4.0 RULE 6.4.4: EXHIBIT D–MINING PLAN

4.1 INTRODUCTION

4.1.1 BACKGROUND

Per discussion with CDRMS, Exhibit D is amended as follows:

- New Section 4.1 Introduction. Given this permit is only for a Mill processing facility, providing a project overview is considered appropriate.
- Rule 6.4.4 does not provision for a process plant and tailings discussion. These sections are added using 110(2) protocols. Section 4.2 Mining is per Rule 6.3.3. Section 4.3 is added to discuss the process facility. Section 4.4 is added to discuss the Filtered Tailings Deposit (FTD).

4.1.2 OPERATING PLAN

The Mill (currently permitted under Permit M1990-057) is scheduled to commence operations with mill closure 10 years after commencement, approximately 2033. The planned facility, with the reconstructed ECS (**Section 4.4**, Emergency Containment Sump), has sufficient capacity to operate over this timeframe after future phased expansions.

Leadville Mining and Milling, Inc. constructed the mill in 1989 to process ore from the Hopemore Mine located 8mi East of the Mill. The mine and Mill commenced production in 1989 and operated sporadically for approximately 10 years. A building permit was obtained in December 1987 and certificates of occupancy (**Exhibit M**) were issued for the crusher building on October 5, 1990 and the Mill building on November 9, 1990.

The Mill site is in a heavily wooded area on the lee side of an east-west trending hill which affords maximum protection from the normal prevailing wind from the northwest. The Mill maintains a minimum cleared area to afford a good firebreak distance around the buildings, roads, and tailings storage area.

The nearest inhabited buildings to the Mill permit boundary is a structure (Benson) located about (300ft) northwest, a house (Fowler) located approximately 800ft West and a house (Wood) located approximately 550ft West.

Exhibit S, describes and illustrates the location of “Permanent Man-Made Structures” within 200ft of the permit boundary.

The Mill and tailings deposit and associated facilities are illustrated on **Figure 4-1.** The current facility includes 2 separate metal buildings and an emergency spillage containment facility:

- Mill Building. The Mill building contains the fine ore bin, reagent storage area, ball mill circuit, concentrate thickener, laboratory, Mill office, safety/training/change room, concentrate storage room, and restroom.
- Crushing Building. The crushing building contains the run of mine (RoM) grizzly, primary, and secondary crushers. It is connected to the Mill building via an enclosed conveyor crossover bridge.
- Emergency Containment Sump (ECS). The area currently constructed will serve as a 100% spill containment facility in the event of spillage events.

Upgrades proposed include:

- New crusher building.
- RoM storage pad.
- Filter building.
- Tailings deposit.
- Truck scale.
- Conveyor connecting new crusher to main building.
- Leach tank and pad.
- Detox tank.
- Haul truck entrance.

Other facilities include:

- 2 primary on-site water monitoring wells.
- 1 shallow monitoring well in mostly dry perched aquifer.
- Electric utility line with transformer.
- Trailer foundation.
- Sewage lift station.
- Upper and lower gravel Mill access roads.
- 3 ore stockpiles, 1 topsoil stockpile, and 1 ECS overburden stockpile.

The facility can be accessed by either a driveway located immediately West of Leadville Sanitation on the South side of the property or the new haul road providing access from the northeast side of the property North of Leadville Sanitation, accessing from the Arkansas Valley Slag Project Property.

The fine ore feed bin, chemicals and reagents are contained in the existing Mill building. Reagents and chemicals used in ore processing will be stored in over-pack drums or within secondary containment structures. Cyanide will be stored in a conex next to the leach pad. Any leakage, or containment issues with the stored chemicals or reagents will be directed to the Mill sump and then to the ECS (**Figure 4-1)** and collected and disposed in an approved disposal facility. Waste management activities are discussed in greater detail in **Exhibit U.**

4.2 MINING PLAN (PER RULE 6.3.4, JULY 2022 REVISION)

The mining plan shall supply the following information, correlated with the affected lands, map(s) and timetables:

(a) description of the method(s) of mining to be employed in each stage of the operation as related to any surface disturbance on affected lands;

There is no mining proposed in the permit application.

(b) earthmoving;

Not applicable.

(c) all water diversions and impoundments; and

Water diversions are described in **Exhibit U.**

(d) the size of area(s) to be worked at any one time.

Not applicable.

(e) An approximate timetable to describe the mining operation. The timetable is for the purpose of establishing the relationship between mining and reclamation during the different phases of a mining operation. An Operator/Applicant shall not be required to meet specific dates for initiation, or completion of mining in a phase as may be identified in the timetable. This does not exempt an Operator/Applicant from complying with the performance standards of Rule 3.1. If the operation is intended to be an intermittent operation as defined in Section 34-32-103(6)(a)(II), C.R.S., the applicant should include in this exhibit a statement that conforms to the provisions of Section 34-32-103(6)(a)(II), C.R.S. Such timetable should include:

Not applicable.

(i) an estimate of the periods of time which will be required for the various stages or phases of the operation;

Not applicable.

(ii) a description of the size and location of each area to be worked during each phase; and

Not applicable.

(iii)outlining the sequence in which each stage or phase of the operation will be carried out.

Not applicable.

(Timetables need not be separate and distinct from the mining plan, but may be incorporated therein.)

Not applicable.

(f) A map (in Exhibit C - Pre-Mining and Mining Plan Maps(s) of Affected Lands, Rule 6.4.3) may be used along with a narrative to present the following information:

Not applicable. This is provided in Section 4.3 and 4.4.

(i) nature, depth and thickness of the ore body or deposit to be mined and the thickness and type of overburden to be removed (may be marked "CONFIDENTIAL," pursuant to Rule 1.3(3)); and

Not applicable.

(ii) nature of the stratum immediately beneath the material to be mined in sedimentary deposits.

Not applicable.

(g) Identify the primary and secondary commodities to be mined/extracted and describe the intended use; and

Not applicable.

(h) name and describe the intended use of all expected incidental products to be mined/extracted by the proposed operation.

Not applicable.

(i) Specify if explosives will be used in conjunction with the mining (or reclamation). In consultation with the Office, the Applicant must demonstrate, pursuant to Rule 6.5(4), Geotechnical Stability Exhibit, that off-site areas will not be adversely affected by blasting.

Not applicable.

(j) Specify the dimensions of any existing or proposed roads that will be used for the mining operation. Describe any improvements necessary on existing roads and the specifications to be used in the construction of new roads. New or improved roads must be included as part of the affected lands and permitted acreage. Affected land shall not include off-site roads which existed prior to the date on which notice was given or permit application was made to the office and which were constructed for purposes unrelated to the proposed mining operation and which will not be substantially upgraded to support the mining operation. Describe any associated drainage and runoff conveyance structures to include sufficient information to evaluate structure sizing.

Not applicable. This is provided in Section 4.3.

4.3 MILL MANAGEMENT ACTIVITIES (PER RULE 6.3.3, JULY 2019 REVISION)

(1)(m) specify whether the deposit/ore will be processed on site. Processing includes crushing, screening, washing, concrete or asphalt mixing, leaching or milling. If the deposit/ore will be processed, then describe the nature of the process, facilities and chemicals utilized. The process area and any structures must be described on Exhibit E - Map.

4.3.1 OVERVIEW

The plant is anticipated to operate at a nominal rate of 20tph ore throughput using 3 8-hr shifts per day for a 20-shift cycle with the 21st shift reserved for maintenance.

The Mill will use conventional agitated leaching, using sodium cyanide from low-grade vein dumps (RoM) located nearby. Each area supplying RoM will operate on an independent Reclamation Permit to be issued by CDRMS.

RoM will be geochemically characterized, and ore metal values will be evaluated prior to processing. Characteristics of the RoM will be determined prior to receiving or processing ore.

4.3.2 PROCESS FLOWSHEET

Figure 4-2, shows a simplified process flowsheet and material balance. Process Flow Diagrams (PFDs) are shown in **Appendix 4-1**. Design criteria used to develop this flowsheet are based on metallurgical test work completed in January 2021. Key design parameters are summarized in **Table 4-1.**

TABLE 4-1: LEADVILLE MILL, DESIGN CRITERIA

Item	Design Parameter	Value	Unit
	Physical Parameters		
1	RoM Moisture	4%	-
2	Plant Capacity	400	dstpd
3	Plant Availability	92%	-
4	Calculated Capacity	453	stpd
	Crushing Circuit		
5	Operating Hours	8	hr/day
6	Availability	75%	-
7	Feed Rate	50% 277.8 31.7	% stpd stph
8	RoM Feed, F_{80}	102	mm
9	Crusher Product, P_{80}	12.5	mm
10	Fine Ore Bin Capacity	280	stpd
	Mill Circuit		
11	Ball Mill Work Index (BWi)	15.45	-
12	Mill Feed, F_{80}	12,500	micron
13	Mill Product, P_{80} (cyclone O/F)	104	micron
	Leach Circuit		
14	Thickener Feed	30%	solids
15	Leach Feed	40%	solids
16	Leach Time	18	hours
17	Feed Solids, Pressure Filter	40%	solids
18	Filtration Rate	500	lb/ft^2-hr
19	Filtration Product	80%	solids
20	Repulp Tank	50%	solids
21	Detox Tank	50% 4	solids hours
22	Vacuum Filter, Drum	100	lb/ft^2-hr

CRUSHING CIRCUIT

A new crushing building will house the crusher and screens. Basis of crusher design includes the following:

- The RoM ore delivered by trucks, weighed, and stored in an 800st capacity coarse ore bin, will be crushed in a single-stage operation to a final size of about -3/8". A conveyor will move the ore to the 280st fine ore bin located in the Mill building.
- The crusher will operate during day shift. This will mitigate noise during nighttime hours.

Crusher circuit equipment performance criteria are shown in **Table 4-2**.

TABLE 4-2: CRUSHER PERFORMANCE CRITERIA

Equipment Performance	Value	Unit
Primary Crusher		
Feed	57	stph
F_{80}	50	mm
P_{80}	18	mm
Screen Aperture	18	mm

GRINDING CIRCUIT

The ball mill will operate at a nominal rate of 20stph and will be scheduled 24hr/day.

The thickener will stabilize the operation, providing a steady 20stph feed to the leach circuit.

Crusher circuit equipment performance criteria are shown in **Table 4-3**.

TABLE 4-3: GRINDING PERFORMANCE CRITERIA

Equipment Performance	Value	Unit
Fine Ore Bin		
Capacity	280	st
Ball Mill		
F_{80}	12,500	micron
P_{80}	104	micron
Bwi	15.45	-
Operating Hours	20	hr/day
Horsepower	40	hp
Horsepower Max	50	hp
Ball Mill Sump		
Flowrate	600	gpm
Residue Time	4	min
Sump Capacity (@90% capacity)	2,670	gal
Cyclone		
Operating Units	2	units
Standby Units	1	units
Flowrate, total	600	gpm
Flowrate, per unit	300	gpm
Pre-Leach Thickener		
Feed	25%	% solids
Unit Area	0.12	ft^2/tpd
Underflow	40	% solids
Diameter	12	ft

LEACH & MERRILL CROWE CIRCUIT

Dissolution of gold (Au) and silver (Ag) using cyanide (CN) was developed in the late-19th century. Dissolution occurs as:

$$4Au + 8NaCN + O_2 + 2H_2O \rightarrow 4NaAu(CN)_2 + 4NaOH$$

Merrill Crowe is a process which uses zinc (Zn) to precipitate Au and Ag from cyanide (CN) solution using direct reduction reactions as:

$$2Au(CN)_2 + Zn \rightarrow 2Au + Zn(Cl)_4^{-2}$$

$$2Au(CN)_2 + Zn + 3OH^{-1} \rightarrow 2Au + HZnO_2^{-1} + CN^{-1} + H_2O$$

Crusher circuit equipment performance criteria are shown in **Table 4-4**.

TABLE 4-4: LEACH & MERRILL CROWE PERFORMANCE CRITERIA

Area	Value	Units
Leach Circuit		
Feed	40	% solids
Leach Time	18	hours
Volume (w/ 10% freeboard)	22,000	ft^3
Tanks	4	no. of units
Tanks Size, 18-hour leach	15 x 31	ft dia. x ft height
Surge Tank		
Feed	40	% solids
Tank Size	12 x 24	ft dia. x ft height
Volume	2,700	ft^3
Vacuum Filter		
Feed	40	% solids
Filtration Rate	500	lb/ft^2-hr
Area Required	80	ft^2
Filter Cake	80	% solids
Repulp Tank		
Residence Time	5	min
Volume	600	ft^3
Solids	50	% solids
Tank Size	9 x 9	ft dia. x ft height
Detox		
Feed	50	% solids
Residence Time	8	min
Volume	1,150	ft^3
Tank Size	2@9 x 9	ft dia. x ft height
Vacuum Filter		
Feed	50	% solids
Filtration Rate	100	lb/ft^2-hr
Filter Cake	80	% solids
Area Required	80	ft^2

4.3.3 PROCESS MATERIAL BALANCE

The material balance for the Mill was developed in concurrence with the process flowsheet and is shown in **Table 4-5**. The stream numbers shown correspond with the orange-colored numbers in the **Figure 4-2** flowsheet.

TABLE 4-5: PROCESS MATERIAL BALANCE

Stream	Description	Solids (%)	TPH		Slurry (gpm)
			Solids	Water	
1	RoM Ore	96.0%	54.30	2.26	-
2	Primary Crusher Product	95.0%	27.15	1.43	-
3	Feed to Screen	95.0%	33.94	1.79	-
4	Screen Oversize	95.0%	6.79	0.36	-
5	Secondary Crusher Product	95.0%	6.79	0.36	-
6	Feed to Storage Bin	95.0%	27.15	1.43	-
7	Fine Ore Bin discharge	95.0%	5.00	0.26	-
8	Ball Mill Feed	57.0%	18.58	13.84	83.98
9	Ball Mill Discharge	57.0%	18.58	13.84	83.98
10	Cyclone Feed	25.6%	45.73	136.35	591.29
11	Cyclone Underflow	50.0%	13.58	13.58	74.82
12	Cyclone Overflow	20.7%	32.15	123.27	530.80
13	Thickener Feed	18.2%	20.00	89.72	396.00
14	Thickener O/F	-	-	73.36	238.54
15	Thickener U/F	40.0%	20.00	30.00	150.40
16	Leach Circuit Feed	40.0%	20.00	30.00	150.40
17	Leach Circuit Discharge	40.0%	20.00	30.00	150.40
18	Holding Tank	40.0%	20.00	30.00	150.40
19	Pressure Filter Cake	80.0%	20.00	5.00	20.00
20	Pregnant Solution	-	-	30.00	120.00
21	Feed to Merrill Crowe	-	-	30.00	120.00
22	Barren Solution	-	-	30.00	120.00
23	Gold Precipitate	-	0.12	trace	-
24	Repulp Tank	50.0%	20.00	20.00	110.20
25	Drum Filter Feed	50.0%	20.00	20.00	110.20
26	Filtrate	-	-	13.33	53.32
27	Leach Residue	75.0%	20.00	6.67	55.20
28	Process Water	-	-	124.44	-
29	Process Water to Sump	-	-	22.88	-
30	Wash Water	-	-	5.00	20.00
31	Barren Solution	-	-	15.00	-

4.3.4 LABORATORY

Laboratory activities will include bulk density, screening, AA assaying and thickening testing. A Marcy bulk density scale will be used for bulk density testing. Both wet and dry screening will take place in the laboratory. Samples for screen test will be crushed and ground with laboratory scale equipment. Wet screen material will be dried in a microwave oven.

Thickening test will be conducted using small amounts of environmentally friendly polyacrylates.

Sample preparation will also be performed in the laboratory.

4.3.5 REAGENT INVENTORY

Reagents are further discussed in **Exhibit U**.

CRUSHING CIRCUIT

Lime will be added to the crusher product prior to conveying to the fine ore bin.

GRINDING & AGITATED LEACH CIRCUIT

Unit consumption rates as well as daily and monthly reagent consumption is shown in **Table 4-6**. A small amount of copper sulfate will be kept on site for testing, although not required for the process

TABLE 4-6: REAGENT CONSUMPTION, GRINDING & AGITATED LEACH CIRCUIT

No.	Reagent	Consumption		
		Unit/Rate (lbs./st)	Daily (lbs)	Monthly (tons)
1	Water	587	234,600	3,578
2	Flocculant/TNS	1.66	664.00	10.1
3	Lime - CaO	8.00	3,200	49
3.5	Caustic Soda-NaOH	0.10	40	0.61
4	Sodium Cyanide-NaCN	4.00	1,600	24.4
5	Sodium Bisulfite - NaHSO3	0	0	0
6	Copper Sulfate - CuSO4	0	0	0
7	Lead Nitrate - Pb(NO3)2	0.01	4.00	0.06
8	Ferrous Sulfate-FeSO4	0.5	200	3.1
9	Zinc Powder-Zn	0.11	44	0.67
10	Diatomaceous Earth	0.01	4	0.06
	Flux Materials			
11	Potassium Nitrate-KNO3	0.007	2.8	0.04
12	Silica-Si	0.01	4	0.06
13	Borax Glass	0.01	4	0.06
14	Flourspar-CaF2	<100Lbs/y		
15	Soda Ash-Na2CO3	0.0014	0.56	0.0085
16	Salt-NaCl	<100Lbs/y		

REFINERY

Unit consumption rates as well as daily and monthly reagent consumption is shown in **Table 4-7**.

TABLE 4-7: REAGENT CONSUMPTION, REFINERY

No.	Reagent	Consumption			
		Quantity	Units	Daily (lbs)	Monthly (lbs)
1	Zinc Oxide - ZnO	0.53	lb/ton	212	6,400
2	Borax - $Na_2[B_4O_5(OH)_4]$				200
3	Soda Ash - Na_2O_3				100
4	Silica Sand - SiO_2				400
5	Potasium Nitrate - KNO_3				150
6	Flourspar - CaF_2				5
7	Silicon Carbide Cement - SiC (1)	-	-	-	-<10

(1) These reagents are used during Au-Ag pours, so only monthly values are reported.
(2) Silicon Carbide is used as needed for furnace repair.

OTHER REAGENTS

Other reagents and chemicals that will be on site are shown in **Table 4-8**.

TABLE 4-8: REAGENT CONSUMPTION, OTHER

No.	Reagent	Consumption			
		Quantity	Units	Monthly Quantity	Units
1	Diesel Fuel	20	gal/day	600	gallons
2	Gasoline	2	gal/day	60	gallons

ON-SITE INVENTORY

On-site inventory is shown in **Table 4-9**. Reagents will be stored in a secured-access area in the Mill. Lubricants will be stored in flame-protected metal cabinets.

TABLE 4-9: ON-SITE REAGENT INVENTORY

No.	Reagent	Quantity	Units
1	Water - H_2O (1)	30,000	gal
2	Flocculant	243	lbs
3	Lime - CaO	24	tons
4	Sodium Cyanide - NaCN	6	tons
5	Sodium Bisulfite - $NaHSO_3$	3	tons
6	Lead Nitrate - $Pb(NO_3)2$	122	lbs
7	Zinc Oxide - ZnO	3	tons
8	Borax - $Na_2[B_4O_5(OH)_4]$	50	lbs
9	Soda Ash - Na_2O_3	50	lbs
10	Silica Sand - SiO_2	50	lbs
11	Potassium Nitrate - KNO_3	50	lbs
12	Fluorspar - CaF_2	50	lbs
13	Silicon Carbide Cement - SiC (1)	50	lbs
14	Diesel Fuel	125	gallons

4.3.6 SOLUTION MANAGEMENT

MILL BUILDING

Solutions within the Mill building will contain RoM, and reagents requisite to gold and silver recovery. Small amounts of liquid reagent quantities will be used at any one time (see **Table 4-10**) thus minimizing risk due to spillage and waste. Chemicals not immediately required will be stored in over-pack Barrel containers. The reagent mixing area is at the fine ore bin level.

Spill containment within the Mill building will be accomplished by; first localizing containment and clean-up, and second by directing any remaining spill to the sump area built into the concrete floor and located at the lower end of the Mill building. The Mill building sump capacity is approximately 5,000 gallons.

In the unlikely event of a catastrophic failure – resulting in a situation exceeding the sump capacity – excess solution will report via gravity flow to the ECS.

LEACH TANKS

Spill containment at leach tanks located outside the Mill building will be accomplished by; first, localizing containment and clean-up, and second, capturing spills within the leach tank spill containment area which has a capacity of 13,400 gallons.

As with Mill building solution management, in the unlikely event of a catastrophic failure at the leach tank area – resulting in a situation exceeding the designed containment capacity – excess solution will report via gravity flow to the ECS.

4.3.7 DUST CONTROL

Dust control within the Mill and crusher buildings will be accomplished utilizing a 4,000cfm UAS Dust Hawg horizontal cartridge dust collector. Dust will be managed in the crushing plant by use of a ducted exhaust air system which will draw air and dust down through the crusher and transfer points. Dust from the screening, primary and secondary crushing circuits, conveyance systems, and fine ore storage operations will be limited to fugitive particulate matter. Negative pressure ventilation will direct venting to the dust collector to control the flow of fugitive particulate matter during screening and crushing operations.

The unit is estimated to operate at air velocities of 3,500-4,500fpm based on demand and manual control dampers at each collection point. The dust collector is rated at 4,000cfm and upgradable to 6,000cfm. The dust control unit is designed to capture 28.2tpy crushed ore fugitive particulate matter and an additional 0.4tpy reagent fugitive particulate matter for a combined 165lb/day at a 99.8% at 0.5µm published design efficiency. The captured dust will be pulse-cleaned off the filters in the dirty air plenum and collected in drums and returned to the material flow in the grinding circuit.

4.4 EMERGENCY CONTAINMENT SUMP (ECS)

4.4.1 OVERVIEW

The ECS was originally constructed as a tailings storage facility (TSF) under a 110(d) permit application approved by CDRMS in 2012 and constructed by CJK during the fall of 2021.

The ECS covers a 4.6ac area. The ECS plan view is shown on **Figure 4-3** and cross-section is shown on **Figure 4-4**. The leak detection system and sump design are shown on **Figure 4-3**.

The facility is a cut and fill structure, constructed using approximately 18,000bcy (bank cubic yards) of fill. Approximately 4,500bcy represents the excess cut material stockpiled from the original TSF construction and incorporated into the cut and fill balance for construction (**Table 4-10**). The total pond capacity is 22.4ac-ft.

TABLE 4-10: ECS IMPOUNDMENT VOLUMES

Description	Volumes
Cut(yd^3)	18,000
Fill(yd^3)	23,000
Net Excess(yd^3)	(4,500)

TABLE 4-11: ECS CAPACITY

Description	Volumes (ft³)	Total Sump(%)
Total Capacity	947,000	100
Sump Capacity	331,000	35
Above Grade Capacity	616,000	65
Contents		
Fresh Make-up Water	297,000	90
Emergency Containment	34,000	10

*These number do not include the 1ft freeboard to the bottom of the spillway

ECS design criteria include:

- Pond excavation limited to 21ft does not impact aquifers at 80-100ft depth below the surface.
- Embankment construction using available onsite soils borrowed from the containment site area as outlined by CTL Thompson, Inc., Permeability Study, April 10, 1990, and Slope Stability Evaluation, July 8, 2011. See **Appendix 4-2**.
- Compaction during construction.
- Zero-discharge facility with 3ft of freeboard.
- Non-disturbed drainage is diverted around the ECS while disturbed area drainage from the mill area disturbance reports to the ECS.
- Observation well down gradient from ECS area is maintained in its current location and monitored.
- Topsoil, in accordance with the topsoil plan will be removed and stockpiled.
- Stability analysis completed by CTL Thompson, Inc. May 12, 2011, and the CTL Thompson Letter Report of July 8, 2011. Subsequently, CTL Thompson issued an update to the July 8, 2011, Report, presented as, Response to CDRMS Slope Stability Evaluation, dated September 1, 2011. See **Appendix 4-2**.
- 2.5:1 (horizontal to vertical) outside face and a 2:1 interior face embankment dam with a berm 12ft wide at the crest.
- Geosynthetic clay liner of 1 x 10^{-6}cm/sec permeability (or less), or equivalent material liner.
- Seepage/leak detection drainage net system between the geosynthetic clay liner and the 45-mil polypropylene geomembrane with the collection sump located in the northwest corner of the impoundment, and the pond bottom sloping at 0.5% to the northwest.

- Synthetic pond liner of 45-mil polypropylene geomembrane or equivalent.
- Compaction testing during construction.

4.4.2 PLANNED USE

The ECS will serve as make-up water storage, and solution containment.

Notwithstanding the overall capacity of the ECS, CJK plans to utilize only the lower portion of the facility that is below grade. Thus, the facility is a sump which will virtually eliminate the chance of spillage into the environment and will provide the following features.

- Down gradient. The ECS is located down-gradient of the entire process facility. In the unlikely event of a catastrophic failure, all solids and solutions within the process will flow via gravity into the ECS.
- Double-lined facility with leak detection (see section 4.4.1).
- Sump capacity of 331,000 ft^3. This represents the below-grade capacity of the ECS. There is an additional 616,000 ft^3 of capacity that is above grade (below the spillway). Above grade capacity will not be used.
- Makeup water storage. The facility can store up to 297,000ft^3 of fresh make-up water and will still have the capacity to hold 110% of all process facility solution. This water will not contain any process reagents and will account for as much as 90% of the total sump capacity.
- Emergency containment. 10% of total ECS sump capacity, representing 110% of the total process facility capacity. Should any spillage occur, solution will, via gravity, naturally flow into the ECS and reagents will be immediately mitigated via dilution with the fresh water. Assuming complete catastrophic failure and 297,000ft^3 of fresh water, cyanide concentration in the sump would be diluted from about 5.0g/l to about 0.5g/l.

Immediate dilution is the first mitigation step. In the event of any spillage in the sump, process operations will immediately stop, and the entire sump volume will be pumped out and treated through the plant cyanide detox circuit. This process would take approximately 4 weeks. In addition to the double-lined protection of the ECS, the very short time that contaminated water remains in the sump is further assurance of groundwater protection.

TABLE 4-12: OPERATION SOLUTION VOLUMES

Description	Primary Containment (gallons)	Secondary Containment (gallons)	Tertiary (ECS) Containment (gallons)
Interior Mill Building			
Primary Process Water Tank No. 1	5,000	-	-
Primary Process Water Tank No. 2	5,500	-	-
Domestic Water	2,000	-	-
Reclaim Tank No. 1	1,650	-	-
Reclaim Tank No. 2	2,250	-	-
Grinding			
Ball Mill	232	-	-
Ball Mill Sump	300		
Thickener	6,800		
Thickener Feed Tank	200		
Thickener Overflow Tank	200		
Grinding Area Floor Sump	200		
Leaching			
Leach Tank No. 1	41,000		
Leach Tank No. 2	41,000		
Leach Tank No. 3	41,000		
Leach Tank No. 4	41,000		
Filter Feed Head Tank	20,300		
Leach Area Floor Sump	200		
Merrill Crowe			
Pregnant Solution Storage	5,000		
Clarifier	20		
Pre Coat Mix & Storage Tank	200		
D.E. Slurry Floor Sump	60		
Vacuum Tower	260		
Steady Head Tank	100		
Cooling Bath	50		
CN Detox			
Re-Pulp Tank	4,300		
CN Destruct Tank No. 1	4,300		
CN Destruct Tank No. 2	4,300		
Wash Solution Holding Tank	500		
Re-Pulp Area Sump	200		
Reagents & Utilities			
CN Mixing Tank	400		
Ferric Sulfite Mixing Tank	100		
Floc Mixing Tank	50		
Totals			
Total Volume of Solutions	228,672		
Main Building Sump		5,000	-
Subtotal Interior Mill Building		5,000	0
ECS (1ft freeboard)			7,083,560
Total Containment		5,000	7,083,560

4.5 FILTERED TAILINGS DEPOSIT (FTD) (PER RULE 6.3.3, JULY 2019 REVISION)

(2) If tailing ponds are part of the milling process, the mine plan description should address the following:

(a) Plant Facilities: Describe the chemical types and quantities to be utilized, chemical storage and spill containment and emergency response plans for on- site spills. Plant operation details should include tank capacities and operating solution volumes.

Chemical types and quantities are described in **Section 4.3.5** and listed in **Table 4-6**. On-site inventory is shown in **Table 4-9**. Spill containment and emergency response plans are presented in **Exhibit U** (**Section 21** of this report). The process flowsheet including tank and storage bin capacities is discussed in **Section 4.3.2**, and a process flowsheet showing operating volumes is shown in **Figure 4-2**.

(b) Tailings: Describe the geochemical constituents of the tailing or leached ore, the chemistry of any leachate, anticipated impacts to ground or surface waters and design details such as liners, ponds and embankments, diversions or chemical treatment facilities to be used to control these impacts, and ground and surface water monitoring systems, to include proposed groundwater points of compliance.

The FTD design and proposed operating management plan is described in **Appendix 4-2**, at the end of this section. Refer to Annex 4 for the FTD discussion. **Section 2** of the FTD Management Plan describes geochemical constituents within the tailings as well as leachate testing results. **Section 6** of the FTD Management Plan presents the preliminary tailings deposit.

The FTD should not impact groundwater. The FTD will contain filtered (20%-25% moisture) tailings. This moisture is entrained in the tailings and will not easily drain. The FTD is designed to minimize water infiltration for rain and snow and will be on a lined surface.

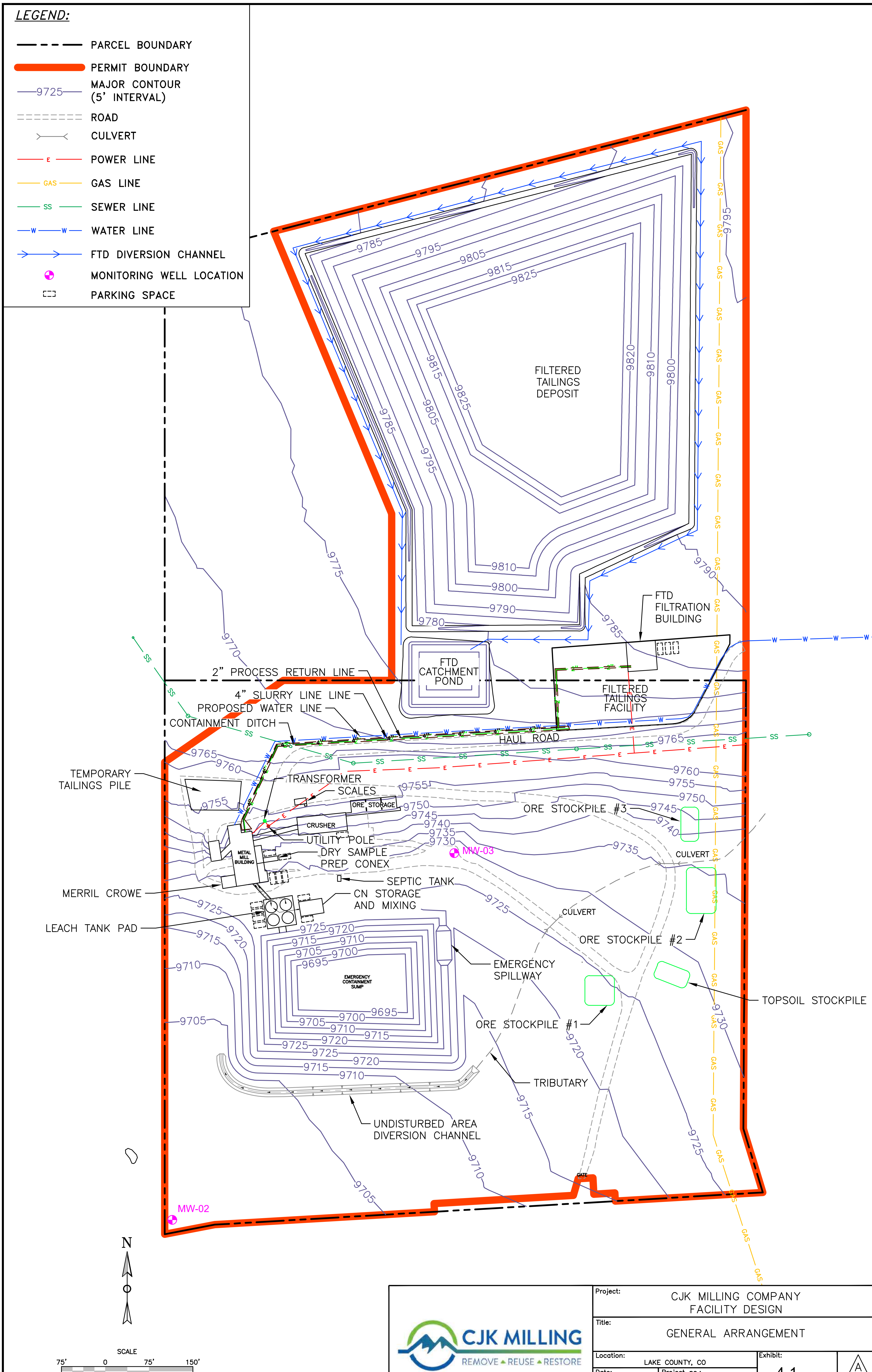
Water information including recent past and future monitoring systems is described in **Exhibit G** (**Section 7** of this report).

(c) Drainage Control: Describe the measures used to divert upland drainage away from the site both during and after operation. This must include design details demonstrating the capacity of ditches and impoundment structures to contain operating solutions and the volume of water generated by a one hundred (100) year 24-hour rainfall event.

