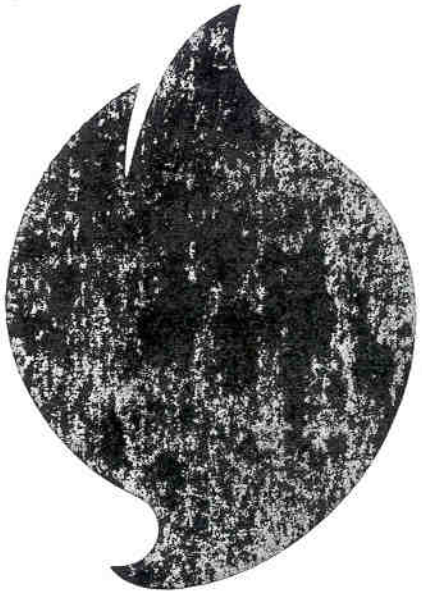
Umetco Minerals Corporation

CELL 4 DESIGN

WHITE MESA PROJECT

BLANDING, UTAH



UMETCO MINERALS CORPORATION

3.4 Stability Considerations

3.4.1 Embankment Stability Analysis

The dike stability analysis was performed using the "STABR" computer model developed by Guy LeFebre at the University of California, Berkely.

The program calculates factors of safety by the Ordinary Method of Slices and Bishop's Modified Method for circular slip surfaces tangent to any horizontal level or through a specified point. The program can also search for the critical circular slip surface with the minimum factor of safety. Seismic forces can be introduced to pseudostatically analyze the effects of the earthquake ground motions.

For this analysis, Bishop's Modified Method was used and three horizontal tangent levels were examined. The automatic search feature was also used to determine the critical circular slip surface.

A factor of safety of 1.0 indicates that the slope would be at incipient failure. For this analysis a factor of safety of 1.5 or more under static conditions indicates an acceptable level of stability along the analyzed circular surface.

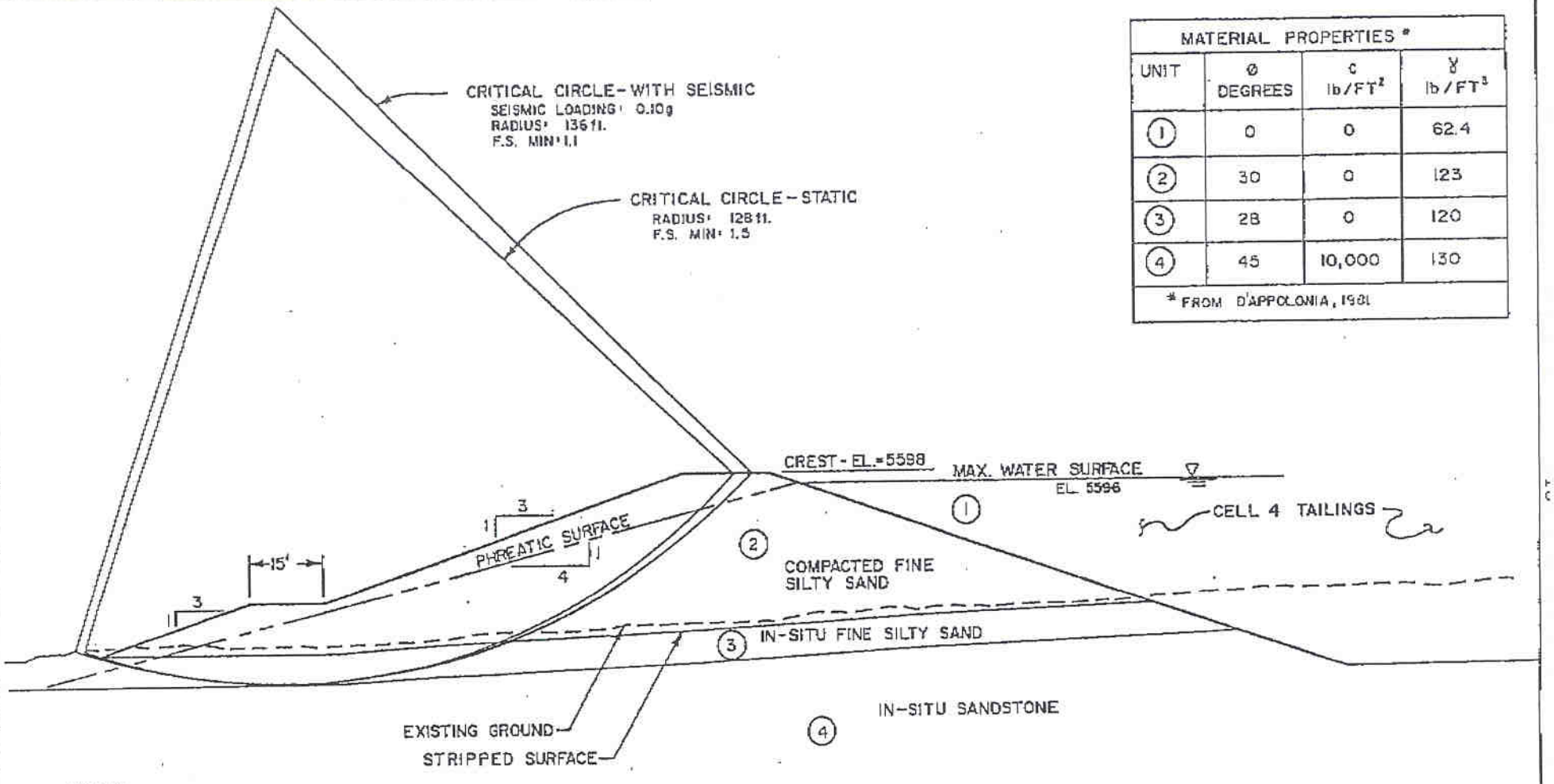
The acceptable factor of safety under seismic loading conditions (maximum credible earthquake 0.10 g) is 1.0. The maximum seismic loading of 0.10g was assumed to occur at the center of the slice.

