McCulley, Frick & Gilman, inc.
providing environmental consulting and engineering services

CONSTRUCTION COMPLETION REPORT

CASH MINE /GOLD HILL MILL
TAILINGS POND EXPANSION
GOLD HILL, COLORADO

December 22, 1998

Prepared for:

ITEC ENVIRONMENTAL COLORADO, INC.
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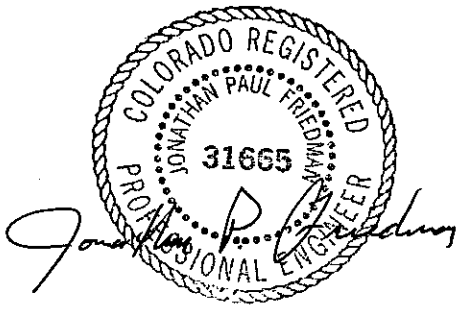
MFG Project No. 5461

CERTIFICATION

I hereby certify that, to the best of my knowledge and based on observations and documentation provided, the construction of the tailings impoundment associated with the Gold Hill Mill, located approximately 0.5 miles east of Gold Hill, Colorado was performed in general accordance with the design plans and specifications and approved project changes as described in this report. No written or otherwise intended guarantee is provided for the integrity or performance of the tailings impoundment.



Jonathan P. Friedman, P.E.
Colorado Registered Professional Engineer
No. 31665

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1.0 INTRODUCTION

This Construction Report documents the construction activity completed at the Cash Mine Gold Hill Mill Tailings Storage Facility (Site), which is located approximately ½ mile east of Gold Hill, Colorado. The work was completed in general accordance with the Design Report prepared by McCulley Frick & Gilman, Inc. (MFG), dated August 5, 1998. Completed construction activities include:

- Excavation of the expanded tailings impoundment basin;
- Placement of biaxial geogrid reinforcement on existing tailings surface;
- Placement and compaction of fill for the embankment raise;
- Excavation and backfill of the geosynthetics anchor trench around Phase 1 area;
- Placement of a sand cushion layer over the entire basin and embankment face;
- Placement of composite Geo-synthetic Clay Liner (GCL) and 60 mil High Density Poly-Ethylene (HDPE) liner in Phase 1 area of impoundment;
- Excavation of 24 inches of existing tailing including all organic matter from original impoundment;
- Placement of 18 to 24 inches of granular material in the area in which the tailings and organics were removed;
- Excavation of a geosynthetics anchor trench around the Phase 2 area;
- Placement of biaxial geogrid reinforcement on remaining exposed tailing surface;
- Placement of buttressing fill on biaxial geogrid and exposed tailing surface;
- Placement of composite GCL and 60 mil HDPE liner in Phase 2 area of impoundment;
- Backfill of the geosynthetics anchor trench around Phase 2 area;
- Placement of erosion control silt fence at the downstream toe of the embankment and topsoil stock pile; and
- Installation of 8 ft wire mesh security/game fence around the tailing impoundment perimeter.

The objectives of this construction report are to document the construction activities and provide as-built drawings of the tailings impoundment facility.

The Gold Hill Mill Tailings Impoundment is located approximately 100 feet northeast of the mill building, as illustrated on the site plan, (Drawing 5461-C1A). The original impoundment encompassed approximately 18,000 ft^2. The expanded tailings impoundment encompasses a total of 48,680 ft^2.

Earthwork activities were implemented under the direction and oversight of ITEC. MFG coordinated field Quality Assurance (QA) of the earthwork. Colorado Lining International (CLI) was the geosynthetics lining contractor. The Colorado Department of Natural Resources Division of Mines Geology (DMG) was present at various times throughout the construction to provide input and address issues during the construction. The earthwork construction activities outlined in the design were performed by Lens Excavating, Inc. under contract to ITEC. Additional excavation and fill placement activities were performed by Max Yeager and KAS Pond & Lagoon, Inc., both under contract to ITEC. Surveying activities were conducted by Mountain Surveying & Mineral Services under contract to ITEC and under the direction of ITEC and MFG.

This Construction Report consists of four major sections. Section 2 presents the 1998 construction chronology. Section 3 presents a discussion of the construction activities completed and addresses modifications to the Design. Section 4 details the QA activities performed throughout the progress of the project.

2.0 CONSTRUCTION CHRONOLOGY

Construction activities associated with the Gold Hill Mill tailings impoundment expansion commenced August 17, 1998 and continued through November 23, 1998. Minor work such as security fencing, embankment slope dressing, and installation of erosion control fencing was completed by December 4, 1998. Construction of the upgradient diversion channel around the tailings impoundment was completed December 18, 1998. A chronology of activities conducted is presented in Table 1.

3.0 CONSTRUCTION ACTIVITIES

The construction activities completed at the Gold Hill Mill tailings impoundment expansion were conducted in general accordance with the design and approved field changes. The following sections highlight the activities conducted to complete the scope of work described in the Design Report.

3.1 Embankment Raise and Phase 1 Basin Excavation

The impoundment basin is divided into two parts referred to as Phase 1 and Phase 2. A divider dike or interim berm separates the two areas as illustrated on Drawing 5461-C2. Material used for the embankment raise was generated from the Phase 1 portion of the tailings impoundment basin. Approximately 8915 cubic yards (cy) of soil and rock were excavated from the Phase 1 basin of which 1400 cy of topsoil were stockpiled for future reclamation purposes. The constructed embankment raise required approximately 7500 cy of fill.

Excavation of the Phase 1 impoundment area was accomplished with a Caterpillar D-10 dozer, ripping the subgrade to the extent that sufficient material was generated before being hauled and placed for the embankment. The loosened material was hauled to the area of placement, placed, spread and compacted with a CAT 966 front-end track loader. This process was repeated until the designed embankment was fully constructed. Quality control compaction testing and construction material laboratory testing was performed by HP Geotechnical, Inc under direction of MFG. Compaction/density conformance testing is presented in Appendix A.

The basin shape was governed by the excavatability of the underlying bedrock. A massive quartz vein trending approximately N 10° W was encountered in the northeast side of the basin, which precluded any further excavation in this direction due to the indurated nature of this material. A slight variation in the embankment alignment was necessary to maintain a safe working distance from overhead electric power lines. The re-alignment occurs at the southern end of the embankment where the crest shifts approximately 5 degrees to the southwest.

Two piezometers (P-1 and P-2) we installed at the locations shown on Drawing 5461-C2. The piezometers were installed approximately 12 feet into the embankment footprint from the upstream embankment toe and were manually advanced to the bottom of the existing pond floor. The piezometers were constructed of 1 inch diameter schedule 40 PVC tubing, with ⅛-inch wide slots cut into the bottom 2 feet. The end was capped and cotton mesh textile was loosely wrapped and secured with electrical tape around the slotted length to prevent clogging of the slotted openings. The as-constructed piezometers are illustrated on Drawing 5461-C7.

Water levels in the piezometers were read regularly to monitor the pore water pressure change in response to increase pressure developed by the overlying embankment fill. Water levels as recorded, are presented Table 2. A graphical representation of the water levels in each piezometer coupled with embankment elevation over time is presented in Figure 1. As illustrated, the water level rose in each piezometer due to the increased load of the embankment; however, over time pore water pressures within the tailings dissipated which is reflected in the decrease in the water level readings. The reduction in pore water pressure is indicative of pore pressure stabilization and increased shear strength of the tailings.

Two settlement plates (S-1 and S-2) were installed near P-1 and P-2, respectively, and surveyed to monitor the amount of consolidation settlement occurring over time due to the increased load of the overlying embankment fill. The location of the settlement plates is shown on Drawing 5461-C2. The settlement plates consisted of a 1.5' x 1.5' galvanized steel plate, with a 12 foot long, 1/4" diameter continuously threaded steel rod bolted on both sides of the plate through the center. A 10 foot length of 1 inch diameter Schedule 40 PVC casing was placed around the steel rod to reduce friction from the surrounding fill. The inner steel rod was continuously threaded to allow for extensions as necessary. . The as-constructed settlement plates are illustrated on Drawing 5461-C7. Settlement plate monitoring readings are presented in Table 3.

3.2 Phase 1 Basin Preparation

The subgrade in the Phase 1 basin area was smoothed with the heavy equipment and manually cleared of loose rock fragments greater than 2 inches in diameter. A cushion layer consisting of a

medium to coarse sand was placed over the entire subgrade surface with a CAT IT28F rubber tired front end loader. The sand cushion layer thickness varied from 2 to 4 inches.

As part of the basin preparation, the geosynthetics anchor trench was excavated prior to the placement of the geosynthetic liners. The Phase 1 geosynthetics anchor trench was excavated using a backhoe excavator. In areas where more resistive material, i.e. massive quartz veins, were encountered, a skid steer mounted pneumatic chisel hammer was used to achieve the required anchor depth and width of 24 inches. The anchor trench was backfilled with the material that was excavated from the trench and compacted once the geosynthetic liners were installed.

3.3 Phase 1 Geosynthetics Installation

Deployment of the geosynthetics liner system consisted of the placement of a Bentofix geosynthetic clay liner (GCL) overlain by 60 mil High Density Poly-ethylene (HDPE) flexible membrane liner. The GCL was deployed from the anchor trench down into the basin. A rubber tired extend-a-load forklift equipped with a spreader bar was used to hold the respective roll of geosynthetic while the material was manually unrolled and placed. The spreader bar was required for ease in un-rolling/deploying the respective material. Once the material was placed as specified, (i.e.). with proper overlap), all seams were welded as per the technical specifications. Quality control, which was performed by CLI, consisted of destructive peal and shear tests on the welds and non-destructive air lance tests and/or vacuum box tests on all seams. Quality control documentation for the weld and seam testing as well as the 'as-constructed' geosynthetic panel layout is presented in Appendix B.

3.4 Phase 2 Basin Preparation

Prior to the placement of geosynthetics in the Phase 2 basin area, all vegetation, and deleterious materials, including tailings, were removed from the existing tailings surface to a maximum depth of 2 feet. Due to the potential upstream instability of the embankment raise as a result of the removal of this material, the biaxial geogrid was extended over the exposed tailings surface area and a minimum of 1.5 ft of granular fill was placed on top of the geogrid to act as a buttress for the embankment. Details

of the embankment buttress are discussed in more detail in Technical Revision No. 1, which is included as part of this report in Appendix C.

Instrumentation

Three settlement plates (S-3, S-4, and S-5) were installed and surveyed to monitor the amount of tailings consolidation occurring over time due to the load of the buttressing fill and subgrade materials. The location of these settlement plates are shown on Drawing 5461-C2. The settlement plates consisted of a 1.5' x 1.5' galvanized steel plate, with a 4 foot long, ¼" diameter threaded steel rod bolted on both sides of the plate through the center. A 2 foot length of 1 inch diameter Schedule 40 PVC casing was placed around the steel rod to reduce friction from the surrounding fill. The inner steel rod was continuously threaded to allow for extensions as necessary. Details of the settlement plate construction and installation are shown on drawing 5461-C7. Settlement plate monitoring readings are presented in Table 3 and a graphical representation of settlement over time is presented in Figure 2.

Relocation and placement of excavated organic matter and tailings

The excavated tailings materials were transported to the Phase 1 area using the access road located along the south side of the impoundment in between the impoundment basin and the mill. Removal of the organic matter and upper 1.5 to 2 feet of existing tailings was accomplished with a track-mounted Link Belt 3400 excavator equipped with a 60 foot boom. The excavator operated from the embankment crest allowing the operator a more advantageous position. This material was then placed in the bucket of of a track-mounted dozer which hauled the tailings around the southern edge of the impoundment, dumping the material at the southwest edge of the Phase 1 basin. This process was repeated until all required material was removed.

Due to excessive moisture caused by an early season snowstorm, a minor modification was made to the Phase 2 basin subgrade section. A detailed description of the field modification is presented in Appendix C. As a result of the discussion between ITEC, DMG and MFG representatives, a detached sheet of scrap of 60 mil HDPE was placed over two separate areas containing excessive moisture to provide a more suitable subgrade for the GCL composite liner.

3.5 Phase 2 Geosynthetics Installation

Prior to the commencement of geosynthetic installation activities, settlement plates S-1, S-2, S-3, S-4, and S-5 and piezometers P-1 and P-2 were decommissioned. Decommissioning entailed cutting the respective apparatus 6 inches below the finished subgrade surface, capping the PVC casing and backfilling to the surrounding subgrade surface.

Deployment of the geosynthetics liner within the Phase 2 area was performed in the same manner as in the Phase 1 area. The installation procedure is the same as described in Section 3.3. Quality control documentation for the weld and seam testing as well as the 'as constructed' geosynthetic panel layout for Phase 2 is presented in Appendix B.

On the afternoon of November 20, 1998, eight panels of geosynthetics averaging 75 feet in length had been deployed, welded and sand bagged by the day's end. Between the evening of November 20, 1998 and early morning of November 21, 1998 high winds lifted the working/leading edge of the geomembrane, forcing the 60 mil HDPE liner to pull out of the partially backfilled anchor trench and tear along the interim berm. None of the GCL panels were displaced. The HDPE material was creased and wrinkled beyond use and had to be cut into scrap pieces. The scrap pieces of HDPE were placed evenly and as flat as possible over the Phase 2 basin floor that had not yet been covered by the GCL. The remainder of the Phase 2 area was lined as designed. Placement of the GCL and HDPE continued without further incident.

3.6 Security/Game Fence

A security fence constructed of wooden and steel posts and wire mesh was erected and is located as shown on Drawing 5461-C2. Fence construction details are illustrated on drawing 5461-C5. The intention of the fence is to provide security as well as keep animals from entering the lined area.

3.7 Surface Water Diversion Ditch

In order to maintain positive drainage away from the tailings impoundment and minimize ponding of water on the placed tailings, a surface water run-on diversion channel was excavated around the western edge of the impoundment. Improvements were also made to the mill/impoundment access road to divert run-off away from the impoundment and mill building foundation area.

4.0 QUALITY CONTROL

Earthworks

Quality control of the embankment fill compaction was done by Hepworth Pawlak Geotechnical, Inc. under the direction of MFG. A total of 53 nuclear densometer tests and three sand cone reference density tests were performed on the embankment fill. Fill compaction frequency testing averaged 1 test per 140 cy placed compared to 1 test per 500 cy as specified in the earthwork specifications. A comparison of the specified test frequency and actual test frequency is summarized in the following table.

TESTING FREQUENCY

Material	Test Designations	Test Frequency (1 Per)	
		Specified	Actual
Embankment Random Fill	Particle Size Analysis	2,000 cy* or 1 per material type	2 per material type
	Moisture Content	2,000 cy or 1 per material type	1 per 140 cy
	Laboratory Compaction	2,000 cy or 1 per material type	2 per material type
	Field Density/Moisture	500 cy min. or the discretion of the field engineer	1 per 140 cy

*cy = cubic yard.

Field and laboratory data sheets for the embankment compaction verification tests are presented in Appendix A.

Geosynthetics

Installation reports for the geosynthetics, including field data sheets and the destructive and non-destructive QA testing of the 60 mil HDPE geomembrane liner, are presented in Appendix B. An 'As-Constructed' panel diagram for each Phase is also included as part of the installation report.

5.0 REFERENCES

Colorado Lining International, Inc., Quality Assurance Manual for the Installation of Flexible Membrane Lining Systems. Prepared by Colorado Lining International, Inc.

ITEC Environmental Colorado, Inc., Cash Mine / Gold Hill Mill, Gold Hill, Colorado, Tailings Pond Expansion and Site Development, Design Report. Prepared by McCulley, Frick & Gilman, Inc., August 5, 1998.

ITEC Environmental Colorado, Inc., Cash Mine Site Development, Gold Hill, Colorado, Tailings Pond Expansion, Technical Specifications. Prepared by McCulley, Frick & Gilman, Inc., September 2, 1998.

TABLES

TABLE 1

CONSTRUCTION CHRONOLOGY
GOLD HILL MILL TAILINGS IMPOUNDMENT EXPANSION
1998 CONSTRUCTION

ACTIVITY DESCRIPTION	DATES OF PERFORMANCE
Earthworks	
Mobilization/Preparatory Work for Primary Earthworks	August 17, 1998
Tailings Basin and Borrow Area Development	August 18 thru September 25, 1998
Embankment Fill Placement	August 18 thru September 25, 1998
Excavation of Phase 1 Area Anchor Trench	September 26, 27, 1998
Clean-up/Demobilization of Primary Earthwork Contractor	September 26, 1998
Excavation and Placement of Tailings in Phase 1 Impoundment	October 10, 1998
Excavation of Phase 2 Area Anchor Trench	November 12, 13, 1998
Geosynthetics	
Mobilization/Preparatory Work for Phase 1	September 28, 1998
Installation of GCL and HDPE Liners in Phase 1 Basin	September 29 thru October 2, 1998
Clean-up/Demobilization of Geosynthetics Contractor Phase 1	October 2, 1998
Mobilization/Preparatory Work for Phase 2	November 16, 1998
Installation of GCL and HDPE Liners in Phase 2 Basin	November 16 - November 23, 1998
Clean-up/Demobilization of Geosynthetics Contractor Phase 2	November 23, 1998

TABLE 2

PIEZOMETER READING SUMMARY
GOLD HILL MILL TAILINGS IMPOUNDMENT EXPANSION

Date	Depth to Top of Water Piezometer P-1 (ft)*	Depth to Top of Water Piezometer P-2 (ft)*	Comments
September 22, 1998	7.85	4.98	embankment construction over previous tailings surface commenced September 2, 1998
September 25, 1998	7.50	3.90	embankment construction completed September 25, 1998
October 3, 1998	7.50	6.05	
October 7, 1998	8.65	6.87	readings taken prior to the removal of organic matter
October 26, 1998	9.50	8.86	readings taken after organic matter removed
November 11, 1998	8.96	8.58	
November 16, 1998	8.95	8.55	piezometers decommissioned, Phase 2 geosynthetics installation commences November 16, 1998

* Note: Readings were measured from the top of the piezometer casing.

TABLE 3

SETTLEMENT PLATE SURVEY DATA
GOLD HILL MILL TAILINGS IMPOUNDMENT EXPANSION

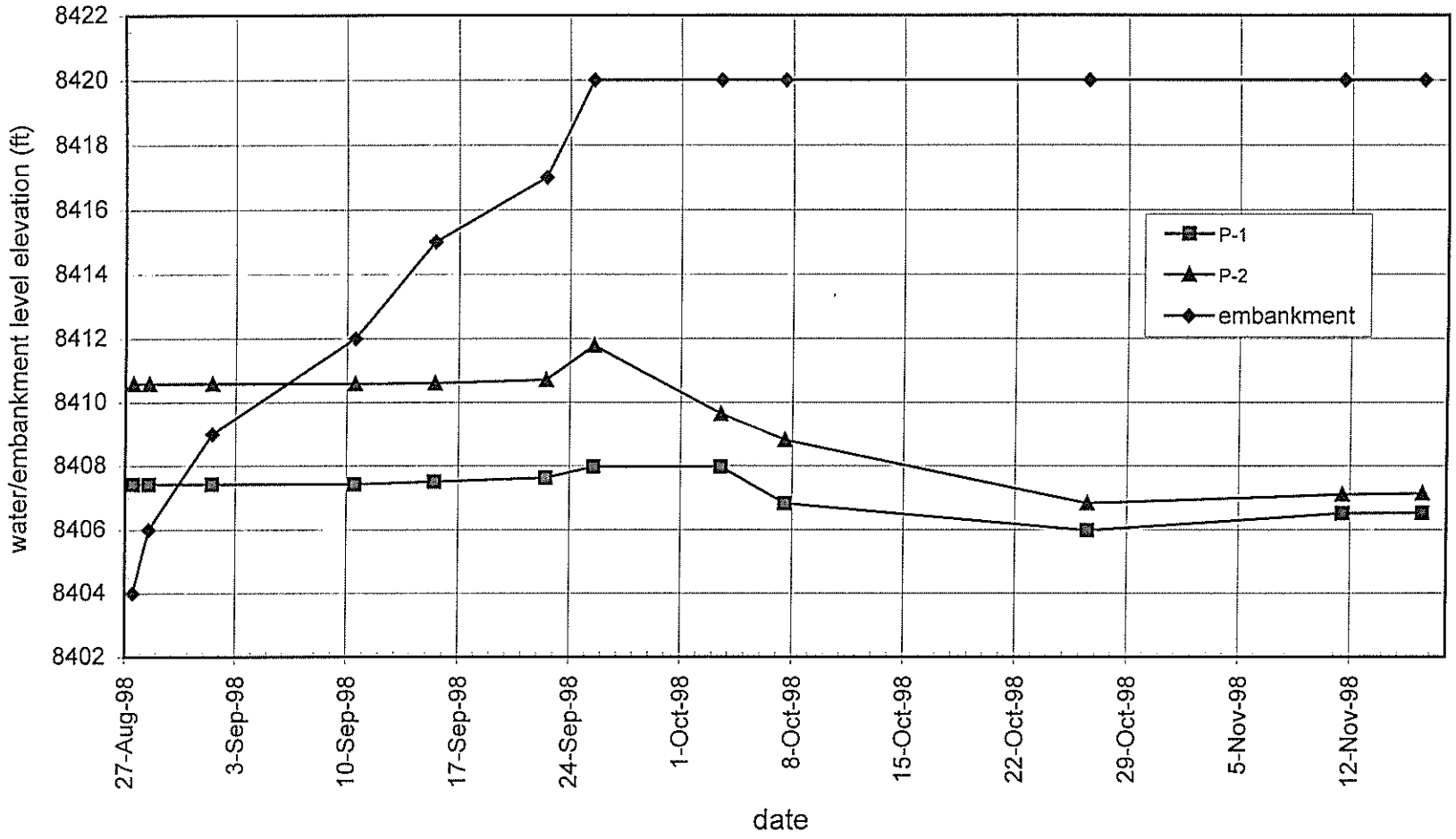
Date Surveyed	Settlement Plate Displacement				
	S-1 (feet)	S-2 (feet)	S-3 (inches)	S-4 (inches)	S-5 (inches)
September 14, 1998	8417.22	8417.60	-	-	-
September 21, 1998	8417.52	8417.54	-	-	-
October 27, 1998	-	-	0.0	0.0	0.0
October 28, 1998	-	-	0.0	0.0	0.0
October 29, 1998	-	-	-1.00	0.25	0.0
October 30, 1998	-	-	-1.00	0.25	0.25
October 31, 1998	-	-	-1.00	0.0	0.0
November 1, 1998	-	-	-1.00	0.0	0.0
November 2, 1998	-	-	-1.00	0.0	0.0
November 3, 1998	-	-	-1.00	0.0	-0.125
November 4, 1998	-	-	-1.125	0.0	0.125
November 5, 1998	-	-	-1.125	-0.125	0.0
November 6, 1998	-	-	-1.125	-0.125	0.0
November 7, 1998	-	-	-1.125	-0.125	0.0
November 16, 1998	8416.76	8417.31	-1.25	-0.25	-0.125
Net Settlement (inches)	-5.52	-3.48	-1.25	-0.25	-0.125

Notes: Negative Settlement values indicate downward movement.
Settlement readings for S-3, S-4 and S-5 are relative.

FIGURES

FIGURES

Piezometer Phreatic Level vs Time



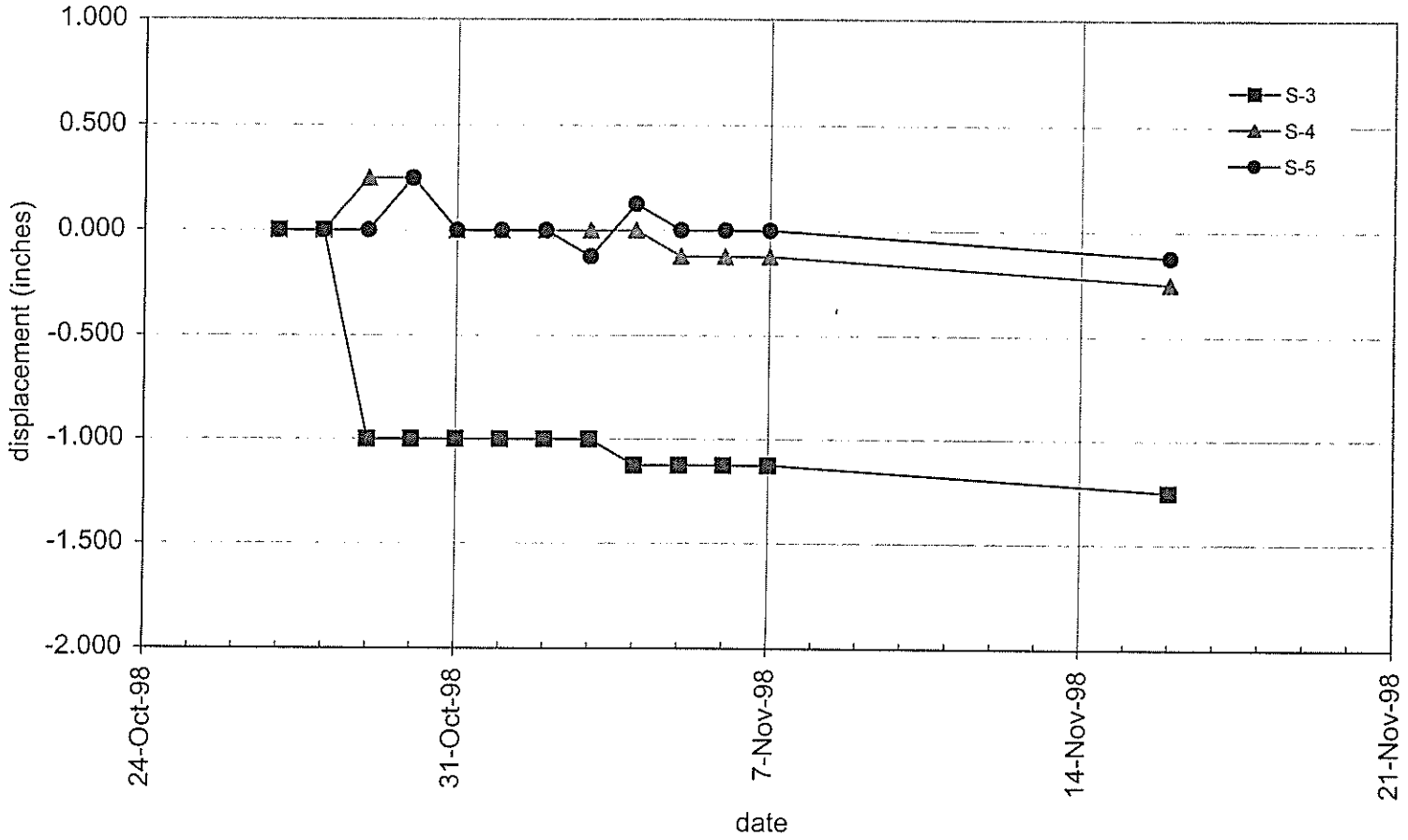
the total length of piezometer P-1 was 13.17 ft
the elevation at the top of P-1 casing was 8415.47 ft
the bottom of the existing tailings basin at P-1 is 8402.30 ft

the total length of piezometer P-2 was 14.33 ft
the elevation at the top of P-2 casing was 8415.68 ft
the bottom of the existing tailings basin at P-2 is 8401.35 ft

J:\5461\instrmntdata\piezochrt2.xls

Figure 1

Settlement Plate Vertical Displacement vs Time



top of tailings surface 0.0
settlement plates were positioned on top of tailings surface
tailings depth in areas of settlement plates is estimated to be between 4 and 6 feet

j:\5461\instrmntdata\sttlmtchrt.xls

Figure 2

DRAWINGS

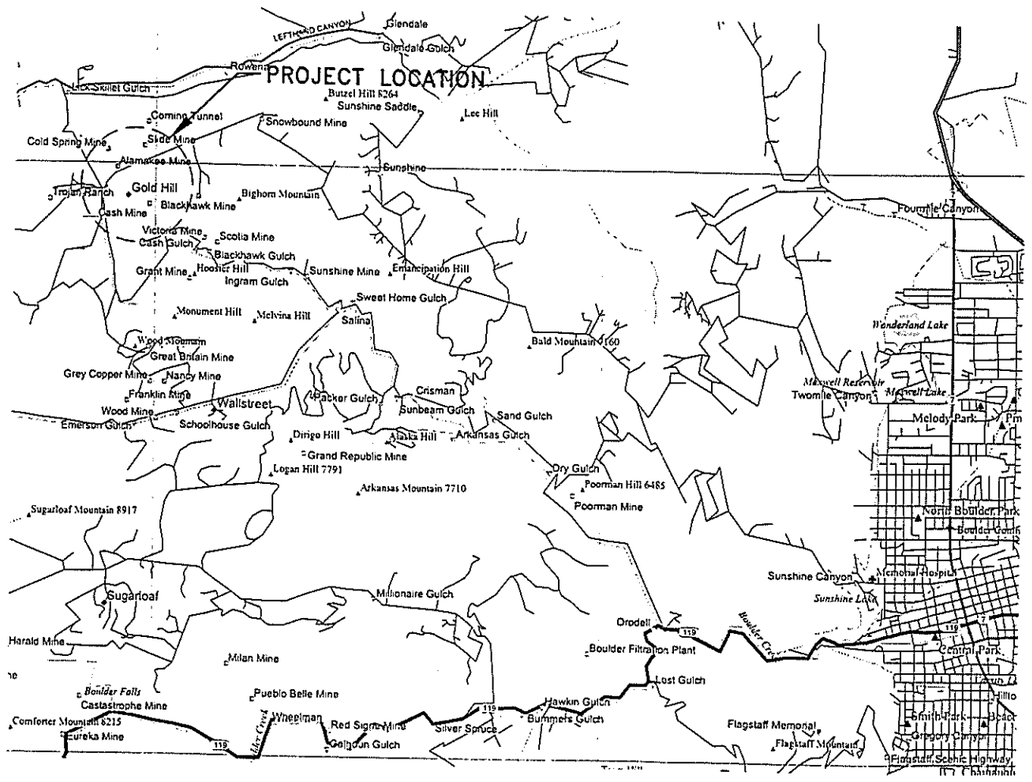
DRAWINGS

ITEC - Environmental Colorado Incorporated

CASH MINE SITE DEVELOPMENT
GOLD HILL, COLORADO

DRAWING LIST

TITLE	NUMBER
Title Page, Drawing List and Vicinity Map	5461-G1
Site Plan	5461-C1A
Tailings Impoundment Plan	5461-C2
Tailings Impoundment Sections	5461-C4A
Tailings Impoundment Details	5461-C5
Piezometer and Settlement Plate Configuration Details	5461-C7



Vicinity Map

Scale: 1 inch = Approx. 1.2 miles

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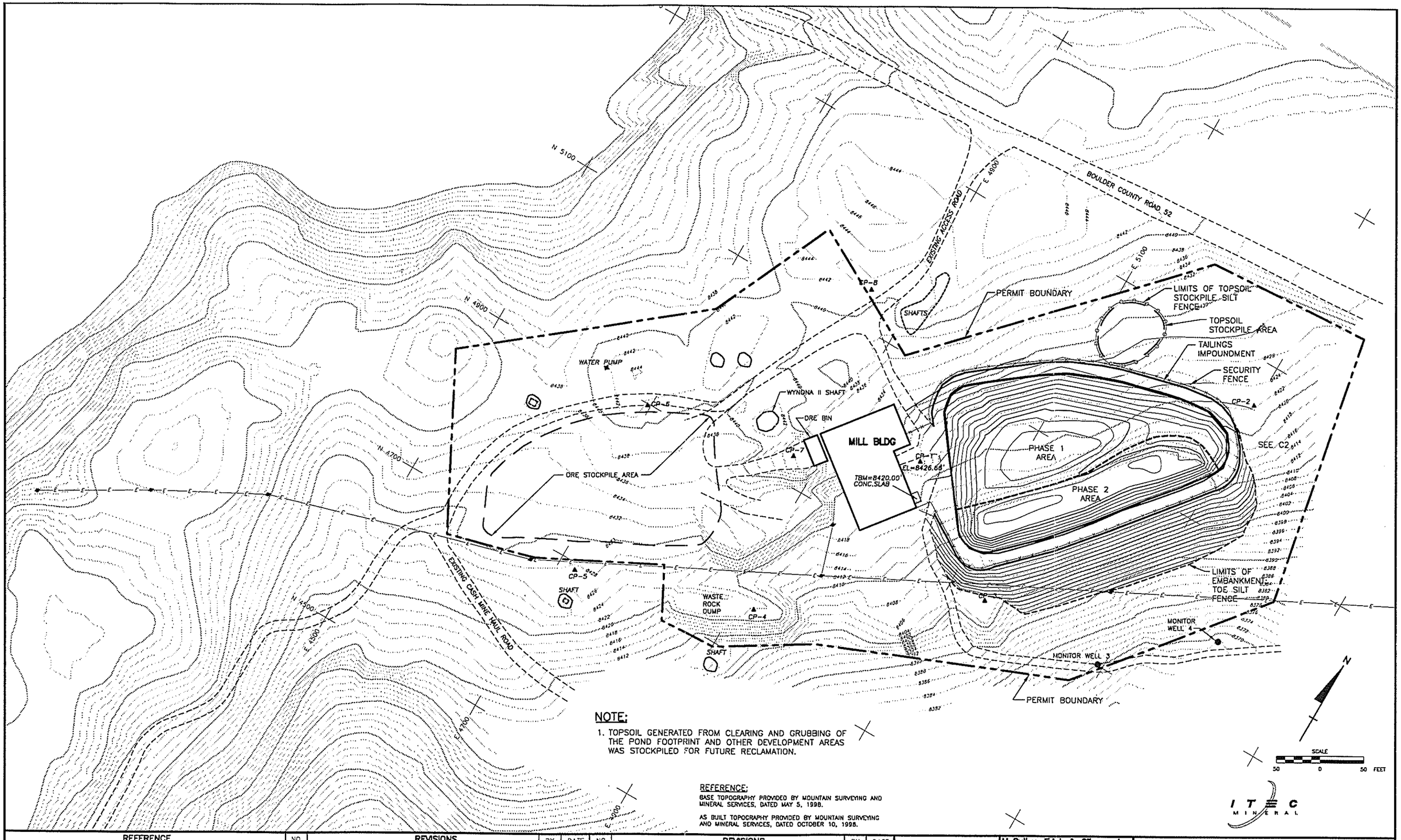
Frick &
Gilman, inc.

Issue For As Built
5461-G1



NOTE:

1. TOPSOIL GENERATED FROM CLEARING AND GRUBBING OF THE POND FOOTPRINT AND OTHER DEVELOPMENT AREAS WAS STOCKPILED FOR FUTURE RECLAMATION.

REFERENCE:

BASE TOPOGRAPHY PROVIDED BY MOUNTAIN SURVEYING AND MINERAL SERVICES, DATED MAY 5, 1998.

AS BUILT TOPOGRAPHY PROVIDED BY MOUNTAIN SURVEYING AND MINERAL SERVICES, DATED OCTOBER 10, 1998.

REFERENCE	NO.	REVISIONS	BY	DATE

NO.	REVISIONS	BY	DATE
2	ISSUE FOR ASBUILT	JPF	12/98
1	ISSUE FOR CONSTRUCTION	LCO	8/98
0	ISSUE FOR REVIEW -- NOT FOR CONSTRUCTION	LCO	6/98

COLORADO REGISTERED JONATHAN P. FRIEDZON 31665 PROFESSIONAL ENGINEER

NOT VALID UNLESS SIGNED

McCulley, Frick & Gilman, Inc.
providing environmental consulting and engineering services

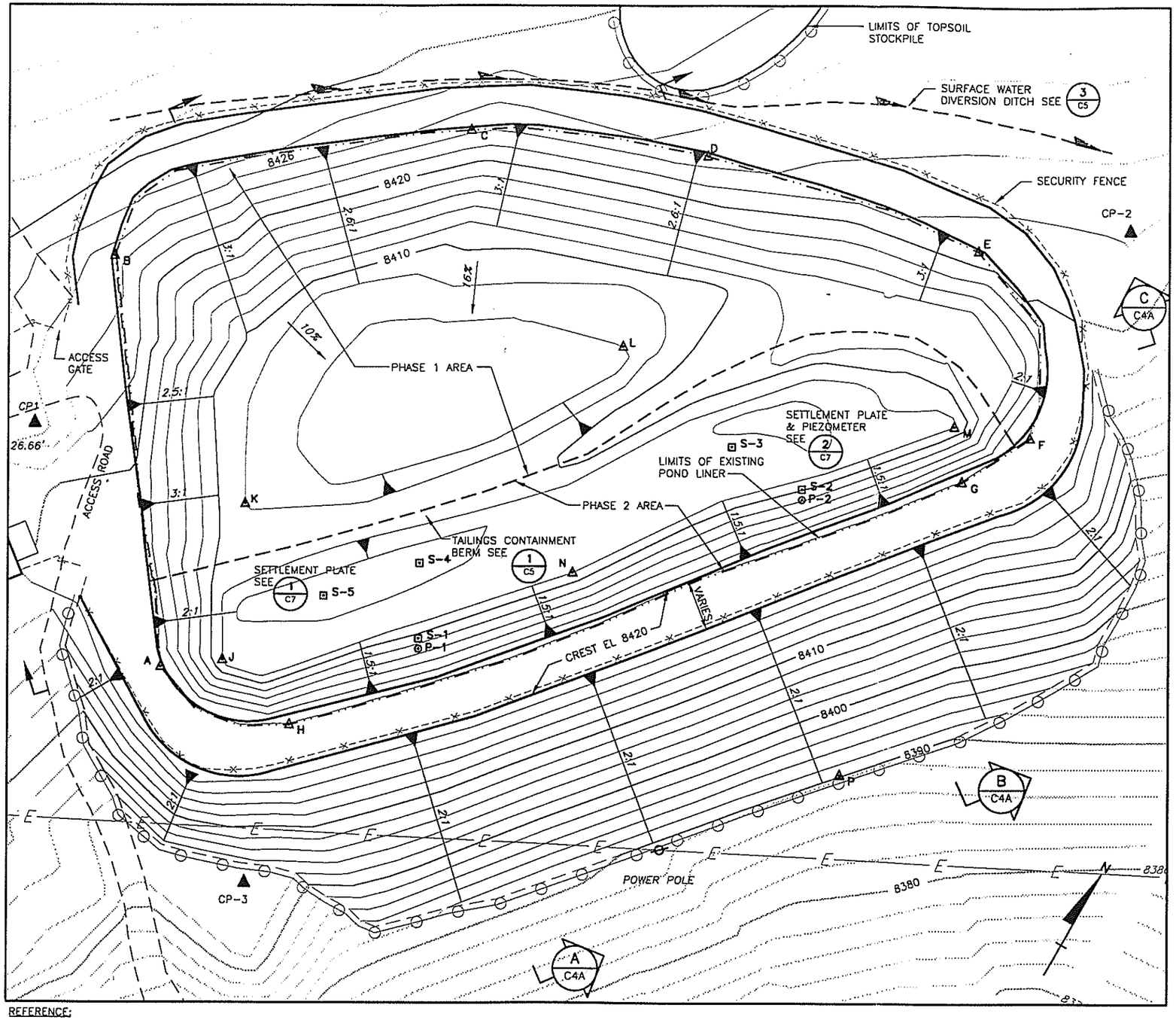
DESIGNED BY:	DJH
DRAWN BY:	PRM/SCG
CHECKED BY:	DJH
APPROVED BY:	JPF
FILE NAME:	D:\5461\5461-C1A.DWG

ITEC ENVIRONMENTAL COLORADO INC.

CASH MINE SITE DEVELOPMENT

SITE PLAN

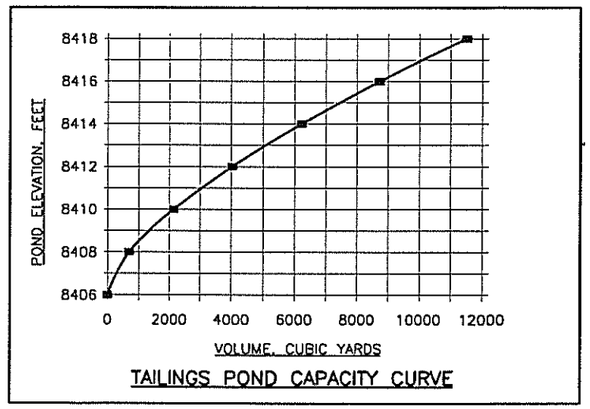
DATE MAY '998 | DRAWING NO. 5461-C1A | REVISION 1



POINT	NORTHING	EASTING	ELEVATION
A	1745.04	6874.85	8425.29
C	1931.29	6983.28	8425.29
D	1922.51	7065.76	8425.29
E	1889.89	7160.77	8425.29
F	1825.14	7178.37	8425.29
G	1809.97	7155.27	8425.29
H	1724.83	6920.19	8425.29
J	1747.49	6896.52	8408.00
K	1802.19	6904.43	8408.00
L	1856.89	7036.37	8406.00
M	1829.24	7152.70	8408.00
N	1778.20	7018.95	8408.00

LEGEND

- FENCE
- LIMITS OF LINER
- SILT FENCE
- DIVERSION TRENCH
- 8430 EXISTING CONTOUR
- 8420 CONSTRUCTION CONTOUR
- EXISTING ROAD



TAILINGS POND CAPACITY CURVE

NOTES:

1. THE CUT SLOPE AROUND THE POND PERIMETER VARIES DUE TO THE VARIABLE HARDNESS OF THE MATERIAL ENCOUNTERED.
2. A FREEBOARD OF 2 FEET IS TO BE MAINTAINED AT ALL TIMES.

REFERENCE:

BASE TOPOGRAPHY PROVIDED BY MOUNTAIN SURVEYING AND MINERAL SERVICES, DATED MAY 5, 1998.

AS BUILT TOPOGRAPHY PROVIDED BY MOUNTAIN SURVEYING AND MINERAL SERVICES, DATED OCTOBER 10, 1998.

TAILINGS POND EXPANSION PLAN

SCALE 20 0 20 FEET

ITEC MINERAL

REFERENCE	NO.	REVISIONS	BY	DATE
TOPOGRAPHIC MAPPING RECEIVED FROM _____ ON _____,1998.				

NO.	REVISIONS	BY	DATE
2	ISSUE FOR ASBUILT	JPF	12/98
1	ISSUE FOR CONSTRUCTION	LCO	8/98
0	ISSUE FOR REVIEW - NOT FOR CONSTRUCTION	LCO	6/98

COLORADO REGISTERED JOHN P. FRITZLEN 31665 PROFESSIONAL ENGINEER

NOT VALID UNLESS SIGNED

McCulley, Frick & Gilman, Inc.
providing environmental consulting and engineering services

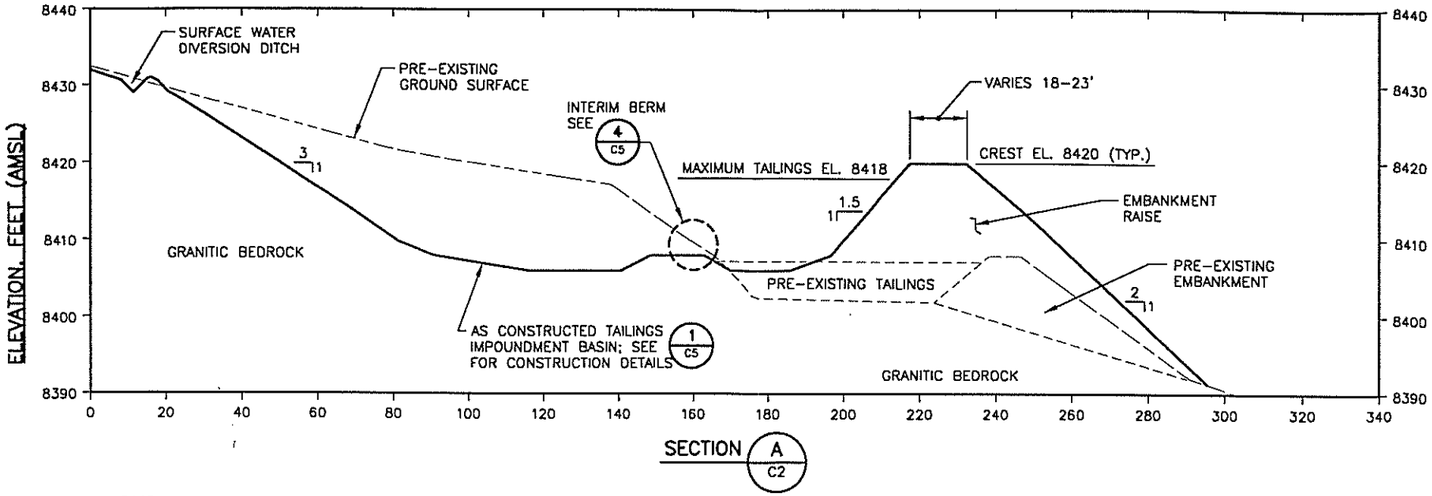
DESIGNED BY:	DJH
DRAWN BY:	PRM/SCG
CHECKED BY:	DJH
APPROVED BY:	JPF
FILE NAME:	D:\5461\5461-BA.DWG

ITEC ENVIRONMENTAL COLORADO INC.