Drainage diversions of non-contact water and surface water management of contact water within the FTD is described in **Appendix 4-2** (**Section 6** of the FTD Management Plan).

(d) Maps and Plans: Design drawings must, at a minimum, describe specific design details for tailing ponds and embankments, ponds and ditches, ore and tail transport systems, and ground and surface water monitoring systems.

Design drawings and plans for the FTD are described in **Appendix 4-2** (**Section 6** of the FTD Management Plan).



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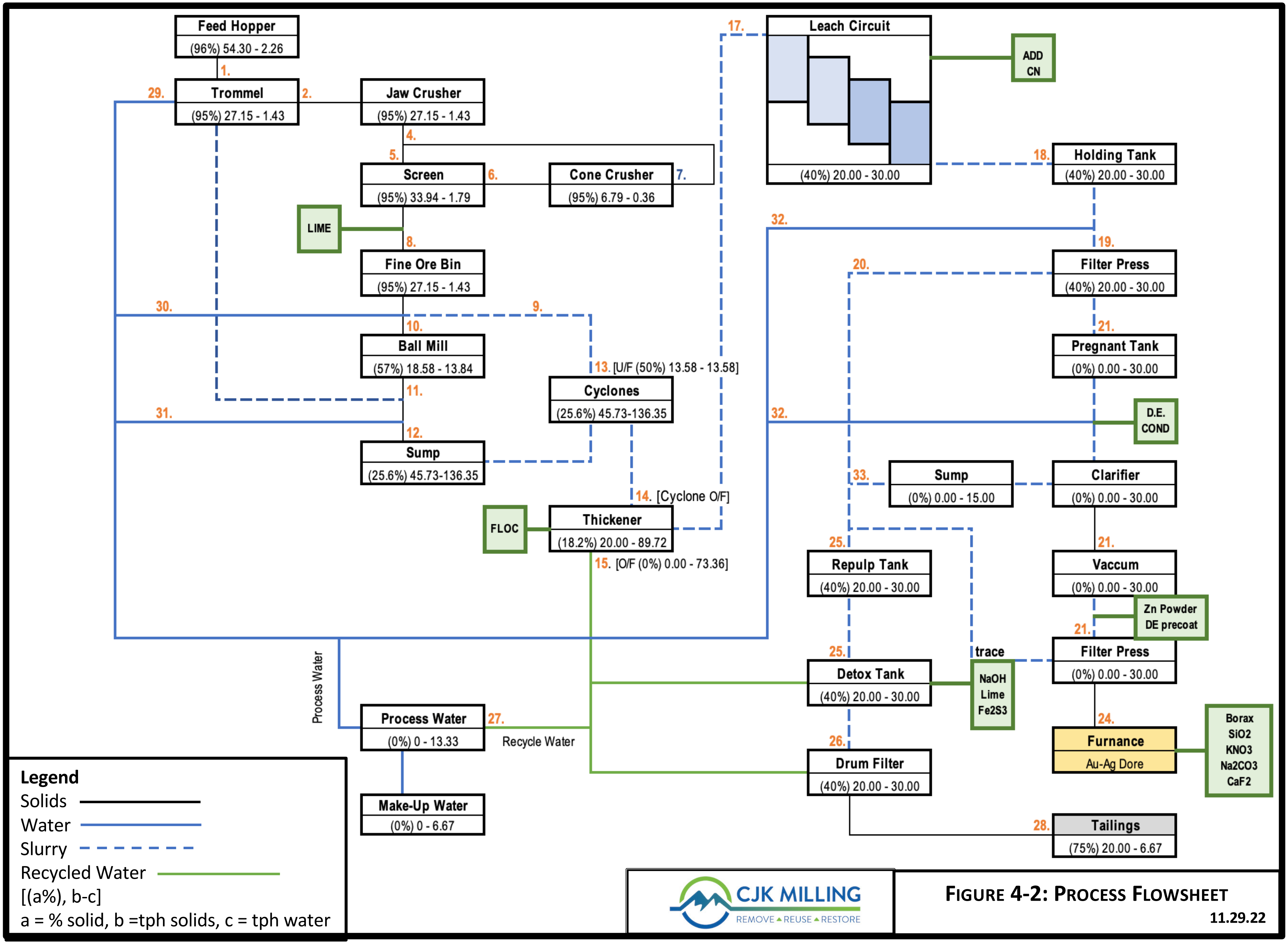
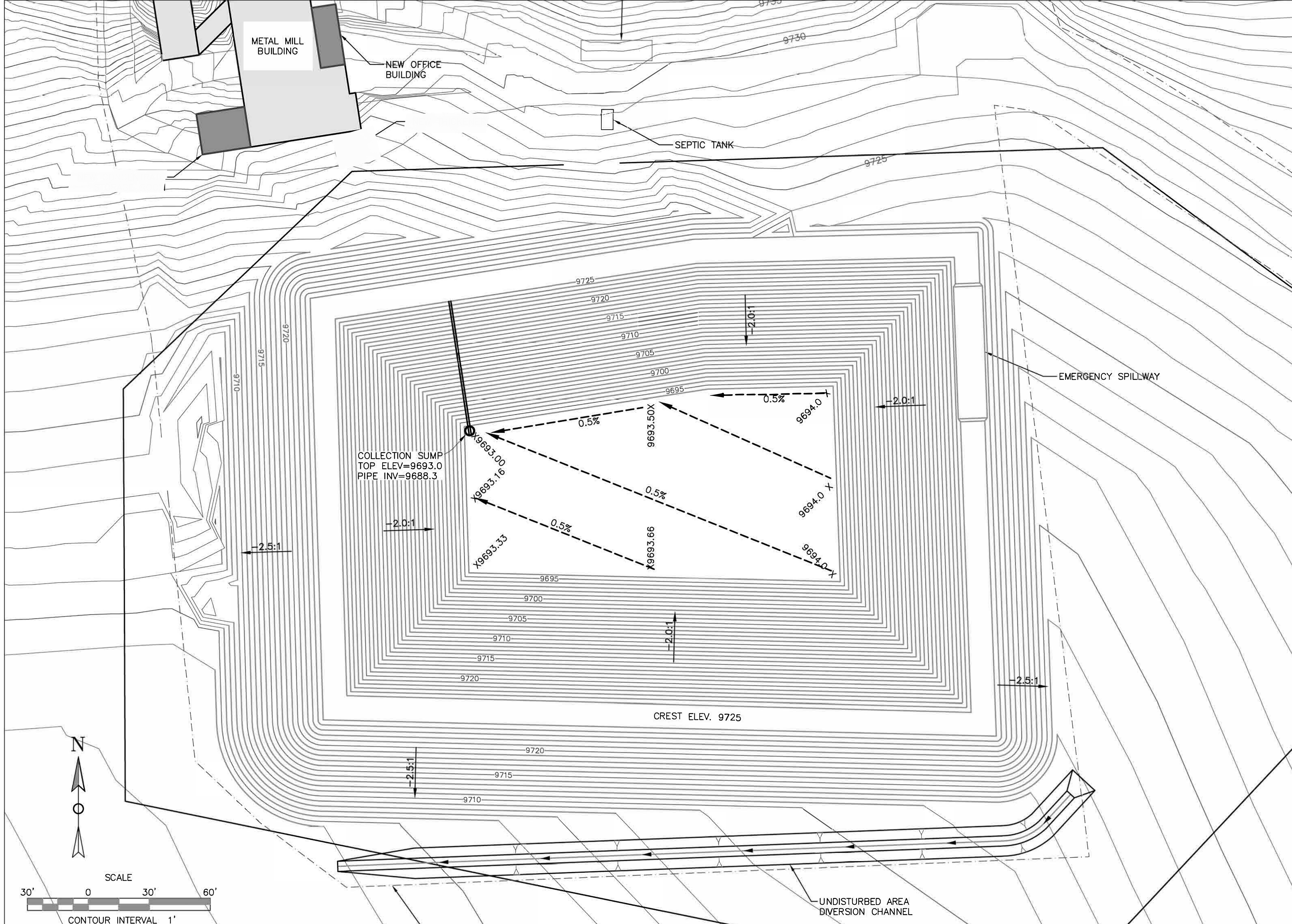
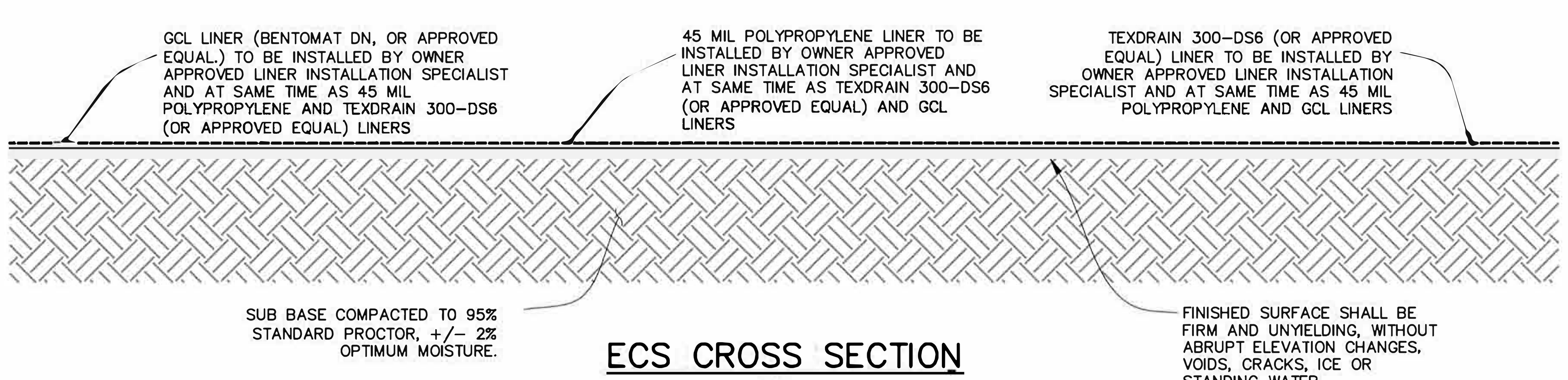


Figure 4-2: Process Flowsheet

11.29.22





ECS CROSS SECTION

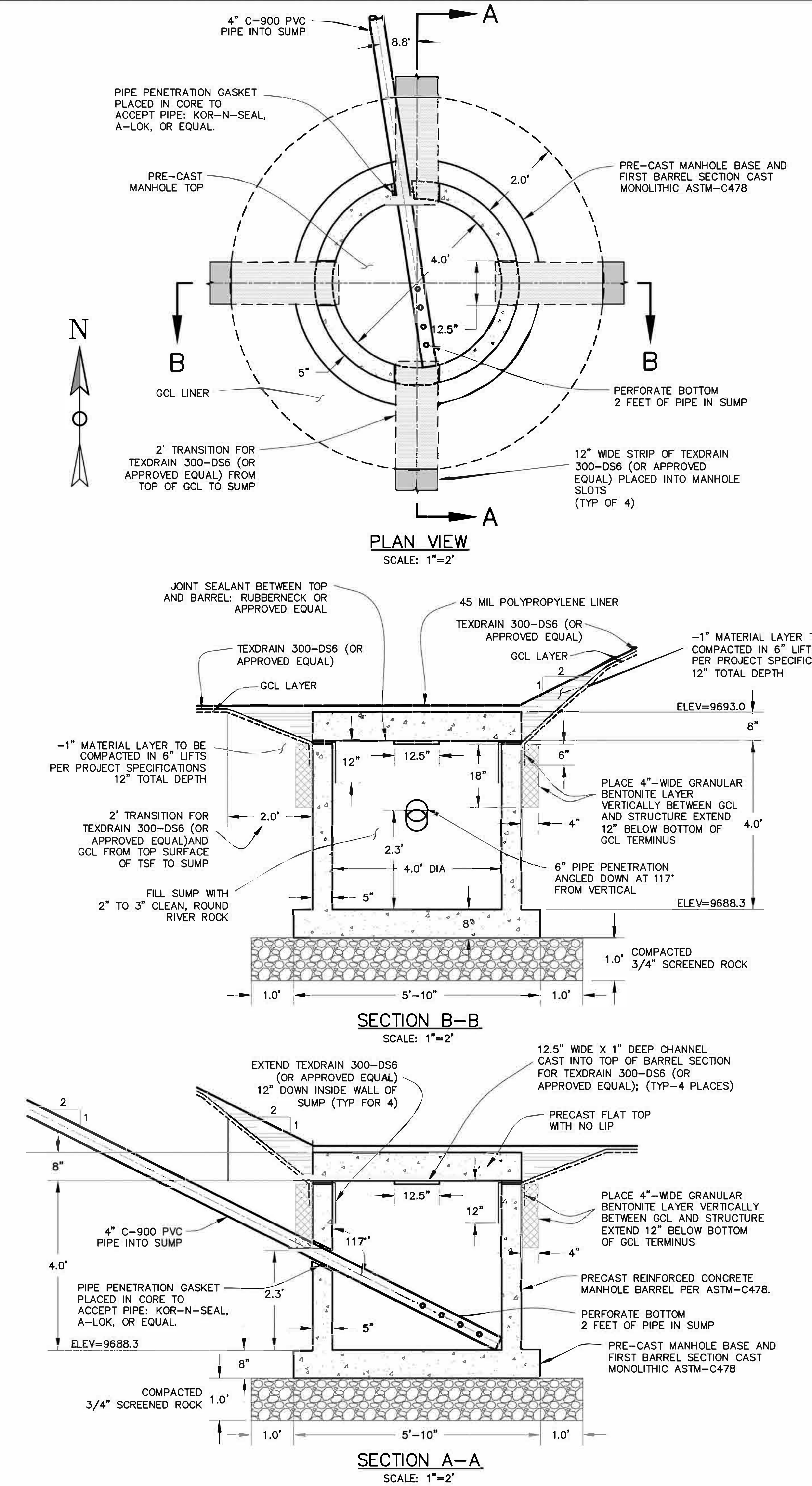
NTS

NOTES

1. SUBGRADE SURFACES CONSISTING OF GRANULAR SOILS OF GRAVEL ARE NOT ACCEPTABLE DUE TO THEIR LARGE VOID FRACTION AND PUNCTURE POTENTIAL.
2. SUBGRADE SURFACE SHALL BE SMOOTH AND FREE OF VEGETATION, SHARP-EDGED ROCKS, STONES, STICKS, CONSTRUCTION DEBRIS AND OTHER FOREIGN MATTER THAT COULD CONTACT THE GCL. THE SUBGRADE TO BE ROLLED WITH A SMOOTH-DRUM COMPACTOR TO REMOVE ANY WHEEL RUTS, FOOT PRINTS, OR OTHER ABRUPT GRADE CHANGES.
3. ALL PROTRUSIONS EXTENDING MORE THAN 1/2" FROM SUBGRADE SHALL BE REMOVED, CRUSHED, OR PUSHED INTO SUBGRADE WITH A SMOOTH-DRUM COMPACTOR.

NOTES

1. JOINT BETWEEN SUMP BARREL, TOP AND AROUND PIPE INTO SUMP SHALL BE WATERTIGHT.
2. ALL CONCRETE WORK SHALL COMPLY WITH LATEST ACI-318 SPECIFICATIONS.
3. ALL EXPOSED BARE CONCRETE SURFACES ON INSIDE AND OUTSIDE OF SUMP TO TO COATED WITH 2 APPLICATIONS OF SPRAY ON POLYUREA COATING.



DETECTION LAYER COLLECTION SUMP

This document was prepared by me or under my direct supervision and the information presented is true and correct to the best of my knowledge and belief

Kenneth W. Curfman
Colorado PE, PLS 25620

COLORADO REGISTERED KENNETH W. CURFMAN 25620 P.E. AND P.L.S.

Issued by: CJK MILLING — REMOVE ▲ REUSE ▲ RESTORE	Project: LEADVILLE MILL
	Title: EMERGENCY CONTAINMENT SUMP PLAN VIEW & LEAK DETECTION
	Location: LAKE COUNTY, CO
	Date: 5/28/2012 · Project no.: · Exhibit: 4-3 · REVISION B

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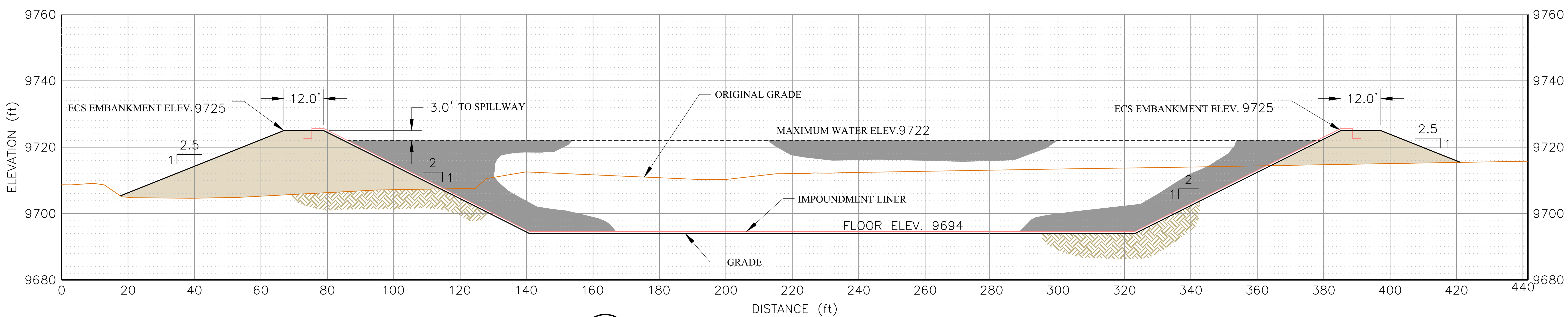
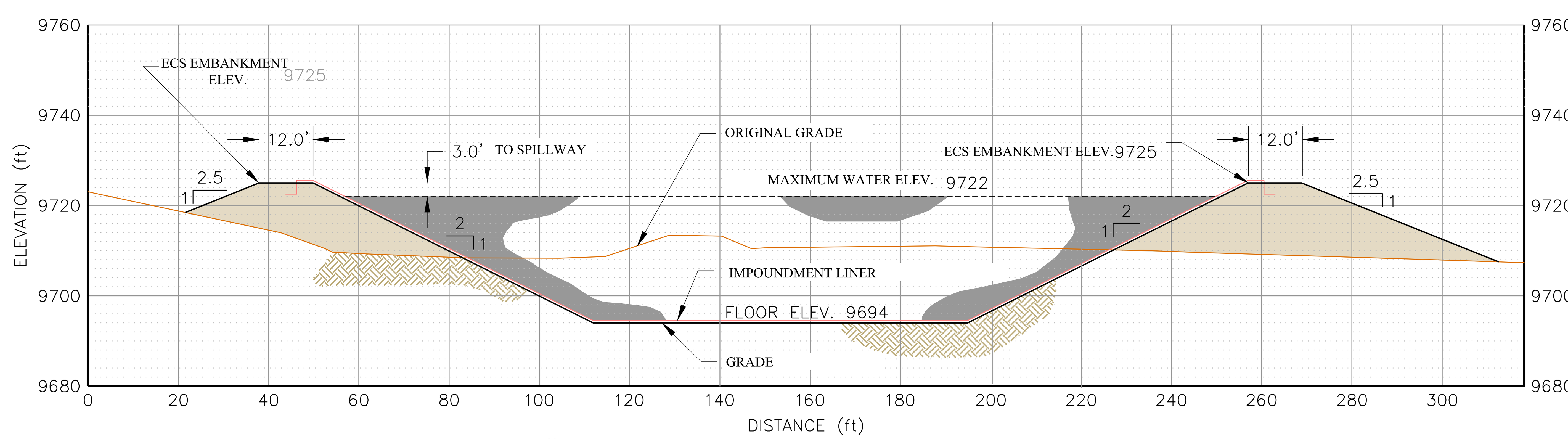


A 02 04 EMERGENCY CONTAINMENT SUMP CROSS SECTIONS



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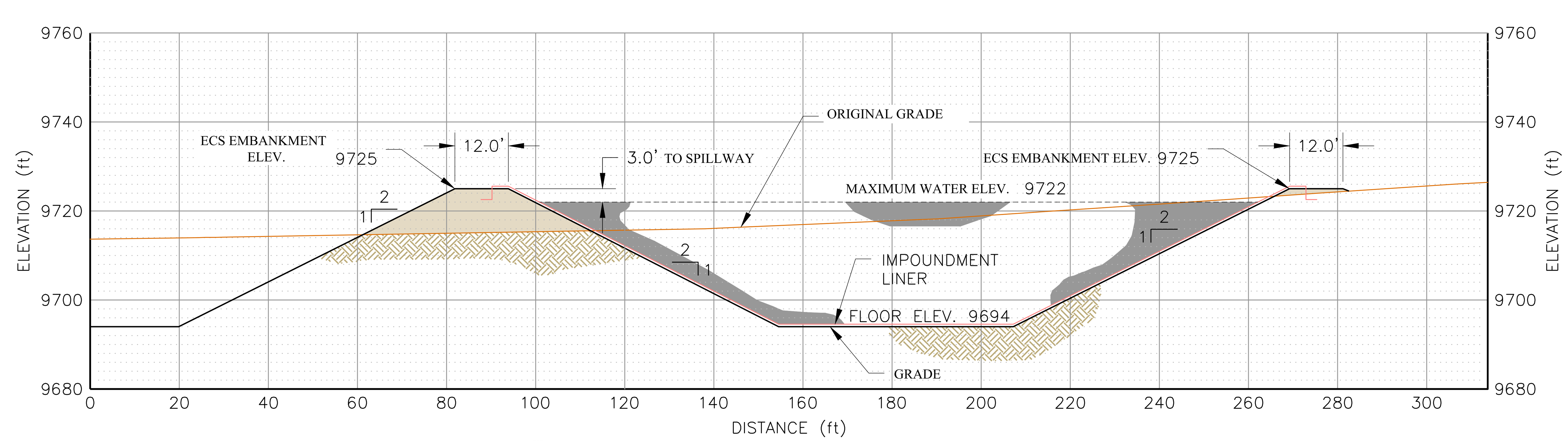

C 03 04 EMERGENCY CONTAINMENT SUMP CROSS SECTIONS

This document was prepared by me or under my direct supervision and the information presented is true and correct to the best of my knowledge and belief.

J. Michael Elder, PE
Colorado Registered Professional Engineer 15803

(Seal: Colorado Registered Professional Engineer, J. Michael Elder, 15803)

Issued by: CJK MILLING — REMOVE ▲ REUSE ▲ RESTORE

Project:	LEADVILLE MILL
Title:	EMERGENCY CONTAINMENT SUMP (ECS) CROSS SECTIONS
Location:	LAKE COUNTY, CO
Date:	5/13/2011
Project no.:	
Exhibit:	4-4
Revision	A

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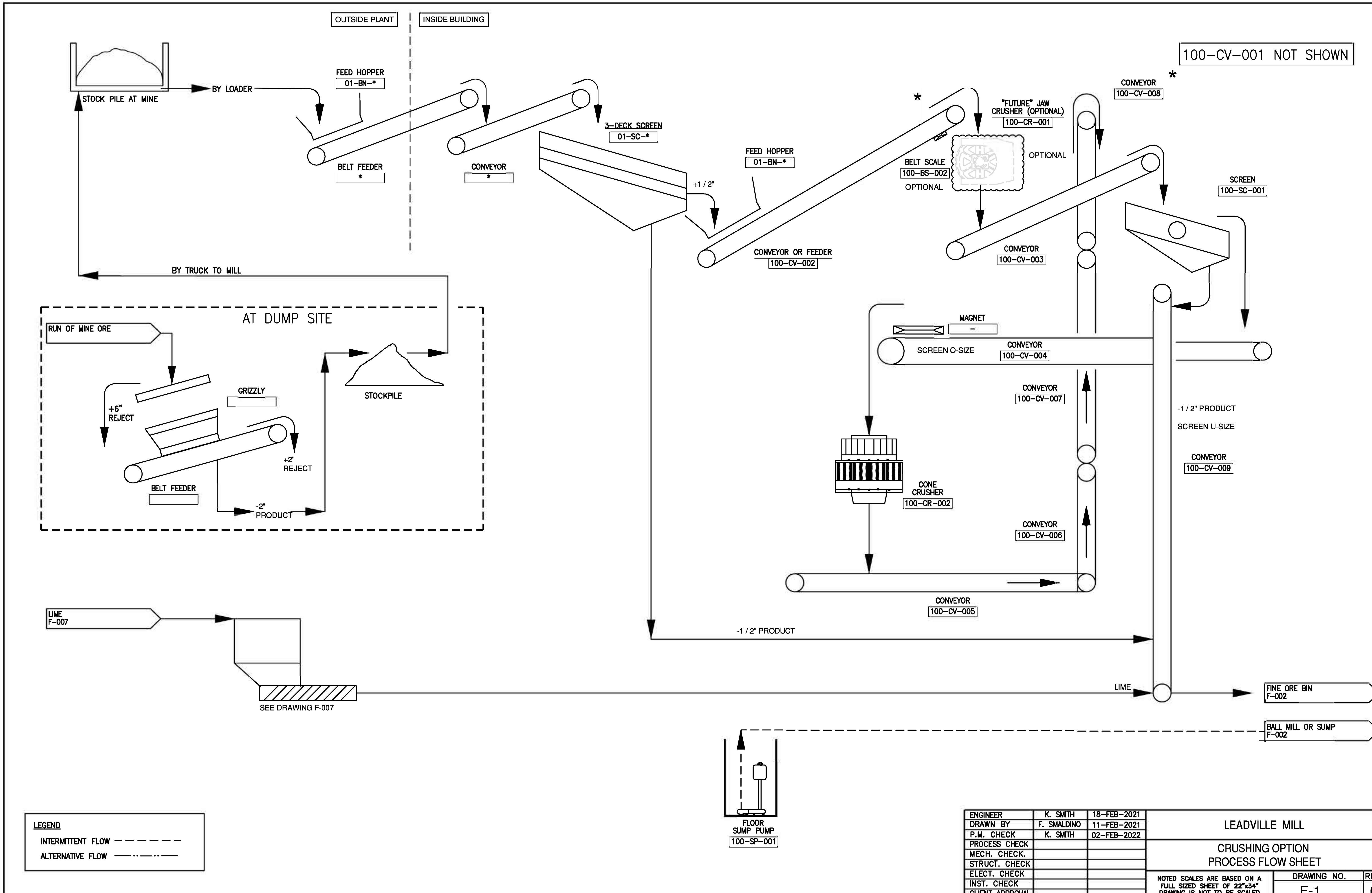
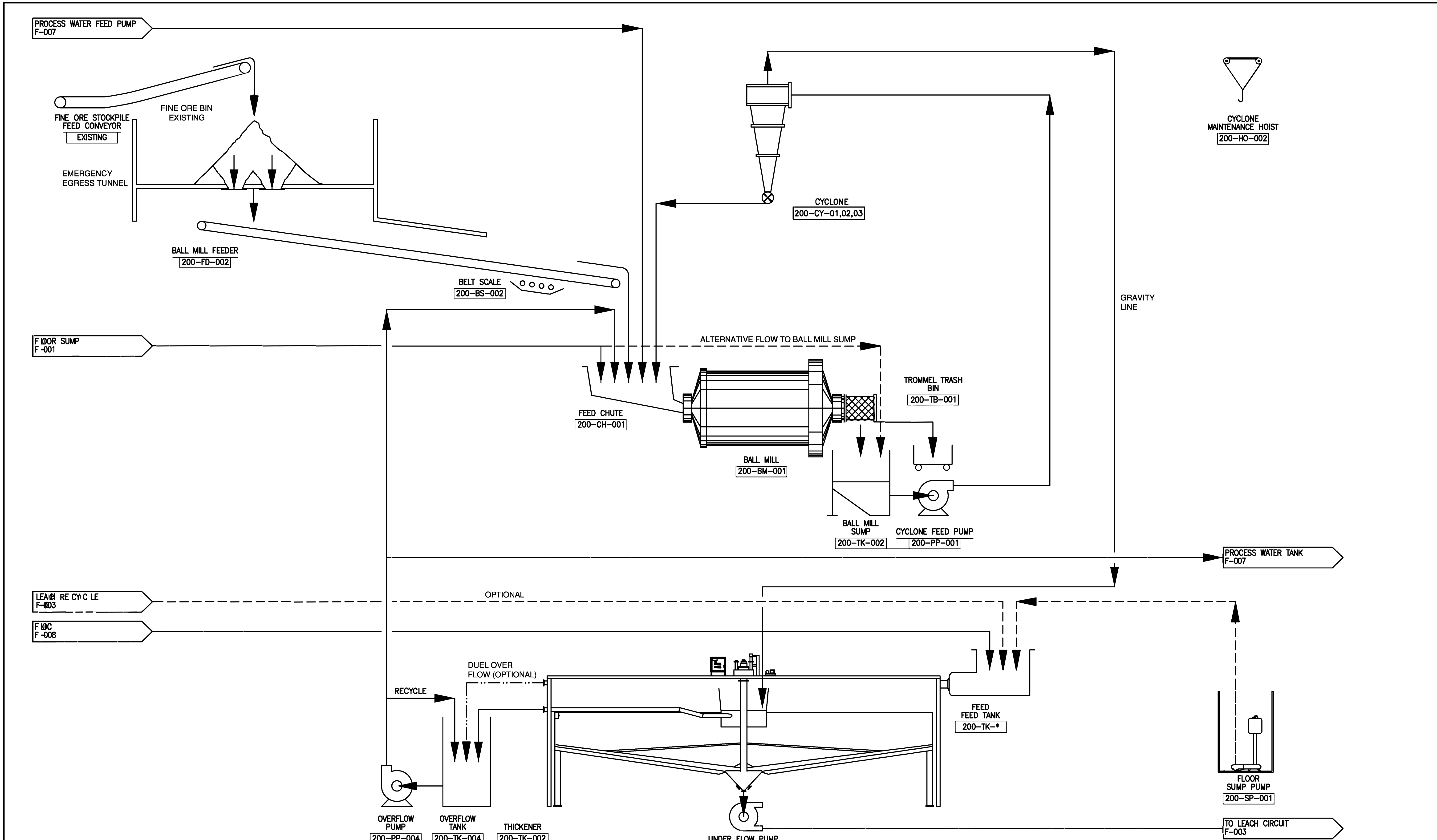
APPENDIX 4-1

PROCESS FLOW DIAGRAMS


OUTSIDE PLANT
INSIDE BUILDING
100-CV-001 NOT SHOWN
STOCK PILE AT MINE
BY LOADER
FEED HOPPER
01-BN-*
BELT FEEDER
*
CONVEYOR
*
3-DECK SCREEN
01-SC-*
+1 / 2"
FEED HOPPER
01-BN-*
CONVEYOR OR FEEDER
100-CV-002
*
BELT SCALE
100-BS-002
OPTIONAL
"FUTURE" JAW
CRUSHER (OPTIONAL)
100-CR-001
OPTIONAL
CONVEYOR
100-CV-003
CONVEYOR
100-CV-008
*
SCREEN
100-SC-001
BY TRUCK TO MILL
AT DUMP SITE
RUN OF MINE ORE
GRIZZLY
+6"
REJECT
+2"
REJECT
BELT FEEDER
-2"
PRODUCT
STOCKPILE
MAGNET
–
SCREEN O-SIZE
CONVEYOR
100-CV-004
CONVEYOR
100-CV-007
-1 / 2" PRODUCT
SCREEN U-SIZE
CONVEYOR
100-CV-009
CONE
CRUSHER
100-CR-002
CONVEYOR
100-CV-006
CONVEYOR
100-CV-005
LIME
F-007
SEE DRAWING F-007
-1 / 2" PRODUCT
LIME
FINE ORE BIN
F-002
BALL MILL OR SUMP
F-002
FLOOR
SUMP PUMP
100-SP-001
LEGEND
INTERMITTENT FLOW
ALTERNATIVE FLOW
ENGINEER K. SMITH 18-FEB-2021
DRAWN BY F. SMALDINO 11-FEB-2021
P.M. CHECK K. SMITH 02-FEB-2022
PROCESS CHECK
MECH. CHECK.
STRUCT. CHECK
ELECT. CHECK
INST. CHECK
CLIENT APPROVAL
LEADVILLE MILL
CRUSHING OPTION
PROCESS FLOW SHEET
NOTED SCALES ARE BASED ON A FULL SIZED SHEET OF 22"x34" DRAWING IS NOT TO BE SCALED
DRAWING NO.
F-1
REV.
0



ENGINEER	K. SMITH	18-FEB-2021
DRAWN BY	F. SMALDINO	11-FEB-2021
P.M. CHECK	K. SMITH	02-FEB-2022
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

