15.0 GEOTECHNICAL STABILITY (SEC 6.5)

The tailings facility has been constructed and complies or exceeds design and as-built (See Section (Section 4.3) regulatory requirements.

~~UMC is constructing a Tailings Storage Facility (TSF) for the Leadville Mill (the Mill). The TSF stability analysis is provided in the following section to comply with Section 6.5 regulatory requirements. The original TSF construction activities commenced in 1990 with the construction of a site monitoring well is provided in detail in Appendix 15-1.~~

~~During the 1990 site investigation, a foundation permeability (Appendix 15-2), a percent compaction measurement (Appendix 15-3) and a compaction test (Appendix 15-4) were completed. Tailings were initially stored within the constructed facility and ceased operation in 1991.~~

~~UMC acquired the Mill in 2009 and proceeded to upgrade the mill building, facilities and the TSF. UMC filed and received CDRMS authorization to construct the TSF using the design presented in Appendix 15-5 & 15-6. The completion of the TSF will be finalized with as-built drawings in 2013~~.

APPENDIX 15-1

GEOTECHNICAL STABILITY
OBSERVATION HOLE CHARACTERIZATION

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

April 10, 1990

Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

Attention: Mr. Don Wilson

Subject: Observation Hole
Leadville Mining & Milling Corporation Mill
Near Leadville, Colorado
Job No. 16,768

Gentlemen:

CTL/Thompson, Inc. installed the requested observation hole downhill of your tailings disposal area at the location shown on Figure 1. The summary log of the soils penetrated by the hole and its fitting to be an observation hole are shown on Figure 2.

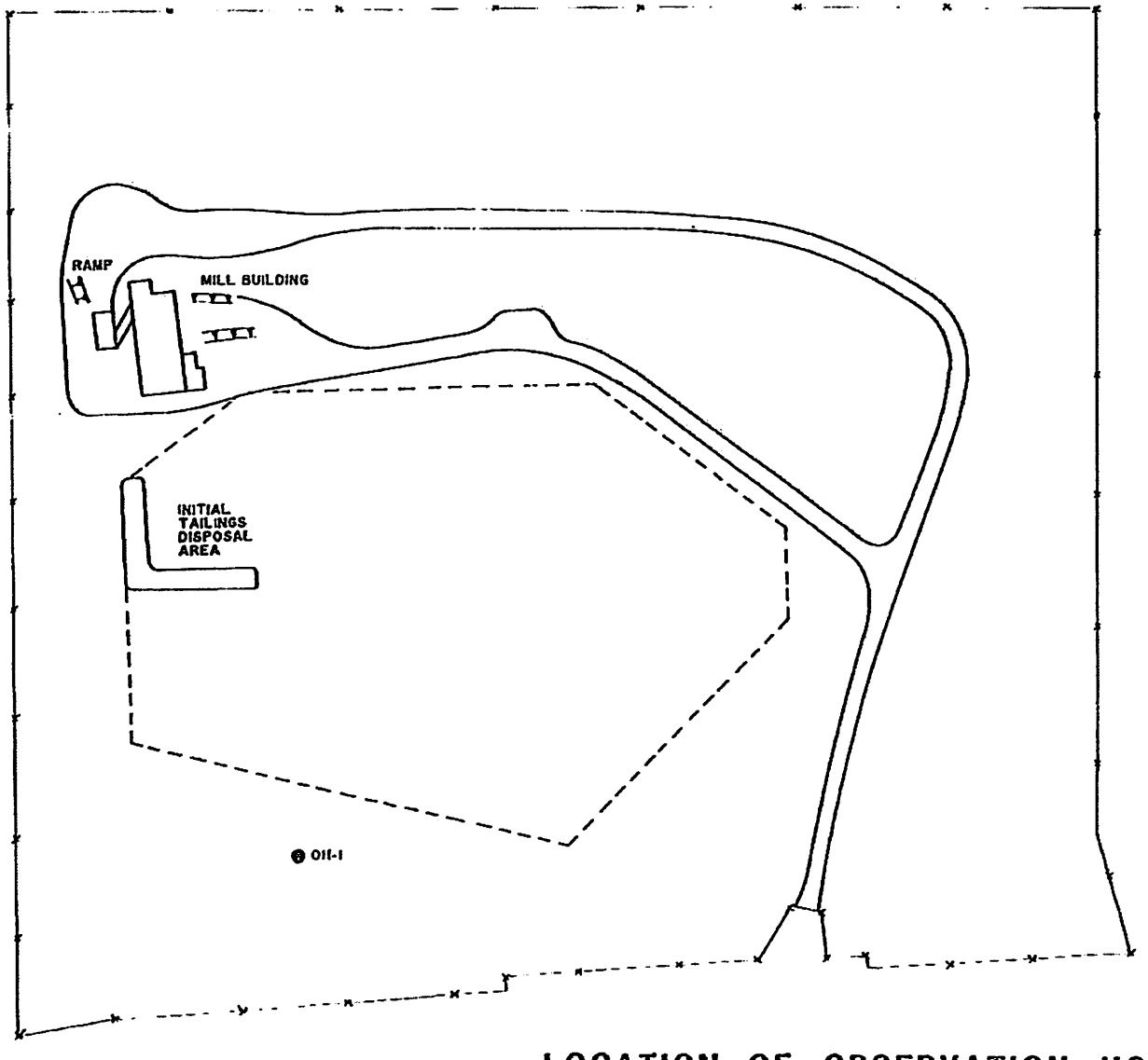
Please call if you have questions.

Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:dd
(5 copies sent)



N

SCALE: 1" = 100'

LEGEND:

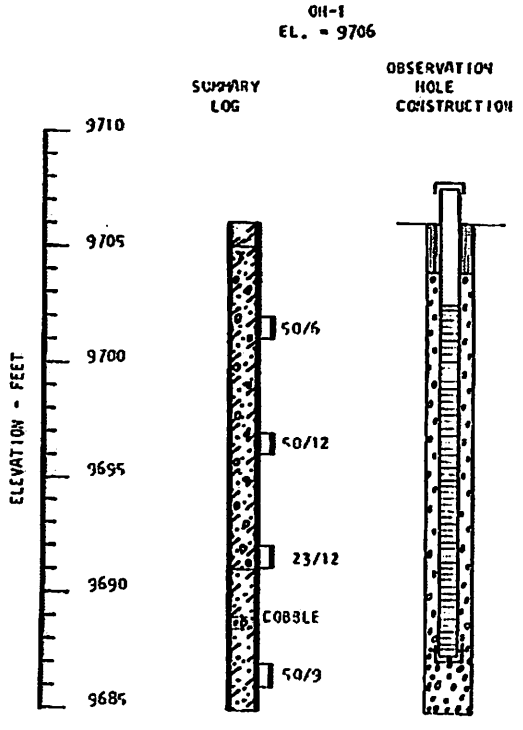
OH-1
● INDICATES LOCATION OF OBSERVATION HOLE

NOTE:
MILL LOCATED IN SECTIONS 28 & 33, T 9 S, R 80 W, LAKE COUNTY, COLORADO

LOCATION OF OBSERVATION HOLE

JOB NO. 16,768

FIG. 1



NOTES:

1. THE OBSERVATION HOLE WAS DRILLED MARCH 16,1990 WITH A 6-INCH DIAMETER CONTINUOUS FLIGHT AUGER.
2. THE OBSERVATION HOLE ELEVATION IS APPROXIMATE AND WAS TAKEN FROM A MAP PROVIDED BY LEADVILLE MINING AND MILLING CORP.

LEGEND - SUMMARY LOG:

- CLAY, STIFF, SANDY, GRAVELLY, MOIST, RED-BROWN (CL)
- GRAVEL, DENSE, VERY CLAYEY, VERY SANDY, MOIST, RED-BROWN (GC)
- SAND, DENSE, VERY CLAYEY, GRAVELLY, MOIST, RED-BROWN (SC)
- DRIVE SAMPLE. THE SYMBOL 50/6 INDICATES THAT 50 BLOWS OF A 140 POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5 INCH O.D. SAMPLER 6 INCHES.

LEGEND - OBSERVATION HOLE CONSTRUCTION:

- INDICATES PIPE CAP
- INDICATES 4 INCH INSIDE DIAMETER PLASTIC PIPE
- INDICATES 4 INCH INSIDE DIAMETER PLASTIC WELL SCREEN
- INDICATES SCREEN COVERING PIPE BOTTOM
- INDICATES CONCRETE IN ANULAR SPACE AROUND PIPE
- INDICATES GRAVEL PACK IN ANULAR SPACE AROUND PIPE

SUMMARY LOG OF OBSERVATION HOLE AND OBSERVATION HOLE CONSTRUCTION

JOB NO. 16,768

FIG. 2

APPENDIX 15-2

GEOTECHNICAL STABILITY
PERMEABILITY STUDY

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

PERMEABILITY STUDY
TAILING POND AREA
LEADVILLE MINING & MILLING CORPORATION MILL
NEAR
LEADVILLE, COLORADO

Job No. 16,768

April 10, 1990

1971 WEST 12TH AVENUE • DENVER COLORADO 80204 • (303) 825-0777

TABLE OF CONTENTS

INTRODUCTION

Leadville Mining & Milling Corporation has a mill near Leadville, Colorado in Sections 28 and 33, T. 9 S, R. 80 W. Tailings from the mill will be discharged into the tailings disposal area immediately south and east of the mill building on Corporation property. The tailings are fine and will be ponded behind a compacted soil dike. Soils for the dike will be excavated from the "reservoir" area.

CTL/Thompson, Inc. was retained to study the permeability of the soils that will be the sides and bottom of the tailings disposal area. This is the report of our permeability study. The locations of our permeability holes are shown on Figure 1 and their summary logs on Figure 2. The results of laboratory tests are on Figures 3 and 4 and in Table I. The results of our permeability tests are shown on Figure 2.

SUMMARY

The tailings disposal area soils are colluvial. They appear to be two types. Most of the tailings disposal area is over a lower permeability (k = 2 ft/yr to 7 ft/yr) soil. The uphill edge of the area appears to be over the leading edge of a colluvial deposit with a permeable lens (5000 ft/yr) at about 8 feet. The lens is about 1.5 feet thick but does not appear to extend under the entire area.

STUDY METHOD

Our study included permeability test holes and a site inspection by the undersigned to log the soils exposed in natural and man-made exposures in and around the tailings disposal area. Samples were taken from the exposures and from the permeability test holes for selected laboratory tests.

There was snow covering the area during our inspection but the steeper exposures were free of snow. The most instructive exposure was the wall of the excavated trench at the location shown on Figure 1. In this wall were 0 to 7 feet of sandy, gravelly clays overlying sandy, cobbly gravels to 10 feet. The clays and gravel were red-brown.

Ground permeabilities were measured using falling head permeability procedures. Four permeability test holes were drilled and cased with plastic well screen. The anular space between the ground and the screen was gravel packed. The holes were filled with water and the drop measured over about a 24-hour period except for P-4 which was drilled and tested the same day. Procedures published by the U.S. Bureau of Reclamation in the Earth Manual, Second Edition on Page 576 and following for packer tests were modified to calculate permeabilities from the collected data. The results of the permeability tests, as we interpret them, are shown on Figure 2 beside the summary logs.

LABORATORY TESTS

Sack samples of the clays and gravels from the trench and samples obtained from the permeability test holes with a drive sampler were returned to our laboratory. The soils in the sacks were gradation and Atterberg limit tested (see Fig. 3) for classification and the natural moisture content and densities (see Table I) were measured for the drive samples from P-2.

Leadville Mining & Milling had completed a shakedown run and produced some tailings which were ponded in the tailings disposal area. We sampled the tailings and gradation and Atterberg tested (see Fig. 4) the sample.

CONCLUSIONS

The tailing disposal area soils generally have low permeabilities. Our tests measured average permeabilities between 2 ft/yr and 230 ft/yr. The higher permeability was in P-1 which was located at the uphill edge of the disposal area. We saw in the existing trench and measured a more permeable (5000 ft/yr) lens in P-1 at about 8 feet. This lens in P-1 was about 1.5 feet thick.

We have concluded the clays overlying the gravel lens and the clayey gravels and clayey sands are comparatively impervious. For comparison, some sandy compacted clays have permeabilities of the order of 1 ft/yr. We suggest excavation which might reduce the natural clay cover over the gravel lens be omitted or minimized to the minimum to leave the natural clay surface layer uninterrupted or nearly uninterrupted. The pond bottom should be stripped and compacted before filling with tailings to decrease the permeability of the ground immediately under the tailings.

Should the gravel lens be exposed we recommend such exposures be blocked with 3 feet of the shallow clays densely compacted in thin lifts.

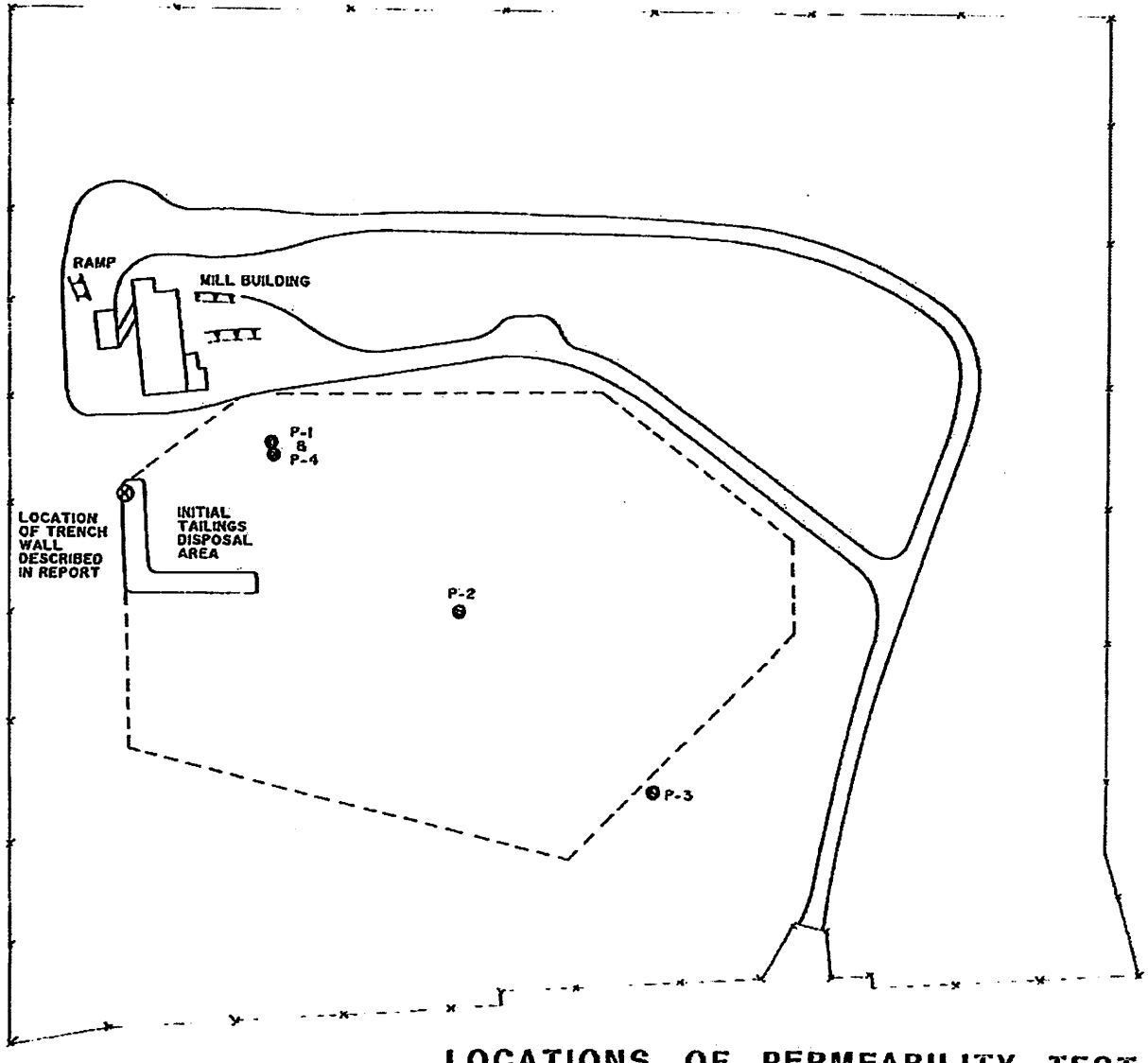
CTL/Thompson, Inc. performed the permeability tests reported herein to assist Leadville Mining & Milling Corporation to prepare their permit for the Colorado Mined Land Reclamation Board. Consultation and analyses regarding the tailings disposal area dikes or the amount or direction of water flow in the event water leaves the tailings disposal area were not a part of the scope of our work. Our work was limited to measuring the ground permeabilities in the field, laboratory testing for soil sample classification and our general impression of the impact of the ground permeabilities on the tailings disposal area construction.

The above summarizes our opinions. The data collected during our field work and our calculations are available in our files for future reference. If we can be of further service evaluating the geotechnical aspects of the tailings disposal area please call.

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:dd
(5 copies sent)



N

SCALE: 1" = 100'

LEGEND:

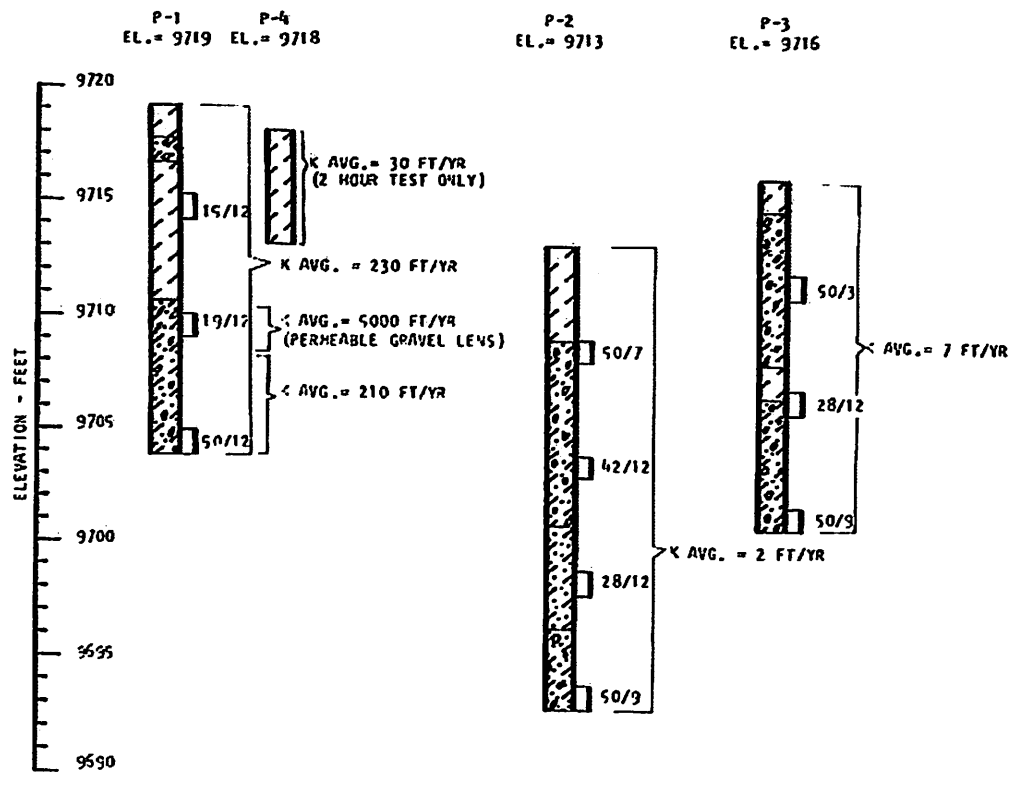
P-1 INDICATES LOCATION OF PERMEABILITY TEST HOLE

NOTE:
MILL LOCATED IN SECTIONS 28 & 33
T 9 S, R 80W, LAKE COUNTY,
COLORADO

LOCATIONS OF PERMEABILITY TEST HOLES

JOB NO. 16,768

FIG. 1



LEGEND:

CLAY, STIFF, SANDY, GRAVELLY, MOIST, RED-BROWN (CL)

GRAVEL, DENSE, VERY CLAYEY, VERY SANDY, MOIST, RED-BROWN (GC)

SAND, DENSE, VERY CLAYEY, GRAVELLY, MOIST, RED-BROWN (SC)

DRIVE SAMPLE. THE SYMBOL 15/12 INDICATES THAT 15 BLOWS OF A 140 POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5 INCH O.D. SAMPLER 12 INCHES.

K AVG. INDICATES AVERAGE PERMEABILITY MEASURED

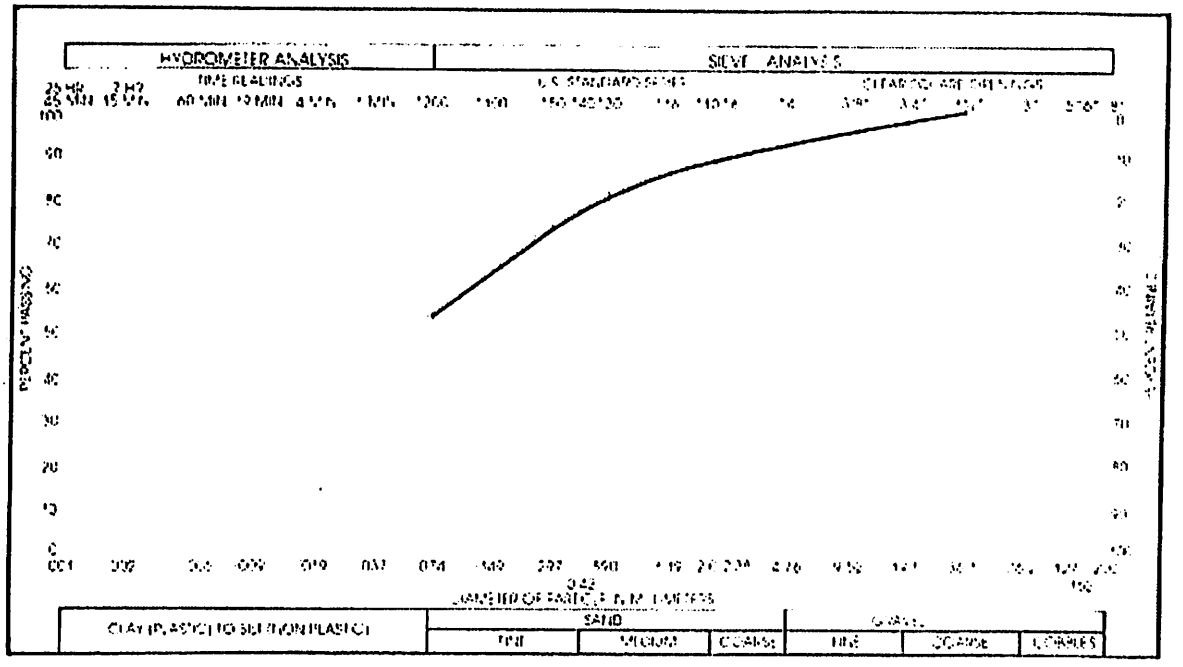
NOTES:

1. PIEZOMETER HOLES WERE DRILLED MARCH 15 AND 16, 1990 WITH A 6-INCH DIAMETER CONTINUOUS FLIGHT AUGER.
2. PIEZOMETER HOLE ELEVATIONS ARE APPROXIMATE AND WERE TAKEN FROM MAP FURNISHED BY LEADVILLE MINING AND MILLING CORP.
3. PIEZOMETER HOLES WERE CASED WITH 4-INCH INSIDE DIAMETER PLASTIC WELL SCREEN AND THE ANULAR SPACE GRAVEL PACKED TO PREVENT CAVING DURING THE TEST. ALL TESTS RUN OVER-NIGHT EXCEPT P-4.
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS AS CONTAINED IN THIS REPORT.