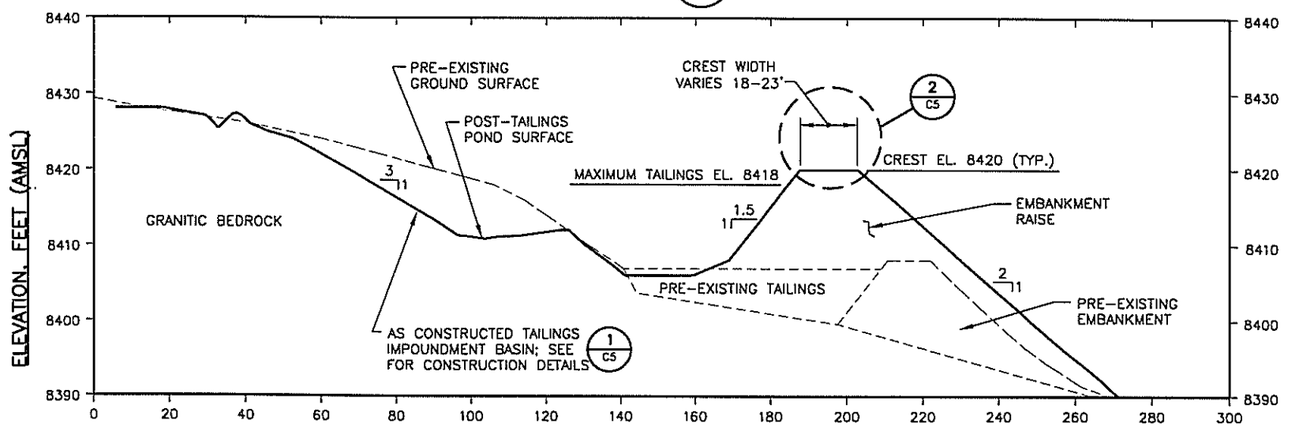
CASH MINE SITE DEVELOPMENT

TAILINGS IMPOUNDMENT PLAN

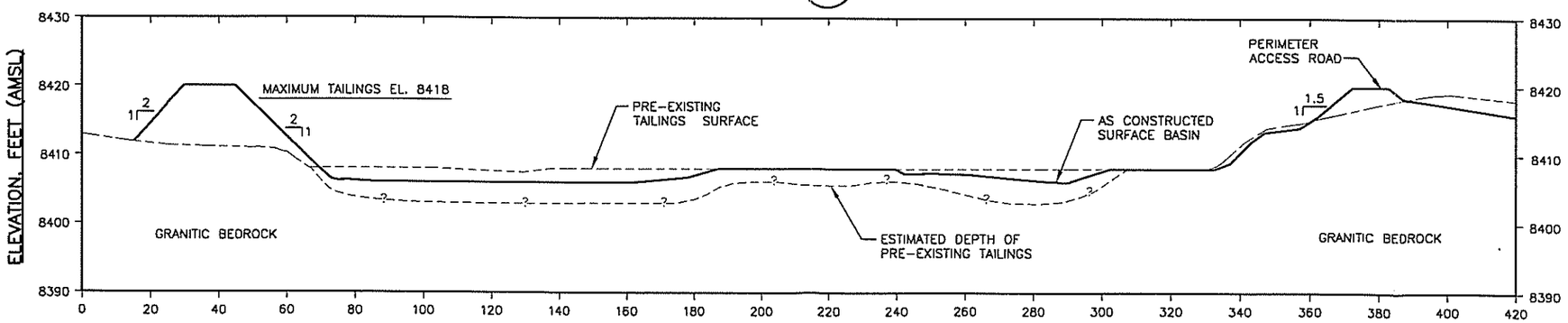
DATE JUNE 1998 | DRAWING NO. 5461-C2 | REVISION 1



SECTION A C2



SECTION B C2



SECTION C C2

VERTICAL SCALE
10 0 10 FEET
HORIZONTAL SCALE
20 0 20 FEET
VERTICAL EXAGGERATION = 2x

ITEC MINERAL

REFERENCE	NO.	REVISIONS	BY	DATE
	2	ISSUE FOR ASBUILT	JPF	12/98
	1	ISSUE FOR CONSTRUCTION	LCO	8/98
	0	ISSUE FOR ASBUILT	JPF	12/98

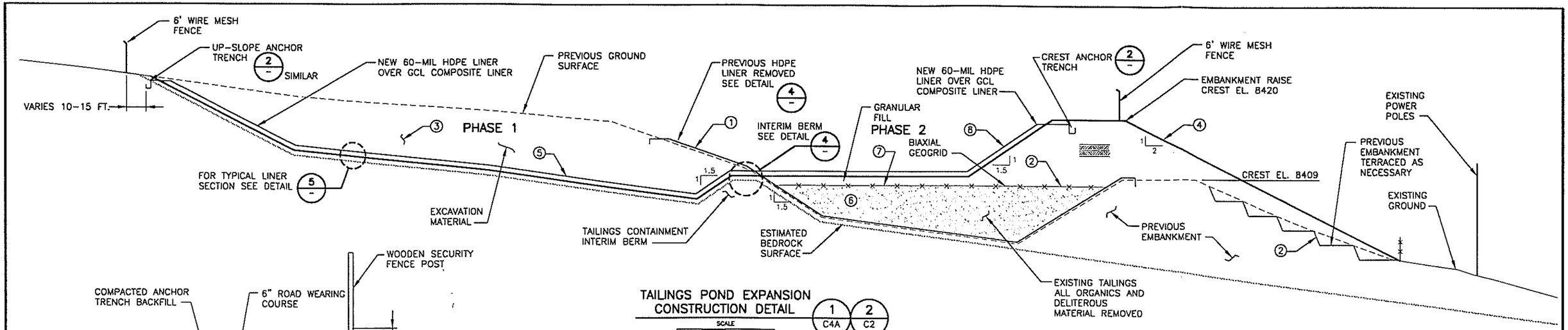
COLORADO REGISTERED JOHNATHAN P. FRIEDMANN 31665 PROFESSIONAL ENGINEER
NOT VALID UNLESS SIGNED

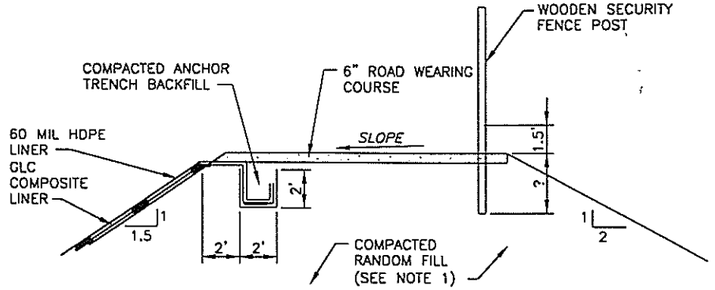
McCulley, Frick & Gilman, Inc.
providing environmental consulting and engineering services

DESIGNED BY:	JPF
DRAWN BY:	SCG/PRM
CHECKED BY:	DJH
APPROVED BY:	JPF
FILE NAME:	D:\5461\5461-15A.DWG

ITEC ENVIRONMENTAL COLORADO INC.
CASH MINE SITE DEVELOPMENT
TAILINGS IMPOUNDMENT SECTIONS

DATE JUNE 1998 | DRAWING NO. 5461-C4A | REVISION 0



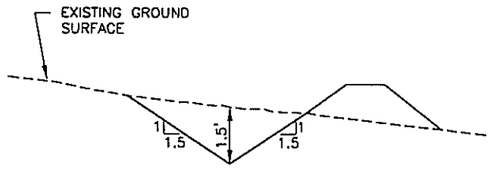


NOTES:

1. RANDOM FILL CONSISTS OF BORROW MATERIAL GENERATED FROM POND EXCAVATION. LARGE ROCK FRAGMENTS AND BOULDERS THAT WERE GREATER THAN 6" IN DIAMETER WERE GRADED TO THE DOWNSTREAM FACE.
2. ALL FILL PLACED WAS COMPACTED TO A MINIMUM OF 90% OF MAX. DRY DENSITY, AS DETERMINED BY ASTM D-1557.

TAILINGS POND EXPANSION CONSTRUCTION DETAIL 1 C4A / 2 C2

SCALE 10 0 10 FEET (HORIZ. & VERT.)



NOTES:

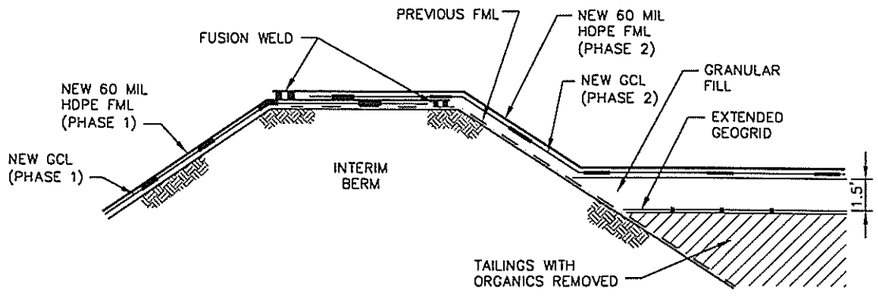
1. SLOPE OF DITCH TO BE MAINTAINED AT NO GREATER THAN 2%.
2. HAY BALES SHALL BE PLACED PERIODICALLY ALONG DITCH LENGTH AND AT THE DITCH OUTLET FOR SEDIMENT CONTROL.

TAILINGS POND CREST GEOMEMBRANE/GCL ANCHOR TRENCH 2 –

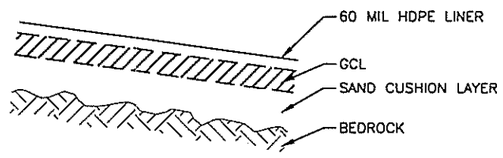
SCALE 4 0 4 FEET

V-NOTCH DRAINAGE DITCH 3 C2

SCALE 2 0 2 FEET



LINER CONNECTIONS AT INTERIM BERM 4 C4 / 4 – NOT TO SCALE



TYPICAL LINER SECTION 5 – / 5 C4A NOT TO SCALE

CONSTRUCTION SEQUENCE:

① THE PREVIOUSLY EXPOSED LINER LOCATED ON THE NORTH BANK OF THE EXISTING POND AND THE FENCE SURROUNDING THE POND WAS REMOVED.

② A BIAXIAL GEOGRID WAS PLACED OVER THE EXISTING TAILINGS WHICH WAS COVERED BY THE EMBANKMENT EXTENSION/RAISE. THE DOWNSTREAM SLOPE OF THE EXISTING EMBANKMENT WAS TERRACED AS NECESSARY TO PROPERLY PLACE AND COMPACT THE NEW EMBANKMENT MATERIAL.

③ EXCAVATE THE MATERIAL NORTH OF THE EXISTING POND TO THE CONTOUR SHOWN ON DRAWING 5461-C2. AN INTERIM CONTAINMENT BERM WAS CONSTRUCTED BETWEEN THE NEW EXCAVATION AND THE EXISTING TAILINGS POND.

④ THE EXCAVATED MATERIAL TO FORM THE EMBANKMENT EXTENSION WAS PLACED AND COMOPACTED AS SPECIFIED.

⑤ THE NEW 60-MIL HDPE LINER AND GCL WAS INSTALLED IN THE NEWLY EXCAVATED PORTION OF THE POND (PHASE 1) FROM THE UP-SLOPE ANCHOR TRENCH TO THE CONTAINMENT BERM.

⑥ SURFICIAL VEGETATION/ORGANIC MATERIAL WAS REMOVED FROM EXPOSED TAILING.

⑦ BIAXIAL GEOGRID WAS PLACED OVER REMAINING TAILING SURFACE. PLACE SETTLEMENT MONUMENTS WERE PLACED ON TOP OF GEOGRID SURFACE. PLACE GRANULAR SURCHARGE FILL OVER THE BIAXIAL GEOGRID.

⑧ MONITOR SETTLEMENT, THEN INSTALL THE NEW LINER AND GCL FROM THE CONTAINMENT BERM, ACROSS THE EXISTING POND, AND UP THE NEW EMBANKMENT EXTENSION TO THE CREST ANCHOR TRENCH. SETTLEMENT PLATES WERE DECOMMISSIONED PRIOR TO LINER PLACEMENT.

⑨ SECURITY FENCE WAS PLACED AROUND POND PERIMETER AND EMBANKMENT CREST.

ITEC MINERAL

REFERENCE	NO.	REVISIONS	BY	DATE

NO.	REVISIONS	BY	DATE
4	ISSUE FOR ASBUILT	JPF	12/98
3	REISSUED FOR TECHNICAL REVISION	LCO	9/9/98
1	ISSUE FOR CONSTRUCTION	LCO	8/98
0	ISSUE FOR REVIEW – NOT FOR CONSTRUCTION	LCO	6/98

COLORADO REGISTERED JOHN P. FRIEDMANN 31665 PROFESSIONAL ENGINEER

NOT VALID UNLESS SIGNED

McCulley, Frick & Gilman, Inc.
providing environmental consulting and engineering services

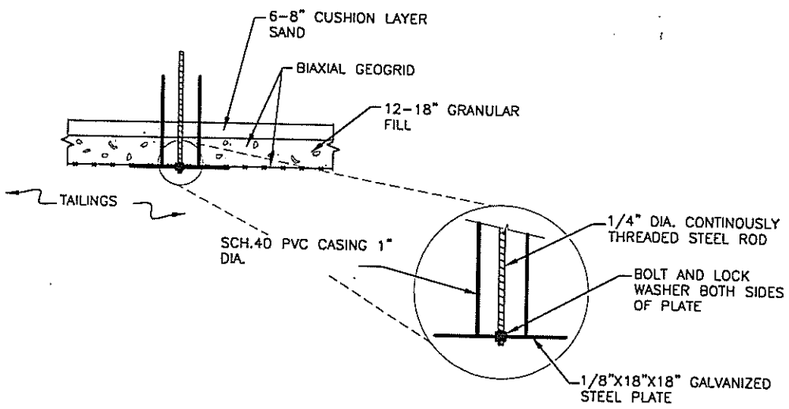
DESIGNED BY:	DJH
DRAWN BY:	PRM/SCG
CHECKED BY:	DJH
APPROVED BY:	JPF
FILE NAME:	D:\5461\5461-11A.DWG

ITEC ENVIRONMENTAL COLORADO INC.

CASH MINE SITE DEVELOPMENT

TAILINGS IMPOUNDMENT DETAILS

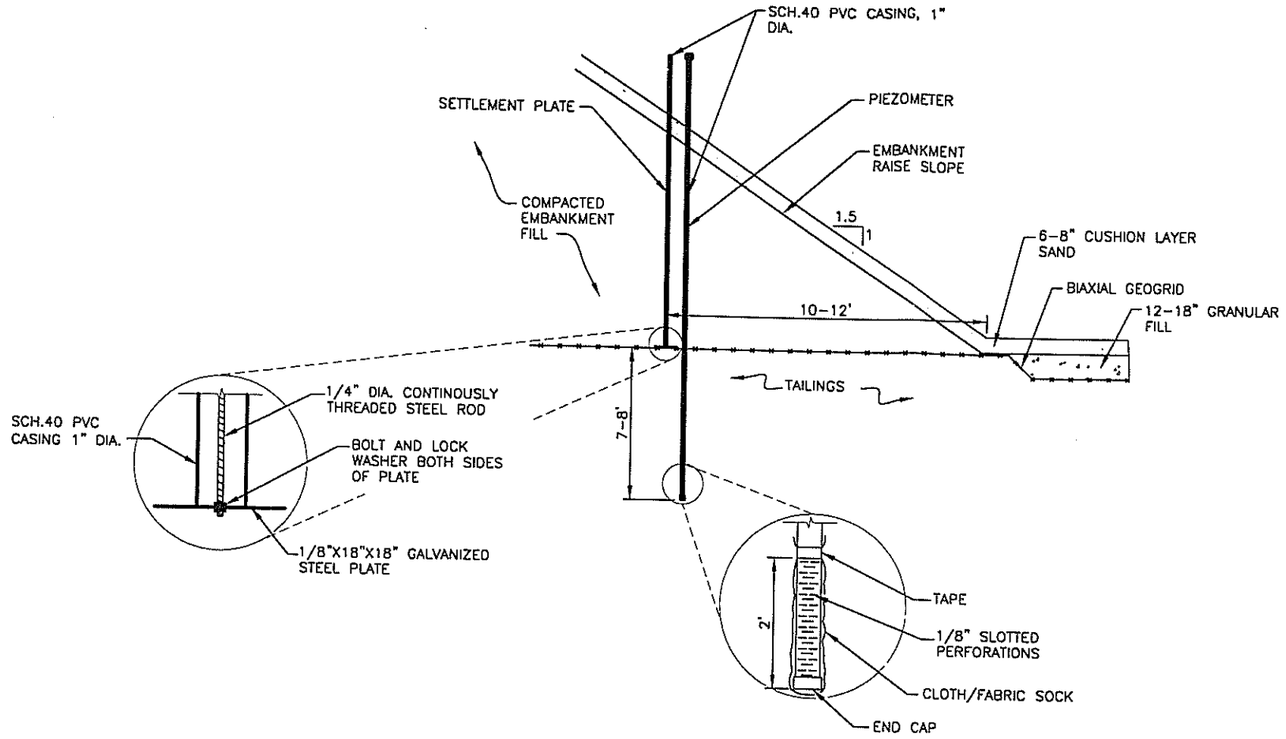
DATE JUNE 1998 | DRAWING NO. 5461-C5 | REVISION 2



TYPICAL EMBANKMENT BUTTRESS SETTLEMENT CONFIGURATION (SETTLEMENT PLATES S-3,S-4, & S-5)

NOT TO SCALE

1 / C2



TYPICAL EMBANKMENT PIEZOMETER AND SETTLEMENT PLATE CONFIGURATION (PIEZOMETER P-1,P-2 & SETTLEMENT PLATES S-1,S-2)

NOT TO SCALE

2 / C2

REFERENCE	NO.	REVISIONS	BY	DATE	NO.	REVISIONS	BY	DATE
					2	ISSUE FOR ASBUILT	JPF	12/98
					1	ISSUE FOR CONSTRUCTION	LCO	8/98
					0	ISSUE FOR ASBUILT	JPF	12/96

COLORADO REGISTERED JOHN P. PITTENGER 31665 PROFESSIONAL ENGINEER

NOT VALID UNLESS SIGNED

McCulley, Frick & Gilman, Inc.
providing environmental consulting and engineering services

DESIGNED BY:	JPF
DRAWN BY:	CAA
CHECKED BY:	DJH
APPROVED BY:	JPF
FILE NAME:	D:\5461\5461-22.DWG

ITEC MINERAL

ITEC ENVIRONMENTAL COLORADO INC.

CASH MINE SITE DEVELOPMENT

BUTTRESS & PIEZOMETER SETTLEMENT PLATE CONFIGURATION DETAILS

DATE JUNE 1998 | DRAWING NO. **5461-C7** | REVISION **0**

APPENDIX A

APPENDIX A

Geotechnical Field & Laboratory Quality Control Data Sheets

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

10214 South Progress Ln.
Parker, CO 80134

Fax 303 841-7556
Phone 303 841-7119

September 3, 1998

ITEC Environmental Colorado Inc.
c/o McCulley, Frick, and Gilman
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

Dear Mr. Friedman:

Enclosed are daily field report numbers 1 through 6 for nuclear density testing performed on the raise to the existing tailings embankment at the Cash Mine Redevelopment. The criteria established for the fill are a minimum dry density exceeding 90% of the maximum Modified Proctor (ASTM D1557) within 2 percent of optimum moisture content.

Results of the Modified Proctor and gradation testing are presented on Figures 1 and 2. Because of local variations in the fill beneath nuclear density test locations, both rock corrected and uncorrected maximum dry density and moisture content values have been used. Our field technician determines which values to use depending on visual observation of the soils beneath the nuclear gage to the probe depth.

If you have any questions, please call.

Sincerely,

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

Dennis L. Hanneman

Dennis L. Hanneman, P.E.

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/24/98
DAILY REPORT # 1
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Required

METHOD OF ADDING MOISTURE: Natural

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
1	85' S.W., 17' N.W.	8394	137.1	5.8	124.0	5.7	90	90	Silty Gravelly Sand
2	At power pole, 16' N.W.	8393	130.4	7.7	119.9	5.6	92	90	Silty Gravelly Sand
3	91' N.E., 14' N.W.	8395	137.1	5.8	130.3	4.3	95	90	Silty Gravelly Sand

PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Bill, Len, & Jon (* preliminary)

PROGRESS REPORT:

At the time of our site visit (9:00), Len's Excavating was excavating for the expansion of the Tailings Pond. A lift of fill was in place on the first bench of the embankment.

We tested the first lift of embankment fill for in-place moisture-density and obtained a sample of the embankment fill for moisture-density relationships (Modified Proctor) and classification, shown on attached Figures 1 and 2. All locations were referenced from the power pole.

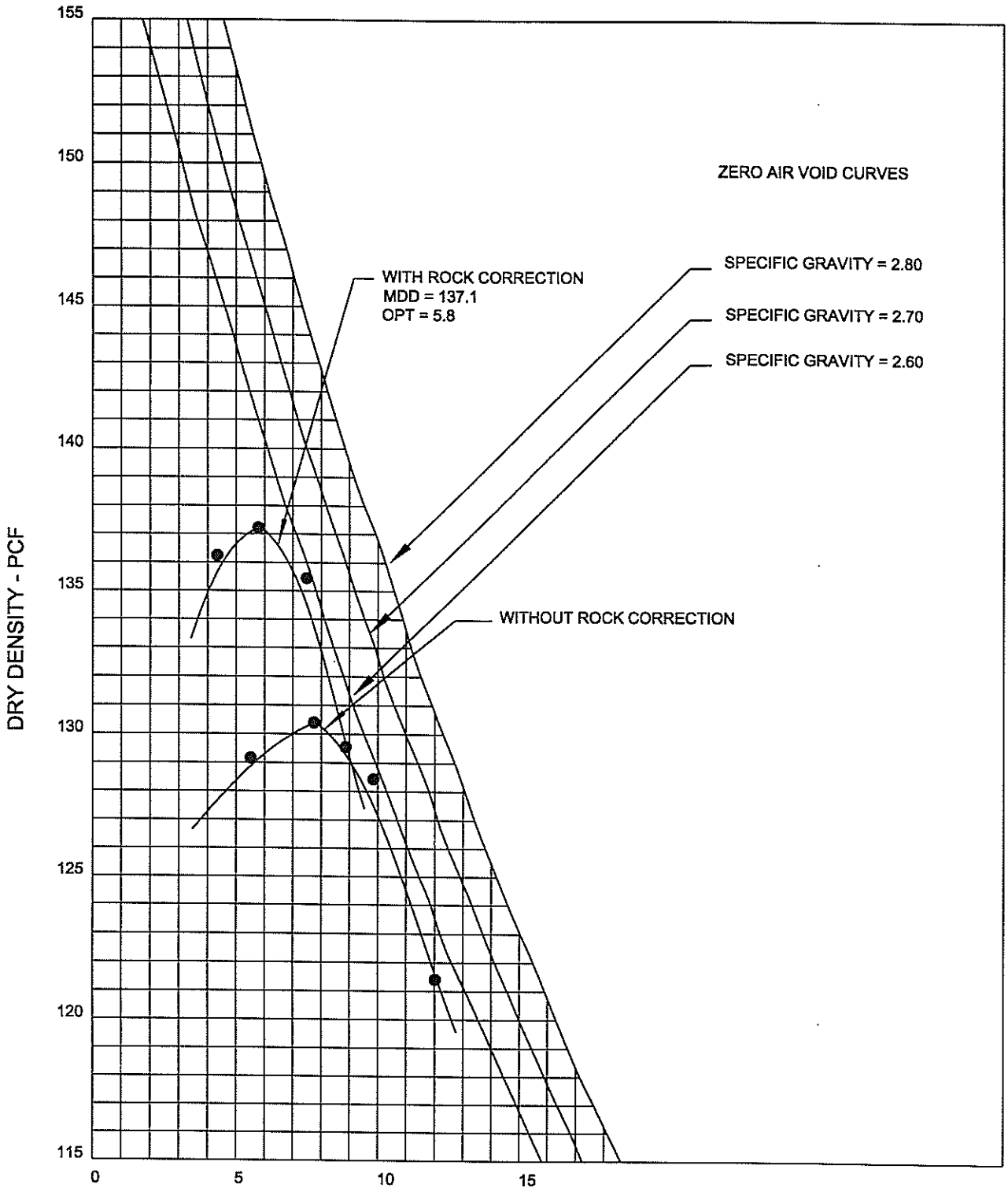
* Note: Verbal preliminary results were given in the field, based on standard Proctor test performed by Knight Piesold LLC, Project #5451.1, 6/8/98.

We discussed the construction schedule with Bill Hamling (Cash Mine), Len Cole (Len's Excavating), and Jon Friedman (MFG). We recommended that the surface of the first lift of embankment fill be watered prior to placement of the next lift. It was agreed that we return on 8/25/98 to test the second lift of embankment fill.

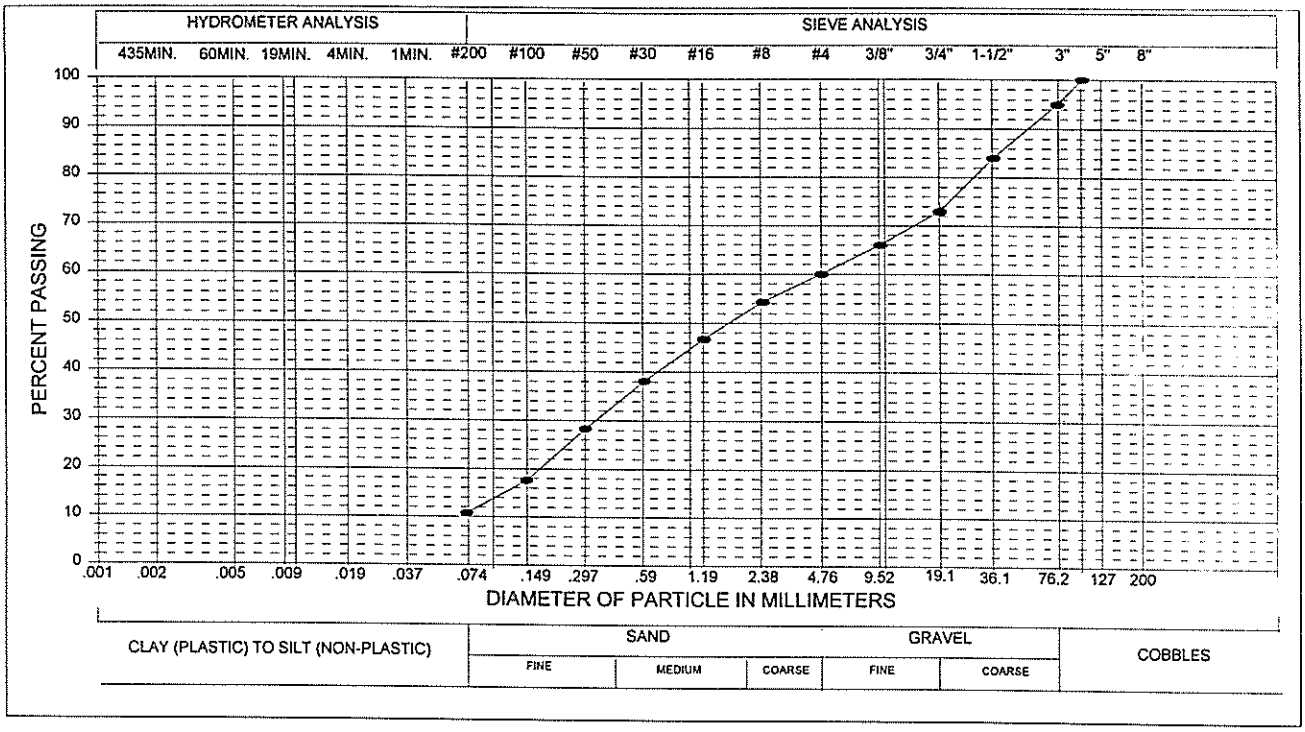
COPIES:

Jim Riley
FIELD OBSERVER

Dennis Hanneman, P.E.
REVIEWED BY



LOCATION : Tailings Pond, SE embankment expansion. (Sample No. 1)	MOISTURE-DENSITY RELATIONSHIPS
SOIL DESCRIPTION : Silty Gravelly Sand	HEPWORTH-PAWLAK GEOTECHNICAL, Inc.
MAX. DRY DENSITY : 130.4 PCF OPT. MOIST. CONTENT : 7.7 %	PROCEDURE : ASTM D1557-91 METHOD C
LIQUID LIMIT : PLASTICITY INDEX : NP	JOB NO. : 298 187
GRAVEL : 40 % SAND : 49 % SILT AND CLAY (−200) : 11 %	DATE : 8/24/98 FIG. 1



GRAVEL:	40 %	SAND:	49 %	SILT AND CLAY:	11 %
LIQUID LIMIT:				PLASTICITY INDEX:	NP
SAMPLE OF :	Silty Gravelly Sand			FROM :	Tailings Pond, SE embankment expansion

298 187	HEPWORTH-PAWLAK GEOTECHNICAL, INC.	**CASH MINE GRADATION ANALYSIS**	FIG. 2

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/25/98
DAILY REPORT #2
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
4	110' N.E., 40' N.W.	8397	137.1	5.8	131.9	5.9	96	90	Silty Gravelly Sand
5	16' N.E., 24' N.W.	8395	"	"	127.0	5.8	93	90	Silty Gravelly Sand
6	57' S.W., 20' N.W.	8396	"	"	126.9	6.2	93	90	Silty Gravelly Sand

PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: Tests were taken in the tailings pond embankment fill. All locations were referenced from the power pole.

COPIES:

Dave Cassidy — FIELD OBSERVER

Jim Riley — REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/26/98
DAILY REPORT # 3
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: 1'

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
7	75' N.E., 22' N.W.	8400	130.4	7.7	128.3	7.0	98	90	Silty Gravelly Sand
8	20' N.E., 24' N.W.	8398	"	"	123.8	6.9	95	90	Silty Gravelly Sand
9	30' S.W., 22' N.W.	8399	"	'	124.5	7.5	96	90	Silty Gravelly Sand
10	88' S.W., 26' N.W.	8400	137.1	5.8	130.0	7.7	95	90	Silty Gravelly Sand

ART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: The tests were taken in the tailings pond embankment fill. All tests were referenced off the power pole.

Len informed us that his lift thickness was one foot, minus and that the cut areas were watered prior to placement of fill.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/27/98
DAILY REPORT # 4
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
11	120' N.E., 40' N.W.	8404	130.4	7.7	122.5	7.1	94	90	Silty Gravelly Sand
12	100' N.E., 40' N.W.	8402	"	"	123.0	7.0	94	90	Silty Gravelly Sand
13	48' N.E., 38' N.W.	8403	137.1	5.8	130.4	7.2	95	90	Silty Gravelly Sand
14	30' N.E., 42' N.W.	8404	"	"	129.3	7.6	94	90	Silty Gravelly Sand
15	36' N.W. of power pole	8402	130.4	7.7	123.2	7.0	95	90	Silty Gravelly Sand
16	45' S.W., 38' N.W.	8404	"	"	127.3	7.4	98	90	Silty Gravelly Sand
17	60' S.W., 38' N.W.	8402	"	"	126.8	7.1	97	90	Silty Gravelly Sand
18	105' S.W., 38' N.W.	8404	130.4	7.7	127.4	7.1	98	90	Silty Gravelly Sand

PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO:

PROGRESS REPORT: The tests were taken in the tailing pond embankment fill, all test locations were referenced off the power pole.

COPIES:

Dave Cassidy — FIELD OBSERVER

Jim Riley — REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 8/28/98
DAILY REPORT #5
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
19	130' N.E., 42' N.W.	8406	137.1	5.8	131.5	4.4	96	90	Silty Gravelly Sand
20	115' N.E., 40' N.W.	8404	"	"	130.4	4.5	95	90	Silty Gravelly Sand
21	65' N.E., 39' N.W.	8405	"	"	136.7	3.7	100	90	Silty Gravelly Sand
22	45' N.E., 40' N.W.	8406	"	"	124.5	4.6	91	90	Silty Gravelly Sand
23	20' N.W., 40' N.W.	8406	"	"	136.9	5.1	100	90	Silty Gravelly Sand
24	40' N.W. of power pole	8406	"	"	127.9	5.7	93	90	Silty Gravelly Sand
25	30' S.W., 40' N.W.	8404	"	"	130.3	5.7	95	90	Silty Gravelly Sand
26	50' S.W., 42' N.W.	8406	137.1	5.8	127.8	5.8	93	90	Silty Gravelly Sand
27	80' S.W., 42' N.W.	8406	130.4	7.7	125.8	6.1	97	90	Silty Gravelly Sand
28	110' S.W., 42' N.W.	8406	"	"	123.6	5.8	95	90	Silty Gravelly Sand

FULL TIME/PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: Tests were taken in the tailings pond embankment fill, all tests were referenced to the power pole.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/1/98
DAILY REPORT # 6
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
29	115' N.E., 48' N.W.	8410	130.4	7.7	119.7	8.5	92	90	Silty Gravelly Sand
30	45' N.E., 50' N.W.	8406	"	"	125.9	8.0	97	90	Silty Gravelly Sand
31	50' N.W. of power pole	8409	137.1	5.8	129.5	7.3	94	90	Silty Gravelly Sand
32	38' S.W., 49' N.W.	8409	"	"	131.2	7.6	96	90	Silty Gravelly Sand
33	95' S.W., 50' N.W.	8410	"	"	131.6	7.2	96	90	Silty Gravelly Sand

FULL TIME/PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/ Len/s Excavating

PROGRESS REPORT: Tests were taken in the tailing pond embankment fill, all the locations were referenced to the power pole.

COPIES:

Dave Cassidy — FIELD OBSERVER

Jim Riley — REVIEWED BY

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

10214 South Progress Ln.
Parker, CO 80134

Fax 303 841-7556
Phone 303 841-7119

October 5, 1998

ITEC Environmental Colorado Inc.
c/o McCulley, Frick, and Gilman
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

Dear Mr. Friedman:

Enclosed are daily field report numbers 7 through 12 for nuclear density testing performed on the raise to the existing tailings embankment at the Cash Mine Redevelopment. The criteria established for the fill are a minimum dry density exceeding 90% of the maximum Modified Proctor (ASTM D1557) within 2 percent of optimum moisture content. Nuclear gage density testing indicates that the tested fill meets the compaction and moisture specifications.

Results of additional Modified Proctor and gradation testing are presented on Figures 3 and 4. Three sand cone tests were performed on September 25th as requested. The sand cone test results correlate well with the nuclear gage results, considering the relatively large maximum particle size of the fill.

We appreciate the opportunity to have provided construction materials testing services for the Cash Mine Project and look forward to the possibility of working with McCulley, Frick, and Gilman on future projects. With four offices throughout Colorado in Parker, Glenwood Springs, Silverthorne, and Colorado Springs, we are capable of meeting your needs regardless of the project location.

If you have any questions, please call.

Sincerely,

HEPWORTH-PAWLAK GEOTECHNICAL, Inc.

Dennis L. Hanneman

Dennis L. Hanneman, P.E.

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF CONSTRUCTION ACTIVITIES

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick, and Gilman, Inc
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

JOB NO. 298 187
DATE: 9/3/98
DAILY REPORT #7
SHEET 1 OF 1

PROJECT: Cash Mine Redevelopment near Gold Hill, Co (Raise existing tailings embankment)

WEATHER CONDITIONS AND TEMPERATURE: Sunny +70°s

CONTRACTORS CONSTRUCTION ACTIVITIES:

MAJOR EQUIPMENT:

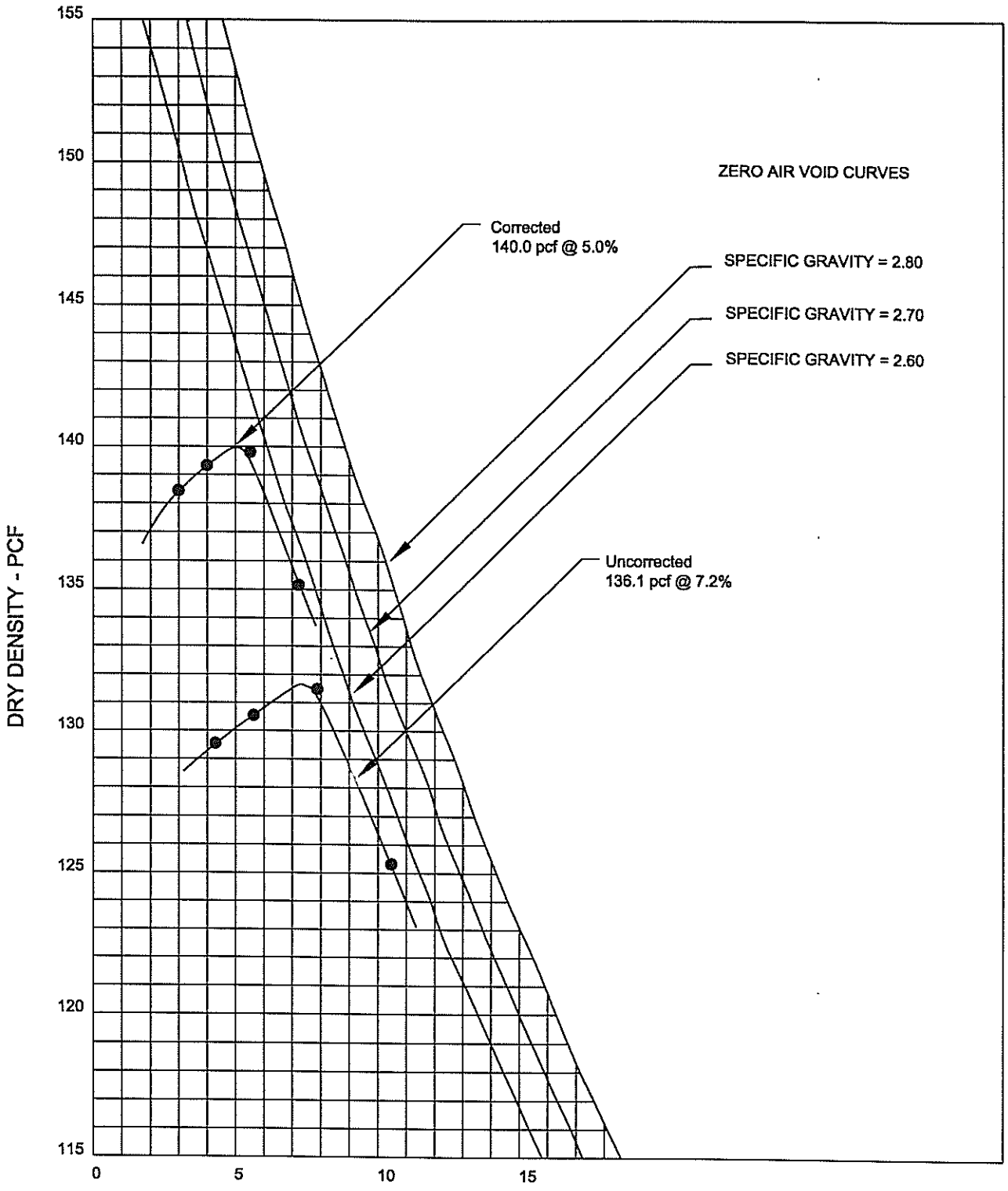
HP GEOTECH'S SITE ACTIVITIES:
We made a site visit as scheduled to provide compaction tests on the embankment fill, there was not enough fill in place to require testing. We obtained a sample of the embankment fill to return to our laboratory for moisture-density relationships (Modified Proctor) and classification, the results are shown on attached Figures 3 and 4.

VERBAL COMMUNICATION WITH CONTRACTOR, ENGINEER, ARCHITECT, OWNER:
We spoke with Len with Lens Excavating, he stated that it would take him two days to place a lift of embankment fill before he would be in need of compaction testing. Len stated that he would be placing fill over geo grid throughout the day and there was no compaction specifications for this.

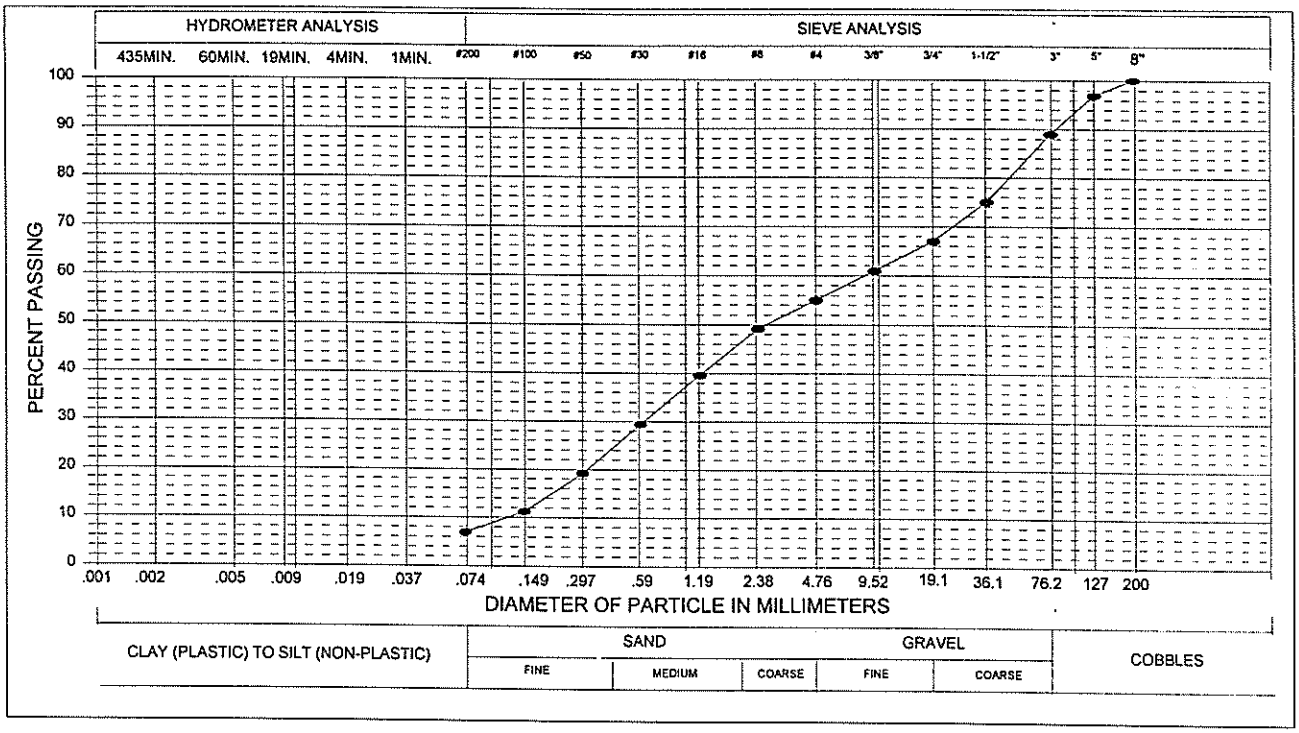
COPIES:

Dave Cassidy — FIELD OBSERVER

Jim Riley — REVIEWED BY



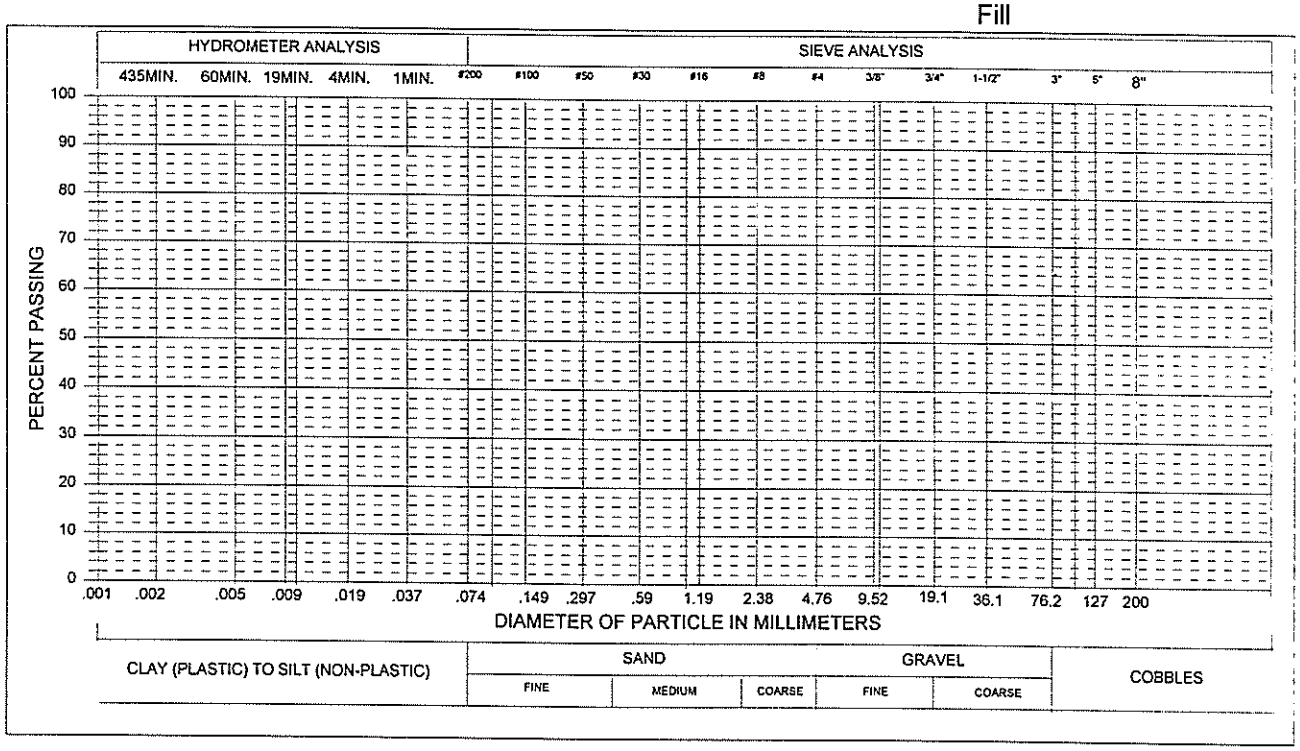
LOCATION : Tailings Pond Embankment Fill (Sample No. 2)	MOISTURE-DENSITY RELATIONSHIPS
SOIL DESCRIPTION : Silty Gravel and Sand	HEPWORTH-PAWLAK GEOTECHNICAL, Inc.
MAX. DRY DENSITY : PCF OPT. MOIST. CONTENT : %	PROCEDURE : ASTM D1557 METHOD C
LIQUID LIMIT : PLASTICITY INDEX : NP	JOB NO. : 298 187
GRAVEL : 45 % SAND : 48 % SILT AND CLAY (−200) : 7 %	DATE : 9/3/98 FIG. 3



GRAVEL: 45 % SAND: 48 % SILT AND CLAY: 7 %

LIQUID LIMIT: PLASTICITY INDEX: NP

SAMPLE OF : Silty Gravel & Sand FROM : Tailings Pond Embankment Fill



GRAVEL: % SAND: % SILT AND CLAY: %

LIQUID LIMIT: PLASTICITY INDEX:

SAMPLE OF : FROM :

298 187	HEPWORTH-PAWLAK GEOTECHNICAL, INC.	GRADATION ANALYSIS	FIG. 4

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/10/98
DAILY REPORT #8
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION FROM POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
34	110' N.E., 50' N.W.	8412	137.1	5.8	123.7	5.9	90	90	Silty Gravelly Sand
35	65' N.E., 52' N.W.	8412	"	"	125.8	6.0	92	90	Silty Gravelly Sand
36	52' N.W. of Power Pole	8412	140.0	5.0	130.1	5.2	93	90	Silty Gravel & Sand
37	58' S.W., 51' N.W.	8412	137.1	5.8	126.1	5.6	92	90	Silty Gravelly Sand
38	90' S.W., 52' N.W.	8412	140.0	5.0	146.9	4.6	100	90	Silty Gravel & Sand

PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Lens Excavating

PROGRESS REPORT: The tests were taken in the tailings pond embankment fill, the locations were referenced to the power pole. The dozer was down for repairs. Len stated that he would be setting up a screening plant most of the day and that he would call us if needed on 9/14/98.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/15/98
DAILY REPORT #9
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATION REFERENCED FROM POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
39	110' N.E., 55' N.W.	8415	140.0	5.0	141.1	4.9	100+	90	Silty Gravel & Sand
40	50' N.E., 56' N.W.	8415	137.1	5.8	128.7	6.7	94	90	Silty Gravelly Sand
41	57' N.W. of Power Pole	8415	"	"	126.0	5.2	92	90	Silty Gravelly Sand
42	43' S.W., 55' N.W.	8415	"	"	132.5	4.3	97	90	Silty Gravelly Sand
43	90' S.W., 56' N.W.	8415	"	"	132.8	4.9	97	90	Silty Gravelly Sand

FULL TIME/PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Lens Excavating

PROGRESS REPORT: Tests were taken in tailings pond embankment fill, all locations were referenced off the power pole.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF CONSTRUCTION ACTIVITIES

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick, and Gilman, Inc
4900 Pearl East Circle, Suite 300w
Boulder, CO 80303

JOB NO. 298 187
DATE: 9/18/98
DAILY REPORT #10
SHEET 1 OF 1

ROJECT: Cash Mine Redevelopment near Gold Hill, Co (Raise existing tailings embankment)

/EATHER CONDITIONS AND TEMPERATURE: Sunny - 70°F.

ONTRACTORS CONSTRUCTION ACTIVITIES:

AJOR EQUIPMENT:

-P GEOTECH'S SITE ACTIVITIES:

VERBAL COMMUNICATION WITH CONTRACTOR, ENGINEER, ARCHITECT, OWNER:
We arrived at the job site as scheduled, upon arrival Len informed us that they had canceled the compaction for today, we had not been informed of this. Len requested that we return on 9/22/98 for compaction testing, he stated that he would inform us if there is a change.