GRINDING CIRCUIT
PROCESS FLOW SHEET

NOTED SCALES ARE BASED ON A FULL SIZED SHEET OF 22"x34" DRAWING IS NOT TO BE SCALED

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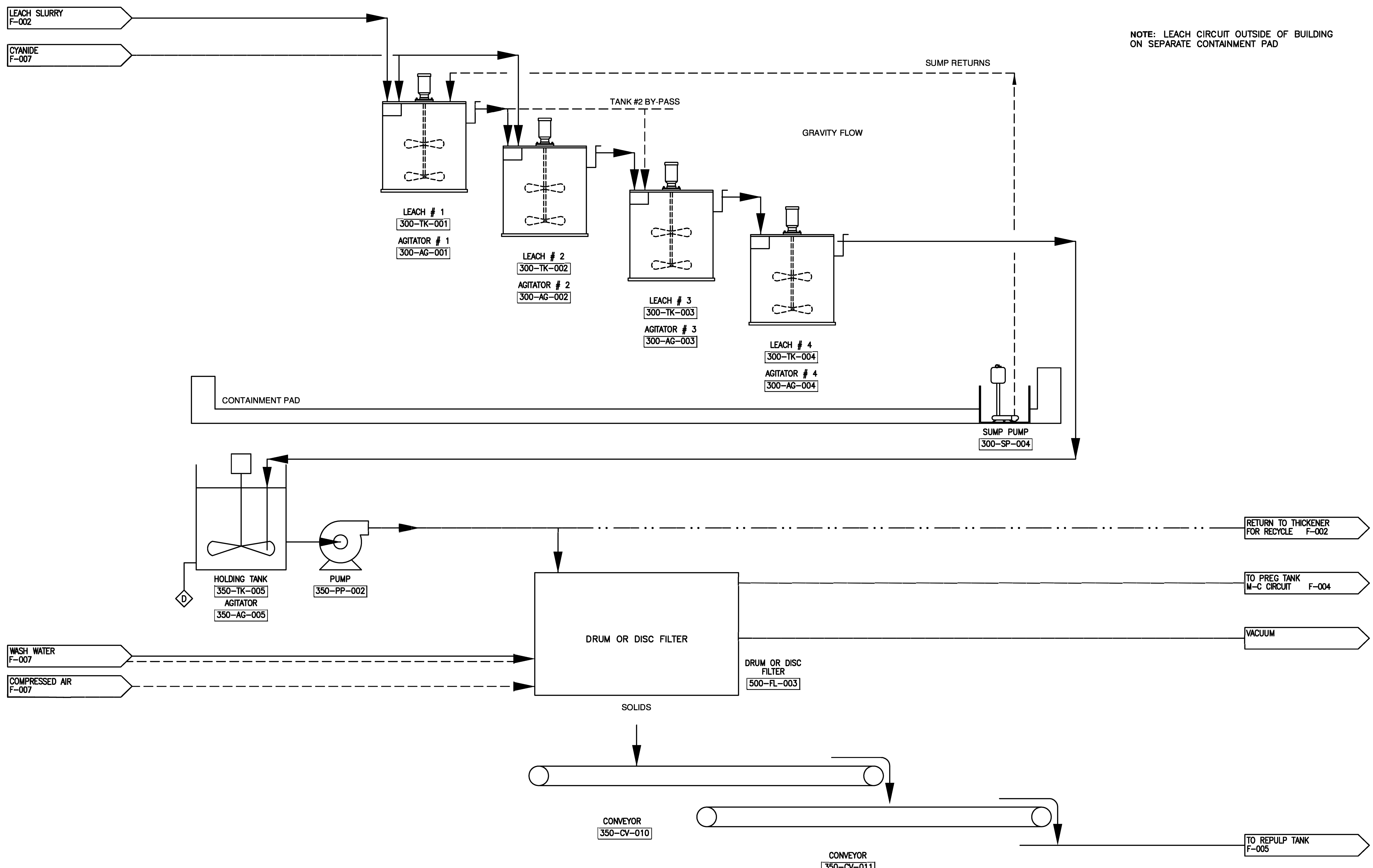

LEGEND

INTERMITTENT FLOW — — — —

ALTERNATIVE FLOW —··—··—

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P.M. CHECK	K. SMITH	02-FEB-2022
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

LEACH CIRCUIT
PROCESS FLOW SHEET

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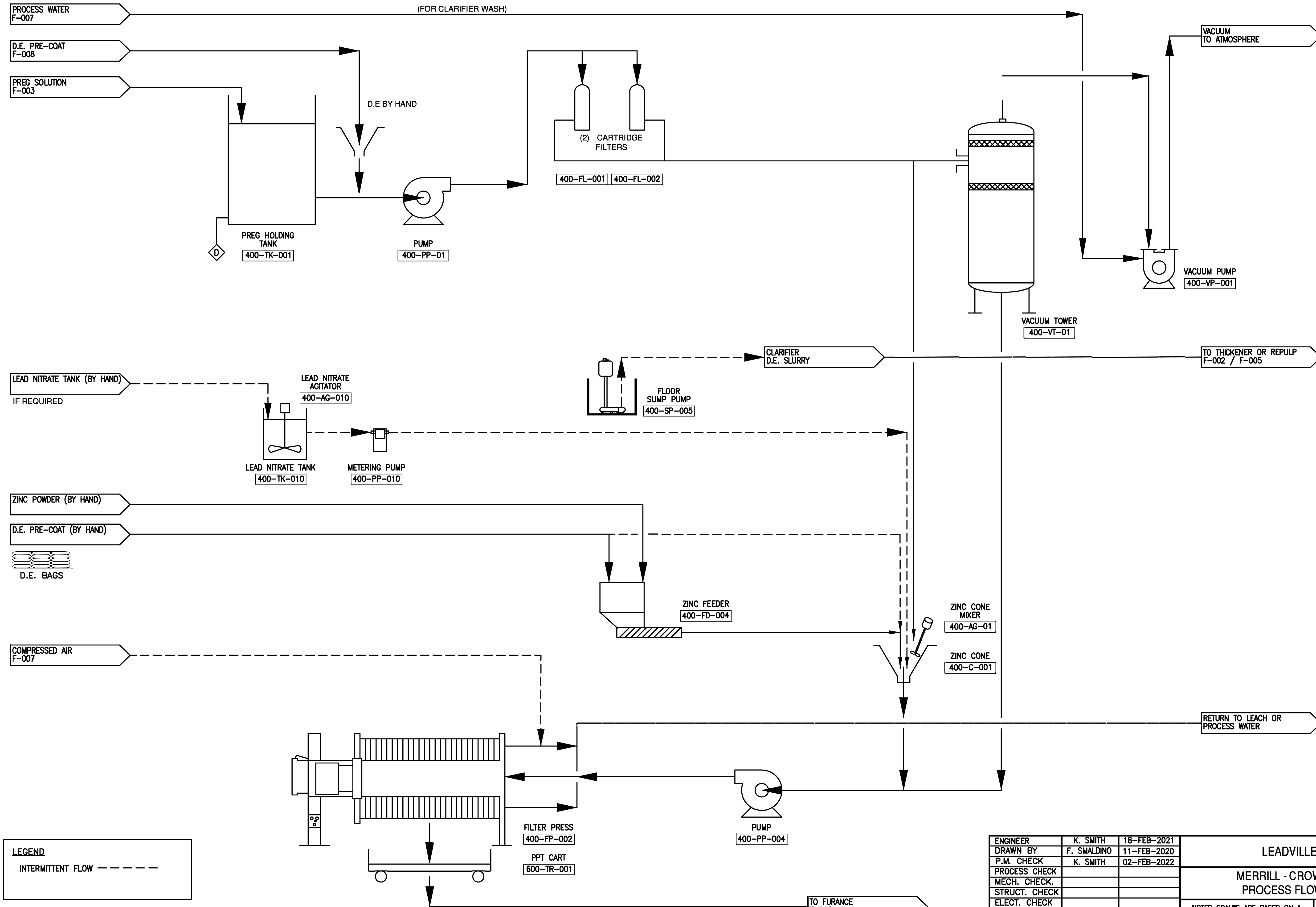

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P.M. CHECK	K. SMITH	02-FEB-2022
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

MERRILL - CROWE CIRCUIT
PROCESS FLOW SHEETS

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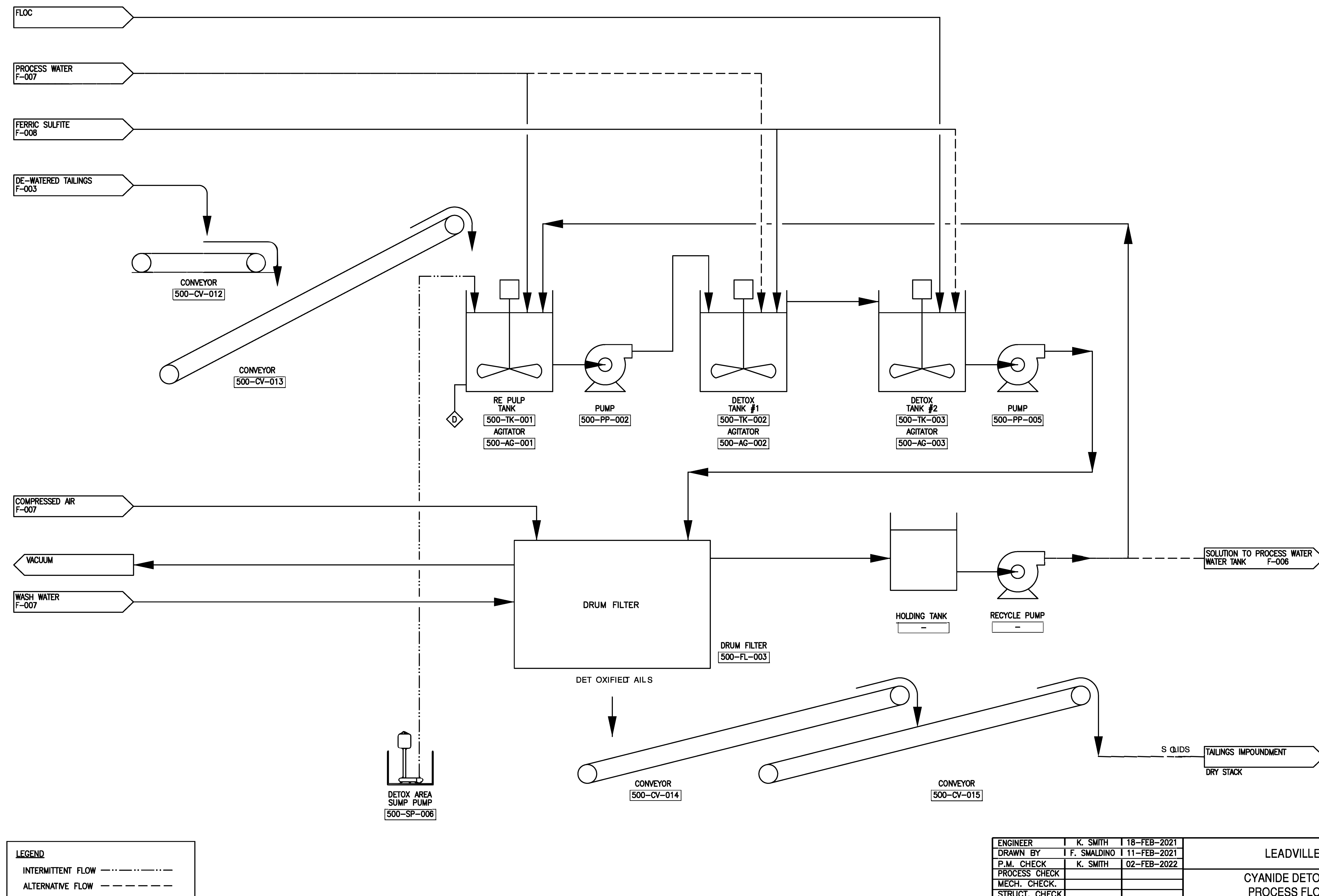
DRAWING NO. F-4

REV. 0



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PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

CYANIDE DETOX CIRCUIT
PROCESS FLOW SHEET

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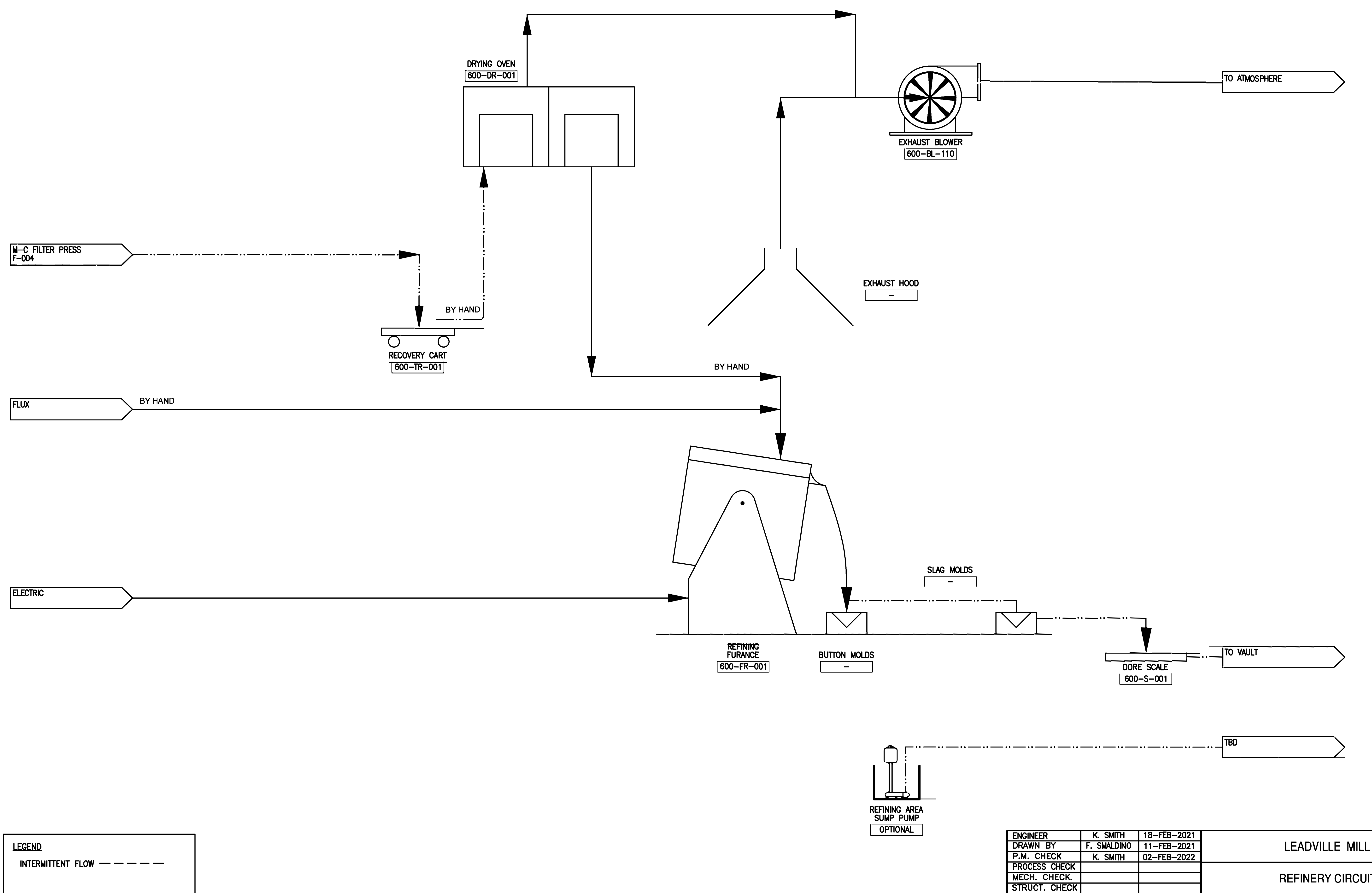

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DRAWN BY	F. SMALDINO	11-FEB-2021
P.M. CHECK	K. SMITH	02-FEB-2022
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

REFINERY CIRCUIT

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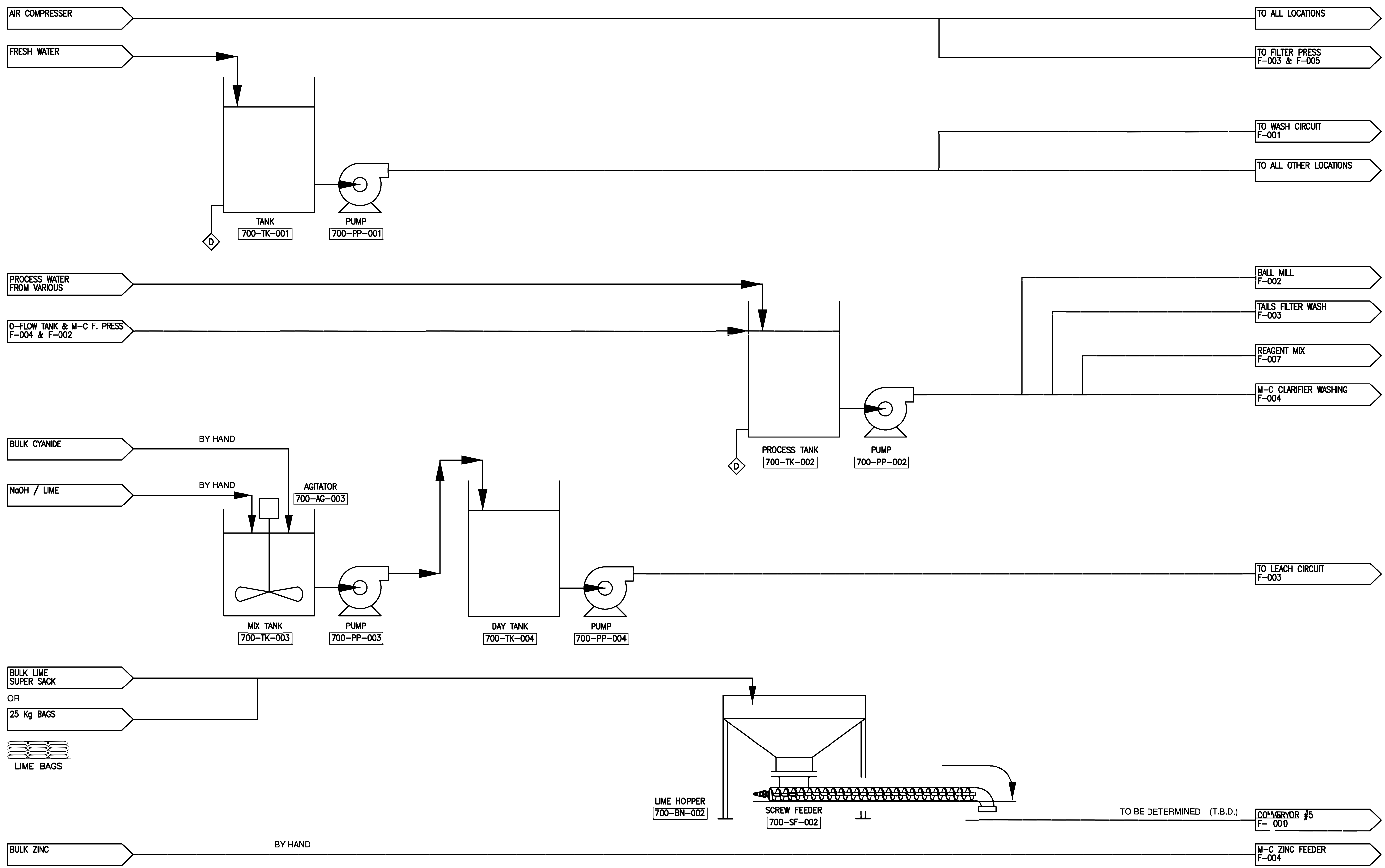

LEGEND

INTERMITTENT FLOW — — — — —

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PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

REAGENT & UTILITIES PAGE 1 OR 2
PROCESS FLOW SHEETS

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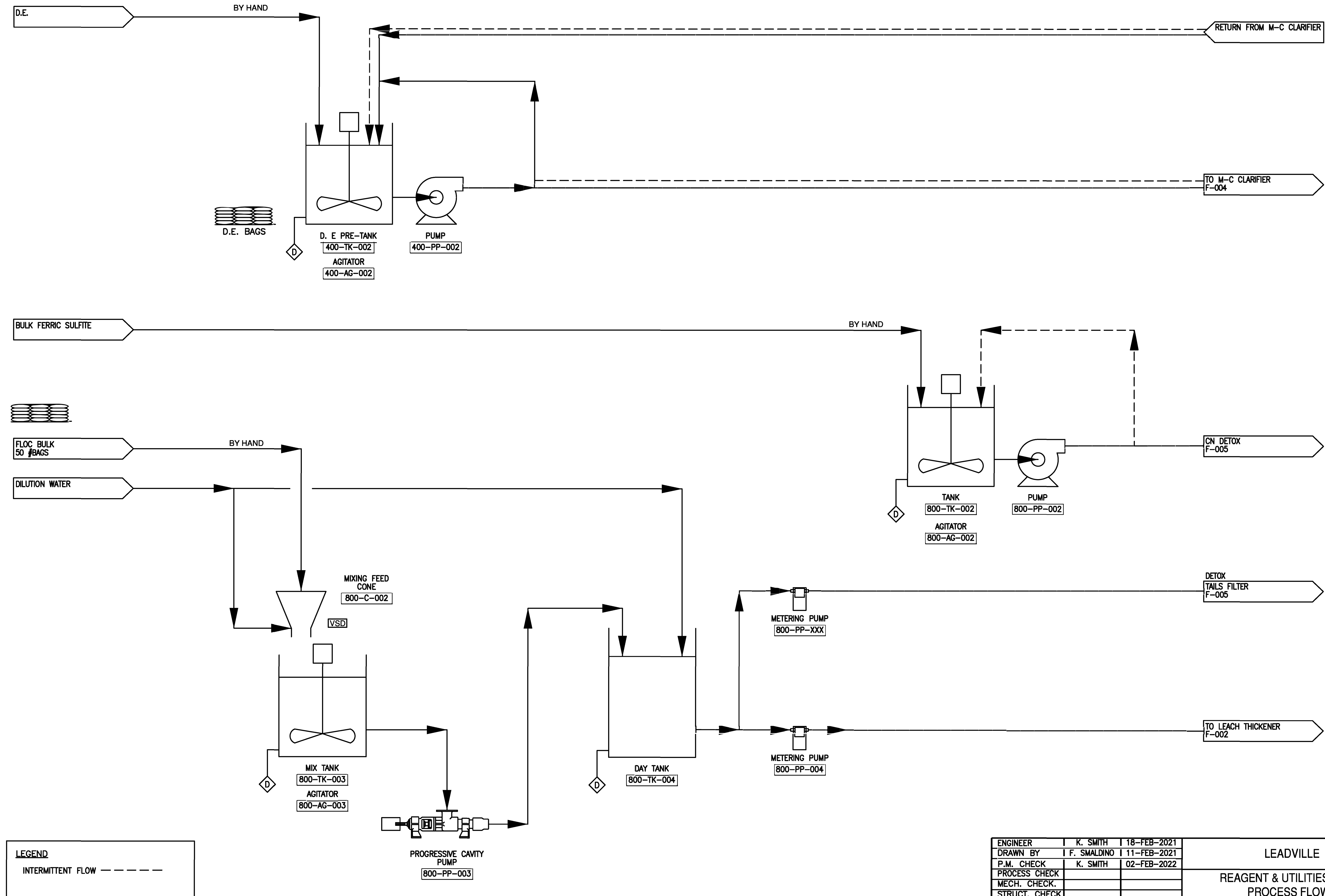

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PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LEADVILLE MILL

REAGENT & UTILITIES PAGE 2 OF 2
PROCESS FLOW SHEET

NOTED SCALES ARE BASED ON A FULL SIZED SHEET OF 22"x34" DRAWING IS NOT TO BE SCALED

DRAWING NO.	REV.
F-8	0

APPENDIX 4-2

FILTERED TAILINGS DEPOSIT MANAGEMENT PLAN

CJK MILLING COMPANY, LLC
33084 BERGEN MOUNTAIN ROAD
EVERGREEN, CO 80439

Filtered Tailings Deposit Management Plan
Leadville Mill

December 2022

Prepared by

Union Milling Contractors, LLC
P.O. Box 620490
Littleton, CO 80162-0490

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1.0 PURPOSE

The purpose of this report is to provide a guidance manual for the removal, handling, and permanent placement of tailings at the Leadville Mill operation. It is important that proper procedures be followed in various steps in the process:

- Accepting tailings from the mill based on moisture content and pH,
- Procedures for attaining proper compaction of the tailings and waste rock,
- Measuring and documenting compaction of the tailings,
- Dealing with frozen conditions at site,
- Permanent pile configuration, including slopes, benches, drainage ditches and diversions, and
- Topsoil placement and revegetation of the permanent embankment.

2.0 TAILINGS ACCEPTANCE CRITERIA

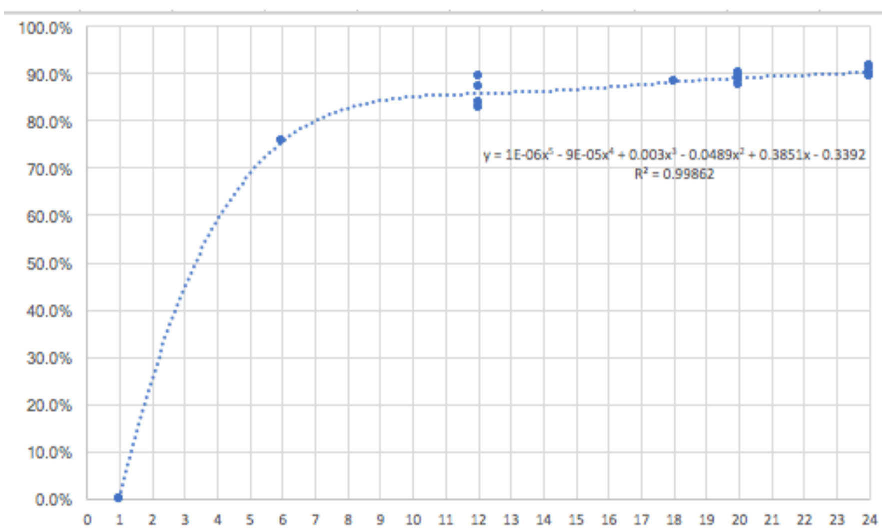
Wet tailings are produced in the cyanide detoxification (CN Detox) process, after gold and silver are recovered in elution. Tailings in the 4,300-gallon CN Detox tank at approximately 30%-40% solids will be pumped to the filter plant, where a disk filter will remove water to produce about a 20% to 25% filtered tailings product assuming a filter cake thickness less than 20mm. Water recovered in the filter process will be recycled back to the process plant. The filtered tailings will be conveyed to the Tailings Deposit for permanent storage.

Table 2-1: Filtration Data

Sample Teat	Cake Thickness (mm)	Filter Cake (% Solids)	Filtration Rate (lbs_{dry}/ft^2-hr)
1 (Vacuum)	9.0	73.1%	97.0
2 (Vacuum)	20.0	71.4%	29.6
3 (Vacuum)	9.0	75.6%	56.9
4 (Vacuum)	19.0	75.2%	22.4
5 (Pressure)	8.0	80.6%	448.2
6 (Pressure)	8.0	82.2%	544.4
7 (Vacuum)	4.8	75.4%	91.7
8 (Vacuum)	22.0	71.5%	155.4
9 (Vacuum)	22.0	71.5%	421.5

It is expected that tailings production could be in a range of 12,000 tons per month. Tailings will be processed in a ball mill to P_{80} 100-mesh and leached for about 18-hours, as required to maximize gold recovery. See **Graph 2-1**.

Graph 2-1: Gold Recovery (%) vs. Leach Time (hrs)



TCLP and RCRA Metals tests shown in **Table 2-2** and **Table 2-3** respectively show that tailings that will be produced at the Mill will be inert. If there are significant deviations from these tailings, this must be evaluated through a new SPLP test.

Table 2-2: Mill Tailings TCLP Results

EPA Waste No.	Hazardous Constituent	Standard (mg/l)	ALS Test Result (mg/l)	% of Standard
D004	Arsenic	5.000	0.045	0.90%
D005	Barium	100.0	0.182	0.18%
D006	Cadmium	1.000	0.008	0.80%
D007	Chromium	5.000	0.020	0.40%
D008	Lead	5.000	0.037	0.74%
D009	Mercury	0.200	0.00975	4.88%
D010	Selenium	1.000	0.050	5.00%
D011	Silver	5.000	0.010	0.20%

Table 2-3: RCRA Metals Results

Hazardous Constituent	Final Residue Solids (ppm)	TCLP Leachate (ppm)	Limit (ppm)	% Reporting to Final Leachate Residue
Barium	520	0.182	100.	0.04%
Lead	1,500	0.037	5.00	0.00%
Silver	13	0.010	5.00	0.08%
Arsenic	340	0.045	5.00	0.01%
Cadmium	1.6	0.008	1.00	0.50%
Chromium	14	0.020	5.00	0.14%
Selenium	1	0.050	1.00	5.00%
Mercury	5.2	0.00975	0.20	0.19%

These results represent process flow sheet expectations.

2.1 RULES

1. Tailings can only be accepted by the surface crew in charge of removing and placing the tails in the embankment when the tails are between13.0% to18.5% moisture and a pH between 7.5 and 10.5. These tests must be performed in the concrete floor of the filter bays, where the tails drop from the filter presses. They cannot be performed after the material has been removed from the filter bays. They also should not be performed before the material enters the filter bays unless it is 100% guaranteed that no wash downs or any other process could add moisture after the tests are made earlier in the mill process. Tails pH will be tested using an Orion Star A321 or similar portable meter and electrode at the same time the moisture reading is taken. Trial compaction tests at higher moisture levels can be performed on site and if these tests attain the 94% (TBD) compaction required, a higher moisture will then be allowed, and this document can be modified.

2. If the material is within the limits described in No. 1 above, the material can be removed from the filter building and placed in the tailings deposit.

3. Moisture tests should be performed at the frequency of 5 or more tests per 12-hour shift or once per 100 tons until such time as consistency warrants less frequent testing. If the average of these tests is within the moisture limit, the material in the filters is acceptable to be removed to the piles. If this average is above these limits, see No. 4 below.

4. This rule assumes that a true maximum moisture limit has been found from trial compaction tests on site. If the material is not within these moisture limits, the following procedures will be followed:

   a. If the material is within 1.5% of the moisture limit, and if known material of acceptable moisture exists on the piles and is available to mix with this slightly higher moisture material, then it can be removed and blended at the tailings deposit. The Troxler density tests will also record moisture to determine if the proper compaction can be achieved.

   b. If the material is within 1.5% of the moisture limit, and the time of year may allow drying of the material on the surface of the tailings deposit, the material can be loaded out from the filters and allowed to dry in the sun in a shallow lift. This should not be done with any large volume of material since there is such limited room on site.

   c. If the material is more than1.5% above the maximum moisture limit, it must be placed in the concreted apron area to be re-introduced in the filter circuit. Very wet material cannot be accepted for compaction in the piles. Required compaction in the two piles must be achieved at all times.

5. Average moisture content testing procedure using the provided protocol supplement is required (TMP001). Moisture testing is to be performed by trained tails management personnel using the ICT MPKit-406 Soil Moisture Instant Reading Kit. This information is provided in **Annex 3**.

6. Tests sheets are provided in **Annex 4** should be filled out for every test and kept on site in a bound Tailings Notebook.

7. If, or any reason, mill personnel believe that there is a significant change in chemistry or the size consistency of the tails, the mine management and the engineer that certifies the tailings embankment must be notified to determine if any further action or testing is required.

8. SPLP tests of the tailings are to be done every 6 months or sooner if there is reason to believe that the tailings have changed in chemistry or size consistency. These tests should be performed by the Mill Manager or other qualified personnel.

   a. Tailings from the mill must not be overloaded in such a way that spillage occurs. Any spillage of tails must be removed and taken to the Tailings Deposit.

3.0 TAILINGS COMPACTION PROCEDURE

Tailings must attain a compaction of 94% (TBD) maximum dry density according to ASTM Standard D698 (TBD) to attain proper compaction. Compaction test equipment must be on hand at all times to test the material after compaction. There are many types of equipment and methods to attain required compaction. Vibratory rollers or sheep's-foot compactors are very good in this type of material. Front end loaders will also normally get acceptable compaction if they are able to negotiate all areas of the pile during construction. A small manual operated vibratory compactor may be used for small areas that larger equipment cannot reach.

Lift thickness plays an important role in attaining good compaction. The smaller the lift thickness, the better chance of achieving proper compaction. Experimentation with the equipment, lift thicknesses and the number of passes that the equipment makes will determine what will be the most efficient method to attain the compaction. Higher lift thicknesses must avoid problems in creating a zone below the surface that is not compacted properly while the surface shows good compaction.

Initial geotechnical and permeability assumptions rely on work done for the initial TSF (now the ECS). It is reasonable to use this assumption given that the entire region consists of the same alluvial material.

3.1 RULES

1. The compacted tailings shall be tested for proper compaction at a minimum rate of one test per 100 tons until such time as procedures and methodology have been worked out. Once consistent equipment procedures are developed and tests show stable performance, testing can be reduced.

2. Frequency of the compaction testing of the tailings must be increased if there is reason to believe that some unusual condition exists, such as very high moisture content from rain or snow, etc.

3. Lift thicknesses should not be greater than 12 inches (TBD) followed by compaction using surface equipment. Compaction testing will then follow, and this will show if a greater lift thickness is possible. Frequency of testing is discussed in Section 4.

4. No compaction of tailings can take place if the air temperature is below 30°F. Tailings from the mill that are produced under these conditions are to be handled as described in Section 5. Proper compaction cannot take place in frozen conditions and the material must be temporarily stockpiled until conditions allow proper compaction.

4.0 MEASURING & DOCUMENTING TAILINGS COMPACTION

Since compaction testing will occur on an ongoing basis, it is required that a nuclear density Gauge be kept on site and utilized by a designated qualified person at the mine. The machine selected for this process is a Troxler 3440 or similar Gauge which has been widely accepted by the civil engineering community as an excellent on-site device that can accurately record compaction quickly. The tailings and waste rock mixture must attain a compaction of 94% (TBD) maximum dry density according to ASTM Standard D698 (TBD).

