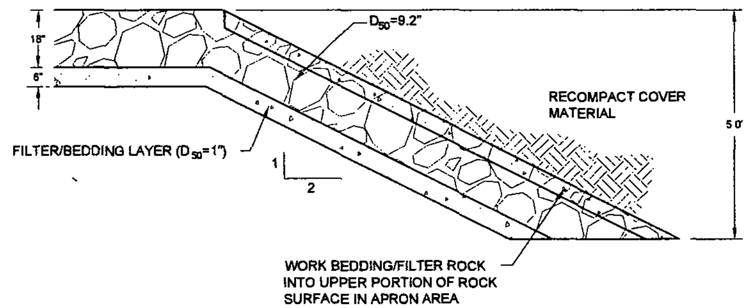
1. Rock Riprap for erosion protection shall be placed in conformance with Appendix F of Design of Erosion Protection for Long-Term Stabilization, U.S. Nuclear Regulatory Commission's NUREG -1623 Final Report.
2. The bottom of the channel shall be constructed flat from side slope to side slope to prevent concentrated flows.
3. The channel excavation shall be constructed with bottoms free of loose debris, vegetation and muddy surfaces
4. The discharge apron erosion protection rock shall be tied into the discharge *channel rock and constructed with a minimum thickness of 16" of* D_{50}=7 8" rock. Areas disturbed during construction of the apron shall be revegetated.
5. The discharge apron erosion protection rock shall be constructed of a rock diameter D_{50}=7 8" conforming to the gradation as presented on Table 7 4
6. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. The filter/bedding material shall extend up the 2H:1V side slopes to the existing grade and end below the erosion protection rock layer on the side slopes and crests as shown above Filter/Bedding materials shall be spread and compacted in one layer
7. The discharge apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50}=1" conforming to the gradation as presented on Table 74 4.

DISCHARGE APRON DETAILS-CHANNEL A TAILINGS CELL 2 EROSION PROTECTION OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07	FIGURE 7.13
FILE NAME: NewFig 7.13-Discharge A.dwg	REVIEWED BY: COS	

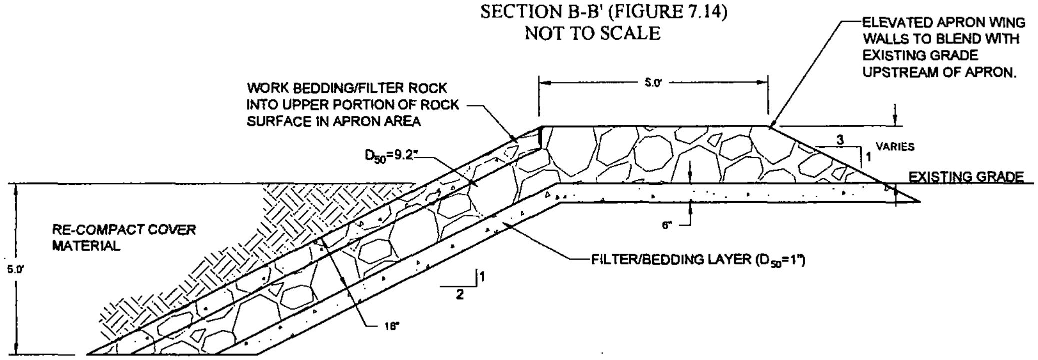
DISCHARGE APRON PLAN VIEW
CHANNEL C
(FIGURE 7.1.A OR 7.1.B)