The stability analysis assumes that the tailings are saturated and are completely fluid. It also assumes that the cell liner has completely failed and that the steady state seepage condition has been reached. Under actual operating conditions it is highly improbable that these conditions could exist. Therefore, the stability analysis produces results that are considered to be extremely conservative.

Two embankment sections were analyzed for static and dynamic stability. Material properties used in the analyses are shown in Figure 3.4-1 and are those used previously by D'Appolonia in their analysis of Cell 3 Embankments (D'Appolonia, 1981).

Figure 3.4-1 is a section through the highest portion of the Cell 4 dike. The maximum height is 31 feet. A 15-foot wide bench has been added on the downstream side of the dike to improve the stability. Using this embankment configuration in the analysis, the minimum factor of safety under static conditions is 1.5. Applying a seismic loading of 0.10g to simulate dynamic conditions, the analysis produces a minimum pseudostatic factor of safety of 1.1.

Figure 3.4-2 shows a dike section with a maximum height above the stripped surface (prepared subgrade) of 25 feet. The dike has 3(H) to 1(V) faces and an 18-foot crest width. The results of the analyses indicate a minimum static factor of safety of 1.5 and a minimum pseudostatic safety factor of 1.1 for a 0.10g lateral loading.



MATERIAL PROPERTIES *			
UNIT	Ø DEGREES	c lb/FT²	γ lb/FT³
1	0	0	62.4
2	30	0	123
3	28	0	120
4	45	10,000	130

* FROM D'APPOLONIA, 1981

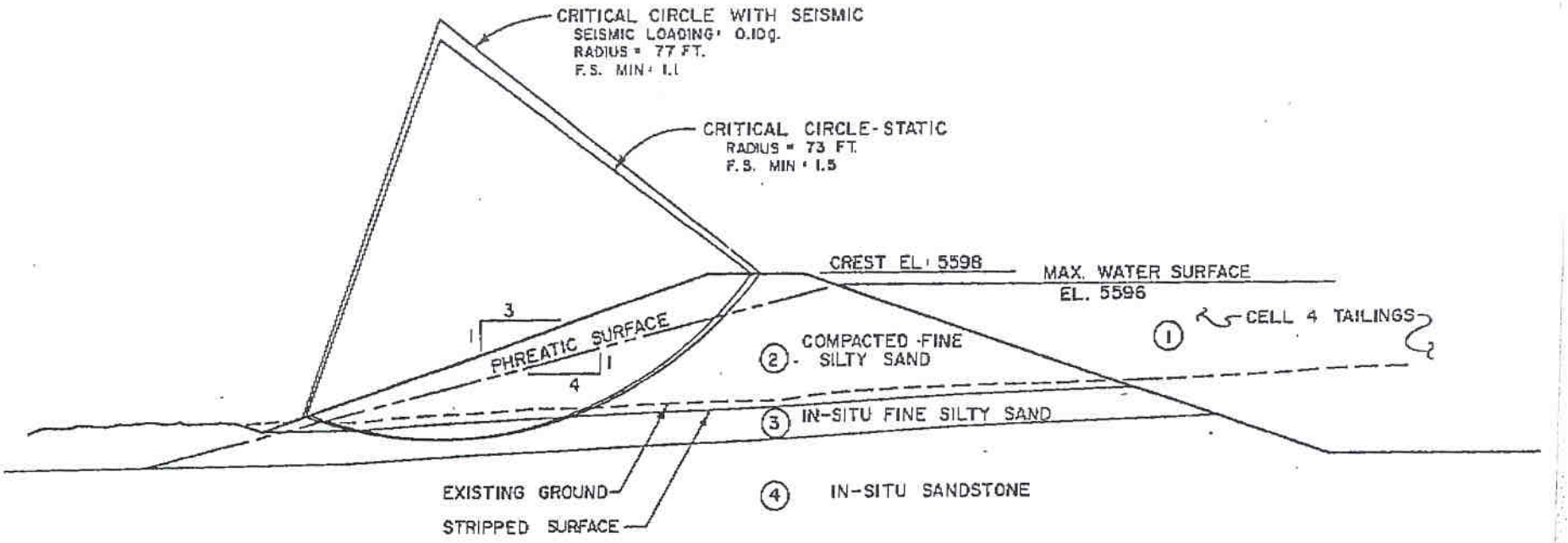
NOTES:

1. ANALYSIS ASSUMES:
   a. COMPLETELY SATURATED TAILINGS (FLUID)
   b. COMPLETELY FAILED LINER
   c. STEADY STATE SEEPAGE CONDITIONS
2. ANALYSIS BASED ON BISHOPS MODIFIED METHOD FOR CIRCULAR SLIP SURFACES.
3. SEISMIC FORCE IS APPLIED AT CENTER OF SLICE

CELL 4 DIKE
MAXIMUM HEIGHT SECTION
SCALE: 1" = 20'

UMETCO MINERALS CORPORATION
WHITE MESA PROJECT
STABILITY ANALYSIS
- CELL 4 -
MAXIMUM HEIGHT SECTION

JUNE, 1988 FIGURE 3.4-1



NOTE:
REFER TO FIGURE 3.4-1 FOR MATERIAL PROPERTIES AND OTHER NOTES

CELL 4 DIKE

25-FT. SECTION

SCALE: 1" = 20'

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WHITE MESA PROJECT