4.1 RULES

1. When conditions allow good compaction (more than 30°F), once a 12-inch thick lift is compacted over an area of approximately 3,000ft^2, a nuclear Gauge compaction test is required. The Operation Manual for the Troxler Gauge is included in Appendix B. This Gauge will be calibrated on site to report dry density of the material, which will then be compared to the xx% required for good compaction. This Gauge has radioactive material (cesium and americium) which require a special license for the purchase and operation of the instrument. The Gauge will also report the percent moisture of the test material. The Gauge cylinder penetrates 12 inches into the ground and this level should be consistently attained for every sample. If, during the penetration, the Gauge hits a rock before the 12-inch depth is attained, the Gauge should be pulled out and moved over until the 12-inch depth is reached.

2. If the Gauge reports a lower compaction than 94% (TBD), the moisture should be checked to see if it is in the range of13%to18%. If it is below 13%, it should be watered slightly. If it is too high, the material in this lift should be dozed and allowed to dry. In either case, the material can be re-spread in the 12-inch lift and re –tested for compaction and moisture. If the moisture is in the proper range but the 94% (TBD) is not achieved, this means that compaction has not been properly done and the surface equipment should be brought back to re -compact that lift.

3. Frequency of the compaction testing of the tailings must be increased if there is reason to believe that some unusual condition exists, such as very high a moisture content from rain or snow, etc.

4. For each compaction test, entries should be made in the forms included in **Annex 3**. These forms will document the percent dry density achieved, the moisture and the location of the test as well as the date. Completed forms should be kept in the Tailings Notebook.

5. Once consistent procedures have been developed and compaction has been achieved using the procedures above with little variability, site personnel can request a lowering of the frequency of the compaction testing to the professional engineer that will provide the as -built report to the CDRMS every year regarding the proper construction of the Tailings Deposit.

5.0 FROZEN CONDITIONS & TEMPORARY TAILINGS STORAGE

As stated above, proper compaction cannot be safely achieved if the air temperature is lower than 30°F. This will basically during the winter and some days in the fall and spring. Since these conditions will be encountered, all tailings and waste rock must be taken to a temporary storage area for compaction during warmer weather.

5.1 RULES

1. When air temperatures are less than 30°F, all tailings should be taken to a temporary stockpile area. This material should be spread, compacted and tested as soon as temperatures increase.

2. As temperatures rise there will be an amount of stockpiled material that will require compaction. Material stockpiled over the winter must be carefully reworked to ensure that no compaction is attempted on material that has frozen deep into the temporary stockpile.

6.0 FILTERED TAILINGS DEPOSIT CONFIGURATION & CONSTRUCTION

Filtered Tailings Deposit FTD specific design criteria are as follows.

6.1 RULES

1. Prior to expanding the FTD area (including any virgin ground areas), the perimeter of the base extent of the FTD should be surveyed and clearly marked for the construction.

2. Prior to stripping topsoil from the FTD, the collection ditches and Sediment Pond must be constructed according to the plans in **Annex 4**. Diversion ditches must also be installed to ensure that water from above the FTD is diverted. These diversion ditches can be installed at the edge of the FTD. The diversion ditch plans are also included in **Annex 4**.

3. All virgin areas should be grubbed of vegetation and then all topsoil must be salvaged to the extent practical. Topsoil thicknesses are expected to be approximately 1 to 4 inches. Suitable Plant Growth Material (SPGM) exists below the topsoil and can be 12 to 18 inches. Topsoil and SPGM can stockpiled for future reclamation. Grubbed vegetation (predominately slash from pine trees) can be mulched and added to the topsoil/SPGM during reclamation or disposed of in some other way.

4. Prior to storing any tails, the base area should be compacted using the surface equipment.

5. The design of both piles are based on installing horizontal lifts of no more than 12in, moving uphill to create a 3.5H:1V slope and every 10ft to 14ft vertically, a bench of 10ft width is placed to slightly tilt to the inside edge, where water will collect and run away from the outside slope of the FTD. The plans for these benches, slopes and ditches are shown in **Annex 4**.

6. As the FTD is constructed, it will be important to create a slight slope to the outside edge of all lift areas (except the 10ft-wide benches) so that no trapping of water and snowmelt builds up and seeps through the FTD. There should be no puddles or anything that can trap water in the embankment. The benches will drain to the sides and carry water from the pile to the Sediment Pond.

7. Surveying should confirm locations of benches and slopes as the FTD expands.

7.0 TOPSOIL PLACMENT & REVEGETATION

As the final graded slopes of FTD are created, topsoil placement must occur followed by seeding. Design criteria regarding the area of the FTD ae as follows.

7.1 RULES

1. Prior to topsoil placement, the slopes and benches to be covered should be graded and checked for slope accuracy and bench locations, width, etc. If this is acceptable, cover can be applied. This should occur in the fall, if possible. There is a shortage of topsoil/SPGM within the site so some material, primarily mulch, will have to be imported to complete the full extent of the FTD.

2. Topsoil should be placed in 6 to 12- inch lifts and should not be compacted. Some vegetation mixed with the soil is acceptable.

3. The area of topsoil cover is dependent upon available material, and the amount of area done at each year is at the discretion of the mill manager. However, it is best to cover as much regraded area as possible, once the regrading is complete. The topsoil does not need to be smooth; it is better if it is slightly rough, which gives the seed good places to get trapped and take root.

4. Once topsoil cover of an area is completed, seeding should take place in late September. Seeding should be done by either broadcast seeding or hydro seeding. Fertilizer can be applied to the area as well using broadcast methods or can be a part of the mixture in the hydro seeding tank brought to the site by the contractor. A tackifier will also be used by the hydro seeding contractor if this method is used.

5. The seed mix to be used is specified in the permit in the table below. Note this table is also presented in **Mine Reclamation Permit M1990-057, Exhibit E, Section 5.5.**

RECLAMATION SEED MIX

Species	Scientific Name	Variety	Pls lbs./Acre
Yarrow	Achillea Lanulosa	-	0.1
Groundsel	Senecio Atratus	-	0.1
Lupine	Lupinus Perennial Lupine	-	1.0
Slender Wheatgrass	Elymus Trachycaulus	San Luis	1.4
Nodding Brome	Bromus Anomalus	-	2.5
Sheep Fescue	Festuca Ovina	Covar	0.5
Hard Festuca	Festuca Ovina Duriuscula	Durar	0.5
Red Fescue	Festuca Rubra	Penniawn	0.5
Tufted Hairgrass	Deschampsia Caespitosa	-	0.5
Redtop	Agrostis Alba	-	0.1
Blue Wildrye	Elymus Glaucus	-	1.75
Muttongrass	Poa Fendleriana	-	0.5
		Total pls lbs./acre (drilled)	**9.45**

The rates above are for dill seeding. Seed application rates will be doubled when using broadcast methods.

6. In the summer following seeding, an evaluation of the success of the seeding will be made by the engineer certifying the embankment and some adjustments to the seed mix may be made.

ANNEX 1
SAVE FOR FUTURE USE

ANNEX 2

TROXLER NUCLEAR GAUGE MANUAL & PROCEDURES

MODEL 3440 SURFACE MOISTURE-DENSITY GAUGE

Specifications

Measurement (U.S. Customary Units)			
Direct Transmission Density (6")	**15 sec.**	**1 min.**	**4 min.**
Precision at 120 pcf	±0.42 pcf	±0.21 pcf	±0.11 pcf
Composition error at 120 pcf	±1.25 pcf	±1.25 pcf	±1.25 pcf
Surface error (0.05", 100% Void)	-1.1 pcf	-1.1 pcf	-1.1 pcf
Backscatter (98%) (4")	**15 sec.**	**1 min.**	**4 min.**
Precision at 120 pcf	±1.00 pcf	±0.50 pcf	±0.25 pcf
Composition error at 120 pcf	±2.50 pcf	±2.50 pcf	±2.50 pcf
Surface error (0.05", 100% Void)	-4.7 pcf	-4.7 pcf	-4.7 pcf
Moisture at 15 pcf	**15 sec.**	**1 min.**	**4 min.**
Precision at 15 pcf	±0.64 pcf	±0.32 pcf	±0.16 pcf
Surface error (0.05", 100% Void) Depth of measurement @ 15 pcf (8.45")	-1.12 pcf	-1.12 pcf	-1.12 pcf
Measurement (S.I. Units)			
Direct Transmission Density-150mm	**15 sec.**	**1 min.**	**4 min.**
Precision at 2000 kg/m3	±6.8 kg/m3	±3.4 kg/m3	±1.7 kg/m3
Composition error at 2000 kg/m3	±20.0 kg/m3	±20.0 kg/m3	±20.0 kg/m3
Surface error (1.25mm, 100% Void)	-17.0 kg/m3	-17.0 kg/m3	-17.0 kg/m3
Backscatter (98%) (100mm)	**15 sec.**	**1 min.**	**4 min.**
Precision at 2000 kg/m3	±16.0 kg/m3	±8.0 kg/m3	±4.0 kg/m3
Composition error at 2000 kg/m3	±40.0 kg/m3	±40.0 kg/m3	±40.0 kg/m3
Surface error (1.25mm, 100% Void)	-75.0 kg/m3	-75.0 kg/m3	-75.0 kg/m3
Moisture	**15 sec.**	**1 min.**	**4 min.**
Precision at 250 kg/m3	±10.3 kg/m3	±5.1 kg/m3	±2.6 kg/m3
Surface error (1.25mm, 100% Void) Meas. Depth @ 250 kg/m3 - 212.5mm	-18.0 kg/m3	-18.0 kg/m3	-18.0 kg/m3
Calibration			
Accuracy of Density Standards	±0.2%		
Accuracy of Moisture Standards	±2.0%		
Calibration Range	70-170 pcf (1100-2700 kg/m3) Density 0-40 pcf (0-640 kg/m3) Moisture		

Radiological	
Gamma Source	8 mCi ±10% Cs-137
Neutron Source	0.060 mCi ±10% Cf-252 or 40 mCi ±10% Am-241:Be
Source Housing	Stainless Steel Encapsulation
Shielding	Tungsten, lead and cadmium
Surface Dose Rates	20.5 mrem/hr max., neutron and gamma
Source Rod Material	Stainless Steel
Shipping Case	DOT 7A, Type A
Sealed Source Approved for Domestic and International Shipments	Special Form
Mechanical	
Case	High Impact Plastic 29.5 L x 14 W x 17 T in.
Vibration Test	0.1 in. (2.5 mm) @ 12.5 Hz
Drop Test	300 mm on 25 mm diameter steel ball
Operating Temp:	Ambient: 14 to 158°F (-10 to 70°C) Surface: 350°F (175°C)
Storage Temp.	-70 to 185°F (-55 to 85°C)
Gauge Size (no handles)	14.8 x 9.1 x 7.2 in. (376 x 231 x 183 mm)
Gauge Height (with handles)	12": 23.25 in. (591 mm) 8": 19.25 in. (489 mm)
Weight	29 lbs. (13.2 kg)
Shipping Weight	90 lbs. (40.8 kg) w/case
Available Models	8" or 12" index rod with 1" or 2" increments (200 or 300 mm index rod with 25 or 50 mm increments)
Electrical	
Time Accuracy and Stability	0.005%, 0.0002% / °C
Power Supply Stability	0.01% / °C
Stored Power	30 watt hours
Battery Recharge Time	14-16 hours (automatic cutoff)
Charger	110/220 VAC, 50-60 Hz or 12-14 V DC
Readout	4 x 16 alpha-numeric liquid crystal display

Notes:

Gauge returns to Gauge Ready (power saving mode) after two minutes of inactivity, except in standard, stat test, drift test, and in nomograph programs when a 30-minute delay is provided. After 5 hours of inactivity, gauge performs complete power shutdown.

Battery packs are fully protected against overcharge and over discharge. Remaining battery voltage is indicated on the display.

Emergency Use - Capable of operation with D size alkaline batteries.

ANNEX 3

MOISTURE METER MANUAL & PROCEDURES

MP406 Moisture Probe Operation Manual

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1. Introduction

The MP406 Moisture Probe can be used to measure the moisture content in many materials such as soil, food and materials used in roadway and building construction.

The MP406 can be used to measure the soil moisture for scientific research or irrigation management. In either situation the MP406 can:
- rapidly measure the soil moisture by pushing the needles of the sensor into the soil surface or soil profile;
- make measurements over time by permanently burying the MP406 and connecting it to a data logger;
- control irrigation by permanently burying the MP406 and connecting it into an irrigation controller.

2. Operation

2.1 Hand Held Moisture Probe Meter

The MP406 has a connector which plugs directly into the MPM-160 hand held meter for direct readout.

The meter provides the power to the MP406 for the reading, display and storage of measurements. The returned mV signal is displayed directly as mV and is also converted and displayed as Volumetric Water Content (VSW%). Refer to section 2.4.4 for the conversion table.

When being used with a hand held meter the MP406 is usually connected to a set of chrome extension rods which have a T handle on the end.

The extension rods enable the operator to insert the needles of the MP406 into the soil surface without bending over and then for him to more conveniently read the MPM-160 meter.

2.2 Data Logging or Irrigation Control

2.2.1 General

The MP406 exterior is made from extremely durable ABS plastic formed into a custom designed tube. The electronics is totally sealed within this tube. The needles are made from high quality stainless steel. Then the MP406 can be buried permanently at a location as part of either an input to a data logging system or for an input to an irrigation controller or environmental monitoring system.

2.2.2 Installation

The MP406 can be installed by drilling a close fitting hole into the soil profile, either at an angle or vertically or it can be installed horizontally from a larger augered hole or soil pit. In all situations care must be taken to ensure the needles are in contact with soil profile after installation. It is usual practice to install the MP406 with the 3 needles in a horizontal plane in order to maximise the measurement of soil spatial variability. The MPM-160 meter should be used during the installation process to ensure good contact of the needles and the soil is maintained during back filling of the hole.

2.2.3 Cable Length

The standard cable length is 4.5 m. This may be extended by using suitable cable.

Multi Core Polypropylene Insulated Irrigation Control Cable, specifications 9 core (9 x 7/0.30) has been tested successfully over 500 m. Two wires were connected for power supply positive from the data logger to the MP406.

2.2.4 Power

The MP406 is normally powered by a voltage in the range 7.0 to 18.0 volts using 18 mA of power. It can function satisfactorily within the voltage limits of 7.0 to 18.0 volts provided 18 mA is maintained.

1 x MP406 = 32 mA (maximum power use)

5 seconds of warmup/hour = 5/3600 x 32 = 0.04 mAh

Total of 16 x MP406 = 16 x 0.04 mAh = 0.64 mAh

Logging for 24 hours on an hourly frequency = 0.64 x 24 = 15.36 mAh/day

Gel Cell Battery 7 Ah capacity. Then = 7/0.01536 = 455 days

In other words a Gel Cell battery is capable of supplying enough power for about 455 days. The battery would need to be recharged within about 30 days as it will self discharge in this time.

2.3 Theory of Operation

2.3.1 Theory

The MP406 has a high frequency moisture detector which uses the standing wave principle to indicate the ratio of two or more substances forming a body of material, each substance having a different electric constant (Ka).

The moisture measurement of the material is based upon the fact that in a water: soil: air matrix, the dielectric constant is dominated by the amount of water present. The dielectric constant of water is approximately equal to 80 whereas the dielectric constant of soil is approximately equal to 3 or 4 and air is equal to 1. Therefore any changes in the volume matrix ratio of water will result in a substantial change in the dielectric constant of the matrix. Then the soil water content can be measured exactly because changes in water content of the soil result in changes in the dielectric constant of the soil.

The material that can be measured by the MP406 is often soil but can be any composition of non-metallic powdered, liquid or solid phase substance into which the needles are inserted.

2.3.2 Results

The results from measurement of absolute volumetric soil water percent (VSW%) from prepared soil samples using the MP406 are given in Figure 1. This result is typical of the results obtained from comparative testing of the MP406 in prepared soil samples, for a wide range of agricultural soils.

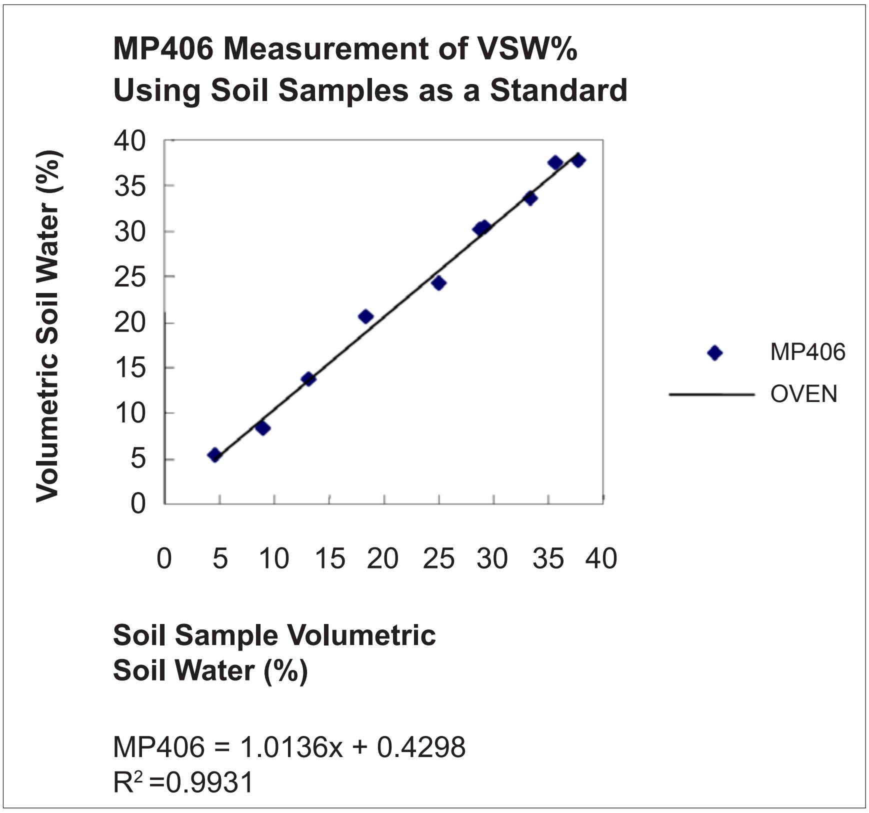


Figure 1. MP406 Measurement of Absolute Volumetric Soil Water Percent from Prepared Soil Samples as a Standard.

The results from measurement of the absolute volumetric soil water percent (VSW%) using the MP406 when compared with TDR technology are given in Figure 2. This result is typical of the results obtained from comparative testing of the MP406 compared to TDR technology for a wide range of agricultural soils.

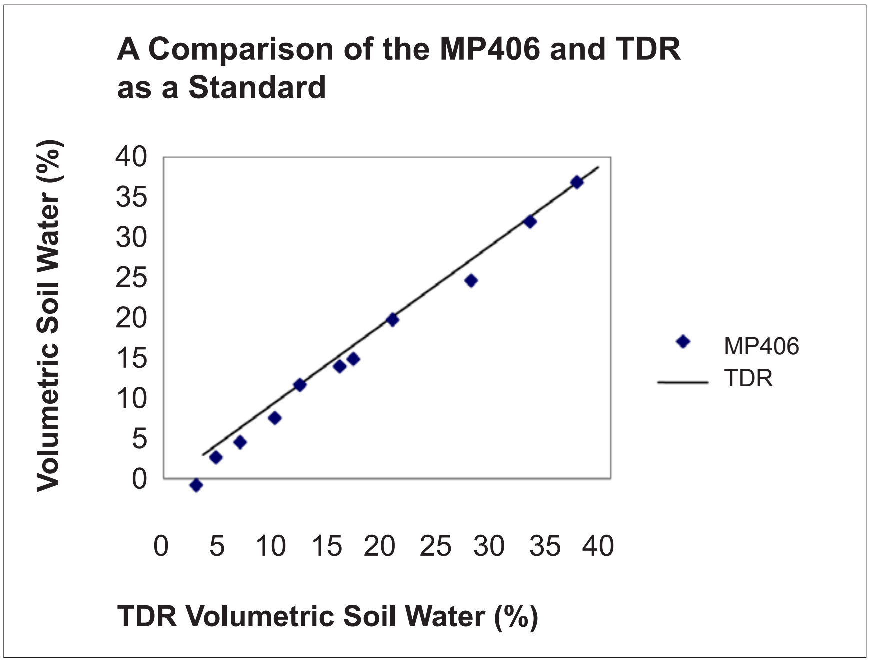


Figure 2. The MP406 in comparison to TDR Measurement of Absolute Volumetric Soil Water Percent as a Standard.

2.3.3 Definitions

Gravimetric Soil Water Content is defined as

$\theta_G = \frac{Mw}{Ms}$ Where Mw is the mass of water in the soil sample and Ms is the total mass of the dry soil sample.

Volumetric Soil Moisture Content is defined as

$\theta_V = \theta_G * Ps$ Where Ps is the bulk density of the soil sample $\left(= \frac{Ms}{Vs} \right)$

Where Ms is the total mass of the dry sample and Vs is the total volume of the dry soil sample.

Volumetric Soil Water Percent (VSW%)

$VSW\% = \theta v * 100$

The VSW% typically varies in the field from 2–5% for sandy soils at permanent wilting point to 45–55% for clay soils at saturation.

2.4.4 Polynomial Lookup Table

Linearisation tables can be added to Data Loggers using the following data:

A: Conversion Table for MP-406 - From VSW% to mV & mA in mineral soil.

VSW%	mV MP-406	mA MP-406	VSW%	mV MP-406	mA MP-406
-5.0	0.0	4.00	55.00	1015	18.50
2.00	120	5.71	60.00	1025	18.64
5.00	210	6.99	65.00	1035	**18.785**
10.00	310	8.43	70.00	1045	18.93
15.00	415	9.93	75.00	1055	19.07
20.00	510	11.285	80.00	1065	19.21
25.00	610	12.71	85.00	1070	19.28
30.00	720	14.285	90.00	1080	19.43
35.00	825	15.785	95.00	1095	19.64
40.00	895	16.785	100.00	1120	20.00
45.00	955	17.64	105.00	2090	
50.00	1005	18.35			

B: Polynomial Lookup Table for Organic and Mineral Soil

Soil moisture θ_v, $m^3.m^{-3}$	mV, organic soil	mV, mineral soil	soil moisture θ_v, $m^3.m^{-3}$	mV, organic soil	mV, mineral soil
-0.0	-209	-209	0.55	985	1015
0	50	120	0.6	1010	1025
0.05	140	210	0.65	1020	1035
0.1	230	310	0.7	1030	1045
0.15	320	415	0.75	1045	1055
0.2	415	510	0.8	1055	1065
0.25	500	610	0.85	1070	1070
0.3	600	720	0.9	1080	1080
0.35	700	825	0.95	1095	1095
0.4	800	895	1.0	1106	1106
0.45	875	955	1.05	2090	2090
0.5	940	1005			

2.5 Wiring

The MP406 is supplied with 4.5 m of four core shielded wire.

Wiring

Red = 7-16V dc

Blue and shield = Analogue Ground (Signal Return)

Yellow = signal +

Black = DC Ground

Moisture Probe Sensor Operation

MP406 & MP306 Soil Moisture Sensor

The MP406 and MP306 sensor has a high frequency moisture detector which uses the standing wave principle to indicate the ratio of two or more substances forming the body of a material, each substance having dielectric constant (Ka).

Water (Ka)	= 80
Clay (Ka)	= 3
Sand (Ka)	= 2
Air (Ka)	= 1

The moisture measurement of the material is based upon the fact that in a water, soil, air matrix, the dielectric constant is dominated by the amount of water present. Soil water content can be measured exactly as changes in the water content of the soil result in changes in the dielectric constant of the soil.

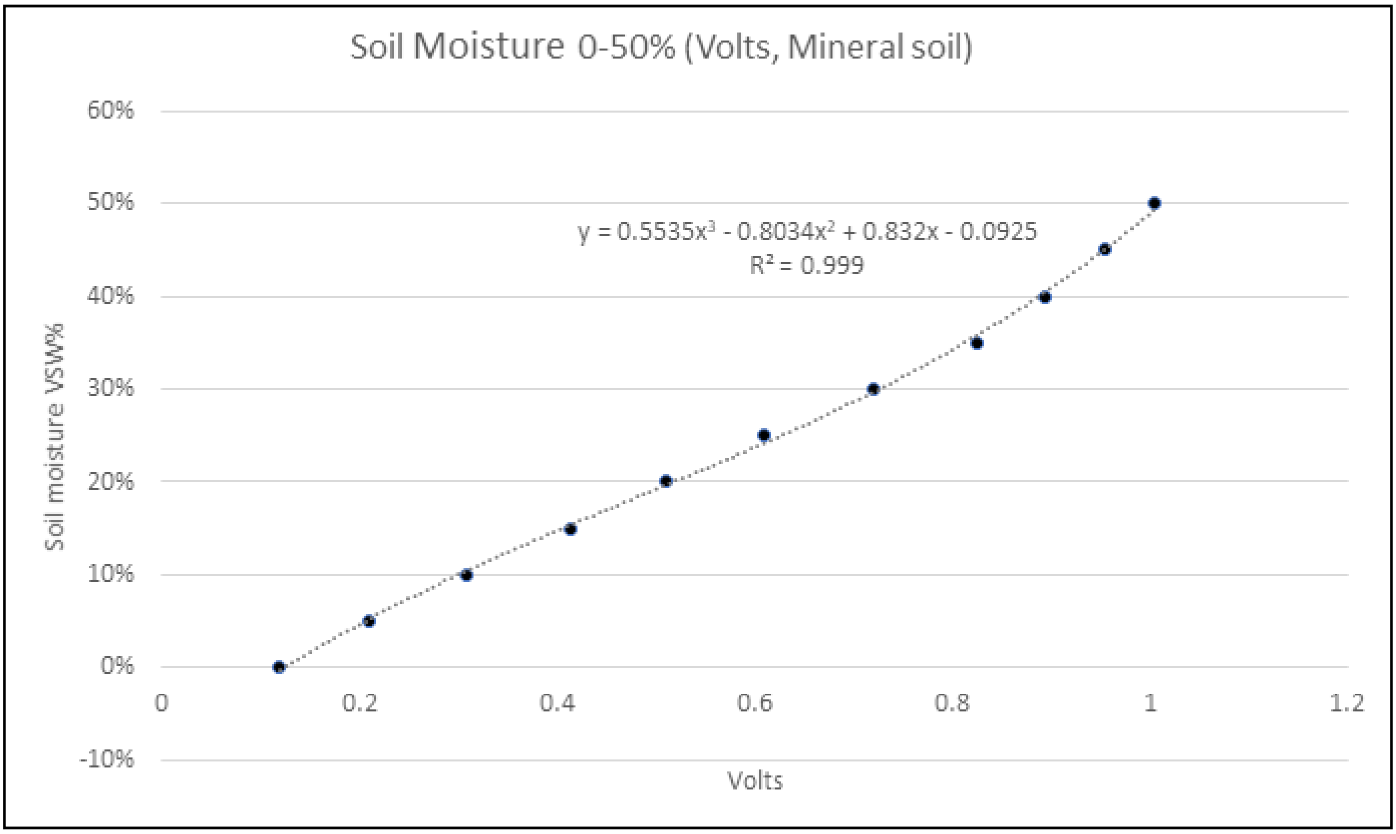
Materials that can be measured by the MP406/MP306 sensor are most often soil, but can also be any composition of non-metallic powdered, liquid or solid phase substance into which the needles are inserted.

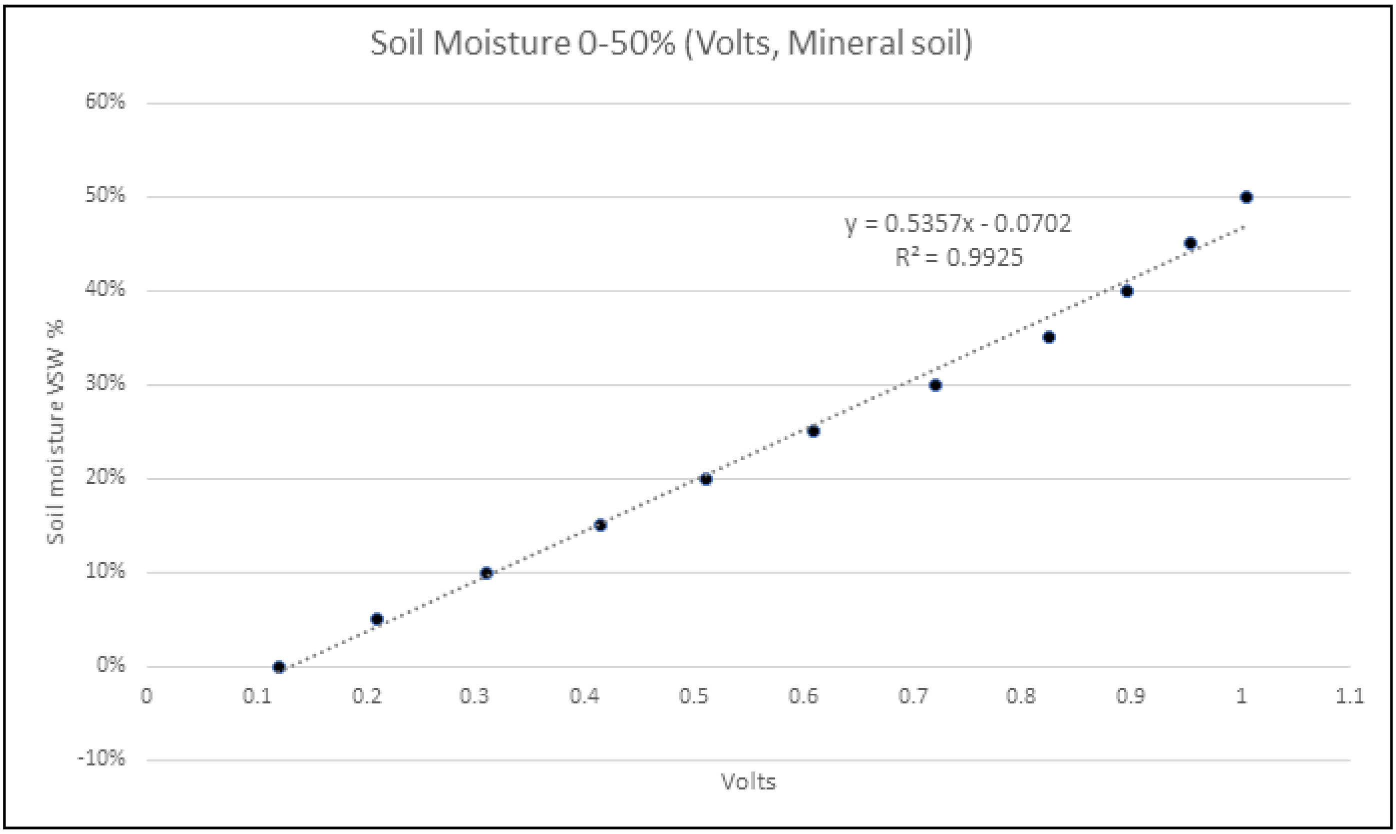
Results

The results from measurement of absolute volumetric soil water percent (VSW%) from prepared soil samples using the MPKit are given in Figure 1. This result is typical of the results obtained from comparative testing of the MPKit in prepared soil samples, for a wide range of agricultural soils.

The results from measurement of the absolute volumetric soil water percent (VSW%) using the MPKit when compared with Trase® TDR technology (Soil Moisture Equipment Corp.) are given in Figure 2. This result is typical of the results obtained from comparative testing of the MPKit compared to Trase® TDR technology for a wide range of agricultural soils.

Moisture Probe Equations & Polynomial Lookup Table





The formulas to derive these equations are available as both Microsoft Excel files and as an R Script on request.

Moisture Probe Sensor Calibration

The results obtained from measurement of the absolute volumetric soil water percent (VSW%) using the MPKit are expected to be within ± 2-5% of the actual soil moisture as determined in the laboratory by gravimetric and volumetric methods of determination.

Recalibration is not expected to be necessary for most applications in most commonly occurring agricultural soils. This is especially so when it is considered that for practical end uses such as irrigation scheduling and irrigation control the **change** in VSW% is the most important variable to be determined for management decision making. The **change** measured will be correct in absolute VSW% units or mm of water applied as the relationship of voltage output to water content, hence calibration slope remains constant, across all soil types.

Scientists or regulatory authorities may wish to calibrate the MPKit to verify the data measured. In this case, it is simply necessary to compare the MPKit output in mV to the VSW% from the soil samples, either prepared in the laboratory or obtained in the field. The resultant regression of these variables will provide the new calibration of the MPKit. All MP306/MP406 are manufactured to be identical. All MPKit respond to changes in water content of the soil and the resultant changes in the dielectric constant in the same way and hence the same calibration will apply to all MPKits.

Equations for Programming IoT Nodes that Use MP406

The formulas to derive these equations are available as both Microsoft Excel files and as an R Script on request.

Linear Calibration

VSW% 0~50	= a + b χ
	= INTERCEPT + SLOPE
	= -0.5357 + 0.0702
	R^2 =0.9925

Where χ = MP Sensor output in volts

{Output Range of Sensor 0 ≤ Sensor ≤ 1200 mV
{Limits of VSW% 0% ≤ VSW% ≤ 50%

Polynomial Calibration

VSW% 0~50	$= a_o + a1\chi + a2\chi^2 + a3\chi^3$
	$= -0.0925 + 0.8319\chi - 0.8034\chi^2 + 0.5535\chi^3$
	R^2 Value =0.9990

Where χ = MP Sensor output in volts

{Output Range of Sensor 0 ≤ Sensor ≤ 1.20 V
{Limits of VSW% 0% ≤ VSW% ≤ 50%

Definitions

Gravimetric Soil Water Content

$\Theta_G = \frac{M_w}{M_s}$ Where Mw is the mass of water in the soil sample and Ms is the total mass of the dry soil sample.