DISCHARGE APRON TOE
SECTION A-A' (FIGURE 7.14)
NOT TO SCALE



DISCHARGE APRON WING WALL
SECTION B-B' (FIGURE 7.14)
NOT TO SCALE

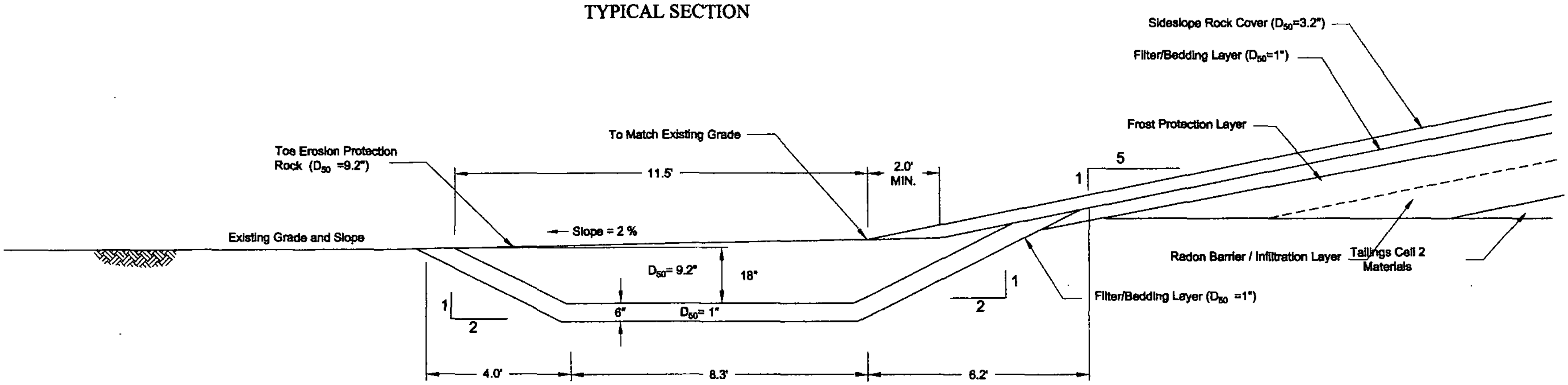


CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection shall be placed in conformance with Appendix F of Design of Erosion Protection for Long-Term Stabilization, U.S. Nuclear Regulatory Commission's NUREG -1623 Final Report.
2. The bottom of the channel shall be constructed flat from side slope to side slope to prevent concentrated flows.
3. The channel excavation shall be constructed with bottoms free of loose debris, vegetation and muddy surfaces
4. The discharge apron erosion protection rock shall be tied into the discharge channel rock and constructed with a minimum thickness of 16" of D_{50}=7.8" rock Areas disturbed during construction of the apron shall be revegetated.
5. The discharge apron erosion protection rock shall be constructed of a rock diameter D_{50}=9.2" conforming to the gradation as presented on Table 7.4.
6. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. The filter/bedding material shall extend up the 2H:1V side slopes to the existing grade and end below the erosion protection rock layer on the side slopes and crests as shown above. Filter/Bedding materials shall be spread and compacted in one layer.
7. The discharge apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50}=1" conforming to the gradation as presented on Table 7.4.
8. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size
9. During construction of Channel A discharge apron, the rock protection and radon cover on the existing tailings cover shall be removed and replaced as necessary.

DISCHARGE APRON DETAILS-CHANNEL C TAILINGS CELL 2 EROSION PROTECTION OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07	FIGURE 7.14
FILE NAME: NewFig 7.14-Discharge C.dwg	REVIEWED BY: COS	