OPIES:

Dave Cassidy — FIELD OBSERVER

Jim Riley — REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/22/98
DAILY REPORT # 11
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer; (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO.	LOCATIONS REFERENCED FROM POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
44	103' N.E., 60' N.W.	8417	140.0	5.0	139.1	7.1	99	90	Silty Gravel & Sand
45	65' N.E., 62' N.W.	8418	137.1	5.8	130.0	7.8	95	90	Silty Gravelly Sand
46	63' N.W.	8417	"	"	129.5	7.1	95	90	Silty Gravelly Sand
47	50' S.W., 64' N.W.	8417	"	"	132.9	7.5	97	90	Silty Gravelly Sand
48	110' S.W., 62' N.W.	8417	"	"	128.5	5.5	94	90	Silty Gravelly Sand

PART TIME OBSERVATION

THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.

THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017

PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Len w/Len's Excavating

PROGRESS REPORT: Tests were taken in the tailings pond embankment fill. The the test locations were referenced off the power pole.

COPIES:

Dave Cassidy
FIELD OBSERVER

Jim Riley
REVIEWED BY

HEPWORTH - PAWLAK GEOTECHNICAL, INC.
REPORT OF FIELD NUCLEAR DENSITY TESTING

TO: ITEC Environmental Colorado, Inc.
c/o McCulley, Frick & Gilman, Inc.
Attn: Jon Friedman
4900 Pearl East Circle, Suite 300w
Boulder, CO 80301

JOB NO. 298 187
DATE: 9/25/98
DAILY REPORT #12
PAGE 1 of 1

PROJECT: Cash Mine Redevelopment near Gold Hill, CO (Raise existing tailings embankment)

GENERAL CONTRACTOR: ITEC Environmental Colorado, Inc.

EARTHWORK CONTRACTOR: Len's Excavating,

TYPE AND NUMBER OF EARTH MOVING UNITS: (1) Dozer

THICKNESS OF LIFT: Not Observed

TYPE & # OF COMPACTION UNITS: (1) Track Loader

NUMBER OF PASSES: As Needed

METHOD OF ADDING MOISTURE: Natural/Water Hose

COMPACTION STANDARD : ASTM D-1557 (MODIFIED), 90%, ±2% OMC

TEST NO. & PROBE DEPTH	LOCATIONS REFERENCE FROM POINT ON CREST PERPENDICULAR TO POWER POLE	DEPTH OR ELEV	LABORATORY		FIELD		% COMP	MIN % COMP REQ.	SOIL TYPE
			MAX DRY DENS pcf	OPT MOIST %	DRY DENS pcf	MOIST %			
49 (12")	148' N.E., 2' S.E. OF c.l.	8420	137.1	5.8	137.0	7.3	100	90	Silty Gravelly Sand
49 (6")	" "	"	"	"	134.6	7.7	100+	90	Silty Gravelly Sand
49 SC	" "	"	"	"	137.1	8.0	100	90	Silty Gravelly Sand
50 (12")	60' N.E., 6' N.W. of c.l.	"	"	"	127.6	4.2	93	90	Silty Gravelly Sand
50 (6")	" "	"	"	"	128.7	3.9	94	90	Silty Gravelly Sand
51(12")	16' S.W., on c.l.	"	"	"	134.5	4.9	98	90	Silty Gravelly Sand
51 (6")	" "	"	"	"	131.8	5.1	96	90	Silty Gravelly Sand
51 SC	" "	"	"	"	132.0	4.7	96	90	Silty Gravelly Sand
52 (12")	93' S.W., S.E. Rt.	"	"	"	133.1	4.1	97	90	Silty Gravelly Sand
52 (6")	" "	"	"	"	126.4	4.4	92	90	Silty Gravelly Sand
53 (12")	157' S.W., 6' N.E. of c.l., S.E. on S.E. embankment curve	"	"	"	130.1	4.7	95	90	Silty Gravelly Sand
53 (6")	" "	"	"	"	124.4	4.8	91	90	Silty Gravelly Sand
53 SC	" "	"	"	"	121.2	4.5	88*	90	Silty Gravelly Sand

PART TIME OBSERVATION
THIS REPORT PRESENTS OPINIONS FORMED AS A RESULT OF OUR OBSERVATIONS OF FILL PLACEMENT, WE HAVE RELIED ON THE CONTRACTOR TO CONTINUE APPLYING THE RECOMMENDED COMPACTIVE EFFORT AND MOISTURE TO FILL DURING THE TIMES WHEN OUR OBSERVER IS NOT OBSERVING OPERATIONS.
THE NUCLEAR DENSOMETER METHOD OF TESTING WAS USED IN SUBSTANTIAL ACCORDANCE WITH ASTM D2992 AND D3017
PRELIMINARY OBSERVATIONS AND/OR TEST RESULTS VERBALLY REPORTED TO: Jon Friedman & Len Cole

PROGRESS REPORT: At the time of our testing, embankment fill was placed to near grade elevatiion. Chritina L. Kamnikar with the State of Colorado Division of Minerals and Geology observed the field testing.
* A coarse sized gravel was left in the sidewall of test hole 53 SC, which may have resulted in a somewhat lower calculated density compared to the nuclear gauge test.

S.C. = Sand Cone

Jim Riley — FIELD OBSERVER
Dennis Hanneman — REVIEWED BY

APPENDIX B

APPENDIX B

Geosynthetics Quality Control Data Sheets

Colorado Lining International

Installation Reports

for the

Gold Hill Mill Tailings Impoundment Expansion, Phases 1 & 2

Colorado Lining
INTERNATIONAL

Colorado Lining
INTERNATIONAL

Your Inside Line On Containment

December 4, 1998

Mr. Jon Friedman
McCulley, Frick & Gilman, Inc.
4900 Pearl East Circle, Suite 300W
Boulder, CO 80301

Re: Gold Hill Mill, Tailings Impoundment - 60 mil HDPE & GCL Installation

Dear Jon:

This letter shall serve as certification that the 60 mil High Density Polyethylene (LLDPE) liner and GCL Colorado Lining International (CLI) provided to Gold Hill Mill, met design specifications for this project.

In addition, this liner was installed and tested in accordance with the provided design specifications. The installation and quality assurance testing also met or exceeded documented industry guidelines and standards.

We are providing you with the associated field documentation to support this certification.

On behalf of our dedicated installation team and management staff, we would like to thank you for giving us the opportunity to successfully complete this project for you.

If you have any further requests, please do not hesitate to contact me.

Sincerely,

Michael S. Bair
Vice President

CORPORATE OFFICE
1062 Singing Hills Road Parker, Colorado 80138 303-841-2022 800-524-8672 Fax 303-841-5780 www.coloradolining.com

Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Subgrade Inspection

Date: 9-29-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Colorado Lining International (CLI) is not responsible for subsurface conditions, which may affect lining performance.

Is surface is acceptable for placement of geomembranes? Yes X No____

Comments With the placement of minimum 2" of sand cushion layer and the GCL underliner, Subgrade ~~of~~ ~~be~~ is suitable for primary 60 mil HDPE.

Date ~~Sept.~~ 29, 1998

Accepted By Representative of Owner (Signature) Jon Friedman

Print Name/Title Jon Friedman - Project Engineer / McCulley, Frick & Gilman Inc.

Company

Accepted By Representative of CLI (Signature) Pat Elliott

Print Name/Title Pat Elliott Installation Supervisor

CORPORATE OFFICE
1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com

Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Panel Placement Log

Page 1 of 3

Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Panel No.	Roll Number	Date	Material Type	Width	Length	Seam No.
1	231734	9-29-98	60	22	40	
2	231734	9-29-98	60	6	17	
3	231734	9-29-98	60	8	13	
4	231734	9-29-98	60	22	34	
5	231734	9-29-98	60	20	54	
6	231734	9-29-98	60	7	15	
7	231734	9-29-98	60	22	52	
8	231734	9-29-98	60	22	61	
9	231734	9-29-98	60	22	83	
10	231593	9-29-98	60	22	102	
11	231593	9-29-98	60	22	128	
12	231736	9-30-98	60	22	138	
13	231736	9-30-98	60	22	100	
14	231736	9-30-98	60	22	81	
15	231736	9-30-98	60	22	40	
16	231740	9-30-98	60	22	100	
17	231740	9-30-98	60	22	149	
18	231740	9-30-98	60	22	158	
19	231736	9-30-98	60	22	40	
20	231593	9-30-98	60	22	154	
21	231737	9-30-98	60	22	45	
22	231737	9-30-98	60	22	44	
23	231737	9-30-98	60	22	40	
24	231737	9-30-98	60	22	36	
25	231737	9-30-98	60	22	51	

Total Number of Rolls this Page	Total Square Footage this Page

Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Panel Placement Log

Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Panel No.	Roll Number	Date	Material Type	Width	Length	Seam No.
26	231737	9-30-98	60	11	14	
27	231737	9-30-98	60	22	31	
28	231737	9-30-98	60	12	19	

Total Number of Rolls this Page	Total Square Footage this Page

CORPORATE OFFICE
1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com

Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Daily Installation Report

Date: 9-28-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Nice and warm fairly Gusty

Roll Numbers Installed Today

N/A			

Problems Encountered/Comments

Arrived around 11:00 am, We filled bags and fixed 1 hot shoe and got all three set up and ready to go. Subgrade still in bad shape. State Rep is going to show up late this afternoon and approve or dissaprove subgrade.

CORPORATE OFFICE
1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com

Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Daily Installation Report

Date: 9-29-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Nice, cool, partly cloudy, Afternoon Heavy cloud and rain at 4:30

Roll Numbers Installed Today

231734	stat of 231783	4 rolls of GCL	

Problems Encountered/Comments

Arrived around 6:40. Got set up and Ready to pull liner by 7:45 because key to forklift was in office and they don't arrive till 7:30. 2 new GCL inner bars that are 17 feet long are to short and chains keep falling off, also core on GCL are smashed so very slow and difficult to hook up. We couldn't start till state showed up and they were late so we stood around till 8:20 on them. Then the wouldn't improve N corner till 9:45 were we could start. 9 dz and 5 labor picked rocks for 1hr 15 min we got 3 rolls of GCL out and covered by 1:00 took late lunch. When we got back we put out 4 more rolls of GCL and got them covered just in time for rain to start. 2 more gen went down.

CORPORATE OFFICE
1062 Singing Hills Road Parker, Colorado 80138 800 524 8672 303 841 2022 Fax 303 841 5780 www.coloradolining.com

Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Daily Installation Report

Date: 9-30-98

Project:	**Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO**
Owner:	**ITEC Environmental Colorado, Inc.**
Engineer:	**McCulley, Frick & Gilman**
Contractor:	
Installation Supervisor:	**Pat Elliott**
Material:	**GCL under 60 mil HDPE-Smooth**

Weather Conditions Over cast and cold

Roll Numbers Installed Today

~~finished~~ 231593	231736	231740	[redacted]
231737			

Problems Encountered/Comments

Arrived at 6:30 and Rain last night didn't effect us much, but had to wait till 8:20 to start because subgrade was wet and they had to approve it. 3 labor 7:30 and 2 more at 9:00. Moly Arrived at 9:30. Slow going because of roll staging but we got slot in by lunch and we were beating weather so things went good till 3:30. (Check sheet Attached) They held us up 6:30 on there ditch and subgrade on wall so that set us back but we still beat the weather got to seam run, by 6:30. Had some more problem with generators and extruders but extruded by the light of a flashlight just to get us off floor area wait till tommarow and see if we can't do tie in and wall patches and destruct. and UBox.

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Daily Installation Report

Date: 10-1-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Foggy, wet and cold

Roll Numbers Installed Today

N/A			

Problems Encountered/Comments

Arrived at 8:00 we were going to try and wait out storm by picking up trash and cleaning up sight. Moving rolls measuring 2nd pond. Getting things ready, waited till 11:00 and decided to try again tommarow.

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Daily Installation Report

Date: 10-2-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Cold, breezy and partly cloudy

Roll Numbers Installed Today

N/A			

Problems Encountered/Comments

I arrived at 6:30 to make call on work or not and, got the crew up here by 8:00 and got started. We were going to start on tie in but they held us up till around 10:30 because they didn't know if they were going to have to access that dike or not, to move slude. but by 2:00 all patching and tie in was done. Finished on tie in scrap, paper work, V-Boxing.

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Quality Control Air Testing

Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Type of Air Test: Pressurization X (25-30 psi) Vacuum Box _____ (3-5 inches of Hg) Air Lance _____ (55 psi)

Date of Test	Time of Test	Seam No.	Length of Seam	Welder No.	Operator	Test Results Pass/Fail
9-30-98	10:40	1	17			Pass
9-30-98	10:50	2	14			Pass
9-30-98	11:00	3	38			Pass
9-30-98	11:05	4	48			Pass
9-30-98	11:15	5	17			Pass
9-30-98	11:20	6	55			Pass
9-30-98	11:10	7	53			Pass
9-30-98	11:25	8	61			Pass
9-30-98	11:30	9	52			Pass
9-30-98	1:30	10	105			Pass
9-30-98	1:35	11	39			Pass
9-30-98	1:40	12	115			Pass
9-30-98	1:50	13	50			Pass
9-30-98	5:00	14	133			Pass
9-30-98	5:10	15	43			Pass
9-30-98	5:20	16	22'			Pass
9-30-98	5:30	17	140'			Pass
9-30-98	5:35	18	146'			Pass
9-30-98	5:45	19	148'			Pass
9-30-98	5:55	20	154'			Pass
9-30-98	6:05	21	42'			Pass
9-30-98	6:15	22	37			Pass
9-30-98	6:25	23	43			Pass
9-30-98	6:35	24	15			Pass
9-30-98	6:45	25	14			Pass
9-30-98	6:55	26	17			Pass

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Quality Control Air Testing (continued)

Page 2 of 2

Project: **Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO**

Type of Air Test: Pressurization X 25-30 psi Vacuum Box_____ 3-5 inches of Hg Air Lance_____ 55 psi

Date of Test	Time of Test	Seam No.	Length of Seam	Welder No.	Operator	Test Results Pass/Fail
7-22-25	7:00	27	148			Pass
		28				

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Seam Strength Test

Date: 9-29-98

Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Fusion Weld X Extrusion Weld_____ Unit Type & No. HS-202-1+S236

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Sheer Value	Welding Tech.	Pass/Fail
9-29	7:15	65°	750°	—	10.5	144/146	178	MC	Pass
"	"	"	"	"	"	139/137	176	MC	Pass
"	"	"	"	"	"	129/138		MC	Pass
9-29	7:20	65°	700°	"	10.5	127/123	157	AU	Pass
"	"	"	"	"	"	131/128	159	AU	Pass
"	"	"	"	"	"	135/128		AU	Pass
9-						/			
						/			
						/			
						/			
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Welding Technician: Aaron Unrein, Mike Collins
Quality Control Supervisor: Pat Elliott

Comments: _____

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Seam Strength Test

Date: 9-30-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Fusion Weld + Extrusion Weld + Unit Type & No. _____

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Sheer Value	Welding Tech.	Pass/Fail
9-30	7:10	60°	730°	—	10.5	124/120	146	VD	Pass
—	—	—	—	—	—	118/121	162	VD	Pass
—	—	—	—	—	—	120/120		VD	Pass
9-30	7:15	60°	700°	—	10-5	125/138	190	AJ	Pass
—	—	—	—	—	—	141/151	192	AJ	Pass
—	—	—	—	—	—	121/124		AJ	Pass
9-30	4:00	70°	700°	—	10.5	125/121	162	MI	Pass
—	—	—	—	—	—	120/124	168	MI	Pass
—	—	—	—	—	—	131/130		MI	Pass
9-30	6:10	40°	3500°	500°	—	108	160	AJ	Pass
—	—	—	—	—	—	106	181	AJ	Pass
—	—	—	—	—	—	117		AJ	Pass
						/			
						/			
						/			
						/			
						/			
						/			
						/			
						/			

Welding Technician: _____
Quality Control Supervisor: Pat Elliott

Comments: _____

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Field Seam Destructive Test

Date: 10-2-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

Unit Type & No.: H.S. # 201 & 202						Ambient Air Temp.:
Welder Temp. Setting: 750°			Pre-Heat Temp Setting:			Speed: 11.5
Date of Test	Time of Test	Destruct Sample No.	Specimen No.	Peel Value Inside/Outside	Sheer Value	Action Taken (Pass/Fail)
10-2	8:40	1	1	110/125		PASS
10-2	8:40	1	2 & 4	115/140	176	PASS
10-2	8:40	1	3 & 5	125/142	176	PASS
10-2	8:50	2	1	120/123		PASS
10-2	8:50	2	2 & 4	117/115	152	PASS
10-2	8:50	2	3 & 5	102/110	155	PASS
10-2	9:00	3	1	113/115		PASS
10-2	9:00	3	2 & 4	137/145	170	PASS
10-2	9:00	3	3 & 5	131/125	170	PASS

Welding Technician: Aaron V. & Mollie I.
Quality Control Supervisor: Pat Elliott

Comments: _____

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Geomembrane Installation Approval

Date:_____

Project:	**Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO**
Owner:	**ITEC Environmental Colorado, Inc.**
Engineer:	**McCulley, Frick & Gilman**
Contractor:	
Installation Supervisor:	**Pat Elliott**
Material:	**GCL under 60 mil HDPE-Smooth** (Phase I)

The Geomembrane on this project has been installed, inspected and tested in accordance with Industry Standards and Manufacturer recommendations.

Date 10-2-98

Accepted By (Signature) Bill Hamling

Print Name/Title BILL HAMLING MNG.

Company ITEC ENVIORMENTAL

All warranties to begin on the date of acceptance.
Warranties to be issued upon receipt of final payment

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Material Inventory Log

Page ___ of ____

Date: 9-28-98
Project: Gold Hill MillTailings Pond Expansion-Phase 1, Boulder, CO
Owner: ITEC Environmental Colorado, Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Pat Elliott
Material: GCL under 60 mil HDPE-Smooth

	Roll Number	Width	Length	Material Condition	Return (Factory or CLI)
1	231753	22.5	470	Good	~~left on joint~~
2	231736	22.5	470	Good	Used on pond 1
3	231593	22.5	420	Good	27'
4	231737	22.5	420	Good	99'
5	231734	22.5	420	Good	57'
6	231740	22.5	420	Good	Used on pond 1
7	231748	22.5	420	Good	
8					
9	GCL 11 rolls	15	150		left for 2nd phase
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

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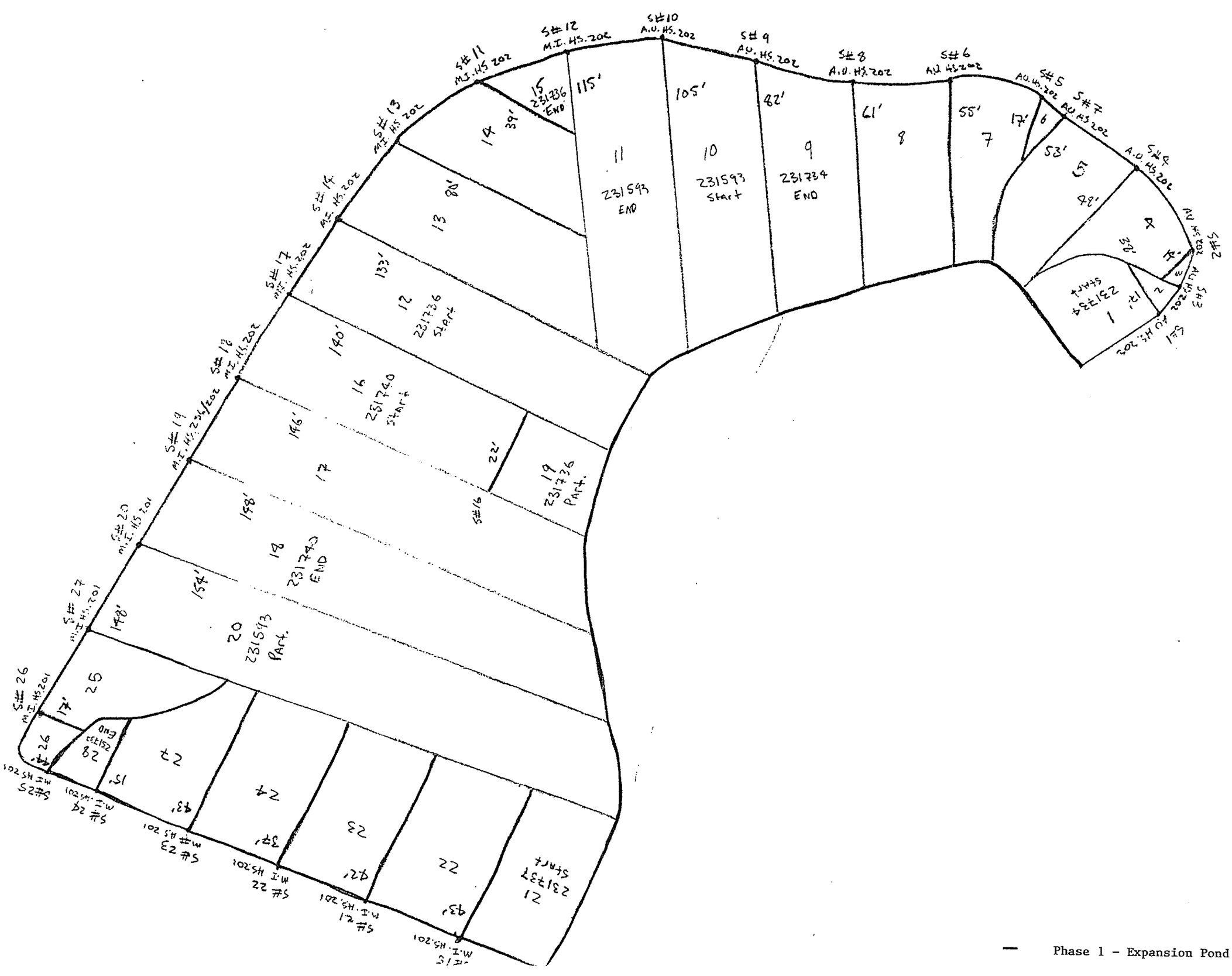

— Phase 1 - Expansion Pond —

AGRU / A :ICA, INC.
Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231737** Lot # **H051253** **Liner Type:SMOOTH**

		METRIC	ENGLISH			
Measurement ASTM D-751/5199	MIN:	**1.531** mm	**60** mil	Thickness	**1.5mm**	**60mil**
	MAX:	**1.578** mm	**62** mil	Length	**128** m	**420** feet
	AVE:	**1.551** mm	**61** mil	Width	**6.86** m	**22.5** feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	**.947**
MFI ASTM D-1238 COND. E GRADE: **chevron 9638**	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	**2.93**
Carbon Black Dispersion ASTM D-5596	Category		1,2	**1**
Tensile Strength ASTM D-638 2 inches / minute)	Yield M.D.	psi	2200	**2,484**
	Yield T.D.	psi	2200	**2,572**
	Break M.D.	psi	4000	**4,312**
	Break T.D.	psi	4000	**5,169**
Elongation ASTM D - 638 Modified 2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**17.92**
	Yield T.D.	%	13	**17.15**
	Break M.D.	%	700	**737.9**
	Break T.D.	%	700	**969.2**
Dimensional Stability ASTM D-1204	M.D.	%	±1	**-.06**
	T.D.	%	±1	**.03**
Tear Resistance ASTM D-1004	M.D.	lbs	45	**50.340**
	T.D.	lbs	45	**47.890**
Puncture Resistance FTMS 101 Method 2065	Load	lbs	80	**96.192**
Puncture Resistance ASTM D-4833	Load	lbs		**134.000**
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
Notched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**ongoing**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Form SM60AA.FRM

Date: **8/6/98**

Signature: .....

Quality Control Department

AGRU / A. .ICA, INC.
Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231593** Lot # **H051283** **Liner Type:SMOOTH**

		METRIC	ENGLISH			
Measurement ASTM D-751/5199	MIN:	**1.529** mm	**60** mil	Thickness	**1.5mm**	**60mil**
	MAX:	**1.598** mm	**63** mil	Length	**128** m	**420** feet
	AVE:	**1.566** mm	**62** mil	Width	**6.86** m	**22.5** feet

			A/A'S DATA SHEET	TEST RESULTS
pecific Gravity STM D-792	Density	g/cc	.948	**.949**
MFI ASTM D-1238 OND. E GRADE: **chevron 9638**	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
arbon Black Content STM D-1603/4218	Range	%	2-3	**2.44**
Carbon Black Dispersion STM D-5596	Category		1,2	**1**
Tensile Strength STM D-638 (2 inches / minute)	Yield M.D.	psi	2200	**2,540**
	Yield T.D.	psi	2200	**2,652**
	Break M.D.	psi	4000	**4,423**
	Break T.D.	psi	4000	**5,263**
Elongation ASTM D - 638 Modified (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**18**
	Yield T.D.	%	13	**16**
	Break M.D.	%	700	**742**
	Break T.D.	%	700	**963**
imensional Stability ASTM D-1204	M.D.	%	±1	**-.37**
	T.D.	%	±1	**+.22**
ear Resistance ASTM D-1004	M.D.	lbs	45	**50.911**
	T.D.	lbs	45	**47.532**
uncture Resistance TMS 101 Method 2065	Load	lbs	80	**102.760**
Puncture Resistance STM D-4833	Load	lbs		**122.140**
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
Notched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**ongoing**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Date: **8/4/98**

Signature: _____

Quality Control Department

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CERTIFICATE OF CONFORMITY

ROLL # **231740** Lot # **H051253** **Liner Type:SMOOTH**

		METRIC	ENGLISH				
Measurement ASTM D-751/5199	MIN:	1.523 mm	60	mil	Thickness	1.5mm	60mil
	MAX:	1.576 mm	62	mil	Length	128 m	420 feet
	AVE:	1.552 mm	61	mil	Width	6.86 m	22.5 feet

			A/A'S DATA SHEET	TEST RESULTS
pecific Gravity STM D-792	Density	g/cc	.948	.947
MFI ASTM D-1238 OND. E GRADE: chevron 9638	Melt Flow Index 190°C /2160 g	- g /10 min	.28	.23
arbon Black Content STM D-1603/4218	Range	%	2-3	2.93
Carbon Black Dispersion STM D-5596	Category		1,2	1
Tensile Strength STM D-638 (2 inches / minute)	Yield M.D.	psi	2200	2,484
	Yield T.D.	psi	2200	2,572
	Break M.D.	psi	4000	4,312
	Break T.D.	psi	4000	5,169
ongation ASTM D - 638 Modified (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	17.92
	Yield T.D.	%	13	17.15
	Break M.D.	%	700	737.9
	Break T.D.	%	700	969.2
imensional Stability ASTM D-1204	M.D.	%	±1	-.06
	T.D.	%	±1	.03
ear Resistance ASTM D-1004	M.D.	lbs	45	50.340
	T.D.	lbs	45	47.890
uncture Resistance FMS 101 Method 2065	Load	lbs	80	96.192
Puncture Resistance STM D-4833	Load	lbs		134.000
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	ONGOING
otched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	ongoing

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Form SM60AA.FRM

Date: 8/6/98

Signature: _____

Quality Control Department

AGRU / A. .ICA, INC.
Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231736** Lot # **H051253** **Liner Type:SMOOTH**

		METRIC	ENGLISH
Measurement ASTM D-751/5199	MIN:	**1.521** mm	**60** mil
	MAX:	**1.597** mm	**63** mil
	AVE:	**1.553** mm	**61** mil

Thickness	**1.5mm**	**60mil**	
Length	**128** m	**420**	feet
Width	**6.86** m	**22.5**	feet

			A/A'S DATA SHEET	TEST RESULTS
ɔecific Gravity STM D-792	Density	g/cc	.948	**.947**
MFI ASTM D-1238 ɔND. E GRADE: **chevron 9638**	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
arbon Black Content STM D-1603/4218	Range	%	2-3	**2.93**
Carbon Black Dispersion STM D-5596	Category		1,2	**1**
Tensile Strength STM D-638 (2 inches / minute)	Yield M.D.	psi	2200	**2,484**
	Yield T.D.	psi	2200	**2,572**
	Break M.D.	psi	4000	**4,312**
	Break T.D.	psi	4000	**5,169**
ɔngation ASTM D - 638 Modified (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**17.92**
	Yield T.D.	%	13	**17.15**
	Break M.D.	%	700	**737.9**
	Break T.D.	%	700	**969.2**
mensional Stability ASTM D-1204	M.D.	%	±1	**-.06**
	T.D.	%	±1	**.03**
ar Resistance ASTM D-1004	M.D.	lbs	45	**50.340**
	T.D.	lbs	45	**47.890**
ɔncture Resistance GRI GMS 101 Method 2065	Load	lbs	80	**96.192**
Puncture Resistance STM D-4833	Load	lbs		**134.000**
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
ɔtched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**ongoing**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Date: **8/6/98**

Signature: _____

Quality Control Department

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Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231734** Lot # **H051253** **Liner Type:SMOOTH**

		METRIC	ENGLISH			
Measurement ASTM D-751/5199	MIN:	**1.521** mm	**60** mil	Thickness	**1.5mm**	**60mil**
	MAX:	**1.585** mm	**62** mil	Length	**128** m	**420** feet
	AVE:	**1.563** mm	**62** mil	Width	**6.86** m	**22.5** feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	**.947**
MFI ASTM D-1238 COND. E GRADE: **chevron 9638**	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	**2.76**
Carbon Black Dispersion ASTM D-5596	Category		1,2	**1**
Tensile Strength ASTM D-638 (2 inches / minute)	Yield M.D.	psi	2200	**2,439**
	Yield T.D.	psi	2200	**2,526**
	Break M.D.	psi	4000	**4,331**
	Break T.D.	psi	4000	**5,355**
Elongation ASTM D - 638 Modified (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**19.73**
	Yield T.D.	%	13	**17.60**
	Break M.D.	%	700	**725.5**
	Break T.D.	%	700	**998.0**
Dimensional Stability ASTM D-1204	M.D.	%	±1	**-.06**
	T.D.	%	±1	**.03**
Tear Resistance ASTM D-1004	M.D.	lbs	45	**49.959**
	T.D.	lbs	45	**47.617**
Puncture Resistance FTMS 101 Method 2065	Load	lbs	80	**98.956**
Puncture Resistance ASTM D-4833	Load	lbs		**133.040**
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
Notched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**ongoing**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Date: **8/6/98**

Signature.....

Quality Control Department

Form SM60AA.FRM

Phase II

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"Your Inside Line On Containment"

Panel Placement Log

Page 1 of ____

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder,CO
Owner: ITEC Environmental Colorado,Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Panel No.	Roll Number	Date	Material Type	Width	Length	Seam No.
1		11-16	60 mil HDPE	22'	80'	1
2	217430	11-17	↓	↓		1/2
3	↓	↓				2/3
4						3/4
5						

Total Number of Rolls this Page	Total Square Footage this Page

CORPORATE OFFICE
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Colorado Lining
INTERNATIONAL
" Your Inside Line On Containment"

Daily Installation Report

Date: 11-16-99
Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder,CO
Owner: ITEC Environmental Colorado,Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Sunny, 58°

Roll Numbers Installed Today

93737		roll bent of 3X	

Problems Encountered/Comments

Arrived on site to find subgrade not ready. Standing water, Ice, excessive access present. Road along east side gave way to fork lift causing 1/2 an hour to 2 delay. Used Labor to pick rocks, scrap ice, + move sand bags. Finally deployed 2 sheets of bentofix + 1 sheet of 60 mil, 80' A 4' section became saturated when Ice melted. That section will be cut out + replaced.

2X6.5 hrs. 10 Labor X 4 hrs.

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Colorado Lining
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Daily Installation Report

Date: 1-17-98
Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder,CO
Owner: ITEC Environmental Colorado,Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Weather Conditions Sunny 53°

Roll Numbers Installed Today

217490			

Problems Encountered/Comments

Labor did not arrive until 9:30a.m., 5 From aurora left at 10:30a.m., Leaving me with only 4 Laborers. Vinnie arrived at 10:30a.m. & I used Carlos John to help deploy GCL. we were able to Install 5 rolls of GCL & 1 roll of 60mil. Wind after lunch slowed deployment down considerably, along with being short handed.

J.T. & N.L. X 10.5hrs. V.D. X 7hrs

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Daily Installation Report

Date: 11/16/96

Project:	**Gold Hill mill Tailings pond expansion, Boulder, CO**
Owner:	**ITEC Colorado**
Engineer:	**MFG**
Contractor:	
Installation Supervisor:	**Ryan Heath**
Material:	**GCL under 60 HDS**

Weather Conditions High Wind

Roll Numbers Installed Today

Problems Encountered/Comments

No Labor, Extreme wind could not work on Liner

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Daily Installation Report

Date: 11/19/98
Project: Gold Hill mill Tailings pond expansion, Boulder, CO
Owner: ITEC Colorado
Engineer: MFG
Contractor:
Installation Supervisor: Ryan Heath
Material: GCL under 60 HDS

Weather Conditions overcast + snowing

Roll Numbers Installed Today

Problems Encountered/Comments

State wouldn't allow us to deploy because of snow on subgrade.

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Daily Installation Report

Date: 11/20/96
Project: Gold Hill mill Tailings pond expansion, Boulder, CO
Owner: ITEC Colorado
Engineer: MFG
Contractor:
Installation Supervisor: Ryan Heath
Material: GCL under 60 HDS

Weather Conditions Cold windy

Roll Numbers Installed Today

Problems Encountered/Comments

Forklift wouldn't start needed to replace starter, All patching finished on plastic that Jason Tapp deployed also Did Tie in to Existing liner. Forklift part arived sometime in evening.

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Daily Installation Report

Date: 11/21/96
Project: Gold Hill mill Tailings pond expansion, Boulder, CO
Owner: ITEC Colorado
Engineer: MFG
Contractor:
Installation Supervisor: Ryan Heath
Material: GCL under 60 HDS

Weather Conditions Extreme wind 60 mph +

Roll Numbers Installed Today

231753.	3 Rolls GCL		
224214.			
started 231749			

Problems Encountered/Comments

Arived on site to find all of the matterial deployed for phase #2 Destroyed. Wind Ripped plastic out of the treanch and tore the intire Tie in Seam. Wind calmed around 11:30am Berrid old liner. Deployed liner beyond exsitiny liner and did Tie in.

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Daily Installation Report

Date: 11/22/96
Project: Gold Hill mill Tailings pond expansion, Boulder, CO
Owner: ITEC Colorado
Engineer: MFG
Contractor:
Installation Supervisor: Ryan Heath
Material: GCL under 60 HDS

Weather Conditions Cool windy

Roll Numbers Installed Today

231749	2rolls GCL		

Problems Encountered/Comments

Ran out of Bendix. Had to wait till monday to finish pond all ~~[illegible]~~ matterial pulled all testing finished.

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Quality Control Air Testing

Page 1 of 1

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder,CO
Owner: ITEC Environmental Colorado,Inc.
Engineer: McCulley, Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Type of Air Test: Pressurization X (25-30 psi) Vacuum Box ____ (3-5 inches of Hg) Air Lance ____ (55 psi)

Date of Test	Time of Test	Seam No.	Length of Seam	Welder No.	Operator	Test Results Pass/Fail
11-22-98	10:36	#1	72'	# 131	Jason Austin	pass
11-22-98	10:45	#2	78'	# 103	Matt Alred	pass
11-22-98	10:42	3	78'	131	JA	pass
11-22-98	10:51	4	22'	103	MA	pass
11-22-98	11:02	5	22'	131	JA	pass
11-22-98	10:44	6	68'	103	MA	pass
11-22-98	10:55	7	70'	131	JA	pass
11-22-98	11:10	8	69'	103	MA	pass
11-22-98	11:20	9	66'	103	MA	pass
11-22-98	11:20	10	67'	131	JA	pass
11-22-98	11:30	11	67'	103	MA	pass
11-22-98	11:32	12	67'	131	JA	pass
11-22-98	11:33	13	69'	103	MA	pass
11-22-98	11:33	14	68'	131	JA	pass
11-23-98	11:34	15	15'	103	Nick Lavin	pass
11-23-98	11:35	16	32'	103	NL	pass
11-23-98	11:45	17	30'	103	NL	pass
11-23-98	11:05	18	66'	103	NL	pass
VB 11-23-98		19*	360'	103	Matt Alred	pass

*- Tie in Vaccum Box

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Seam Strength Test

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2 , Boulder, Co
Owner: ITEC Enviromental Colorado
Engineer: McCulley,Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Fusion Weld X Extrusion Weld_____ Unit Type & No. #6 # 131

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Sheer Value	Welding Tech.	Pass/Fail
11/21/98	900 am	50°	450°	\	11 Fpm	91 / 95	136	Jason Austin	pass
11/21/98	900 am	50°	450°	\	11 Fpm	93 / 96	142	JA	pass
11/21/98	900 am	50°	450°	\	11 Fpm	92 / 99		JA	pass
						/			
11/22/98	945	45°	450°	\	11 Fpm	110 / 112	146	JA	pass
11/22/98	945	45°	450°	\	11 Fpm	98 / 111	149	JA	pass
11/22/98	945	45°	450°	\	11 Fpm	99 / 101		JA	pass
						/			
11/23/98	900 am	45°	450°	~	11 Fpm	113 / 121	146	Nick Lavin	pass
11/23/98	9.00 am	45°	450°	~	11 Fpm	114 / 120	152	NL	pass
11/23/98	900 am	45°	450°	~	11 Fpm	109 / 121		NL	pass
						/			
						/			
						/			
						/			
						/			
						/			
						/			
						/			
						/			

Welding Technician: Jason [redacted] Austin + Nick Lavin
Quality Control Supervisor:

Comments: Good weld!

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Seam Strength Test

Project: Gold Hill Mill Tailings Pond Expansion, Phase 2 , Boulder, Co
Owner: ITEC Enviromental Colorado
Engineer: McCulley,Frick & Gilman
Contractor:
Installation Supervisor: Jason Tapp
Material: GCL under 60 mil HDPE-Smooth

Fusion Weld X Extrusion Weld X Unit Type & No. HS#03 UTR#005

Date of Test	Time of Test	Ambient Air Temp.	Unit Temp.	Pre-Heat Temp.	Unit Speed	Peel Value Inside/Outside	Sheer Value	Welding Tech.	Pass/Fail
11/21/98	900	50°	450°		11.0 FPM	112/99	156	MA	PASS
11/21/98	900	50°	450°		11.0 FPM	104/105	147	MA	PASS
11/21/98	900	50°	450°		11.0 FPM	115/102		MA	PASS
						/			
11/22/98	9:45 AM	45°	450°		11.0 FPM	101/98	149	MA	PASS
↓	↓	↓	↓		↓	105/102	146	MA	PASS
↓	↓	↓	↓		↓	101/102		MA	PASS
						/			
11/23/98	9:00 AM	45°	450°		11.0 FPM	99/99	151	MA	PASS
↓	↓	↓	↓		↓	106/109	141	MA	PASS
↓	↓	↓	↓		↓	99/103		MA	PASS
						/			
						/			
11/22/98	10:00 AM	45°	450°	350°		126/121	161	RG	PASS
↓	↓	↓	↓	↓		119/118	152	RG	PASS
↓	↓	↓	↓	↓		121/126		RG	PASS
						/			
11/23/98	10:05 AM	45°	450°	350°		131/140	159	RG	PASS
↓	↓	↓	↓	↓		129/137	162	RG	PASS
↓	↓	↓	↓	↓		136/134		RG	PASS

Welding Technician: Matt Allred + Ryan Goodyear
Quality Control Supervisor:

Comments: _____

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Geomembrane Installation Approval

Date:_____

Project:	**Gold Hill Mill Tailings Pond Expansion, Phase 2, Boulder,CO**
Owner:	**ITEC Environmental Colorado,Inc.**
Engineer:	**McCulley, Frick & Gilman**
Contractor:	
Installation Supervisor:	**Jason Tapp**
Material:	**GCL under 60 mil HDPE-Smooth**

The Geomembrane on this project has been installed, inspected and tested in accordance with Industry Standards and Manufacturer recommendations.

Date Nov. 25, 1998

Accepted By (Signature) Jon Friedman

Print Name/Title JON FRIEDMAN

Company McCulley, Frick & Gilman

All warranties to begin on the date of acceptance.
Warranties to be issued upon receipt of final payment

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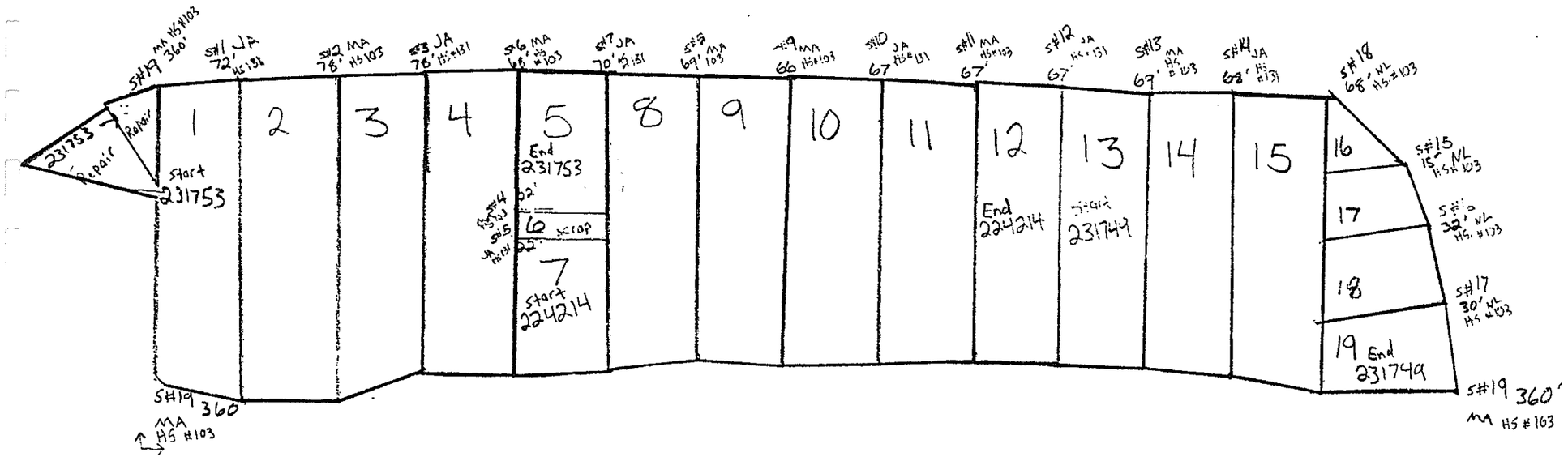


Phase 2 - Expansion Pond

AGRU / A. ICA, INC.
Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231753** Lot # **H051253** **Liner Type:SMOOTH**

		METRIC	ENGLISH				
Measurement ASTM D-751/5199	MIN:	**1.533** mm	**60** mil	Thickness	**1.5mm**	**60mil**	
	MAX:	**1.587** mm	**62** mil	Length	**128** m	**420** feet	
	AVE:	**1.56** mm	**61** mil	Width	**6.86** m	**22.5** feet	

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	**.947**
MFI ASTM D-1238 COND. E GRADE: **chevron 9638**	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	**2.68**
Carbon Black Dispersion ASTM D-5596	Category		1,2	**1**
Tensile Strength ASTM D-638 (2 inches / minute)	Yield M.D.	psi	2200	**2,550**
	Yield T.D.	psi	2200	**2,606**
	Break M.D.	psi	4000	**4,783**
	Break T.D.	psi	4000	**5,048**
Elongation ASTM D - 638 Modified (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**17.67**
	Yield T.D.	%	13	**16.51**
	Break M.D.	%	700	**798.6**
	Break T.D.	%	700	**937.1**
Dimensional Stability ASTM D-1204	M.D.	%	±1	**-.06**
	T.D.	%	±1	**.03**
Tear Resistance ASTM D-1004	M.D.	lbs	45	**51.738**
	T.D.	lbs	45	**49.144**
Puncture Resistance GRI GTMS 101 Method 2065	Load	lbs	80	**106.960**
Puncture Resistance ASTM D-4833	Load	lbs		**124.760**
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
Notched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**ongoing**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Form SM60AA.FRM

Date: **8/6/98**

Signature: .....

Quality Control Department

AGRU / A. .ICA, INC.
Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **224214** Lot # **H031325** **Liner Type:SMOOTH**

		METRIC	ENGLISH			
Measurement ASTM D-751/5199	MIN:	**1.455** mm	**57** mil	Thickness	**1.5mm**	**60mil**
	MAX:	**1.563** mm	**62** mil	Length	**128** m	**420** feet
	AVE:	**1.53** mm	**60** mil	Width	**6.86** m	**22.5** feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	**.948**
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	**2.47**
Carbon Black Dispersion ASTM D-5596	Category		1,2	**1**
Tensile Strength ASTM D-638 (2 inches / minute)	Yield M.D.	psi	2200	**2,557**
	Yield T.D.	psi	2200	**2,638**
	Break M.D.	psi	4000	**4,566**
	Break T.D.	psi	4000	**4,540**
Elongation ASTM D - 638 Modified (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**18.6**
	Yield T.D.	%	13	**17.1**
	Break M.D.	%	700	**764**
	Break T.D.	%	700	**823.9**
Dimensional Stability ASTM D-1204	M.D.	%	±1	**-.69**
	T.D.	%	±1	**.08**
Tear Resistance ASTM D-1004	M.D.	lbs	45	**50.7**
	T.D.	lbs	45	**49.2**
Puncture Resistance TMS 101 Method 2065	Load	lbs	80	**96.8**
Puncture Resistance ASTM D-4833	Load	lbs		**133.9**
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
Notched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**200**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **Reno Cell 1C**

DESTINATION: **Hutchinson, KS**

Form SM60AA.FRM

Date: **6/19/98**

Signature.....

Quality Control Department

AGRU / A ICA, INC.
Subsidiary of AGRU-ALOIS GRUBER GMBH

CERTIFICATE OF CONFORMITY

ROLL # **231749** Lot # **H051253** **Liner Type:SMOOTH**

		METRIC	ENGLISH				
Measurement ASTM D-751/5199	MIN:	**1.522** mm	**60** mil	Thickness	**1.5mm**	**60mil**	
	MAX:	**1.609** mm	**63** mil	Length	**128** m	**420** feet	
	AVE:	**1.569** mm	**62** mil	Width	**6.86** m	**22.5** feet	

			A/A'S DATA SHEET	TEST RESULTS
pecific Gravity STM D-792	Density	g/cc	.948	**.947**
MFI ASTM D-1238 OND. E RADE: **chevron 9638**	Melt Flow Index 190°C /2160 g	- g /10 min	.28	**.23**
arbon Black Content STM D-1603/4218	Range	%	2-3	**2.73**
Carbon Black Dispersion STM D-5596	Category		1,2	**1**
Tensile Strength STM D-638 2 inches / minute)	Yield M.D.	psi	2200	**2,550**
	Yield T.D.	psi	2200	**2,610**
	Break M.D.	psi	4000	**4,564**
	Break T.D.	psi	4000	**4,971**
longation ASTM D - 638 Modified 2 inches / minute) = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	**19.32**
	Yield T.D.	%	13	**17.96**
	Break M.D.	%	700	**772.3**
	Break T.D.	%	700	**922.4**
imensional Stability ASTM D-1204	M.D.	%	±1	**-.06**
	T.D.	%	±1	**.03**
ear Resistance STM D-1004	M.D.	lbs	45	**51.341**
	T.D.	lbs	45	**48.849**
uncture Resistance TMS 101 Method 2065	Load	lbs	80	**106.060**
Puncture Resistance STM D-4833	Load	lbs		**129.120**
ESCR STM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	**ONGOING**
otched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	**ongoing**

CUSTOMER: **Colorado Lining Co.**

P.O.#: **CLI 98/2**

DESTINATION: **Parker, CO**

Date: **8/6/98**

Signature: _____

Quality Control Department

Form SM60AA.FRM

GCL

BENTOFIX TECHNOLOGIES, INC.