Volumetric Soil Moisture Content

$\Theta_G = \Theta_G * \rho_b$ Where ρb is the bulk density of the soil sample

$(= \frac{M_s}{V_s})$ Where Ms is the total mass of dry sample and Vs is the total volume of the dry soil sample

Volumetric Soil Water Percent (VSW%): VSW% = Θ_v * 100

The VSW% typically varies in the field from 2-5% for sandy soils at permanent wilting point to 45-55% for clay soils at saturation.

Polynomial Lookup Table

Soil Moisture (%)	mV, mineral soil	Volts
0	120	0.120
5	*210*	*0.210*
10	310	0.310
15	*415*	*0.410*
20	510	0.510
25	*610*	*0.610*
30	720	0.720
35	*825*	*0.825*
40	895	0.895
45	*955*	*0.955*
50	1005	1.005
55	*1015*	*1.015*
60	1025	1.025
65	*1035*	*1.035*
70	1045	1.045
75	*1055*	*1.055*
80	1065	1.065
85	*1070*	*1.070*
90	1080	1.080
95	*1095*	*1.095*
100	1106	1.106

2.6 Technical Specifications

2.6.1 Mechanical Diagram

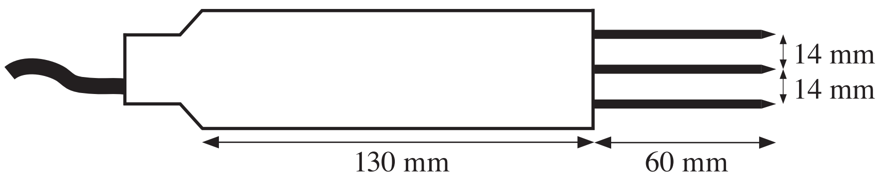


Figure 3. Mechanical Dimensions

2.6.2 Electrical and Mechanical Specifications

Measurement Range	0–100 VSW%
Accuracy	+/-1 VSW%
Interface	Input requirements: 7–18 V DC unregulated Power consumption: 32 mA typical Output signal: 0–1 V for 0–50 VSW%
Response Time	Less than 0.5 seconds
Stabilization Time	5 seconds approximately from power-up
Mechanical	Total length 215 mm. Diameter 40 mm Needle length 60 mm, needle separation 14 mm Exterior ABS Plastic Needles Stainless Steel Cable 4.5 m Standard
Environment	Designed for permanent burial

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ANNEX 4
TAILINGS DEPOSIT DESIGN DETAIL

UNION MILLING FILTERED TAILINGS STACK CONCEPTUAL DESIGN

Leadville, Colorado

6 January 2023
Project No. 21-1338

Prepared for:

CJK Milling

Prepared by:

Global Resource Engineering Ltd.

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1 INTRODUCTION

CJK Milling Co., LLC (CJK Milling) requested Global Resources Engineering (GRE) provide a conceptual level design for the Leadville Mill Filtered Tailings Deposit (FTD) located in Leadville, Colorado, to be used for permitting purposes. It is GRE's understanding that the site has a historical tailings deposit of approximately 1 million tons. This tailings material has some mineral in it that CJK Milling would like to extract and a production of 400 tons per day is expected. After the material is processed the tailings will be stored in an FTD located in a 10-acre dedicated area. The filtered tailings are expected to be composed of material passing the #100 sieve with approximately 20 to 25% clay sized particles and a water content close to 23% (20% process water content). The site sits in a valley on top of a glacial/alluvial deposit.

This conceptual design consists of an FTD that will have a top elevation of 9826 feet a.m.s.l., with a capacity of approximately 501,000 tons, and contact water collection pond and perimeter channels to divert non-contact water. This conceptual design report presents conceptual drawings of for FTD with sections and general design details, including surface water management and liner system design. It also includes slope stability analysis for critical section.

2 SITE CHARACTERIZATION

2.1 Location

The Leadville Mill is located approximately 2.75 miles southwest of town of Leadville, Lake County, Colorado. The site is on top of gently sloping terrain, with the Arkansas River flowing about a mile to the west. Site elevation is approximately 9780 feet a.m.s.l. The old mill building is located southwest of the proposed location for the FTD. The FTD site is bounded by a gas line to the east, water and sewer line to the south and property lines to the west and north. Site location is shown in Figure 2-1.

Figure 2-1 Leadville Mill Site Location. *Google Earth*, earth.google.com/web/.

This area is located in alpine subarctic climate, bordering on a cold semi-arid climate with cold winters and mild summers. The average temperatures in January are a maximum of 31.1 °F and a minimum of 3.1 °F. The average temperatures in July are a maximum of 72.2 °F and a minimum of 37.8 °F. There's an average of 278 days annually with freezing temperatures. The average annual precipitation is 12.19 inches. The average annual snowfall is 142.7 inches (NOAA, 2023).

The Probable Maximum Precipitation (PMP) for a 100 year-24 hour storm is 2.7 inches according to NOAA Atlas 2 (NOAA, 2023). This return period was chosen per Canadian Dam Association (CDA) standards (CDA, 2013). Table 2-1 presents a summary of the precipitation frequency for Leadville, Colorado. For final design a more detailed precipitation study will need to be calculated with additional, site-specific data.

Table 2-1 Precipitation Events

Return Period (years)	Precipitation (inches)	Precipitation Intensity (in/hr)
2-year 6-hour	0.76	0.13
2-year 24-hour	0.95	0.04
100-year 6-hour	1.80	0.30
100-year 24-hour	2.70	0.11

2.2 Geology

2.2.1 General Geology

According to the Geologic Map of the Leadville North 7.5' Quadrangle, Eagle and Lake Counties, Colorado, the surficial geology of the site south of the limits of the quadrangle consists of two formations, the Younger outwash gravel of Bull Lake glaciation (Qgby), and Till of pre-Bull Lake glaciations (Qtpb) (Ruleman, 2018).

The Younger outwash gravel of Bull Lake glaciation (Qgby), estimated to be late to late middle Pleistocene, consists of pebble, cobble, and boulder gravel in a silty sand matrix underlying terraces at elevations above and below units glacial and glacio-fluvial deposits with estimated thicknesses ranging from 1 to 15 meters. Unit mapped on southern margin of quadrangle where younger Bull Lake-age alluvium was deflected to the south by the Bull Lake-age glacier emanating from Mount Arkansas and Fremont Pass east of the map area.

The Till of pre-Bull Lake glaciations (Qtpb), estimated to be middle to early Pleistocene, consists of unsorted, unstratified, deeply weathered boulder gravel in a clayey, silty sand matrix lacking original depositional morphology with estimated thickness of 1 to 40 m. Surface clasts are typically absent on the landform and, where exposed, are deeply weathered and easily pulverized in the hand. Mapped at Leadville along the East Fork Arkansas River extending beyond both Pinedale and Bull Lake glacial limits. Minor drainages south of No Name Gulch and north of the East Fork Arkansas River appear to be unglaciated and associated older pre-Bull Lake deposits (unit Qd) adjacent to the range front are interpreted as debris-flow deposits.

2.2.2 Local Subsurface Conditions

According to a geotechnical investigation performed on site to install an observation well March, 1990 (CTL Thompson, 1990) and a permeability study performed April, 1990 (CTL Thompson, 1990), the subsurface conditions consist of sandy clay overlying clayey sand and gravel to a total depth of 30ft. The top 18 to 24 inches consists of a stiff clay, gravelly and moist; followed by 10 to 12 feet of dense, very clayey gravel; and underlain by dense, very clayey sand. All standard penetration tests went to refusal past the surficial layer. This description is in accordance with the surface geology described above.

3 FILTERED TAILINGS DEPOSIT DESIGN

The conceptual design for the Leadville Mill FTD follows best practices in the industry. In order to adhere to the best practices, international standards such as Canadian Dam Association (CDA) and US Bureau of Reclamation (USBR) have been followed. Design and quantities calculations were performed using the Civil 3D software for civil infrastructure design from AutoDesk.

3.1 General Configuration

The deposit follows a permit boundary provided by CJK Milling and is also bounded by a gas line to the east, water and sewer line to the south and property lines to the west and north. The general configuration of the FTD is shown in the Drawing 01 shown in Appendix A. The catchment pond has been located to the southwest corner of the FTD on the lowest point to allow for gravity flow.

3.2 Deposit Geometry

The deposit will be approximately 46 feet high from ground surface. Overall face slope will be 3.5 Horizontal to 1 Vertical (3.5H:1V) with interbench slopes of 2.5H:1V. There will be a maximum of 4 benches that will be 10 feet wide. These benches will aid in controlling drainage and reduce erosion while allowing easier reclamation. The FTD will also have a perimeter berm to separate contact from non-contact water. Contact water will stay within the FTD footprint and directed to the collection pond. Outside the perimeter berm area, drainage ditches will diver the non-contact water away from the FTD.

3.3 Design Components and Construction

This section offers a general description of the different design components of the FTD and general sequence of construction. The general work described herein is based in the Drawings included in Appendix A.

3.3.1 Filtered Tailings Deposit

The filtered tailings deposit has been designed to accommodate approximately 501,000 tons of tailings. Conceptual design quantities are presented in Drawing 01, Appendix A.

3.3.1.1 Surface Preparation

Before construction work on liner and perimeter berm can be started the site has to be cleared of all vegetation and the top 24 inches of material needs to be removed. Original ground slopes will be maintained as shown in Drawing 02, Appendix A. The removed material will be stockpiled at a designated location in the property to be used during the reclamation stage. The cleared vegetation material can be mulched, stockpiled and allowed to form compost. This composted material can be mixed with the material that will be used as reclamation cover providing a better growing medium for vegetation.

After removal on the top 24 inches, any depressions or holes left from surface preparation will be backfilled and the surface will be compacted and tested for compaction. This will improve the surface for proper liner installation.

3.3.1.2 Perimeter Berm

The perimeter berm is designed to separate contact from non-contact water. Contact water will stay within the FTD footprint and directed to the collection pond. Compacted backfill material will be placed on the FTD perimeter according to Drawings 02 and 05, Appendix A. The FTD liner system will be installed over perimeter berm.

3.3.1.3 Composite Liner System

The FTD composite liner system has been designed as a double liner system consisting of a geosynthetic clay liner (GCL) overlying the prepared subgrade. A high-density polyethylene (HDPE) liner overlies the GCL and finally a layer of sand, a foot thick, overlies the HDPE, protecting the surface from equipment traffic. Liner detail is shown in Drawing 05, Appendix A. The HDPE and GCL liner will be installed according to manufacturer recommendations and anchored in an anchor trench backfilled with compacted backfill.

3.3.1.4 Filtered Tailings Placement

Filtered tailings will be transported to the FTD and spread in thin layers with a dozer and compacted with a vibratory or sheep's foot roller. Layer will be tested for compacted density and moisture content. Layer thicknesses, percent compaction and optimum moisture content of placed material, and final handling equipment will be determined as design is advanced.

3.3.2 Collection Pond

The collection pond has been designed to hold 100 year – 24 hour event falling over the FTD. It has been sized to conservatively hold all runoff without accounting for infiltration and maintain 2 feet of freeboard.

3.3.2.1 Surface Preparation

Surface preparation for the collection pond will follow the same steps as for the FTD as well as excavated material handling. Excavation depths and slopes are shown in Drawings 04 and 05, Appendix A. After removal on the top 24 inches, any depressions or holes left from surface preparation will be backfilled and the surface will be compacted and tested for compaction. This will improve the surface for proper liner installation.

3.3.2.2 Pond Berm

The pond berm is designed to form the containment walls for the collection pond. Contact water will be collected and retained collection pond. Compacted backfill material will be placed on the perimeter according to Drawings 04 and 05, Appendix A. The collection pond liner system will be installed over the berm.

3.3.2.3 Composite Liner System

The collection pond composite liner system has been designed as a double liner system with leak detection consisting of a geosynthetic clay liner (GCL) overlying the prepared subgrade. A secondary HDPE liner overlies the GCL with a geonet on top of the secondary HDPE liner. A primary HDPE liner overlies de geonet and finally a layer of sand, a foot thick, overlies the primary HDPE, protecting the surface from equipment traffic. Liner detail is shown in Drawing 05, Appendix A. The HDPE and GCL liner, as well as the geonet will be installed according to manufacturer recommendations and anchored in an anchor trench backfilled with compacted backfill.

3.3.3 <u>Diversion Channels</u>

Perimeter diversion channels to direct non-contact water runoff have been identified in the drawings. However, these have not been sized at this time. Location of the channels is sufficient for conceptual level design. It is recommended that the channels are properly sized for the next design phase utilizing site specific data.

4 SLOPE STABILITY ANALYSIS

4.1 Model Configuration and Section Location

The models used for slope stability analyses were developed using information from site-specific topographic surfaces, conceptual FTD design and ancillary facilities, and borehole study data provided by CJK Milling. This section discusses the development of the models used for slope stability analysis. Foundation conditions for the facilities reflect geologic conditions encountered during field a exploration program performed by CTL Thomson (CTL Thompson, 1990). The locations of the sections for analysis are in Drawing 1, Appendix A.

4.2 Slope Stability Cross Sections

Slope stability cross sections were developed for three locations in the pit for this analysis. Cross sections were selected to model the most critical section of each facility. The term most critical is generally defined as the tallest and/or steepest section or having critical infrastructure in the vicinity that could be affected by movement of the FTD. Survey was provided by CJK Milling. Subsurface conditions were estimated using the stratigraphic information from the topography of the site and the exploration program performed by CTL Thomson (CTL Thompson, 1990). Slope stability cross sections are shown on Figures 3.1 and 3.2.

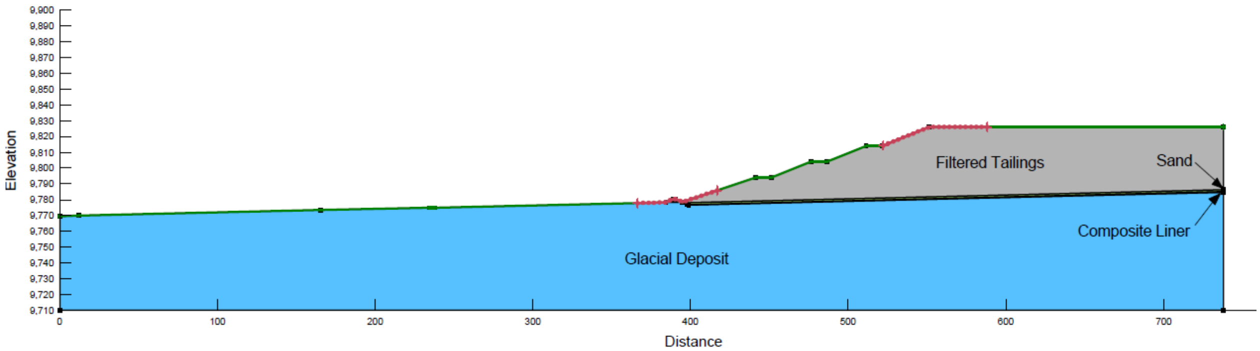

Figure 3-1 Slope Stability Section A

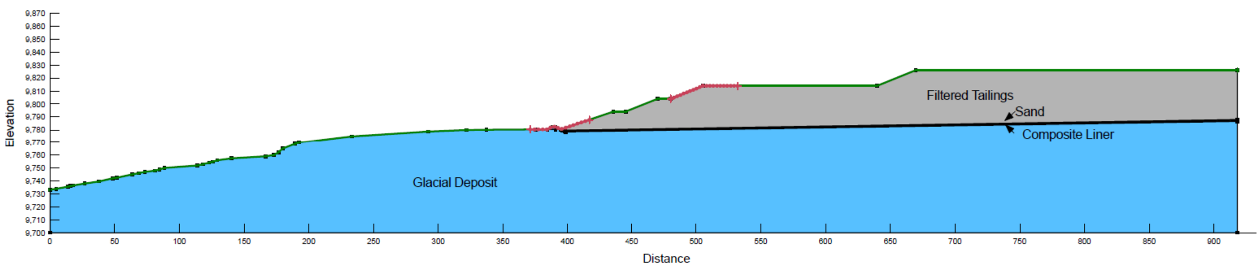

Figure 3-2 Slope Stability Section B

4.3 Material Properties

Material properties used in the slope stability model were estimated using the the exploration program performed by CTL Thomson (CTL Thompson, 1990), experience with these types of materials and engineering judgement. These materials have been modeled as soil utilizing Mohr Coulomb model. The development of shear strength estimations for each of these materials and conditions is discussed below. Material properties used in slope stability analyses are summarized in Table 3-1.

Table 3-1 - Material Strength Properties

Material	Model	Unit Weight (lb/ft^3)	Effective Friction Angle, ϕ' (°)	Effective Cohesion, C' (lb/ft^2)	Reference
Filtered Tailings	Mohr-Coulomb	115	32	0	Similar project
Glacial Deposit	Mohr-Coulomb	120	30	0	Estimated based on PI (Sorensen and Okkels 2013)
Sand	Mohr-Coulomb	118	35	0	Based on experience and engineering judgement
Composite Liner	Mohr-Coulomb	115	18	0	Based on project experience and engineering judgement

Foundation material was designated as Glacial Deposit per the geology in the area, as discussed in previous section. The shear strength properties were estimated based on a correlation developed by Sorensen and Okkels (Clarke, 2018) that uses the PI to estimate effective friction angle. The value obtained compared with similar materials in engineering literature and that have been studied in the past by GRE.

Material properties for the filtered tailings were developed based on experience with similar materials that have been studied in the past by GRE and engineering judgement. Sand properties were selected based on engineering judgement. Composite liner system properties were chosen based on engineering judgement and liner system testing industry database. It is important to note that the composite lner system is only as strong as it's weakest componenet, and in this case it's the HDPE/GCL liner interface.

In order to move from conceptual to the next design phase, it is recommended that a proper geotechnical investigation and laboratory testing program be developed and carried out. Geotechnical drill holes should be located in the FTD area and samples will need to be collected and tested for geotechnical properties.

4.4 Slope Stability Analysis

Slope stability analyses were completed using the computer program SlopeW, part of the GeoStudio 2021.4 software suite (GeoStudio 2021), which enables the user to conduct limit equilibrium slope stability calculations by a variety of methods. Slope allows the use of several methods to search for the critical slip surface, that is, the surface with the lowest factor of safety

(FOS) for a given geometry and material properties. The Morgenstern-Price method was used to search for the optimized critical slip surface, because that procedure satisfies both force and moment equilibrium, thereby yielding a rigorous solution. This is discussed in greater detail in the following sections.

Analyses were performed under static loading conditions. It is estimated that groundwater can be encountered at depth past adverse influence in foundation conditions. However, hudrostatic loading was applied at the base of the FTD above the liner to simmulate the worst case scenario of contact water accumulating at the base due to lack of drainage. One scenario per section was analyzed for overall global stability, which includes the entire slope. For the next design phase it is recommended that laboratory testing from a proper geotechnical campaign be performed on foundation and tailings materials to better asses strength properties for these materials and improve slope stability model.

4.5 Analysis and Results

Accepted minimum Factor of Safety (FOS) for static conditions is 1.5 for closure according the CDA (CDA, 2013). These values are also acceptable for the USBR and other international standards. Slope stability results are summarized in Table 3-2 for Sections A and B. Appendix B has the slope stability analysis results.

Table 3-2 – Slope Stability Results

Scenario	FOS
Section A - Global	1.8
Section B - Global	6.5

In general, the results of the analyses do indicate compliance with adopted minimum FOS for slopes when modeled with Mohr-Coulomb parameters. Due to the preliminary nature of these evaluations and the estimations required for shear strength property inputs, it is important to view these results as conceptual. Testing including triaxial, consolidation, and index tests will aid in the estimation of more accurate shear strength properties.

5 CONCLUSIONS AND RECOMMENDATIONS

This conceptual FTD facility has been designed to accommodate approximately 501,000 tons within the 10 acre permit footprint owned by CJK Milling. It also includes a contact water collection pond and perimeter channels to divert non-contact water. This conceptual design will require additional studies in order to advance this conceptual design meant for permitting. Below is a list of recommendations for additional work.

- A proper geotechnical investigation and laboratory testing program will have to be developed by a geotechnical engineer. Drill holes should be located in the area of the FTD and foundation material samples will need to be collected and tested.
- For final design a more detailed precipitation study will need to be calculated with additional, site-specific data.
- A site-specific hydrologic data collection and evaluation should be performed moving into the design phase to properly size collection pond taking into consideration hydraulic conditivity of the filtered tailings.
- Filtered tailings characterization including geoetchnical index testing, moisture content, Standard Proctor, specific gravity, shear strength testing, water retention capacity, among others.
- Water level information from wells installed in the area.

6 LIMITATIONS

This report has been prepared for the exclusive use of CJK Milling for the specific applications in the area included in this report. Any third party use of this report, or any reliance or decision based on it, is the responsibility of such third parties. GRE does not accept any responsibility for damages suffered by third parties as a result of decisions or actions based on this report. This report has been prepared in accordance with generally accepted engineering practices. No other warranty, express or implied, is made.

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APPENDIX A – CONCEPTUAL DRAWINGS

DESCRIPTION	2D AREA (ft^2)	3D AREA (ft^2)	VOLUME (yd^3)	MASS (TON)
3.5:1 OUTER SLOPE	373,928.82	388,239.99	341,008.44	501,159.43
FOUNDATION EXCAVATION (2-ft)	373,930.92	375,279.35	31,543.37	-
DRAINAGE LAYER (1-ft)	368,810.97	368,921.94	14,040.68	-
PERIMETER BERM (FILL)	-	-	1,059.31	-
COVER MATERIAL (assumes 4-in)	373,928.82	388,239.99	4,745.16	-
COVER MATERIAL (assumes 6-in)	373,928.82	388,239.99	7,189.63	-

No.	Description	Por	Fecha
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REFERENCES

Rev	By	Apr	Description	Date
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REVISIONS

Scale: As Shown

Design: GRE
Drawn: LAQ
Revised by: MRQ
Approved by: MRQ

Prepared by: GRE GLOBAL RESOURCE ENGINEERING

Prepared for: CJK MILLING REMOVE ▲ REUSE ▲ RESTORE

Title:

FTD 3.5:1 SLOPES PLAN VIEW

REVISION 0

Project: CJK MILLING COMPANY FTD DESIGN

Project No. 22-1382

Date: JANUARY 2023

DRAIWING 01

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REVISIONS

Scale: As Shown

Design: GRE
Drawn: LAQ
Revised by: MRQ
Approved by: MRQ

Prepared by: GRE Global Resource Engineering

Prepared for: CJK MILLING REMOVE ▲ REUSE ▲ RESTORE

Title: FTD FOUNDATION EXCAVATION AND BERM

0 REVISION

Project: CJK MILLING COMPANY FTD DESIGN

Project No. 22–1382

Date: JANUARY 2023

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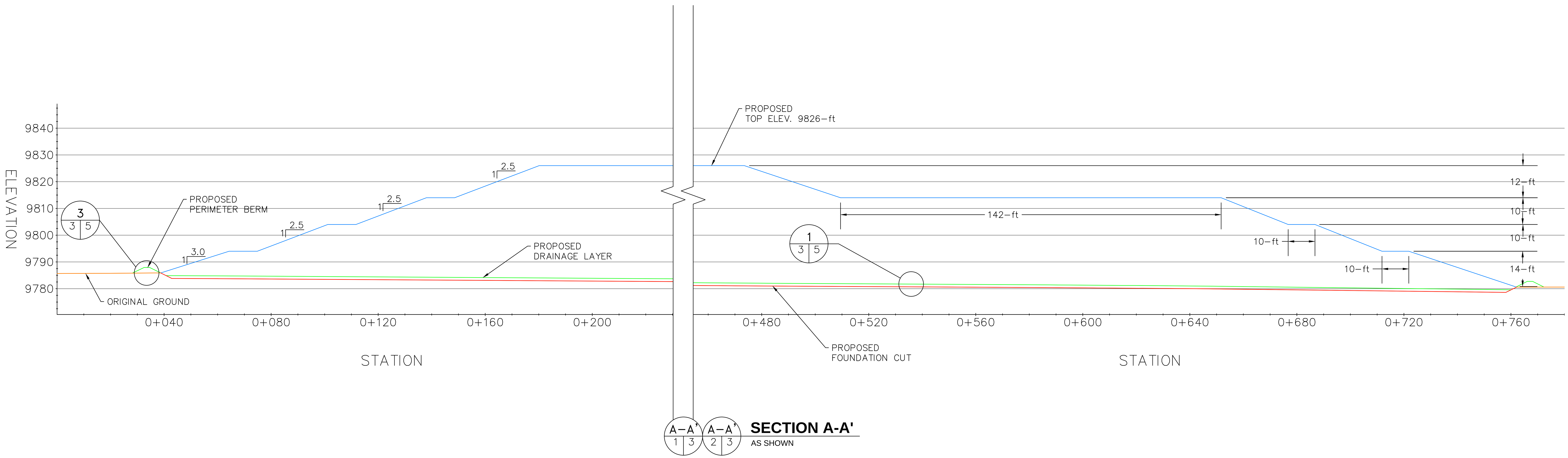

SECTION A-A'
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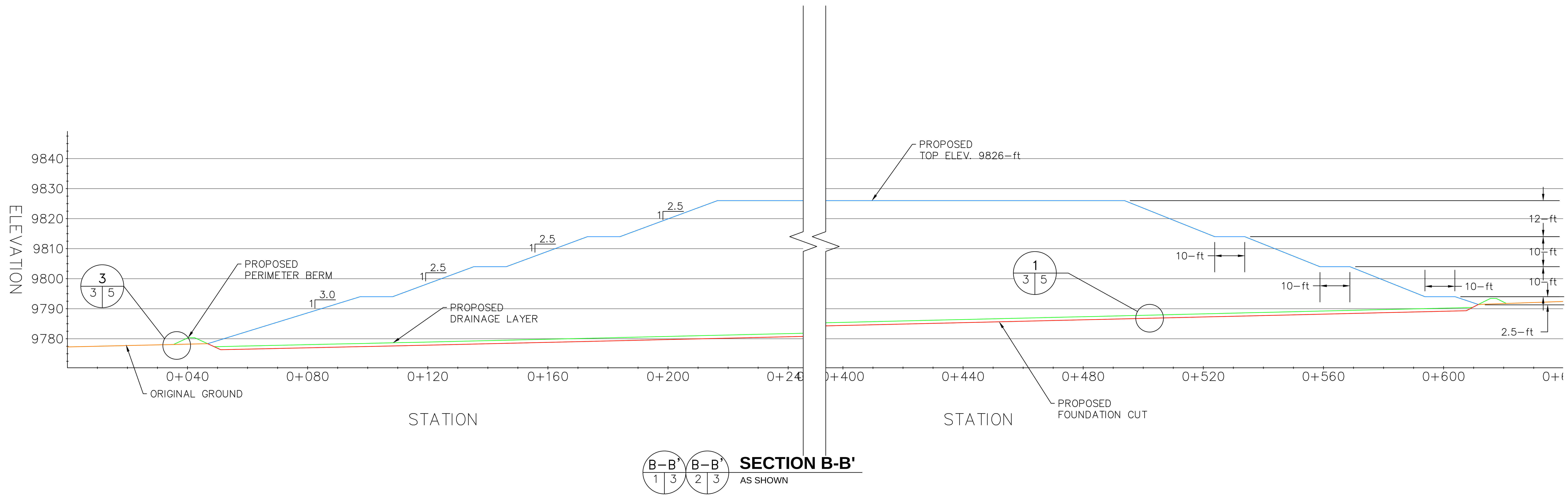

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REFERENCES

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Design: GRE
Drawn: LAQ
Revised by: MRQ
Approved by: MRQ

Prepared by: GRE Global Resource Engineering

Prepared for: CJK MILLING REMOVE ▲ REUSE ▲ RESTORE

Title: FTD 3.5:1 SLOPES SECTIONS

Project: CJK MILLING COMPANY FTD DESIGN

Project No. 22–1382

Date: JANUARY 2023

DRAWING 03

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REVISIONS

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Design: GRE
Drawn: LAQ
Revised by: MRQ
Approved by: MRQ

Prepared by: GRE Global Resource Engineering

Prepared for: CJK MILLING REMOVE ▲ REUSE ▲ RESTORE

Title: FTD CATCHMENT POND PLAN VIEW

REVISION 0

Project: CJK MILLING COMPANY FTD DESIGN

Project No. 22-1382

Date: JANUARY 2023

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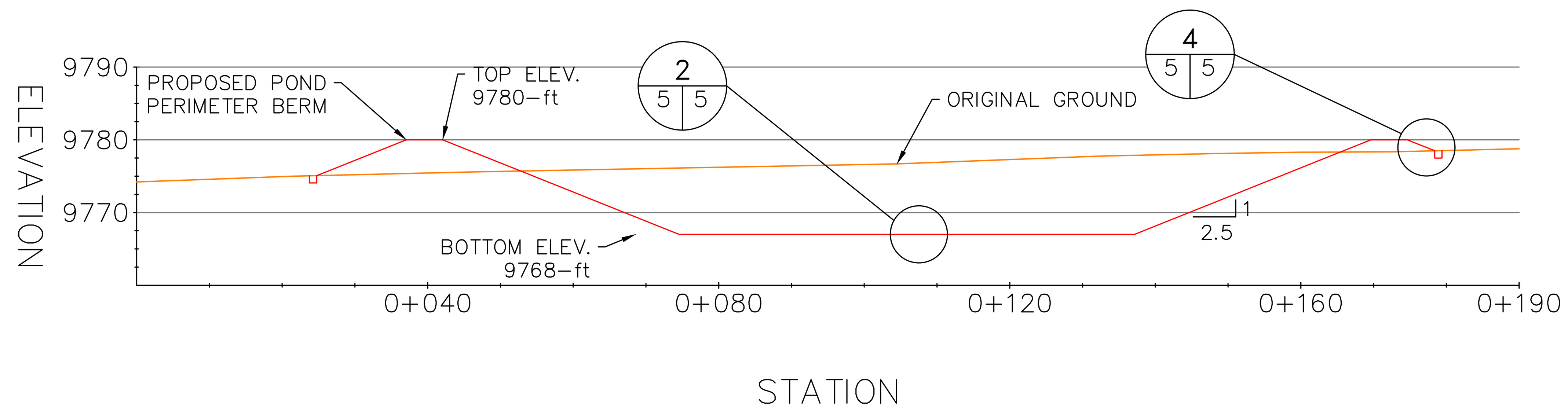

C-C' 1 | 2 **SECTION C-C'**
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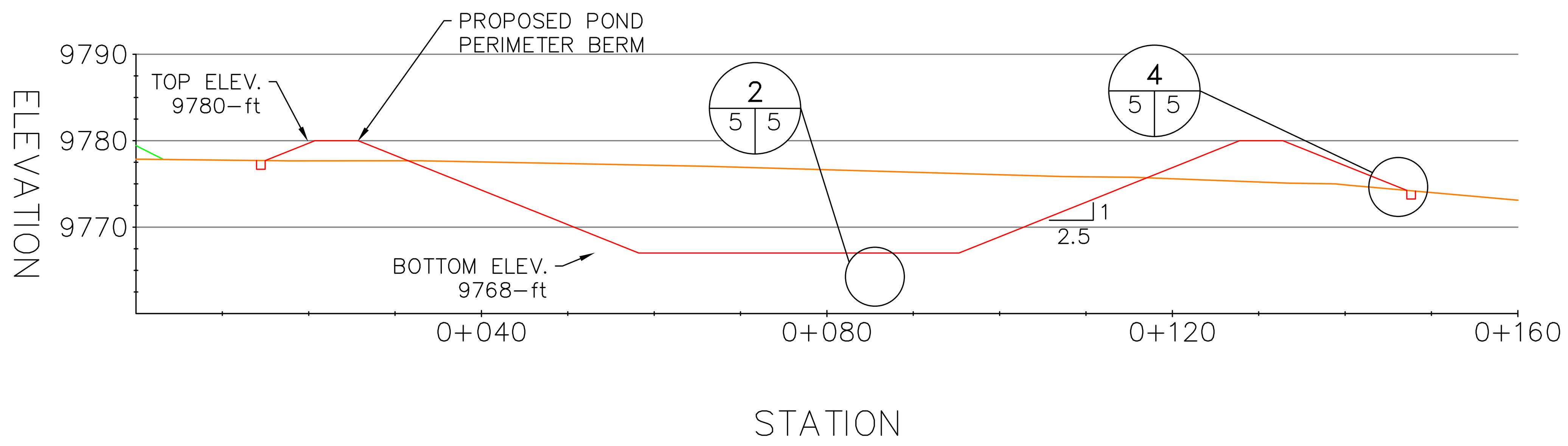

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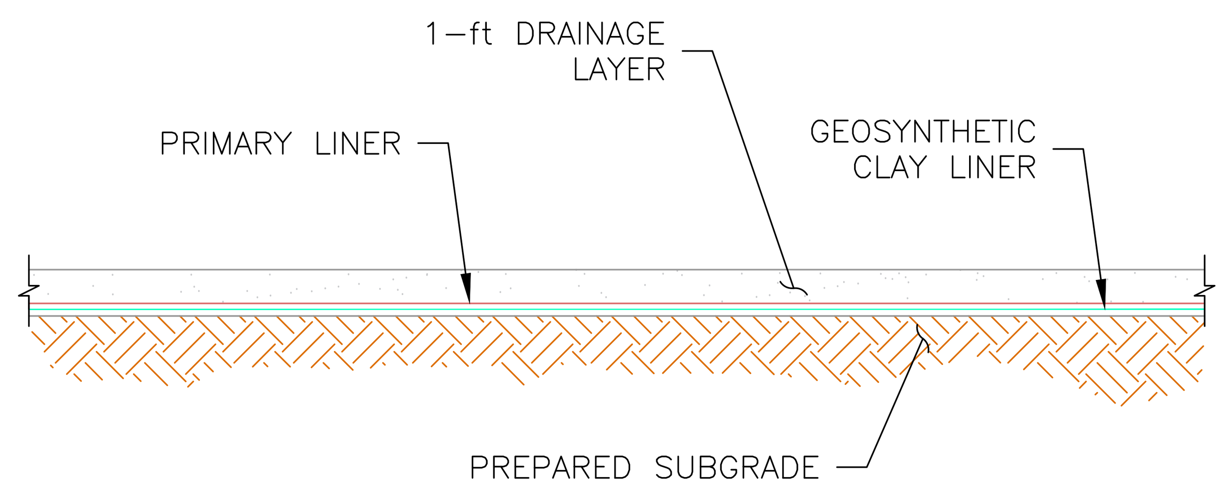
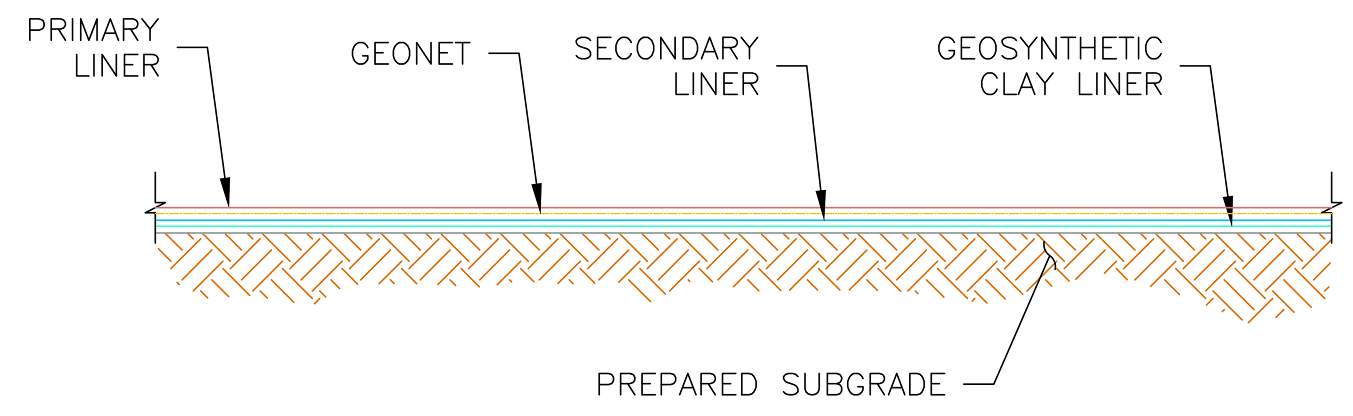


1 3 | 5 **FTD LINER SYSTEM DETAIL**
N.T.S.