SUMMARY LOGS OF PIEZOMETER HOLES

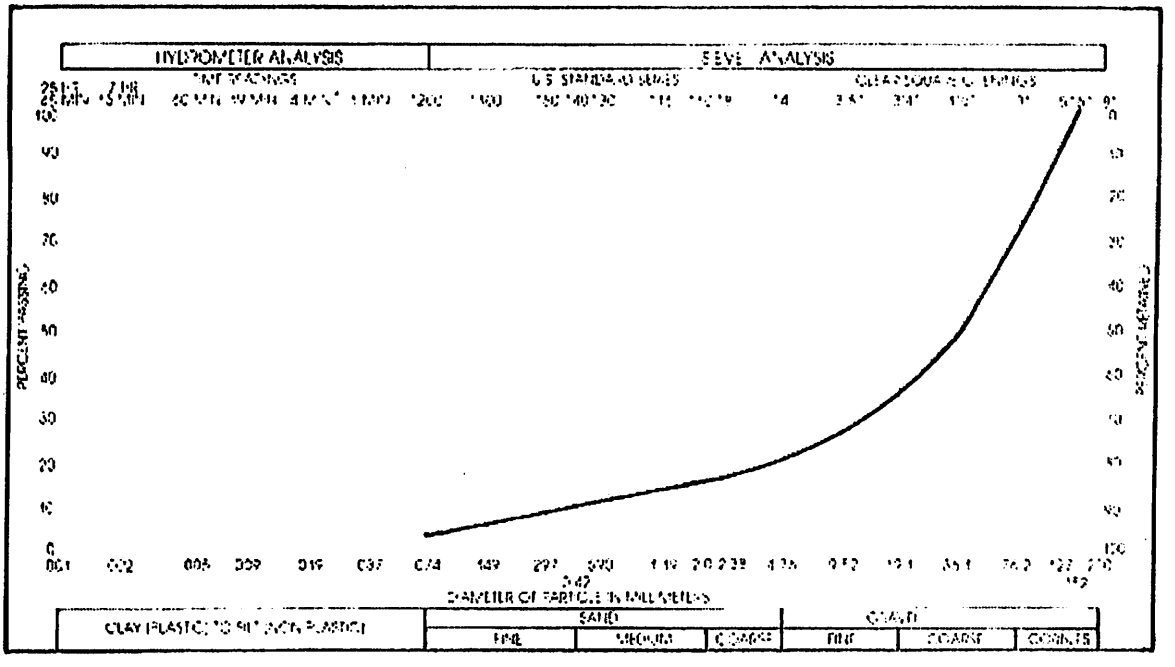
JOB NO. 16,768

FIG. 2



Sample of CLAY, VERY SANDY (CL)
From TRENCH AT 0 TO 7 FEET

GRAVEL 8 % SAND 45 %
SILT & CLAY 53 % LIQUID LIMIT 24 %
PLASTICITY INDEX 10 %



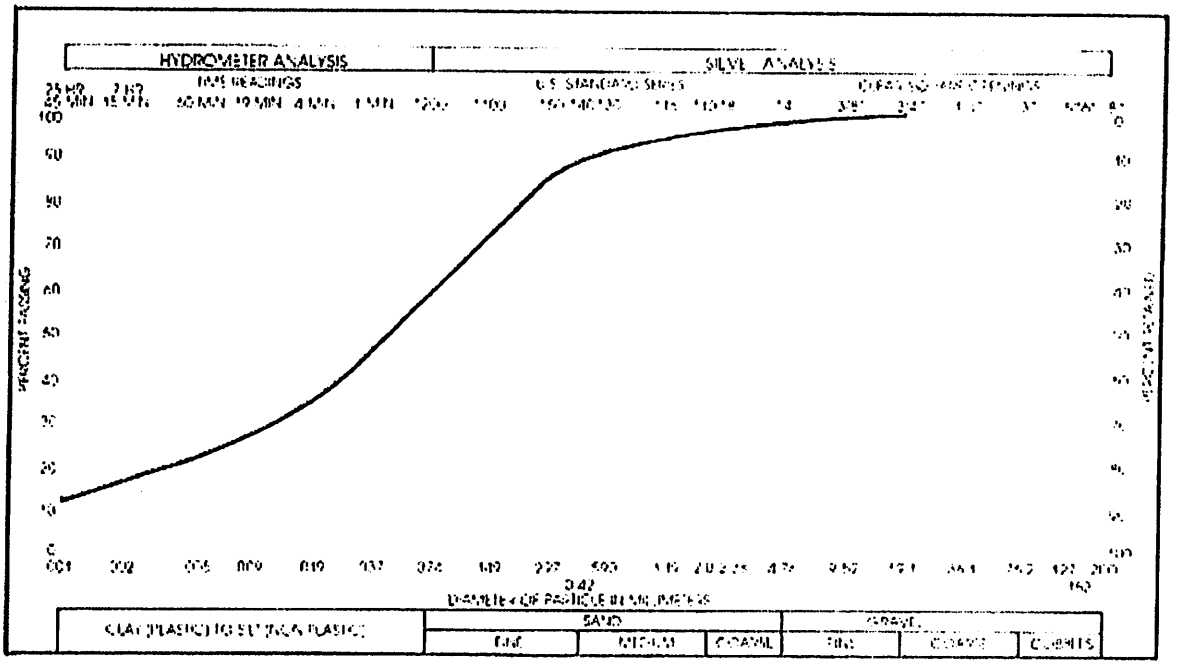
Sample of GRAVEL, SANDY (GP)
From TRENCH AT 7 TO 10 FEET

GRAVEL 80 % SAND 16 %
SILT & CLAY 4 % LIQUID LIMIT - %
PLASTICITY INDEX - %

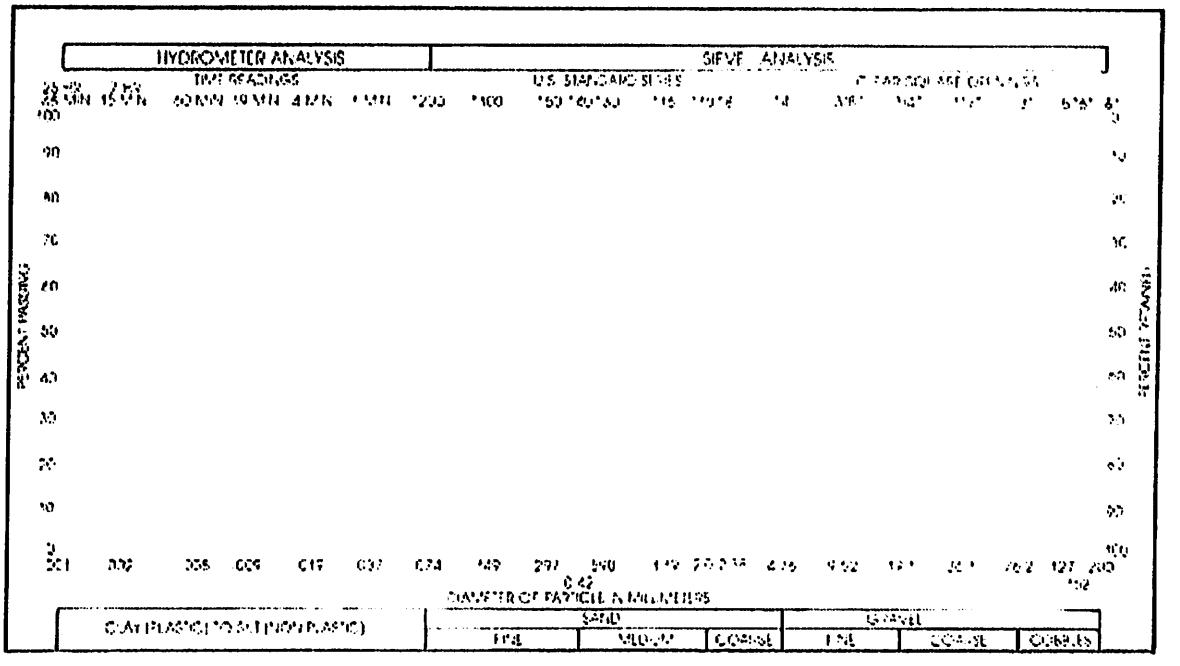
JOB NO. 16,768

Gradation Test Results

FIG. 3



Sample of TAILINGS (SILT,SLIGHTLY CLAYEY)(ML-CL) GRAVEL 0 % SAND 41 %
From SHAKEDOWN RUN SILT & CLAY 59 % LIQUID LIMIT 26 %
PLASTICITY INDEX 7 %



Sample of _____ GRAVEL ___ % SAND ___ %
From _____ SILT & CLAY ___ % LIQUID LIMIT ___ %
PLASTICITY INDEX ___ %

JOB NO. 16,768

Gradation Test Results

FIG. 4

Form 1C

JOB NO. 16,768

TABLE

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	TRIAXIAL SHEAR TESTS			SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)		DEVIATOR STRESS (PSF)	CONFINING PRESSURE (PSF)		
P-2	4	4.4	-							GRAVEL, SL. CLAYEY (GC)
P-2	9	7.6	120							SAND, CLAYEY, GRAVELLY (SC)
P-2	14	8.4	140							SAND, SL. GRAVELLY (SC)
P-2	19	9.0	117							SAND, CLAYEY, GRAVELLY (SC)
TRENCH	0-7	11.4	-	24	10					CLAY, VERY SANDY (CL)
TRENCH	7-10	-	-							GRAVEL, SANDY (GP)
TAILING	-	22.5	-	26	7					SILT, SL. CLAYEY (ML-CL)

APPENDIX 15-3

GEOTECHNICAL STABILITY
PERCENT COMPACTION MEASUREMENTS

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

July 27, 1990

Mr. Don Wilson
Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

Subject: Percent Compaction Measurements
Existing Tailing Pond Embankment
Leadville Mining & Milling Corporation Mill
Near Leadville, Colorado
Job No. 17,106

Dear Mr. Wilson:

The results of our percent compaction measurements in the tailing pond embankment at the Mill are summarized in the following Table. The embankment is located south of the mill building. The embankment centerline is "L" shaped. The long leg of the "L" is oriented east-west and is about 200 feet long. The short leg of the "L" is oriented north-south and is about 100 feet long. The embankment crest is about 15 feet wide and its maximum height about 15 feet. We understand the embankment is constructed of sandy clays and clayey sands excavated from the pond and they were spread in about 8-inch loose lifts and compacted with a sheepsfoot roller.

The test locations were on lines at right angles to the embankment centerline. The compaction standard used was standard Proctor (ASTM D 698) as we discussed. Fig. 1 shows the gradation of the soils used for the standard Proctor test and Fig. 2, the results of the Proctor test and Atterberg limits.

				Laboratory		Field			
Test No.	Location	Depth In.	Test Type	Max Density PCF	OMC %	Dry Density PCF	MC %	Compaction %	Soil Type
1	Midpoint/N-S leg of "L" - downhill slope	8	NUC	117.5	12.5	110.6	14.6	94.1	Clay, sandy, red (CL)
2	Midpoint/N-S leg of "L" - crest	8	NUC	117.5	12.5	113.2	14.8	96.3	Clay, sandy, red (CL)
3	Midpoint/N-S leg of "L" - pond side slope	6	NUC	117.5	12.5	94.1	16.5	80.1	Clay, sandy, red (CL)

4	Intersection/N-S & E-W legs of "L" - pond side @ slope toe	4	NUC	117.5	12.5	106.1	16.3	90.3	Clay, sandy, red (CL)
5	Intersection/N-S & E-W legs of "L" - pond side @ mid slope	6	NUC	117.5	12.5	104.9	17.2	89.3	Clay, sandy, red (CL)
6	Intersection/N-S & E-W legs of "L" - crest	6	NUC	117.5	12.5	114.9	10.9	97.8	Clay, sandy, red (CL)
7	Intersection/N-S & E-W legs of "L" - downhill slope	6	NUC	117.5	12.5	105.2	12.5	89.5	Clay, sandy, red (CL)
8	Midpoint/E-W leg of "L" - pond side slope	8	NUC	117.5	12.5	116.1	15.0	98.8	Clay, sandy, red (CL)
9	Midpoint/E-W leg of "L" - crest	8	NUC	117.5	12.5	111.4	14.5	94.8	Clay, sandy, red (CL)
10	Midpoint/E-W leg of "L" - downhill slope	8	NUC	117.5	12.5	82.4	16.2	70.1	Clay, sandy, red (CL)

You advised the Colorado Mined Land Reclamation Board talked about a percent compaction of 95 percent as their requirement. Three of the compaction test percents are above 95 percent and seven are below. Two of the seven are higher than 94 percent. The average of the compaction percent tests is 90.1 percent.

The above summarizes the results of our compaction percent tests. Please call with questions.

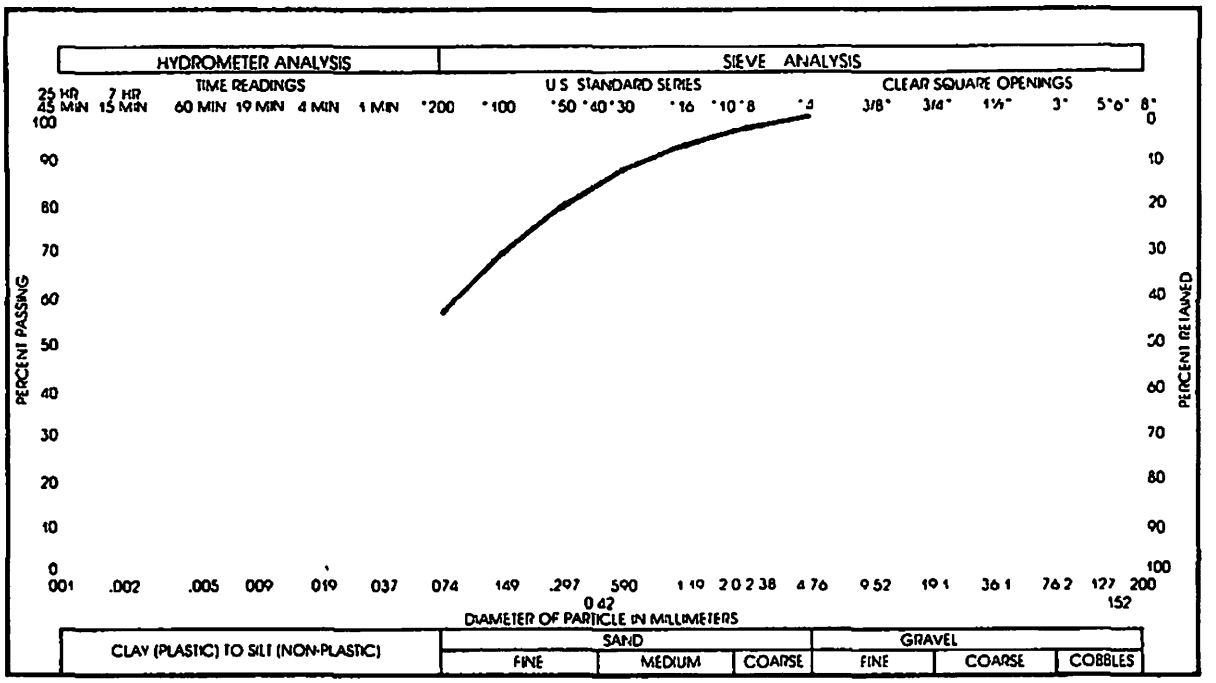
Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P.E.
Principal Engineer

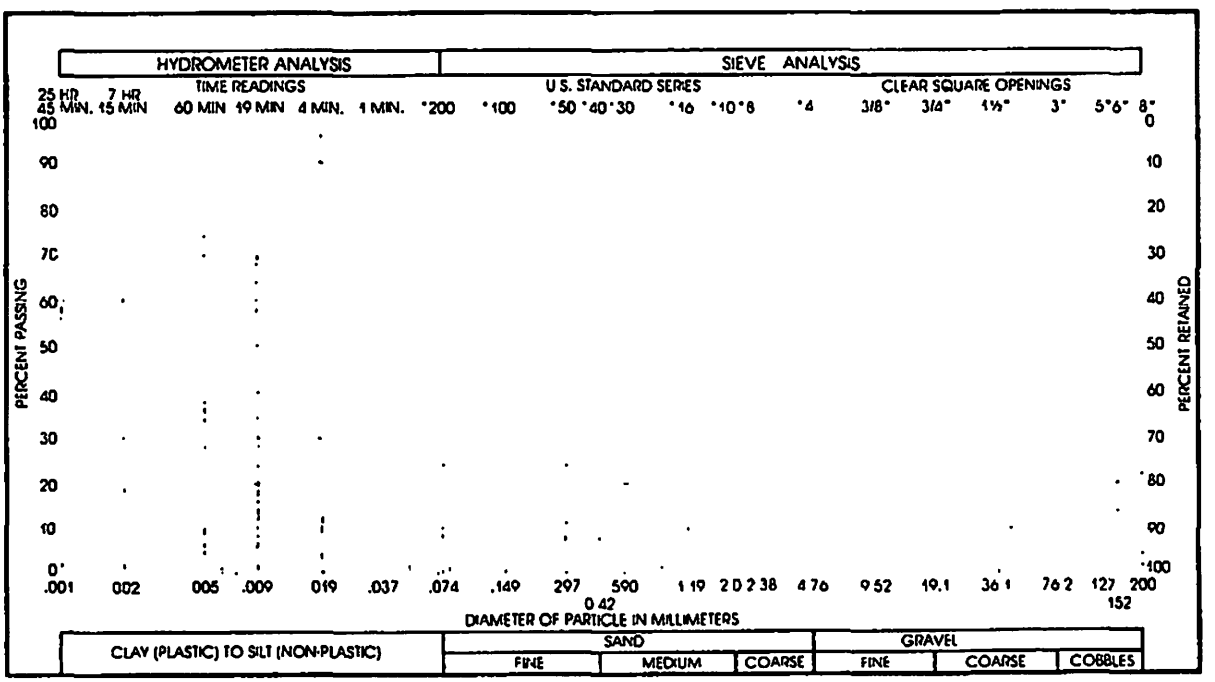
COLORADO REGISTERED FRANK J. HOLLIDAY 6785 PROFESSIONAL ENGINEER

RJH:dsm
(6 copies sent)



Sample of CLAY, SANDY, RED (CL)
From TAILING POND EMBANKMENT

GRAVEL 0 % SAND 42.7 %
SILT & CLAY 57.3 % LIQUID LIMIT 26 %
PLASTICITY INDEX 11 %



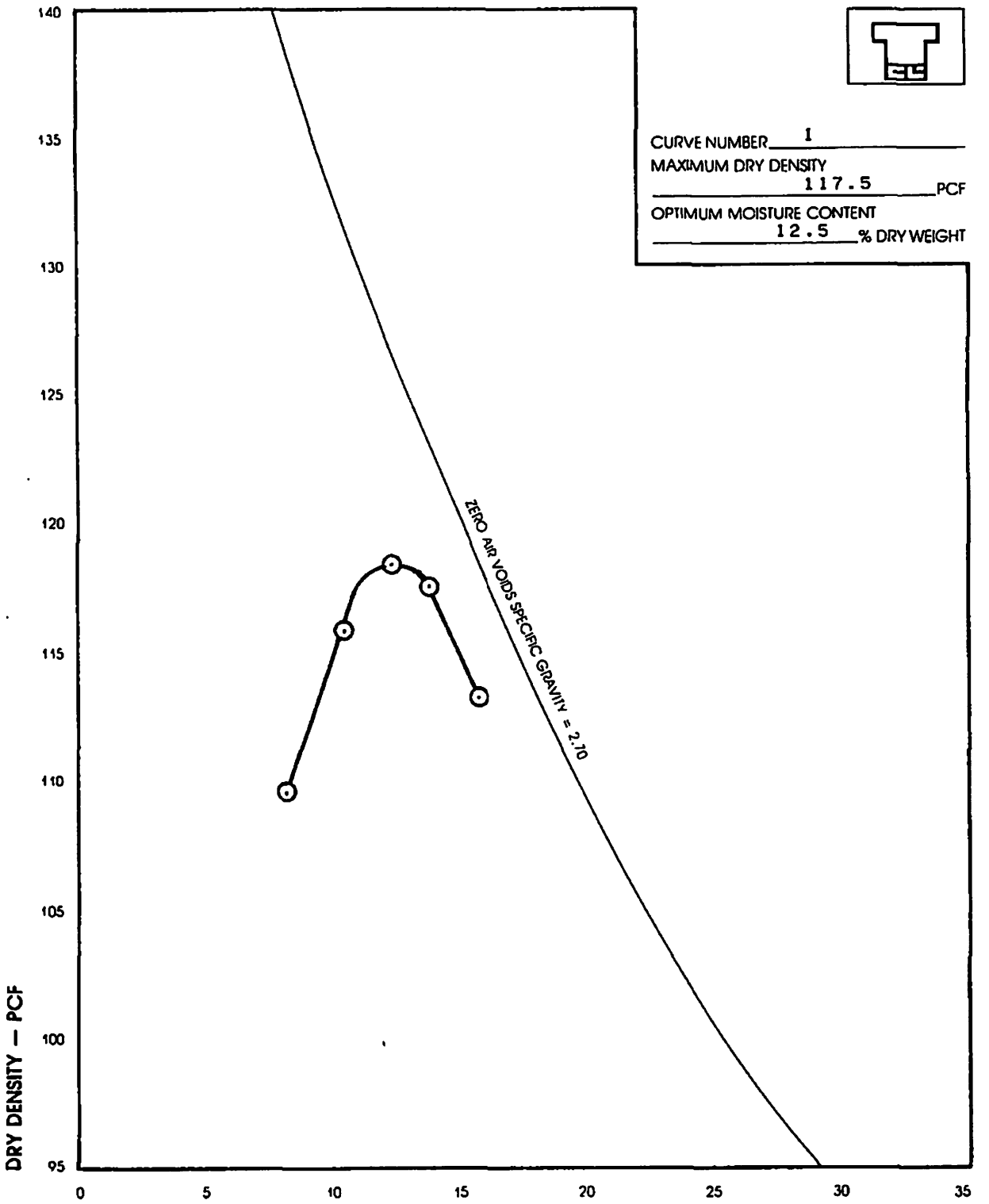
Sample of _____
From _____

GRAVEL _____ % SAND _____ %
SILT & CLAY _____ % LIQUID LIMIT _____ %
PLASTICITY INDEX _____ %

JOB NO. 17,106

Gradation Test Results

FIG. 1



CURVE NUMBER 1

MAXIMUM DRY DENSITY 117.5 PCF

OPTIMUM MOISTURE CONTENT 12.5 % DRY WEIGHT

Sample Description CLAY, SANDY, RED (CL)

Location TAILING POND EMBANKMENT

Compaction Test Procedure ASTM D 698, METHOD "A"

LIQUID LIMIT	26 %
PLASTICITY INDEX	11 %
GRAVEL	0 %
SAND	42.7 %
SILT AND CLAY	57.3 %

JOB NO. 17,106

Compaction Test Results

FIG. 2

APPENDIX 15-4

GEOTECHNICAL STABILITY
LEADVILLE CUSTOM MILL COMPACTION TEST DATA

STATE OF COLORADO

Roy Romer, Governor

DEPARTMENT OF NATURAL RESOURCES

MINED LAND RECLAMATION DIVISION

FRED R. BANTA, Director

MEMO TO FILE

File No: M-90-057

Operator: Leadville Mining & Milling Corporation

Date: 8-3-90

Specialist: Tom Schreiner

Subject: Leadville Custom Mill - Compaction Test Data
M-90-057

Type of Interaction: Meeting, Phone, (Other): In person

Person(s) Contacted and Affiliation: Don Wilson - Leadville M&M

SUMMARY AND RESOLUTION OF INTERACTION:

Met with Don Wilson 8-3-90 @ 8:00 AM to discuss results of compaction tests for tailings disposal area. Test results for sandy clay material (permeability of ≤ 2 ft/yr) reveal average compaction of 92.5% of Proctor Density.

Informed Mr. Wilson that these results indicate an acceptable level of compaction for the embankment and bottom of the tailings disposal facility. Equipment used during compaction were D-9 dozer, sheeps foot roller & rubber tired loader. Copies of test results will be forwarded to the Division.

Mill will be used to process gold, silver, lead, zinc. Flotation process will be used w/ standard reagents. No cyanide will be used.