BENTOFIX MANUFACTURING CERTIFICATION

CUSTOMER: FLUID SYSTEMS

SHIP DATE: 09/11/98

PROJECT:GOLD HILL MILL TAILINGS

NO. ROLLS/B.O.L. NO20/000085

ORDER NUMBER: 8V72110

PRODUCT TYPE: NSL

Bentofix technologies, inc. hereby certifies that the Bentofix Geosynthetic clay liner purchased and shipped for the above referenced project meets or exceeds Bentofix Technologies, Inc.'s specifications for Bentofix.

The Bentofix product has been continuously inspected for the presence of needles and is certified to be needle free.

The tests listed for the bentonite component have been performed on each batch of bentonite. The tests listed for the finished geocomposite product have been performed on at least every 40,000sq. ft. (3,716 sq.MT) for the Mass Per Unit Area according to method ASTM D5261 and for the Grab Tensile according to method ASTM D4632. The tests listed for the finished geocomposite product have been performed on at least every 9,290 sq. Mt. (100,000 sq. ft.) for the geotextile component and the finished geocomposite water permeability according to method GRI GCL-2.

The lot and roll numbers for this project are as follows:

LOT# R8081503

ROLL# 425,483,484

LOT# R8081803

ROLL# 501

LOT# R8082503

ROLL# 735,736,779,780

LOT# R8082603

ROLL# 804,805,827,851

LOT# R8082903

ROLL# 895,938,939

LOT# R8090203

ROLL# 1033

LOT# R8090803

ROLL# 1272,1331,1332

Tim Malloy — 9/11/98

TIM MALLOY
QUALITY CONTROL MANAGER

DATE

STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

BTI 000085

ILER NO 316

SEAL NO

Order No. 8V72110

ORDER NO

CHRISCO Transport

Invoice No. 96

10-Sep-98

E OF CARRIER

DATE

SIGNEE	GOLD HILL MILL TAILINGS	FROM SHIPPER	BENTOFIX TECHNOLOGIES (USA), INC.
EET	1 M.E. OF GOLD HILL W. OF	STREET	300 PARR BLVD.
STINATION	BOULDER, SUNSHINGOLD HILL, CO 80302	ORIGIN	RENO, NV 89512 (702) 333-1003
TE			

NO. SHIPPING UNITS	* HM	KIND OF PACKAGING, DESCRIPTION OF ARTICLES SPECIAL MARKS AND EXCEPTIONS	WEIGHT (SUBJECT TO CORRECTION)	SQ. FEET
20 rolls		Bentofix Material	44618	44950

ID NO.	SIZE LENGTH	SIZE WIDTH	SF	WT	ID NO.	SIZE LENGTH	SIZE WIDTH	SF	WT

Site Contact JOHN HEAP (800) 524-8672.

CALL 24 HOURS PRIOR TO DELIVERY TO SCHEDULE UNLOADING

ALL FLATBED LOADS MUST BE TARPED

TO BE DELIVERED: 11-Sep-98

ADDITIONAL ITEMS

T

.O.D. TO:

DDRESS

COD Amt: $

C.O.D. FEE:
PREPAID ☐ $
COLLECT ☐

TOTAL CHARGES: $

FREIGHT CHARGES
FREIGHT PREPAID Check box (except when box at right is checked) if charges are ☐ to be collected

- Where the rate is dependent on value, shippers are ed to state specifically in writing the agreed or declar- ue of the property.
agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ _____ per _____

This is to certify that the above-named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

_____ Signature

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement.
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

_____ (Signature of Consignor.) _____

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

ER BENTOFIX TECHNOLOGIES (USA), INC.

ER

CARRIER Chrisco #316

PER

DATE

ACCOUNTING A/P

Date:09/10/98
PAGE 1

BENTOFIX TECHNOLOGIES, INC.

BOL # : 000085

Shipment Date: 09/10/98

Roll #	Length	Width
Lot #: R8081503		
425	150.00	15.5
483	100.00	15.5
484	100.00	15.5
* Subtotal [ft]	350.00	
Lot #: R8081803		
501	139.99	15.5
* Subtotal [ft]	139.99	
Lot #: R8082503		
735	150.00	15.5
736	150.00	15.5
779	150.00	15.5
780	150.00	15.5
* Subtotal [ft]	600.00	
Lot #: R8082603		
804	150.00	15.5
805	150.00	15.5
827	150.00	15.5
851	150.00	15.5
* Subtotal [ft]	600.00	
Lot #: R8082903		
895	150.00	15.5
938	150.00	15.5
939	150.00	15.5
* Subtotal [ft]	450.00	
Lot #: R8090203		
1033	150.00	15.5
* Subtotal [ft]	150.00	

BENTOFIX TECHNOLOGIES, INC.

BOL # : 000085

Shipment Date: 09/10/98

	Roll #	Length	Width
Lot #: R8090803			
	1272	150.00	15.5
	1331	150.00	15.5
	1332	150.00	15.5
* Subtotal [ft]		450.00	
* Total [ft]		2739.99	

FIX - 501NSL

BENTOFIX®

Thermal Lock "NSL" Geosynthetic Clay Liner

• Technical Bulletin •

Bentofix Thermal Lock "NSL" is a needlepunch reinforced GCL comprised of a uniform layer of granular sodium bentonite encapsulated between a slit-film woven and a virgin staple fiber nonwoven geotextile. The needlepunched fibers are thermally fused to the woven geotextile to enhance the reinforcing bond.

GEOTEXTILE PROPERTIES	TEST METHOD	MINIMUM TEST FREQUENCY	VALUE - ENGLISH -	VALUE - SI -
Cap Nonwoven Mass/Unit Area	ASTM D 5261	1/200,000 sq. ft (1/20,000 sq. m)	6.0 oz./yd^2 MARV	200 g / m^2 MARV
Woven Scrim Mass/Unit Area	ASTM D 5261	1/200,000 sq. ft (1/20,000 sq. m)	3.1 oz./yd^2 MARV	105 g / m^2 MARV
BENTONITE PROPERTIES				
Swell Index	ASTM D 5890	1/100,000 lbs. (50,000 kg)	24 ml / 2g min.	24 ml / 2g min.
Moisture Content	ASTM D 4643	1/100,000 lbs. (50,000 kg)	12 % max.	12 % max.
Fluid Loss	ASTM D 5891	1/100,000 lbs. (50,000 kg)	18 ml max.	18 ml max.
FINISHED GCL PROPERTIES				
Bentonite Mass per Unit Area[1]	ASTM D 5993	1/40,000 sq. ft (1/4,000 sq. m)	0.75 lb. / sq. ft MARV	3.66 kg / m^2 MARV
Grab Strength[2]	ASTM D 4632	1/40,000 sq. ft (1/4,000 sq. m)	95 lbs MARV	422 N MARV
Grab Elongation[2]	ASTM D 4632	1/40,000 sq. ft (1/4,000 sq. m)	150 % Typical	150 % Typical
Peel Strength[3]	ASTM D 4632	1/40,000 sq. ft (1/4,000 sq. m)	15 lbs. min.	66 N
Permeability[4]	ASTM D 5084	1/100,000 sq. ft (1/10,000 sq. m)	5 x 10^{-9} cm/sec max	5 x 10^{-9} cm/sec max
Index Flux[4]	ASTM D 5887	1/Week	1 x 10^{-8} m^3/m^2/sec max	1 x 10^{-8} m^3/m^2/sec max
Internal Shear Strength[5]	ASTM D 5321	Periodic	500 psf Typical	24 kPa Typical
DIMENSIONS				
Width x Length	nominal	Every Roll	15.5 x 150 ft	4.7 x 45.72 m
Area per Roll	nominal	Every Roll	2325 ft^2	216 m^2
Packaged Weight	typical	Every Roll	2600 lbs	1179 kg

1. Oven-dried measurement. Equates to 0 84 lbs when indexed to a 12% moisture content.
2. Measured at maximum peak, in the weakest principal direction.
3. Modified to use a 4 inch wide grip. The maximum peak of five specimens averaged.
4. De-Aired Tap Water @ 5 psi maximum effective confining stress and 2 psi head.
5. Typical peak value for specimen hydrated for 24 hr and sheared under a 200 psf normal stress.

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8081503	425	09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.OO ft x 15.5 ft
45.72 m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft2)	TENSILE (LB) LENGTH	TENSILE (LB) CROSS	ELONGATION (%) LENGTH	ELONGATION (%) CROSS	PERMEABILITY. K(cm/s)	MOISTURE CONTENT(%)
.940	101	237	72	40	<5E-9	9.4

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
980713205B-1	0.050

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
7378903	0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORBTION(%)	MASS OF BENTONITE
BN-49073	90	25	9.4	663	0.867 (lb/ft2)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8081803	501	09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 139.99FTx 15.5 ft
42.66m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft2)	TENSILE (LB) LENGTH	TENSILE (LB) CROSS	ELONGATION (%) LENGTH	ELONGATION (%) CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
0.969	105	271	76	43	<5E-9	8.8

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
98071305B	0.051

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
7365135	0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORBTION(%)	MASS OF BENTONITE
49341	90	30	8.8	736	0.895 (lb/ft2)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8082503	735	09/11/98

BOL: 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft2)	TENSILE (LB) LENGTH	TENSILE (LB) CROSS	ELONGATION (%) LENGTH	ELONGATION (%) CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
0.924	105	66	255	38	<5E-9	9.3

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
980817205B	0.051

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
7343309	0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORBTION(%)	MASS OF BENTONITE
49317	90	28	9.3	669	0.850 (lb/ft2)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8082603	804	09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft2)	TENSILE (LB) LENGTH	TENSILE (LB) CROSS	ELONGATION (%) LENGTH	ELONGATION (%) CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
0.992	108	247	111	58	<5E-9	8.8

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
980629205B	0.051

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
7358086	0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORBTION(%)	MASS OF BENTONITE
BN-454776	90	25	8.8	663	0.918 (lb/ft2)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8082903	895	09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72 m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

	TENSILE (LB)		ELONGATION (%)			MOISTURE
MASS(lb/ft2)	LENGTH	CROSS	LENGTH	CROSS	PERMEABILITY, K(cm/s)	CONTENT(%)
1.042	115	279	68	157	<5E-9	9.7

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
980721205B	0.050

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
7426745	0.023

4. BENTONITE TYPE: 30 MESH

SHIPMENT#	% MONTMORILLONITE	SWELL INDEX (ml)	MOISTURE CONTENT (%)	MOISTURE ABSORBTION (%)	MASS OF BENTONIT
WHW-361	90	27	9.7	789	0.969 (lb/ft2)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8090203	1033	09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00m x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

MASS(lb/ft2)	TENSILE (LB) LENGTH	TENSILE (LB) CROSS	ELONGATION (%) LENGTH	ELONGATION (%) CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
1.015	103	249	74	43	<5E-9	8.4

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
980825205B	0.047

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
85102	0.023

4. BENTONITE TYPE : 30 MESH

SHIPMENT#	%MONTMORILLONITE	SWELL INDEX(ml)	MOISTURE CONTENT(%)	MOISTURE ABSORBTION(%)	MASS OF BENTONITE
311906	90	27	8.4	580	0.945 (lb/ft2)

BENTOFIX TECHNOLOGIES, INC.

QUALITY CONTROL CERTIFICATE

LOT#	ROLL#	DATE
R8090803	1272	09/10/98

BOL# 000085

PRODUCT: BENTOFIX NSL

DIMENSIONS: 150.00 ft x 15.5 ft
45.72m x 4.72m

1. FINISHED PRODUCT TYPE: BENTOFIX NSL

	TENSILE (LB)		ELONGATION (%)			
MASS(lb/ft2)	LENGTH	CROSS	LENGTH	CROSS	PERMEABILITY, K(cm/s)	MOISTURE CONTENT(%)
1.015	134	277	70	32	<5E-9	10.2

2. TOP LAYER TYPE: NON WOVEN

LAYER #	MASS(lb/ft2)
980821205B	0.053

3. BOTTOM LAYER TYPE : WOVEN

LAYER#	MASS(lb/ft2)
7439706	0.023

4. BENTONITE TYPE: 30 MESH

SHIPMENT#	% MONTMORILLONITE	SWELL INDEX (ml)	MOISTURE CONTENT (%)	MOISTURE ABSORBTION (%)	MASS OF BENTONIT
455986	90	28	10.2	593	0.939 (lb/ft2

APPENDIX C

APPENDIX C

Technical Revision No. 1, Summary of Discussion, November 16, 1998

CASH MINE / GOLD HILL MILL
GOLD HILL, COLORADO

TAILINGS IMPOUNDMENT EXPANSION

TECHNICAL REVISION

A. EMBANKMENT STABILITY AND LINER FOUNDATION

Background

The original design for the expansion of the tailings impoundment at the Gold Hill Mill includes a 12-foot raise of the embankment, based on a modified upstream construction technique. The footprint of the embankment raise extends approximately 40 feet out from the upstream face of the original embankment onto the surface of the existing tailings. Approximately 20 to 25 feet of the existing tailings remain exposed beyond the upstream toe of the embankment raise. A biaxial geogrid was installed on the surface of the existing tailings, within the footprint of the embankment raise, prior to construction of the new embankment, to facilitate placement of the initial fill layers. The geogrid was not specifically designed as a reinforcing member in the embankment raise, although some reinforcement benefit is realized.

The stability of the raised embankment was analyzed as part of the design for the new facility. The rotational failure potential of the upstream and downstream slopes of the facility was evaluated at various stages of filling of the impoundment. The soil parameters used in the computer model analyses were based, in part, on results of laboratory analyses of representative soil and tailings samples collected from the site and, in part, on conservative estimates from published literature and previous experience with similar materials. All of the stability analyses indicated factors of safety greater than the minimum acceptable values. The indicated governing condition was determined to be the post-construction condition, with saturated tailings as the foundation for the embankment raise and no buttressing by newly placed tailings. Minimum calculated factors of safety were 1.2 for static conditions and 1.14 for pseudo static (seismic) conditions. Throughout the analyses, it was assumed that the existing tailings would be left in place.

It was subsequently proposed that a portion of the exposed saturated tailings upstream of the embankment raise be removed to improve foundation conditions below the new liner system for the expanded impoundment. Observation of the embankment raise following completion of construction has revealed no evidence of distress that would indicate potential instability of the foundation. However, initiation of mechanical removal of the exposed tailings and established vegetation in two areas of the existing impoundment gave rise to concerns that such removal may compromise the stability of the embankment through removal of the existing materials that are providing passive resistance against movement of the foundation tailings under the embankment raise. Analysis of possible block failure mechanisms in the embankment and foundation tailings was conducted using the soil property and soil/liner interface friction values employed in the original stability analyses. This analysis of possible block failure mechanisms indicated potential instability, even with the existing tailings left in place. The factors of safety calculated through the analysis were in the range between 0.85 and 0.91.

Proposed Design Revision

A proposal was made to leave the existing tailings in place, and to enhance the foundation conditions for the new liner system over these tailings by extending the geogrid across the full surface area of the tailings and placing a nominal layer of granular soil over the geogrid prior to installing the liner system. This proposal was rejected by the Colorado Division of Minerals and Geology. The Division acknowledged the validity of the concern regarding the stability of the embankment, but cited concerns regarding the long-term integrity of the liner system on a foundation of unconsolidated tailings in support of their rejection of the proposal. Accordingly, a compromise proposal was developed as follows:

- Surficial organic materials are to be removed.
- The majority of the existing tailings are to be left in place.
- The geogrid reinforcement layer is to be extended across the balance of the surface of the existing tailings, secured to the previously placed geogrid mat near the upstream toe of the embankment raise, but left unsecured at the other edge of the mat extension near the toe of the interim berm.
- Settlement gauges are to be installed at representative locations on top of the geogrid mat extension.
- Surcharge fill (waste rock or other available material) is to be placed on the geogrid mat to preload the tailings (At ITEC's discretion, excess fill material may be placed in order to expedite consolidation).
- Consolidation of the underlying tailings is to be monitored via the settlement gauges.
- When the rate of settlement is observed to decrease significantly, indicating achievement of primary consolidation of the tailings, the majority of the surcharge fill material may be removed, at ITEC's discretion, and a cushion layer of finer grained material placed over the fill, as necessary.
- The second phase of the bentonite geocomposite liner (GCL) and HDPE primary liner is to be installed to complete the liner system.

Supplementary Stability Analysis

Based on the observation that there has been no distress of the embankment and underlying tailings foundation following completion of the embankment construction, the values for material properties and interface friction used in the previous stability analyses were reviewed. The block failure analyses were rerun to back calculate appropriate realized values for the various parameters, given that the apparent factor of safety is at least unity under current conditions. Figures 1a and 1b present graphical representations of the existing post-construction scenario (static and pseudo static, respectively), which are considered to be conservative. Table 1 presents the apparent minimum realized values for the various parameters.

Table 1
Strength and Physical Property Values for Soil, Tailings and Geomembrane Interface used in the Slope Stability Analysis

Soil Unit	Material	Bulk Density (pcf)	Saturated Density (pcf)	Cohesion (psf)	Friction Angle (degrees)
1	Tailings	94	100	40	20
2	Embankment (proposed)	130	130	0	35
3	Embankment (existing)	123	130	0	30
4	Overburden	125	130	0	32
5	Bedrock	138	138	0	37
6	Tailing/Geomembrane Interface	100	100	30	17
7	Soil Buttress above Tailings	110	115	0	33

The minimum apparent parameter values, determined through the reanalysis of the existing condition at the site were then utilized in further stability analyses to assess the factor of safety against block failure if the existing exposed tailings were to be removed. This procedure was also used to determine the thickness of surcharge material that should be left in place over the existing tailings upstream of the embankment raise to provide a minimum safety factor of 1.2 against failure under static loading conditions. Figures 2a, 2b, 3a and 3b (static and pseudo static, respectively) present these scenarios graphically and Table 2 summarizes the predicted factors of safety for the respective conditions. The results show that removal of the tailings would result in instability of the embankment (F.S. = 0.81 for the static condition and 0.77 for the pseudo static condition). The required surcharge thickness was determined to be approximately 1.5 ft. The stability of the embankment will be further enhanced as tailings are placed in the new impoundment. The tailings will be spiggoted from the new embankment so that the initial beach will be established immediately against the upstream face of the embankment raise and the loading from the tailings will act to increase the ballast on the existing underlying tailings upstream of the embankment raise. The impoundment will be maintained such that the decant pond is toward the back of the impoundment. A revised design cross-section through the impoundment is shown on Drawing 5461-C5.

Table 2
Summary of Slope Stability Analyses Results

Figure	XSTABL file	Parameters	Safety Factor	
			Static	Pseudostatic (k_h=0.02g)
1	PCRB20	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.02	0.98
2	UPXRB1	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, wedge of the tailings removed, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	0.81	0.77
3	PCRB21L	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, 1.5 ft of soil buttress on top of tailings, saturated tails (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.20	1.15

B. LINER EXTENSION AND CONTINUITY

Background

The original design of the liner system for the tailings impoundment expansion contemplated that the trimmed upstream edge of the existing HDPE FML would be secured in an anchor trench excavated in an interim berm left between the original pond and the excavation area of the expanded pond. The first phase of the new liner system (GCL and FML) would then be secured in the same anchor trench, followed by the second phase GCL component of the new liner system. Finally, the upstream edge of the second phase of the new FML would be deployed such that it would overlap the anchor trench and this edge of the FML would be welded to the previously installed first phase FML to produce a continuous new liner system throughout the impoundment. During excavation of the expanded impoundment, bedrock was encountered in the vicinity of the interim berm that precluded the effective construction of an appropriate anchor trench.

Proposed Liner System Design Modification

The following alternate approach is proposed to secure and maintain the effective continuity of the various components of the liner systems:

- Trim the upstream edge of the existing HDPE FML such that it terminates along the crest of the interim berm.
- Deploy the GCL component of the first phase of the new liner system such that it significantly overlaps the trimmed free edge of the existing FML.
- Deploy the FML component of the first phase of the new liner system such that it extends beyond the end of the deployed GCL and weld the new FML to the underlying existing FML.
- Deploy the GCL component of the second phase of the new liner system such that it significantly overlaps the weld securing the first phase FML to the previously existing FML and the first phase GCL.
- Place a bead of granular bentonite along the free ends of the second phase GCL panels to provide an enhanced seal against moisture migrating under the GCL.
- Deploy the FML component of the second phase of the new liner system such that it overlaps the free end of the second phase GCL component and weld the second phase FML to the first phase FML.

All FML seams are to be tested both non-destructively and destructively, in accordance with approved protocols, to ensure the integrity and strength of the welds. A typical cross-section of the proposed liner system design modification at the interim berm is shown on Detail 4, Drawing 5461-C5.

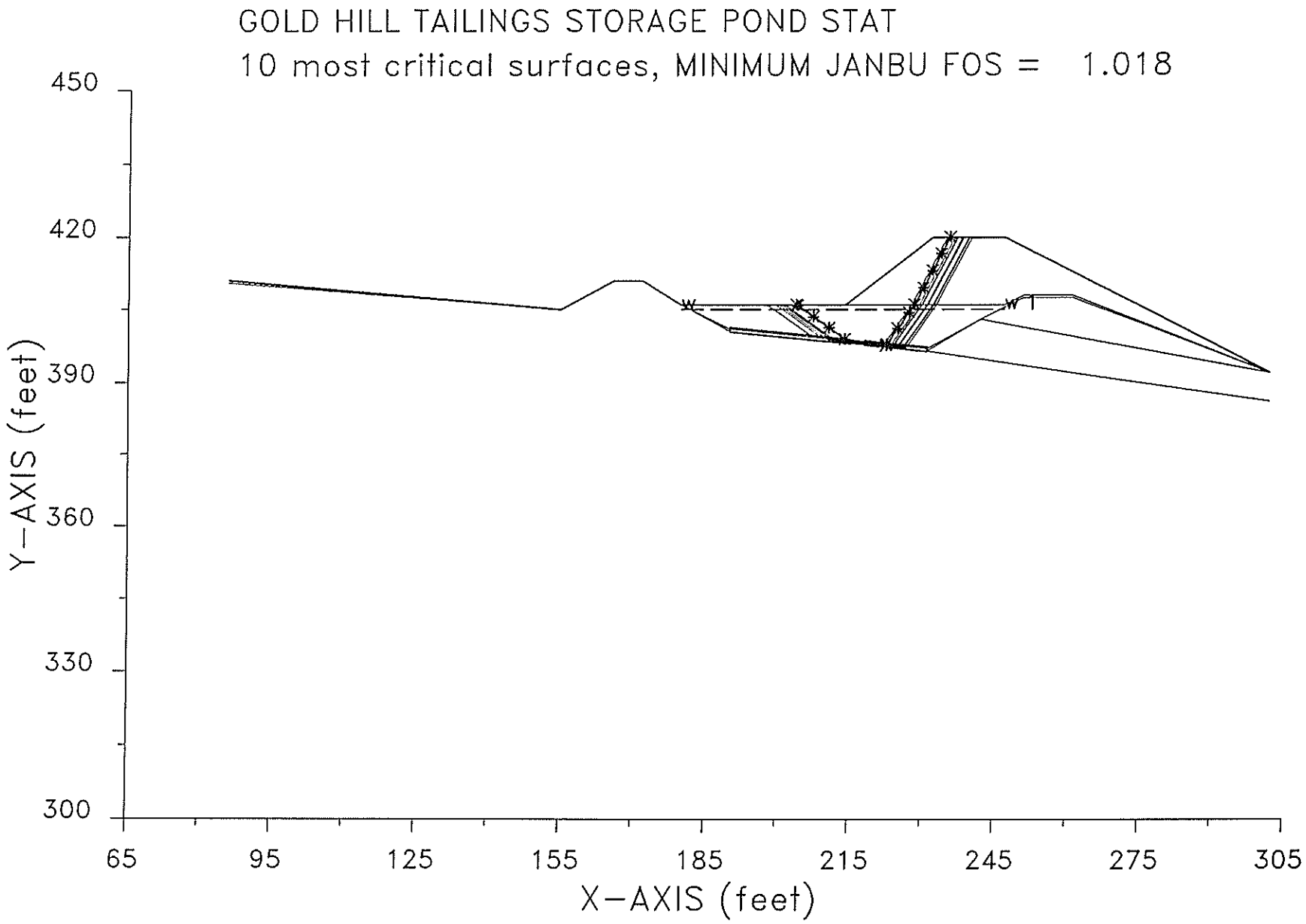

GOLD HILL TAILINGS STORAGE POND STAT
10 most critical surfaces, MINIMUM JANBU FOS = 1.018
450
420
390
360
330
300
Y-AXIS (feet)
65
95
125
155
185
215
245
275
305
X-AXIS (feet)

FIGURE 1a

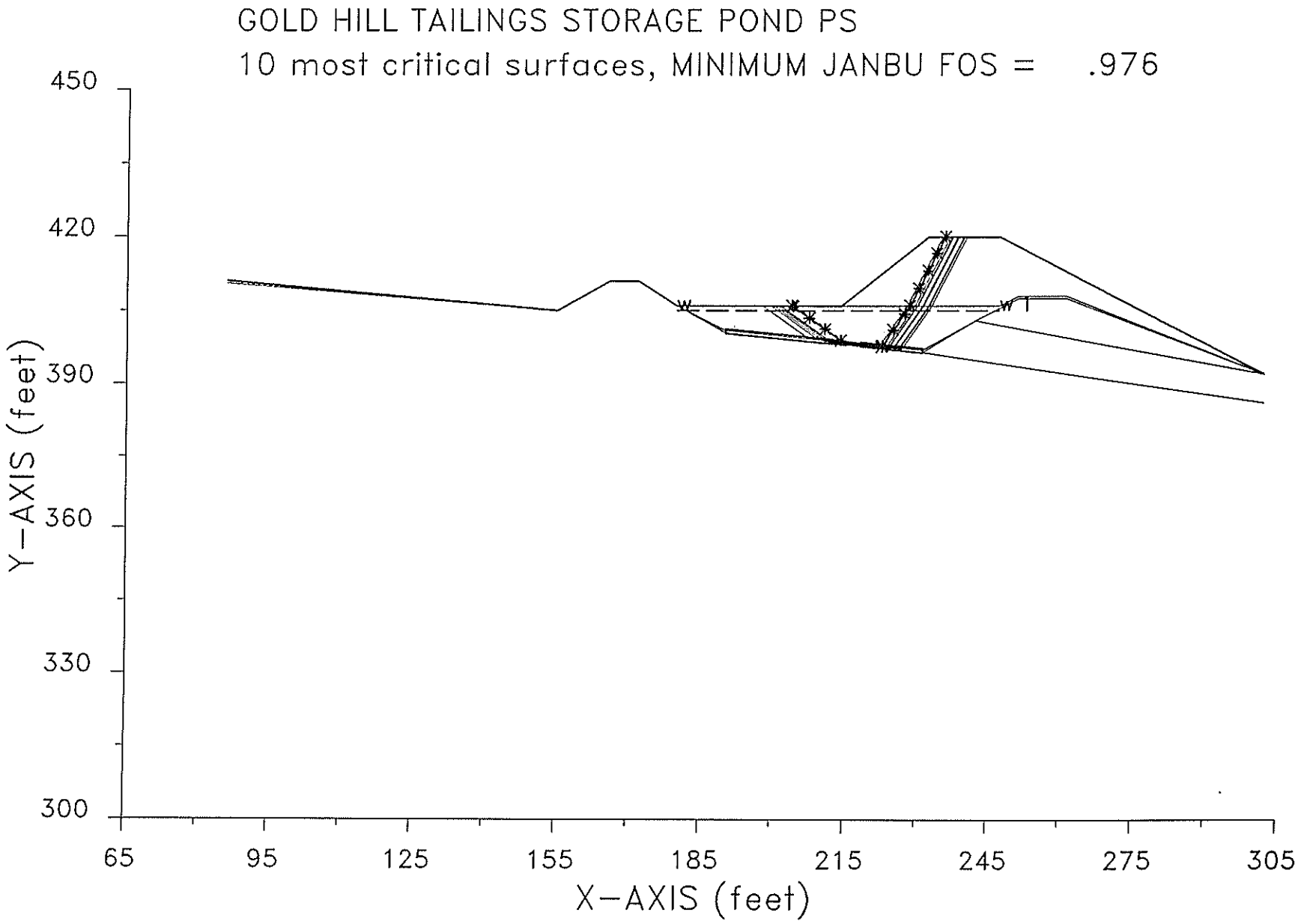

GOLD HILL TAILINGS STORAGE POND PS
10 most critical surfaces, MINIMUM JANBU FOS = .976
450
420
390
360
330
300
Y-AXIS (feet)
65
95
125
155
185
215
245
275
305
X-AXIS (feet)

FIGURE 1b

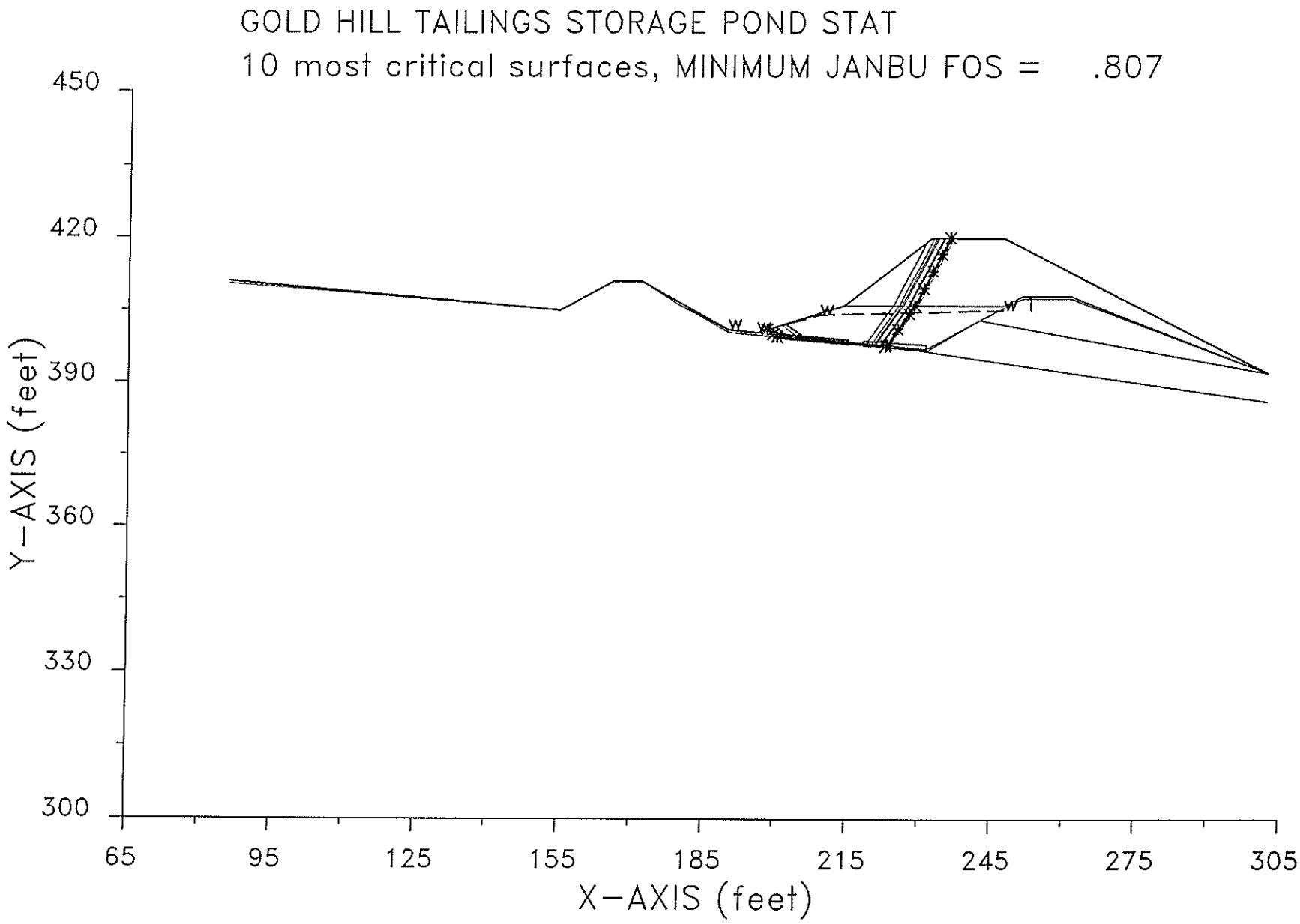

GOLD HILL TAILINGS STORAGE POND STAT
10 most critical surfaces, MINIMUM JANBU FOS = .807
450
420
390
360
330
300
Y-AXIS (feet)
65
95
125
155
185
215
245
275
305
X-AXIS (feet)

FIGURE 2a

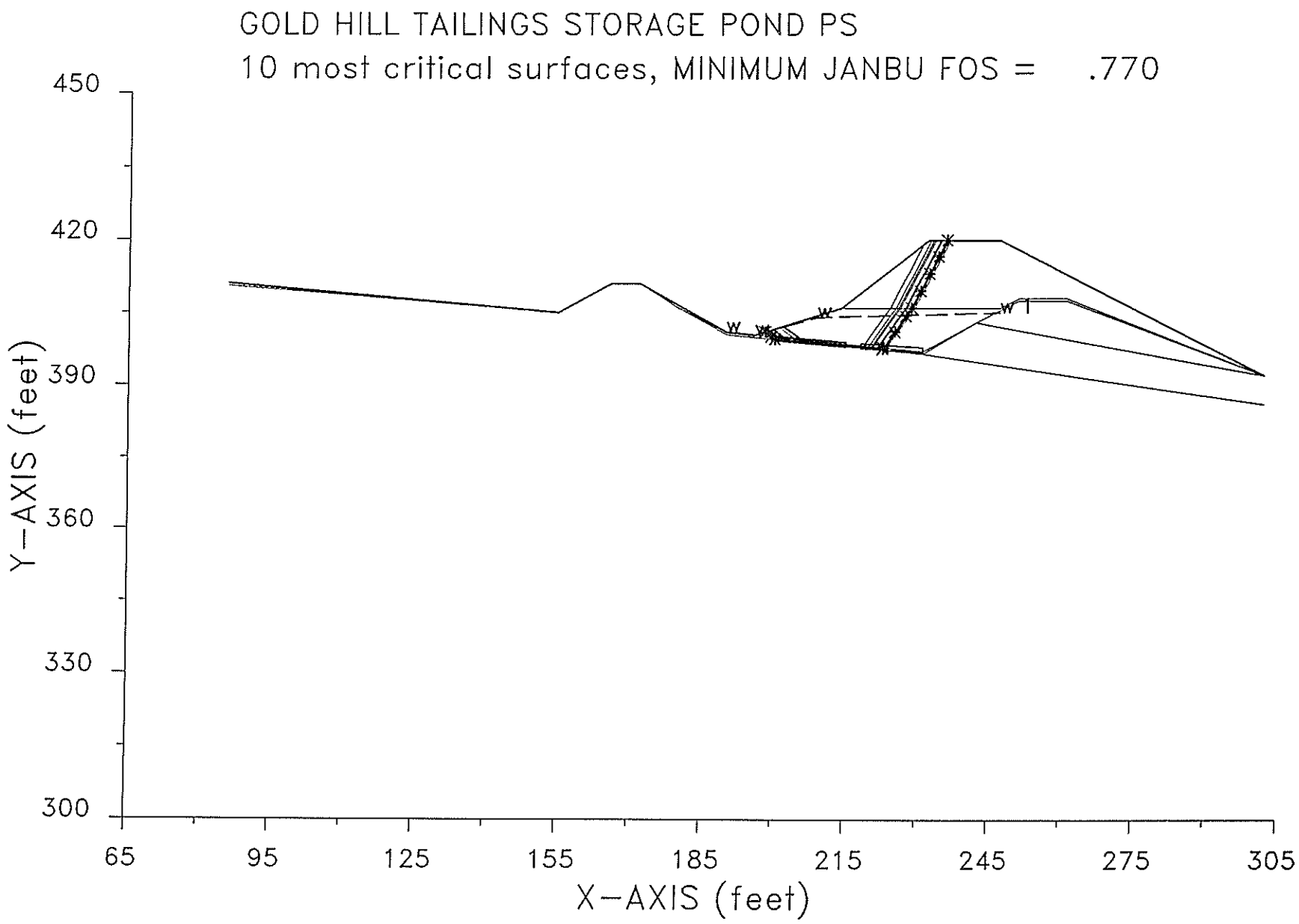

GOLD HILL TAILINGS STORAGE POND PS
10 most critical surfaces, MINIMUM JANBU FOS = .770
450
420
390
360
330
300
Y-AXIS (feet)
65
95
125
155
185
215
245
275
305
X-AXIS (feet)

FIGURE 2b

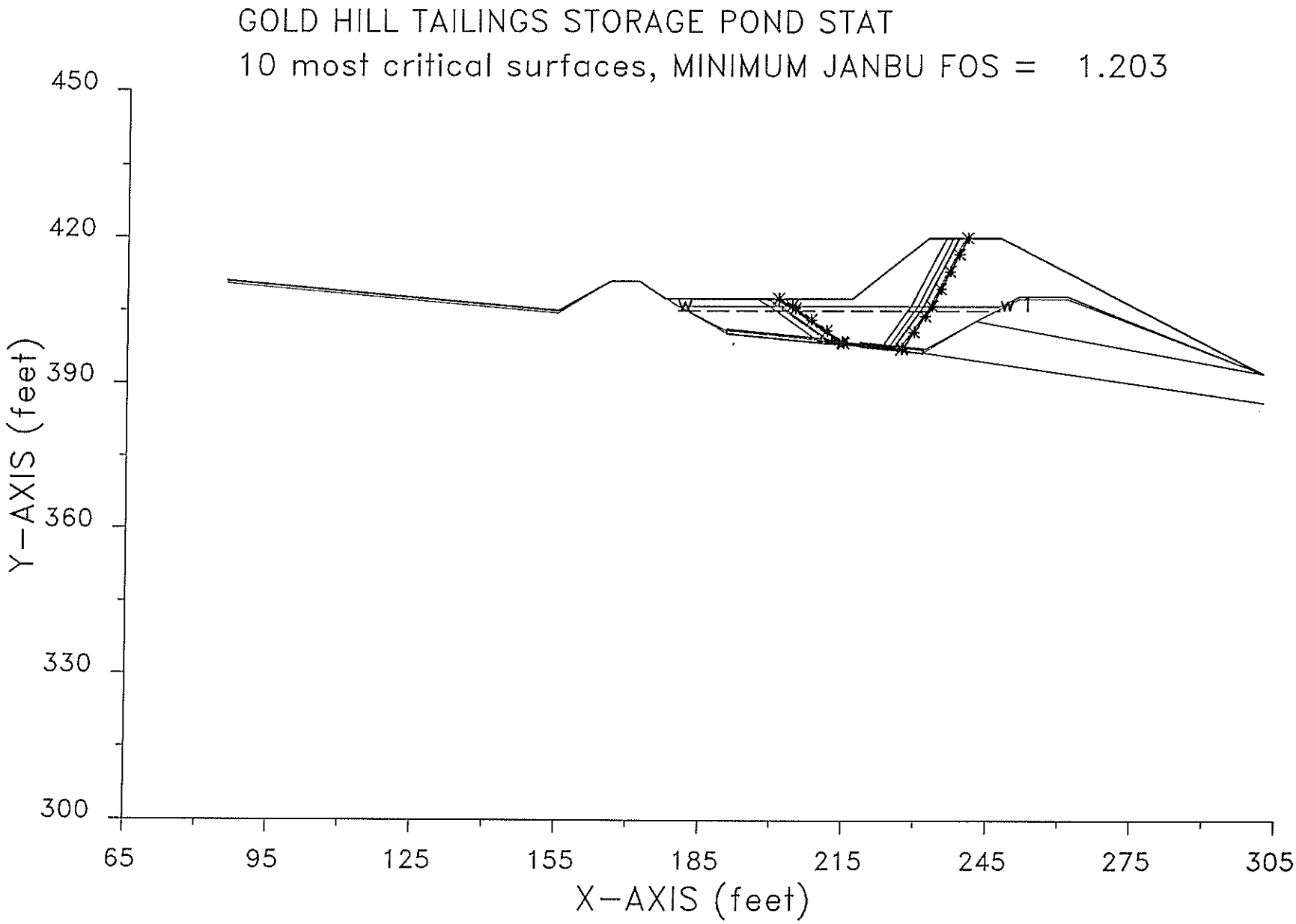

GOLD HILL TAILINGS STORAGE POND STAT
10 most critical surfaces, MINIMUM JANBU FOS = 1.203
450
420
390
360
330
300
Y-AXIS (feet)
65
95
125
155
185
215
245
275
305
X-AXIS (feet)
WT

FIGURE 3a

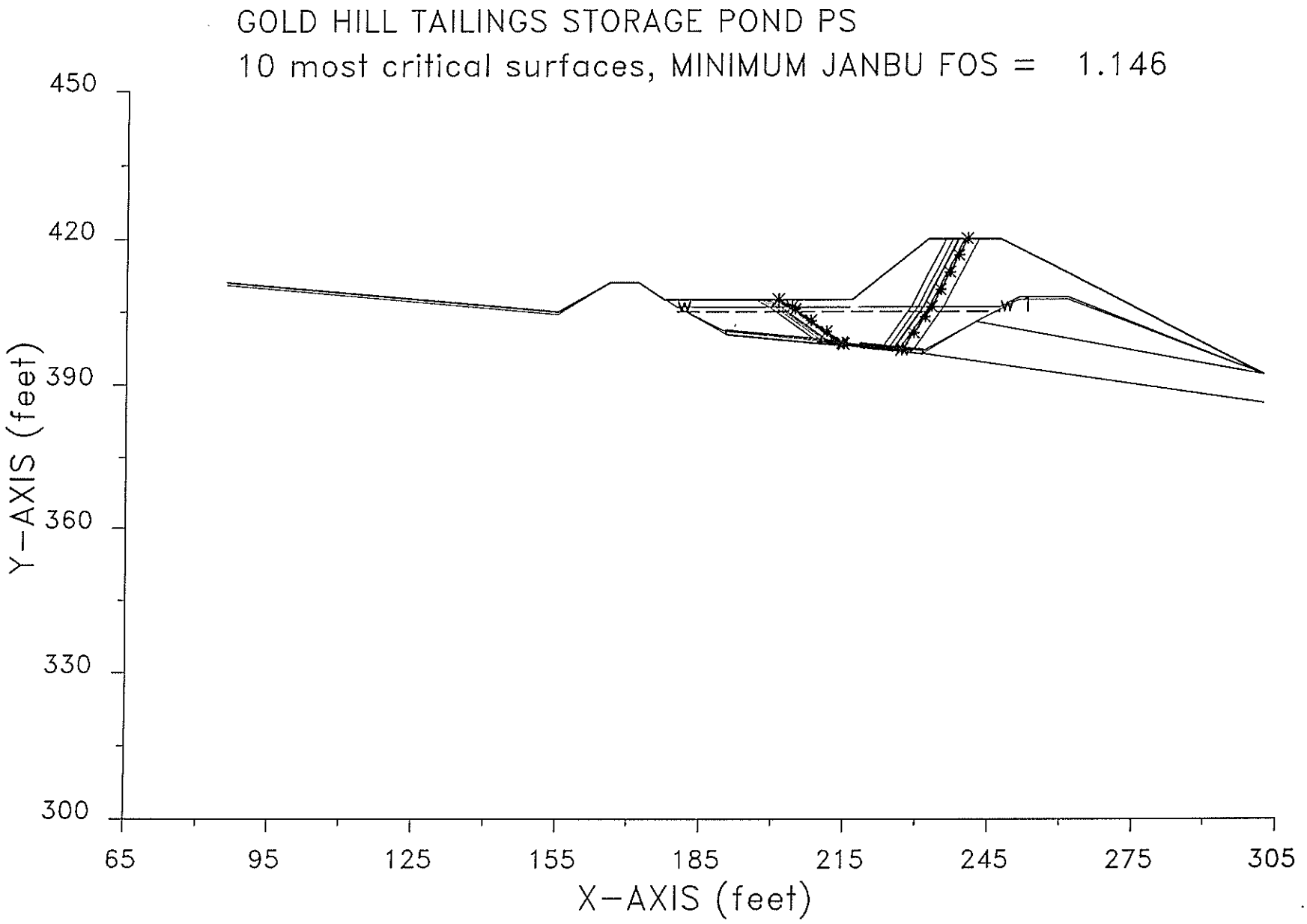
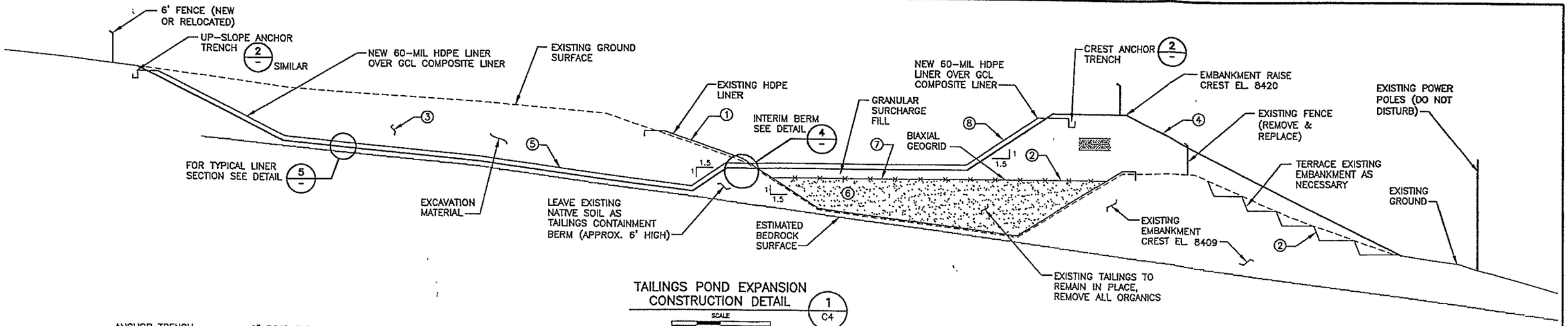
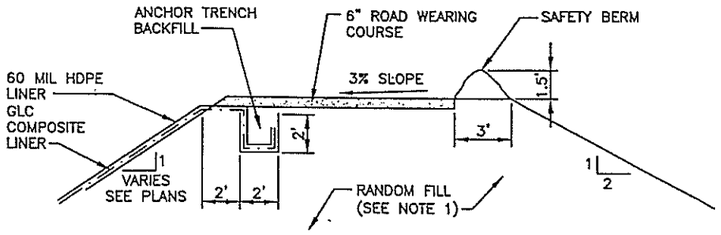

GOLD HILL TAILINGS STORAGE POND PS
10 most critical surfaces, MINIMUM JANBU FOS = 1.146
450
420
390
360
330
300
Y-AXIS (feet)
65
95
125
155
185
215
245
275
305
X-AXIS (feet)

FIGURE 3b



TAILINGS POND EXPANSION CONSTRUCTION DETAIL 1/C4

SCALE 10 0 10 FEET (HORIZ. & VERT.)

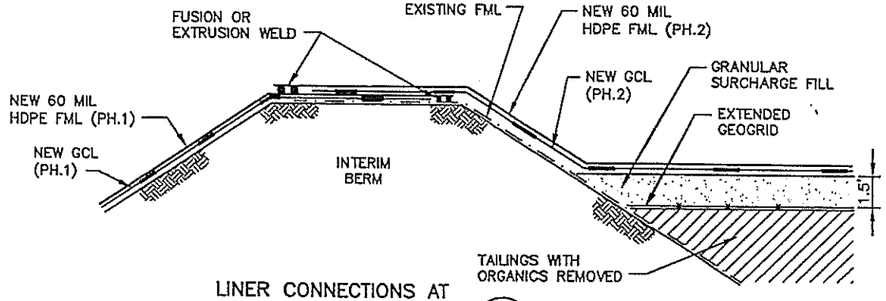


NOTES:

1. RANDOM FILL CONSISTS OF BORROW MATERIAL GENERATED FROM POND EXCAVATION. LARGE ROCK FRAGMENTS AND BOULDERS THAT ARE GREATER THAN 6" IN DIAMETER SHALL BE GRADED TO THE DOWNSTREAM FACE. FINER GRAIN MATERIAL SHALL BE PLACED IN THE UPSTREAM ZONE OF THE EMBANKMENT.
2. ALL FILL PLACED SHALL BE COMPACTED TO 90% OF MAX. DRY DENSITY, AS DETERMINED BY ASTM D-1557.