STABILITY ANALYSIS
– CELL 4 –
25-FOOT HIGH SECTION

JUNE, 1988 FIGURE 3.4-2

The results indicate the Cell 4 embankment to be stable during operating conditions even under loadings induced by the Maximum Credible Earthquake (MCE).

3.4.2 Foundation Settlement

Settlement analysis indicates the foundation soils will settle on the order of one to two inches due to the weight of the embankment. The majority of this settlement is expected to occur during construction.

3.4.3 Embankment Settlement

The embankment will settle under self-weight loading and due to compaction. It is anticipated that embankment settlement will be on the order of two inches and that approximately 90 percent of this settlement will occur during construction.

3.4.4 Liquefaction Potential

The potential for foundation or embankment materials to experience liquefaction under the long-term predicted seismic loadings is nil. Tailings placed within the Cell could liquefy as a result of severe seismic shock. This condition is similar to the state of the tailings immediately after deposition from the slurry line. The disposal cell is an engineered earth structure and is designed to contain any liquefied tailings.

3.4.5 Erosion Potential

The downstream face of the embankment will be placed on a 3(H) to 1(V) slope. Erosion protection will be maintained by active intervention as needed. Daily inspections are conducted on the Tailings Management System. Any signs of erosion will be reported on the daily inspection form and any deteriorated areas will be repaired as required.

3.5 Impoundment Features

3.5.1 Leak Detection System

A leak detection (underdrain) system will be installed beneath the synthetic liner and will consist of 4-inch diameter perforated HDPE or PVC pipe in the configuration shown on Drawing Nos. C4-4 and C4-5. The pipe will be embedded in granular material (crushed sandstone) in trenches in the clayey base with a nominal depth of 12 inches and with a 40 mil HDPE or 30 mil PVC lining. The openings of the drainage pipe will be compatible with the size of the granular drainage material. Filter criteria will be used to size the openings. The drain will connect to a 12-inch diameter HDPE or PVC access pipe as shown Drawing Nos. C4-4 and C4-5.