(Rev. 5/9/88)
5720F

APPENDIX 15-5

GEOTECHNICAL STABILITY
SLOPE STABILITY EVALUATION

CTL | THOMPSON

July 8, 2011

The Union Milling Company
PO Box 36099
Denver, Colorado 80236

Attention: Mike Elder
John Danio

Subject: Slope Stability Evaluation
Tailings Pond Embankment and Future Tailings Slope
Union Mill
Leadville, Colorado
Project No. DN45,584-130

This letter presents the results of our slope stability evaluation for the proposed tailing pond embankment at the Union Mill and the future tailings slope. Union Mill is located north of Highway 24 and southwest of Leadville, in Lake County, Colorado. The legal description for the property is: portions of Sections 28 and 33, Township 9 South, Range 80 West. The access drive is about ¾ mile south west of County Road 23 (Airport Road) on the north side of Highway 24. There is an existing mill facility and tailings pond at the site. The general mill location is shown on Figure 1.

We understand the existing tailings and embankment will be removed and then a compacted fill embankment will be constructed. The facility will include two separate ponds as shown on Figure 2. The embankment will have a 2.5:1 (horizontal to vertical) outside face, and a 2:1 interior face. A clay liner with specified permeability of $1x\ 10^{-6}$ gal/day/ft^2 will be installed on the interior face and floor. Seepage/leak collection wells will be installed on top of the clay. The pond will then be lined with a man-made material and the existing tailings replaced. The pond will then be put into service for future milling operations. Once the pond is filled to the crest of the new embankment, four additional, 5-foot lifts of tailing materials will be added. The lifts will be placed using cyclone methods typical for tailings facilities.

The scope of our work included:

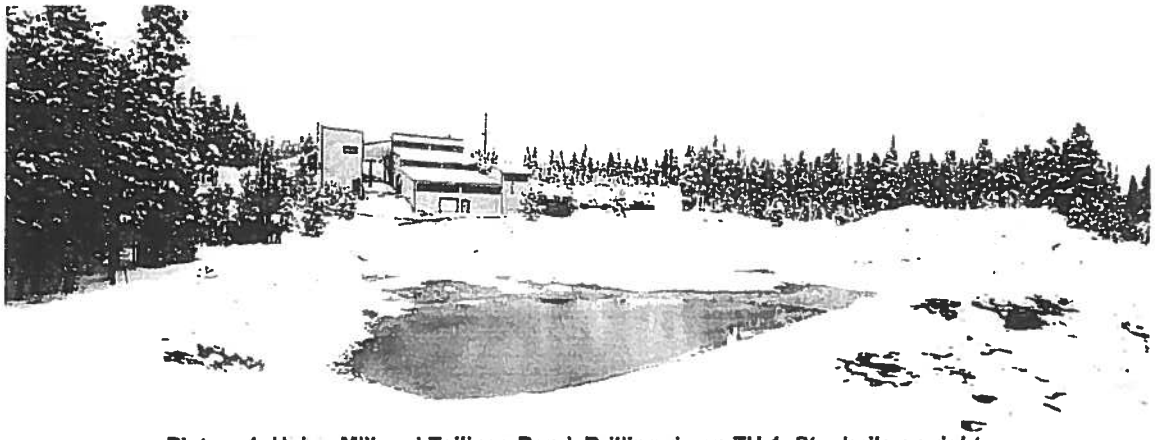
- Drilling two exploratory borings on or near the existing embankment;
- Testing the classification and strength of the material anticipated for the embankment, the underlying native soils, the existing on-site fill stockpile, and a sample of tailings material provided to us;
- Evaluating the slope stability of the embankment and the final tailings configuration; and

- providing a description of geological hazards that may impact the site

This letter contains descriptions of subsoil and ground water conditions found in our exploratory borings and discussion of slope stability of the proposed embankment and tailings configuration. It also contains descriptions of the site geology and potential geologic hazards. The letter was prepared based on conditions found in our borings, results of laboratory tests, engineering analysis of field and laboratory data, geologic reconnaissance and research, and our experience.

SITE CONDITIONS

Union Mill is located north of Highway 24 several miles southwest of Leadville, Colorado. The Leadville water treatment plant is adjacent, uphill to the east. There are houses and associated out buildings south and west of the site and undeveloped land to the north. California Gulch, tributary to the Arkansas River, is adjacent to Highway 24 south of the property. The ground is hummocky, consistent with a glacial outwash origin, and rises to the north. The general area is thickly forested with pine trees. At the time of our field investigation it was snowing and the ground was covered with snow. The existing mill facility and tailings pond are shown on Picture 1.



Picture 1. Union Mill and Tailings Pond. Drilling rig on TH-1. Stockpile on right.

PREVIOUS INVESTIGATIONS

Our firm previously performed a Permeability Study for the Tailing Pond Area (Job No. 16,768, dated April 10,1990) This work included digging four test pits and installing an observation well. Information from this study was considered in this investigation. The locations of the test pits and observation well from the previous work are shown on Figure 1. Copies of the previous reports are attached in Appendix C.

INVESTIGATION

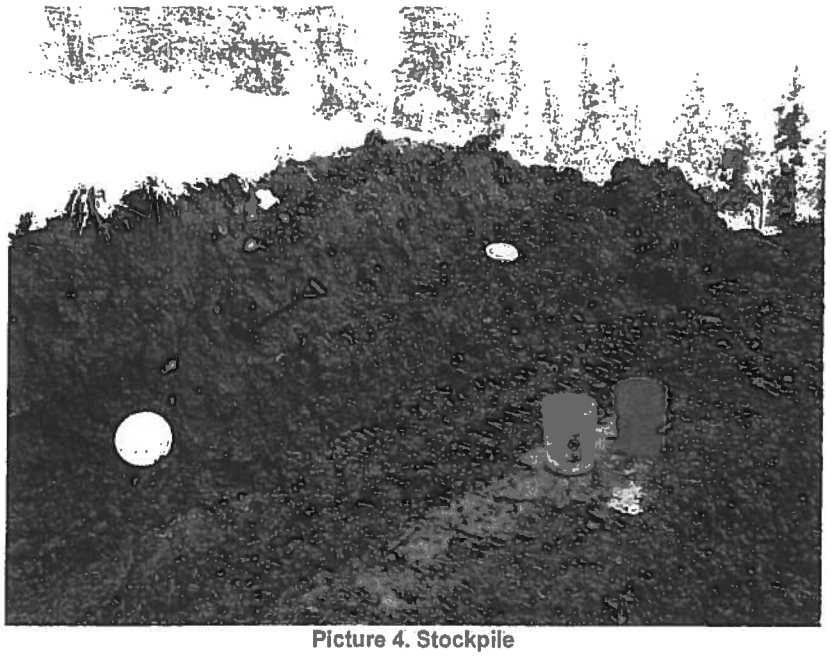
Subsurface conditions were investigated by drilling 2 borings. Our intent was to drill through the embankment, if possible. Field conditions allowed us to drill one hole on the embankment. The other hole was adjacent to the embankment, below the mill. □ et, snowy conditions re□uired bulldozer assistance in moving the drill rig. Additionally, we sampled the stockpile created during the excavation for the tailings pond. The bulldozer cut through the middle of the pile where we obtained a bulk sample.

The borings were drilled to a total depth of 30 feet at the approximate locations shown on Figure 1 and in Pictures 2 and 3. Our representative observed drilling operations, logged the subsoils found in the borings and obtained samples. Summary logs of the borings, results of field penetration resistance tests and a portion of laboratory test data are presented on Figure 3.

Picture 2. Drilling rig on TH-2 on the embankment

Picture 3. Bulldozer used to access TH locations. Bulldozer at approximate site of TH-1

Soil samples obtained during drilling and excavating were visually examined and laboratory tests were assigned. Moisture content, dry density and gradation tests were performed. Additionally, direct shear tests were performed on the remolded bulk sample from the stockpile and the mill tailings sample provided to us. The results of laboratory testing are summarized in Appendix A and in Table B.



Picture 4. Stockpile

SUBSURFACE CONDITIONS

The subsoils found in the borings generally consisted of sandy clay overlying clayey sand and gravel to the total depth drilled of 30 feet. Three feet of embankment fill was encountered in TH-2. TH-1 was drilled adjacent to the embankment where we encountered 7 feet of sandy clay. The test pits from our previous work also encountered sandy clay at the ground surface underlain by clayey gravel and sand. Refusal due to rocks occurred in TH-1 at 17 feet. □e encountered groundwater in TH-2 at 25 feet.

The clay was very stiff and very sandy. Three samples obtained during drilling contained 52 to 58 percent silt and clay-size particles (passing the No. 200 sieve). Four samples contained from 3 to 33 percent gravel in our gradation analysis and from 23 to 58 percent silt and clay-size particles (passing the No. 200 sieve). The particle size in these samples was limited by the sampling barrel (1.935 inch I.D.). The gravel was medium dense and very clayey and sandy with thin layers of sand and□or clay. Based upon the material observed in the stockpile, there are also cobbles within the gravel deposits. □e were not able to sample the cobbles in our borings due to the size of the sampling barrel. Sampling of the stockpile involved random grab samples as shown in Picture 4. Sampling included gravel and cobbles from the stockpile. The samples may not be fully representative of the larger sized material (cobbles) in the stockpile or natural ground.

REGULATIONS

The Colorado Mined Land Reclamation Board administers the rules and regulations that govern tailings pond embankments. Rule 6.5 of the □Hard Rock, Metal, and Designated Mining Operations□ dated September 30, 2010 provides the geotechnical re□uirements an Applicant must meet for a permit. There are several provisions in this rule that this letter addresses.

- *an Applicant shall be required to provide a geotechnical evaluation of all geologic hazards that have the potential to affect any proposed impoundment, slope, embankment, highwall or waste pile in the affected area.*
  - □e have not identified any geologic hazard that would preclude the development of the tailings pond as designed for the Union Mill.
- *an Applicant shall be required to provide engineering stability analysis for proposed final reclaimed slopes, highwalls, waste piles, embankments, and ore leach facilities.*
  - □e have performed stability analysis for the proposed embankment and planned tailings configuration. □e find that a factor of safety of 2.3 or greater applies to the proposed design.

- *Where there is potential for off-site impacts due to failure of any geologic structure or constructed earthen facility...the Applicant shall demonstrate through appropriate geotechnical and stability analyses that off-site areas will be protected with appropriate factors of safety incorporated into the analysis.*

    - **Our factors of safety are based upon conservative estimates of the onsite soil and rock strength as described in SLOPE STABILITY, and indicate the planned embankment will be stable.**

SITE GEOLOGY AND GEOLOGIC HA□ARDS

Geologic mapping by the United States Geological Survey (USGS) indicates that the property is underlain by alluvium. Our subsurface investigation encountered material consistent with this interpretation. The surface and near surface soils are vulnerable to erosion especially from concentrated flows. The Civil Engineer should address control of surface drainage. Faults are mapped in the Leadville area. A map published by the Colorado Office of Emergency Management in 1999 shows the most recent movement of the faults occurred in the late to middle □uaternary (130 thousand to 750 thousand years ago) The area is considered by the 1997 Uniform Building Code (UBC) as □one I, its least active zone designation. The soil is not expected to respond unusually to seismic activity. □ e did not identify any geologic hazards at the site that would preclude the proposed tailings pond and embankment.

DIRECT SHEAR TESTING

As part of our investigation, we performed direct shear testing. The testing was conducted on samples from the mill tailings you provided as well as on samples from the stockpile. The results of this testing are given in Appendix B and summarized in Table A.

The material that will be placed adjacent to the embankment within the pond will be cycloned tailings. □ e were given a typical sample considered to be consistent with future mill tailings. A gradation analysis was performed on this sample and contained a minus 200 fraction of about 50 percent. Based upon information in Vick[1], single-stage cycloning reduces the minus 200 fraction of the tailings by about 30-40□[1]. □ e attempted to duplicate this reduction on the sample used in the direct shear test. The gradations for the tailings sample are shown in Appendix A on Figure A-4. Our attempt to match the cycloning reduction for the minus 200 fraction achieved a 12 □ reduction. Additional tests are in process with a higher reduction.

The results of the direct shear testing are shown in Table A. □ e performed testing on the stockpile material to provide an indication of the strength of the native soils and proposed embankment. The tests were done at natural moisture (6□) and relatively low density (105 pcf) and near optimum moisture content and 95

[1] Planning, Design, and Analysis of Tailings Dams by Steven G. Vick, 2nd Printing, 1990

percent of the maximum determined by our Proctor density on this material. □e replaced the fraction of gravel larger than 3□8-inch in the stockpile sample tested with sand so that tests could be performed using our e□uipment (nominal 3-inch diameter shear ring). The gradation for the stockpile sample is shown on Fig. A-3 and the modified sample on Fig. A-5. The low density stockpile sample had a peak friction angle of 39 degrees and the material remolded at 95 percent Proctor density and optimum moisture had a peak friction angle of 43 degrees. The tailings materials yielded peak friction angles of 50 and 52 degrees. These results are higher than values from Vick for similar materials. According to the cited literature, gold slimes have drained friction angles of 28 to 40.5 degrees. Vick also indicates friction angles for clayey gravelly sand as 31 degrees. □e considered these lower friction angles in our slope stability analysis.

TABLE A
DIRECT SHEAR TEST RESULTS

Material	Peak Friction Angle (Degrees)	Dry Density (PCF	Moisture Content ( )	
			Before	After
Stockpile at 6 Moisture and Low Density	39	105	5.7	7.9
		105	5.7	15.7
		105	5.7	14.5
Stockpile at 95 max. Proctor Density and Optimum Moisture	43	113	12.1	-
		113	12.5	14.9
		113	12.5	14.6
Tailings (No Compaction)	52	64	1.6	28.9
		64	1.6	26.7
		64	1.6	25.8
Tailings (Slightly Tamped)	50	67	1.8	31.3
		67	1.8	28.6
		67	1.8	27.6

SLOPE STABILITY

□e analyzed the stability of two sections of the proposed tailing pond embankment and proposed tailings configuration shown on Fig. 2. The profiles were based on drawings provided by The Union Milling Company dated May 13, 2011. The stability of the slopes was evaluated for the following conditions: a) embankment, b) embankment with tailings and water in-filled to the crest, c) embankment with tailings mounded 20 feet above the crest with water. □e estimated shear strength parameters from the literature, results of laboratory strength tests, and our experience. Shear strength parameters and unit weights used in our analysis are summarized in Table B.

TABLE B
PARAMETERS USED OF SLOPE STABILITY ANALYSIS

Soil Type	Friction Angle (degree)	Cohesion (psf)	Unit eight (pcf)
Embankment	31	250	134
Cycloned Tailings	28-38	0	88
Tailings Slime	28-40.5	50	88
Natural Sandy Clay	31	250	125

Vick also provided a suggested phreatic surface profile for gold and silver slimes which we included in our model.

Stability calculations were performed using Slope □ (Geoslope). Table C summarizes results for the embankment stability and Table D shows results for the future tailings slope above the embankment. Graphical output from the analysis is provided in Appendix B.

TABLE C
FACTORS OF SAFETY AGAINST EMBANKMENT SLOPE FAILURE

Condition	Factor of Safety			
	Calculated Value		State of Colorado Minimum for ater Dams	Referenced Figure
	A-A	B-B□		
Empty Tailings Pond (Embankment Only)	2.3	2.8	1.0[2]	B-1 B-4
Filled Tailings Pond with ater	2.3	2.8	-	B-2 B-5

TABLE D
FACTORS OF SAFETY AGAINST TAILINGS SLOPE FAILURE

Condition	Factor of Safety			
	Calculated Value		Friction Angle	Referenced Figures
	A-A	B-B□		
Mounded Tailings(20 feet above embankment) with phreatic surface	1.5	1.7	40.5	B-3 B-6

[2] U.S. Bureau of Reclamation Criterion

Our computer analysis of the stability of the future tailings slope assumed the cycloned sands would form a slope of about 28 degrees (the minimum fraction angle or angle of repose) cited by Vick. This would result in a factor of safety of 1.0 if we used 28 degrees in stability calculations based on a infinite slope analysis (factor of safely □ tangent of angle of friction divided by tangent of slope angle). Vick indicates that cycloned materials typically flow as a thick, ropy discharge and assume an angle of repose of 3:1 (18 degrees) to 4:1 (14 degrees). If we use the internal angle of friction of 28 degrees and a slope angle of 14 to 18 degrees, the infinite slope factor of safety for 3:1 and 4:1 slope is 1.6 and 2.1□respectively.

The results of our slope stability analysis indicate that the overall design for the tailings pond will result in a stable configuration for both the embankment and initial tailings placed within it. The cycloned sands will stabilize in the mounded tailings at the angle of repose. This will likely be between about 14 to 18 degrees. This initial slope will increase in stability as the cycloned sands drain.

EMBANKMENT FILL

□e understand that the natural, onsite soils below or near the planned tailings pond will be used to construct the embankment. Topsoil, organic soils, and other deleterious materials should not be used as embankment fill. Fill material should have a maximum particle size of 6 inches and contain at least 50 percent silt and clay sized particles (passing the No. 200 sieve). Natural soil samples obtained from beneath and adjacent to the embankment had natural in-situ moisture contents between about 5 and 18 percent. A Standard Proctor test performed on a sample from the stockpile indicated optimum moisture content of the soil will be 12.5 percent. This Proctor result is based upon 26 percent sand and 24 percent gravel with 50 percent silt and clay sized particles. Should gravel amounts in the material used as embankment fill vary significantly from this amount additional Proctor tests should be run. The near surface material (top five feet) was greater than 12.5 percent moisture content. Depending upon the time of year that construction takes place it should be anticipated that the top five feet of natural soils will need to be dried prior to placement as fill. □ater will be re□uired to raise the moisture content in the fill material taken from greater depths than about five feet and should be available during fill placement. Mixing with the wetter and shallower material may result in fill closer to the re□uired moisture content. □ater should be uniformly mixed into the fill during processing and prior to placement.

Fill should be placed in 10 to 12 inch thick lifts. Compaction should be with a large, self-propelled sheepsfoot compactor. Smooth drum rollers should not be allowed. Fill should be moisture conditioned to within 2 percent of optimum moisture content and be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). Embankment fill should be placed in level lifts. Lifts should be scarified prior to placement of the next lift. A representative of

CTL | Thompson, Inc. should observe and test placement of the embankment fill during placement.

SURFACE DRAINAGE

Good surface drainage around the tailings pond is essential to protect the embankment and reduce water infiltration. The underlying soils are sandy, clayey gravels that are permeable. Snow melt should not be allowed to pond adjacent to the embankment. Onsite drainage should be directed away from the embankment.

The surface and near surface soils are vulnerable to erosion especially from concentrated flows. The Civil Engineer should address control of surface drainage. In any case, concentrated surface runoff should not occur on unprotected natural soils or near the embankment area.

CONSTRUCTION OBSERVATION

An earthen embankment is built of materials that are variable. The best pre-design investigation and design activities cannot foresee all the conditions that will arise during construction. Variations in the soils not indicated by our exploratory borings and previous permeability test pits will occur.

Observations by experienced geotechnical engineers and□or technicians are, in our opinion, essential during construction to discover conditions that may impact the design of the embankment. The proper handling of soil will be important to the final □uality of the embankment. □e believe it is essential to have a □ualified geotechnical technician observe the processing and placement methods used by the contractor and test materials during embankment construction.

□e recommend full-time construction observation and testing by geotechnical personnel experienced in tailings-pond embankment construction to verify the appropriate use of soils and rock and construction procedures and that ade□uate compaction is achieved.

LIMITATIONS

Our boring locations were selected to provide a general characterization of subsurface conditions to supplement previous exploration. Drilling access was limited. □e believe thls investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made.

If we can be of further service in discussing either the contents of this letter or the analysis of the influence of subsurface conditions on the design of the proposed development, please call.

Very truly yours,

CTL | THOMPSON, INC.

Jonathan R. Lovekin, P.G.
Project Manager

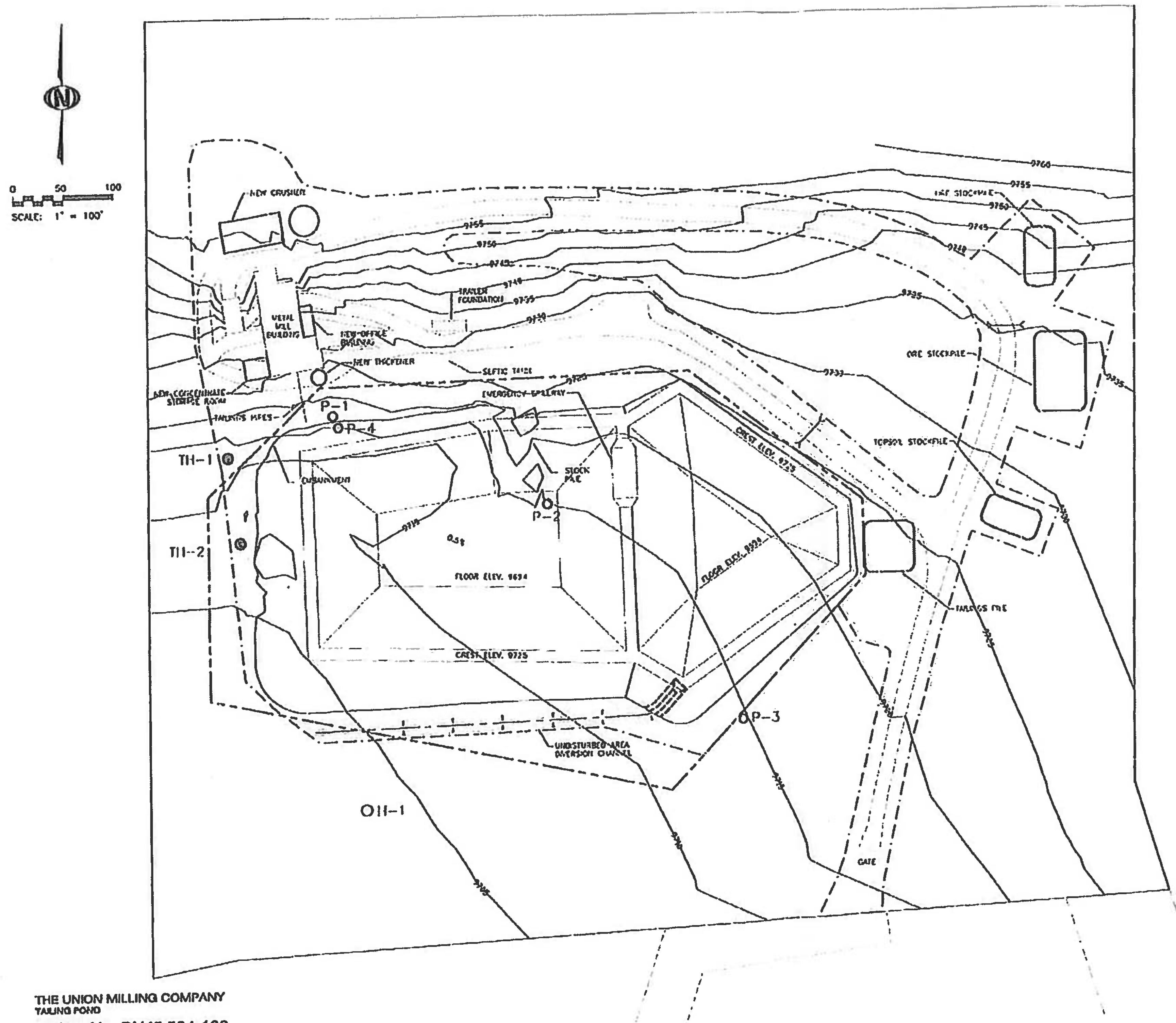
Reviewed by:

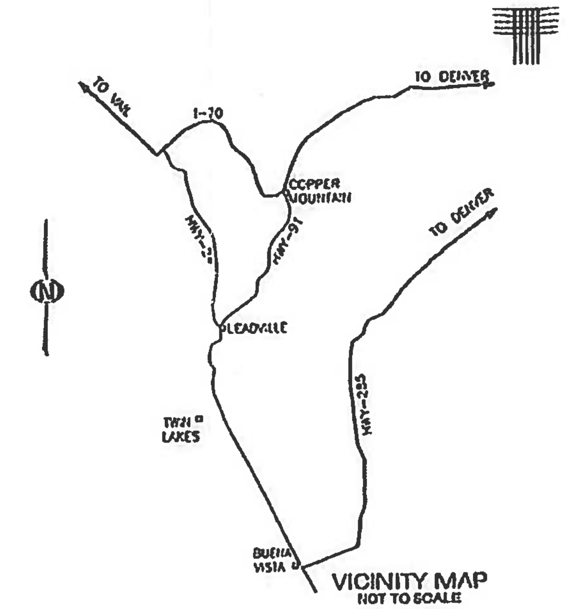
Ronald M. McOmber, P.E., D.GE
Chairman & CEO

COLORADO REGISTERED RONALD M. McOMBER 20243 7/8/11 PROFESSIONAL ENGINEER

JRL:RMM/jrl/nt
(3 copies)

via email: melder@unionmilling.com





LEGEND:

TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING

9730 EXISTING GROUND SURFACE ELEVATION (FEET)

P-1 APPROXIMATE LOCATION OF PERMEABILITY TEST HOLE, JOB NO. 16,768, DATED APRIL 10, 1990.