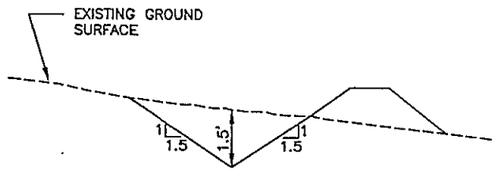
TAILINGS POND CREST GEOMEMBRANE/GCL ANCHOR TRENCH 2/C4

SCALE 4 0 4 FEET



LINER CONNECTIONS AT INTERIM BERM 4/C4

NOT TO SCALE

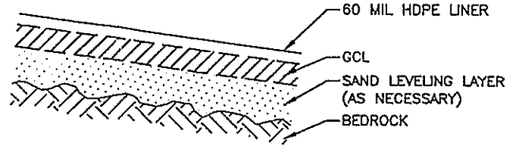


NOTES:

1. CAST EXCAVATED SPOIL TO DOWNSLOPE SIDE OF DITCH, SHAPE COMPACT AND TRIM TO CONFIGURATION SHOWN.
2. SLOPE OF DITCH TO BE MAINTAINED AT NO GREATER THAN 2%.
3. HAY BALES SHALL BE PLACED PERIODICALLY ALONG DITCH LENGTH AND AT THE DITCH OUTLET FOR SEDIMENT CONTROL.

V-NOTCH DRAINAGE DITCH 3/C4

SCALE 2 0 2 FEET



TYPICAL LINER SECTION 5/C4

NOT TO SCALE

CONSTRUCTION SEQUENCE

① REMOVE THE EXPOSED LINER LOCATED ON THE NORTH BANK OF THE EXISTING POND AND THE FENCE SURROUNDING THE POND.

② PLACE A BIAXIAL GEOGRID OVER THE EXISTING TAILINGS WHICH ARE TO BE COVERED BY THE EMBANKMENT EXTENSION/RAISE. TERRACE THE DOWNSTREAM SLOPE OF THE EXISTING EMBANKMENT AS NECESSARY TO PROVIDE SUITABLE SURFACE FOR PLACEMENT AND COMPACTION OF MATERIAL.

③ EXCAVATE THE MATERIAL NORTH OF THE EXISTING POND TO THE CONTOUR SHOWN ON DRAWING 5461-C2. LEAVE AN INTERIM CONTAINMENT BERM BETWEEN THE NEW EXCAVATION AND THE EXISTING TAILINGS POND. SECURE EDGE OF EXISTING LINER IN INTERIM ANCHOR TRENCH.

④ PLACE AND COMPACT THE EXCAVATED MATERIAL TO FORM THE EMBANKMENT EXTENSION. TERRACE THE DOWNSTREAM SLOPE OF THE EXISTING EMBANKMENT AS NECESSARY TO PROPERLY PLACE AND COMPACT THE NEW EMBANKMENT MATERIAL.

⑤ INSTALL THE NEW 60-MIL HDPE LINER AND GCL IN THE NEWLY EXCAVATED PORTION OF THE POND FROM THE UP-SLOPE ANCHOR TRENCH TO THE CONTAINMENT BERM. TEMPORARILY ANCHOR THE LINER AND GCL AT THE CONTAINMENT BERM USING SAND BAGS.

⑥ REMOVE SURFICIAL VEGETATION/ORGANIC MATERIAL FROM EXPOSED TAILING.

⑦ PLACE BIAXIAL GEOGRID OVER REMAINING TAILING SURFACE. PLACE SETTLEMENT MONUMENTS ON TOP OF GEOGRID SURFACE. PLACE GRANULAR SURCHARGE FILL OVER THE BIAXIAL GEOGRID.

⑧ MONITOR SETTLEMENT, THEN INSTALL THE NEW LINER AND GCL FROM THE CONTAINMENT BERM, ACROSS THE EXISTING POND, AND UP THE NEW EMBANKMENT EXTENSION TO THE CREST ANCHOR TRENCH.

⑨ PLACE FENCE AROUND POND PERIMETER AND EMBANKMENT CREST.

ITEC MINERAL

REFERENCE	NO.	REVISIONS	BY	DATE	NO.	REVISIONS	BY	DATE
					1	REISSUED FOR TECHNICAL REVISION	LCO	10/9/98
					0	ISSUE FOR REVIEW – NOT FOR CONSTRUCTION	LCO	6/98

McCulley, Frick & Gilman, Inc.
providing environmental consulting and engineering services

DESIGNED BY:	DJH
DRAWN BY:	PRM
CHECKED BY:	LCO
APPROVED BY:	–
FILE NAME:	5461-11.DWG

ITEC ENVIRONMENTAL COLORADO INC.

CASH MINE SITE DEVELOPMENT

POND DETAILS

DATE JUNE, 1998 | DRAWING NO. 5461-C5 | REVISION 1

CASH MINE / GOLD HILL MILL
GOLD HILL, COLORADO

TAILINGS IMPOUNDMENT EXPANSION

AMENDMENT TO TECHNICAL REVISION
DATED 10/09/98

The Technical Revision (TR) submitted to the Colorado Division of Minerals and Geology (DMG) on October 9, 1998 presented, in part, a proposal to install a layer of ballast material on the remaining exposed tailings in the original tailings impoundment at the Gold Hill Mill site. The effects of this ballast material will be to preconsolidate those tailings, prior to placement of the liner system for the expanded impoundment facility, and to enhance the stability of the embankment raise constructed partly on the adjacent portion of the originally impounded tailings. The proposal presented in that TR was based on the outcome of field discussions and follow-up telephone conversations between representatives of the DMG and the operator's consultant, as well as the DMG inspection report of October 7, 1998.

Subsequent to preparation and submittal of that TR, additional data has been obtained regarding the depths of tailings at various locations along the approximate centerline of the remaining exposed portion of the original tailings impoundment. The tailings depths range from less than one foot to a maximum of approximately 4.5 feet. A plot of the approximate locations of the soundings and the corresponding depths of tailings is attached. There is a significant area in the central portion of the exposed tailings empoundment where the depth of tailings is approximately one foot or less. This area of shallow depths is consistent with the alignment of an underlying bedrock ridge that was encountered during excavation of the western portion of the expanded impoundment and the intermediate berm. Another area at the north end of the impoundment reflects a shallowing of the tailings towards the lateral boundary of the original basin. The data regarding depths of the exposed tailings is consistent with the depth trend identified during earlier limited soundings along the upstream toe of the new embankment raise. The data from these soundings are also shown on the attached plot.

In light of the newly obtained data, it is suggested that it would be neither necessary nor appropriate to universally apply the consolidation and stability enhancing measures proposed in the TR over the full area of the exposed tailings. The block failure analysis conducted in support of the TR, and described therein, conservatively evaluated conditions for the maximum cross-section through the impoundment. Similarly, the estimate of possible consolidation and surface settlement in the remaining area of exposed tailings was based on the maximum cross-section with tailings depths under the embankment raise taken to be as much as ten feet. The new data indicates that these analyses were overly conservative.

Accordingly, it is proposed that the tailings consolidation and stability enhancing actions described in the TR be refined as follows:

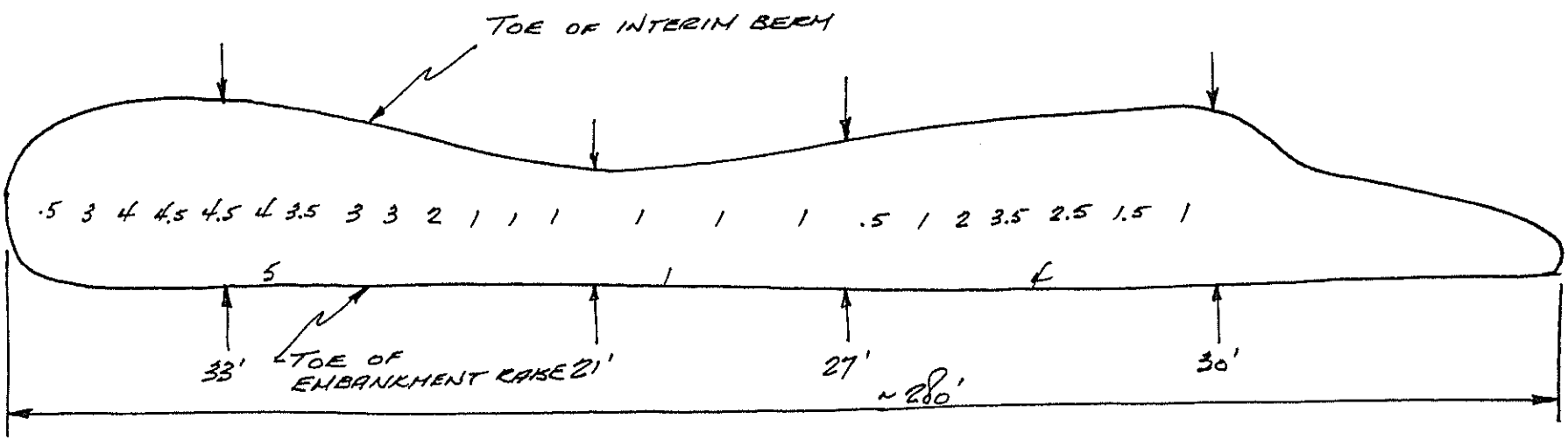
- Remove surficial organic materials from the tailings (now completed).

- Extend the geogrid reinforcement layer over the full surface area of the exposed tailings, as proposed.
- Install settlement gauges at representative locations on top of the geogrid layer.
- Place a ballast layer of waste rock (selected oversized material screened from the stock being prepared for mill feed) over the full width of the exposed tailings in the two areas where the indicated tailings depths exceed one foot. As previously proposed, the final thickness of the ballast layer will be at least 18 inches, but the operator may initially place the material to a thickness greater than 18 inches in order to expedite consolidation.
- Place no ballast material in areas where the indicated tailings depth is less than one foot.
- Monitor the consolidation of the surcharged tailings, through regular surveys of the settlement gauges.
- When the rate of settlement is observed to decrease significantly, remove or redistribute any excess waste rock ballast, and place a cushion layer of finer grained material (minimum 4-inch thickness), as a base for the liner system.
- Install the second phase of the liner system for the expanded impoundment.

The actions proposed herein will effectively consolidate, in a timely manner, those portions of the remaining exposed tailings where surface settlement subsequent to installation of the liner system might compromise the integrity of the liner. The waste rock material will also provide appropriate ballast to adequately increase the factor of safety against block failure of the foundation materials supporting the embankment raise during the immediate "post-construction" period, prior to buttressing of the embankment by newly placed tailings.

CASH MINE / GOLD HILL MILL

RESIDUAL TAILINGS DEPTH.



NORTH

1" = 30'

Albuquerque Office
8100 Mountain Road, NE
Suite 210
Albuquerque, NM
87110
505/266-8880
FAX: 505/266-8881

Austin Office
8900 Business Park Drive
Austin, TX
78759-7439
512/338-1667
Fax: 512/338-1331

Boston Office
500 West Cummings Park
Suite 1050
Woburn, MA
01801
781/937-0500
Fax: 781/937-0578

Boulder Office
4900 Pearl East Circle
Suite 300W
Boulder, CO
80301
303/447-1823
Fax: 303/447-1836

Iselin Office
33 Wood Avenue South
Suite 600
Iselin, NJ
08830
732/603-5228
FAX: 732/603-5240

Missoula Office
P.O. Box 7158
Missoula, MT
59807-7158
406/728-4600
Fax: 406/728-4698

Pittsburgh Office
800 Vinial Street
Suite 408B
Pittsburgh, PA
15212
412/321-2278
FAX: 412/321-2283

Port Lavaca Office
320 East Main
Port Lavaca, TX
77979
512/552-8839
Fax: 512/553-6115

San Francisco Office
71 Stevenson Street
Suite 1450
San Francisco, CA
94105
415/495-7110
Fax: 415/495-7107

Santa Ana Office
640 North Tustin Avenue
Suite 101
Santa Ana, CA
92705
714/973-3090
FAX: 714/973-3097

Seattle Office
19203 36th Avenue W.
Suite 101
Lynnwood, WA
98036-5707
425/921-4000
Fax: 425/921-4040

Wallace Office
P.O. Box 30
Wallace, ID
83873
208/556-6811
Fax: 208/556-7271

TAILINGS STORAGE FACILITY EMBANKMENT STABILITY ANALYSIS

The tailings facility at the Gold Hill Mill was expanded in 1998 under the supervision of the Colorado Division of Reclamation, Mining, and Safety. As part of the Designated Mining Operation conversion, CDRMS has asked for a re-evaluation of the stability of the embankment of the tailings storage facility. The analysis detailed here addresses this request.

1. Site Specific Data

The tailings storage facility was expanded in 1998 by ITEC. The construction of the expansion consisted of installation of a new liner atop of a taller embankment to increase the total storage capacity. An overall diagram of the expansion is shown in Figure 2. Material properties for all components of the construction were documented in the as-built from McCulley, Frick, and Gilman, Inc. (Figure 1). The material properties were determined by assuming the pre-1998 embankment was stable at unity (FOS = 1.0) and determining the material properties that would generate that FOS for the pre-1998 embankment. This method of determining the material properties is very conservative; the pre-1998 embankment likely had a stability FOS > 1.0. The material properties determined by McCulley have been used in this contemporary analysis, carrying forward both the conservative and site specific nature of the material properties.

The geometry of the embankment in the Lewicki analysis is the same geometry as the McCulley analysis. McCulley figures from their report have been rebuilt in GALENA software to model the embankment stability conditions. See McCulley Figures 1a – 3b in their report for reference.

The Tailings/Geomembrane Interface material is used in a thin layer over the model where the liner was installed, include in the anchor trench in the embankment. As it is a very thin material layer it is not easily visible on the GALENA software output figures.

Strength and Physical Property Values for Soil, Tailings and Geomembrane Interface used in the Slope Stability Analysis

Soil Unit	Material	Bulk Density (pcf)	Saturated Density (pcf)	Cohesion (psf)	Friction Angle (degrees)
1	Tailings	94	100	40	20
2	Embankment (proposed)	130	130	0	35
3	Embankment (existing)	123	130	0	30
4	Overburden	125	130	0	32
5	Bedrock	138	138	0	37
6	Tailing/Geomembrane Interface	100	100	30	17
7	Soil Buttress above Tailings	110	115	0	33

Figure 1. Material Properties

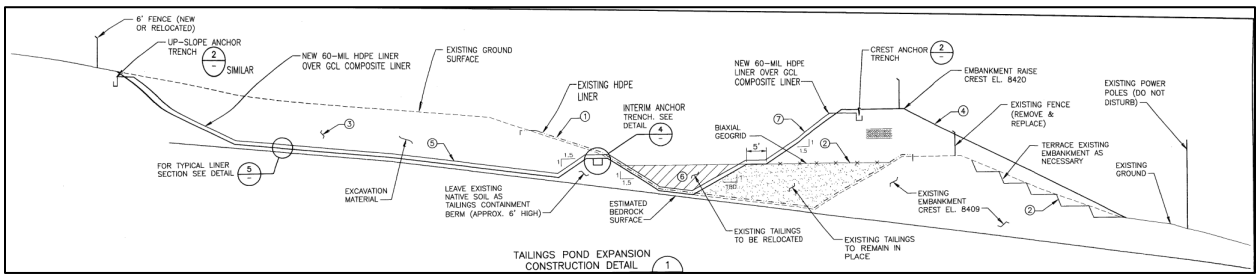


Figure 2. Tailings Expansion Diagram.

2. Analyses Conducted

There are two slope conditions that could potentially affect the stability of the embankment: the inslope and the out slope. Inslope failure must be analyzed for to determine if a failure condition would lead to the embankment being reduced in width in a manner that threatens the liner installation (: i.e., does the minimum Factor of Safety failure condition reach the anchor trench of the liner?) or overall embankment width (i.e., does the minimum FOS failure condition reach the mid-point of the embankment?). Outslope failure must be analyzed to determine if a failure condition would lead to the embankment being reduced in width to a manner that threatens the liner installation or the overall bank presence.

During the last expansion of the Tailings Storage Facility, the design engineers (McCulley) evaluated the slope stability of the embankment in-slope in various scenarios. The results of this analysis determined that the tailings within the TSF were providing a buttressing benefit to the existing and raised embankment and that a proposed removal of these tailings could lead to an unacceptably low embankment inslope stability condition (FOS = 0.81). Therefore, the design engineers and CDRMS agreed to placement of surcharge material against the inslope toe in order to enhance the buttress effect of the existing tailings. This revised plan was analyzed and suitable factors of safety were determined (FOS = 1.20). Table 2 in the 1998 slope stability analysis summarized the factors of safety in the various scenarios:

Table 2
Summary of Slope Stability Analyses Results

Figure	XSTABL file	Parameters	Safety Factor	
			Static	Pseudostatic (k_h=0.02g)
1	PCRB20	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.02	0.98
2	UPXRB1	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, wedge of the tailings removed, saturated tailings (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	0.81	0.77
3	PCRB21L	Up stream analysis, Rankine block (tailings - geomembrane interface), post construction of embankment raise, 1.5 ft of soil buttress on top of tailings, saturated tails (phreatic surface 1 ft below exposed surface), static and pseudo-static ground motion.	1.20	1.15

The net result of the analysis conducted shows the embankment stability increases (0.81 to 1.20) with additional material placed against the inslope of the embankment (Figures 1-3).

Tailings material has continued to be placed within the TSF since the embankment raising in 1998.

2.1. Inslope

Lewicki & Associates does not have access to the original software model used in the 1998 analysis. Therefore, a GALENA-software model has been built to re-create the original analysis geometry. Using the material properties determined in 1998, a Bishop's method of slices slope stability analysis was run on the re-created 1998 stable condition: material placed against the toe of the embankment inslope, which had a factor of safety of 1.20. The GALENA model reported a FOS = 1.3, similar to the McCulley model of 1.2. The recreated McCulley model can then be used as the basis of evaluating slope stability in more modern conditions.

Using recreated McCulley model as a starting point, additional analyses were conducted with the tailings becoming deeper and deeper. These follow-up analyses showed close to a factor of safety of 1.2 for the embankment inslope, similar to the McCulley model.

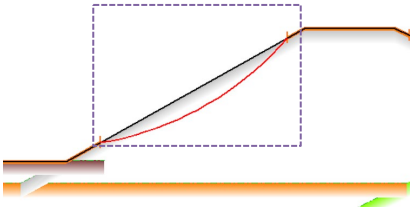
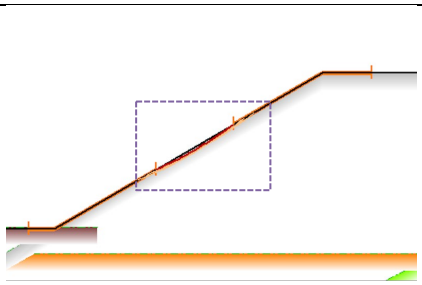
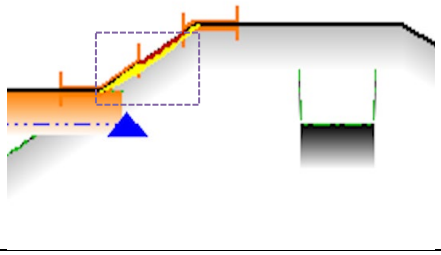
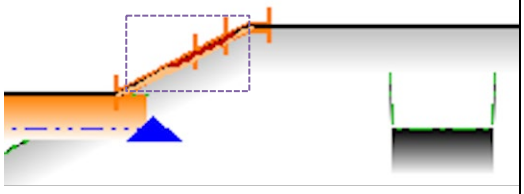
In total three model scenarios of the inslope were analyzed under non-seismic and seismic conditions.

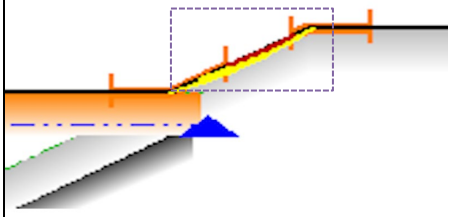
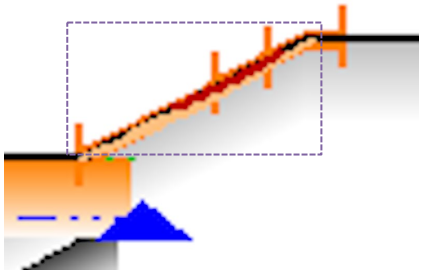
1. Tailings storage facility in the same condition as the 1998 stable model (~10-ft from top of embankment to top of tailings/fill)
2. Tailings storage facility filled to a lower level of five feet below the maximum level.
3. Tailings storage facility filled to the maximum level (two feet of freeboard).

The first scenario is the re-creation of the 1998 stable model with minimum tailings fill along the inslope toe. The second scenario represents operating, or active state, with additional room remaining for more tailings but not as much as in 1998. The third scenario represents the tailings storage facility in its end state filled with tailings to the minimum required freeboard depth. In McCulley's original embankment stability analysis, the presence of tailings as a buttress at the inside toe of the embankment was determined to be a key part of the stability of the embankment inslope. The embankment continuing to be stable in the same manner as additional tailings are added is to be expected. The lowest two inslope FOSs both show "sliver" failures: very thin failures that only occur because the depth of material resisting movement is very shallow (<0.1-ft). The inslope of the embankment is covered with liner material which restrains material in the embankment; sliver failures will not move beneath the liner.

To evaluate more potentially impactful inslope failure scenarios, the GALENA model iterations were reviewed to find the FOS > 1.30 (seismic FOS > 1.15) failure circle. FOS = 1.30 is the CDRMS standard for slope stability of critical structures with site specific materials properties. It should be noted that the 1998 embankment raise was determined to be acceptable by CDRMS under the slope stability standards at the time (FOS >1.20). The FOS > 1.30 failure circle were identified for each tailings depth scenario. Table 1 shows these failure circles (yellow or red arcs) within the emabnkment inslope for each tailings depth scenario. Based on the results of the Bishop's Method of Slices analyses conducted for the inslope scenarios show no failure scenario that threatens the embankment integrity or the liner installation. All scenarios can be considered satisfactorily stable.

Table 1. Location of Failure Circles within Embankment Inslope (in box)

10-ft below top of embankment (McCulley rebuilt)		FOS = 1.3
		Seismic FOS > 1.15 (orange arcs)
5-ft below top of embankment		FOS > 1.3 (yellow arcs) Anchor trench can be seen with green lines and black gradient bottom.
		Seismic FOS > 1.15 (orange arcs)

2-ft below top of embankment		FOS < 1.30 (Yellow arcs) Anchor trench outside of figure to the right. This figure is zoomed in more due to the small size of failure arcs.
		Seismic FOS > 1.15 (orange arcs)

2.2. Outslope

Given that the embankment inslope has shown to be consistently stable, the only other risk of slope stability is the outslope. An outslope model was assembled in GALENA as well, and showed a FOS = 1.39 (seismic = 1.20). Only the scenario of greatest tailings depth was evaluated for outslope stability; tailings depth does not provide any buttress benefit to the outslope. The outslope failure circles show no risk to the embankment width or the liner anchor trench. Therefore the outslope can be considered stable.

A list of the Factors of Safety for different scenarios modelled in GALENA are listed in Table 1. GALENA output figures and data log are located in Attachment 1.

Table 2. Factors of Safety for Slope Stability

GALENA Analysis	Lowest Factor of Safety	Depth from top of embankment to top of tailings (ft)	Condition
1	1.26	2	Static model, inslope of embankment
2	1.12	2	Seismic model, iterated from static minimum FoS
3	1.19	5	Static model, inslope of embankment
4	1.04	5	Seismic model, iterated from static minimum FoS
5	1.30	10	Static model, inslope of embankment
6	1.09	10	Seismic model, iterated from static minimum FoS
7	1.39	2	Static model, outslope of embankment
8	1.20	2	Seismic model, iterated from static minimum FoS

3. Conclusion

Colorado Division of Reclamation, Mining, and Safety requirements for typical slope stability analysis are outline in a 2018 memo[1]. Non-critical structures are expected to have a minimum factor of safety of 1.25 (seismic > 1.1) with strength data from onsite testing. Critical structures are expected to have a minimum factor of safety of 1.3 (seismic > 1.15). The structure in question at the Gold Hill Mill is the tailings embankment as its failure could lead to a discharge or tailings downhill towards Gold Run Road. Gold Run Road is roughly 2500-ft downhill of the TSF embankment. Potential failure of the embankment exists in two scenarios: inslope failure that leads to compromising of the embankment from within the TSF or outslope failure that causes embankment failure.

3.1. Inslope Failure

Inslope failure was evaluated by McCulley in 1998, with follow up analysis in this report. The inslope of the TSF embankment was shown to have a factor of safety of 1.20 to 1.30 depending on the scenario within the GALENA model. The highest factor of safety was in the GALENA model of the McCulley stable scenario. The lowest factor of safety was in the same base model, but with more tailings in place. No inslope model scenario shows a minimum FOS arc that reaches the midpoint of the embankment or the liner trench.

The danger of inslope failure within the TSF is very limited with the current presence of tailings within the TSF. This can be seen with the very limited failure arc for each analysis. Furthermore, all of the embankment material that could fail on the inslope is located below the plastic liner which is sandwiched against the existing tailings. This greatly limits the potential damage to the embankment of any inslope failure and the risk to downstream structures and human life in the event of any inslope failure shown in the models.

3.2. Outslope Failure

Outslope failure was not evaluated by McCulley in 1998. The GALENA model in this report does. The outslope was modelled based on the design criteria in the McCulley analysis. The lowest factor of safety for the outslope was 1.39 (seismic = 1.20). Failure of the outslope would lead to potential failure of the embankment, making it the appropriate slope stability to analyze and compare to CDRMS standards.

The outslope minimum factor of safety is above the CDRMS standards (FOS = 1.3, seismic = 1.15) for Critical Structures with site specific data. The outslope analysis passes both of these standards.

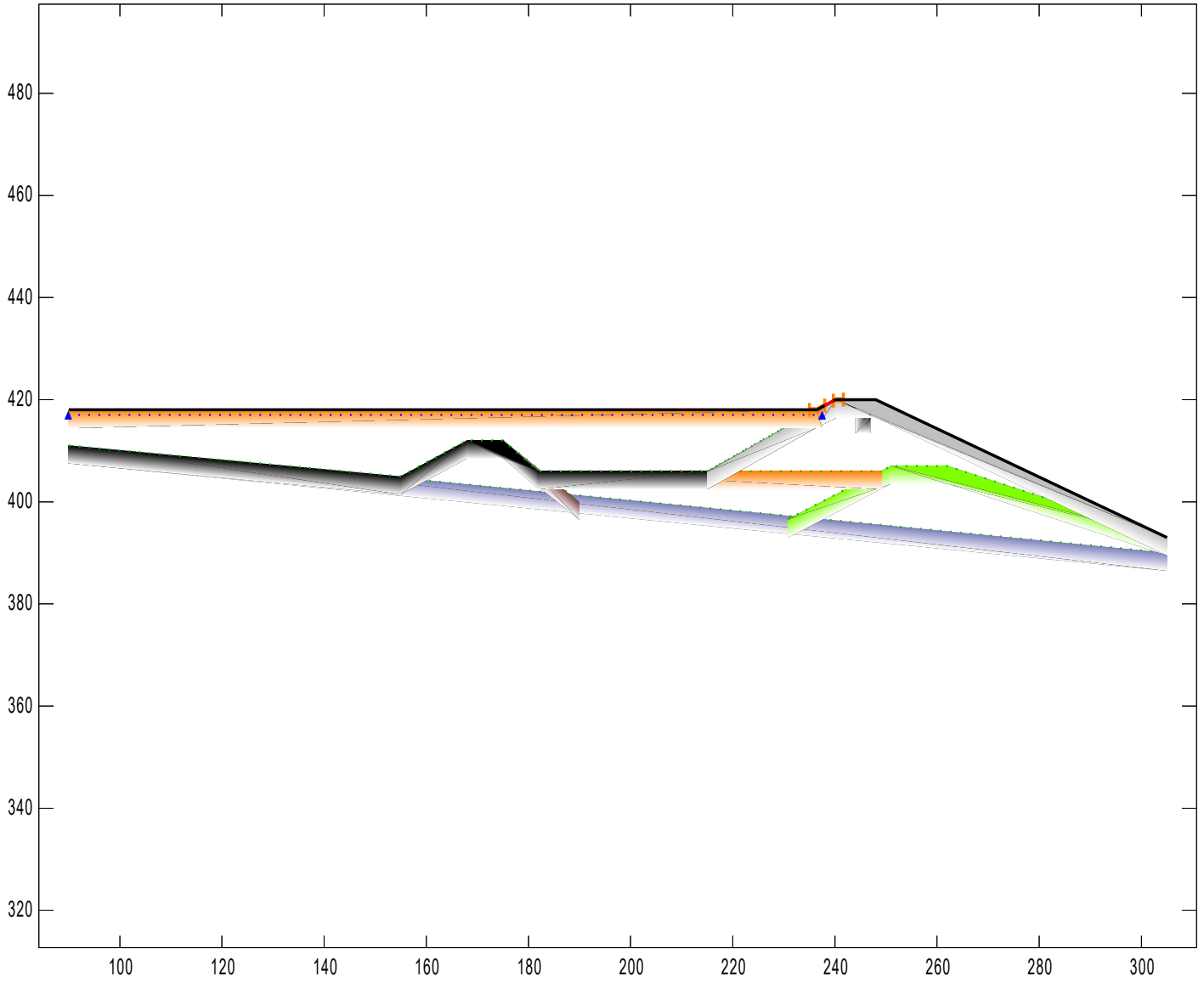
[1] Based on *Factors of Safety for Slope Stability/Geotechnical Analyses Associated with Mining Operations* from CDRMS, dated May 16, 2018.

The slope stability analysis in this permit has been prepared according to appropriate engineering standards and practices.

Ben Langenfeld, P.E.

P.E.# 0047151

ATTACHMENT-1 GALENA INFORMATION



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 1

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

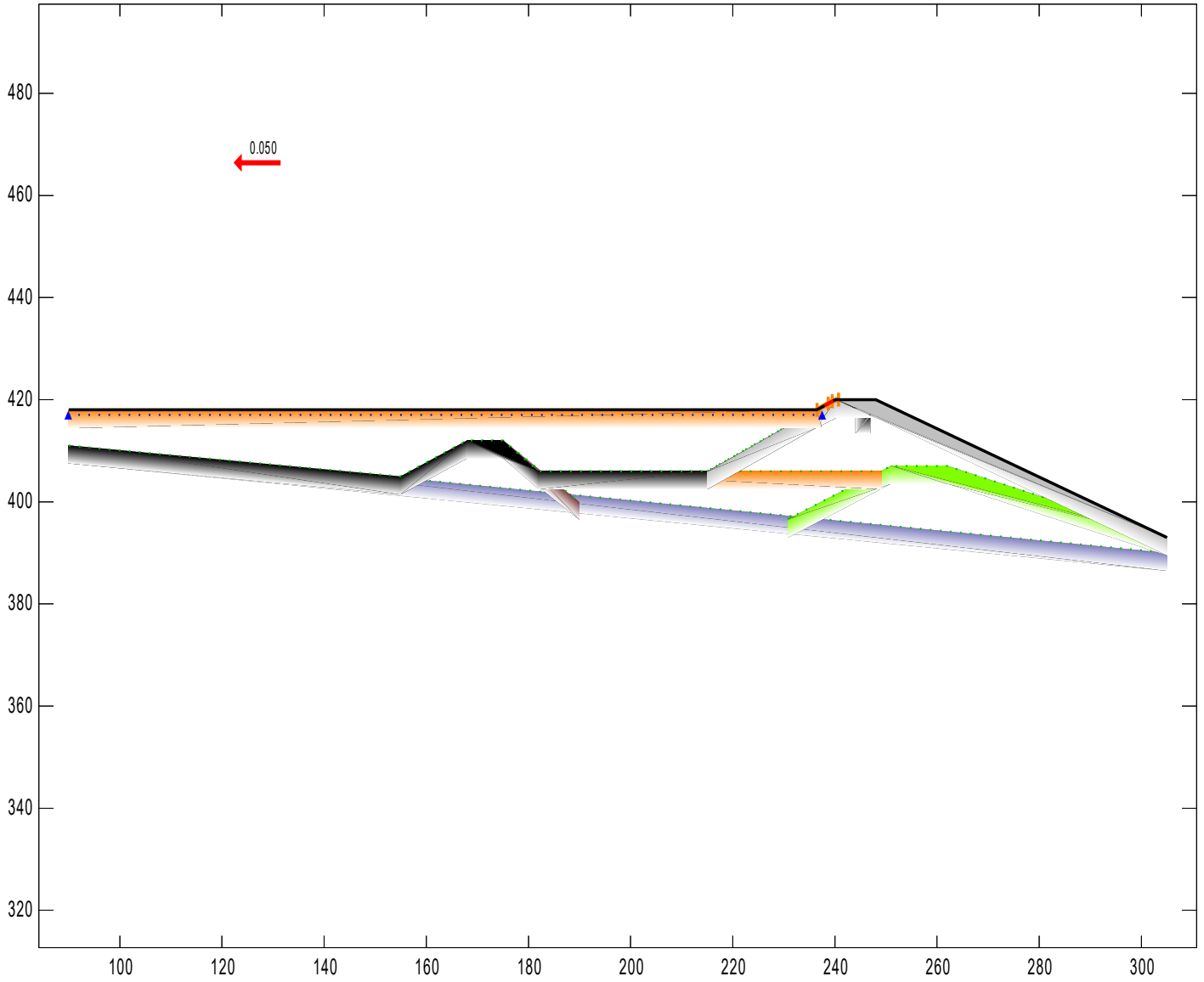
Critical Factor of Safety: 1.26

Edited: 1 Aug 2023
Processed: 1 Aug 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 2FT Below Top of Embankment

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 2

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular (Critical Seed)

Results

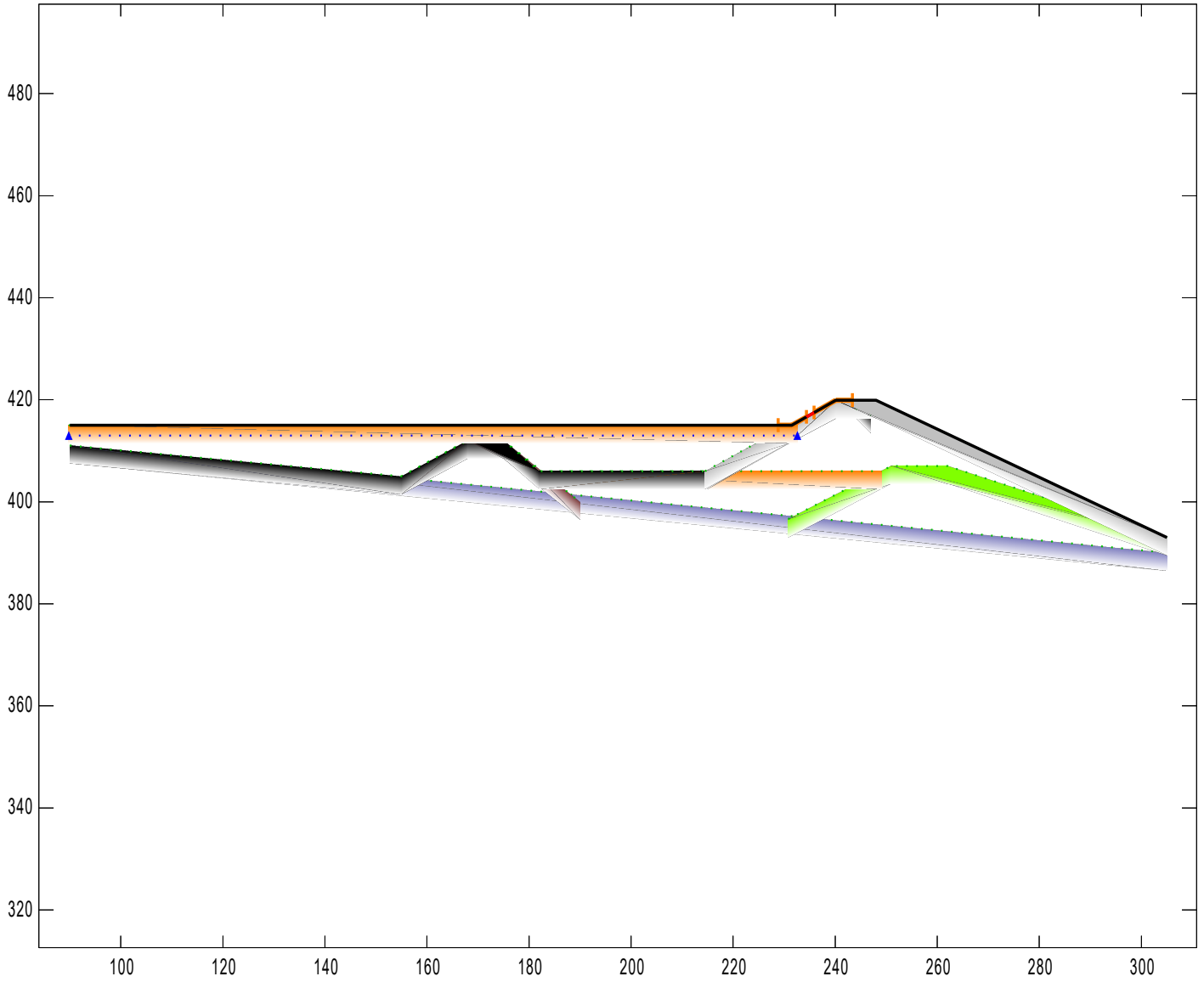
Critical Factor of Safety: 1.12

Edited: 1 Aug 2023
Processed: 1 Aug 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 3

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

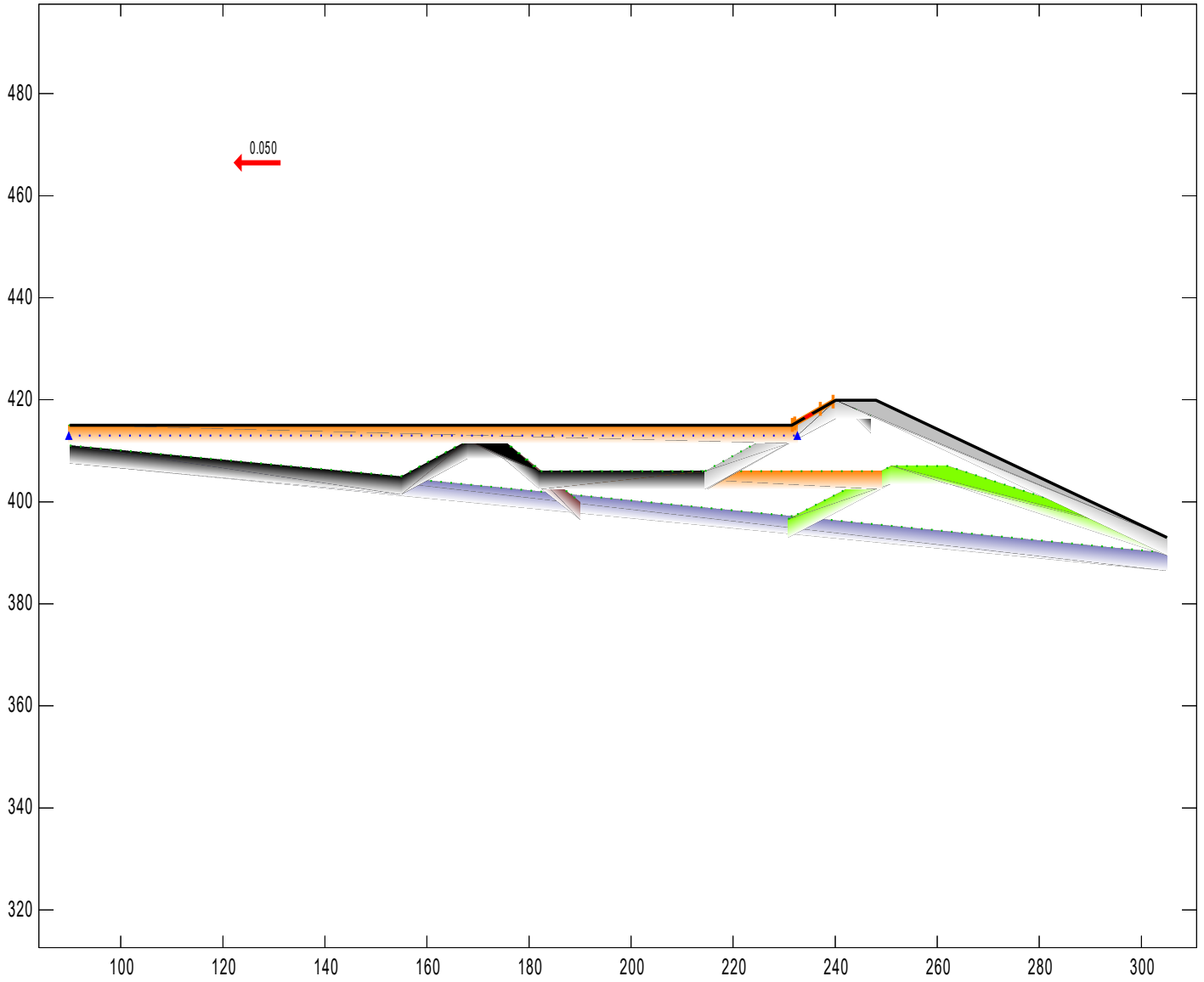
Critical Factor of Safety: 1.23

Edited: 1 Aug 2023
Processed: 1 Aug 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 5FT Below Embankment Top

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 4

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular (Critical Seed)

Results

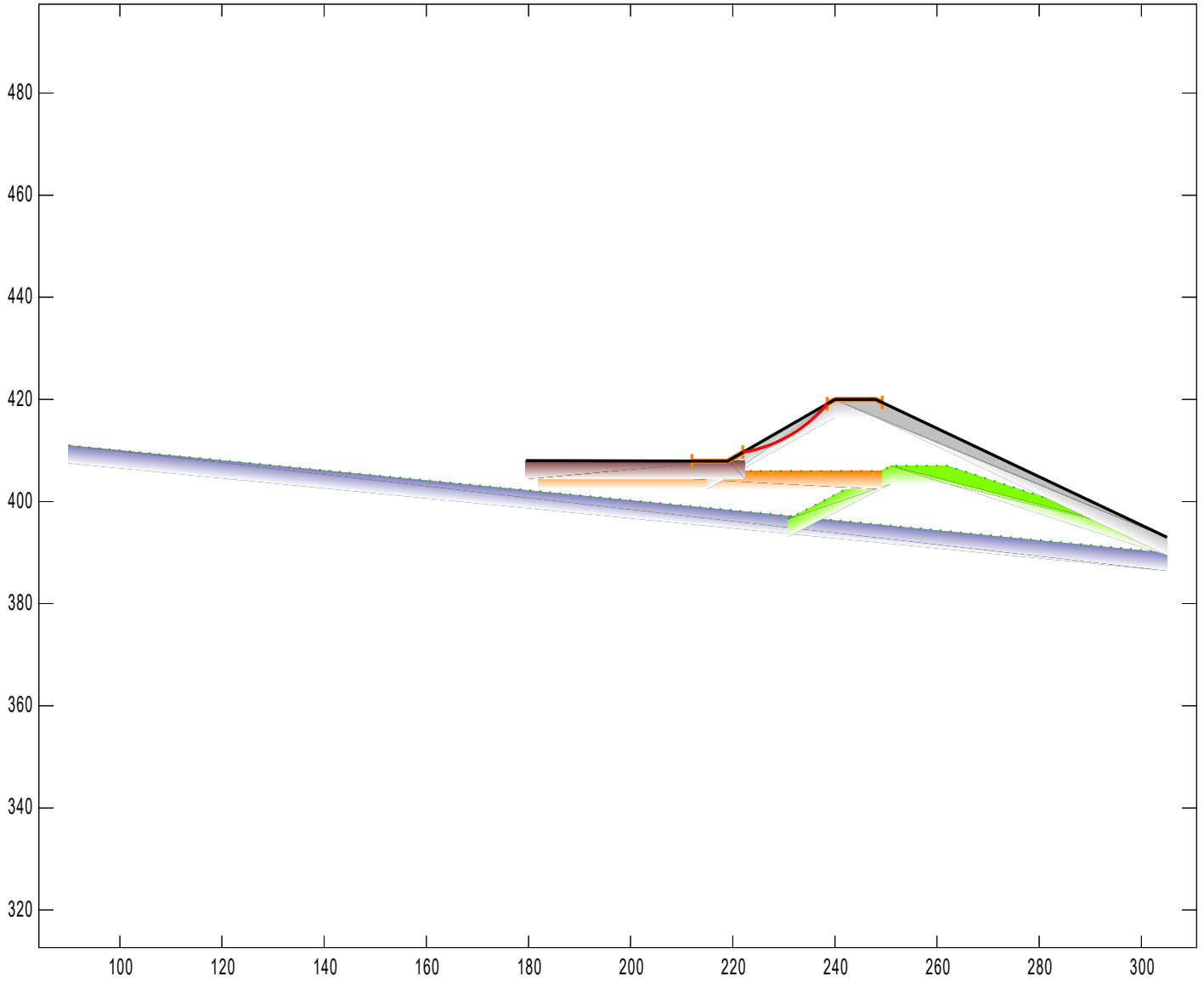
Critical Factor of Safety: 1.10

Edited: 1 Aug 2023
Processed: 1 Aug 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 5