DETAIL 5 (FIGURE 7.4)
TAILINGS CELL 2 EROSION PROTECTION
CATCHMENT 4 APRON
TYPICAL SECTION

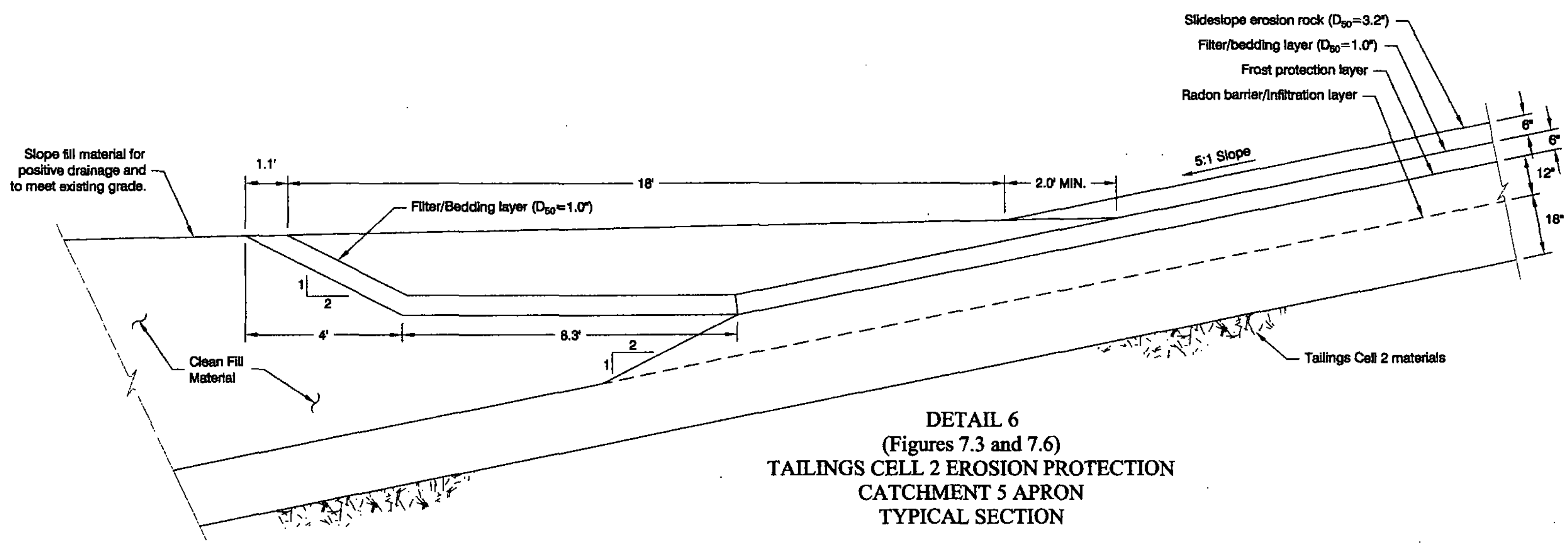


NOT TO SCALE

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.
2. The erosion protection apron width was designed based on NUREG recommendations in conjunction with local storm run off parameters and calculations. Per NUREG methods, the required rock size for the apron with a local storm PMF is equal to a D_{50}= 7.6". To minimize rock types required to complete erosion protection systems at the site, the rock size detailed in this apron is similar to the rock size used in other design tasks at the site, D_{50}=9.2".
3. Erosion protection aprons shall be sloped to the downstream edge with a minimum slope of two percent or at a slope that matches the slope of the natural ground, should it be steeper than two percent.
4. Erosion protections apron excavations shall be constructed with 2H:1V slopes to permit placement of the filter materials as shown above.
5. The erosion protection apron shall be constructed of a rock diameter D_{50}=9.2" conforming to the gradation as presented on Table 7.4.
6. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. The filter/bedding material shall extend up the 2V:1H sides and end below the Tailings Cell 2 erosion protection rock. Filter/bedding material shall be spread and compacted in one layer.
7. The apron erosion protection filter/bedding layers shall be constructed of a rock diameter D_{50}=1" conforming to the gradation as presented on Table 7.4.
8. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.
9. The erosion protection apron shall be constructed continuously along the base of catchment 4 of Tailings Cell 2 to the limits shown on Figure 7.1.A or 7.1.B.
10. The erosion protection apron shall be constructed level throughout to prevent longitudinal flows within the apron. The erosion protection apron shall be constructed such that flow from the embankment will flow perpendicular to the apron and onto the existing grade where it will drain away from the erosion protection apron.

DETAIL 5 TAILINGS CELL 2 EROSION PROTECTION CATCHMENT 4, OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07	FIGURE 7.15
FILE NAME: NewFig 7.15-Detail5.dwg	REVIEWED BY: JMM	