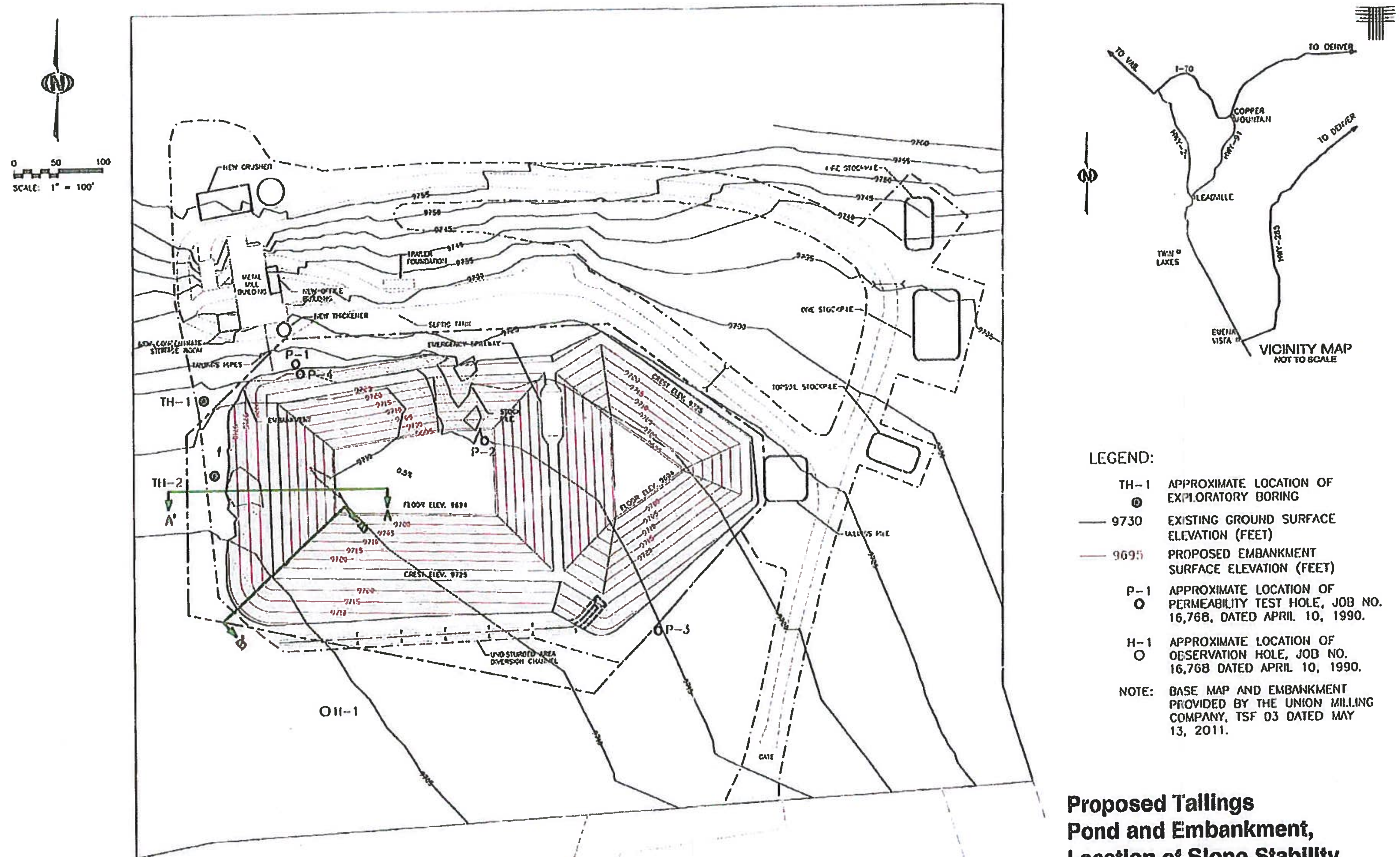
H-1 APPROXIMATE LOCATION OF OBSERVATION HOLE, JOB NO. 16,768 DATED APRIL 10, 1990.

NOTE: BASE MAP PROVIDED BY THE UNION MILLING COMPANY, TSF 01 DATED MAY 13, 2011.

THE UNION MILLING COMPANY
TAILING POND
Project No. DN45,584-130

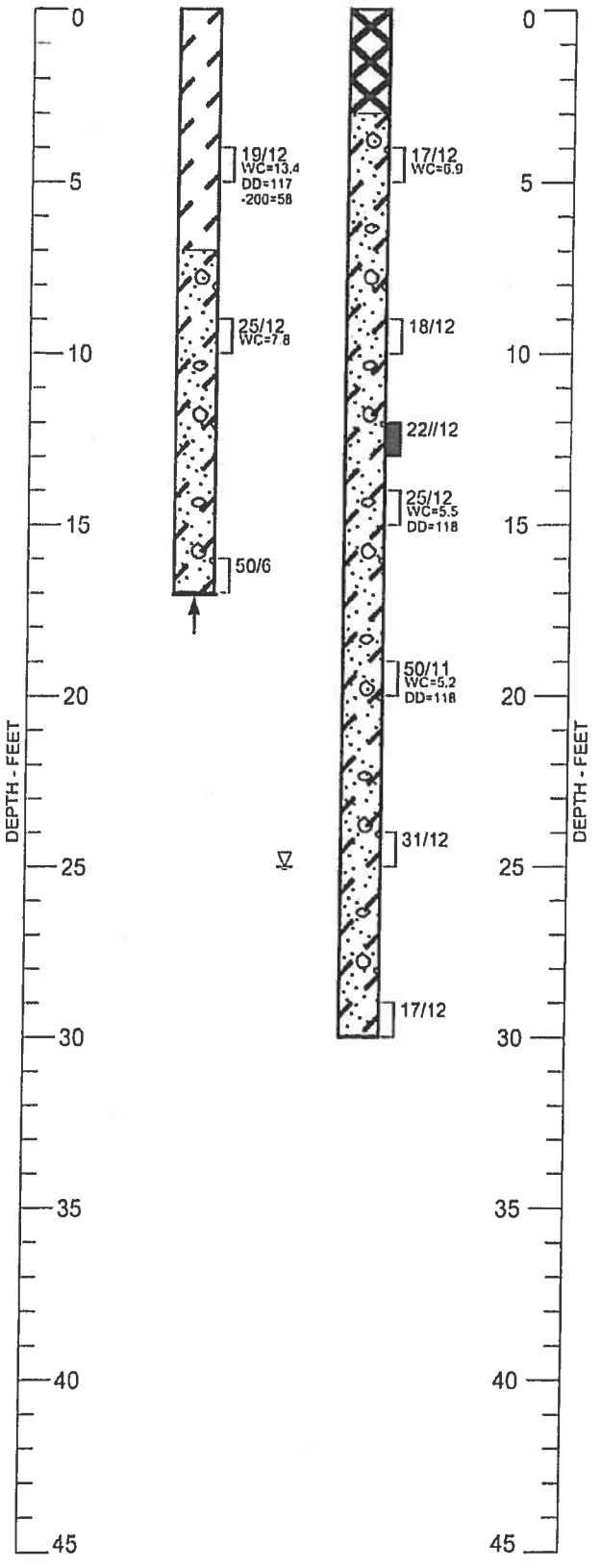
Locations of Exploratory Borings

Fig. 1



THE UNION MILLING COMPANY
TAILING POND
Project No. DN46,584-130

Proposed Tailings Pond and Embankment, Location of Slope Stability Cross Sections Fig. 2



LEGEND:

FILL, CLAY, SANDY, VERY STIFF, VERY MOIST, BROWN.

CLAY, SANDY, VERY STIFF, MOIST, BROWN (CL).

GRAVEL, SANDY, CLAYEY, MEDIUM DENSE, SLIGHTLY MOIST, BROWN, GRAY (GC).

DRIVE SAMPLE.THE SYMBOL 19/12 INDICATES 19 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

DRIVE SAMPLE.THE SYMBOL INDICATES BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.0-INCH O.D. SAMPLER INCHES.

WATER LEVEL MEASURED AT TIME OF DRILLING.

PRACTICAL DRILL REFUSAL.

NOTES:

1. THE BORINGS WERE DRILLED ON MAY 12, 2011 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A TRUCK-MOUNTED DRILL RIG.
2. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (pcf).
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
3. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS AS CONTAINED IN THIS REPORT.

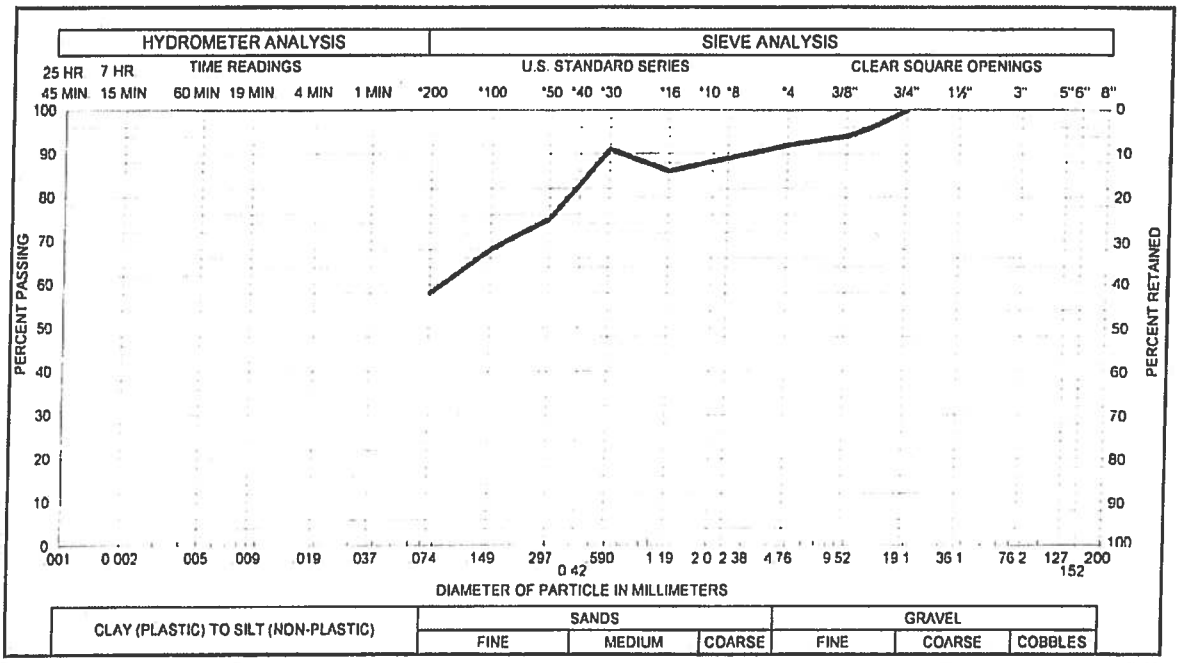
S:\PROJECTS\45500\DN45584.000\13012. REPORTS\R1\DN45584-130-R1-G.GPJ

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45.584-130

Summary Logs of Exploratory Borings

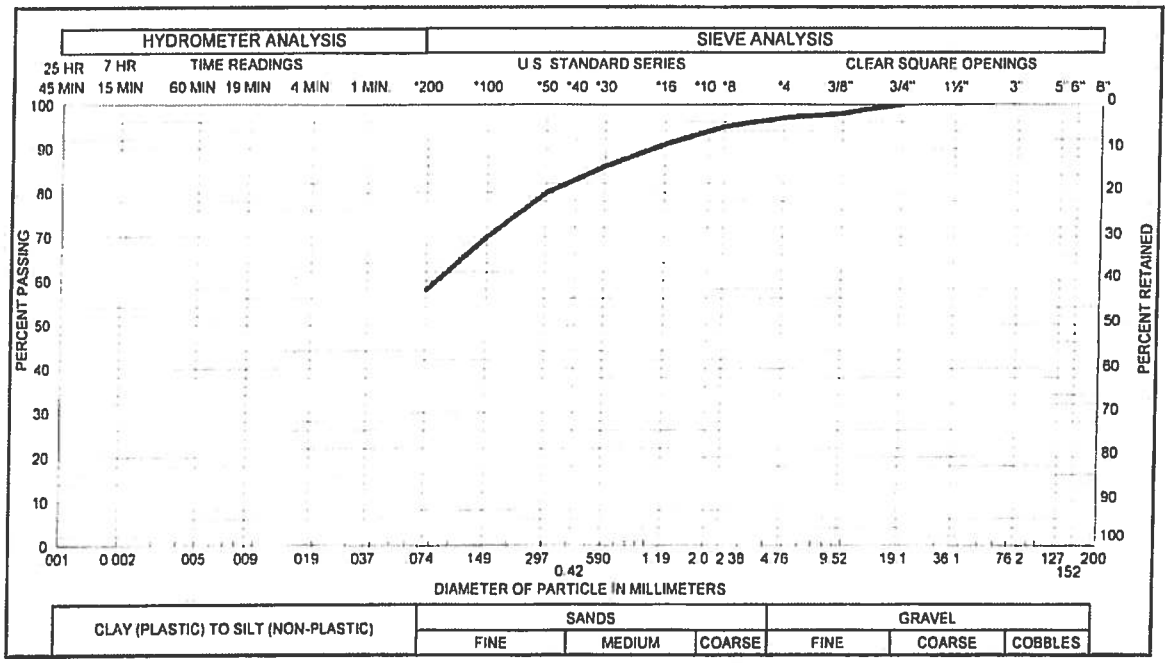
FIG. 3

APPENDIX A
LABORATORY TEST RESULTS



Sample of CLAY, SANDY (CL)
From TH - 1 AT 4 FEET

GRAVEL	8 %	SAND	34 %
SILT & CLAY	58 %	LIQUID LIMIT	%
PLASTICITY INDEX			%



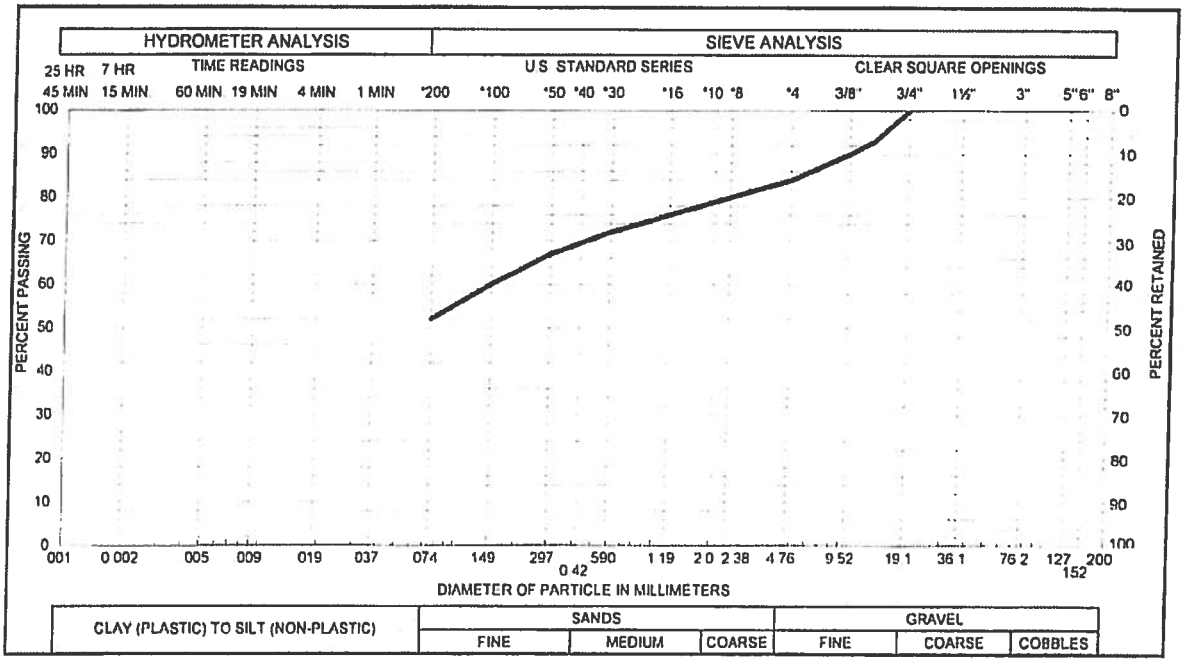
Sample of CLAY, SANDY (CL)
From TH - 2 AT 1 FEET

GRAVEL	3 %	SAND	39 %
SILT & CLAY	58 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

Gradation Test Results

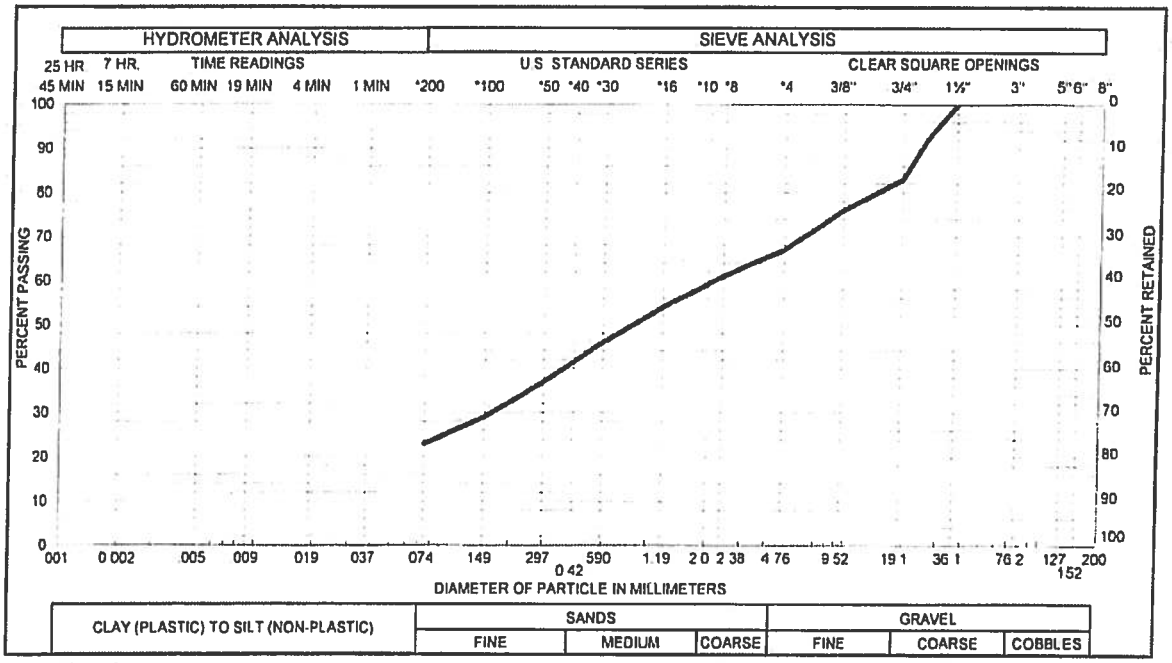
FIG. A-1

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L11\DN45584-130-L1-X1(grad)



Sample of CLAY, SANDY (CL)
From TH - 2 AT 6 FEET

GRAVEL	16 %	SAND	32 %
SILT & CLAY	52 %	LIQUID LIMIT	%
PLASTICITY INDEX			%



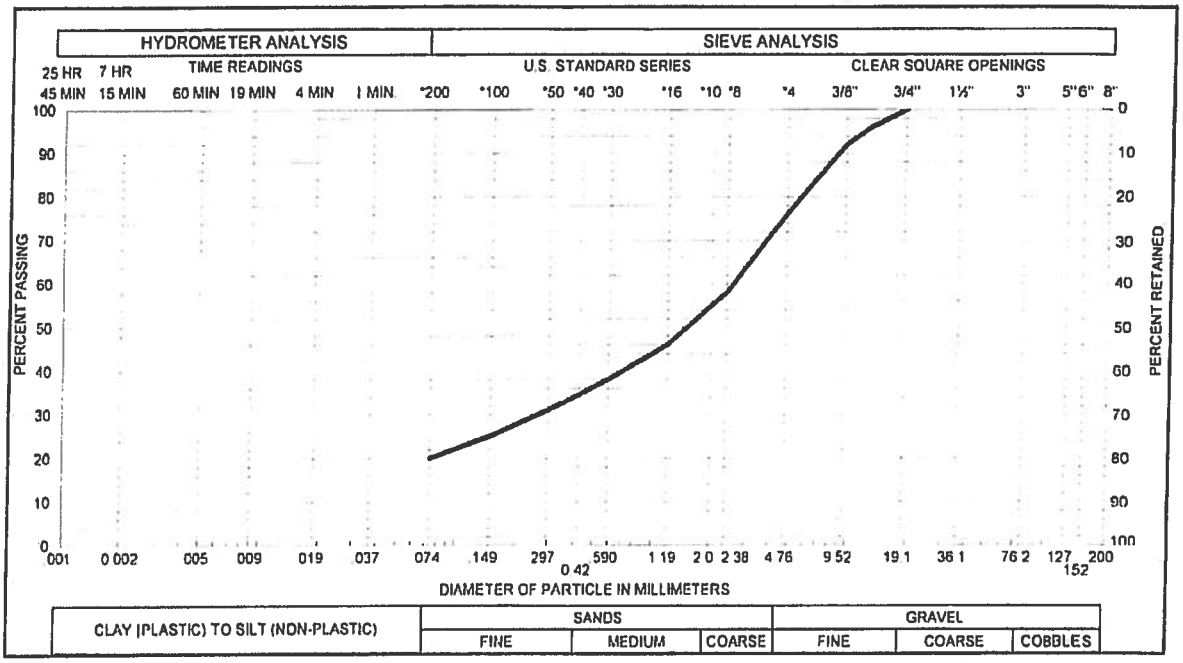
Sample of SAND AND GRAVEL, CLAYEY (SC)
From TH - 2 AT 11 FEET

GRAVEL	33 %	SAND	44 %
SILT & CLAY	23 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

Gradation Test Results

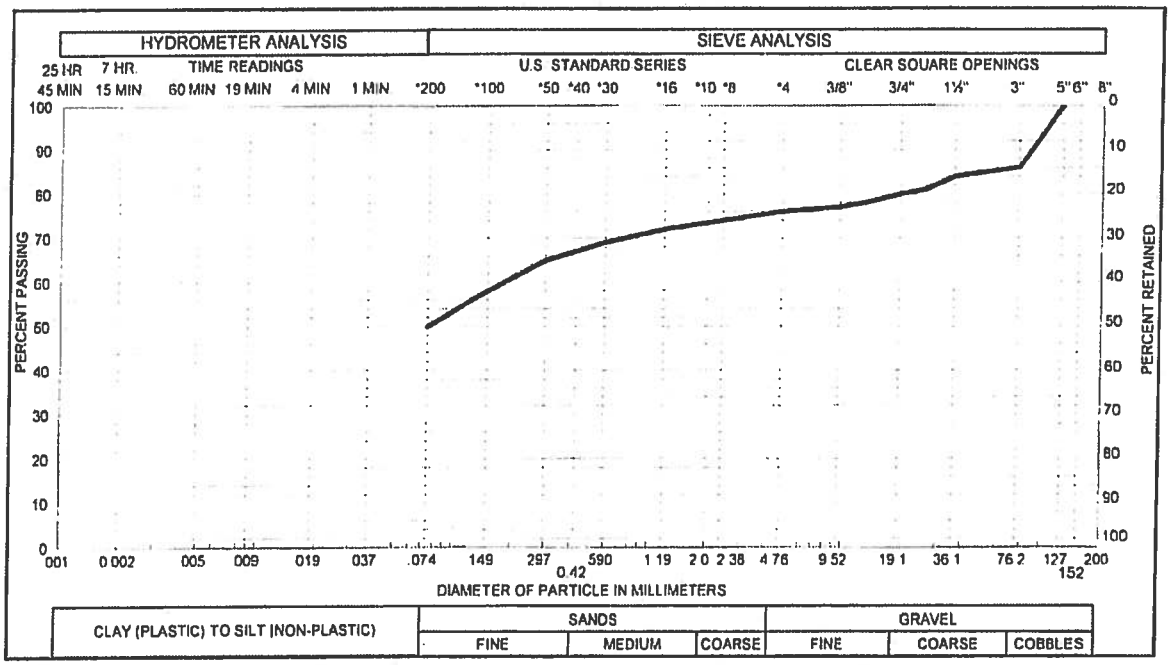
FIG. A-2

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L1\DN45584-130-L1-X1(grad)