2 5 | 5 **POND LINER SYSTEM DETAIL**
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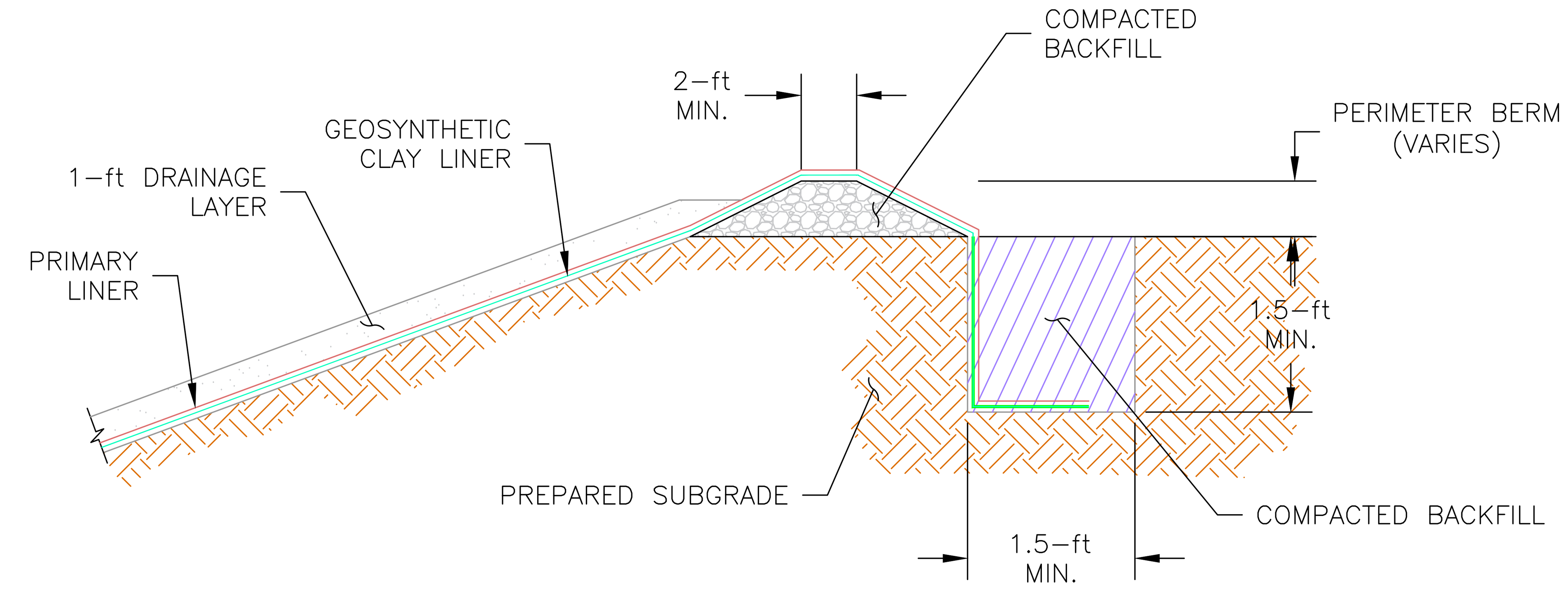

3 3 | 5 **FTD ANCHOR TRENCH DETAIL**
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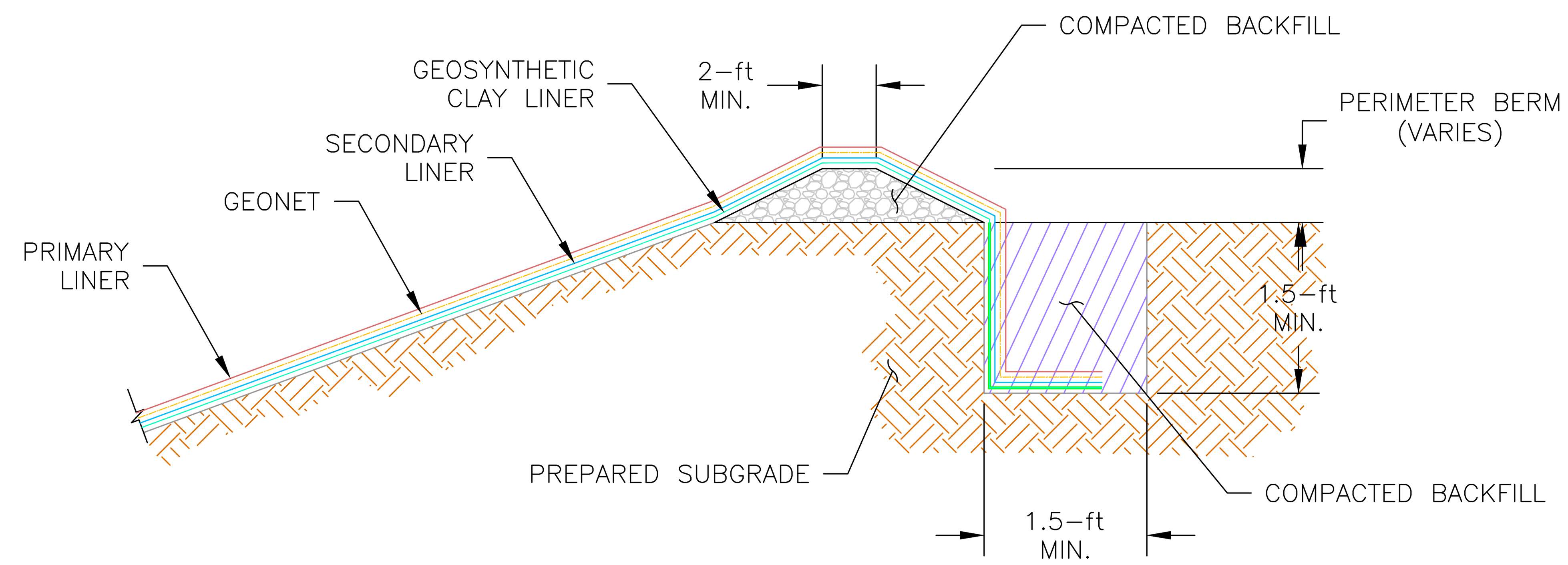

4 5 | 5 **FTD POND TRENCH DETAIL**
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REFERENCES

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Revised by: MRQ
Approved by: MRQ

Prepared by: GRE Global Resource Engineering

Prepared for: CJK MILLING — REMOVE ▲ REUSE ▲ RESTORE

Title: **FTD CATCHMENT POND SECTIONS AND DETAILS**

REVISION 0

Project: CJK MILLING COMPANY FTD DESIGN

Project No. 22-1382

Date: JANUARY 2023

DRAIWING 05

LOCATION: C:\Users\Luis Q\OneDrive - Global Resource Engineering, LTD\Union Milling\CAD\22-1382 CJK-FTD_GFA_OPT 6_POND.dwg DATE: 1/5/2023 2:31 PM PLOT SCALE = 1:8.7041 PLOTTED BY: LUIS Q

APPENDIX B – GEOTECHNICAL REPORTS BY OTHERS

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

April 10, 1990

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

Attention: Mr. Don Wilson

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

Gentlemen:

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

Please call if you have questions.

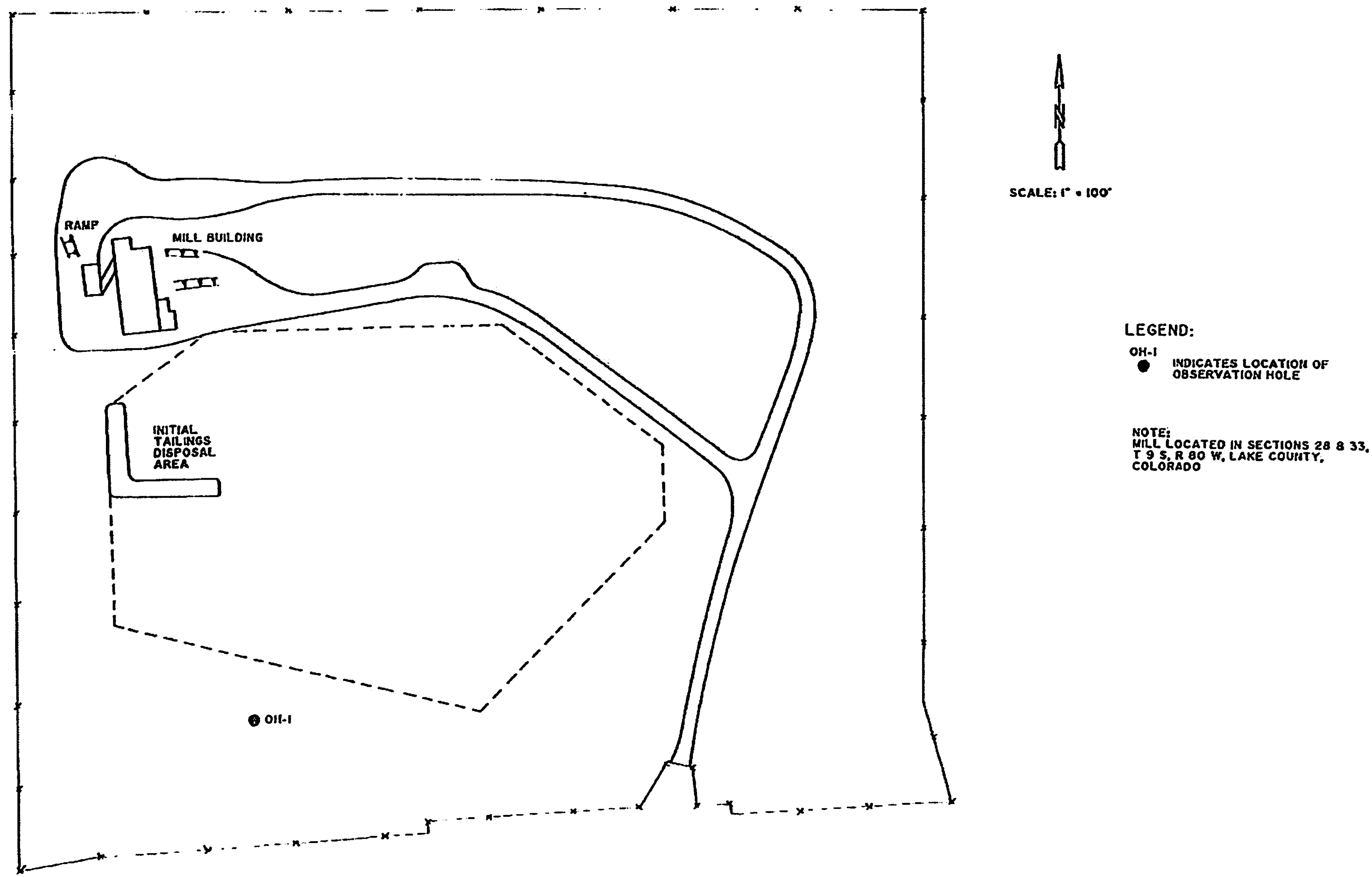
Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:dd
(5 copies sent)

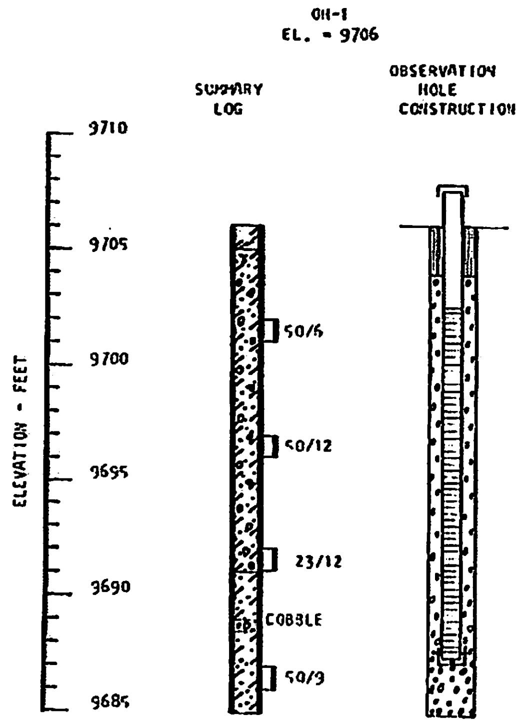
1971 WEST 12TH AVENUE • DENVER, COLORADO 80204 • (303) 825-0777



LOCATION OF OBSERVATION HOLE

JOB NO. 16,768

FIG. 1



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

LEGEND - SUMMARY LOG:

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

LEGEND - OBSERVATION HOLE CONSTRUCTION:

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

SUMMARY LOG OF OBSERVATION HOLE AND OBSERVATION HOLE CONSTRUCTION

JOB NO. 16,768

FIG. 2

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

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

Job No. 16,768

April 10, 1990

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

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INTRODUCTION

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

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

SUMMARY

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

STUDY METHOD

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

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

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

LABORATORY TESTS

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

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

CONCLUSIONS

The tailing disposal area soils generally have low permeabilities. Our tests measured average permeabilities between 2 ft/yr and 230 ft/yr. The higher permeability was in P-l which was located at the uphill edge of the disposal area. We saw in the existing trench and measured a more permeable (5000 ft/yr) lens in P-l at about 8 feet. This lens in P-l was about l.5 feet thick.

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

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

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

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

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

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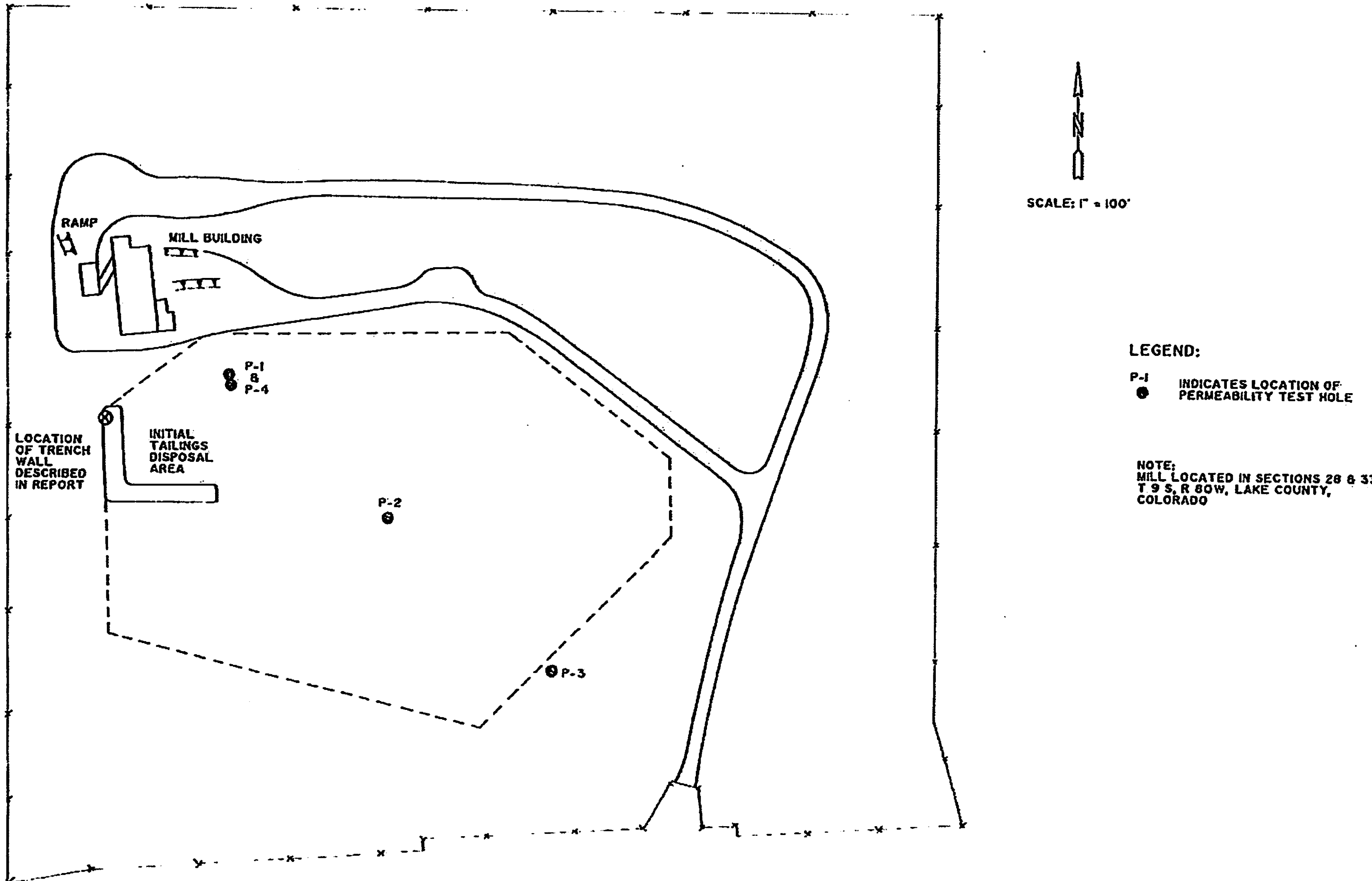
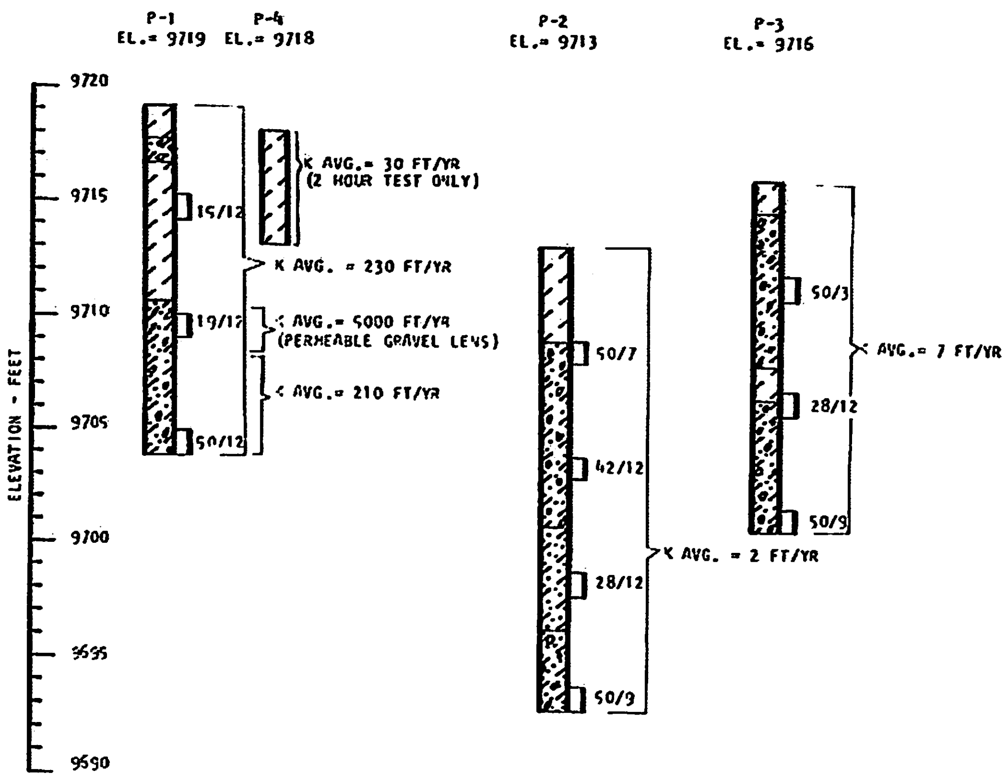


LOCATIONS OF PERMEABILITY TEST HOLES

JOB NO. 16,768

FIG. 1



LEGEND:

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

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

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

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

K AVG. INDICATES AVERAGE PERMEABILITY MEASURED

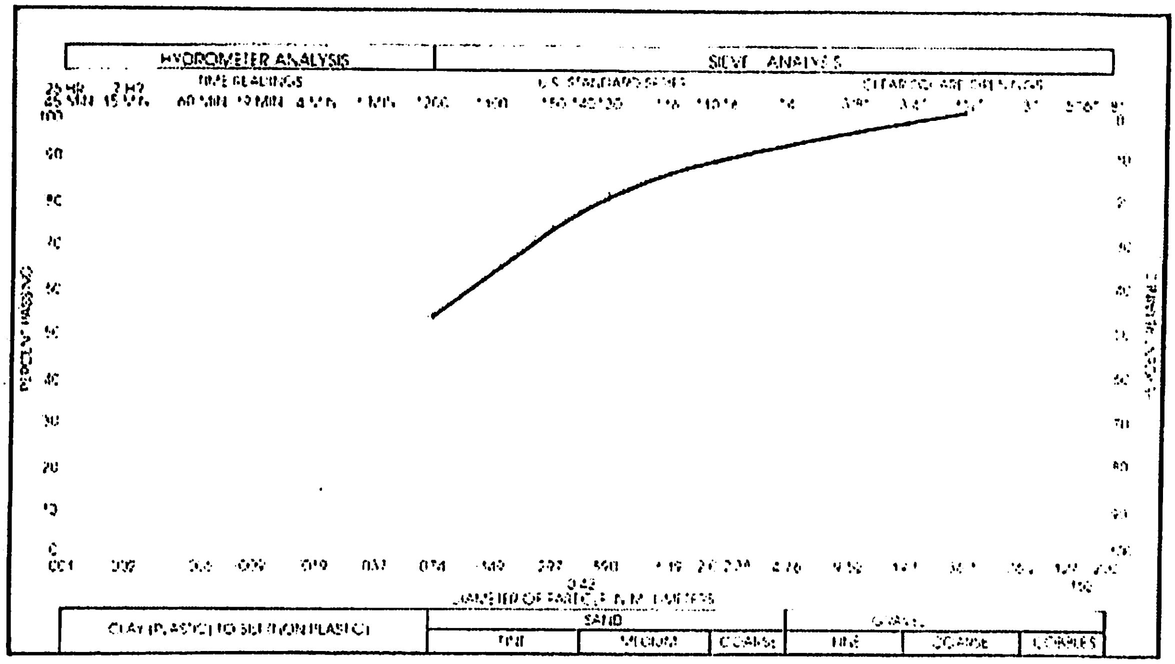
NOTES:

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

SUMMARY LOGS OF PIEZOMETER HOLES

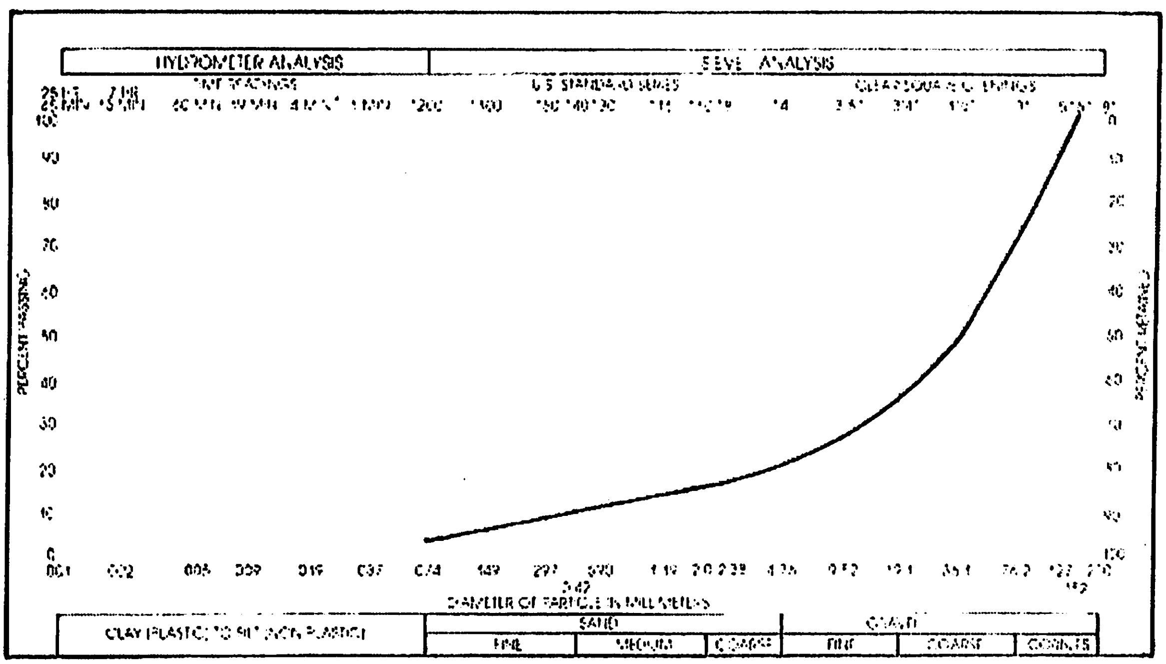
JOB NO. 16,768

FIG. 2



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

GRAVEL 8 % SAND 65 %
SILT & CLAY 53 % LIQUID LIMIT 24 %
PLASTICITY INDEX 10 %



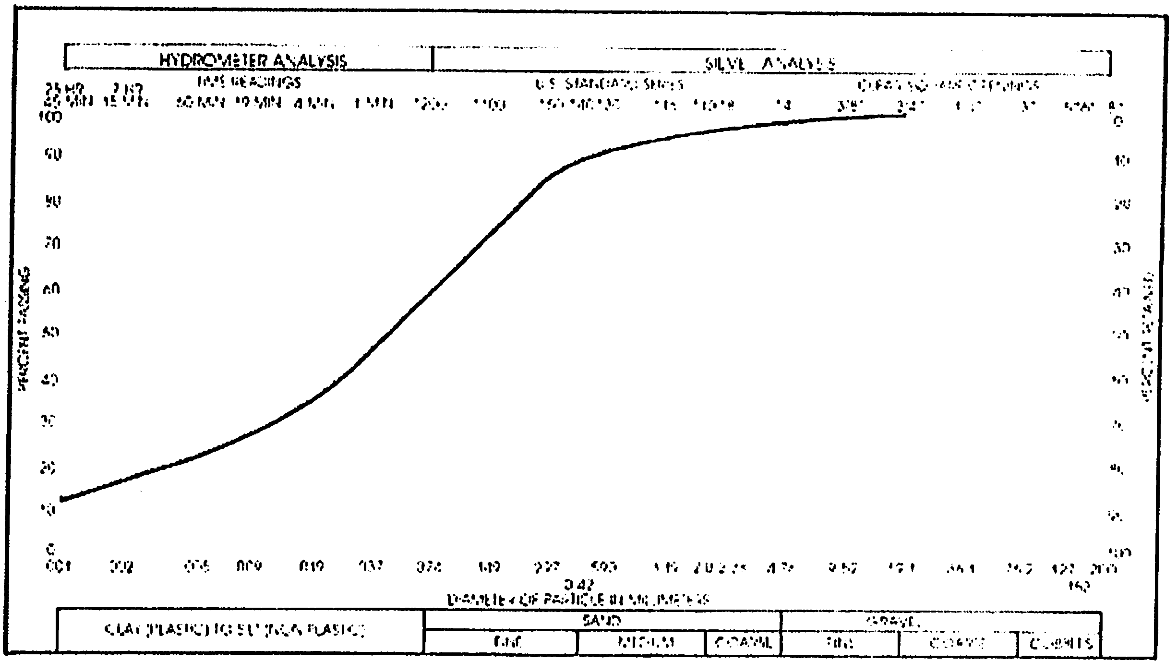
Sample of GRAVEL, SANDY (GP)
From TRENCH AT 7 TO 10 FEET

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

JOB NO. 16,768

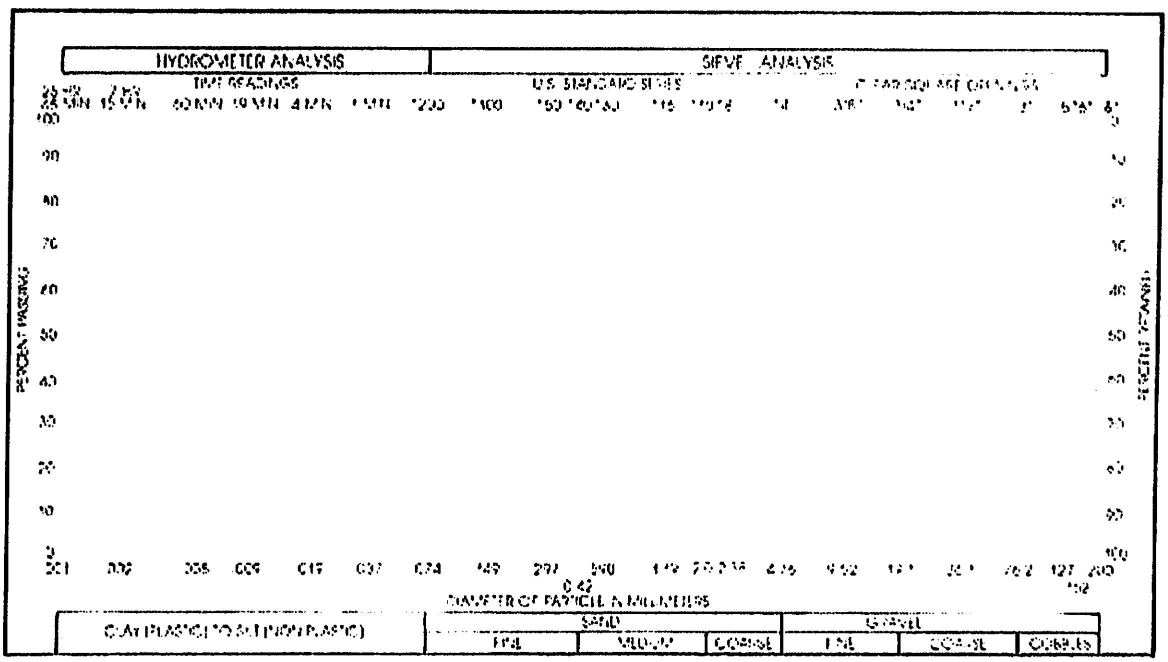
Gradation Test Results

FIG. 3



Sample of TAILINGS (SILT, SLIGHTLY CLAYEY) (ML-CL)
From SHAKEDOWN RUN

GRAVEL 0 % SAND 41 %
SILT & CLAY 59 % LIQUID LIMIT 26 %
PLASTICITY INDEX 7 %



Sample of ______
From ______

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

JOB NO. 16,768

Gradation Test Results

FIG. 4

Form 10

JOB NO. 16,768

TABLE
SUMMARY OF LABORATORY TEST RESULTS

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

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

July 27, 1990

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

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

Dear Mr. Wilson:

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

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

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

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

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

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

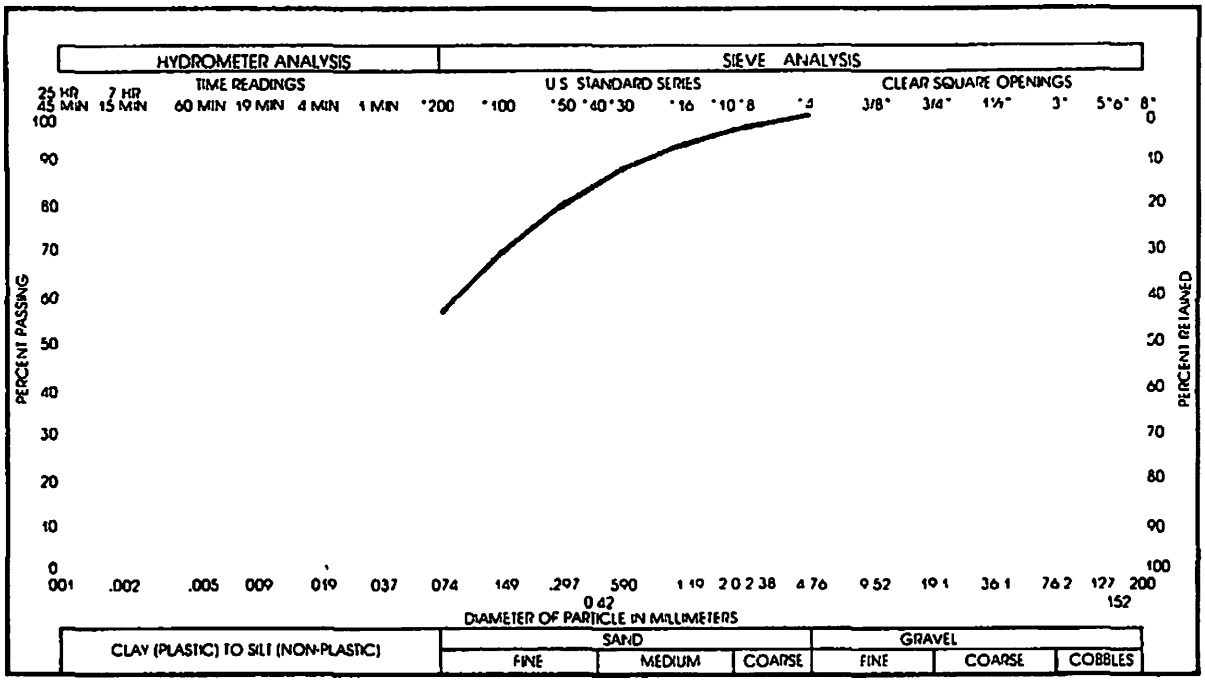
Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P.E.
Principal Engineer

COLORADO REGISTERED
FRANK J. HOLLIDAY
6785
PROFESSIONAL ENGINEER

RJH:dsm
(6 copies sent)



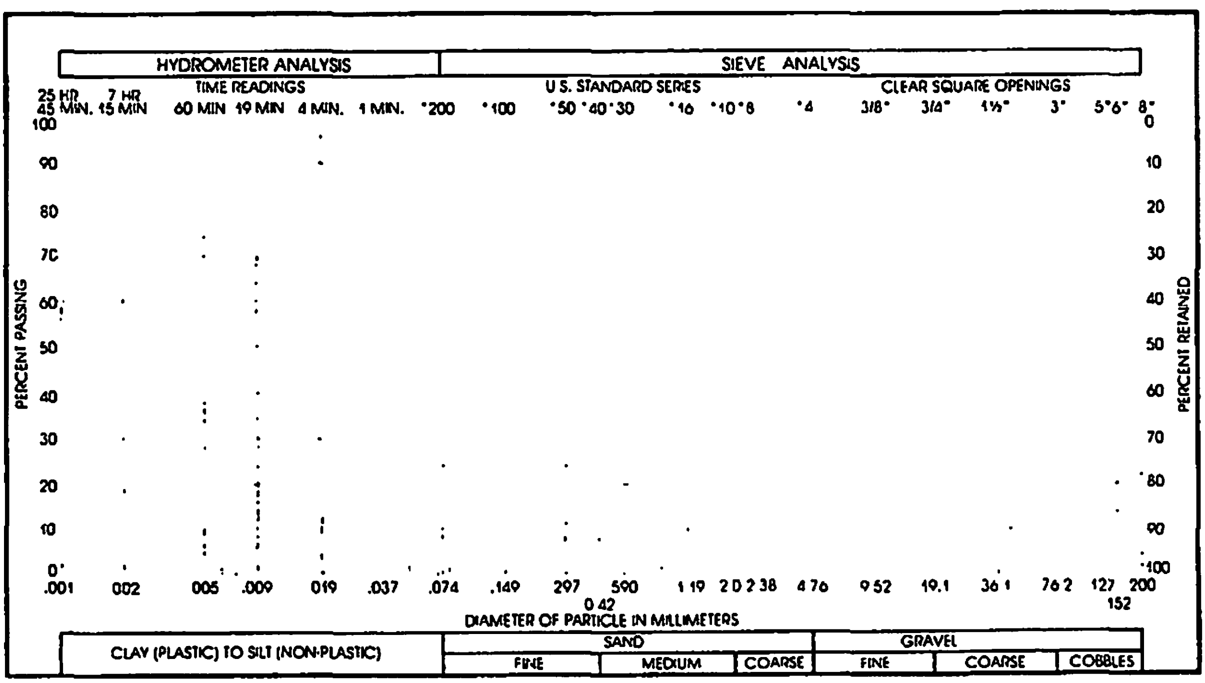
Sample of CLAY, SANDY, RED (CL)

From TAILING POND EMBANKMENT

GRAVEL 0 % SAND 42.7 %

SILT & CLAY 57.3 % LIQUID LIMIT 26 %

PLASTICITY INDEX 11 %



Sample of ______

From ______

GRAVEL ____ % SAND ____ %

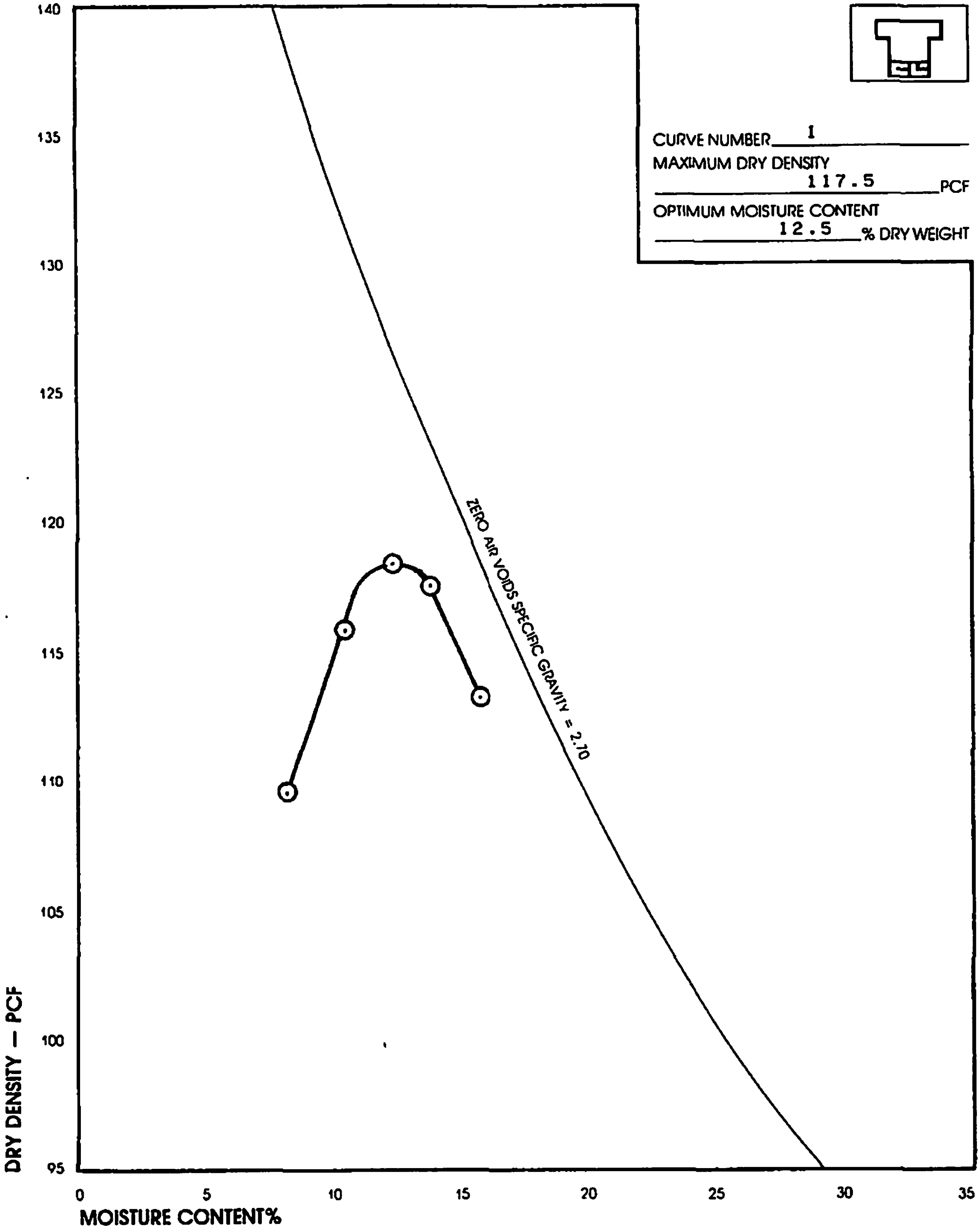
SILT & CLAY ____ % LIQUID LIMIT ____ %

PLASTICITY INDEX ____ %

JOB NO. 17,106

Gradation Test Results

FIG. 1



Sample Description CLAY, SANDY, RED (CL)

Location TAILING POND EMBANKMENT

Compaction Test Procedure ASTM D 698, METHOD "A".

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

JOB NO. 17,106

Compaction Test Results

FIG. 2

999

STATE OF COLORADO

Roy Romer, Governor

DEPARTMENT OF NATURAL RESOURCES

MINED LAND RECLAMATION DIVISION

FRED R. BANTA, Director

MEMO TO FILE

File No: M-90-057

Operator: Leadville Mining & Milling Corporation

Date: 8-3-90

Specialist: Tom Schreiner

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

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

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

SUMMARY AND RESOLUTION OF INTERACTION:

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

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

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

(Rev. 5/9/88)
572OF

CTL | THOMPSON

July 8, 2011

The Union Milling Company
PO Box 36099
Denver, Colorado 80236

Attention: Mike Elder
John Danio

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

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

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

The scope of our work included:

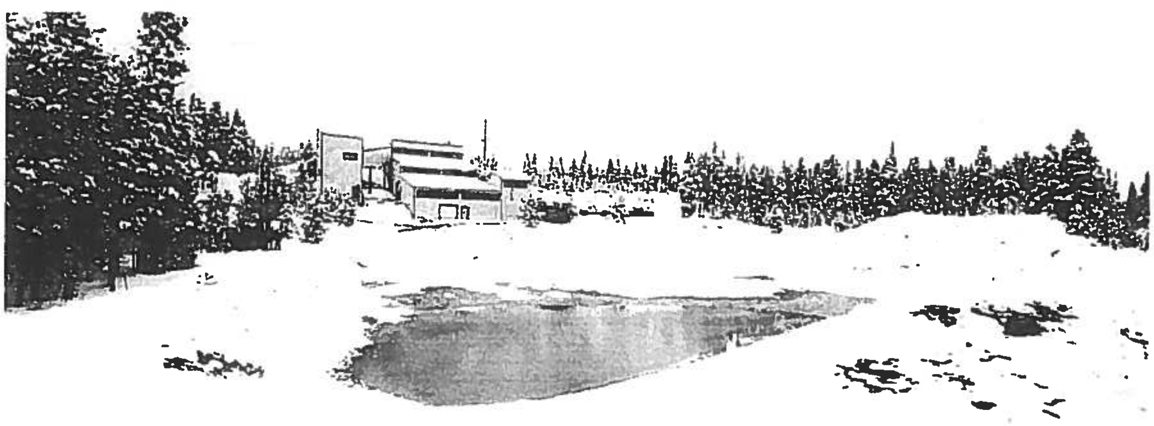
- Drilling two exploratory borings on or near the existing embankment;
- Testing the classification and strength of the material anticipated for the embankment, the underlying native soils, the existing on-site fill stockpile, and a sample of tailings material provided to us;
- Evaluating the slope stability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

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

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

SITE CONDITIONS

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



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

PREVIOUS INVESTIGATIONS

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

INVESTIGATION

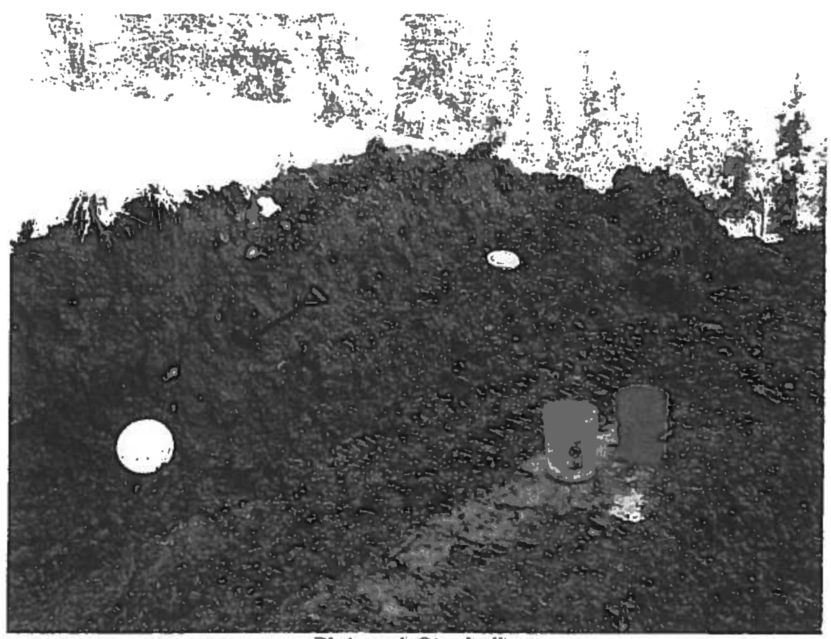
Subsurface conditions were investigated by drilling 2 borings. Our intent was to drill through the embankment, if possible. Field conditions allowed us to drill one hole on the embankment. The other hole was adjacent to the embankment, below the mill. □ et, snowy conditions re□uired bulldozer assistance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

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


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

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

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



Picture 4. Stockpile

SUBSURFACE CONDITIONS

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

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

REGULATIONS

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

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

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

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

SITE GEOLOGY AND GEOLOGIC HA□ARDS

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

DIRECT SHEAR TESTING

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

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

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

---

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

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

TABLE A
DIRECT SHEAR TEST RESULTS

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

SLOPE STABILITY

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

TABLE B
PARAMETERS USED OF SLOPE STABILITY ANALYSIS

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

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

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

TABLE C
FACTORS OF SAFETY AGAINST EMBANKMENT SLOPE FAILURE

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

TABLE D
FACTORS OF SAFETY AGAINST TAILINGS SLOPE FAILURE

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

[2] U.S. Bureau of Reclamation Criterion

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

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

EMBANKMENT FILL

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

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

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

SURFACE DRAINAGE

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

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

CONSTRUCTION OBSERVATION

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

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

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

LIMITATIONS

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

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

Very truly yours,

CTL | THOMPSON, INC.

Jonathan R. Lovekin, P.G.
Project Manager

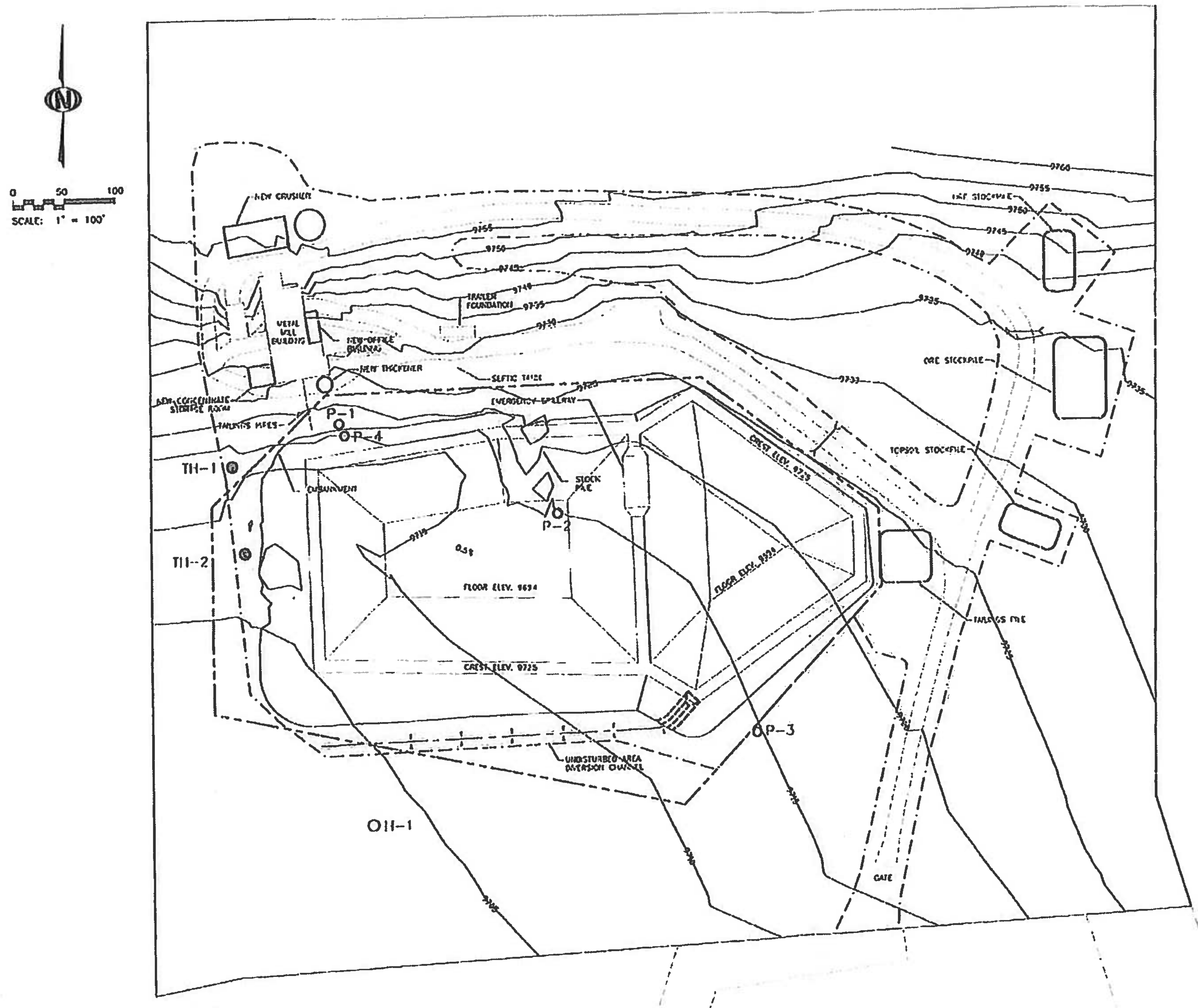
Reviewed by:

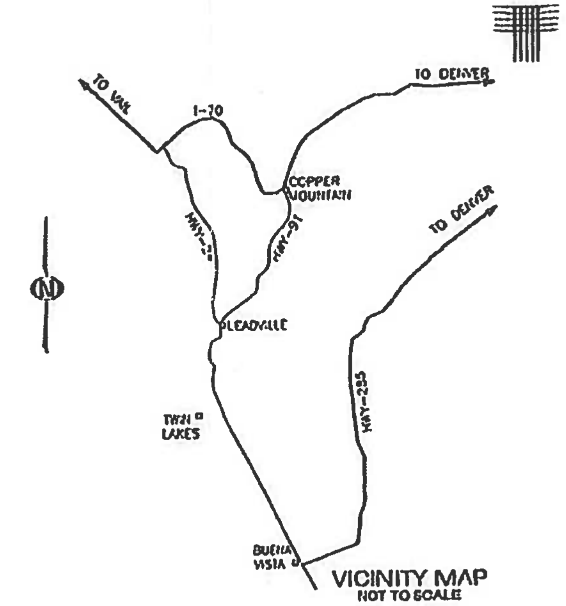
COLORADO REGISTERED
RONALD M. McOMBER
20243
7/8/11
PROFESSIONAL ENGINEER

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

JRL:RMM/jrl/nt
(3 copies)

via email: melder@unionmilling.com





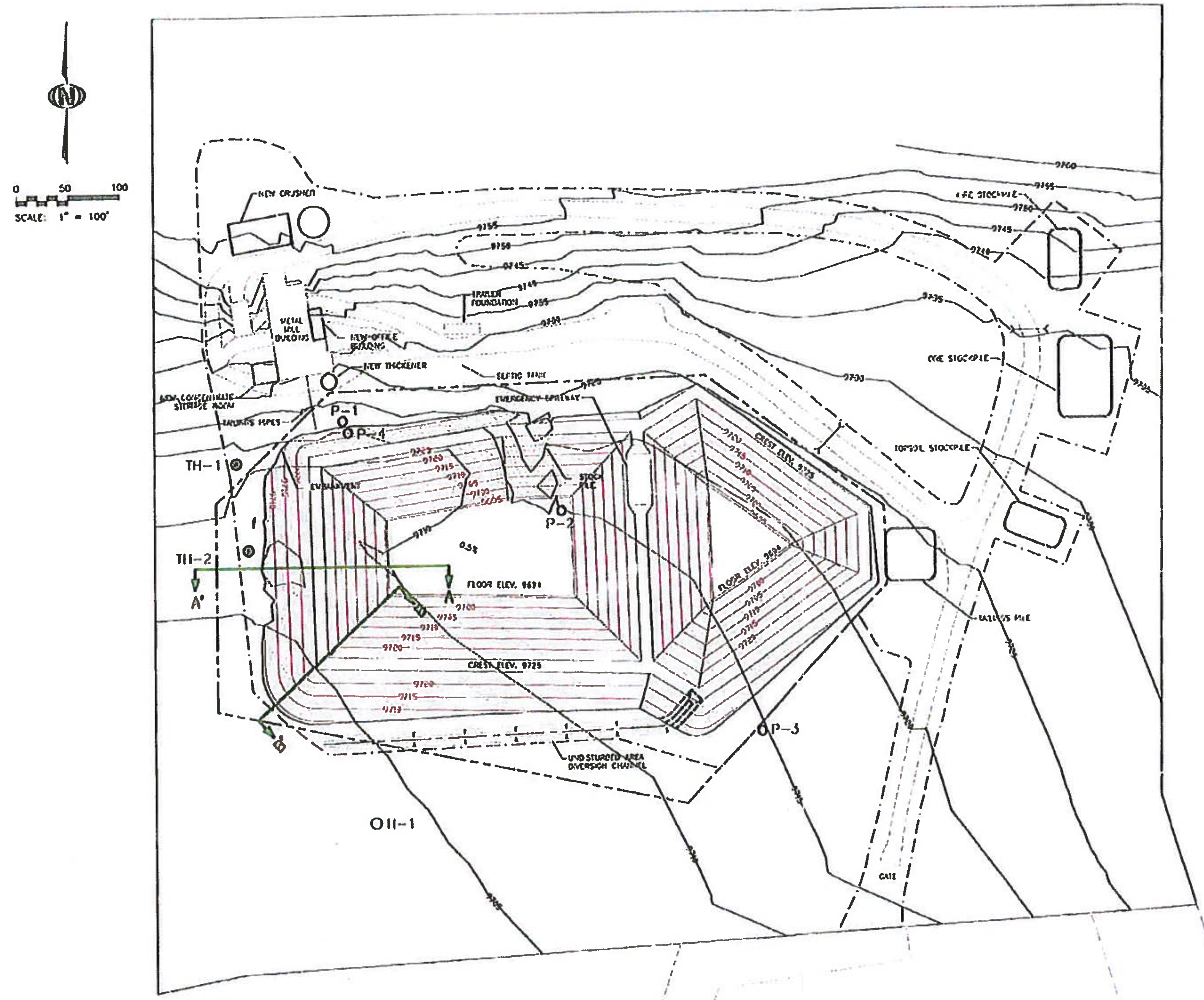
LEGEND:

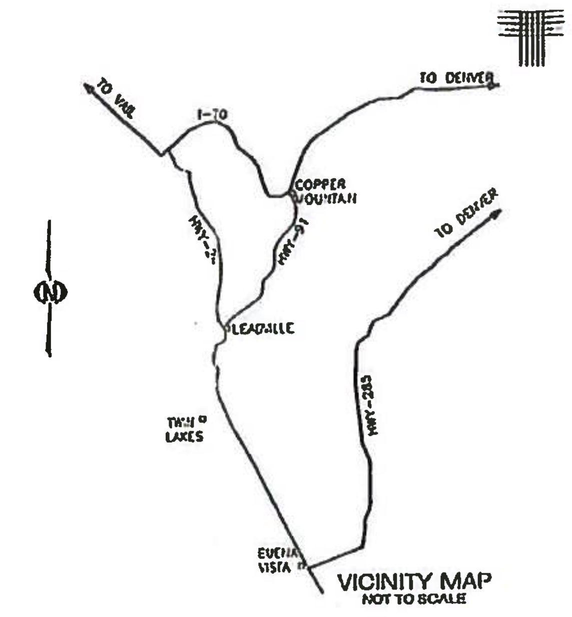
TH-1 ⊚	APPROXIMATE LOCATION OF EXPLORATORY BORING
9730	EXISTING GROUND SURFACE ELEVATION (FEET)
P-1 O	APPROXIMATE LOCATION OF PERMEABILITY TEST HOLE, JOB NO. 16,768, DATED APRIL 10, 1990.
H-1 O	APPROXIMATE LOCATION OF OBSERVATION HOLE, JOB NO. 16,768 DATED APRIL 10, 1990.
NOTE:	BASE MAP PROVIDED BY THE UNION MILLING COMPANY, TSF 01 DATED MAY 13, 2011.

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

Locations of Exploratory Borings

Fig. 1





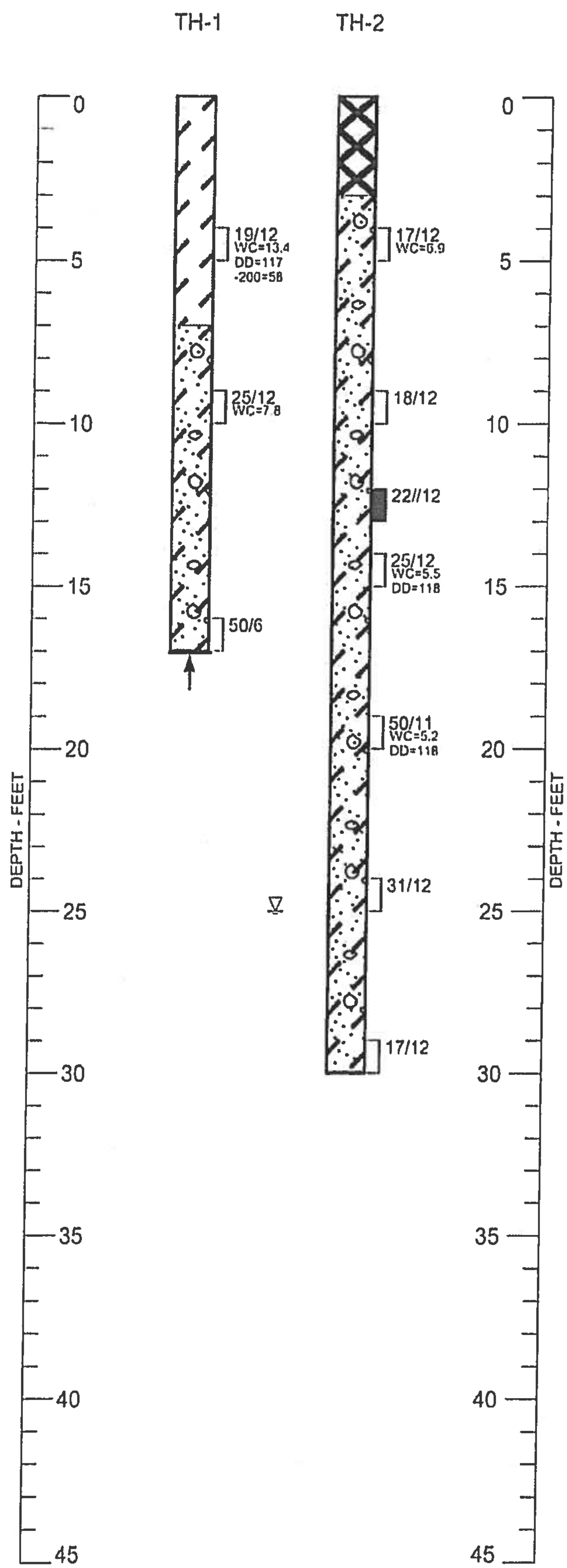
LEGEND:

TH-1	APPROXIMATE LOCATION OF EXPLORATORY BORING
9730	EXISTING GROUND SURFACE ELEVATION (FEET)
9695	PROPOSED EMBANKMENT SURFACE ELEVATION (FEET)
P-1	APPROXIMATE LOCATION OF PERMEABILITY TEST HOLE, JOB NO. 16,768, DATED APRIL 10, 1990.
H-1	APPROXIMATE LOCATION OF OBSERVATION HOLE, JOB NO. 16,768 DATED APRIL 10, 1990.
NOTE:	BASE MAP AND EMBANKMENT PROVIDED BY THE UNION MILLING COMPANY, TSF 03 DATED MAY 13, 2011.

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

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

Fig. 2



LEGEND:

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

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

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

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

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

∇ WATER LEVEL MEASURED AT TIME OF DRILLING.

PRACTICAL DRILL REFUSAL.