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

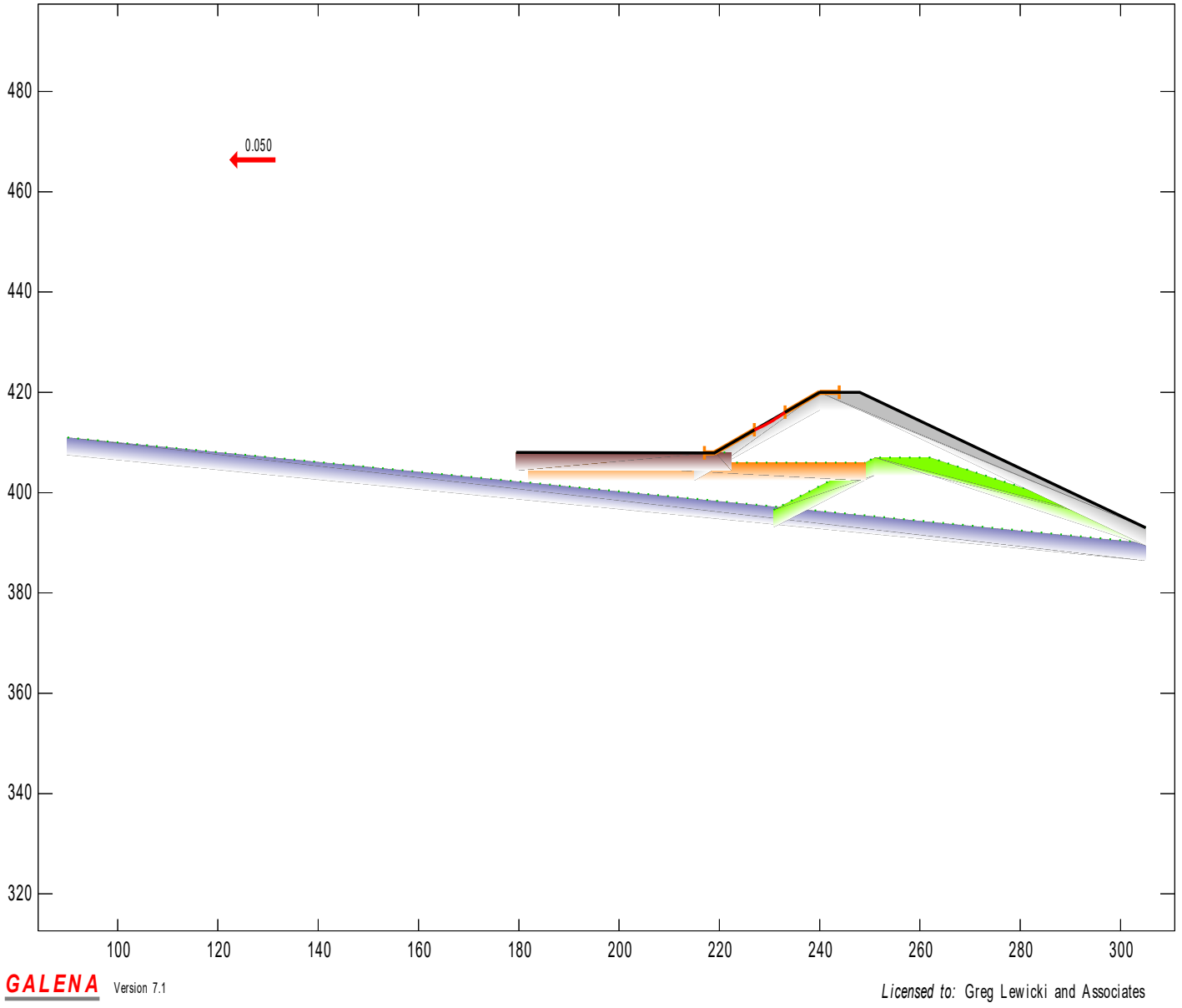
Critical Factor of Safety: 1.30

Edited: 31 Jul 2023
Processed: 31 Jul 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 6

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular (Critical Seed)

Results

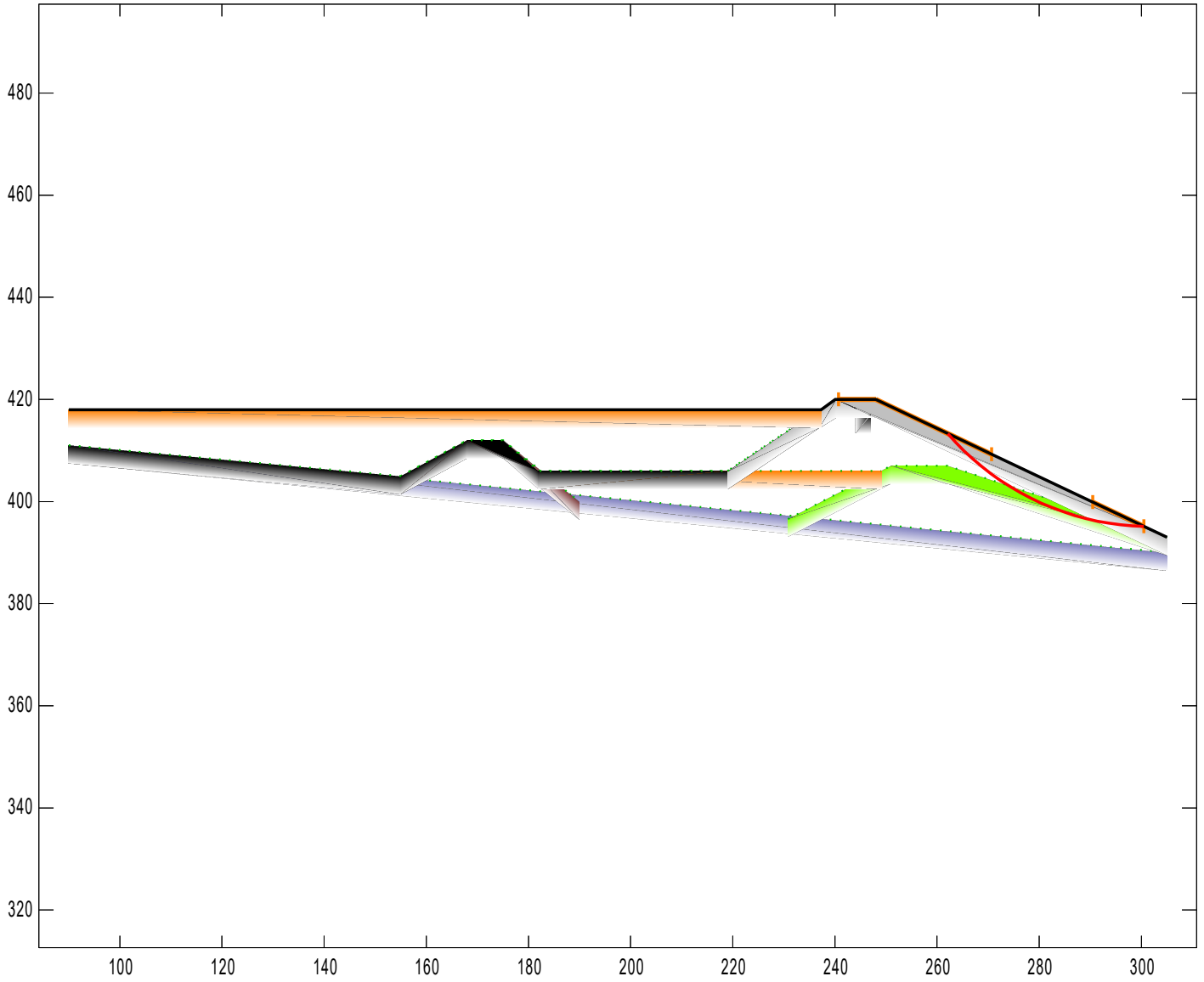
Critical Factor of Safety: 1.09

Edited: 31 Jul 2023
Processed: 31 Jul 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - 10FT Below Embankment Top - Seismic

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

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Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 7

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular

Results

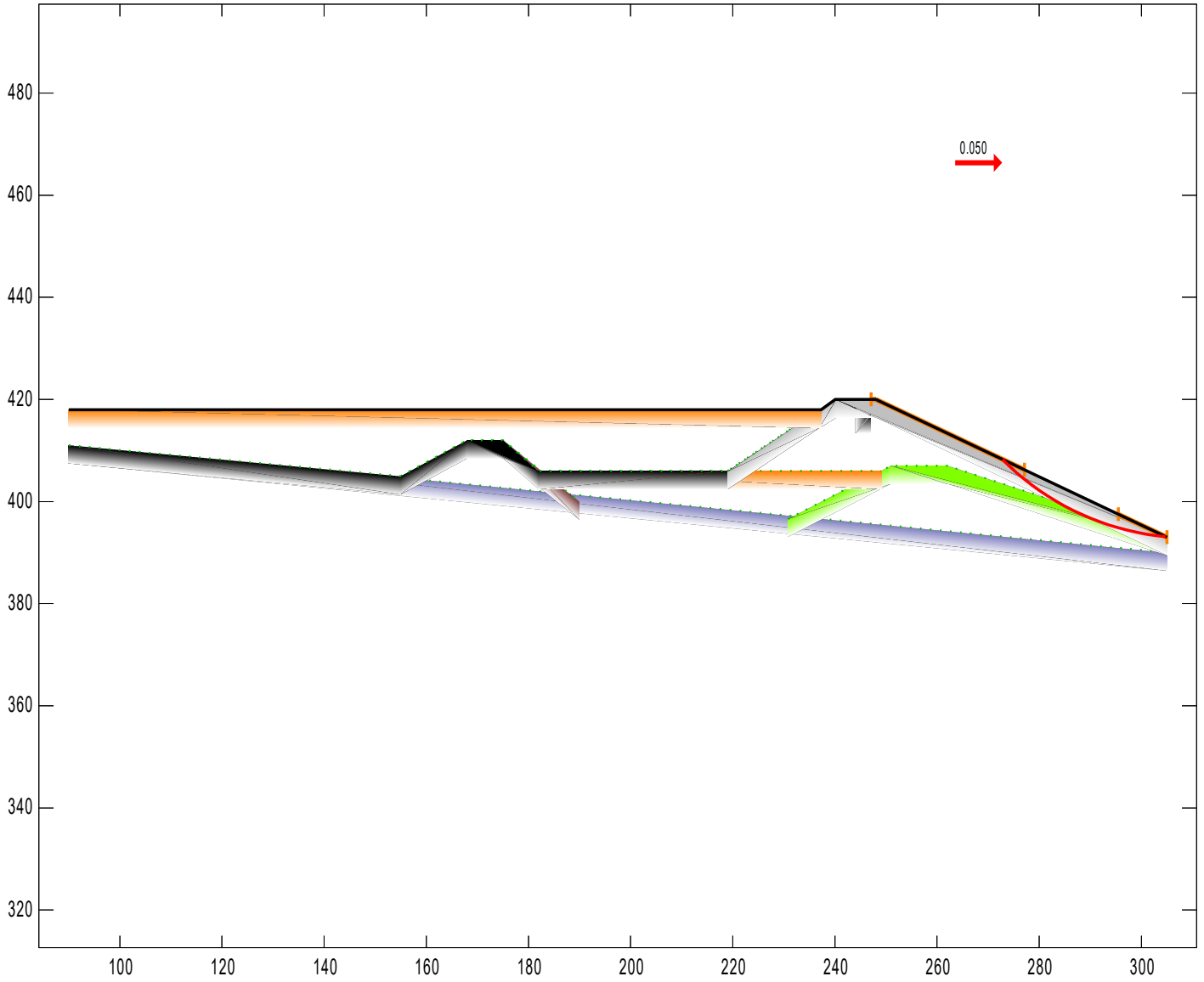
Critical Factor of Safety: 1.39

Edited: 31 Jul 2023
Processed: 31 Jul 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - Outslope

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Tailings
2: Embankment (Proposed)
3: Embankment (Existing)
4: Soil Buttress
5: Bedrock
6: Tailings/Geomembrane Interface

Analysis 8

Multiple Stability Analysis
Method: Bishop Simplified
Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 1.20

Edited: 31 Jul 2023
Processed: 31 Jul 2023

Project GHM - Tailings Storage Facility
2023 Embankment Stability - Outslope

File: E:\Work\GL...\GHM-Tailings Storage Facility COMBINED.gmf

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GALENA 7.1 Analysis Results Version: 7.10.1.04 Licensee: Greg Lewicki and Associates

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Project: GHM - Tailings Storage Facility
File: E:\Work\GLA Dropbox\Ben Langenfeld\Colorado Milling Company\Tailings Pond-...\GHM-Tailings Storage Facility COMBINED.gmf

Processed: 01 Aug 2023 17:48:59

DATA: Analysis 1 - 2023 Embankment Stability - 2FT Below Top of Embankment

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings
Cohesion Phi UnitWeight Ru
40.00 20.0 94.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
Cohesion Phi UnitWeight Ru
0.00 35.0 130.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
Cohesion Phi UnitWeight Ru
0.00 30.0 123.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
Cohesion Phi UnitWeight Ru
0.00 33.0 110.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
Cohesion Phi UnitWeight Ru
0.00 37.0 138.00 Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
Cohesion Phi UnitWeight Ru
30.00 17.0 100.00 Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
Cohesion Phi UnitWeight Ru
0.00 33.0 110.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Bedrock
90.00 411.00 305.00 390.00
Profile: 2 (4 points) Material beneath: 3 - Embankment (Existing)
230.80 396.60 251.00 407.00 262.00 407.00

```
305.00      393.00
Profile:  3 (4 points)   Material beneath:  4 - Soil Buttress
    155.00      405.00         168.00      412.00         175.00      412.00
190.00      400.00
Profile:  4 (2 points)   Material beneath:  1 - Tailings
    182.00      406.00         249.10      406.00
Profile:  5 (11 points)   Material beneath:  6 - Tailings/Geomembrane Interface
     90.00      411.00         155.00      405.00         168.00      412.00
175.00      412.00          182.00      406.00
    215.00      406.00         240.00      420.10         244.00      420.10
244.10      417.00          246.90      417.00
    247.00      420.00
Profile:  6 (4 points)   Material beneath:  2 - Embankment (Proposed)
    215.00      406.00         240.00      420.00         248.00      420.00
305.00      393.00
Profile:  7 (2 points)   Material beneath:  1 - Tailings
     90.00      418.00         237.30      418.00

Slope Surface (5 points)
-------------
     90.00      418.00         236.50      418.00         240.10      420.00
248.00      420.00          305.00      393.00

Piezometric Surfaces (1 surface)
--------------------
Surface within profile:  7 (2 points) - Tailings
     89.90      417.00         237.50      417.00

Failure Surface
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:     236.50      YL:     418.00      XR:     240.70      YR:
420.00
      Centre:  XC:     231.58      YC:     433.75                  Radius:  R:
16.50

Variable Restraints
-------------------
Parameter descriptor:              XL         XR         R
Range of variation:               3.00       2.00      10.00
Trial positions within range:       5          5         10

-  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --
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RESULTS: Analysis  1 - 2023 Embankment Stability - 2FT Below Top of Embankment

Bishop Simplified Method of Analysis - Circular Failure Surface
---------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques
```

Factor of Safety for initial failure surface approximation: 1.421

There were: 151 successful analyses from a total of 251 trial surfaces
            100 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.26

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS
1	238.00	418.83	239.70	419.78	228.42	438.08	21.50	1.261 <-- Critical Surface
2	238.00	418.83	239.70	419.78	228.96	437.11	20.39	1.262
3	238.00	418.83	239.70	419.78	229.50	436.14	19.28	1.262
4	238.00	418.83	239.70	419.78	230.04	435.16	18.17	1.262
5	238.00	418.83	239.70	419.78	230.58	434.19	17.06	1.262
6	238.00	418.83	239.70	419.78	231.12	433.22	15.94	1.263
7	237.25	418.42	239.70	419.78	228.06	437.85	21.50	1.263
8	238.00	418.83	239.70	419.78	231.66	432.24	14.83	1.263
9	237.25	418.42	239.70	419.78	228.60	436.88	20.39	1.263
10	238.00	418.83	239.70	419.78	232.20	431.27	13.72	1.263
11	237.25	418.42	239.70	419.78	229.14	435.90	19.28	1.264
12	237.25	418.42	239.70	419.78	229.68	434.93	18.17	1.264
13	238.00	418.83	239.70	419.78	232.74	430.30	12.61	1.264
14	237.25	418.42	239.70	419.78	230.22	433.96	17.06	1.265
15	238.00	418.83	239.70	419.78	233.29	429.32	11.50	1.265
16	236.50	418.00	239.70	419.78	227.70	437.62	21.50	1.265
17	237.25	418.42	239.70	419.78	230.76	432.98	15.94	1.265
18	236.50	418.00	239.70	419.78	228.24	436.64	20.39	1.265
19	237.25	418.42	239.70	419.78	231.30	432.01		

14.83	1.266						
20	236.50	418.00	239.70	419.78	228.78	435.66	
19.28	1.266						
21	236.50	418.00	239.70	419.78	229.32	434.69	
18.17	1.267						
22	237.25	418.42	239.70	419.78	231.85	431.03	
13.72	1.267						
23	236.50	418.00	239.70	419.78	229.86	433.71	
17.06	1.268						
24	237.25	418.42	239.70	419.78	232.39	430.05	
12.61	1.268						
25	236.50	418.00	239.70	419.78	230.41	432.73	
15.94	1.269						
26	237.25	418.42	239.70	419.78	232.93	429.08	
11.50	1.270						
27	236.50	418.00	239.70	419.78	230.95	431.76	
14.83	1.270						
28	236.50	418.00	239.70	419.78	231.50	430.78	
13.72	1.272						
29	236.50	418.00	239.70	419.78	232.04	429.80	
12.61	1.274						
30	236.50	418.00	239.70	419.78	232.59	428.81	
11.50	1.277						
31	236.50	418.00	240.20	420.00	228.18	437.82	
21.50	1.278						
32	236.50	418.00	240.20	420.00	228.71	436.84	
20.39	1.279						
33	236.50	418.00	240.20	420.00	229.24	435.86	
19.28	1.279						
34	236.50	418.00	240.20	420.00	229.77	434.87	
18.17	1.280						
35	236.50	418.00	240.20	420.00	230.30	433.89	
17.06	1.281						
36	236.50	418.00	240.20	420.00	230.83	432.90	
15.94	1.282						
37	237.25	418.42	240.20	420.00	228.59	438.09	
21.50	1.283						
38	237.25	418.42	240.20	420.00	229.12	437.11	
20.39	1.283						
39	237.25	418.42	240.20	420.00	229.64	436.13	
19.28	1.283						
40	237.25	418.42	240.20	420.00	230.17	435.15	
18.17	1.283						
41	237.25	418.42	240.20	420.00	230.70	434.16	
17.06	1.284						
42	236.50	418.00	240.20	420.00	231.37	431.92	
14.83	1.284						
43	237.25	418.42	240.20	420.00	231.23	433.18	
15.94	1.284						
44	237.25	418.42	240.20	420.00	231.75	432.19	

14.83	1.285					
45	237.25	418.42	240.20	420.00	232.28	431.21
13.72	1.286					
46	236.50	418.00	240.20	420.00	231.90	430.93
13.72	1.286					
47	237.25	418.42	240.20	420.00	232.81	430.22
12.61	1.287					
48	236.50	418.00	240.20	420.00	232.44	429.94
12.61	1.289					
49	237.25	418.42	240.20	420.00	233.34	429.23
11.50	1.289					
50	236.50	418.00	240.20	420.00	232.97	428.95
11.50	1.292					
51	238.00	418.83	240.20	420.00	232.70	431.49
13.72	1.294					
52	238.00	418.83	240.20	420.00	232.18	432.48
14.83	1.294					
53	238.00	418.83	240.20	420.00	233.22	430.50
12.61	1.294					
54	238.00	418.83	240.20	420.00	231.65	433.46
15.94	1.294					
55	238.00	418.83	240.20	420.00	231.13	434.44
17.06	1.294					
56	238.00	418.83	240.20	420.00	233.74	429.52
11.50	1.294					
57	238.00	418.83	240.20	420.00	230.61	435.43
18.17	1.295					
58	238.00	418.83	240.20	420.00	230.09	436.41
19.28	1.295					
59	238.00	418.83	240.20	420.00	229.57	437.40
20.39	1.295					
60	238.00	418.83	240.20	420.00	229.04	438.38
21.50	1.296					
61	236.50	418.00	240.70	420.00	231.58	433.75
16.50	1.421					
62	236.50	418.00	240.70	420.00	231.82	433.24
15.94	1.421					
63	236.50	418.00	240.70	420.00	231.34	434.25
17.06	1.421					
64	236.50	418.00	240.70	420.00	232.30	432.23
14.83	1.422					
65	236.50	418.00	240.70	420.00	230.85	435.27
18.17	1.422					
66	236.50	418.00	240.70	420.00	230.37	436.28
19.28	1.422					
67	236.50	418.00	240.70	420.00	232.79	431.21
13.72	1.422					
68	236.50	418.00	240.70	420.00	229.89	437.29
20.39	1.423					
69	236.50	418.00	240.70	420.00	229.41	438.30

21.50	1.423						
70	236.50	418.00	240.70	420.00	233.27	430.19	
12.61	1.424						
71	236.50	418.00	240.70	420.00	233.76	429.17	
11.50	1.427						
72	237.25	418.42	240.70	420.00	233.77	430.54	
12.61	1.474						
73	237.25	418.42	240.70	420.00	233.31	431.56	
13.72	1.474						
74	237.25	418.42	240.70	420.00	234.24	429.52	
11.50	1.474						
75	237.25	418.42	240.70	420.00	232.84	432.58	
14.83	1.475						
76	237.25	418.42	240.70	420.00	232.37	433.60	
15.94	1.476						
77	237.25	418.42	240.70	420.00	231.91	434.61	
17.06	1.477						
78	237.25	418.42	240.70	420.00	231.44	435.63	
18.17	1.478						
79	237.25	418.42	240.70	420.00	230.97	436.64	
19.28	1.479						
80	237.25	418.42	240.70	420.00	230.51	437.66	
20.39	1.480						
81	237.25	418.42	240.70	420.00	230.04	438.67	
21.50	1.481						
82	238.00	418.83	240.70	420.00	234.83	429.89	
11.50	1.569						
83	238.00	418.83	240.70	420.00	234.38	430.91	
12.61	1.571						
84	238.00	418.83	240.70	420.00	233.94	431.94	
13.72	1.572						
85	238.00	418.83	240.70	420.00	233.50	432.97	
14.83	1.574						
86	238.00	418.83	240.70	420.00	233.05	433.99	
15.94	1.575						
87	238.00	418.83	240.70	420.00	232.61	435.01	
17.06	1.577						
88	238.00	418.83	240.70	420.00	232.17	436.04	
18.17	1.578						
89	238.00	418.83	240.70	420.00	231.73	437.06	
19.28	1.580						
90	238.00	418.83	240.70	420.00	231.28	438.08	
20.39	1.581						
91	238.00	418.83	240.70	420.00	230.84	439.11	
21.50	1.582						
92	236.50	418.00	241.20	420.00	232.69	433.48	
15.94	1.594						
93	236.50	418.00	241.20	420.00	232.25	434.52	
17.06	1.594						
94	236.50	418.00	241.20	420.00	231.81	435.55	

```
18.17     1.594
  95       236.50      418.00      241.20      420.00      233.13      432.45
14.83     1.594
  96       236.50      418.00      241.20      420.00      231.37      436.58
19.28     1.595
  97       236.50      418.00      241.20      420.00      233.57      431.41
13.72     1.595
  98       236.50      418.00      241.20      420.00      230.93      437.61
20.39     1.595
  99       236.50      418.00      241.20      420.00      230.49      438.64
21.50     1.596

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     238.00      YL:     418.83      XR:     239.70      YR:
419.78
    Centre:  XC:     228.42      YC:     438.08                  Radius:  R:
21.50
Generated failure surface: (20 points)
    238.00    418.83          238.09    418.88          238.18    418.93
238.27    418.97          238.36    419.02
    238.46    419.07          238.55    419.11          238.64    419.16
238.73    419.21          238.82    419.26
    238.91    419.31          238.99    419.36          239.08    419.41
239.17    419.46          239.26    419.51
    239.35    419.57          239.44    419.62          239.53    419.67
239.61    419.72          239.70    419.78

Slice Geometry and Properties - Critical Failure Surface (circle 1,  38 slices)
-------------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
        PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
  1      238.00      0.00    26.6     0.05     0.05     2       0.00    35.0
0.01        0.00         0.13    0.88
  2      238.05      0.00    26.6     0.05     0.05     2       0.00    35.0
0.02        0.00         0.38    0.88
  3      238.09      0.00    26.9     0.05     0.05     2       0.00    35.0
0.04        0.00         0.62    0.87
  4      238.14      0.00    26.9     0.05     0.05     2       0.00    35.0
0.05        0.00         0.85    0.87
  5      238.18      0.00    27.2     0.05     0.05     2       0.00    35.0
0.06        0.00         1.06    0.87
  6      238.23      0.00    27.1     0.05     0.05     2       0.00    35.0
0.07        0.00         1.25    0.87
  7      238.27      0.00    27.4     0.05     0.05     2       0.00    35.0
0.08        0.00         1.43    0.87
  8      238.32      0.00    27.4     0.05     0.05     2       0.00    35.0
0.09        0.00         1.60    0.87
```

9	238.36	0.00	27.7	0.05	0.05	2	0.00	35.0
0.10	0.00	1.75	0.87					
10	238.41	0.00	27.7	0.05	0.05	2	0.00	35.0
0.11	0.00	1.89	0.87					
11	238.46	0.00	27.9	0.05	0.05	2	0.00	35.0
0.12	0.00	2.01	0.87					
12	238.50	0.00	28.0	0.05	0.05	2	0.00	35.0
0.12	0.00	2.12	0.87					
13	238.55	0.00	28.2	0.05	0.05	2	0.00	35.0
0.13	0.00	2.22	0.87					
14	238.59	0.00	28.2	0.05	0.05	2	0.00	35.0
0.13	0.00	2.30	0.87					
15	238.64	0.00	28.5	0.04	0.05	2	0.00	35.0
0.14	0.00	2.37	0.87					
16	238.68	0.00	28.5	0.04	0.05	2	0.00	35.0
0.14	0.00	2.42	0.87					
17	238.73	0.00	28.8	0.04	0.05	2	0.00	35.0
0.14	0.00	2.46	0.87					
18	238.77	0.00	28.8	0.04	0.05	2	0.00	35.0
0.15	0.00	2.48	0.87					
19	238.82	0.00	29.0	0.04	0.05	2	0.00	35.0
0.15	0.00	2.49	0.87					
20	238.86	0.00	29.1	0.04	0.05	2	0.00	35.0
0.15	0.00	2.49	0.87					
21	238.91	0.00	29.3	0.04	0.05	2	0.00	35.0
0.14	0.00	2.47	0.87					
22	238.95	0.00	29.3	0.04	0.05	2	0.00	35.0
0.14	0.00	2.45	0.87					
23	238.99	0.00	29.6	0.04	0.05	2	0.00	35.0
0.14	0.00	2.39	0.87					
24	239.04	0.00	29.6	0.04	0.05	2	0.00	35.0
0.14	0.00	2.34	0.87					
25	239.08	0.00	29.9	0.04	0.05	2	0.00	35.0
0.13	0.00	2.26	0.87					
26	239.13	0.00	29.9	0.04	0.05	2	0.00	35.0
0.13	0.00	2.18	0.87					
27	239.17	0.00	30.2	0.04	0.05	2	0.00	35.0
0.12	0.00	2.08	0.87					
28	239.22	0.00	30.1	0.04	0.05	2	0.00	35.0
0.12	0.00	1.97	0.87					
29	239.26	0.00	30.4	0.04	0.05	2	0.00	35.0
0.11	0.00	1.84	0.87					
30	239.31	0.00	30.4	0.04	0.05	2	0.00	35.0
0.10	0.00	1.71	0.87					
31	239.35	0.00	30.7	0.04	0.05	2	0.00	35.0
0.09	0.00	1.55	0.87					
32	239.39	0.00	30.7	0.04	0.05	2	0.00	35.0
0.08	0.00	1.39	0.87					
33	239.44	0.00	31.0	0.04	0.05	2	0.00	35.0
0.07	0.00	1.21	0.87					

```
 34      239.48      0.00    31.0     0.04     0.05     2       0.00    35.0
0.06        0.00         1.02    0.87
 35      239.53      0.00    31.2     0.04     0.05     2       0.00    35.0
0.05        0.00         0.81    0.87
 36      239.57      0.00    31.2     0.04     0.05     2       0.00    35.0
0.03        0.00         0.60    0.87
 37      239.61      0.00    31.5     0.04     0.05     2       0.00    35.0
0.02        0.00         0.36    0.88
 38      239.66      0.00    31.5     0.04     0.05     2       0.00    35.0
0.01        0.00         0.12    0.88
                 --------                    -------
----------
     X-S Area:       0.03    Path Length:      1.95              X-S Weight:
3.70
```

DATA: Analysis 2 - 2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

Cohesion	Phi	UnitWeight	Ru
40.00	20.0	94.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)

Cohesion	Phi	UnitWeight	Ru
0.00	35.0	130.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)

Cohesion	Phi	UnitWeight	Ru
0.00	30.0	123.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Material: 5 (Mohr-Coulomb Isotropic) - Bedrock

Cohesion	Phi	UnitWeight	Ru
0.00	37.0	138.00	Auto

Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface

Cohesion	Phi	UnitWeight	Ru
30.00	17.0	100.00	Auto

Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings

Cohesion	Phi	UnitWeight	Ru
0.00	33.0	110.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (7 profiles)

Profile: 1 (2 points)   Material beneath: 5 - Bedrock
90.00 411.00 305.00 390.00
Profile: 2 (4 points)   Material beneath: 3 - Embankment (Existing)
230.80 396.60 251.00 407.00 262.00 407.00
305.00 393.00
Profile: 3 (4 points)   Material beneath: 4 - Soil Buttress
155.00 405.00 168.00 412.00 175.00 412.00
190.00 400.00
Profile: 4 (2 points)   Material beneath: 1 - Tailings
182.00 406.00 249.10 406.00
Profile: 5 (11 points)   Material beneath: 6 - Tailings/Geomembrane Interface
90.00 411.00 155.00 405.00 168.00 412.00
175.00 412.00 182.00 406.00
215.00 406.00 240.00 420.10 244.00 420.10
244.10 417.00 246.90 417.00
247.00 420.00
Profile: 6 (4 points)   Material beneath: 2 - Embankment (Proposed)
215.00 406.00 240.00 420.00 248.00 420.00
305.00 393.00
Profile: 7 (2 points)   Material beneath: 1 - Tailings
90.00 418.00 237.30 418.00

Slope Surface (5 points)

90.00 418.00 236.50 418.00 240.10 420.00
248.00 420.00 305.00 393.00

Piezometric Surfaces (1 surface)

Surface within profile: 7 (2 points) - Tailings
89.90 417.00 237.50 417.00

Failure Surface (Critical, from previous analysis)

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 238.00 YL: 418.83 XR: 239.70 YR:
419.78
Centre: XC: 228.42 YC: 438.08 Radius: R:
21.50

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	3.00	2.00	10.00

Trial positions within range: 5 5 10

- --
-- -- -- -- -- -- -- -- -- -- -- -- -

RESULTS: Analysis 2 - 2023 Embankment Stability - 2FT Below Top of Embankment - Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface
----

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.125

There were: 156 successful analyses from a total of 251 trial surfaces
95 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.12

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	238.00	418.83	239.70	419.78	225.99	442.46	26.50	1.124	<-- Critical Surface
2	238.00	418.83	239.70	419.78	226.53	441.48	25.39	1.124	
3	238.00	418.83	239.70	419.78	227.07	440.51	24.28	1.125	
4	238.00	418.83	239.70	419.78	227.61	439.54	23.17	1.125	
5	237.25	418.42	239.20	419.50	225.37	442.10	26.50	1.125	
6	237.25	418.42	239.20	419.50	225.91	441.13	25.39	1.125	
7	238.00	418.83	239.70	419.78	228.15	438.57	22.06	1.125	
8	237.25	418.42	238.70	419.22	228.89	435.17	18.72	1.125	
9	238.00	418.83	239.70	419.78	228.42	438.08	21.50	1.125	
10	237.25	418.42	239.20	419.50	226.45	440.16	24.28	1.125	
11	238.00	418.83	239.70	419.78	228.69	437.59	20.94	1.125	
12	237.25	418.42	238.70	419.22	229.43	434.20	17.61	1.125	
13	236.50	418.00	238.70	419.22	224.74	441.75	26.50	1.125	

14	237.25	418.42	239.20	419.50	226.99	439.19	23.17	1.125
15	238.00	418.83	239.70	419.78	229.23	436.62	19.83	1.125
16	236.50	418.00	238.70	419.22	225.29	440.78	25.39	1.125
17	237.25	418.42	238.70	419.22	229.97	433.22	16.50	1.125
18	237.25	418.42	239.20	419.50	227.53	438.21	22.06	1.125
19	236.50	418.00	238.70	419.22	225.83	439.81	24.28	1.125
20	238.00	418.83	239.70	419.78	229.77	435.65	18.72	1.125
21	237.25	418.42	239.70	419.78	225.62	442.23	26.50	1.125
22	237.25	418.42	239.20	419.50	228.07	437.24	20.94	1.125
23	236.50	418.00	238.70	419.22	226.37	438.83	23.17	1.125
24	238.00	418.83	239.70	419.78	230.31	434.68	17.61	1.125
25	237.25	418.42	239.70	419.78	226.16	441.26	25.39	1.125
26	237.25	418.42	239.20	419.50	228.61	436.27	19.83	1.126
27	236.50	418.00	238.70	419.22	226.91	437.86	22.06	1.126
28	237.25	418.42	239.70	419.78	226.70	440.28	24.28	1.126
29	236.50	418.00	239.20	419.50	225.00	441.88	26.50	1.126
30	238.00	418.83	239.70	419.78	230.85	433.70	16.50	1.126
31	237.25	418.42	239.20	419.50	229.15	435.30	18.72	1.126
32	236.50	418.00	238.70	419.22	227.45	436.89	20.94	1.126
33	237.25	418.42	239.70	419.78	227.24	439.31	23.17	1.126
34	236.50	418.00	239.20	419.50	225.54	440.90	25.39	1.126
35	237.25	418.42	239.20	419.50	229.69	434.32	17.61	1.126
36	236.50	418.00	238.70	419.22	227.99	435.91	19.83	1.126
37	237.25	418.42	239.70	419.78	227.79	438.34	22.06	1.126
38	236.50	418.00	239.20	419.50	226.08	439.93	24.28	1.126

39	236.50	418.00	239.20	419.50	226.62	438.96	23.17	1.126
40	237.25	418.42	239.70	419.78	228.33	437.36	20.94	1.126
41	236.50	418.00	238.70	419.22	228.53	434.94	18.72	1.126
42	237.25	418.42	239.20	419.50	230.23	433.35	16.50	1.126
43	236.50	418.00	239.70	419.78	225.26	442.00	26.50	1.127
44	236.50	418.00	239.20	419.50	227.17	437.98	22.06	1.127
45	237.25	418.42	239.70	419.78	228.87	436.39	19.83	1.127
46	236.50	418.00	238.70	419.22	229.07	433.97	17.61	1.127
47	236.50	418.00	239.70	419.78	225.80	441.03	25.39	1.127
48	236.50	418.00	239.20	419.50	227.71	437.01	20.94	1.127
49	237.25	418.42	239.70	419.78	229.41	435.42	18.72	1.127
50	236.50	418.00	239.70	419.78	226.34	440.05	24.28	1.127
51	236.50	418.00	238.70	419.22	229.61	432.99	16.50	1.127
52	236.50	418.00	239.20	419.50	228.25	436.03	19.83	1.127
53	236.50	418.00	239.70	419.78	226.88	439.08	23.17	1.127
54	237.25	418.42	239.70	419.78	229.95	434.44	17.61	1.127
55	236.50	418.00	239.20	419.50	228.79	435.06	18.72	1.128
56	236.50	418.00	239.70	419.78	227.43	438.10	22.06	1.128
57	237.25	418.42	239.70	419.78	230.49	433.47	16.50	1.128
58	236.50	418.00	239.70	419.78	227.97	437.13	20.94	1.128
59	236.50	418.00	239.20	419.50	229.33	434.09	17.61	1.128
60	236.50	418.00	239.70	419.78	228.51	436.15	19.83	1.129
61	236.50	418.00	239.20	419.50	229.87	433.11	16.50	1.129
62	236.50	418.00	239.70	419.78	229.05	435.18	18.72	1.129
63	236.50	418.00	239.70	419.78	229.59	434.20	17.61	1.130

64	236.50	418.00	239.70	419.78	230.14	433.22	16.50	1.131
65	236.50	418.00	240.20	420.00	225.79	442.24	26.50	1.138
66	236.50	418.00	240.20	420.00	226.32	441.26	25.39	1.138
67	236.50	418.00	240.20	420.00	226.85	440.28	24.28	1.139
68	236.50	418.00	240.20	420.00	227.38	439.30	23.17	1.139
69	236.50	418.00	240.20	420.00	227.91	438.31	22.06	1.139
70	236.50	418.00	240.20	420.00	228.44	437.33	20.94	1.140
71	236.50	418.00	240.20	420.00	228.97	436.35	19.83	1.140
72	236.50	418.00	240.20	420.00	229.50	435.37	18.72	1.141
73	236.50	418.00	240.20	420.00	230.04	434.38	17.61	1.142
74	236.50	418.00	240.20	420.00	230.57	433.40	16.50	1.143
75	237.25	418.42	240.20	420.00	227.80	439.57	23.17	1.143
76	237.25	418.42	240.20	420.00	228.32	438.59	22.06	1.143
77	237.25	418.42	240.20	420.00	228.85	437.60	20.94	1.143
78	237.25	418.42	240.20	420.00	227.27	440.55	24.28	1.143
79	237.25	418.42	240.20	420.00	226.74	441.53	25.39	1.143
80	237.25	418.42	240.20	420.00	229.38	436.62	19.83	1.143
81	237.25	418.42	240.20	420.00	226.22	442.51	26.50	1.143
82	237.25	418.42	240.20	420.00	229.91	435.64	18.72	1.143
83	237.25	418.42	240.20	420.00	230.43	434.66	17.61	1.144
84	237.25	418.42	240.20	420.00	230.96	433.67	16.50	1.144
85	238.00	418.83	240.20	420.00	231.39	433.95	16.50	1.153
86	238.00	418.83	240.20	420.00	230.87	434.94	17.61	1.153
87	238.00	418.83	240.20	420.00	230.35	435.92	18.72	1.153
88	238.00	418.83	240.20	420.00	229.83	436.90	19.83	1.153

```
  89       238.00      418.83      240.20      420.00      229.30      437.89
20.94     1.154
  90       238.00      418.83      240.20      420.00      228.78      438.87
22.06     1.154
  91       238.00      418.83      240.20      420.00      228.26      439.85
23.17     1.154
  92       238.00      418.83      240.20      420.00      227.74      440.84
24.28     1.155
  93       238.00      418.83      240.20      420.00      227.22      441.82
25.39     1.155
  94       238.00      418.83      240.20      420.00      226.70      442.80
26.50     1.155
  95       238.75      419.25      240.20      420.00      231.90      434.26
16.50     1.179
  96       238.75      419.25      240.20      420.00      231.39      435.25
17.61     1.180
  97       238.75      419.25      240.20      420.00      230.88      436.24
18.72     1.181
  98       238.75      419.25      240.20      420.00      230.37      437.23
19.83     1.182
  99       238.75      419.25      240.20      420.00      229.86      438.21
20.94     1.182

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     238.00      YL:     418.83      XR:     239.70      YR:
419.78
    Centre:  XC:     225.99      YC:     442.46                  Radius:  R:
26.50
Generated failure surface: (20 points)
    238.00    418.83          238.09    418.88          238.18    418.93
238.27    418.97          238.36    419.02
    238.45    419.07          238.54    419.12          238.63    419.17
238.72    419.22          238.81    419.27
    238.90    419.31          238.99    419.36          239.08    419.42
239.17    419.47          239.26    419.52
    239.35    419.57          239.44    419.62          239.52    419.67
239.61    419.72          239.70    419.78

Slice Geometry and Properties - Critical Failure Surface (circle 1,  38 slices)
-----------------------------------------------------
Slice               X-S     ------------------- Base ---------------------
        PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
  1      238.00      0.00    27.1     0.05     0.05     2       0.00    35.0
0.01        0.00         0.10    0.85
  2      238.05      0.00    27.1     0.05     0.05     2       0.00    35.0
0.02        0.00         0.30    0.85
  3      238.09      0.00    27.3     0.05     0.05     2       0.00    35.0
```

0.03	0.00	0.49	0.85					
4	238.14	0.00	27.3	0.05	0.05	2	0.00	35.0
0.04	0.00	0.67	0.85					
5	238.18	0.00	27.5	0.05	0.05	2	0.00	35.0
0.05	0.00	0.83	0.85					
6	238.23	0.00	27.5	0.05	0.05	2	0.00	35.0
0.06	0.00	0.99	0.85					
7	238.27	0.00	27.7	0.05	0.05	2	0.00	35.0
0.07	0.00	1.13	0.85					
8	238.32	0.00	27.7	0.05	0.05	2	0.00	35.0
0.08	0.00	1.26	0.85					
9	238.36	0.00	27.9	0.05	0.05	2	0.00	35.0
0.08	0.00	1.38	0.85					
10	238.41	0.00	27.9	0.05	0.05	2	0.00	35.0
0.09	0.00	1.49	0.85					
11	238.45	0.00	28.2	0.05	0.05	2	0.00	35.0
0.10	0.00	1.59	0.85					
12	238.50	0.00	28.2	0.05	0.05	2	0.00	35.0
0.10	0.00	1.67	0.85					
13	238.54	0.00	28.4	0.05	0.05	2	0.00	35.0
0.11	0.00	1.75	0.85					
14	238.59	0.00	28.4	0.05	0.05	2	0.00	35.0
0.11	0.00	1.82	0.85					
15	238.63	0.00	28.6	0.04	0.05	2	0.00	35.0
0.11	0.00	1.87	0.85					
16	238.68	0.00	28.6	0.04	0.05	2	0.00	35.0
0.12	0.00	1.91	0.85					
17	238.72	0.00	28.8	0.04	0.05	2	0.00	35.0
0.12	0.00	1.94	0.85					
18	238.77	0.00	28.8	0.04	0.05	2	0.00	35.0
0.12	0.00	1.96	0.85					
19	238.81	0.00	29.1	0.04	0.05	2	0.00	35.0
0.12	0.00	1.97	0.85					
20	238.86	0.00	29.0	0.04	0.05	2	0.00	35.0
0.12	0.00	1.97	0.85					
21	238.90	0.00	29.3	0.04	0.05	2	0.00	35.0
0.12	0.00	1.95	0.85					
22	238.95	0.00	29.3	0.04	0.05	2	0.00	35.0
0.12	0.00	1.93	0.85					
23	238.99	0.00	29.5	0.04	0.05	2	0.00	35.0
0.11	0.00	1.89	0.85					
24	239.04	0.00	29.5	0.04	0.05	2	0.00	35.0
0.11	0.00	1.85	0.85					
25	239.08	0.00	29.7	0.04	0.05	2	0.00	35.0
0.11	0.00	1.79	0.85					
26	239.13	0.00	29.7	0.04	0.05	2	0.00	35.0
0.10	0.00	1.72	0.85					
27	239.17	0.00	29.9	0.04	0.05	2	0.00	35.0
0.10	0.00	1.65	0.85					
28	239.22	0.00	29.9	0.04	0.05	2	0.00	35.0

```
0.09        0.00         1.56    0.85
 29      239.26      0.00    30.2     0.04     0.05     2       0.00    35.0
0.09        0.00         1.46    0.85
 30      239.30      0.00    30.1     0.04     0.05     2       0.00    35.0
0.08        0.00         1.35    0.85
 31      239.35      0.00    30.4     0.04     0.05     2       0.00    35.0
0.07        0.00         1.23    0.85
 32      239.39      0.00    30.4     0.04     0.05     2       0.00    35.0
0.07        0.00         1.10    0.85
 33      239.44      0.00    30.6     0.04     0.05     2       0.00    35.0
0.06        0.00         0.96    0.85
 34      239.48      0.00    30.6     0.04     0.05     2       0.00    35.0
0.05        0.00         0.81    0.85
 35      239.52      0.00    30.8     0.04     0.05     2       0.00    35.0
0.04        0.00         0.64    0.85
 36      239.57      0.00    30.8     0.04     0.05     2       0.00    35.0
0.03        0.00         0.47    0.85
 37      239.61      0.00    31.0     0.04     0.05     2       0.00    35.0
0.02        0.00         0.29    0.85
 38      239.66      0.00    31.1     0.04     0.05     2       0.00    35.0
0.01        0.00         0.10    0.85
                 --------                   -------
----------
     X-S Area:       0.02    Path Length:      1.95              X-S Weight:
3.00

_____________________________________________________________________________
_____________________________________________

DATA: Analysis  3 - 2023 Embankment Stability - 5FT Below Embankment Top

Material Properties (7 materials)
-------------------
Material:  1 (Mohr-Coulomb Isotropic) - Tailings
   Cohesion   Phi   UnitWeight   Ru
     40.00   20.0      94.00    Auto
Material:  2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
   Cohesion   Phi   UnitWeight   Ru
      0.00   35.0     130.00    Auto
Material:  3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
   Cohesion   Phi   UnitWeight   Ru
      0.00   30.0     123.00    Auto
Material:  4 (Mohr-Coulomb Isotropic) - Soil Buttress
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto
Material:  5 (Mohr-Coulomb Isotropic) - Bedrock
   Cohesion   Phi   UnitWeight   Ru
      0.00   37.0     138.00    Auto
Material:  6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
   Cohesion   Phi   UnitWeight   Ru
```

```
     30.00   17.0     100.00    Auto
Material:  7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto

Water Properties
----------------
Unit weight of water: 62.400           Unit weight of water/medium above ground:
0.000

Material Profiles (7 profiles)
-----------------
Profile:  1 (2 points)   Material beneath:  5 - Bedrock
     90.00      411.00         305.00      390.00
Profile:  2 (4 points)   Material beneath:  3 - Embankment (Existing)
    230.80      396.60         251.00      407.00         262.00      407.00
305.00      393.00
Profile:  3 (4 points)   Material beneath:  4 - Soil Buttress
    155.00      405.00         168.00      412.00         175.00      412.00
190.00      400.00
Profile:  4 (2 points)   Material beneath:  1 - Tailings
    182.00      406.00         249.10      406.00
Profile:  5 (11 points)   Material beneath:  6 - Tailings/Geomembrane Interface
     90.00      411.00         155.00      405.00         168.00      412.00
175.00      412.00          182.00      406.00
    215.00      406.00         240.00      420.10         244.00      420.10
244.10      417.00          246.90      417.00
    247.00      420.00
Profile:  6 (4 points)   Material beneath:  2 - Embankment (Proposed)
    214.50      406.00         240.00      420.00         248.00      420.00
305.00      393.00
Profile:  7 (2 points)   Material beneath:  1 - Tailings
     89.80      415.00         232.60      415.00

Slope Surface (5 points)
-------------
     90.00      415.00         231.50      415.00         240.10      419.90
248.00      419.90          305.00      393.00

Piezometric Surfaces (1 surface)
--------------------
Surface within profile:  7 (2 points) - Tailings
     89.80      413.00         232.60      413.00

Failure Surface
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:     231.60      YL:     415.06      XR:     239.60      YR:
419.62
      Centre:  XC:     228.53      YC:     429.74                  Radius:  R:
```

15.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	5.50	7.50	2.70
Trial positions within range:	10	10	10

- -

RESULTS: Analysis 3 - 2023 Embankment Stability - 5FT Below Embankment Top

Bishop Simplified Method of Analysis - Circular Failure Surface

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.434

There were: 606 successful analyses from a total of 1001 trial surfaces
395 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.23

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	234.35	416.62	235.85	417.48	227.02	431.24	16.35	1.231	<-- Critical Surface
2	234.35	416.62	235.85	417.48	227.17	430.98	16.05	1.231	
3	234.35	416.62	235.85	417.48	227.31	430.72	15.75	1.231	
4	234.35	416.62	235.85	417.48	227.46	430.45	15.45	1.231	
5	234.35	416.62	235.85	417.48	227.61	430.19	15.15	1.231	
6	234.35	416.62	235.85	417.48	227.76	429.93	14.85	1.231	
7	234.35	416.62	235.85	417.48	227.91	429.67	14.55	1.231	
8	234.35	416.62	235.85	417.48	228.06	429.41	14.25	1.231	
9	234.35	416.62	235.85	417.48	228.21	429.15	13.95	1.231	
10	234.35	416.62	235.85	417.48	228.36	428.89	13.65	1.231	
11	233.74	416.28	235.85	417.48	226.72	431.04			