Sample of SAND WITH GRAVEL, CLAYEY (SC)
From TH - 2 AT 21 FEET

GRAVEL	24 %	SAND	56 %
SILT & CLAY	20 %	LIQUID LIMIT	%
PLASTICITY INDEX			%



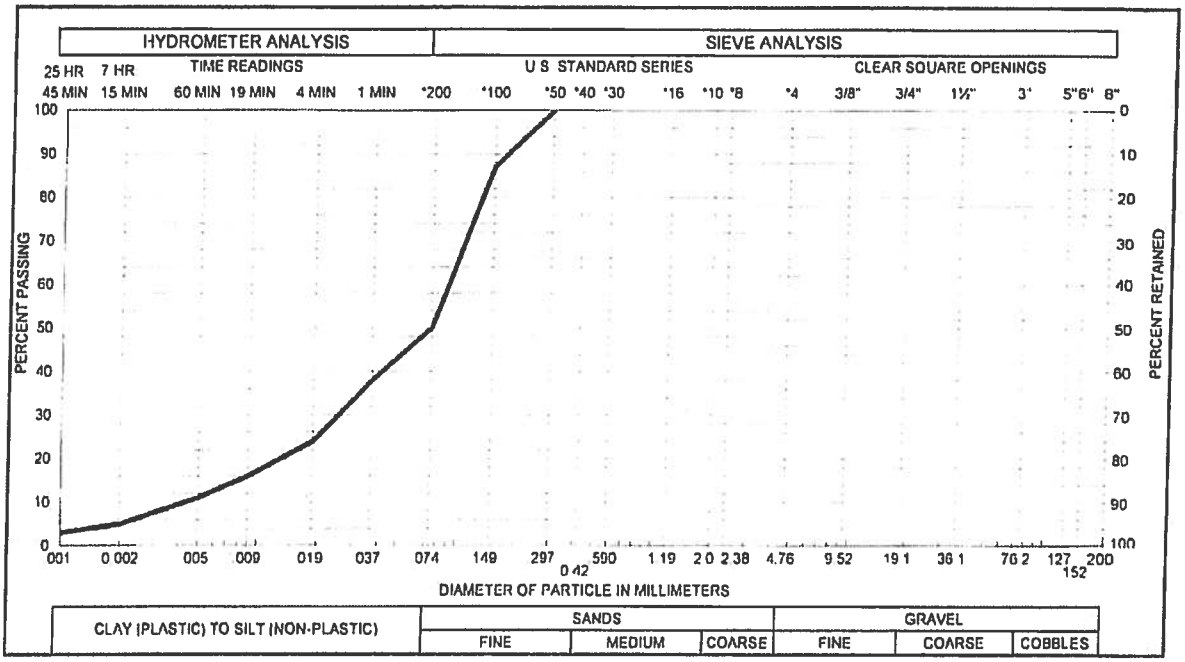
Sample of CLAY, SANDY, GRAVELLY (CL)
From Bulk sample from Stockpile

GRAVEL	24 %	SAND	26 %
SILT & CLAY	50 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

Gradation Test Results

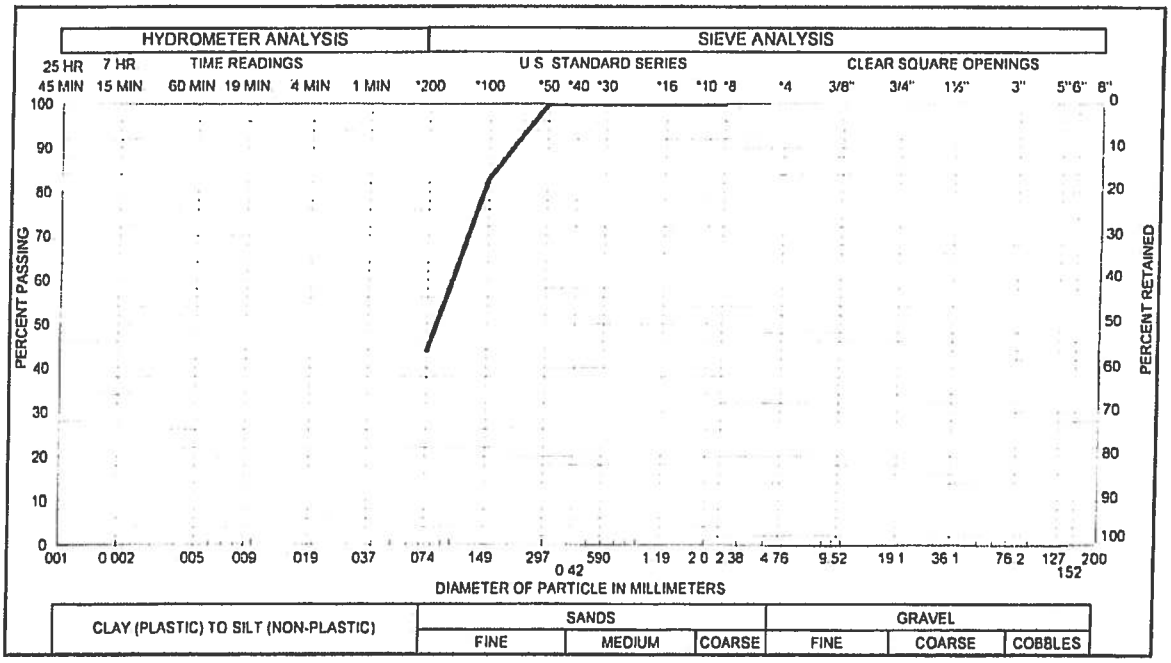
FIG. A-3

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3. Letters\L1\DN45584-130-L1-X1(grad)



Sample of TAILINGS
From

GRAVEL	0 %	SAND	50 %
SILT & CLAY	50 %	LIQUID LIMIT	%
PLASTICITY INDEX			%



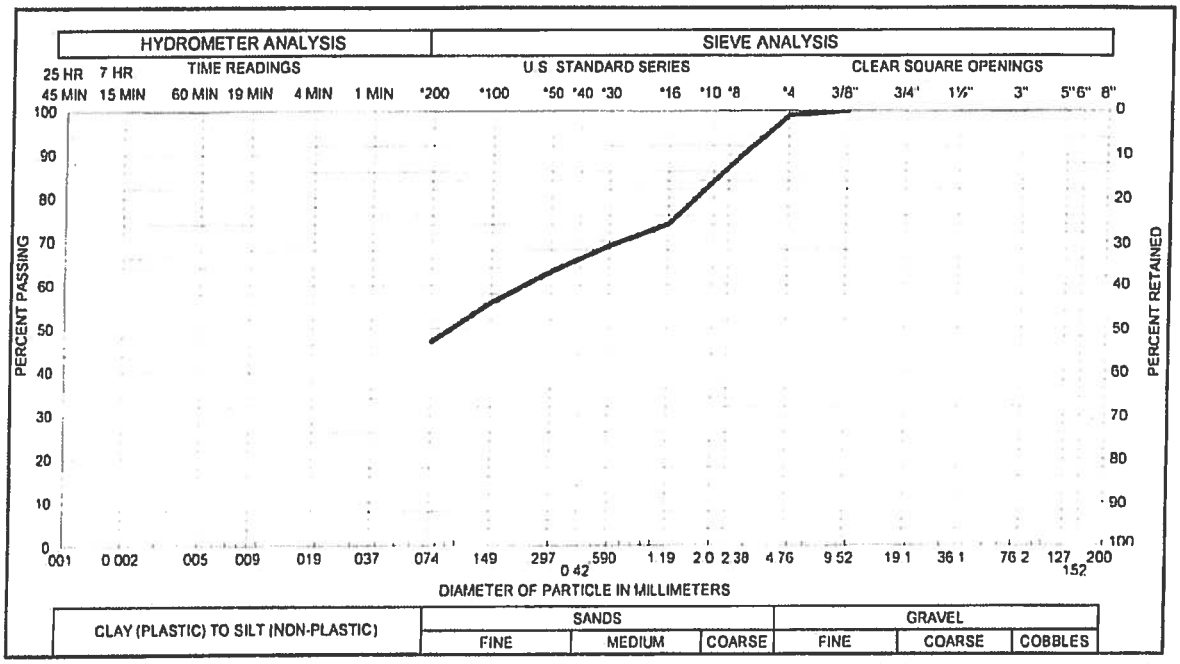
Sample of CLAY, SANDY (CL)
From Modified Tailings

GRAVEL	0 %	SAND	56 %
SILT & CLAY	44 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

Gradation Test Results

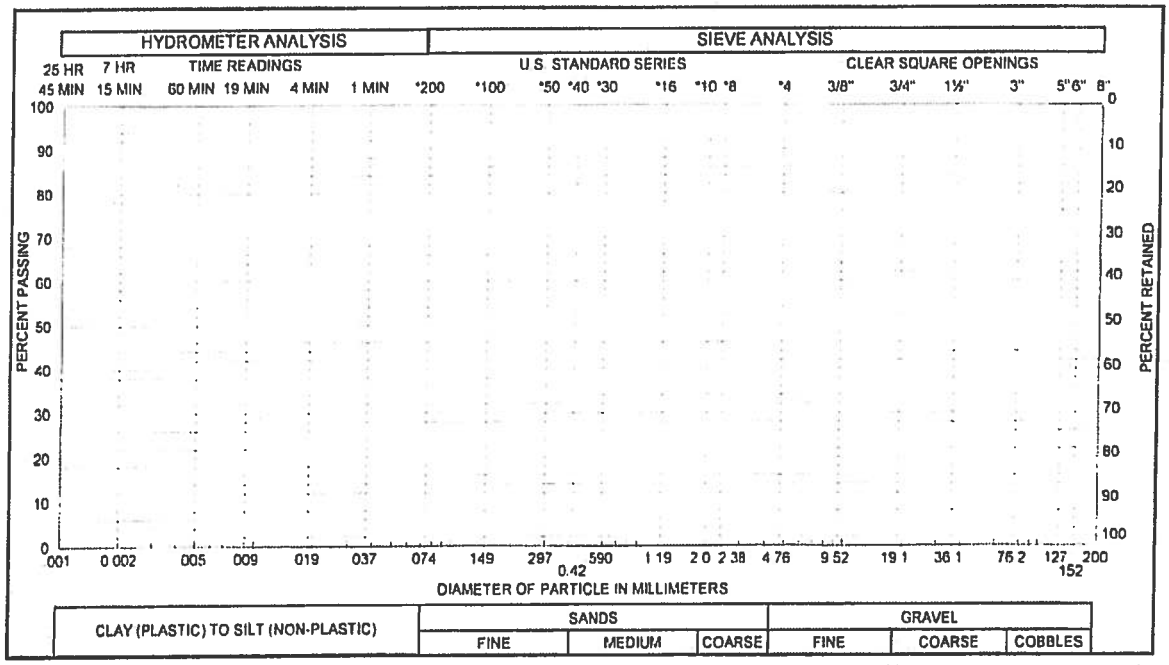
FIG. A-4

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584 000\130\3. Letters\L 1\DN45584-130-L1-X1(grad)



Sample of SAND, CLAYEY (SC)
From Stockpile material used in Direct Shear Test

GRAVEL	1 %	SAND	52 %
SILT & CLAY	47 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

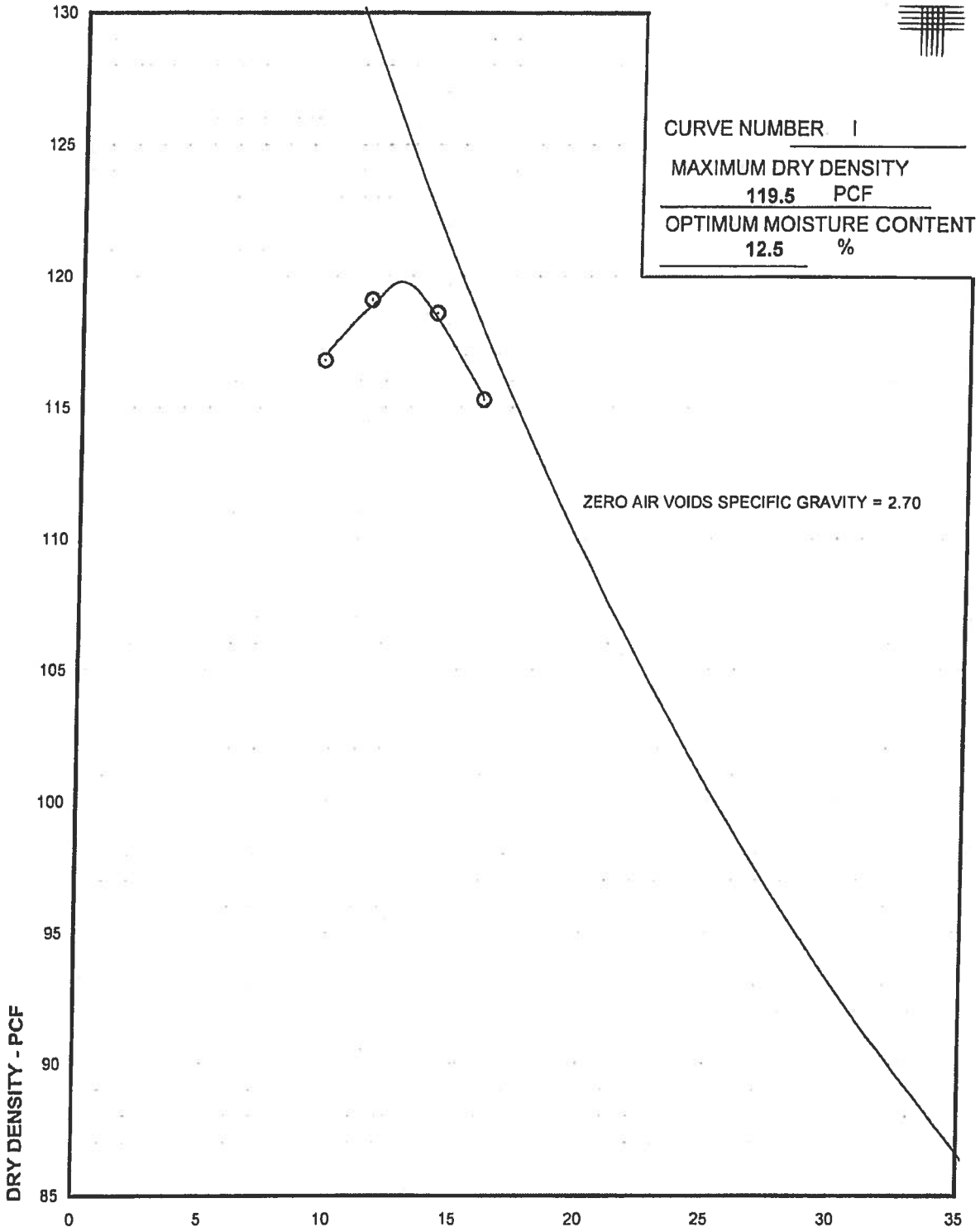


Sample of
From

GRAVEL	%	SAND	%
SILT & CLAY	%	LIQUID LIMIT	%
PLASTICITY INDEX			%

Gradation Test Results FIG. A-5

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584 000\130\3 Letters\L1\DN45584-130-L1-X1(grad)



Sample Description Clay, Sandy, Gravelly

Location Bulk sample from Stockpile

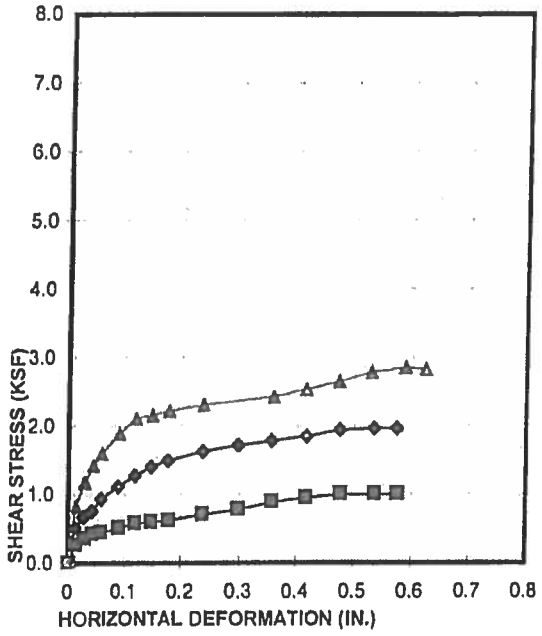
Compaction Test Procedure ASTM D 698
METHOD "A"

LIQUID LIMIT		%
PLASTICITY INDEX		%
GRAVEL	-	%
SAND	-	%
SILT AND CLAY	50	%

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L1\DN45584-130-R1-X3(PROCTOR)

Compaction Test Results

Fig. A -6

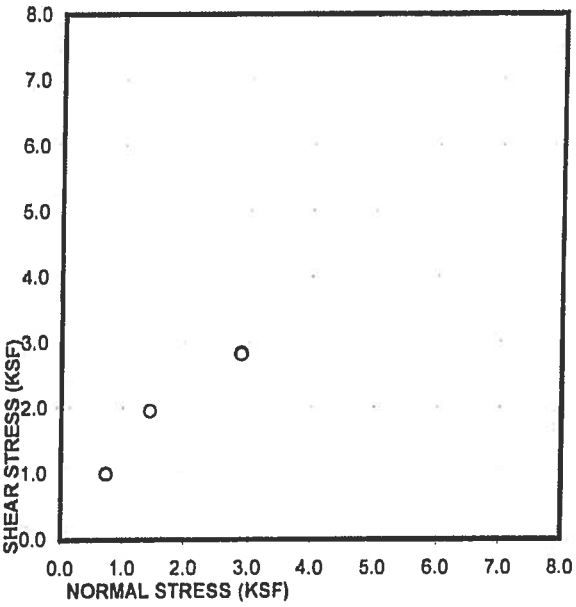


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1 ■	Stockpile		5.7	7.9	105.2
2 ◆	Stockpile		5.7	15.7	105.2
3 ▲	Stockpile		5.7	14.5	105.2

LL, %: 0 PI, %: 0 -200: 0.0 Clay Content, % 0

Thickness (in): 1.5 Diameter (in): 2.873

Shearing Rate (in/min): 0.0063



Sample No.	Normal Stress (KSF)	Peak Shear Stress (KSF) ●	Large Displacement Shear Stress (KSF) ○	Large Displacement Displacement (IN.) ○
1	0.72	1	1	0.37
2	1.44	1.95	1.95	0.37
3	2.88	2.84	2.82	0.37

Peak ϕ (DEG): 39

Large Displacement. ϕ (DEG): 39

Peak C (PSF): 560

Large Displacement C (PSF): 570

Sample Description: Stockpile, Sand, clayey (SC)

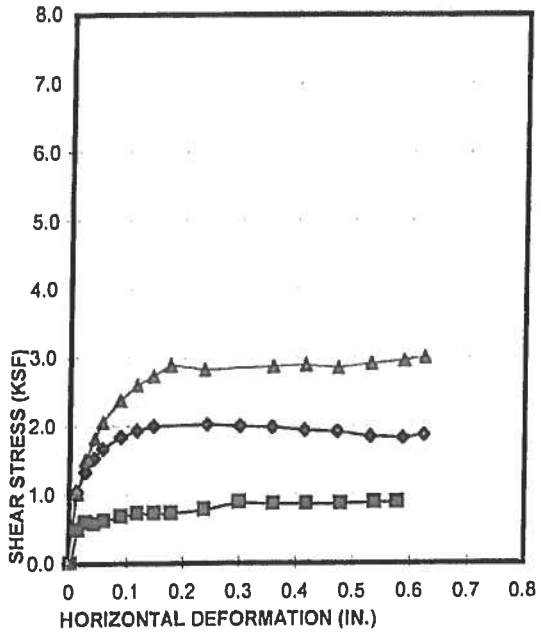
Sample Type: Remold at low density and moisture

Remarks: Plus 4 sieve material replaced with sand

Direct Shear Test Results

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45.584-130
S:\PROJECTS\45500\DN45584.000\130\3. Letters\L1\dn45584 barrow 6% moisture

Fig. A - 7

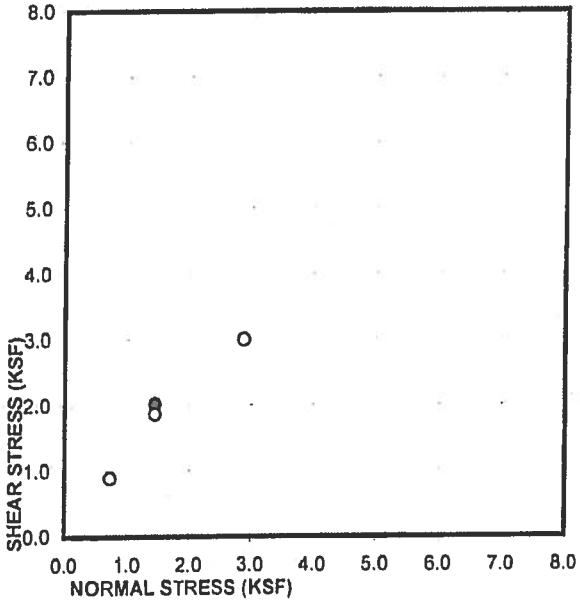


Sample No.		Boring No.	Depth (FT)	Moisture Content (%) Before	After	Dry Density (PCF)
1	■	Stockpile		12.1		113.6
2	◆	Stockpile		12.5	14.9	113.2
3	▲	Stockpile		12.5	14.6	113.2

LL, %: 0 PI, %: 0 -200: 0.0 Clay Content, % 0

Thickness (in): 1.5 Diameter (in): 2.873

Shearing Rate (in/min): 0.0096



Sample No.	Normal Stress (KSF)	Peak Shear Stress (KSF) ●	Large Displacement Shear Stress (KSF) ○	Large Displacement Displacement (IN.) ○
1	0.72	0.89	0.89	0.37
2	1.44	2.02	1.87	0.37
3	2.88	3	3	0.37

Peak ϕ (DEG): 43

Large Displacement. ϕ (DEG): 44

Peak C (PSF): 400

Large Displacement C (PSF): 320

Sample Description: Stockpile

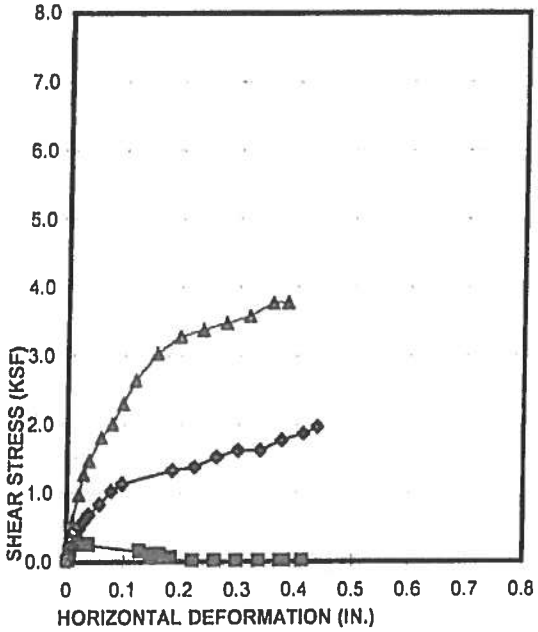
Sample Type: Remold at approximately 95% maximum ASTM D698 dry density

Remarks: Plus 4 material replaced with sand

Direct Shear Test Results

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L11\dn-45584 barrow per Proctor

Fig. A - 8

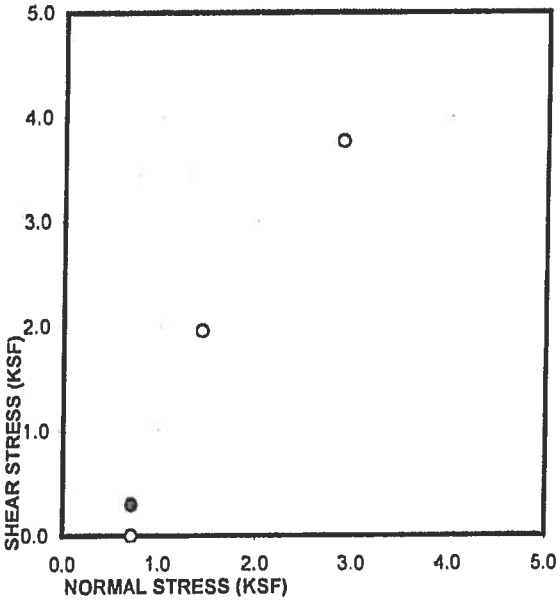


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1 ■	Tailings	0.00	1.6	28.9	64.2
2 ◆	Tailings	0.00	1.6	26.7	64.2
3 ▲	Tailings	0.00	1.6	25.8	64.2

LL, %: 0 PI, %: 0 -200: 0.0 Clay Content, % 0

Thickness (in): 1.5 Diameter (in): 1.935

Shearing Rate (in/min): 0.0063



Sample No.	Normal Stress (KSF)	Peak Shear Stress (KSF) ●	Large Displacement Shear Stress (KSF) ○	Large Displacement Displacement (IN.) ○
1	0.72	0.29	0	0.37
2	1.44	1.96	1.96	0.37
3	2.88	3.77	3.77	0.37

Peak ϕ (DEG): 52

Large Displacement. ϕ (DEG): 51

Peak C (PSF): 0

Large Displacement C (PSF): 0

Sample Description: Tailings

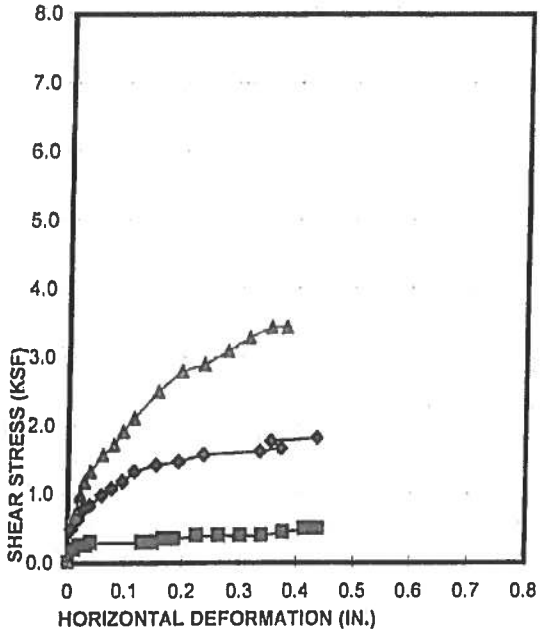
Sample Type: Placed in shear ring with no compaction prior to application of normal stress

Remarks: Silt and clay content reduced 12 percent.