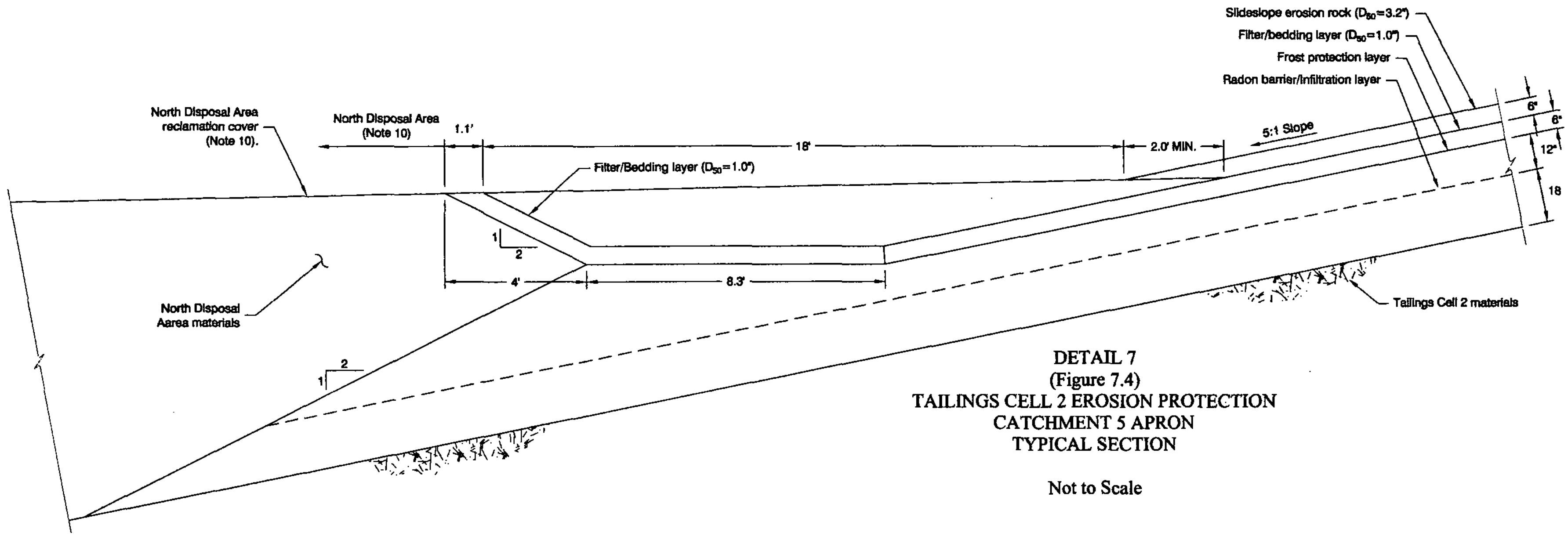
DETAIL 6
(Figures 7.3 and 7.6)
TAILINGS CELL 2 EROSION PROTECTION
CATCHMENT 5 APRON
TYPICAL SECTION

Not to Scale

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization,* U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.
2. The erosion protection apron width was designed based on NUREG recommendations in conjunction with local storm run off parameters and calculations. Per NUREG methods, the required rock size for the apron with a local storm PMF is equal to a D_{50}= 8.8". To minimize rock types required to complete erosion protection systems at the site, the rock size detailed in this apron is similar to the rock size used in other design tasks at the site, D_{50}=9.2".
3. Erosion protection aprons shall be sloped to the downstream edge with a minimum slope of two percent or at a slope that matches the slope of the natural ground, should it be steeper than two percent.
4. Erosion protection apron excavations shall be constructed with *2H:1V* slopes to permit placement of the filter materials as shown above.
5. The erosion protection apron shall be constructed of a rock diameter D_{50}=9.2" conforming to the gradation as presented on Table 7.4.
6. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. The filter/bedding material shall extend up the 2H:1V sides and end below the Tailings Cell 2 erosion protection rock. Filter/bedding material shall be spread and compacted in one layer.
7. The apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50}=1.0" conforming to the gradation as presented on Table 7.4.
8. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.
9. The erosion protection apron shall be constructed continuously along the base of catchment 5 of Tailings Cell 2 to the limits shown on Figure 7.1.A or 7.1.B.
10. The erosion protection apron shall be constructed level throughout to prevent longitudinal flows within the apron. The erosion protection apron shall be constructed such that flow from the embankment will flow perpendicular to the apron and onto the existing grade where it will drain away from the erosion protection apron.

DETAIL 6 TAILINGS CELL 2 EROSION PROTECTION CATCHMENT 5, OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: EJS 8/1/07	FIGURE 7.16
FILE NAME: RioAlgom Details.DWG	REVIEWED BY: COS	



DETAIL 7
(Figure 7.4)
TAILINGS CELL 2 EROSION PROTECTION
CATCHMENT 5 APRON
TYPICAL SECTION

Not to Scale

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.