16.35 1.232
12 233.74 416.28 235.85 417.48 226.87 430.78
16.05 1.232
13 233.74 416.28 235.85 417.48 227.02 430.52
15.75 1.233
14 233.74 416.28 235.85 417.48 227.17 430.26
15.45 1.233
15 233.74 416.28 235.85 417.48 227.32 430.00
15.15 1.233
16 233.74 416.28 235.85 417.48 227.47 429.74
14.85 1.233
17 234.35 416.62 236.68 417.95 227.45 431.45
16.35 1.233
18 233.74 416.28 235.85 417.48 227.62 429.47
14.55 1.233
19 234.35 416.62 236.68 417.95 227.60 431.18
16.05 1.233
20 234.35 416.62 236.68 417.95 227.75 430.92
15.75 1.233
21 233.74 416.28 235.85 417.48 227.77 429.21
14.25 1.233
22 234.35 416.62 236.68 417.95 227.90 430.66
15.45 1.234
23 233.74 416.28 235.85 417.48 227.91 428.95
13.95 1.234
24 234.35 416.62 236.68 417.95 228.05 430.40
15.15 1.234
25 233.74 416.28 235.85 417.48 228.06 428.69
13.65 1.234
26 234.35 416.62 236.68 417.95 228.20 430.14
14.85 1.234
27 234.35 416.62 236.68 417.95 228.34 429.88
14.55 1.234
28 234.35 416.62 236.68 417.95 228.49 429.61
14.25 1.235
29 234.35 416.62 236.68 417.95 228.64 429.35
13.95 1.235
30 234.35 416.62 236.68 417.95 228.79 429.09
13.65 1.235
31 233.74 416.28 236.68 417.95 227.16 431.24
16.35 1.236
32 233.74 416.28 236.68 417.95 227.31 430.98
16.05 1.236
33 233.74 416.28 236.68 417.95 227.46 430.72
15.75 1.236
34 233.74 416.28 236.68 417.95 227.61 430.46
15.45 1.237
35 234.35 416.62 237.52 418.43 227.89 431.64
16.35 1.237
36 233.74 416.28 236.68 417.95 227.76 430.20

15.15 1.237
37 234.35 416.62 237.52 418.43 228.04 431.38
16.05 1.237
38 233.74 416.28 236.68 417.95 227.91 429.93
14.85 1.237
39 234.35 416.62 237.52 418.43 228.19 431.12
15.75 1.237
40 233.74 416.28 236.68 417.95 228.06 429.67
14.55 1.238
41 234.35 416.62 237.52 418.43 228.34 430.86
15.45 1.238
42 233.74 416.28 236.68 417.95 228.21 429.41
14.25 1.238
43 234.35 416.62 237.52 418.43 228.49 430.59
15.15 1.238
44 233.74 416.28 236.68 417.95 228.36 429.15
13.95 1.238
45 234.35 416.62 237.52 418.43 228.64 430.33
14.85 1.239
46 233.74 416.28 236.68 417.95 228.51 428.88
13.65 1.239
47 234.35 416.62 237.52 418.43 228.79 430.07
14.55 1.239
48 234.35 416.62 237.52 418.43 228.94 429.81
14.25 1.239
49 234.35 416.62 237.52 418.43 229.09 429.54
13.95 1.240
50 233.74 416.28 237.52 418.43 227.61 431.43
16.35 1.240
51 234.35 416.62 237.52 418.43 229.24 429.28
13.65 1.240
52 233.74 416.28 237.52 418.43 227.76 431.17
16.05 1.241
53 233.74 416.28 237.52 418.43 227.91 430.91
15.75 1.241
54 233.74 416.28 237.52 418.43 228.06 430.64
15.45 1.242
55 234.35 416.62 238.35 418.90 228.34 431.83
16.35 1.242
56 234.35 416.62 238.35 418.90 228.49 431.56
16.05 1.242
57 233.74 416.28 237.52 418.43 228.21 430.38
15.15 1.242
58 234.35 416.62 238.35 418.90 228.64 431.30
15.75 1.243
59 233.74 416.28 237.52 418.43 228.36 430.12
14.85 1.243
60 234.35 416.62 238.35 418.90 228.79 431.04
15.45 1.243
61 233.74 416.28 237.52 418.43 228.51 429.85

14.55	1.243						
62	234.35	416.62	238.35	418.90	228.94	430.77	
15.15	1.244						
63	233.74	416.28	237.52	418.43	228.66	429.59	
14.25	1.244						
64	234.35	416.62	238.35	418.90	229.09	430.51	
14.85	1.245						
65	233.74	416.28	237.52	418.43	228.81	429.32	
13.95	1.245						
66	234.35	416.62	238.35	418.90	229.24	430.25	
14.55	1.245						
67	233.74	416.28	237.52	418.43	228.96	429.06	
13.65	1.245						
68	234.35	416.62	238.35	418.90	229.39	429.98	
14.25	1.246						
69	233.74	416.28	238.35	418.90	228.06	431.61	
16.35	1.246						
70	234.35	416.62	238.35	418.90	229.54	429.72	
13.95	1.247						
71	233.74	416.28	238.35	418.90	228.21	431.34	
16.05	1.247						
72	233.74	416.28	238.35	418.90	228.36	431.08	
15.75	1.247						
73	234.35	416.62	238.35	418.90	229.69	429.45	
13.65	1.248						
74	234.35	416.62	239.18	419.38	228.79	432.00	
16.35	1.248						
75	233.74	416.28	238.35	418.90	228.51	430.81	
15.45	1.248						
76	234.35	416.62	239.18	419.38	228.94	431.74	
16.05	1.249						
77	233.74	416.28	238.35	418.90	228.66	430.55	
15.15	1.249						
78	234.35	416.62	239.18	419.38	229.09	431.47	
15.75	1.249						
79	233.13	415.93	237.52	418.43	228.38	429.36	
14.25	1.250						
80	233.74	416.28	238.35	418.90	228.81	430.28	
14.85	1.250						
81	234.35	416.62	239.18	419.38	229.24	431.21	
15.45	1.250						
82	233.74	416.28	238.35	418.90	228.96	430.02	
14.55	1.251						
83	234.35	416.62	239.18	419.38	229.39	430.94	
15.15	1.251						
84	233.74	416.28	238.35	418.90	229.11	429.75	
14.25	1.252						
85	234.35	416.62	239.18	419.38	229.55	430.68	
14.85	1.252						
86	233.74	416.28	238.35	418.90	229.26	429.49	

```
13.95     1.253
  87       234.35      416.62      239.18      419.38      229.70      430.41
14.55     1.253
  88       233.74      416.28      239.18      419.38      228.52      431.77
16.35     1.253
  89       233.74      416.28      238.35      418.90      229.42      429.22
13.65     1.254
  90       233.13      415.93      238.35      418.90      228.24      430.58
15.45     1.254
  91       234.35      416.62      239.18      419.38      229.85      430.14
14.25     1.254
  92       233.74      416.28      239.18      419.38      228.67      431.50
16.05     1.254
  93       233.13      415.93      238.35      418.90      228.39      430.32
15.15     1.255
  94       233.74      416.28      239.18      419.38      228.82      431.24
15.75     1.255
  95       234.35      416.62      239.18      419.38      230.00      429.88
13.95     1.255
  96       234.35      416.62      240.02      419.85      229.25      432.16
16.35     1.255
  97       233.13      415.93      238.35      418.90      228.54      430.05
14.85     1.256
  98       233.74      416.28      239.18      419.38      228.97      430.97
15.45     1.256
  99       234.35      416.62      240.02      419.85      229.40      431.89
16.05     1.256

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     234.35      YL:     416.62      XR:     235.85      YR:
417.48
    Centre:  XC:     227.02      YC:     431.24                  Radius:  R:
16.35
Generated failure surface: (20 points)
    234.35    416.62          234.43    416.66          234.51    416.71
234.59    416.75          234.67    416.79
    234.75    416.83          234.83    416.88          234.91    416.92
234.99    416.96          235.07    417.01
    235.15    417.05          235.23    417.10          235.31    417.15
235.39    417.19          235.46    417.24
    235.54    417.29          235.62    417.33          235.70    417.38
235.77    417.43          235.85    417.48

Slice Geometry and Properties - Critical Failure Surface (circle 1,  38 slices)
-------------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
        PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
```

1	234.35	0.00	26.8	0.04	0.05	2	0.00	35.0
0.01	0.00	0.13	0.87					
2	234.39	0.00	26.8	0.04	0.05	2	0.00	35.0
0.02	0.00	0.39	0.87					
3	234.43	0.00	27.1	0.04	0.05	2	0.00	35.0
0.03	0.00	0.64	0.87					
4	234.47	0.00	27.1	0.04	0.05	2	0.00	35.0
0.05	0.00	0.88	0.87					
5	234.51	0.00	27.4	0.04	0.05	2	0.00	35.0
0.06	0.00	1.09	0.87					
6	234.55	0.00	27.4	0.04	0.05	2	0.00	35.0
0.07	0.00	1.30	0.87					
7	234.59	0.00	27.8	0.04	0.05	2	0.00	35.0
0.08	0.00	1.48	0.87					
8	234.63	0.00	27.8	0.04	0.05	2	0.00	35.0
0.09	0.00	1.66	0.87					
9	234.67	0.00	28.1	0.04	0.05	2	0.00	35.0
0.09	0.00	1.81	0.87					
10	234.71	0.00	28.1	0.04	0.05	2	0.00	35.0
0.10	0.00	1.96	0.87					
11	234.75	0.00	28.4	0.04	0.05	2	0.00	35.0
0.11	0.00	2.08	0.87					
12	234.79	0.00	28.4	0.04	0.05	2	0.00	35.0
0.11	0.00	2.20	0.87					
13	234.83	0.00	28.7	0.04	0.05	2	0.00	35.0
0.12	0.00	2.29	0.87					
14	234.87	0.00	28.7	0.04	0.05	2	0.00	35.0
0.12	0.00	2.38	0.87					
15	234.91	0.00	29.0	0.04	0.05	2	0.00	35.0
0.13	0.00	2.44	0.87					
16	234.95	0.00	29.0	0.04	0.05	2	0.00	35.0
0.13	0.00	2.50	0.87					
17	234.99	0.00	29.4	0.04	0.05	2	0.00	35.0
0.13	0.00	2.53	0.87					
18	235.03	0.00	29.4	0.04	0.05	2	0.00	35.0
0.13	0.00	2.56	0.87					
19	235.07	0.00	29.7	0.04	0.05	2	0.00	35.0
0.13	0.00	2.57	0.87					
20	235.11	0.00	29.7	0.04	0.05	2	0.00	35.0
0.13	0.00	2.57	0.87					
21	235.15	0.00	30.0	0.04	0.05	2	0.00	35.0
0.13	0.00	2.55	0.87					
22	235.19	0.00	30.0	0.04	0.05	2	0.00	35.0
0.13	0.00	2.52	0.87					
23	235.23	0.00	30.3	0.04	0.05	2	0.00	35.0
0.13	0.00	2.46	0.87					
24	235.27	0.00	30.3	0.04	0.05	2	0.00	35.0
0.13	0.00	2.41	0.87					
25	235.31	0.00	30.6	0.04	0.05	2	0.00	35.0
0.12	0.00	2.33	0.87					

```
 26      235.35      0.00    30.6     0.04     0.05     2       0.00    35.0
0.12        0.00         2.25    0.87
 27      235.39      0.00    30.9     0.04     0.05     2       0.00    35.0
0.11        0.00         2.14    0.87
 28      235.43      0.00    30.9     0.04     0.05     2       0.00    35.0
0.11        0.00         2.03    0.87
 29      235.46      0.00    31.3     0.04     0.05     2       0.00    35.0
0.10        0.00         1.90    0.87
 30      235.50      0.00    31.3     0.04     0.05     2       0.00    35.0
0.09        0.00         1.75    0.87
 31      235.54      0.00    31.6     0.04     0.05     2       0.00    35.0
0.08        0.00         1.60    0.87
 32      235.58      0.00    31.6     0.04     0.05     2       0.00    35.0
0.07        0.00         1.43    0.87
 33      235.62      0.00    31.9     0.04     0.05     2       0.00    35.0
0.06        0.00         1.24    0.87
 34      235.66      0.00    31.9     0.04     0.05     2       0.00    35.0
0.05        0.00         1.04    0.87
 35      235.70      0.00    32.2     0.04     0.05     2       0.00    35.0
0.04        0.00         0.84    0.87
 36      235.73      0.00    32.2     0.04     0.05     2       0.00    35.0
0.03        0.00         0.61    0.87
 37      235.77      0.00    32.5     0.04     0.05     2       0.00    35.0
0.02        0.00         0.37    0.87
 38      235.81      0.00    32.5     0.04     0.05     2       0.00    35.0
0.01        0.00         0.13    0.87
                 --------                  -------
----------
     X-S Area:       0.03    Path Length:      1.73              X-S Weight:
3.40

_____________________________________________________________________________
_____________________________________________

DATA: Analysis  4 - 2023 Embankment Stability - 5FT Below Top of Embankment -
Seismic

Material Properties (7 materials)
-------------------
Material:  1 (Mohr-Coulomb Isotropic) - Tailings
   Cohesion   Phi   UnitWeight   Ru
     40.00   20.0      94.00    Auto
Material:  2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
   Cohesion   Phi   UnitWeight   Ru
      0.00   35.0     130.00    Auto
Material:  3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
   Cohesion   Phi   UnitWeight   Ru
      0.00   30.0     123.00    Auto
Material:  4 (Mohr-Coulomb Isotropic) - Soil Buttress
   Cohesion   Phi   UnitWeight   Ru
```

```
      0.00   33.0     110.00    Auto
Material:  5 (Mohr-Coulomb Isotropic) - Bedrock
   Cohesion   Phi   UnitWeight   Ru
      0.00   37.0     138.00    Auto
Material:  6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
   Cohesion   Phi   UnitWeight   Ru
     30.00   17.0     100.00    Auto
Material:  7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto

Water Properties
----------------
Unit weight of water: 62.400           Unit weight of water/medium above ground:
0.000

Material Profiles (7 profiles)
------------------
Profile:  1 (2 points)   Material beneath:  5 - Bedrock
     90.00      411.00         305.00      390.00
Profile:  2 (4 points)   Material beneath:  3 - Embankment (Existing)
    230.80      396.60         251.00      407.00         262.00      407.00
305.00      393.00
Profile:  3 (4 points)   Material beneath:  4 - Soil Buttress
    155.00      405.00         168.00      412.00         175.00      412.00
190.00      400.00
Profile:  4 (2 points)   Material beneath:  1 - Tailings
    182.00      406.00         249.10      406.00
Profile:  5 (11 points)   Material beneath:  6 - Tailings/Geomembrane Interface
     90.00      411.00         155.00      405.00         168.00      412.00
175.00      412.00          182.00      406.00
    215.00      406.00         240.00      420.10         244.00      420.10
244.10      417.00          246.90      417.00
    247.00      420.00
Profile:  6 (4 points)   Material beneath:  2 - Embankment (Proposed)
    214.50      406.00         240.00      420.00         248.00      420.00
305.00      393.00
Profile:  7 (2 points)   Material beneath:  1 - Tailings
     89.80      415.00         232.60      415.00

Slope Surface (5 points)
-------------
     90.00      415.00         231.50      415.00         240.10      419.90
248.00      419.90          305.00      393.00

Piezometric Surfaces (1 surface)
--------------------
Surface within profile:  7 (2 points) - Tailings
     89.80      413.00         232.60      413.00
```

Failure Surface (Critical, from previous analysis)

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 234.35 YL: 416.62 XR: 235.85 YR: 417.48
Centre: XC: 227.02 YC: 431.24 Radius: R: 16.35

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	5.50	7.50	2.70
Trial positions within range:	10	10	10

- -

RESULTS: Analysis 4 - 2023 Embankment Stability - 5FT Below Top of Embankment - Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface
----

Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.099

There were: 528 successful analyses from a total of 1001 trial surfaces
473 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.10

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	234.04	416.45	235.43	417.24	225.99	432.21	17.70	1.098	<-- Critical Surface
2	234.04	416.45	235.43	417.24	226.13	431.95	17.40	1.098	
3	234.04	416.45	235.43	417.24	226.28	431.69	17.10	1.098	
4	236.49	417.84	237.93	418.67	228.46	433.62	17.70	1.098	
5	234.04	416.45	235.43	417.24	226.43	431.43	16.80	1.098	

6	236.49	417.84	237.93	418.67	228.61	433.36	17.40	1.098
7	234.04	416.45	235.43	417.24	226.58	431.16	16.50	1.098
8	236.49	417.84	237.93	418.67	228.76	433.09	17.10	1.099
9	234.04	416.45	235.43	417.24	226.73	430.90	16.20	1.099
10	236.49	417.84	237.93	418.67	228.90	432.83	16.80	1.099
11	234.04	416.45	235.43	417.24	226.88	430.64	15.90	1.099
12	236.49	417.84	237.93	418.67	229.05	432.57	16.50	1.099
13	236.49	417.84	237.93	418.67	229.20	432.31	16.20	1.099
14	234.04	416.45	235.43	417.24	227.03	430.38	15.60	1.099
15	234.04	416.45	235.43	417.24	227.17	430.12	15.30	1.099
16	236.49	417.84	237.93	418.67	229.35	432.05	15.90	1.099
17	234.66	416.80	236.27	417.72	226.71	432.61	17.70	1.099
18	234.35	416.62	235.85	417.48	227.02	431.24	16.35	1.099
19	234.66	416.80	236.27	417.72	226.86	432.35	17.40	1.099
20	234.04	416.45	235.43	417.24	227.32	429.86	15.00	1.099
21	236.49	417.84	237.93	418.67	229.50	431.79	15.60	1.099
22	234.66	416.80	236.27	417.72	227.01	432.09	17.10	1.099
23	237.10	418.19	238.77	419.14	229.18	434.02	17.70	1.099
24	236.49	417.84	237.93	418.67	229.65	431.53	15.30	1.099
25	237.10	418.19	238.77	419.14	229.33	433.76	17.40	1.099
26	234.66	416.80	236.27	417.72	227.16	431.83	16.80	1.099
27	236.49	417.84	237.93	418.67	229.80	431.27	15.00	1.099
28	237.10	418.19	238.77	419.14	229.48	433.50	17.10	1.099
29	234.66	416.80	236.27	417.72	227.31	431.57	16.50	1.099
30	237.10	418.19	238.77	419.14	229.63	433.24	16.80	1.099

31	234.66	416.80	236.27	417.72	227.45	431.31	16.20	1.099
32	237.10	418.19	238.77	419.14	229.78	432.98	16.50	1.099
33	234.66	416.80	236.27	417.72	227.60	431.05	15.90	1.099
34	237.10	418.19	238.77	419.14	229.93	432.72	16.20	1.099
35	234.66	416.80	236.27	417.72	227.75	430.79	15.60	1.099
36	235.27	417.15	237.10	418.19	227.44	433.02	17.70	1.099
37	237.10	418.19	238.77	419.14	230.08	432.46	15.90	1.099
38	234.66	416.80	236.27	417.72	227.90	430.53	15.30	1.099
39	235.27	417.15	237.10	418.19	227.59	432.76	17.40	1.099
40	237.10	418.19	238.77	419.14	230.23	432.19	15.60	1.099
41	235.27	417.15	237.10	418.19	227.73	432.50	17.10	1.099
42	234.66	416.80	236.27	417.72	228.05	430.27	15.00	1.099
43	237.10	418.19	238.77	419.14	230.37	431.93	15.30	1.099
44	235.27	417.15	237.10	418.19	227.88	432.24	16.80	1.099
45	235.27	417.15	237.10	418.19	228.03	431.98	16.50	1.100
46	237.10	418.19	238.77	419.14	230.52	431.67	15.00	1.100
47	233.43	416.10	235.43	417.24	225.69	432.02	17.70	1.100
48	235.27	417.15	237.10	418.19	228.18	431.71	16.20	1.100
49	233.43	416.10	235.43	417.24	225.84	431.76	17.40	1.100
50	235.27	417.15	237.10	418.19	228.33	431.45	15.90	1.100
51	235.88	417.49	237.93	418.67	228.16	433.42	17.70	1.100
52	233.43	416.10	235.43	417.24	225.99	431.50	17.10	1.100
53	235.27	417.15	237.10	418.19	228.48	431.19	15.60	1.100
54	235.88	417.49	237.93	418.67	228.31	433.16	17.40	1.100
55	233.43	416.10	235.43	417.24	226.14	431.23	16.80	1.100

56	235.27	417.15	237.10	418.19	228.63	430.93	15.30	1.100
57	235.88	417.49	237.93	418.67	228.46	432.90	17.10	1.100
58	233.43	416.10	235.43	417.24	226.29	430.97	16.50	1.100
59	235.88	417.49	237.93	418.67	228.61	432.64	16.80	1.100
60	235.27	417.15	237.10	418.19	228.78	430.67	15.00	1.100
61	233.43	416.10	235.43	417.24	226.43	430.71	16.20	1.100
62	235.88	417.49	237.93	418.67	228.76	432.38	16.50	1.100
63	234.04	416.45	236.27	417.72	226.42	432.42	17.70	1.100
64	233.43	416.10	235.43	417.24	226.58	430.45	15.90	1.100
65	235.88	417.49	237.93	418.67	228.91	432.12	16.20	1.100
66	234.04	416.45	236.27	417.72	226.57	432.16	17.40	1.100
67	233.43	416.10	235.43	417.24	226.73	430.19	15.60	1.100
68	236.49	417.84	238.77	419.14	228.89	433.83	17.70	1.100
69	235.88	417.49	237.93	418.67	229.06	431.86	15.90	1.100
70	234.04	416.45	236.27	417.72	226.71	431.90	17.10	1.100
71	233.43	416.10	235.43	417.24	226.88	429.93	15.30	1.101
72	236.49	417.84	238.77	419.14	229.04	433.57	17.40	1.101
73	235.88	417.49	237.93	418.67	229.21	431.60	15.60	1.101
74	234.04	416.45	236.27	417.72	226.86	431.64	16.80	1.101
75	233.43	416.10	235.43	417.24	227.03	429.67	15.00	1.101
76	236.49	417.84	238.77	419.14	229.19	433.31	17.10	1.101
77	235.88	417.49	237.93	418.67	229.35	431.33	15.30	1.101
78	234.04	416.45	236.27	417.72	227.01	431.38	16.50	1.101
79	236.49	417.84	238.77	419.14	229.34	433.04	16.80	1.101
80	235.88	417.49	237.93	418.67	229.50	431.07	15.00	1.101

```
  81       234.04      416.45      236.27      417.72      227.16      431.11
16.20     1.101
  82       234.66      416.80      237.10      418.19      227.14      432.82
17.70     1.101
  83       236.49      417.84      238.77      419.14      229.49      432.78
16.50     1.101
  84       234.04      416.45      236.27      417.72      227.31      430.85
15.90     1.101
  85       234.66      416.80      237.10      418.19      227.29      432.56
17.40     1.101
  86       236.49      417.84      238.77      419.14      229.63      432.52
16.20     1.101
  87       237.10      418.19      239.60      419.62      229.62      434.23
17.70     1.101
  88       234.04      416.45      236.27      417.72      227.46      430.59
15.60     1.101
  89       234.66      416.80      237.10      418.19      227.44      432.30
17.10     1.101
  90       236.49      417.84      238.77      419.14      229.78      432.26
15.90     1.101
  91       237.10      418.19      239.60      419.62      229.77      433.97
17.40     1.101
  92       234.04      416.45      236.27      417.72      227.61      430.33
15.30     1.101
  93       234.66      416.80      237.10      418.19      227.59      432.04
16.80     1.101
  94       236.49      417.84      238.77      419.14      229.93      432.00
15.60     1.101
  95       237.10      418.19      239.60      419.62      229.91      433.71
17.10     1.101
  96       234.04      416.45      236.27      417.72      227.76      430.07
15.00     1.101
  97       234.66      416.80      237.10      418.19      227.74      431.78
16.50     1.101
  98       236.49      417.84      238.77      419.14      230.08      431.74
15.30     1.102
  99       237.10      418.19      239.60      419.62      230.06      433.45
16.80     1.102

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     234.04      YL:     416.45      XR:     235.43      YR:
417.24
    Centre:  XC:     225.99      YC:     432.21                 Radius:  R:
17.70
Generated failure surface: (20 points)
    234.04    416.45          234.12    416.49          234.19    416.53
234.27    416.57          234.34    416.61
    234.42    416.65          234.49    416.69          234.56    416.73
234.64    416.77          234.71    416.81
```

```
    234.78    416.85          234.86    416.89          234.93    416.93
235.00    416.98          235.07    417.02
    235.15    417.06          235.22    417.11          235.29    417.15
235.36    417.20          235.43    417.24

Slice Geometry and Properties - Critical Failure Surface (circle 1,  38 slices)
-----------------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
        PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
  1      234.04      0.00    27.2     0.04     0.04     2       0.00    35.0
0.01        0.00         0.10    0.85
  2      234.08      0.00    27.2     0.04     0.04     2       0.00    35.0
0.01        0.00         0.30    0.85
  3      234.12      0.00    27.5     0.04     0.04     2       0.00    35.0
0.02        0.00         0.49    0.85
  4      234.16      0.00    27.5     0.04     0.04     2       0.00    35.0
0.03        0.00         0.67    0.85
  5      234.19      0.00    27.8     0.04     0.04     2       0.00    35.0
0.04        0.00         0.84    0.85
  6      234.23      0.00    27.8     0.04     0.04     2       0.00    35.0
0.05        0.00         1.00    0.85
  7      234.27      0.00    28.1     0.04     0.04     2       0.00    35.0
0.06        0.00         1.14    0.85
  8      234.31      0.00    28.0     0.04     0.04     2       0.00    35.0
0.06        0.00         1.27    0.85
  9      234.34      0.00    28.3     0.04     0.04     2       0.00    35.0
0.07        0.00         1.39    0.85
 10      234.38      0.00    28.3     0.04     0.04     2       0.00    35.0
0.07        0.00         1.50    0.85
 11      234.42      0.00    28.6     0.04     0.04     2       0.00    35.0
0.08        0.00         1.60    0.85
 12      234.45      0.00    28.6     0.04     0.04     2       0.00    35.0
0.08        0.00         1.69    0.85
 13      234.49      0.00    28.8     0.04     0.04     2       0.00    35.0
0.09        0.00         1.76    0.84
 14      234.53      0.00    28.9     0.04     0.04     2       0.00    35.0
0.09        0.00         1.83    0.84
 15      234.56      0.00    29.1     0.04     0.04     2       0.00    35.0
0.09        0.00         1.88    0.84
 16      234.60      0.00    29.2     0.04     0.04     2       0.00    35.0
0.10        0.00         1.92    0.84
 17      234.64      0.00    29.4     0.04     0.04     2       0.00    35.0
0.10        0.00         1.95    0.84
 18      234.67      0.00    29.4     0.04     0.04     2       0.00    35.0
0.10        0.00         1.97    0.84
 19      234.71      0.00    29.7     0.04     0.04     2       0.00    35.0
0.10        0.00         1.98    0.84
 20      234.75      0.00    29.7     0.04     0.04     2       0.00    35.0
```

```
0.10        0.00         1.97    0.84
 21      234.78      0.00    29.9     0.04     0.04     2        0.00    35.0
0.10        0.00         1.96    0.84
 22      234.82      0.00    29.9     0.04     0.04     2        0.00    35.0
0.10        0.00         1.94    0.84
 23      234.86      0.00    30.2     0.04     0.04     2        0.00    35.0
0.09        0.00         1.90    0.84
 24      234.89      0.00    30.2     0.04     0.04     2        0.00    35.0
0.09        0.00         1.86    0.84
 25      234.93      0.00    30.5     0.04     0.04     2        0.00    35.0
0.09        0.00         1.80    0.84
 26      234.97      0.00    30.5     0.04     0.04     2        0.00    35.0
0.09        0.00         1.73    0.84
 27      235.00      0.00    30.7     0.04     0.04     2        0.00    35.0
0.08        0.00         1.65    0.84
 28      235.04      0.00    30.8     0.04     0.04     2        0.00    35.0
0.08        0.00         1.56    0.84
 29      235.07      0.00    31.0     0.04     0.04     2        0.00    35.0
0.07        0.00         1.46    0.84
 30      235.11      0.00    31.0     0.04     0.04     2        0.00    35.0
0.07        0.00         1.35    0.84
 31      235.15      0.00    31.3     0.04     0.04     2        0.00    35.0
0.06        0.00         1.23    0.84
 32      235.18      0.00    31.3     0.04     0.04     2        0.00    35.0
0.05        0.00         1.10    0.84
 33      235.22      0.00    31.6     0.04     0.04     2        0.00    35.0
0.05        0.00         0.96    0.84
 34      235.25      0.00    31.6     0.04     0.04     2        0.00    35.0
0.04        0.00         0.81    0.84
 35      235.29      0.00    31.9     0.04     0.04     2        0.00    35.0
0.03        0.00         0.64    0.84
 36      235.33      0.00    31.9     0.04     0.04     2        0.00    35.0
0.02        0.00         0.47    0.84
 37      235.36      0.00    32.1     0.04     0.04     2        0.00    35.0
0.01        0.00         0.29    0.84
 38      235.40      0.00    32.1     0.04     0.04     2        0.00    35.0
0.00        0.00         0.10    0.84
                 --------                  -------
----------
     X-S Area:       0.02    Path Length:      1.60              X-S Weight:
2.50
```

DATA: Analysis 5 - 2023 Embankment Stability - 10FT Below Embankment Top

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings

```
   Cohesion   Phi   UnitWeight   Ru
     40.00   20.0      94.00    Auto
Material:  2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
   Cohesion   Phi   UnitWeight   Ru
      0.00   35.0     130.00    Auto
Material:  3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
   Cohesion   Phi   UnitWeight   Ru
      0.00   30.0     123.00    Auto
Material:  4 (Mohr-Coulomb Isotropic) - Soil Buttress
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto
Material:  5 (Mohr-Coulomb Isotropic) - Bedrock
   Cohesion   Phi   UnitWeight   Ru
      0.00   37.0     138.00    Auto
Material:  6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
   Cohesion   Phi   UnitWeight   Ru
     30.00   17.0     100.00    Auto
Material:  7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto

Water Properties
----------------
Unit weight of water: 62.400           Unit weight of water/medium above ground:
0.000

Material Profiles (7 profiles)
------------------
Profile:  1 (2 points)   Material beneath:  5 - Bedrock
     90.00      411.00         305.00      390.00
Profile:  2 (4 points)   Material beneath:  3 - Embankment (Existing)
    230.80      396.60         251.00      407.00         262.00      407.00
305.00      393.00
Profile:  3 (4 points)   Material beneath:  4 - Soil Buttress
    155.00      405.00         168.00      412.00         175.00      412.00
190.00      400.00
Profile:  4 (2 points)   Material beneath:  1 - Tailings
    182.00      406.00         249.10      406.00
Profile:  5 (4 points)   Material beneath:  2 - Embankment (Proposed)
    215.00      406.00         240.00      420.00         248.00      420.00
305.00      393.00
Profile:  6 (2 points)   Material beneath:  4 - Soil Buttress
    179.50      408.00         222.40      408.00
Profile:  7 (11 points)   Material beneath:  6 - Tailings/Geomembrane Interface
     90.10      410.90         155.00      404.40         168.00      411.80
175.20      411.70          181.80      405.60
    215.00      406.00         240.00      420.10         244.00      420.10
244.10      417.00          246.90      417.00
    247.00      420.00
```

Slope Surface (5 points)

179.50 408.00 219.00 407.90 240.00 420.00
248.00 420.00 305.00 393.00

Piezometric Surfaces (1 surface)

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 217.00 YL: 407.91 XR: 243.90 YR:
420.00
Centre: XC: 222.17 YC: 432.36 Radius: R:
25.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	10.00	10.80	5.00
Trial positions within range:	15	15	25

- --
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RESULTS: Analysis 5 - 2023 Embankment Stability - 10FT Below Embankment Top

Bishop Simplified Method of Analysis - Circular Failure Surface
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Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.612

There were: 5373 successful analyses from a total of 5625 trial surfaces
252 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.30

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	222.00	409.63	238.50	419.14	217.37	436.74	27.50	1.298	<-- Critical Surface
2	222.00	409.63	238.50	419.14	217.48	436.54	27.29	1.299	
3	222.00	409.63	238.50	419.14	217.59	436.35	27.08	1.301	
4	222.00	409.63	238.50	419.14	217.70	436.16			

26.88	1.302						
5	222.00	409.63	238.50	419.14	217.81	435.96	
26.67	1.304						
6	222.00	409.63	238.50	419.14	217.93	435.77	
26.46	1.305						
7	221.29	409.22	238.50	419.14	217.09	436.40	
27.50	1.306						
8	222.00	409.63	239.27	419.58	217.84	436.81	
27.50	1.306						
9	222.00	409.63	238.50	419.14	218.04	435.58	
26.25	1.307						
10	221.29	409.22	238.50	419.14	217.20	436.20	
27.29	1.307						
11	222.00	409.63	239.27	419.58	217.95	436.62	
27.29	1.308						
12	222.00	409.63	238.50	419.14	218.15	435.38	
26.04	1.308						
13	221.29	409.22	238.50	419.14	217.31	436.01	
27.08	1.309						
14	222.00	409.63	239.27	419.58	218.06	436.42	
27.08	1.310						
15	222.00	409.63	238.50	419.14	218.26	435.19	
25.83	1.310						
16	221.29	409.22	238.50	419.14	217.43	435.81	
26.88	1.310						
17	222.00	409.63	239.27	419.58	218.18	436.23	
26.88	1.311						
18	222.00	409.63	238.50	419.14	218.37	435.00	
25.62	1.312						
19	221.29	409.22	238.50	419.14	217.54	435.62	
26.67	1.312						
20	222.00	409.63	239.27	419.58	218.29	436.04	
26.67	1.313						
21	222.00	409.63	238.50	419.14	218.48	434.80	
25.42	1.313						
22	221.29	409.22	238.50	419.14	217.65	435.42	
26.46	1.314						
23	220.57	408.81	238.50	419.14	216.82	436.05	
27.50	1.314						
24	222.00	409.63	239.27	419.58	218.40	435.84	
26.46	1.314						
25	221.29	409.22	239.27	419.58	217.56	436.46	
27.50	1.315						
26	222.00	409.63	238.50	419.14	218.60	434.61	
25.21	1.315						
27	221.29	409.22	238.50	419.14	217.76	435.23	
26.25	1.315						
28	220.57	408.81	238.50	419.14	216.93	435.85	
27.29	1.316						
29	222.00	409.63	240.04	420.00	218.34	436.88	

27.50 1.316
30 222.00 409.63 239.27 419.58 218.51 435.65
26.25 1.316
31 221.29 409.22 239.27 419.58 217.68 436.27
27.29 1.316
32 222.00 409.63 238.50 419.14 218.71 434.41
25.00 1.317
33 221.29 409.22 238.50 419.14 217.87 435.03
26.04 1.317
34 220.57 408.81 238.50 419.14 217.04 435.66
27.08 1.317
35 222.00 409.63 240.04 420.00 218.45 436.69
27.29 1.318
36 222.00 409.63 239.27 419.58 218.62 435.45
26.04 1.318
37 221.29 409.22 239.27 419.58 217.79 436.07
27.08 1.318
38 222.00 409.63 238.50 419.14 218.82 434.22
24.79 1.319
39 221.29 409.22 238.50 419.14 217.99 434.84
25.83 1.319
40 220.57 408.81 238.50 419.14 217.15 435.46
26.88 1.319
41 222.00 409.63 240.04 420.00 218.56 436.49
27.08 1.319
42 222.00 409.63 239.27 419.58 218.74 435.26
25.83 1.320
43 221.29 409.22 239.27 419.58 217.90 435.88
26.88 1.320
44 222.00 409.63 238.50 419.14 218.93 434.02
24.58 1.321
45 221.29 409.22 238.50 419.14 218.10 434.64
25.62 1.321
46 220.57 408.81 238.50 419.14 217.27 435.27
26.67 1.321
47 222.00 409.63 240.04 420.00 218.67 436.30
26.88 1.321
48 222.00 409.63 239.27 419.58 218.85 435.06
25.62 1.322
49 221.29 409.22 239.27 419.58 218.02 435.68
26.67 1.322
50 222.00 409.63 238.50 419.14 219.05 433.82
24.38 1.323
51 221.29 409.22 238.50 419.14 218.21 434.45
25.42 1.323
52 220.57 408.81 238.50 419.14 217.38 435.07
26.46 1.323
53 222.00 409.63 240.04 420.00 218.79 436.10
26.67 1.323
54 219.86 408.39 238.50 419.14 216.54 435.69

27.50	1.323					
55	222.00	409.63	239.27	419.58	218.96	434.86
25.42	1.323					
56	221.29	409.22	239.27	419.58	218.13	435.49
26.46	1.324					
57	220.57	408.81	239.27	419.58	217.29	436.11
27.50	1.324					
58	222.00	409.63	238.50	419.14	219.16	433.63
24.17	1.325					
59	221.29	409.22	238.50	419.14	218.33	434.25
25.21	1.325					
60	220.57	408.81	238.50	419.14	217.49	434.87
26.25	1.325					
61	219.86	408.39	238.50	419.14	216.66	435.50
27.29	1.325					
62	222.00	409.63	240.04	420.00	218.90	435.90
26.46	1.325					
63	221.29	409.22	240.04	420.00	218.06	436.53
27.50	1.325					
64	222.00	409.63	239.27	419.58	219.08	434.67
25.21	1.325					
65	221.29	409.22	239.27	419.58	218.24	435.29
26.25	1.325					
66	220.57	408.81	239.27	419.58	217.41	435.91
27.29	1.325					
67	219.86	408.39	238.50	419.14	216.77	435.30
27.08	1.327					
68	220.57	408.81	238.50	419.14	217.60	434.68
26.04	1.327					
69	221.29	409.22	240.04	420.00	218.18	436.33
27.29	1.327					
70	221.29	409.22	238.50	419.14	218.44	434.05
25.00	1.327					
71	222.00	409.63	240.04	420.00	219.01	435.71
26.25	1.327					
72	222.00	409.63	238.50	419.14	219.27	433.43
23.96	1.327					
73	220.57	408.81	239.27	419.58	217.52	435.72
27.08	1.327					
74	221.29	409.22	239.27	419.58	218.35	435.09
26.04	1.327					
75	222.00	409.63	239.27	419.58	219.19	434.47
25.00	1.327					
76	219.86	408.39	238.50	419.14	216.88	435.10
26.88	1.328					
77	221.29	409.22	240.04	420.00	218.29	436.13
27.08	1.328					
78	220.57	408.81	238.50	419.14	217.72	434.48
25.83	1.329					
79	222.00	409.63	240.04	420.00	219.12	435.51

```
26.04     1.329
  80       221.29      409.22      238.50      419.14      218.55      433.86
24.79     1.329
  81       222.00      409.63      238.50      419.14      219.39      433.23
23.75     1.329
  82       220.57      408.81      239.27      419.58      217.63      435.52
26.88     1.329
  83       221.29      409.22      239.27      419.58      218.47      434.90
25.83     1.329
  84       222.00      409.63      239.27      419.58      219.30      434.27
24.79     1.330
  85       219.86      408.39      238.50      419.14      217.00      434.91
26.67     1.330
  86       221.29      409.22      240.04      420.00      218.40      435.94
26.88     1.330
  87       220.57      408.81      238.50      419.14      217.83      434.28
25.62     1.331
  88       222.00      409.63      240.04      420.00      219.24      435.31
25.83     1.331
  89       221.29      409.22      238.50      419.14      218.67      433.66
24.58     1.331
  90       222.00      409.63      238.50      419.14      219.50      433.04
23.54     1.331
  91       220.57      408.81      239.27      419.58      217.75      435.32
26.67     1.331
  92       221.29      409.22      239.27      419.58      218.58      434.70
25.62     1.331
  93       222.00      409.63      239.27      419.58      219.42      434.08
24.58     1.332
  94       219.14      407.98      238.50      419.14      216.28      435.33
27.50     1.332
  95       221.29      409.22      240.04      420.00      218.52      435.74
26.67     1.332
  96       219.86      408.39      238.50      419.14      217.11      434.71
26.46     1.332
  97       222.00      409.63      240.04      420.00      219.35      435.12
25.62     1.333
  98       220.57      408.81      238.50      419.14      217.95      434.09
25.42     1.333
  99       219.86      408.39      239.27      419.58      217.03      435.75
27.50     1.333

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     222.00      YL:     409.63      XR:     238.50      YR:
419.14
    Centre:  XC:     217.37      YC:     436.74                  Radius:  R:
27.50
Generated failure surface: (20 points)
    222.00    409.63          223.01    409.82          224.00    410.05
```

224.99 410.31 225.97 410.62
  226.94 410.95 227.89 411.33 228.83 411.74
229.75 412.18 230.65 412.66
  231.54 413.17 232.41 413.71 233.25 414.29
234.08 414.89 234.88 415.53
  235.66 416.20 236.41 416.89 237.13 417.61
237.83 418.36 238.50 419.14

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S	Base						
	PoreWater	Normal	Test					
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force	Stress	Factor					
1	222.00	0.05	10.8	0.50	0.51	2	0.00	35.0
6.34	0.00	11.45	0.92					
2	222.50	0.15	10.8	0.50	0.51	2	0.00	35.0
19.03	0.00	34.34	0.92					
3	223.01	0.24	12.9	0.50	0.51	2	0.00	35.0
30.79	0.00	54.95	0.91					
4	223.50	0.32	12.9	0.50	0.51	2	0.00	35.0
42.03	0.00	75.00	0.91					
5	224.00	0.40	15.0	0.49	0.51	2	0.00	35.0
52.09	0.00	92.07	0.90					
6	224.50	0.48	15.0	0.49	0.51	2	0.00	35.0
61.86	0.00	109.34	0.90					
7	224.99	0.54	17.2	0.49	0.51	2	0.00	35.0
70.19	0.00	123.07	0.90					
8	225.48	0.60	17.2	0.49	0.51	2	0.00	35.0
78.51	0.00	137.65	0.90					
9	225.97	0.65	19.3	0.48	0.51	2	0.00	35.0
85.09	0.00	148.19	0.89					
10	226.45	0.71	19.3	0.48	0.51	2	0.00	35.0
91.95	0.00	160.14	0.89					
11	226.94	0.74	21.4	0.48	0.51	2	0.00	35.0
96.78	0.00	167.68	0.89					
12	227.41	0.79	21.4	0.48	0.51	2	0.00	35.0
102.20	0.00	177.08	0.89					
13	227.89	0.81	23.6	0.47	0.51	2	0.00	35.0
105.32	0.00	181.78	0.88					
14	228.36	0.84	23.6	0.47	0.51	2	0.00	35.0
109.33	0.00	188.71	0.88					
15	228.83	0.85	25.7	0.46	0.51	2	0.00	35.0
110.77	0.00	190.73	0.88					
16	229.29	0.87	25.7	0.46	0.51	2	0.00	35.0
113.40	0.00	195.26	0.88					
17	229.75	0.87	27.8	0.45	0.51	2	0.00	35.0
113.23	0.00	194.76	0.88					
18	230.20	0.88	27.8	0.45	0.51	2	0.00	35.0
114.52	0.00	196.98	0.88					

```
 19      230.65      0.87    29.9     0.44     0.51     2       0.00    35.0
112.83        0.00       194.14    0.88
 20      231.10      0.87    30.0     0.44     0.51     2       0.00    35.0
112.83        0.00       194.14    0.88
 21      231.54      0.84    32.1     0.43     0.51     2       0.00    35.0
109.72        0.00       189.11    0.88
 22      231.97      0.83    32.1     0.43     0.51     2       0.00    35.0
108.48        0.00       186.98    0.88
 23      232.41      0.80    34.2     0.42     0.51     2       0.00    35.0
104.06        0.00       179.92    0.88
 24      232.83      0.78    34.2     0.42     0.51     2       0.00    35.0
101.64        0.00       175.74    0.88
 25      233.25      0.74    36.3     0.41     0.51     2       0.00    35.0
96.06         0.00       166.85    0.89
 26      233.67      0.71    36.3     0.41     0.51     2       0.00    35.0
92.54         0.00       160.72    0.89
 27      234.08      0.66    38.5     0.40     0.51     2       0.00    35.0
85.94         0.00       150.17    0.89
 28      234.48      0.63    38.5     0.40     0.51     2       0.00    35.0
81.39         0.00       142.20    0.89
 29      234.88      0.57    40.6     0.39     0.51     2       0.00    35.0
73.95         0.00       130.16    0.90
 30      235.27      0.53    40.6     0.39     0.51     2       0.00    35.0
68.43         0.00       120.45    0.90
 31      235.66      0.46    42.7     0.38     0.51     2       0.00    35.0
60.34         0.00       107.15    0.91
 32      236.03      0.42    42.7     0.38     0.51     2       0.00    35.0
53.95         0.00        95.80    0.91
 33      236.41      0.35    44.9     0.36     0.51     2       0.00    35.0
45.39         0.00        81.44    0.92
 34      236.77      0.29    44.9     0.36     0.51     2       0.00    35.0
38.22         0.00        68.57    0.92
 35      237.13      0.23    47.0     0.35     0.51     2       0.00    35.0
29.40         0.00        53.37    0.93
 36      237.48      0.17    47.0     0.35     0.51     2       0.00    35.0
21.54         0.00        39.11    0.93
 37      237.83      0.10    49.1     0.33     0.51     2       0.00    35.0
12.67         0.00        23.31    0.94
 38      238.17      0.03    49.1     0.33     0.51     2       0.00    35.0
4.22        0.00         7.77    0.94
                --------                    -------
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     X-S Area:      21.67    Path Length:     19.44              X-S Weight:
2817.05

_____________________________________________________________________________
_____________________________________________

DATA: Analysis  6 - 2023 Embankment Stability - 10FT Below Embankment Top - Seismic
```

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings
   Cohesion   Phi   UnitWeight   Ru
     40.00   20.0   94.00   Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
   Cohesion   Phi   UnitWeight   Ru
      0.00   35.0   130.00   Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
   Cohesion   Phi   UnitWeight   Ru
      0.00   30.0   123.00   Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0   110.00   Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
   Cohesion   Phi   UnitWeight   Ru
      0.00   37.0   138.00   Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
   Cohesion   Phi   UnitWeight   Ru
     30.00   17.0   100.00   Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0   110.00   Auto

Water Properties

Unit weight of water: 62.400   Unit weight of water/medium above ground:
0.000

Material Profiles (7 profiles)

Profile: 1 (2 points)   Material beneath: 5 - Bedrock
     90.00   411.00   305.00   390.00
Profile: 2 (4 points)   Material beneath: 3 - Embankment (Existing)
    230.80   396.60   251.00   407.00   262.00   407.00
305.00   393.00
Profile: 3 (4 points)   Material beneath: 4 - Soil Buttress
    155.00   405.00   168.00   412.00   175.00   412.00
190.00   400.00
Profile: 4 (2 points)   Material beneath: 1 - Tailings
    182.00   406.00   249.10   406.00
Profile: 5 (4 points)   Material beneath: 2 - Embankment (Proposed)
    215.00   406.00   240.00   420.00   248.00   420.00
305.00   393.00
Profile: 6 (2 points)   Material beneath: 4 - Soil Buttress
    179.50   408.00   222.40   408.00
Profile: 7 (11 points)   Material beneath: 6 - Tailings/Geomembrane Interface
     90.10   410.90   155.00   404.40   168.00   411.80
175.20   411.70   181.80   405.60
    215.00   406.00   240.00   420.10   244.00   420.10

```
244.10     417.00        246.90     417.00
    247.00     420.00

Slope Surface (5 points)
-------------
    179.50     408.00        219.00     407.90        240.00     420.00
248.00     420.00        305.00     393.00

Piezometric Surfaces (1 surface)
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Failure Surface (Critical, from previous analysis)
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:     222.00      YL:     409.63      XR:     238.50      YR:
419.14
      Centre:  XC:     217.37      YC:     436.74                  Radius:  R:
27.50

Earthquake Force
----------------
Pseudo-static earthquake (seismic) coefficient:  0.050

Variable Restraints
-------------------
Parameter descriptor:              XL         XR         R
Range of variation:              10.00      10.80       5.00
Trial positions within range:      15         15         25

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RESULTS: Analysis  6 - 2023 Embankment Stability - 10FT Below Embankment Top -
Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface
---------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation:   1.163

There were: 4761 successful analyses from a total of 5625 trial surfaces
            864 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety:  1.09
__________________________________________

Results Summary - Lowest 99 Factor of Safety circles
----------------------------------------------------
Circle    X-Left      Y-Left     X-Right     Y-Right     X-Centre    Y-Centre
```