Direct Shear Test Results

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L1\dn-45584 tailings no compaction

Fig. A - 9

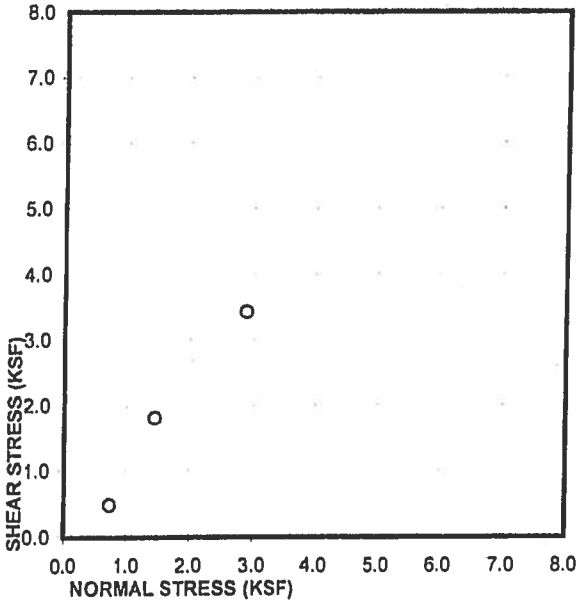


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1 ■	Tailings		1.8	31.3	66.9
2 ◆	Tailings		1.8	28.6	66.9
3 ▲	Taillngs		1.8	27.6	66.9

LL, %: 0 PI, %: 0 -200: 0.0 Clay Content, %: 0

Thickness (in): 1.5 Diameter (in): 1.935

Shearing Rate (in/min): 0.0063



Sample No.	Normal Stress (KSF)	Peak Shear Stress (KSF) ●	Large Displacement Shear Stress (KSF) ○	Large Displacement Displacement (IN.) ○
1	0.72	0.49	0.49	0.37
2	1.44	1.81	1.81	0.37
3	2.88	3.43	3.43	0.37

Peak ϕ (DEG): 50

Large Displacement. ϕ (DEG): 50

Peak C (PSF): 0

Large Displacement C (PSF): 0

Sample Description: Tailings

Sample Type: Slightly tamped prior to application of normal stress

Remarks: Silt and clay content reduced 12 percent

Direct Shear Test Results

THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L1\dn-45584 direct shear Tailings

Fig. A-10

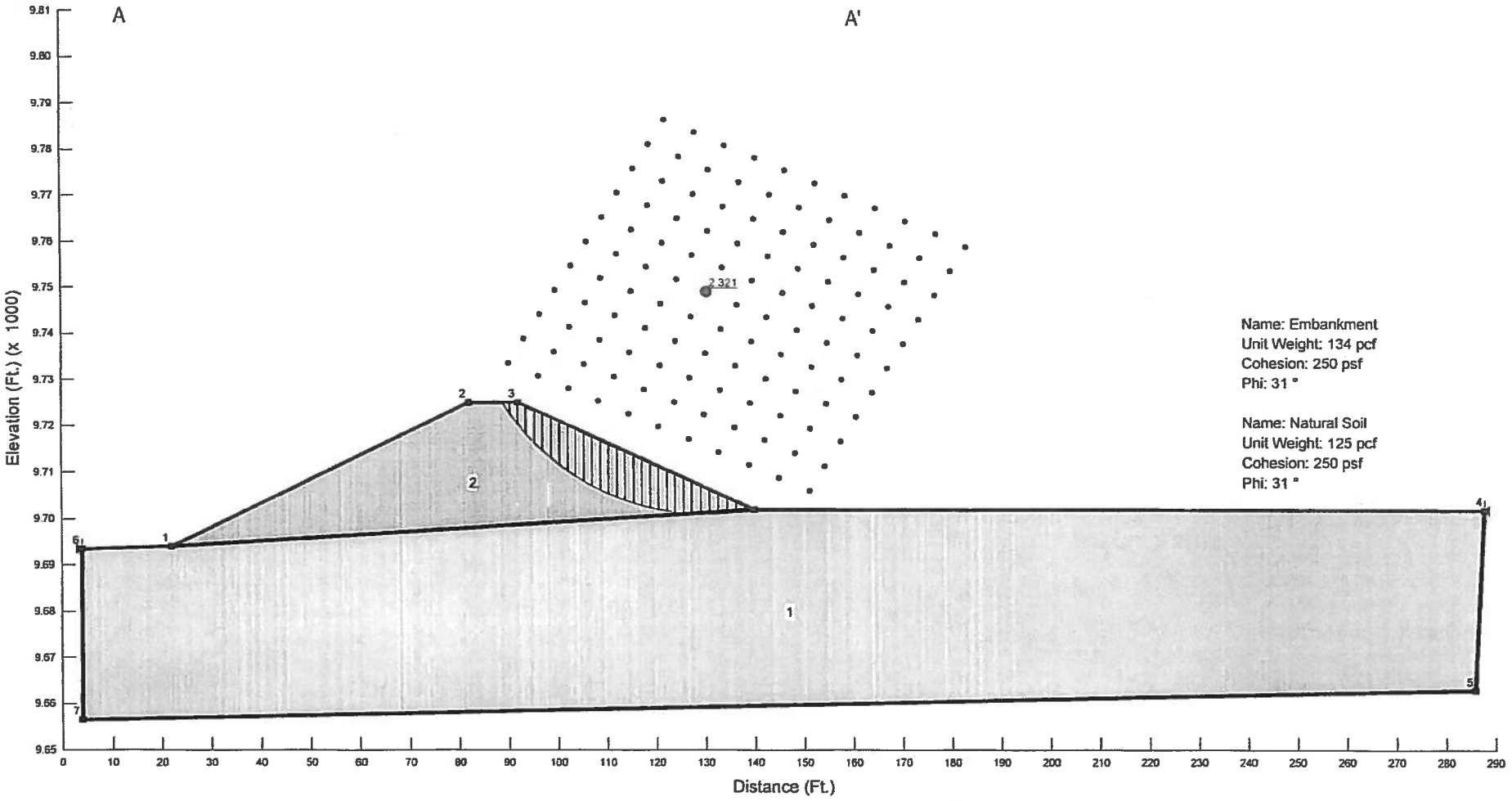
TABLE I

SUMMARY OF LABORATORY TEST RESULTS

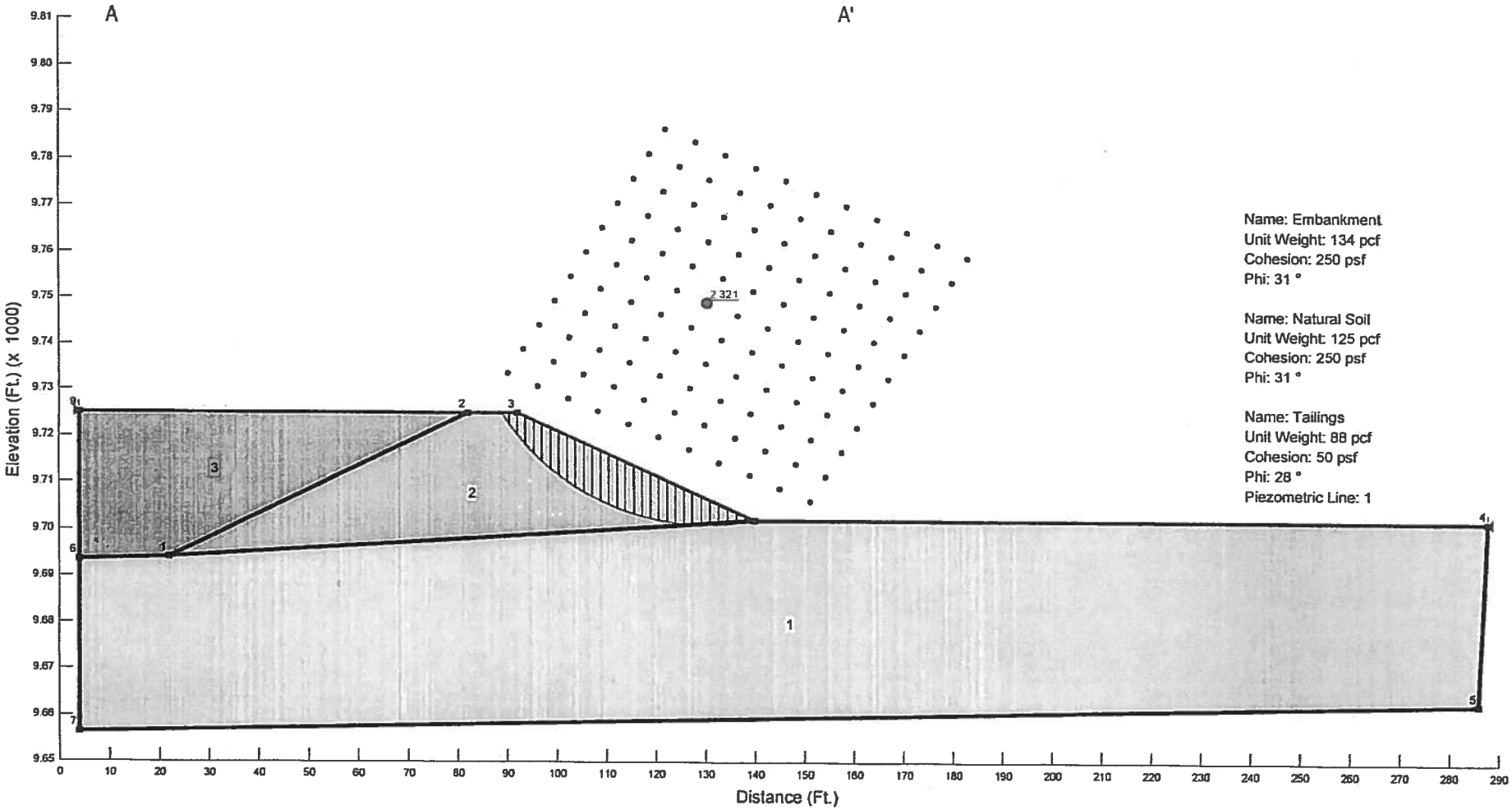
BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
TH-1	4	13.4		58	CLAY, SANDY (CL)
TH-1	4	13.1	117		CLAY, SANDY (CL)
TH-1	9	7.8			SAND, CLAYEY (SC)
TH-2	1	18.2		58	CLAY, SANDY (CL)
TH-2	4	6.9			CLAY, SANDY (CL)
TH-2	6	8.6		52	CLAY, SANDY (CL)
TH-2	11	4.6		23	SAND, CLAYEY (SC)
TH-2	14	5.5	118		CLAY, SANDY (CL)
TH-2	19	5.2	118		CLAY, SANDY (CL)
TH-2	21	4.7		20	SAND, CLAYEY (SC)
COMBINED SAMPLE		1.4		50	CLAY, SANDY (CL)
BULK SAMPLE				50	CLAY, SANDY (CL)

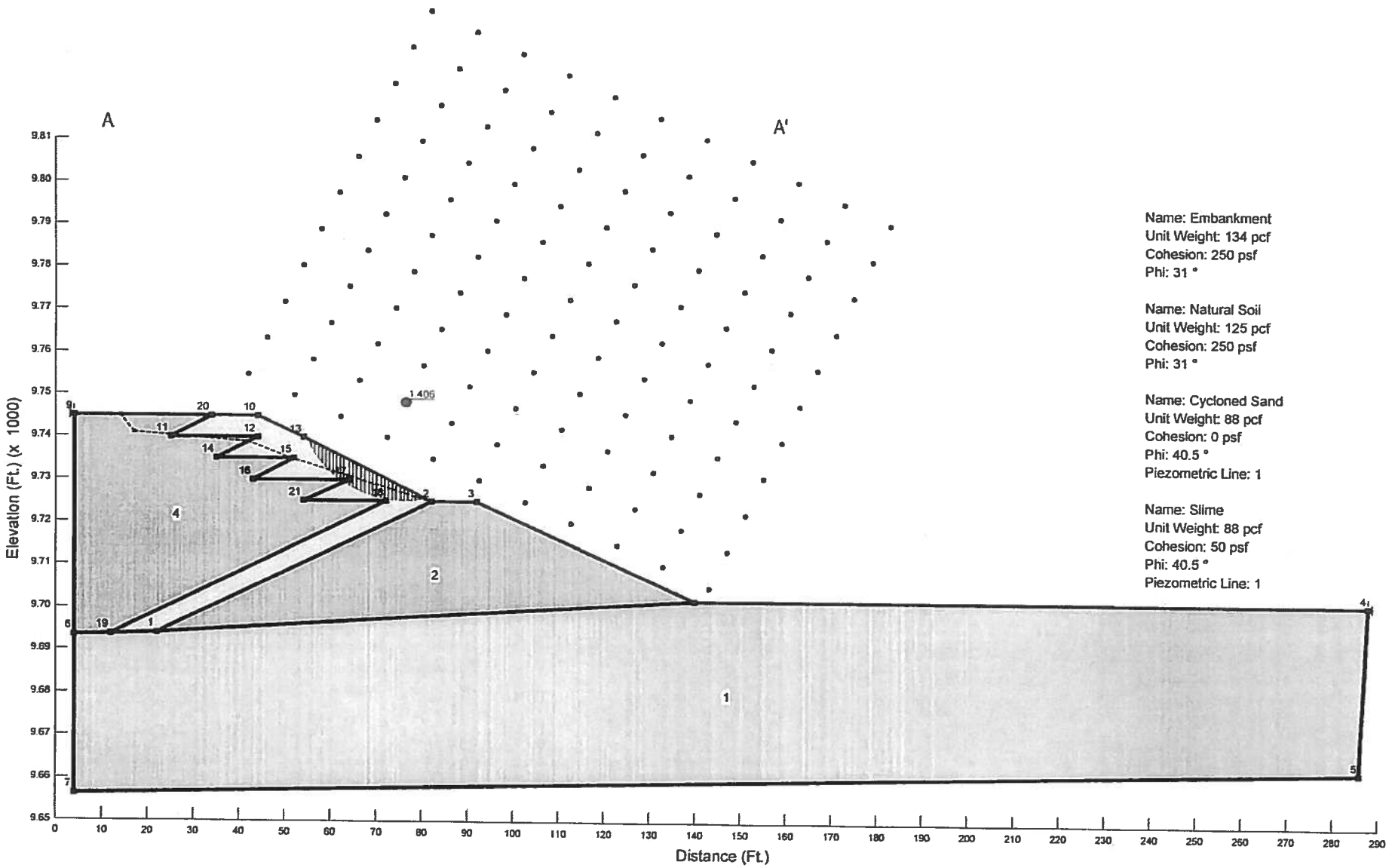
APPENDIX B

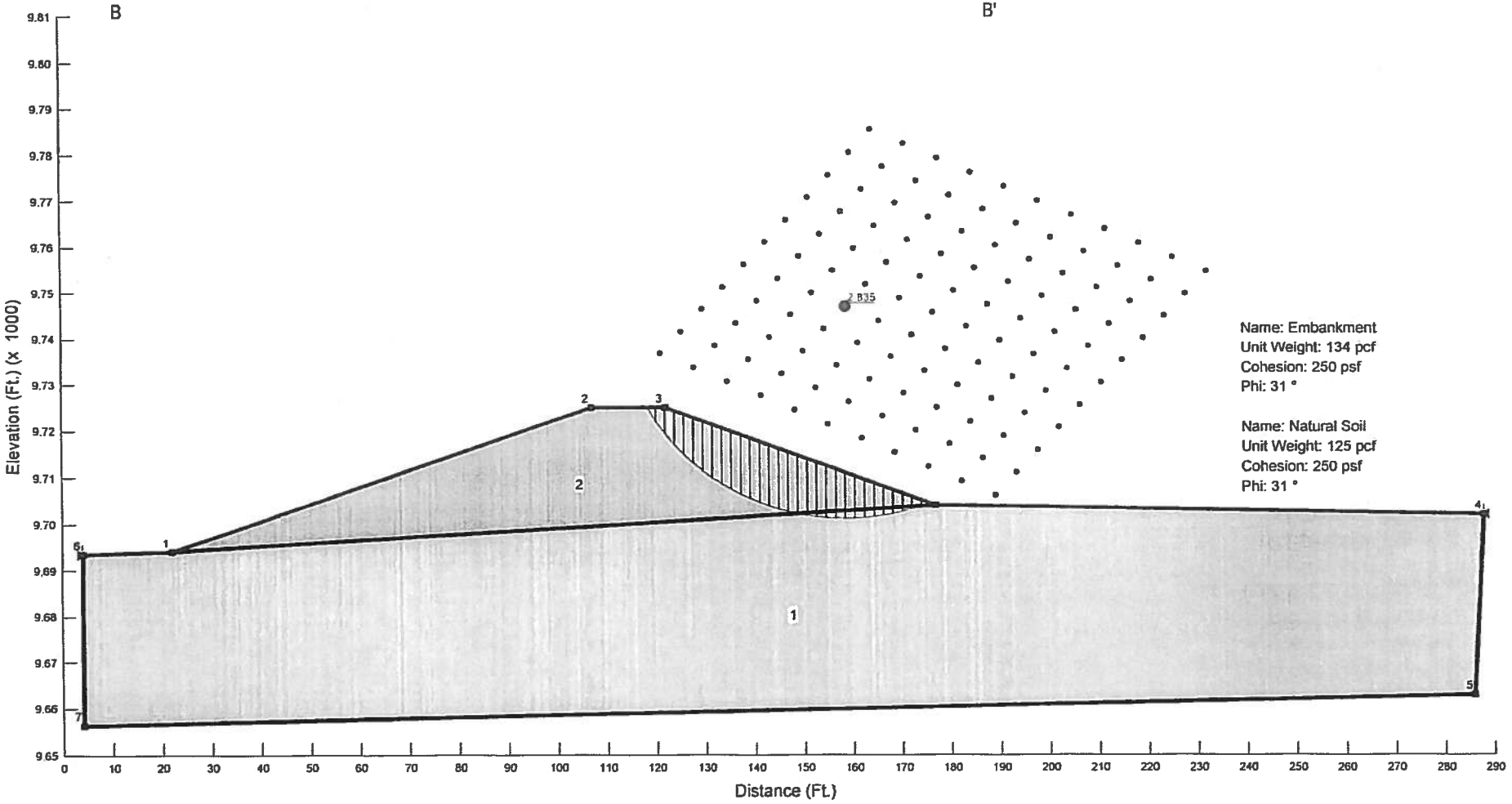
SLOPE STABILITY ANALYSIS


A
A'
Elevation (Ft.) (x 1000)
9.81
9.80
9.79
9.78
9.77
9.76
9.75
9.74
9.73
9.72
9.71
9.70
9.69
9.68
9.67
9.66
9.65
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
Distance (Ft.)
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °

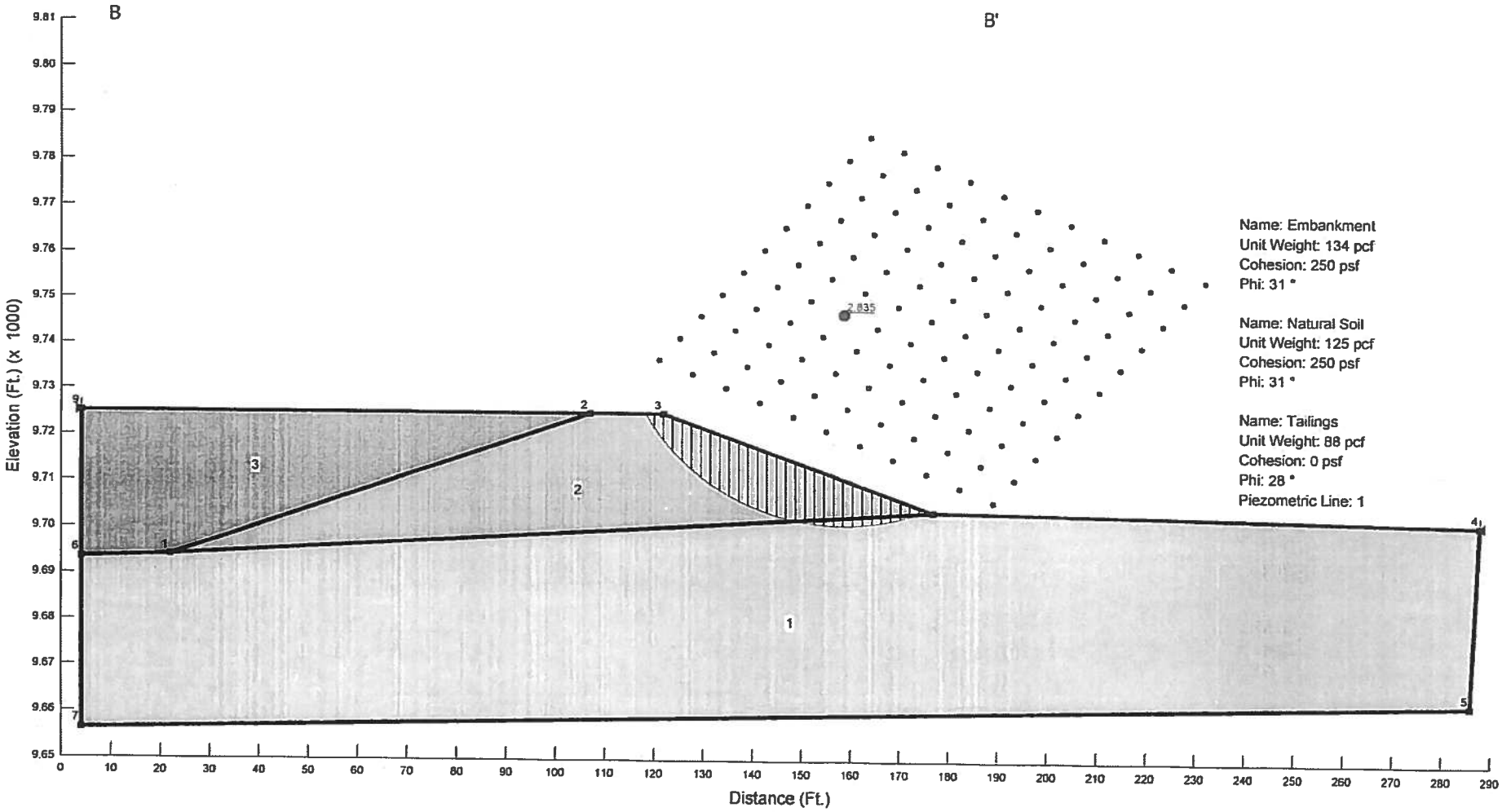
B-1

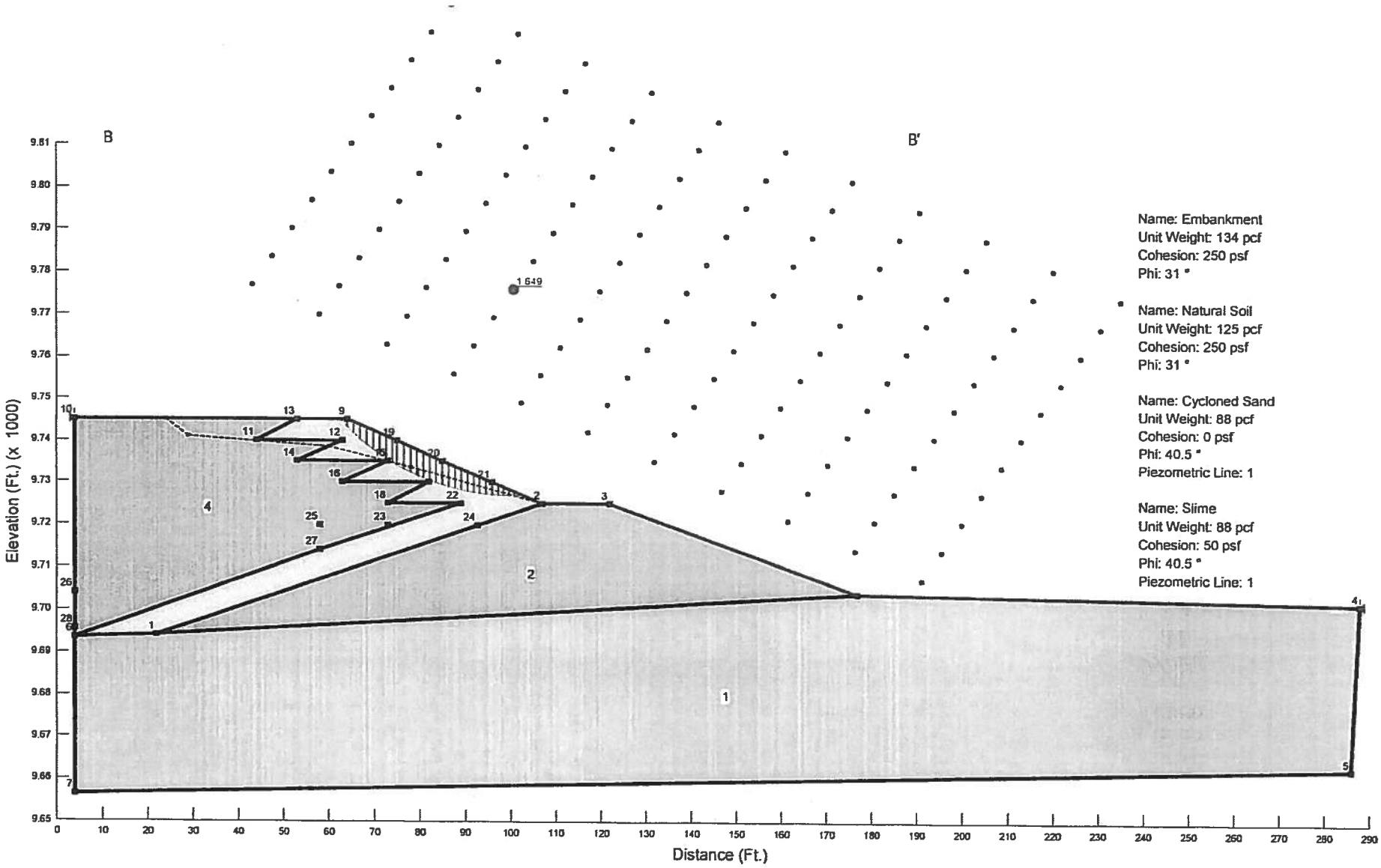

A
A'
Elevation (Ft.) (x 1000)
Distance (Ft.)
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Tailings
Unit Weight: 88 pcf
Cohesion: 50 psf
Phi: 28 °
Piezometric Line: 1


A
A'
1.406
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Cycloned Sand
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 40.5 °
Piezometric Line: 1
Name: Slime
Unit Weight: 88 pcf
Cohesion: 50 psf
Phi: 40.5 °
Piezometric Line: 1
Elevation (Ft.) (x 1000)
Distance (Ft)


B
B'
Elevation (Ft.) (x 1000)
9.81
9.80
9.79
9.78
9.77
9.76
9.75
9.74
9.73
9.72
9.71
9.70
9.69
9.68
9.67
9.66
9.65
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
Distance (Ft.)
1
2
3
4
5
6
7
2.835
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °

B4


B
B'
Elevation (Ft.) (x 1000)
9.81
9.80
9.79
9.78
9.77
9.76
9.75
9.74
9.73
9.72
9.71
9.70
9.69
9.68
9.67
9.66
9.65
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
Distance (Ft.)
1
2
3
4
5
6
7
9
2.835
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Tailings
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 28 °
Piezometric Line: 1


B
B'
1.649
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Cycloned Sand
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 40.5 °
Piezometric Line: 1
Name: Slime
Unit Weight: 88 pcf
Cohesion: 50 psf
Phi: 40.5 °
Piezometric Line: 1
Elevation (Ft.) (x 1000)
Distance (Ft.)

APPENDI□ C

PREVIOUS □ ORK

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

March 9, 1990

State of Colorado
Division of Water Resources
1313 Sherman Street
Room 818
Denver, Colorado 80203

Subject: Notice/Installation of Observation Holes
Leadville Mining & Milling Mill
Near Leadville, Colorado
Job No. 16,768

Gentlemen:

This letter is notice to the State of Colorado pursuant to Leadville Mining and Milling installing one (1) or two (2) observation holes on their property near Leadville, Colorado. Please be advised of the following:

1. Owners name: Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

2. Location: A portion of Sections 28 and 33, T. 9S., R. 80W., 6th P.M., County of Lake, State of Colorado.

3. Number and Type of Holes: One (1) or two (2) observation holes for the purpose of periodically measuring depth to groundwater will be installed.

4. Estimated Depths: The estimated depth of the observation holes is 20 feet.

Please call the undersigned if additional information is needed. Installation of the proposed observation holes will be during the week of March 12, 1990. Please advise if this is not acceptable to the State of Colorado.

Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holiday, P. E.
Principal Engineer

FJH:tl
(3 copies sent)

cc: Mr. Don Wilson
Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

1971 WEST 12TH AVENUE • DENVER COLORADO 80204 • (303) 825-0777

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

April 10, 1990

Mr. Don Wilson
Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

Subject: Permeability Study
Tailing Pond Area
Leadville Mining & Milling Corporation Mill
Near Leadville, Colorado
Job No. 16,768

Dear Mr. Wilson:

Please find enclosed (a) five copies of our report for our permeability study, (b) five copies of our letter regarding the installation of the observation hole required by Lake County, (c) a copy of the State permit for the observation hole and (d) a copy of the letter to the State showing the summary log and construction of the observation hole they require.

Note the last line of the first paragraph of the State permit letter requires the observation hole be plugged or permanently permitted within one year. It takes several weeks to get a permanent permit which would have held up placing the hole, therefore, we choose to notify the State of the construction of the hole. We are available to help Leadville Mining & Milling Corporation to permanently permit the observation hole, if desired.

Thank you for retaining our firm for the permeability study. Please call when we can be of further service.

Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:dd
1 copy sent w/enclosures

1971 WEST 12TH AVENUE • DENVER, COLORADO 80204 • (303) 825-7277

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

April 10, 1990

State of Colorado
Office of the State Engineer
Division of Water Resources
1313 Sherman Street, Room 818
Denver, Colorado 80203

Attention: Mr. Fred M. Lee
Water Resources Geologist
Ground Water Section

Subject: Installation of Observation Hole
Leadville Mining & Milling Mill
Near Leadville, Colorado
Colorado File No. MH-15950
CTL/Thompson Job No. 16,768

Gentlemen:

Please find enclosed a copy of the location, summary log and observation hole construction for the observation hole MH-15950 at the Leadville Mining & Milling Mill near Leadville, Colorado. Observation hole MH-15949 was not constructed.

Please call the undersigned with questions.

Very truly yours,

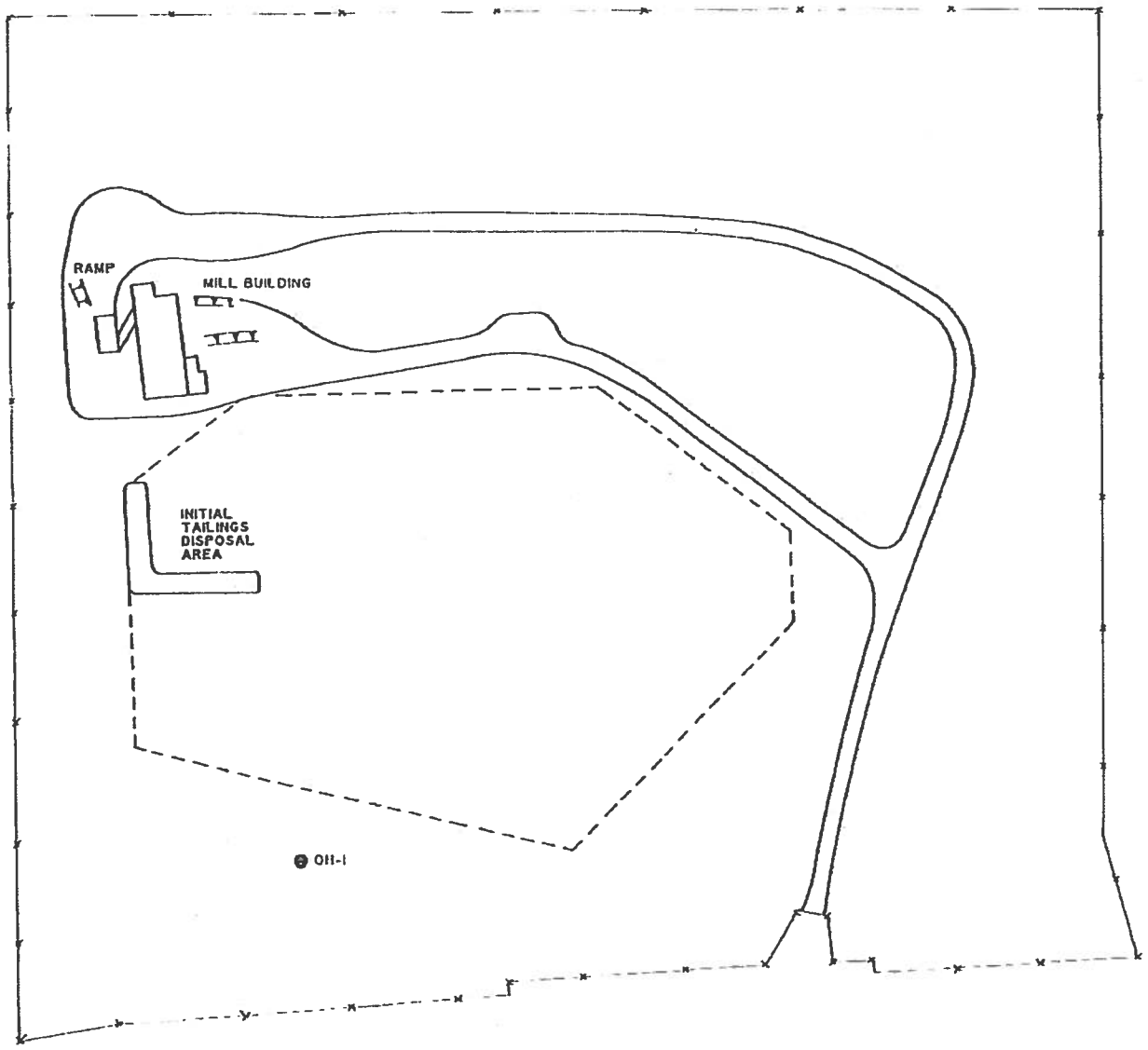
CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:bdd
(1 copy sent)

cc: Mr. Don Wilson
Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

1971 WEST 12TH AVENUE • DENVER COLORADO 80204 • (303) 825-0777



N

SCALE: 1" = 100'

LEGEND:

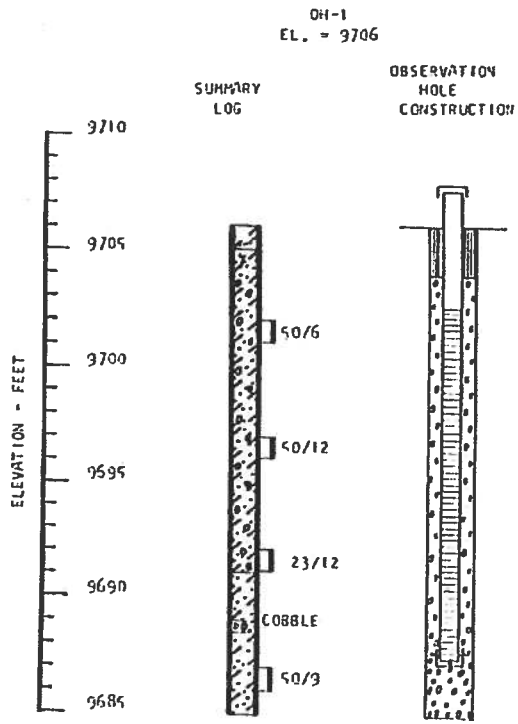
OH-1
INDICATES LOCATION OF OBSERVATION HOLE

NOTE:
MILL LOCATED IN SECTIONS 28 & 33, T 9 S, R 80 W, LAKE COUNTY, COLORADO

LOCATION OF OBSERVATION HOLE

JOB NO. 16,768

FIG. 1



NOTES:

1. THE OBSERVATION HOLE WAS DRILLED MARCH 16,1990 WITH A 6-INCH DIAMETER CONTINUOUS FLIGHT AUGER.
2. THE OBSERVATION HOLE ELEVATION IS APPROXIMATE AND WAS TAKEN FROM A MAP PROVIDED BY LEADVILLE MINING AND MILLING CORP.

LEGEND - SUMMARY LOG:

CLAY, STIFF, SANDY, GRAVELLY, MOIST, RED-BROWN (CL)

GRAVEL, DENSE, VERY CLAYEY, VERY SANDY, MOIST, RED-BROWN (GC)

SAND, DENSE, VERY CLAYEY, GRAVELLY, MOIST, RED-BROWN (SC)

DRIVE SAMPLE. THE SYMBOL 50/6 INDICATES THAT 50 BLOWS OF A 140 POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5 INCH O.D. SAMPLER 6 INCHES.

LEGEND - OBSERVATION HOLE CONSTRUCTION:

INDICATES PIPE CAP

INDICATES 4 INCH INSIDE DIAMETER PLASTIC PIPE

INDICATES 4 INCH INSIDE DIAMETER PLASTIC WELL SCREEN

INDICATES SCREEN COVERING PIPE BOTTOM

INDICATES CONCRETE IN ANULAR SPACE AROUND PIPE

INDICATES GRAVEL PACK IN ANULAR SPACE AROUND PIPE

SUMMARY LOG OF OBSERVATION HOLE AND OBSERVATION HOLE CONSTRUCTION

JOB NO. 16,768

FIG. 2

CTL|THOMPSON

August 17, 2011

The Union Milling Company
PO Box 36099
Denver, Colorado 80236

Attention: Mike Elder
John Danio

Subject: Slope Stability Evaluation
Tailings Pond Embankment and Future Tailings Slope
Union Mill
Leadville, Colorado
Project No. DN45,584-130

CTL|Thompson, Inc. analyzed the stability of the proposed Union Milling Company tailings pond embankment and future tailings slope and presented results in a letter dated July 8, 2011. As part of our evaluation, we performed direct shear tests on samples of tailings materials you provided. A gradation analysis was performed on the sample and it contained a minus 200 fraction of about 50 percent. Based upon information in Vick[1], single-stage cycloning reduces the minus 200 fraction of the tailings by about 30-40%[1]. We attempted to duplicate this reduction on the sample used in the previous direct shear tests. The sample tested represented a reduction of only 12%.

After our July 8 letter, we prepared an additional sample and achieved a reduction of 30%. The gradations for the tailings sample and the "modified sample" are shown on Figure 1. A direct shear test was performed on the modified sample and results are shown on Fig. 2. During this test, the shear rate was increased because we observed soil particles had migrated out of the sample during the previous tests which may have influenced the results. An internal angle of friction of 35 degrees was measured during the latest test. This result compares well with published literature.

Vick indicates that cycloned materials typically flow as a thick, ropy discharge and assume an angle of repose of 3:1 (18 degrees) to 4:1 (14 degrees). If we use the internal angle of friction of 35 degrees and a slope angle of 14 to 18 degrees, the infinite slope factor of safety for 3:1 and 4:1 slope is 2.1 and 2.8; respectively. These values represent the minimum factors of safety assuming no water surface develops in the tailings materials above the embankment.

We also used the results of the latest direct shear testing to evaluate slope stability including a water surface develops in the tailings materials. Example results are shown in Appendix A. We assumed the cycloned sand would form "wedges" with 3:1 outer and internal slopes. We analyzed two potential water

[1] "Planning, Design, and Analysis of Tailings Dams" by Steven G. Vick, 2nd Printing, 1990

surfaces within the tailings materials, including assumptions that (1) water could rise to the upward extend of tailings slime, and (2) the water would only rise to the lower extent of the cyclone sand "wedges." The resulting calculated factors of safety are about 1.3 and 2.1, respectively, if the tailings slime is assumed to have the same angle of internal friction as the cycloned sand (35 degrees), and 1.2 and 2.1 if the friction angle for the slime is 30 degrees. We note our analysis was based on a 3:1 outslope. If the cycloned sand flows to a less steep configuration, slope stability will also be enhanced (i.e. a higher factor of safety).

As one would expect, the calculated factor of safety decreases as the assumed water surface rises toward the outward slope. We believe that if the water surface in the decant pool is controlled at about 5 feet below the crest of the cycloned sand, adequate slope stability will be maintained. In no case should the water level in the decant pool be allowed to rise to the crest of the cycloned sand. We note our analysis was based on a 3:1 outslope. If the cycloned sand flows to a less steep configuration, slope stability will also be enhanced (i.e. a higher factor of safety).

If we can be of further service in discussing either the contents of this letter or the analysis of the influence of subsurface conditions on the design of the proposed tailings facility, please call.

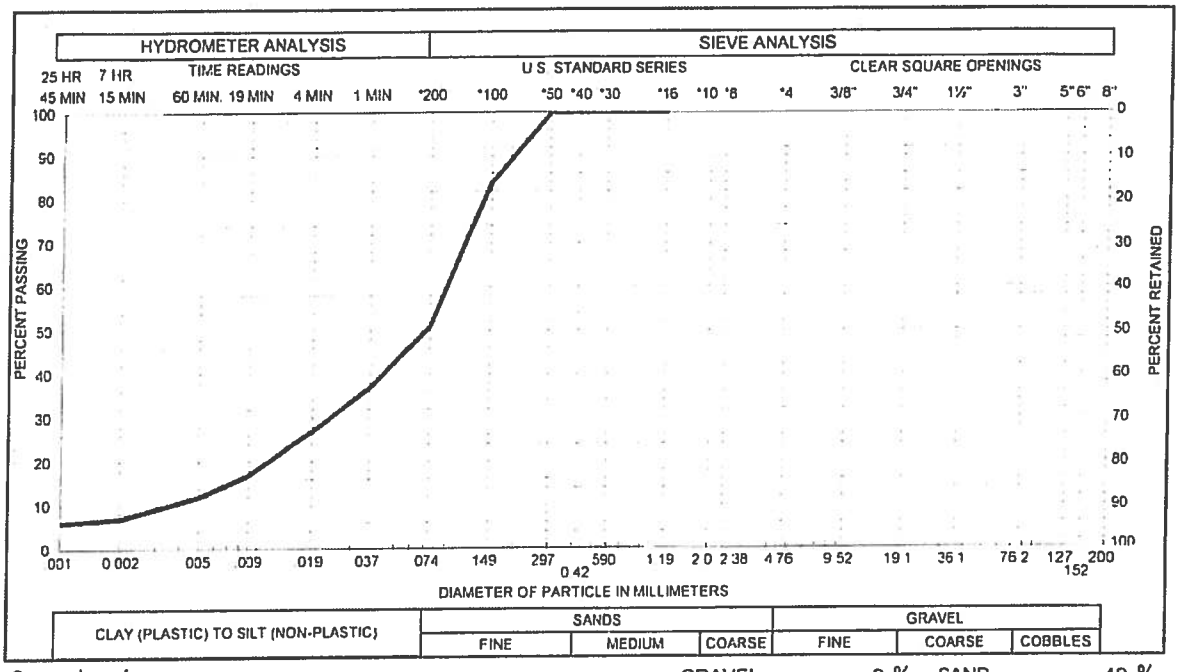
Very truly yours,

CTL | THOMPSON, INC.