2. The erosion protection apron width was designed based on NUREG recommendations in conjunction with local storm run off parameters and calculations. Per NUREG methods, the required rock size for the apron with a local storm PMF is equal to a D_{50}= 8.8". To minimize rock types required to complete erosion protection systems at the site, the rock size detailed in this apron is similar to the rock size used in other design tasks at the site, D_{50}=9.2".

3. Erosion protection aprons shall be sloped to the downstream edge with a minimum slope of two percent or at a slope that matches the slope of the natural ground, should it be steeper than two percent.

4. Erosion protection apron excavations shall be constructed with 2H:1V slopes to permit placement of the filter materials as shown above.

5. The erosion protection apron shall be constructed of a rock diameter D_{50}=9.2" conforming to the gradation as presented on Table 7.4.

6. The erosion protection filter/bedding layer shall be placed at a minimum thickness of 6" along the length of the apron. The filter/bedding material shall extend up the 2H:1V sides and end below the Tailings Cell 2 erosion protection rock. Filter/bedding material shall be spread and compacted in one layer.

7. The apron erosion protection filter/bedding layer shall be constructed of a rock diameter D_{50}=1.0" conforming to the gradation as presented on Table 7.4.

8. Gradation test results for erosion protection rock will be reviewed per the specified gradation bands of the rock size and will also be checked against the minimum D_{50} for the specified rock size.

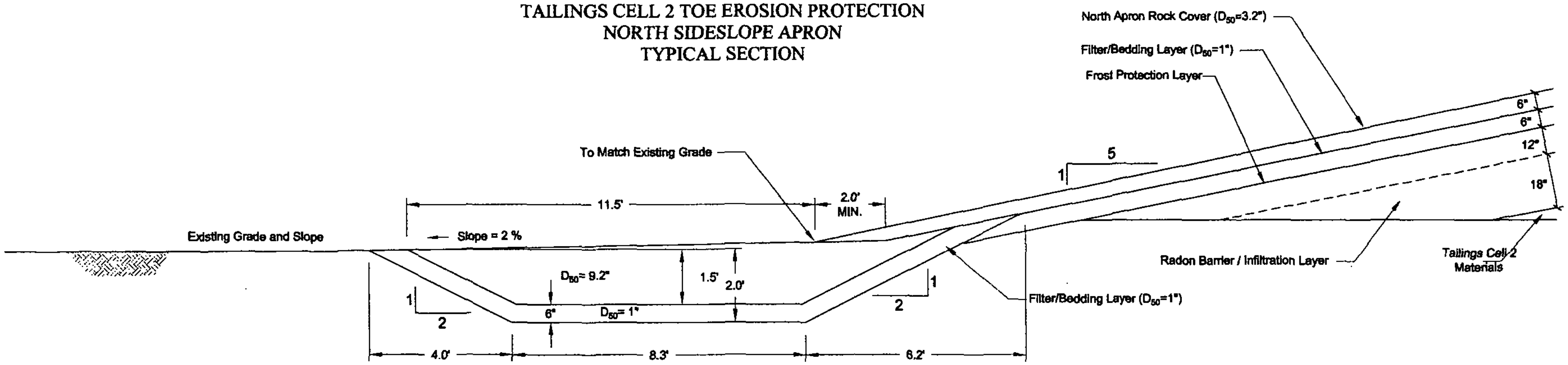
9. The erosion protection apron shall be constructed continuously along the base of catchment 5 of Tailings Cell 2 to the limits shown on Figure 7.1.A or 7.1.B.

10. The erosion protection apron shall be constructed level throughout to prevent longitudinal flows within the apron. The erosion protection apron shall be constructed such that flow from the embankment will flow perpendicular to the apron and onto the existing grade where it will drain away from the erosion protection apron.

11. North disposal area and cover design to be included under a future design package. The final design will be submitted to NRC for approval prior to placement of cover over the North disposal cell (License condition #32).