Radius	FoS						
1	227.00	412.51	233.10	416.02	215.18	440.08	
30.00	1.094	<-- Critical Surface					
2	227.00	412.51	233.10	416.02	215.28	439.90	
29.79	1.094						
3	227.00	412.51	233.10	416.02	215.39	439.72	
29.58	1.094						
4	227.00	412.51	233.10	416.02	215.49	439.54	
29.38	1.094						
5	227.00	412.51	233.10	416.02	215.60	439.35	
29.17	1.094						
6	227.00	412.51	233.10	416.02	215.70	439.17	
28.96	1.094						
7	227.00	412.51	233.10	416.02	215.80	438.99	
28.75	1.095						
8	227.00	412.51	233.10	416.02	215.91	438.81	
28.54	1.095						
9	227.00	412.51	233.10	416.02	216.01	438.63	
28.33	1.095						
10	227.00	412.51	233.10	416.02	216.12	438.44	
28.12	1.095						
11	227.00	412.51	233.10	416.02	216.22	438.26	
27.92	1.095						
12	227.00	412.51	233.10	416.02	216.33	438.08	
27.71	1.095						
13	227.00	412.51	233.10	416.02	216.43	437.90	
27.50	1.095						
14	227.00	412.51	233.10	416.02	216.54	437.72	
27.29	1.096						
15	227.00	412.51	233.10	416.02	216.64	437.53	
27.08	1.096						
16	227.00	412.51	233.10	416.02	216.75	437.35	
26.88	1.096						
17	226.29	412.10	233.10	416.02	214.84	439.83	
30.00	1.096						
18	227.00	412.51	233.10	416.02	216.85	437.17	
26.67	1.096						
19	226.29	412.10	233.10	416.02	214.95	439.65	
29.79	1.096						
20	227.00	412.51	233.87	416.47	215.59	440.25	
30.00	1.096						
21	226.29	412.10	233.10	416.02	215.05	439.47	
29.58	1.096						
22	227.00	412.51	233.10	416.02	216.96	436.99	
26.46	1.096						
23	227.00	412.51	233.87	416.47	215.69	440.07	
29.79	1.096						
24	226.29	412.10	233.10	416.02	215.16	439.28	
29.38	1.096						
25	227.00	412.51	233.87	416.47	215.80	439.89	

29.58 1.096
26 227.00 412.51 233.10 416.02 217.06 436.81
26.25 1.096
27 226.29 412.10 233.10 416.02 215.26 439.10
29.17 1.097
28 227.00 412.51 233.87 416.47 215.90 439.71
29.38 1.097
29 227.00 412.51 233.10 416.02 217.17 436.62
26.04 1.097
30 226.29 412.10 233.10 416.02 215.37 438.92
28.96 1.097
31 227.00 412.51 233.87 416.47 216.01 439.53
29.17 1.097
32 227.00 412.51 233.10 416.02 217.27 436.44
25.83 1.097
33 226.29 412.10 233.10 416.02 215.47 438.74
28.75 1.097
34 227.00 412.51 233.87 416.47 216.11 439.34
28.96 1.097
35 227.00 412.51 233.10 416.02 217.38 436.26
25.62 1.097
36 226.29 412.10 233.10 416.02 215.58 438.56
28.54 1.097
37 227.00 412.51 233.87 416.47 216.22 439.16
28.75 1.097
38 227.00 412.51 233.10 416.02 217.48 436.08
25.42 1.097
39 226.29 412.10 233.10 416.02 215.68 438.37
28.33 1.097
40 227.00 412.51 233.87 416.47 216.32 438.98
28.54 1.097
41 227.00 412.51 233.10 416.02 217.59 435.89
25.21 1.097
42 226.29 412.10 233.10 416.02 215.79 438.19
28.12 1.097
43 227.00 412.51 233.87 416.47 216.43 438.80
28.33 1.097
44 227.00 412.51 233.10 416.02 217.69 435.71
25.00 1.098
45 226.29 412.10 233.10 416.02 215.89 438.01
27.92 1.098
46 227.00 412.51 233.87 416.47 216.53 438.61
28.12 1.098
47 226.29 412.10 233.10 416.02 216.00 437.83
27.71 1.098
48 227.00 412.51 233.87 416.47 216.64 438.43
27.92 1.098
49 226.29 412.10 233.10 416.02 216.10 437.64
27.50 1.098
50 227.00 412.51 233.87 416.47 216.74 438.25

27.71 1.098
51 226.29 412.10 233.10 416.02 216.21 437.46
27.29 1.098
52 227.00 412.51 233.87 416.47 216.85 438.07
27.50 1.098
53 225.57 411.69 233.10 416.02 214.52 439.58
30.00 1.098
54 226.29 412.10 233.10 416.02 216.31 437.28
27.08 1.098
55 227.00 412.51 233.87 416.47 216.96 437.89
27.29 1.098
56 225.57 411.69 233.10 416.02 214.62 439.39
29.79 1.098
57 226.29 412.10 233.87 416.47 215.26 440.00
30.00 1.098
58 226.29 412.10 233.10 416.02 216.42 437.10
26.88 1.099
59 227.00 412.51 233.87 416.47 217.06 437.70
27.08 1.099
60 225.57 411.69 233.10 416.02 214.73 439.21
29.58 1.099
61 226.29 412.10 233.87 416.47 215.37 439.82
29.79 1.099
62 227.00 412.51 234.64 416.91 216.01 440.42
30.00 1.099
63 226.29 412.10 233.10 416.02 216.53 436.91
26.67 1.099
64 227.00 412.51 233.87 416.47 217.17 437.52
26.88 1.099
65 225.57 411.69 233.10 416.02 214.83 439.03
29.38 1.099
66 226.29 412.10 233.87 416.47 215.47 439.63
29.58 1.099
67 227.00 412.51 234.64 416.91 216.11 440.24
29.79 1.099
68 226.29 412.10 233.10 416.02 216.63 436.73
26.46 1.099
69 227.00 412.51 233.87 416.47 217.27 437.34
26.67 1.099
70 225.57 411.69 233.10 416.02 214.94 438.85
29.17 1.099
71 226.29 412.10 233.87 416.47 215.58 439.45
29.38 1.099
72 227.00 412.51 234.64 416.91 216.22 440.06
29.58 1.099
73 226.29 412.10 233.10 416.02 216.74 436.55
26.25 1.099
74 227.00 412.51 233.87 416.47 217.38 437.16
26.46 1.099
75 225.57 411.69 233.10 416.02 215.04 438.66

28.96 1.099
76 226.29 412.10 233.87 416.47 215.68 439.27
29.17 1.099
77 227.00 412.51 234.64 416.91 216.32 439.88
29.38 1.099
78 226.29 412.10 233.10 416.02 216.84 436.37
26.04 1.099
79 227.00 412.51 233.87 416.47 217.48 436.97
26.25 1.099
80 225.57 411.69 233.10 416.02 215.15 438.48
28.75 1.099
81 226.29 412.10 233.87 416.47 215.79 439.09
28.96 1.099
82 227.00 412.51 234.64 416.91 216.43 439.69
29.17 1.099
83 226.29 412.10 233.10 416.02 216.95 436.18
25.83 1.100
84 225.57 411.69 233.10 416.02 215.25 438.30
28.54 1.100
85 226.29 412.10 233.87 416.47 215.89 438.90
28.75 1.100
86 227.00 412.51 233.87 416.47 217.59 436.79
26.04 1.100
87 227.00 412.51 234.64 416.91 216.53 439.51
28.96 1.100
88 225.57 411.69 233.10 416.02 215.36 438.11
28.33 1.100
89 226.29 412.10 233.87 416.47 216.00 438.72
28.54 1.100
90 227.00 412.51 234.64 416.91 216.64 439.33
28.75 1.100
91 226.29 412.10 233.10 416.02 217.05 436.00
25.62 1.100
92 227.00 412.51 233.87 416.47 217.69 436.61
25.83 1.100
93 225.57 411.69 233.10 416.02 215.46 437.93
28.12 1.100
94 226.29 412.10 233.87 416.47 216.10 438.54
28.33 1.100
95 227.00 412.51 234.64 416.91 216.74 439.14
28.54 1.100
96 226.29 412.10 233.10 416.02 217.16 435.82
25.42 1.100
97 227.00 412.51 233.87 416.47 217.80 436.42
25.62 1.100
98 225.57 411.69 233.10 416.02 215.57 437.75
27.92 1.100
99 226.29 412.10 233.87 416.47 216.21 438.36
28.12 1.100

Critical Failure Surface (circle 1)

Intersects: XL: 227.00   YL: 412.51   XR: 233.10   YR:
416.02
    Centre: XC: 215.18   YC: 440.08   Radius: R:
30.00
Generated failure surface: (20 points)
    227.00   412.51   227.34   412.66   227.68   412.81
228.02   412.97   228.35   413.13
    228.68   413.29   229.01   413.46   229.34   413.64
229.67   413.81   229.99   414.00
    230.31   414.18   230.63   414.37   230.95   414.56
231.27   414.76   231.58   414.96
    231.89   415.17   232.19   415.38   232.50   415.59
232.80   415.80   233.10   416.02

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice   X-S   ------------------- Base ---------------------
        PoreWater   Normal   Test
        X-Left   Area   Angle   Width   Length Matl   Cohesion   Phi
Weight   Force   Stress   Factor
  1   227.00   0.00   23.6   0.17   0.19   2   0.00   35.0
0.26   0.00   1.21   0.85
  2   227.17   0.01   23.6   0.17   0.19   2   0.00   35.0
0.79   0.00   3.63   0.85
  3   227.34   0.01   24.3   0.17   0.19   2   0.00   35.0
1.28   0.00   5.87   0.85
  4   227.51   0.01   24.3   0.17   0.19   2   0.00   35.0
1.75   0.00   8.01   0.85
  5   227.68   0.02   25.0   0.17   0.19   2   0.00   35.0
2.17   0.00   9.94   0.85
  6   227.85   0.02   25.0   0.17   0.19   2   0.00   35.0
2.58   0.00   11.80   0.85
  7   228.02   0.02   25.7   0.17   0.19   2   0.00   35.0
2.94   0.00   13.43   0.85
  8   228.18   0.03   25.7   0.17   0.19   2   0.00   35.0
3.28   0.00   15.00   0.85
  9   228.35   0.03   26.4   0.17   0.19   2   0.00   35.0
3.58   0.00   16.33   0.85
 10   228.52   0.03   26.4   0.17   0.19   2   0.00   35.0
3.87   0.00   17.64   0.85
 11   228.68   0.03   27.1   0.17   0.19   2   0.00   35.0
4.10   0.00   18.68   0.85
 12   228.85   0.03   27.1   0.17   0.19   2   0.00   35.0
4.33   0.00   19.71   0.85
 13   229.01   0.03   27.8   0.16   0.19   2   0.00   35.0
4.50   0.00   20.47   0.85
 14   229.18   0.04   27.8   0.16   0.19   2   0.00   35.0
4.67   0.00   21.24   0.85

15	229.34	0.04	28.5	0.16	0.19	2	0.00	35.0
4.78	0.00	21.72	0.84					
16	229.51	0.04	28.5	0.16	0.19	2	0.00	35.0
4.89	0.00	22.24	0.84					
17	229.67	0.04	29.2	0.16	0.19	2	0.00	35.0
4.94	0.00	22.45	0.84					
18	229.83	0.04	29.2	0.16	0.19	2	0.00	35.0
5.00	0.00	22.70	0.84					
19	229.99	0.04	30.0	0.16	0.19	2	0.00	35.0
4.99	0.00	22.65	0.84					
20	230.15	0.04	30.0	0.16	0.19	2	0.00	35.0
4.99	0.00	22.65	0.84					
21	230.31	0.04	30.7	0.16	0.19	2	0.00	35.0
4.93	0.00	22.35	0.84					
22	230.47	0.04	30.7	0.16	0.19	2	0.00	35.0
4.87	0.00	22.10	0.84					
23	230.63	0.04	31.4	0.16	0.19	2	0.00	35.0
4.75	0.00	21.56	0.84					
24	230.79	0.04	31.4	0.16	0.19	2	0.00	35.0
4.64	0.00	21.06	0.84					
25	230.95	0.03	32.1	0.16	0.19	2	0.00	35.0
4.47	0.00	20.28	0.84					
26	231.11	0.03	32.1	0.16	0.19	2	0.00	35.0
4.31	0.00	19.54	0.84					
27	231.27	0.03	32.8	0.16	0.19	2	0.00	35.0
4.09	0.00	18.54	0.84					
28	231.42	0.03	32.8	0.16	0.19	2	0.00	35.0
3.87	0.00	17.56	0.84					
29	231.58	0.03	33.5	0.15	0.19	2	0.00	35.0
3.60	0.00	16.33	0.84					
30	231.73	0.03	33.5	0.15	0.19	2	0.00	35.0
3.33	0.00	15.12	0.84					
31	231.89	0.02	34.2	0.15	0.19	2	0.00	35.0
3.01	0.00	13.68	0.84					
32	232.04	0.02	34.2	0.15	0.19	2	0.00	35.0
2.70	0.00	12.24	0.84					
33	232.19	0.02	34.9	0.15	0.19	2	0.00	35.0
2.33	0.00	10.59	0.84					
34	232.35	0.02	34.9	0.15	0.19	2	0.00	35.0
1.97	0.00	8.92	0.84					
35	232.50	0.01	35.6	0.15	0.19	2	0.00	35.0
1.56	0.00	7.08	0.84					
36	232.65	0.01	35.6	0.15	0.19	2	0.00	35.0
1.14	0.00	5.19	0.84					
37	232.80	0.01	36.3	0.15	0.19	2	0.00	35.0
0.69	0.00	3.16	0.84					
38	232.95	0.00	36.3	0.15	0.19	2	0.00	35.0
0.23	0.00	1.05	0.84					

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X-S Area: 0.97 Path Length: 7.06 X-S Weight: 126.17

DATA: Analysis 7 - 2023 Embankment Stability - Outslope

Material Properties (7 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Tailings
Cohesion Phi UnitWeight Ru
40.00 20.0 94.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
Cohesion Phi UnitWeight Ru
0.00 35.0 130.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
Cohesion Phi UnitWeight Ru
0.00 30.0 123.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - Soil Buttress
Cohesion Phi UnitWeight Ru
0.00 33.0 110.00 Auto
Material: 5 (Mohr-Coulomb Isotropic) - Bedrock
Cohesion Phi UnitWeight Ru
0.00 37.0 138.00 Auto
Material: 6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
Cohesion Phi UnitWeight Ru
30.00 17.0 100.00 Auto
Material: 7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
Cohesion Phi UnitWeight Ru
0.00 33.0 110.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (7 profiles)

Profile: 1 (2 points) Material beneath: 5 - Bedrock
90.00 411.00 305.00 390.00
Profile: 2 (4 points) Material beneath: 3 - Embankment (Existing)
230.80 396.60 251.00 407.00 262.00 407.00 305.00 393.00
Profile: 3 (4 points) Material beneath: 4 - Soil Buttress
155.00 405.00 168.00 412.00 175.00 412.00 190.00 400.00
Profile: 4 (2 points) Material beneath: 1 - Tailings
182.00 406.00 249.10 406.00
Profile: 5 (11 points) Material beneath: 6 - Tailings/Geomembrane Interface

```
     90.00      411.00         155.00      405.00         168.00      412.00
175.00      412.00         182.00      406.00
    219.00      406.00         240.00      420.00         244.00      420.00
244.10      417.00         246.90      417.00
    247.00      420.00
Profile:  6 (4 points)   Material beneath:  2 - Embankment (Proposed)
    219.00      406.00         240.00      420.00         248.00      420.00
305.00      393.00
Profile:  7 (2 points)   Material beneath:  1 - Tailings
     90.00      418.00         237.30      418.00

Slope Surface (5 points)
-------------
     90.00      418.00         237.30      418.00         240.10      420.00
248.00      420.00         305.00      393.00

Piezometric Surfaces (1 surface)
--------------------

Failure Surface
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:     255.70      YL:     416.35      XR:     295.50      YR:
397.50
      Centre:  XC:     294.82      YC:     447.50                  Radius:  R:
50.00

Variable Restraints
-------------------
Parameter descriptor:              XL         XR         R
Range of variation:              30.00      10.00       5.00
Trial positions within range:      15         15         25

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RESULTS: Analysis  7 - 2023 Embankment Stability - Outslope

Bishop Simplified Method of Analysis - Circular Failure Surface
---------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation:   1.432

There were: 5613 successful analyses from a total of 5625 trial surfaces
            12 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety:  1.39
```

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	262.13	413.31	300.50	395.13	301.87	447.61	52.50	1.391	<-- Critical Surface
2	264.27	412.29	300.50	395.13	302.09	445.31	50.21	1.391	
3	264.27	412.29	300.50	395.13	303.06	447.36	52.29	1.391	
4	264.27	412.29	300.50	395.13	303.16	447.56	52.50	1.391	
5	262.13	413.31	300.50	395.13	301.77	447.41	52.29	1.391	
6	264.27	412.29	300.50	395.13	302.96	447.16	52.08	1.391	
7	264.27	412.29	300.50	395.13	302.87	446.95	51.88	1.391	
8	264.27	412.29	300.50	395.13	302.77	446.75	51.67	1.391	
9	264.27	412.29	300.50	395.13	302.67	446.54	51.46	1.391	
10	264.27	412.29	300.50	395.13	302.58	446.34	51.25	1.391	
11	262.13	413.31	300.50	395.13	301.67	447.20	52.08	1.391	
12	264.27	412.29	300.50	395.13	302.48	446.13	51.04	1.391	
13	264.27	412.29	300.50	395.13	302.38	445.93	50.83	1.391	
14	264.27	412.29	300.50	395.13	302.29	445.73	50.62	1.392	
15	264.27	412.29	300.50	395.13	301.99	445.11	50.00	1.392	
16	262.13	413.31	300.50	395.13	301.58	447.00	51.88	1.392	
17	264.27	412.29	300.50	395.13	302.19	445.52	50.42	1.392	
18	262.13	413.31	300.50	395.13	301.48	446.79	51.67	1.392	
19	264.27	412.29	300.50	395.13	301.90	444.90	49.79	1.392	
20	262.13	413.31	300.50	395.13	301.38	446.58	51.46	1.392	
21	264.27	412.29	300.50	395.13	301.80	444.70	49.58	1.392	
22	262.13	413.31	300.50	395.13	301.28	446.38	51.25	1.393	
23	264.27	412.29	300.50	395.13	301.70	444.49	49.38	1.393	

24	262.13	413.31	300.50	395.13	301.18	446.17	51.04	1.393
25	264.27	412.29	300.50	395.13	301.60	444.29	49.17	1.393
26	264.27	412.29	300.50	395.13	301.51	444.08	48.96	1.393
27	266.41	411.28	300.50	395.13	304.34	447.28	52.29	1.393
28	262.13	413.31	300.50	395.13	301.09	445.96	50.83	1.393
29	266.41	411.28	300.50	395.13	303.09	444.65	49.58	1.394
30	266.41	411.28	300.50	395.13	302.99	444.44	49.38	1.394
31	266.41	411.28	300.50	395.13	303.18	444.85	49.79	1.394
32	266.41	411.28	300.50	395.13	302.89	444.24	49.17	1.394
33	266.41	411.28	300.50	395.13	302.80	444.04	48.96	1.394
34	266.41	411.28	300.50	395.13	303.28	445.05	50.00	1.394
35	266.41	411.28	300.50	395.13	302.70	443.83	48.75	1.394
36	266.41	411.28	300.50	395.13	303.38	445.26	50.21	1.394
37	266.41	411.28	300.50	395.13	303.47	445.46	50.42	1.394
38	266.41	411.28	300.50	395.13	302.60	443.63	48.54	1.394
39	266.41	411.28	300.50	395.13	303.57	445.66	50.62	1.394
40	266.41	411.28	300.50	395.13	302.51	443.42	48.33	1.394
41	266.41	411.28	300.50	395.13	303.67	445.87	50.83	1.394
42	264.27	412.29	300.50	395.13	301.41	443.87	48.75	1.394
43	266.41	411.28	300.50	395.13	302.41	443.22	48.12	1.394
44	266.41	411.28	300.50	395.13	303.76	446.07	51.04	1.394
45	266.41	411.28	300.50	395.13	302.31	443.01	47.92	1.394
46	266.41	411.28	300.50	395.13	303.86	446.27	51.25	1.394
47	266.41	411.28	300.50	395.13	302.22	442.81	47.71	1.394
48	262.13	413.31	300.50	395.13	300.99	445.75	50.62	1.394

49	266.41	411.28	300.50	395.13	303.95	446.47	51.46	1.394
50	266.41	411.28	300.50	395.13	304.05	446.68	51.67	1.394
51	266.41	411.28	300.50	395.13	304.24	447.08	52.08	1.394
52	266.41	411.28	300.50	395.13	302.12	442.60	47.50	1.394
53	264.27	412.29	300.50	395.13	301.31	443.67	48.54	1.394
54	266.41	411.28	300.50	395.13	304.14	446.88	51.88	1.394
55	259.99	414.32	300.50	395.13	300.57	447.63	52.50	1.394
56	262.13	413.31	300.50	395.13	300.89	445.55	50.42	1.394
57	264.27	412.29	300.50	395.13	301.21	443.46	48.33	1.394
58	259.99	414.32	300.50	395.13	300.47	447.42	52.29	1.395
59	264.27	412.29	300.50	395.13	301.12	443.25	48.12	1.395
60	262.13	413.31	300.50	395.13	300.79	445.34	50.21	1.395
61	266.41	411.28	300.50	395.13	304.43	447.48	52.50	1.395
62	264.27	412.29	300.50	395.13	301.02	443.05	47.92	1.395
63	259.99	414.32	300.50	395.13	300.37	447.21	52.08	1.395
64	262.13	413.31	300.50	395.13	300.69	445.13	50.00	1.395
65	264.27	412.29	300.50	395.13	300.92	442.84	47.71	1.396
66	259.99	414.32	300.50	395.13	300.27	447.01	51.88	1.396
67	262.13	413.31	299.79	395.47	301.00	446.71	51.25	1.396
68	262.13	413.31	300.50	395.13	300.59	444.92	49.79	1.396
69	262.13	413.31	299.79	395.47	301.59	447.94	52.50	1.396
70	262.13	413.31	299.79	395.47	301.49	447.73	52.29	1.396
71	264.27	412.29	300.50	395.13	300.82	442.63	47.50	1.396
72	262.13	413.31	299.79	395.47	301.39	447.53	52.08	1.396
73	262.13	413.31	299.79	395.47	301.29	447.32	51.88	1.396

74	259.99	414.32	300.50	395.13	300.17	446.80	51.67	1.396
75	262.13	413.31	300.50	395.13	300.50	444.71	49.58	1.396
76	262.13	413.31	299.79	395.47	301.20	447.12	51.67	1.396
77	262.13	413.31	299.79	395.47	301.10	446.91	51.46	1.397
78	268.56	410.26	300.50	395.13	303.79	443.35	48.33	1.397
79	262.13	413.31	299.79	395.47	300.90	446.50	51.04	1.397
80	268.56	410.26	300.50	395.13	303.40	442.54	47.50	1.397
81	268.56	410.26	300.50	395.13	303.50	442.75	47.71	1.397
82	259.99	414.32	300.50	395.13	300.07	446.59	51.46	1.397
83	268.56	410.26	300.50	395.13	303.59	442.95	47.92	1.397
84	262.13	413.31	300.50	395.13	300.40	444.51	49.38	1.397
85	268.56	410.26	300.50	395.13	303.69	443.15	48.12	1.397
86	262.13	413.31	299.79	395.47	300.81	446.29	50.83	1.397
87	259.99	414.32	299.79	395.47	300.29	447.97	52.50	1.397
88	262.13	413.31	299.79	395.47	300.71	446.09	50.62	1.397
89	259.99	414.32	300.50	395.13	299.97	446.38	51.25	1.397
90	262.13	413.31	300.50	395.13	300.30	444.30	49.17	1.397
91	259.99	414.32	299.79	395.47	300.19	447.76	52.29	1.398
92	262.13	413.31	299.79	395.47	300.61	445.88	50.42	1.398
93	259.99	414.32	300.50	395.13	299.87	446.17	51.04	1.398
94	259.99	414.32	299.79	395.47	300.09	447.55	52.08	1.398
95	268.56	410.26	300.50	395.13	303.88	443.56	48.54	1.398
96	262.13	413.31	300.50	395.13	300.20	444.09	48.96	1.398
97	262.13	413.31	299.79	395.47	300.51	445.67	50.21	1.398
98	262.13	413.31	300.50	395.13	300.10	443.88	48.75	1.398

```
  99       268.56      410.26      300.50      395.13      303.98      443.76
48.75     1.398

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     262.13      YL:     413.31      XR:     300.50      YR:
395.13
    Centre:  XC:     301.87      YC:     447.61                  Radius:  R:
52.50
Generated failure surface: (20 points)
    262.13    413.31          263.67    411.60          265.28    409.96
266.97    408.39          268.72    406.90
    270.54    405.49          272.41    404.16          274.34    402.91
276.33    401.75          278.36    400.67
    280.44    399.69          282.56    398.79          284.72    397.99
286.91    397.29          289.13    396.68
    291.37    396.17          293.63    395.76          295.91    395.45
298.20    395.24          300.50    395.13

Slice Geometry and Properties - Critical Failure Surface (circle 1,  39 slices)
-------------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
        PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
  1      262.13      0.19    47.9     0.77     1.15     2       0.00    35.0
24.48        0.00        20.40    0.96
  2      262.90      0.57    47.9     0.77     1.15     2       0.00    35.0
73.46        0.00        61.20    0.96
  3      263.67      0.97    45.4     0.81     1.15     2       0.00    35.0
125.50       0.00       102.90    0.94
  4      264.48      1.32    45.4     0.81     1.15     2       0.00    35.0
171.40       0.00       140.52    0.94
  5      265.28      1.72    42.9     0.84     1.15     2       0.00    35.0
223.78       0.00       180.96    0.93
  6      266.13      2.05    42.9     0.84     1.15     2       0.00    35.0
265.87       0.00       214.99    0.93
  7      266.97      2.44    40.4     0.88     1.15     2       0.00    35.0
317.20       0.00       253.52    0.92
  8      267.84      2.73    40.4     0.88     1.15     2       0.00    35.0
354.85       0.00       283.62    0.92
  9      268.72      3.10    37.9     0.91     1.15     2       0.00    35.0
403.54       0.00       319.43    0.91
 10      269.63      3.36    37.9     0.91     1.15     2       0.00    35.0
436.17       0.00       345.25    0.91
 11      270.54      3.70    35.4     0.94     1.15     2       0.00    35.0
481.02       0.00       377.84    0.90
 12      271.47      3.91    35.4     0.94     1.15     2       0.00    35.0
508.08       0.00       399.11    0.90
 13      272.41      3.71    32.9     0.85     1.02     2       0.00    35.0
```

482.65 0.00 426.93 0.90
14 273.26 3.84 32.9 0.85 1.02 2 0.00 35.0
498.97 0.00 441.38 0.90
15 274.12 1.04 32.9 0.23 0.27 3 0.00 30.0
134.93 0.00 470.61 0.94
16 274.34 4.63 30.4 0.99 1.15 3 0.00 30.0
600.90 0.00 487.04 0.93
17 275.33 4.74 30.4 0.99 1.15 3 0.00 30.0
613.47 0.00 497.24 0.93
18 276.33 4.95 27.9 1.02 1.15 3 0.00 30.0
638.01 0.00 514.53 0.93
19 277.34 5.00 27.9 1.02 1.15 3 0.00 30.0
643.89 0.00 519.25 0.93
20 278.36 5.14 25.3 1.04 1.15 3 0.00 30.0
660.63 0.00 531.11 0.92
21 279.40 5.14 25.3 1.04 1.15 3 0.00 30.0
659.55 0.00 530.24 0.92
22 280.44 5.21 22.8 1.06 1.15 3 0.00 30.0
667.82 0.00 536.25 0.92
23 281.50 5.16 22.8 1.06 1.15 3 0.00 30.0
659.38 0.00 529.48 0.92
24 282.56 5.16 20.3 1.08 1.15 3 0.00 30.0
658.61 0.00 529.25 0.92
25 283.64 5.04 20.3 1.08 1.15 3 0.00 30.0
642.61 0.00 516.40 0.92
26 284.72 4.96 17.8 1.10 1.15 3 0.00 30.0
632.43 0.00 509.57 0.93
27 285.81 4.78 17.8 1.10 1.15 3 0.00 30.0
608.78 0.00 490.51 0.93
28 286.91 4.62 15.3 1.11 1.15 3 0.00 30.0
588.96 0.00 476.74 0.93
29 288.02 4.38 15.3 1.11 1.15 3 0.00 30.0
557.40 0.00 451.18 0.93
30 289.13 4.15 12.8 1.12 1.15 3 0.00 30.0
527.86 0.00 430.09 0.94
31 290.25 3.84 12.8 1.12 1.15 3 0.00 30.0
488.34 0.00 397.87 0.94
32 291.37 3.53 10.3 1.13 1.15 3 0.00 30.0
449.20 0.00 369.12 0.95
33 292.50 3.15 10.3 1.13 1.15 3 0.00 30.0
401.82 0.00 330.20 0.95
34 293.63 2.77 7.8 1.14 1.15 3 0.00 30.0
353.17 0.00 293.29 0.96
35 294.77 2.33 7.8 1.14 1.15 3 0.00 30.0
297.96 0.00 247.44 0.96
36 295.91 1.78 5.3 1.08 1.09 3 0.00 30.0
228.87 0.00 203.42 0.97
37 297.00 1.33 5.3 1.08 1.09 3 0.00 30.0
172.58 0.00 153.38 0.97
38 298.08 0.94 3.0 1.21 1.21 2 0.00 35.0

```
121.61        0.00        97.88    0.98
 39      299.29      0.31     2.7     1.21     1.21     2       0.00    35.0
40.49        0.00        32.66    0.98
                 --------                   -------
----------
     X-S Area:     127.67    Path Length:     43.71               X-S Weight:
16416.23

_____________________________________________________________________________
_____________________________________________

DATA: Analysis  8 - 2023 Embankment Stability - Outslope

Material Properties (7 materials)
-------------------
Material:  1 (Mohr-Coulomb Isotropic) - Tailings
   Cohesion   Phi   UnitWeight   Ru
     40.00   20.0      94.00    Auto
Material:  2 (Mohr-Coulomb Isotropic) - Embankment (Proposed)
   Cohesion   Phi   UnitWeight   Ru
      0.00   35.0     130.00    Auto
Material:  3 (Mohr-Coulomb Isotropic) - Embankment (Existing)
   Cohesion   Phi   UnitWeight   Ru
      0.00   30.0     123.00    Auto
Material:  4 (Mohr-Coulomb Isotropic) - Soil Buttress
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto
Material:  5 (Mohr-Coulomb Isotropic) - Bedrock
   Cohesion   Phi   UnitWeight   Ru
      0.00   37.0     138.00    Auto
Material:  6 (Mohr-Coulomb Isotropic) - Tailings/Geomembrane Interface
   Cohesion   Phi   UnitWeight   Ru
     30.00   17.0     100.00    Auto
Material:  7 (Mohr-Coulomb Isotropic) - Soil Buttress above Tailings
   Cohesion   Phi   UnitWeight   Ru
      0.00   33.0     110.00    Auto

Water Properties
----------------
Unit weight of water: 62.400           Unit weight of water/medium above ground:
0.000

Material Profiles (7 profiles)
-----------------
Profile:  1 (2 points)   Material beneath:  5 - Bedrock
     90.00      411.00         305.00      390.00
Profile:  2 (4 points)   Material beneath:  3 - Embankment (Existing)
    230.80      396.60         251.00      407.00         262.00      407.00
305.00      393.00
Profile:  3 (4 points)   Material beneath:  4 - Soil Buttress
```

```
    155.00      405.00         168.00      412.00         175.00      412.00
190.00      400.00
Profile:  4 (2 points)   Material beneath:  1 - Tailings
    182.00      406.00         249.10      406.00
Profile:  5 (11 points)   Material beneath:  6 - Tailings/Geomembrane Interface
     90.00      411.00         155.00      405.00         168.00      412.00
175.00      412.00         182.00      406.00
    219.00      406.00         240.00      420.10         244.00      420.10
244.10      417.00         246.90      417.00
    247.00      420.00
Profile:  6 (4 points)   Material beneath:  2 - Embankment (Proposed)
    219.00      406.00         240.00      420.00         248.00      420.00
305.00      393.00
Profile:  7 (2 points)   Material beneath:  1 - Tailings
     90.00      418.00         237.30      418.00

Slope Surface (5 points)
-------------
     90.00      418.00         237.30      418.00         240.10      420.00
248.00      420.00         305.00      393.00

Piezometric Surfaces (1 surface)
--------------------

Failure Surface (Critical, from previous analysis)
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:     262.13      YL:     413.31      XR:     300.50      YR:
395.13
      Centre:  XC:     301.87      YC:     447.61                  Radius:  R:
52.50

Earthquake Force
----------------
Pseudo-static earthquake (seismic) coefficient:  0.050

Variable Restraints
-------------------
Parameter descriptor:              XL         XR         R
Range of variation:              30.00      10.00       5.00
Trial positions within range:      15         15         25

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RESULTS: Analysis  8 - 2023 Embankment Stability - Outslope

Bishop Simplified Method of Analysis - Circular Failure Surface
-----------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques
```

Factor of Safety for initial failure surface approximation: 1.231

There were: 5238 successful analyses from a total of 5625 trial surfaces
            387 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.20

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	272.84	408.23	304.79	393.10	309.69	444.74	51.88	1.199	<-- Critical Surface
2	272.84	408.23	304.79	393.10	309.60	444.54	51.67	1.199	
3	270.70	409.25	304.79	393.10	309.86	447.87	55.00	1.200	
4	272.84	408.23	304.79	393.10	309.79	444.94	52.08	1.200	
5	272.84	408.23	304.79	393.10	309.88	445.14	52.29	1.200	
6	270.70	409.25	304.79	393.10	309.77	447.67	54.79	1.200	
7	272.84	408.23	304.79	393.10	309.50	444.34	51.46	1.200	
8	272.84	408.23	304.79	393.10	309.98	445.34	52.50	1.200	
9	272.84	408.23	304.79	393.10	310.07	445.54	52.71	1.200	
10	272.84	408.23	304.79	393.10	310.17	445.74	52.92	1.200	
11	272.84	408.23	304.79	393.10	310.26	445.94	53.12	1.200	
12	270.70	409.25	304.79	393.10	309.67	447.47	54.58	1.200	
13	272.84	408.23	304.79	393.10	310.36	446.14	53.33	1.200	
14	272.84	408.23	304.79	393.10	309.41	444.14	51.25	1.200	
15	272.84	408.23	304.79	393.10	310.45	446.34	53.54	1.200	
16	272.84	408.23	304.79	393.10	310.54	446.54	53.75	1.200	
17	272.84	408.23	304.79	393.10	309.31	443.94	51.04	1.200	
18	270.70	409.25	304.79	393.10	309.58	447.27	54.38	1.200	
19	272.84	408.23	304.79	393.10	310.64	446.74			

53.96 1.200
20 274.99 407.22 304.79 393.10 310.09 442.82
50.00 1.200
21 272.84 408.23 304.79 393.10 310.73 446.94
54.17 1.200
22 274.99 407.22 304.79 393.10 310.19 443.02
50.21 1.200
23 272.84 408.23 304.79 393.10 310.83 447.14
54.38 1.200
24 270.70 409.25 304.79 393.10 309.48 447.06
54.17 1.200
25 272.84 408.23 304.79 393.10 309.22 443.74
50.83 1.200
26 274.99 407.22 304.79 393.10 310.28 443.22
50.42 1.200
27 272.84 408.23 304.79 393.10 310.92 447.34
54.58 1.200
28 274.99 407.22 304.79 393.10 310.38 443.42
50.62 1.200
29 272.84 408.23 304.79 393.10 311.02 447.54
54.79 1.200
30 270.70 409.25 304.79 393.10 309.39 446.86
53.96 1.200
31 274.99 407.22 304.79 393.10 310.47 443.62
50.83 1.200
32 272.84 408.23 304.79 393.10 309.12 443.54
50.62 1.200
33 272.84 408.23 304.79 393.10 311.11 447.74
55.00 1.200
34 274.99 407.22 304.79 393.10 310.56 443.81
51.04 1.200
35 270.70 409.25 304.79 393.10 309.29 446.66
53.75 1.200
36 274.99 407.22 304.79 393.10 310.66 444.01
51.25 1.200
37 272.84 408.23 304.79 393.10 309.03 443.34
50.42 1.200
38 274.99 407.22 304.79 393.10 310.75 444.21
51.46 1.200
39 270.70 409.25 304.79 393.10 309.19 446.46
53.54 1.201
40 274.99 407.22 304.79 393.10 310.85 444.41
51.67 1.201
41 272.84 408.23 304.79 393.10 308.93 443.14
50.21 1.201
42 274.99 407.22 304.79 393.10 310.94 444.61
51.88 1.201
43 270.70 409.25 304.79 393.10 309.10 446.26
53.33 1.201
44 274.99 407.22 304.79 393.10 311.04 444.81

52.08 1.201
45 272.84 408.23 304.79 393.10 308.84 442.94
50.00 1.201
46 274.99 407.22 304.79 393.10 311.13 445.01
52.29 1.201
47 270.70 409.25 304.79 393.10 309.00 446.06
53.12 1.201
48 274.99 407.22 304.79 393.10 311.22 445.21
52.50 1.201
49 270.70 409.25 304.79 393.10 308.91 445.86
52.92 1.201
50 274.99 407.22 304.79 393.10 311.32 445.40
52.71 1.201
51 274.99 407.22 304.79 393.10 311.41 445.60
52.92 1.201
52 270.70 409.25 304.79 393.10 308.81 445.66
52.71 1.201
53 274.99 407.22 304.79 393.10 311.50 445.80
53.12 1.201
54 274.99 407.22 304.79 393.10 312.35 447.58
55.00 1.201
55 274.99 407.22 304.79 393.10 311.60 446.00
53.33 1.201
56 270.70 409.25 304.79 393.10 308.72 445.45
52.50 1.201
57 274.99 407.22 304.79 393.10 311.69 446.20
53.54 1.201
58 270.70 409.25 304.79 393.10 308.62 445.25
52.29 1.202
59 274.99 407.22 304.79 393.10 311.79 446.39
53.75 1.202
60 274.99 407.22 304.79 393.10 311.88 446.59
53.96 1.202
61 274.99 407.22 304.79 393.10 312.25 447.38
54.79 1.202
62 270.70 409.25 304.79 393.10 308.53 445.05
52.08 1.202
63 277.13 406.20 304.79 393.10 311.71 443.46
50.83 1.202
64 277.13 406.20 304.79 393.10 311.33 442.67
50.00 1.202
65 274.99 407.22 304.79 393.10 311.97 446.79
54.17 1.202
66 277.13 406.20 304.79 393.10 311.43 442.87
50.21 1.202
67 270.70 409.25 304.79 393.10 308.43 444.85
51.88 1.202
68 274.99 407.22 304.79 393.10 312.07 446.99
54.38 1.202
69 268.56 410.26 304.79 393.10 308.60 447.97

55.00 1.202
70 277.13 406.20 304.79 393.10 311.52 443.07
50.42 1.202
71 274.99 407.22 304.79 393.10 312.16 447.18
54.58 1.202
72 270.70 409.25 304.79 393.10 308.33 444.65
51.67 1.202
73 277.13 406.20 304.79 393.10 311.62 443.26
50.62 1.202
74 268.56 410.26 304.79 393.10 308.50 447.77
54.79 1.202
75 270.70 409.25 304.79 393.10 308.24 444.44
51.46 1.202
76 268.56 410.26 304.79 393.10 308.41 447.56
54.58 1.202
77 270.70 409.25 304.79 393.10 308.14 444.24
51.25 1.203
78 268.56 410.26 304.79 393.10 308.31 447.36
54.38 1.203
79 277.13 406.20 304.79 393.10 311.80 443.66
51.04 1.203
80 270.70 409.25 304.79 393.10 308.05 444.04
51.04 1.203
81 268.56 410.26 304.79 393.10 308.21 447.16
54.17 1.203
82 277.13 406.20 304.79 393.10 311.90 443.86
51.25 1.203
83 270.70 409.25 304.79 393.10 307.95 443.84
50.83 1.203
84 268.56 410.26 304.79 393.10 308.12 446.96
53.96 1.203
85 270.70 409.25 304.79 393.10 307.86 443.63
50.62 1.203
86 268.56 410.26 304.79 393.10 308.02 446.75
53.75 1.203
87 277.13 406.20 304.79 393.10 311.99 444.05
51.46 1.203
88 270.70 409.25 304.07 393.44 308.52 445.96
52.71 1.203
89 268.56 410.26 304.79 393.10 307.93 446.55
53.54 1.203
90 270.70 409.25 304.79 393.10 307.76 443.43
50.42 1.203
91 277.13 406.20 304.79 393.10 312.08 444.25
51.67 1.204
92 268.56 410.26 304.79 393.10 307.83 446.35
53.33 1.204
93 270.70 409.25 304.79 393.10 307.66 443.23
50.21 1.204
94 277.13 406.20 304.79 393.10 312.18 444.45

```
51.88     1.204
  95       270.70      409.25      304.07      393.44      308.42      445.76
52.50     1.204
  96       268.56      410.26      304.79      393.10      307.73      446.14
53.12     1.204
  97       270.70      409.25      304.79      393.10      307.57      443.02
50.00     1.204
  98       277.13      406.20      304.79      393.10      312.27      444.64
52.08     1.204
  99       268.56      410.26      304.79      393.10      307.64      445.94
52.92     1.204

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     272.84      YL:     408.23      XR:     304.79      YR:
393.10
    Centre:  XC:     309.69      YC:     444.74                  Radius:  R:
51.88
Generated failure surface: (20 points)
    272.84    408.23          274.20    406.91          275.61    405.64
277.06    404.41          278.56    403.25
    280.10    402.14          281.68    401.08          283.30    400.09
284.95    399.15          286.63    398.28
    288.35    397.46          290.09    396.71          291.86    396.03
293.66    395.41          295.47    394.86
    297.31    394.37          299.16    393.95          301.02    393.60
302.90    393.32          304.79    393.10

Slice Geometry and Properties - Critical Failure Surface (circle 1,  39 slices)
-------------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
        PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
  1      272.84      0.12    44.2     0.68     0.95     2       0.00    35.0
15.00        0.00        14.06    0.89
  2      273.52      0.35    44.2     0.68     0.95     2       0.00    35.0
45.05        0.00        42.23    0.89
  3      274.20      0.58    42.1     0.70     0.95     2       0.00    35.0
76.02        0.00        70.67    0.88
  4      274.91      0.80    42.1     0.70     0.95     2       0.00    35.0
103.77       0.00        96.46    0.88
  5      275.61      1.03    40.0     0.73     0.95     2       0.00    35.0
134.02       0.00       123.72    0.88
  6      276.34      1.22    40.0     0.73     0.95     2       0.00    35.0
159.16       0.00       146.93    0.88
  7      277.06      1.45    37.9     0.75     0.95     2       0.00    35.0
188.00       0.00       172.59    0.87
  8      277.81      1.62    37.9     0.75     0.95     2       0.00    35.0
210.24       0.00       192.99    0.87
```

9	278.56	1.82	35.8	0.77	0.95	2	0.00	35.0
237.13	0.00	216.77	0.87					
10	279.33	1.97	35.8	0.77	0.95	2	0.00	35.0
256.21	0.00	234.21	0.87					
11	280.10	2.16	33.7	0.79	0.95	2	0.00	35.0
280.49	0.00	255.66	0.87					
12	280.89	2.28	33.7	0.79	0.95	2	0.00	35.0
296.19	0.00	269.97	0.87					
13	281.68	2.44	31.6	0.81	0.95	2	0.00	35.0
317.34	0.00	288.81	0.86					
14	282.49	2.53	31.6	0.81	0.95	2	0.00	35.0
329.40	0.00	299.79	0.86					
15	283.30	2.67	29.5	0.83	0.95	3	0.00	30.0
346.44	0.00	329.62	0.90					
16	284.12	2.73	29.5	0.83	0.95	3	0.00	30.0
353.55	0.00	336.38	0.90					
17	284.95	2.84	27.4	0.84	0.95	3	0.00	30.0
365.91	0.00	347.50	0.90					
18	285.79	2.87	27.4	0.84	0.95	3	0.00	30.0
369.14	0.00	350.59	0.90					
19	286.63	2.94	25.3	0.86	0.95	3	0.00	30.0
377.19	0.00	358.08	0.90					
20	287.49	2.94	25.3	0.86	0.95	3	0.00	30.0
376.40	0.00	357.33	0.90					
21	288.35	2.97	23.2	0.87	0.95	3	0.00	30.0
379.85	0.00	360.93	0.90					
22	289.22	2.94	23.2	0.87	0.95	3	0.00	30.0
374.94	0.00	356.27	0.90					
23	290.09	2.93	21.2	0.89	0.95	3	0.00	30.0
373.47	0.00	355.66	0.90					
24	290.98	2.86	21.2	0.89	0.95	3	0.00	30.0
364.34	0.00	346.96	0.90					
25	291.86	2.81	19.1	0.90	0.95	3	0.00	30.0
357.83	0.00	342.00	0.91					
26	292.76	2.71	19.1	0.90	0.95	3	0.00	30.0
344.32	0.00	329.07	0.91					
27	293.66	2.62	17.0	0.91	0.95	3	0.00	30.0
332.60	0.00	319.46	0.91					
28	294.56	2.48	17.0	0.91	0.95	3	0.00	30.0
314.65	0.00	302.22	0.91					
29	295.47	2.35	14.9	0.92	0.95	3	0.00	30.0
297.63	0.00	287.68	0.92					
30	296.39	2.17	14.9	0.92	0.95	3	0.00	30.0
275.23	0.00	266.03	0.92					
31	297.31	2.00	12.8	0.93	0.95	3	0.00	30.0
252.90	0.00	246.34	0.92					
32	298.23	1.79	12.8	0.93	0.95	3	0.00	30.0
226.01	0.00	220.15	0.92					
33	299.16	1.57	10.7	0.93	0.95	3	0.00	30.0
198.45	0.00	195.07	0.93					

```
 34      300.09      1.32    10.7     0.93     0.95     3       0.00    30.0
167.02        0.00       164.18    0.93
 35      301.02      1.06     8.6     0.94     0.95     3       0.00    30.0
134.30        0.00       133.42    0.94
 36      301.96      0.78     8.6     0.94     0.95     3       0.00    30.0
98.38         0.00       97.74    0.94
 37      302.90      0.45     6.5     0.87     0.87     3       0.00    30.0
57.32         0.00       62.60    0.95
 38      303.77      0.18     6.5     0.87     0.87     3       0.00    30.0
23.17         0.00       25.30    0.95
 39      304.64      0.00     6.5     0.15     0.15     2       0.00    35.0
0.52        0.00         3.29    0.94
                --------                    -------
----------
     X-S Area:      73.36    Path Length:     36.07              X-S Weight:
9409.58
```