Ronald M. McOmber, P.E., D.GE
Chairman & CEO

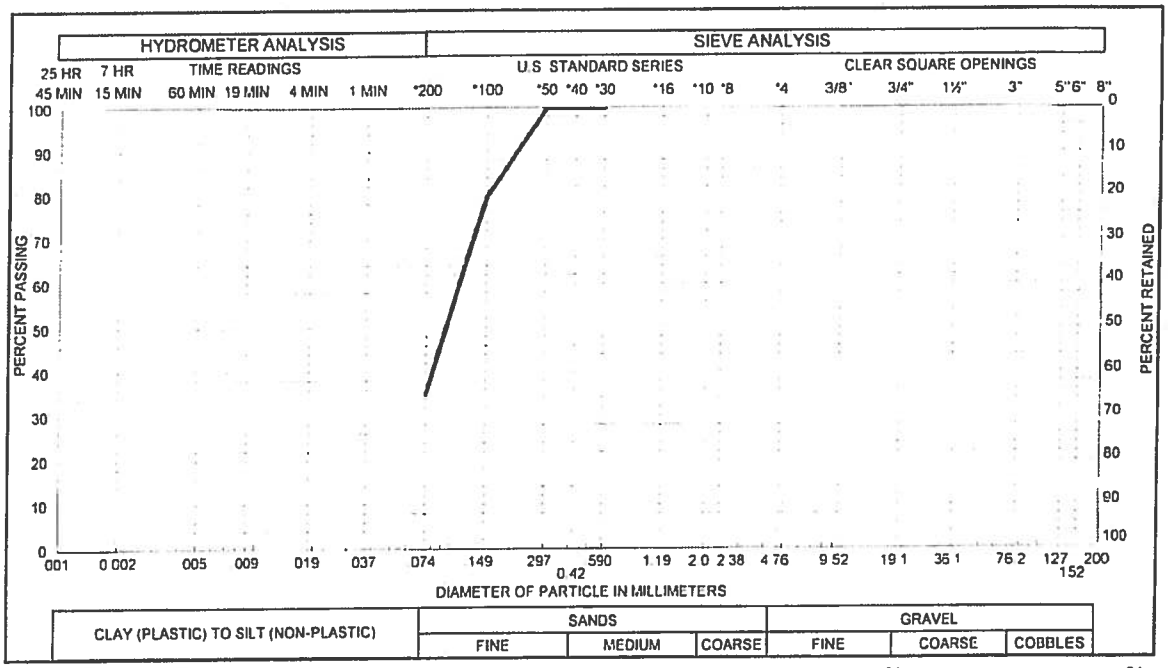
RMM/nt
(3 copies)

via email: melder@unionmilling.com



Sample of TAILINGS
From

GRAVEL	0 %	SAND	49 %
SILT & CLAY	51 %	LIQUID LIMIT	%
PLASTICITY INDEX			%



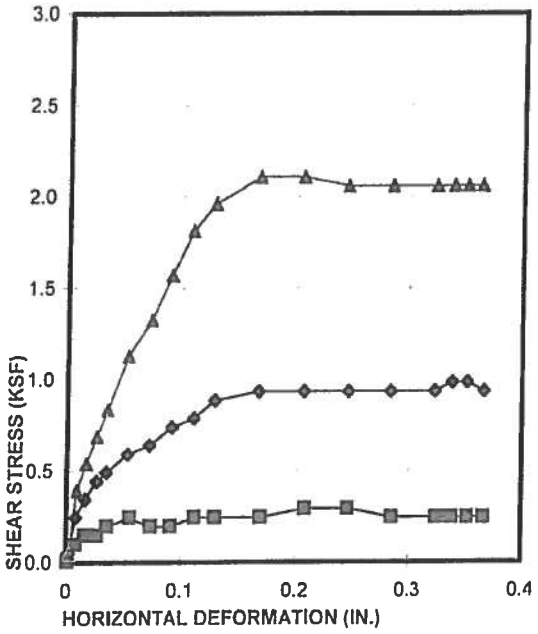
Sample of MODIFIED TAILINGS
From

GRAVEL	%	SAND	%
SILT & CLAY	35 %	LIQUID LIMIT	%
PLASTICITY INDEX			%

Gradation Test Results

FIG. 1

THE UNION MILLING COMPANY
UNION MILL
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L2\DN45584-130-L2-X1(grad)

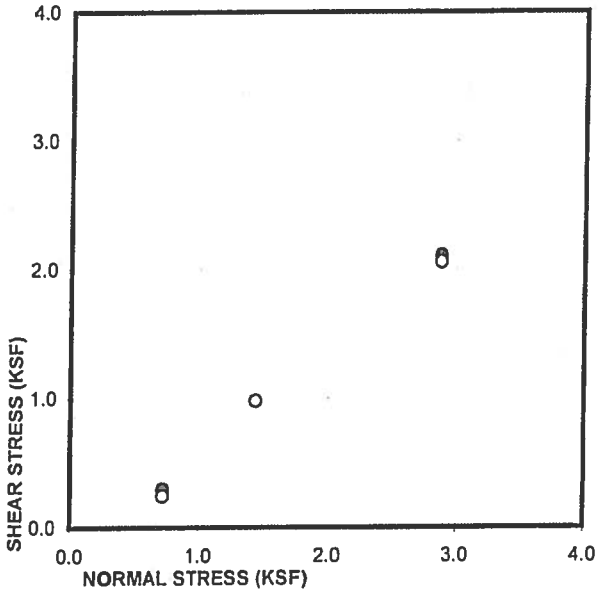


Sample No.	Description	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1 ■	Tailings	0.00	0.6	31.4	68.6
2 ◆	Tailings	0.00	0.6	29.8	68.6
3 ▲	Tailings	0.00	0.6	28.4	68.6

LL, %: 0 Pl, %: 0 -200: 0.0 Clay Content, % 0

Thickness (in): 1.5 Diameter (in): 1.935

Shearing Rate (in/min): 0.019



Sample No.	Normal Stress (KSF)	Peak Shear Stress (KSF) ●	Large Displacement Shear Stress (KSF) ○	Large Displacement Displacement (IN.) ○
1	0.72	0.29	0.24	0.37
2	1.44	0.98	0.98	0.37
3	2.88	2.11	2.06	0.37

Peak ϕ (DEG): 35

Large Displacement. ϕ (DEG): 35

Peak C (PSF): 0

Large Displacement C (PSF): 0

Sample Description: Tailings

Sample Type: Placed in shear ring with no compaction prior to application of normal stress.

Remarks: Silt and clay content reduced 30 percent.

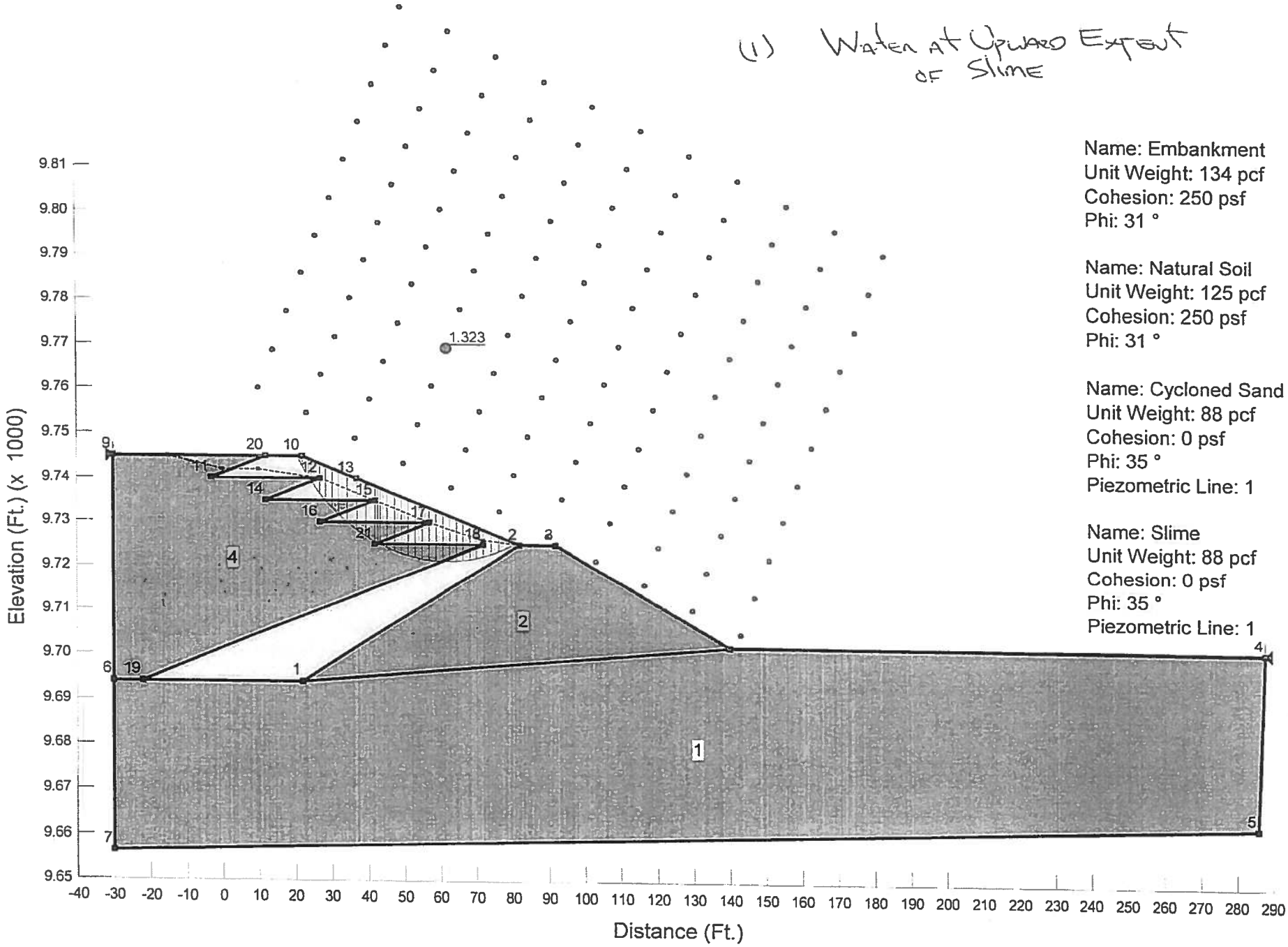
Direct Shear Test Results

THE UNION MILLING COMPANY
UNION MILL
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584.000\130\3 Letters\L2\dn-45584tailings reduced to 35% fines

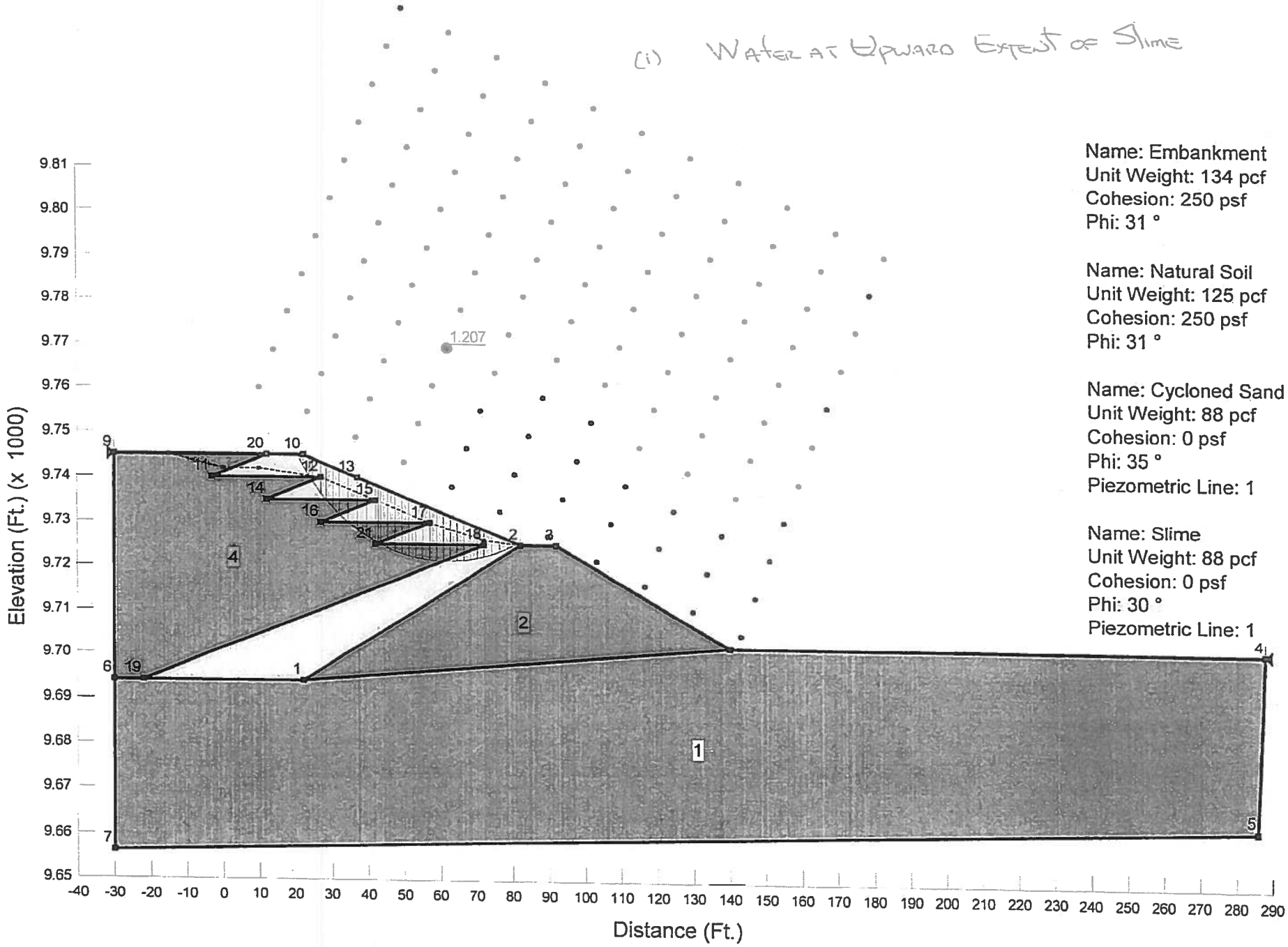
Fig. 2

APPENDIX A
STABILITY ANALYSIS RESULTS

(1) Water at Upward Exit of Slime

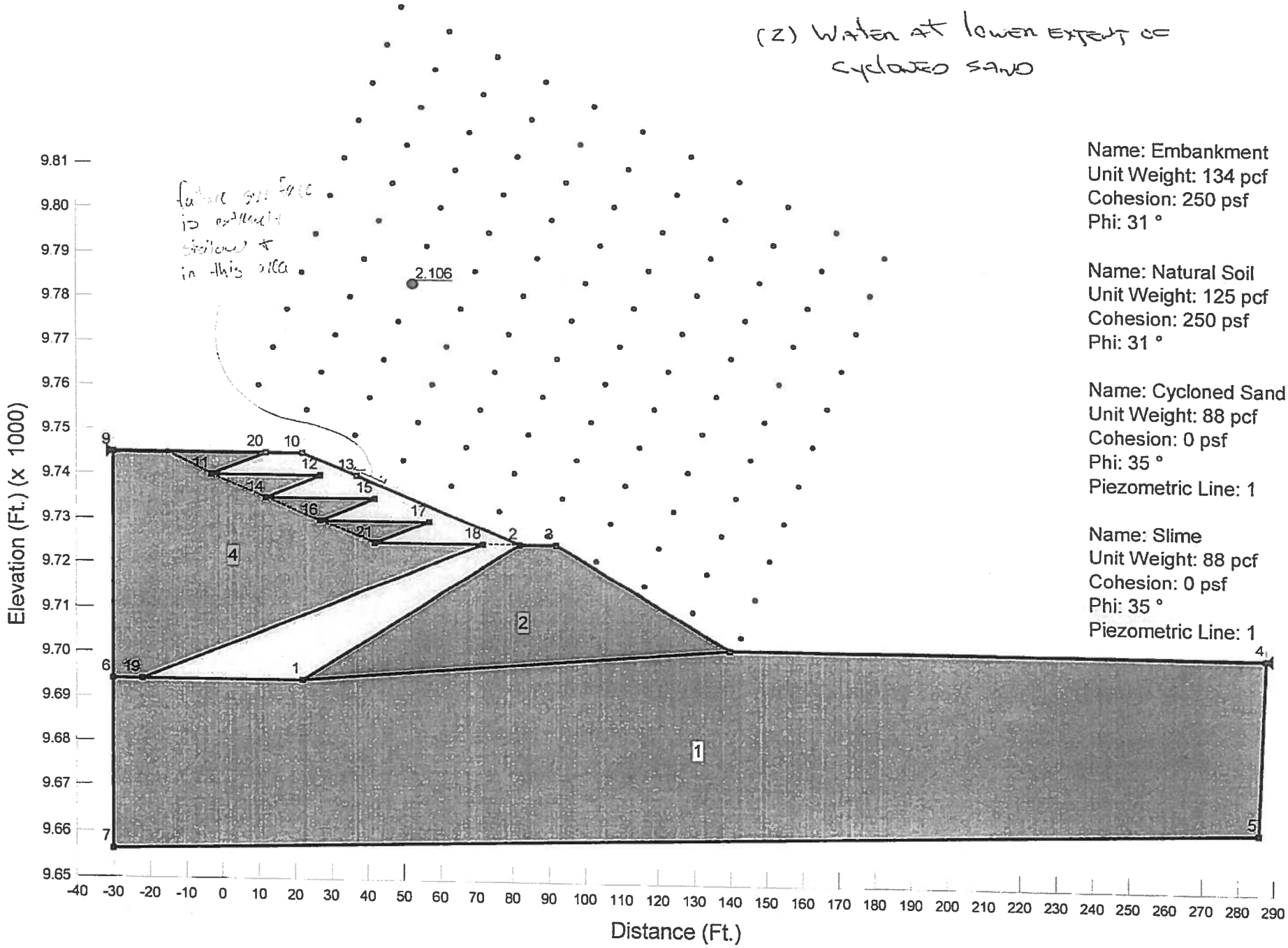


(i) Water at Upward Extent of Slime

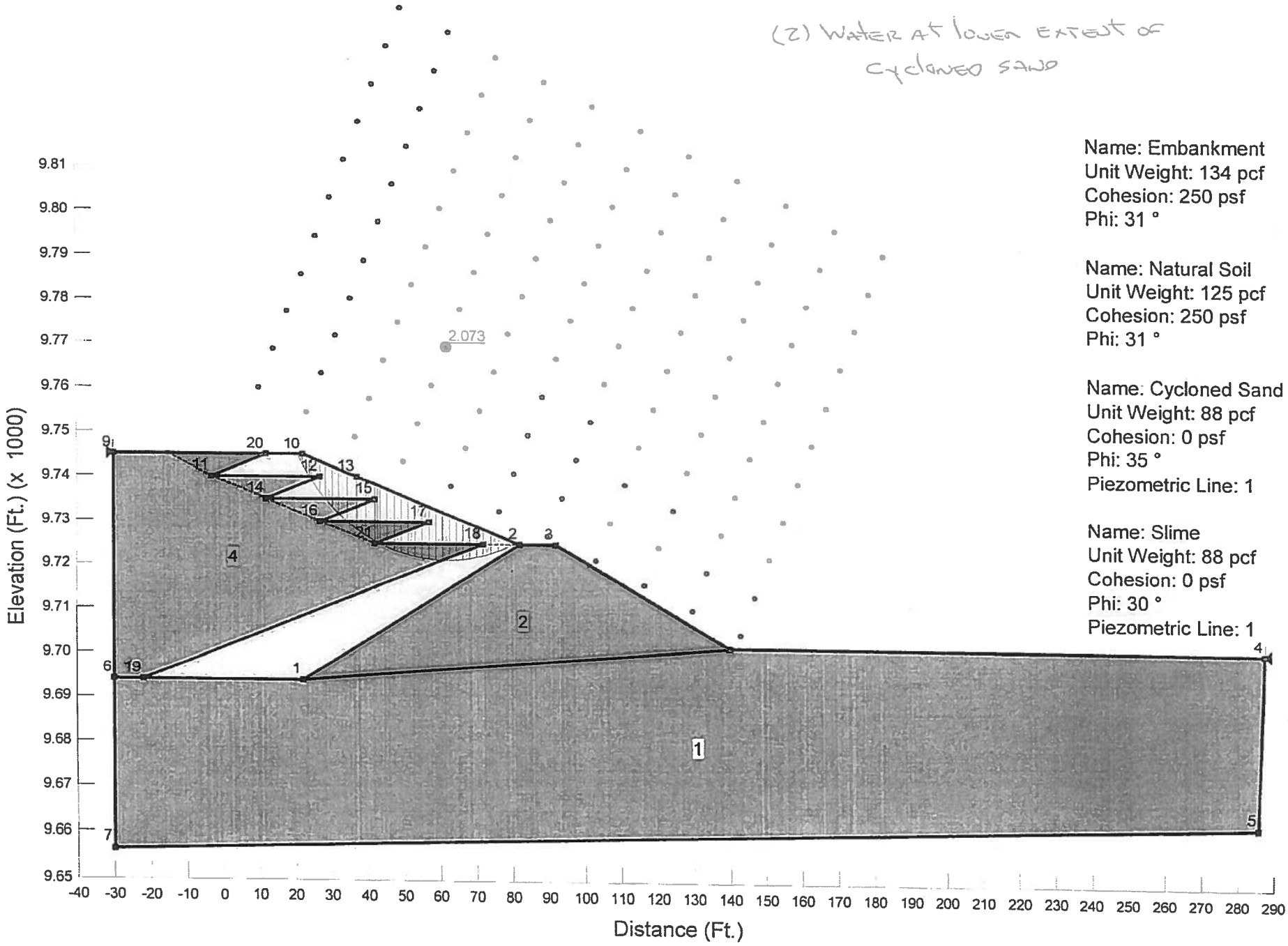


(2) Water at lower extent of cycloned sand

failure surface is outlined shallow & in this area



(2) Water at lower extent of cycloned sand



Appendix A

Slope Stability Evaluation Tailings Pond Embankment and Future Tailing Slope, July 8, 2011

APPENDIX 15-6

GEOTECHNICAL STABILITY
RESPONSE TO CDRMS SLOPE STABILITY EVALUATION

CTL|THOMPSON

September 1, 2011

The Union Milling Company
PO Box 36099
Denver, Colorado 80236

Attention: Mike Elder
John Danio

Subject: Response to Colorado Division of Reclamation, Mining & Safety Memorandum dated August 12, 2011
Slope Stability Evaluation
Tailings Pond Embankment and Future Tailings Slope
Union Mill
Leadville, Colorado
Project No. DN45,584-130

CTL|Thompson, Inc. analyzed the stability of the proposed Union Milling Company tailings pond embankment and approximate future tailings slope and presented initial results in a letter dated July 8, 2011. We subsequently performed additional testing and analysis, and presented supplemental results in a letter dated August 17, 2011. On August 30, you provided a copy of a Colorado Division of Reclamation, Mining and Safety Memorandum from Tim Cazier, P.E. to Michael Cunningham which contains comments regarding our July 8 letter. The purpose of this letter is to address those comments. For clarity, we have numbered our response consistent with the Memorandum.

1. The clay liner permeability units stated in our letter should have been centimeters/second. The specified permeability is $1x10^{-6}$ cm/sec.

2. The stockpile was sampled so that we could include particles larger than those which were obtained during drilling. We consider the stockpile samples to be representative of both the native soils and the materials which will be used to construct the embankment.

3. The site was covered with snow at the time of our field investigation in May and spring melt was in progress. There was a pool of water in the pond adjacent to the exploratory boring. The water found in our boring may be indicative of temporary perched water conditions which develop during snowmelt and the influence of the water within the existing, unlined pond, rather than the "aquifer." In 1995, we drilled an observation hole south of the existing pond and found no water to approximate elevation 9685, or about 9 feet below the proposed excavation level (see Appendix C of July 8 letter).

4. The cyclone tailings will be placed on top of the man-made liner on the inside face of the embankment. We differentiated between cyclone sands and slime in our initial stability analysis because we thought the materials would have slightly differing strength properties. At that time, our direct shear

measurements indicated an angle of internal friction which was higher than published data; we used the upper limit of the published data. (continued in item 5).

5. Additional direct shear tests were performed subsequent to our July 8 letter, and were presented in the August 17 letter. The stability analysis results included in the August 17 letter used the measured friction angle (35 degrees) and zero cohesion for the tailings, which is consistent with the range of drained friction angle provided in Vick Table 2.8 for gold slimes.

6.

a. The configuration of the sand "layer" will be determined by the flow characteristics of the cyclone sand at the time of placement. In our August 17 letter, we used a 3:1 slope for the inside and outside face of the sand. With the same strength parameters used for both the sand and slime, the configuration of the sand has no bearing on computed factors of safety except for the outside slope of the tailings. We believe the 3:1 outside slope is conservative, since literature suggests a 3:1 to 4:1 slope will actually occur.

b. See a.

c. See a. (Our rationale in the July letter was that the increased fines content in the slime would justify some cohesion. Like Mr. Cazier, we re-thought this assumption when we did our supplemental analysis and eliminated the cohesion)

If there are further comments, please contact me.

Very truly yours,

CTL | THOMPSON

COLORADO REGISTERED RONALD M. McCOMBER 20243 PROFESSIONAL ENGINEER

Ronald M. McComber, P.E., D.GE
Chairman & CEO
rmcomber@ctlthompson.com

RMM/nt
(3 copies)

Attachment: Letter dated August 17, 2011

via email: melder@unionmilling.com