DETAIL 7 TAILINGS CELL 2 EROSION PROTECTION CATCHMENT 5, OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: EJS 8/1/07	FIGURE 7.17
FILE NAME: RioAlgom Details.DWG	REVIEWED BY: COS	

CROSS SECTION I-I' (FIGURE 7.1.A AND 7.1.B)
TAILINGS CELL 2 TOE EROSION PROTECTION
NORTH SIDESLOPE APRON
TYPICAL SECTION



NOT TO SCALE

CONSTRUCTION NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.

2. The north sideslope erosion protection apron shall be constructed of a rock diameter D_{50}=3.2" conforming to the gradation as presented on Table 7.4.

3. The North sideslope erosion protection (D_{50}=3.2", same as Sideslope Rock Cover) shall transition into the toe erosion protection rock (D_{50}=9.2").

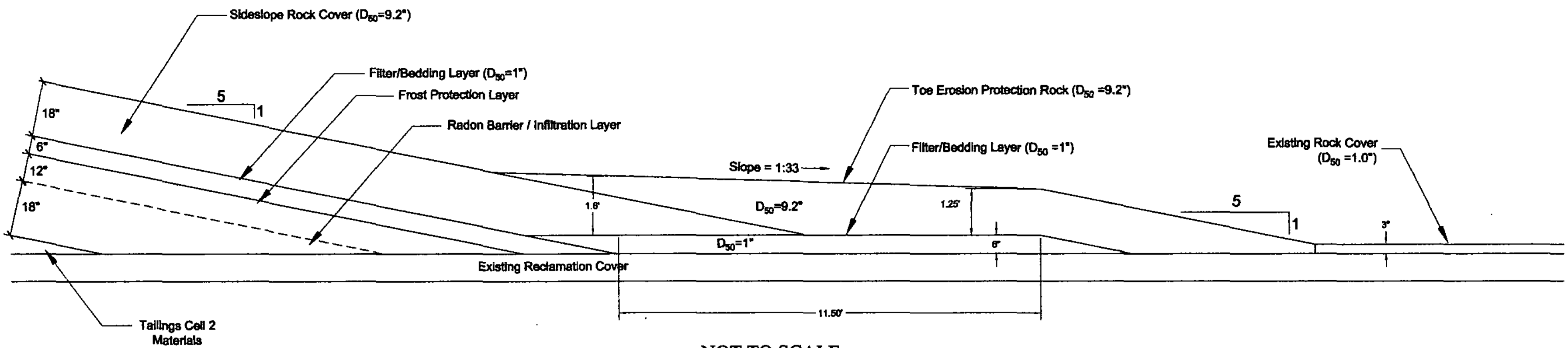
CROSS-SECTION I-I'
TAILINGS CELL 2 EROSION PROTECTION
NORTH SIDESLOPE APRON (OPTION A OR B)
AMBROSIA LAKE MILL
RIO ALGOM MINING LLC
GRANTS, NEW MEXICO

TETRA TECH

PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07
FILE NAME: NewFig7.20-CrossSectionI.dwg	REVIEWED BY: JMM

FIGURE 7.20

CROSS SECTION J-J' (FIGURE 7.1.A AND 7.1.B)
TAILINGS CELL 2 TOE EROSION PROTECTION
SOUTH SIDESLOPE APRON
TYPICAL SECTION



NOT TO SCALE

NOTES:

1. Rock Riprap for erosion protection aprons shall be placed in conformance with Appendix F of *Design of Erosion Protection for Long-Term Stabilization*, U.S. Nuclear Regulatory Commission's NUREG - 1623 Final Report.

2. The south sideslope erosion protection apron shall be constructed of a rock diameter D_{50}=9.2" conforming to the gradation as presented on Table 7.4.

3. The South sideslope erosion protection (D_{50}=9.2") shall transition into the toe erosion protection rock (D_{50}=9.2").

CROSS-SECTION J-J' TAILINGS CELL 2 EROSION PROTECTION SOUTH SIDESLOPE APRON, OPTION A OR B AMBROSIA LAKE MILL RIO ALGOM MINING LLC GRANTS, NEW MEXICO		TETRA TECH
PROJECT No. 4690046-100	DRAWING BY: PAW 8/1/07	FIGURE 7.21
FILE NAME: NewFig 7.21-RioAlgom.dwg	REVIEWED BY: JMM	