NOTES:

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

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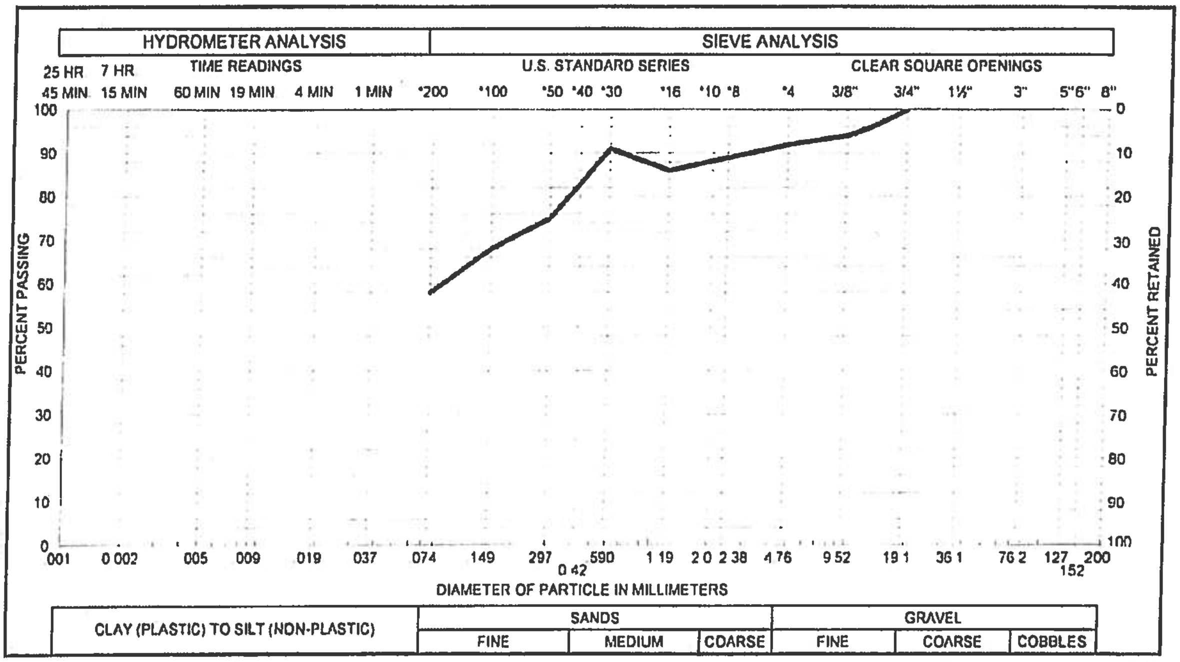
THE UNION MILLING COMPANY
TAILING POND
PROJECT NO. DN45,584-130

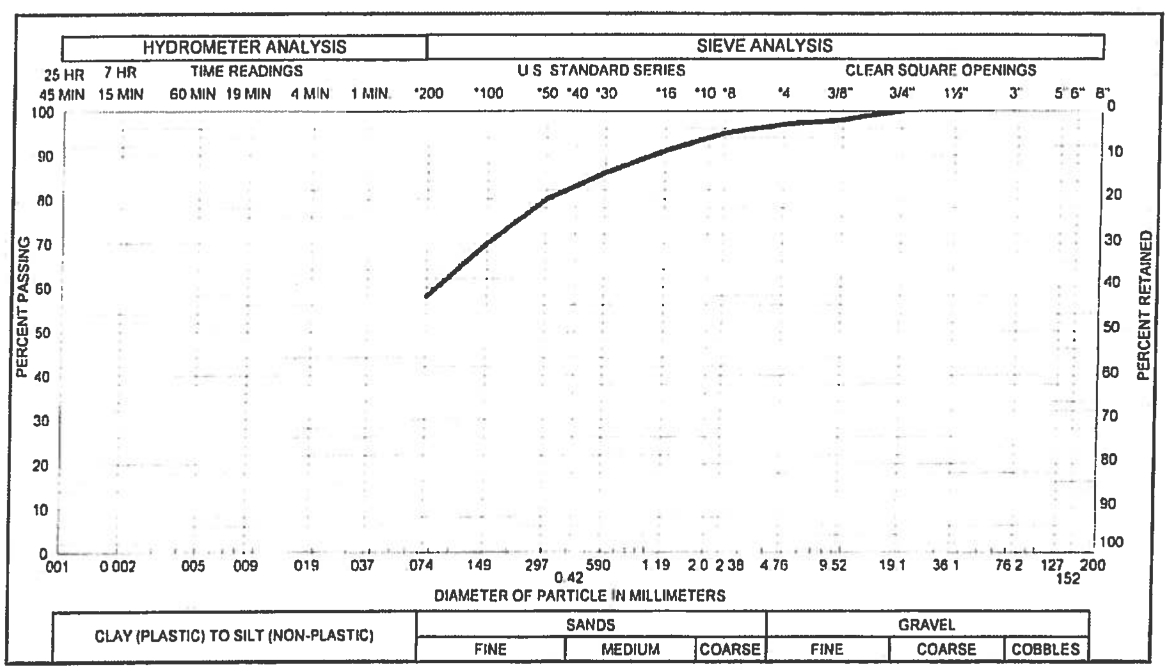
Summary Logs of Exploratory Borings

FIG. 3

APPENDI□ A
LABORATORY TEST RESULTS



Sample of	CLAY, SANDY (CL)	GRAVEL	8 %	SAND	34 %
From	TH - 1 AT 4 FEET	SILT & CLAY	58 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%

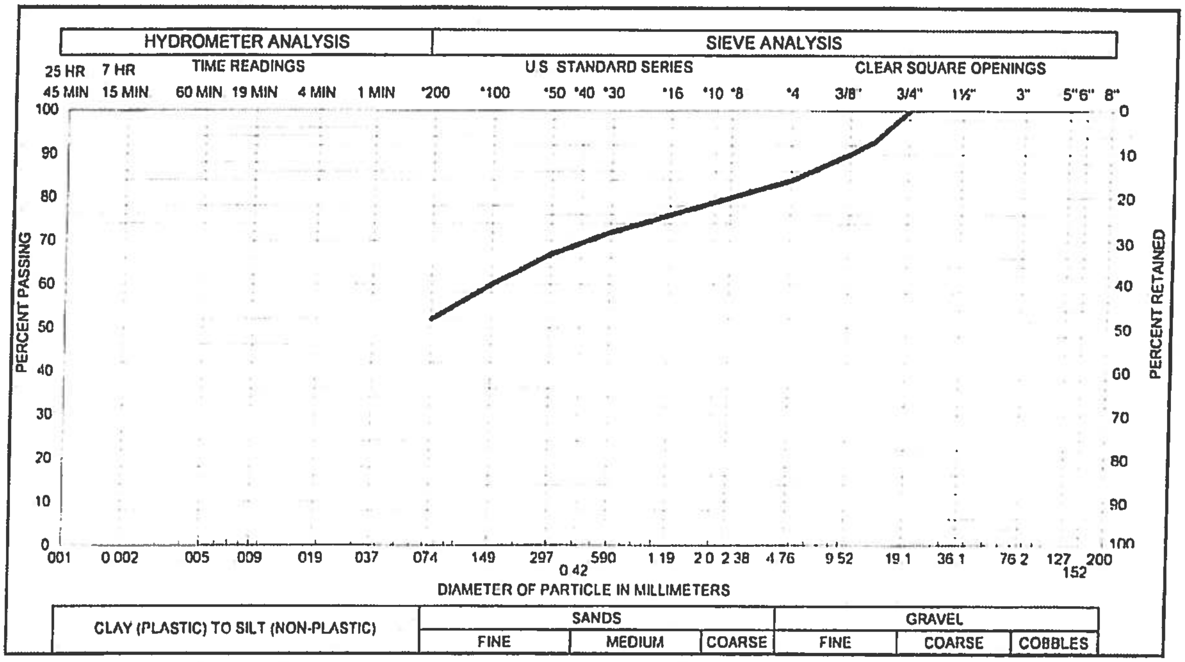


Sample of	CLAY, SANDY (CL)	GRAVEL	3 %	SAND	39 %
From	TH - 2 AT 1 FEET	SILT & CLAY	58 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%

Gradation Test Results

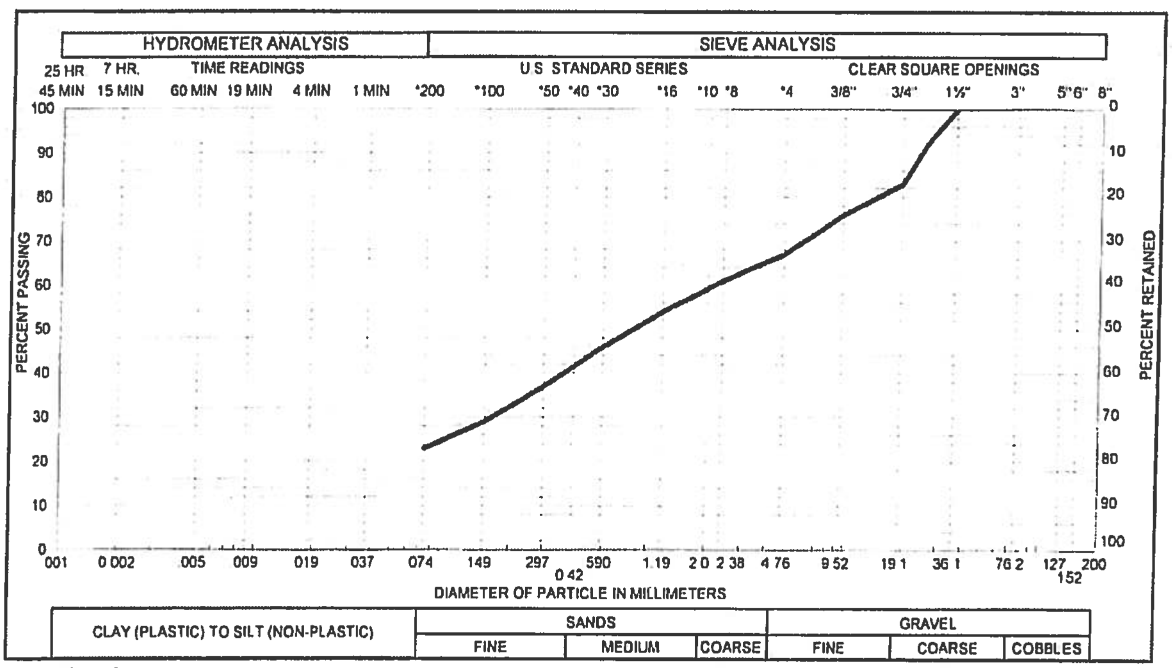
FIG. A-1

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



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

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



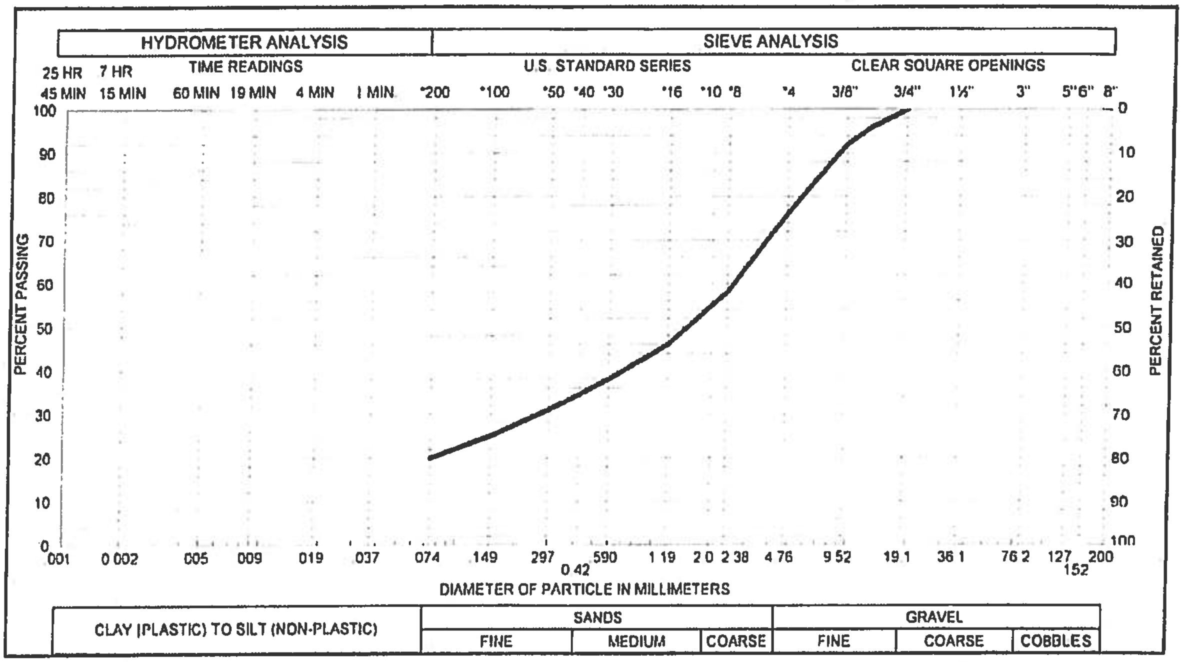
Sample of SAND AND GRAVEL, CLAYEY (SC)
From TH - 2 AT 11 FEET

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

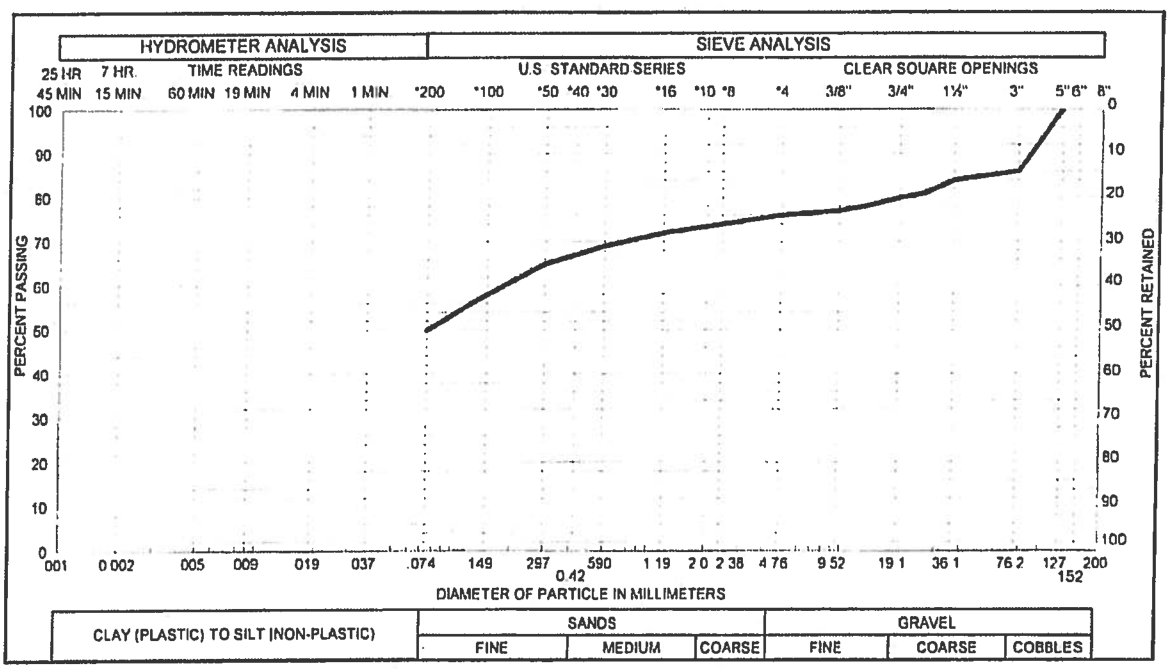
Gradation Test Results

FIG. A-2

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



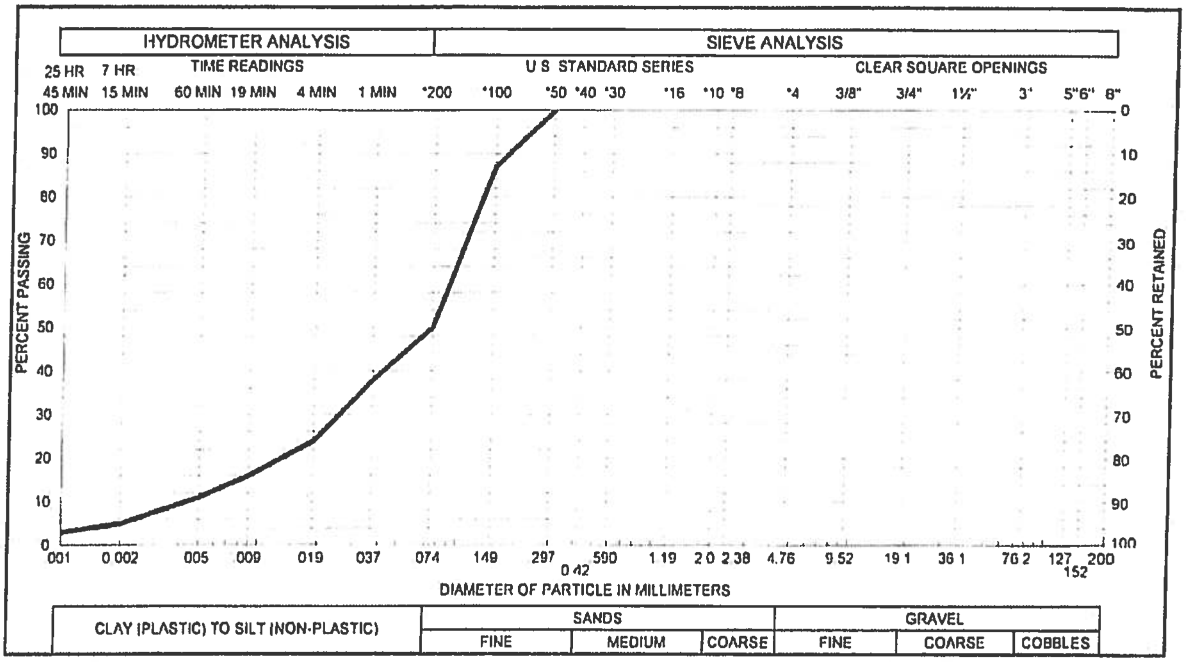
Sample of	SAND WITH GRAVEL, CLAYEY (SC)	GRAVEL	24 %	SAND	56 %
From	TH - 2 AT 21 FEET	SILT & CLAY	20 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%



Sample of	CLAY, SANDY, GRAVELLY (CL)	GRAVEL	24 %	SAND	26 %
From	Bulk sample from Stockpile	SILT & CLAY	50 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%

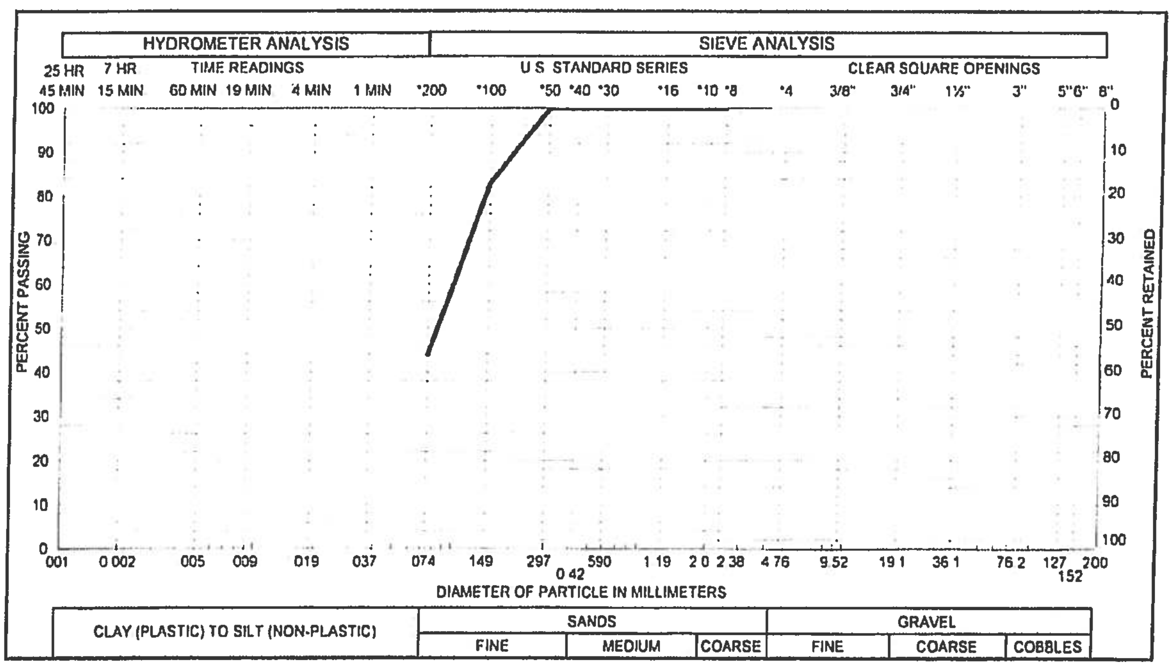
Gradation Test Results

FIG. A-3



Sample of TAILINGS
From

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



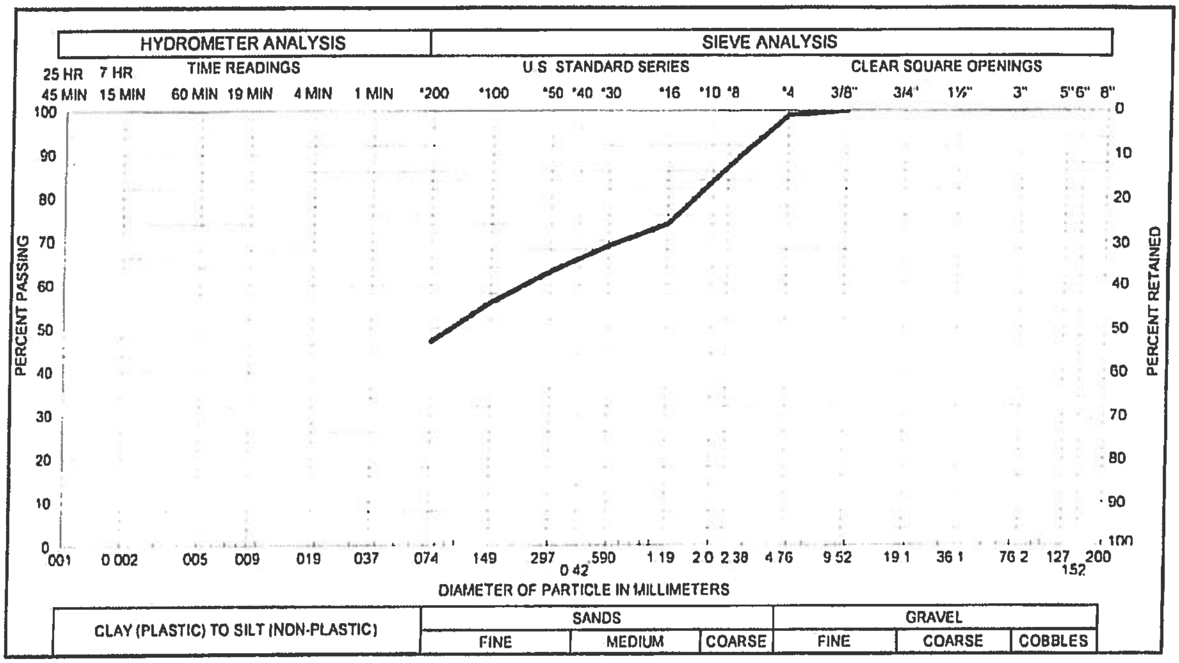
Sample of CLAY, SANDY (CL)
From Modified Tailings

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

Gradation Test Results

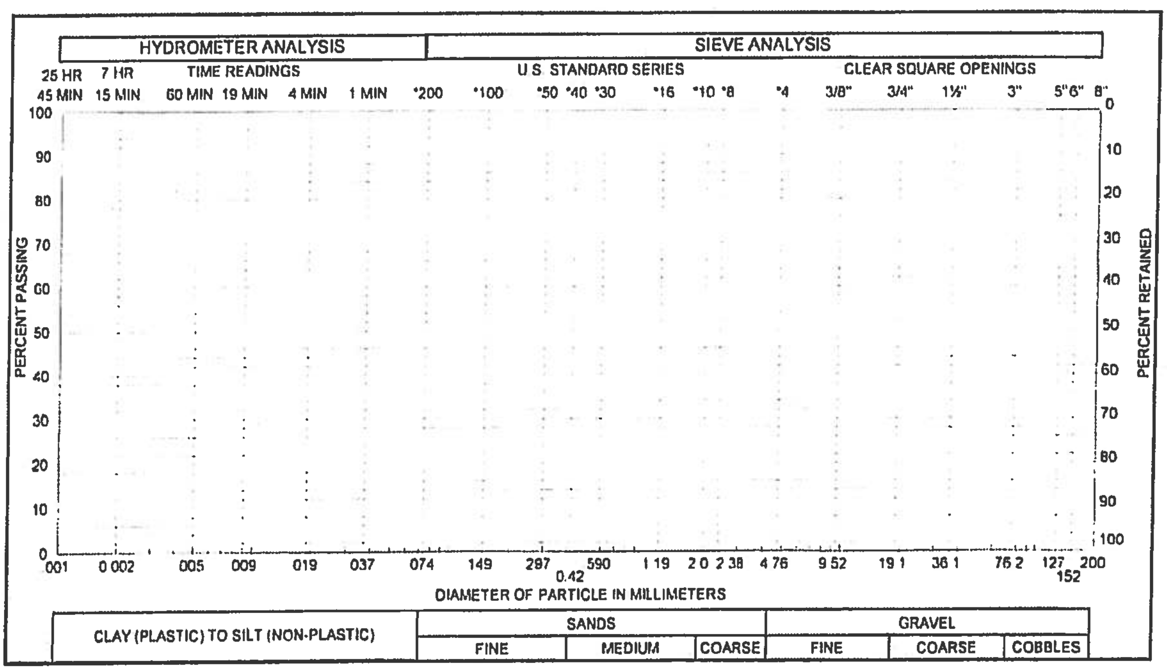
FIG. A-4

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



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

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

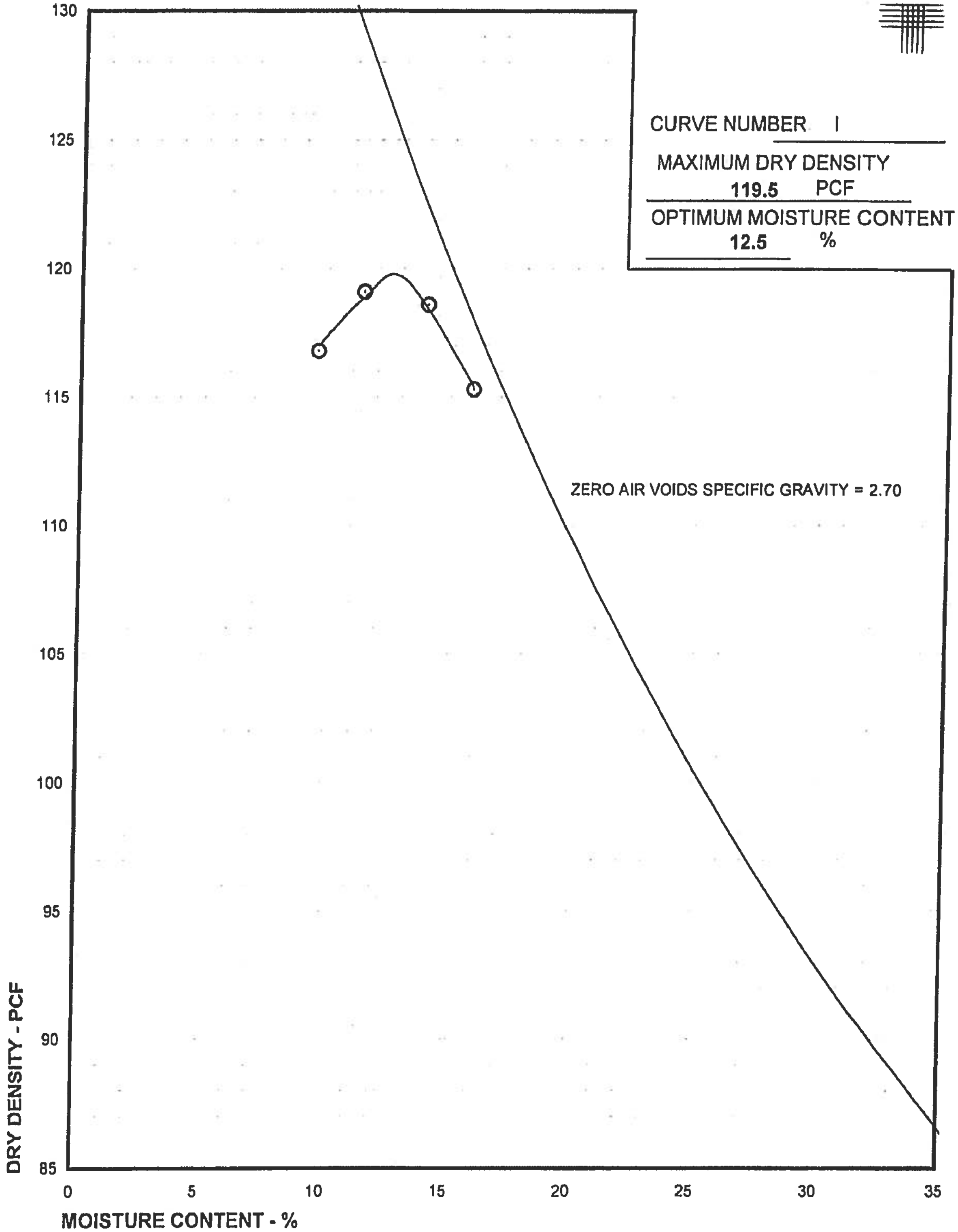


Sample of
From

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

Gradation Test Results FIG. A-5

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



Sample Description Clay, Sandy, Gravelly

Location Bulk sample from Stockpile

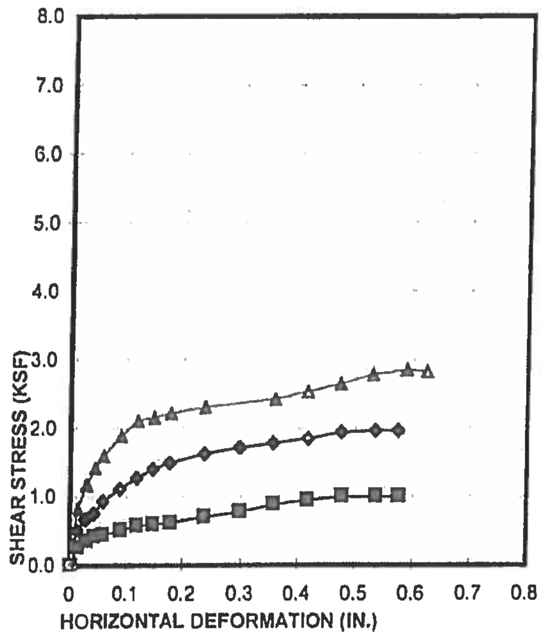
Compaction Test Procedure ASTM D 698 METHOD "A"

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

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

Compaction Test Results

Fig. A -6

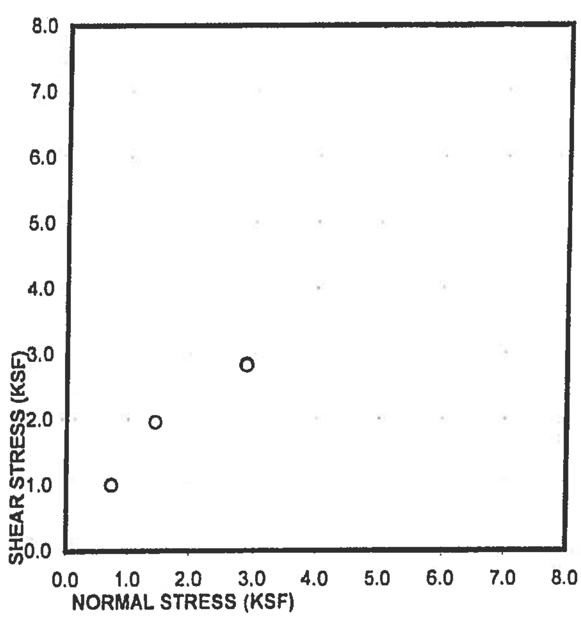


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1 ■	Stockpile		5.7	7.9	105.2
2 ◆	Stockpile		5.7	15.7	105.2
3 ▲	Stockpile		5.7	14.5	105.2

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

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

Shearing Rate (in/min): 0.0063



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

Peak ϕ (DEG): 39

Large Displacement. ϕ (DEG): 39

Peak C (PSF): 560

Large Displacement C (PSF): 570

Sample Description: Stockpile, Sand, clayey (SC)

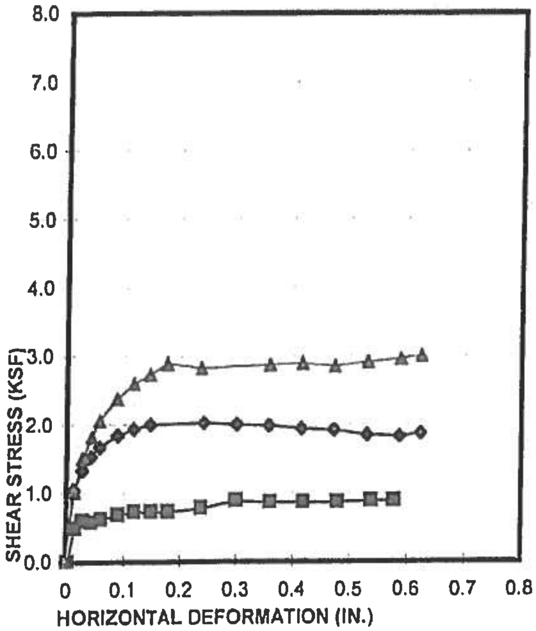
Sample Type: Remold at low density and moisture

Remarks: Plus 4 sieve material replaced with sand

Direct Shear Test Results

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

Fig. A - 7

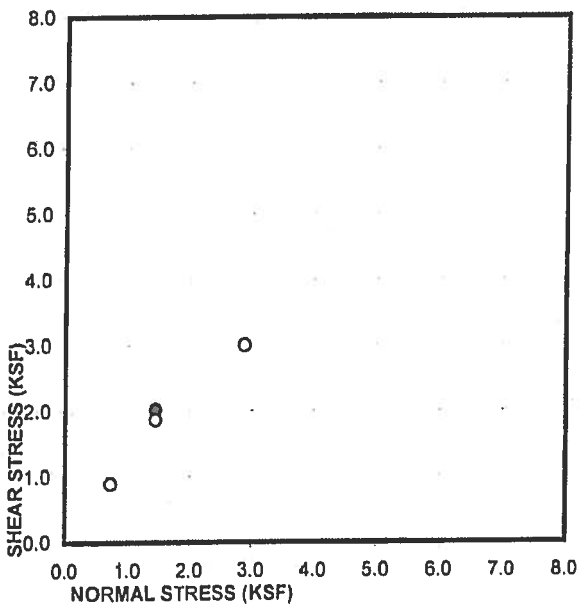


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	After	Dry Density (PCF)
1 ■	Stockpile		12.1		113.6
2 ◆	Stockpile		12.5	14.9	113.2
3 ▲	Stockpile		12.5	14.6	113.2

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

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

Shearing Rate (in/min): 0.0096



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

Peak ϕ (DEG): 43

Large Displacement. ϕ (DEG): 44

Peak C (PSF): 400

Large Displacement C (PSF): 320

Sample Description: Stockpile

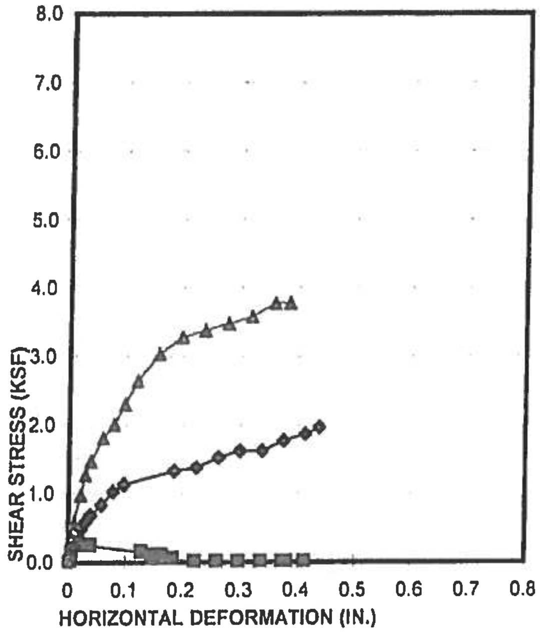
Sample Type: Remold at approximately 95% maximum ASTM D698 dry density

Remarks: Plus 4 material replaced with sand

Direct Shear Test Results

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

Fig. A - 8

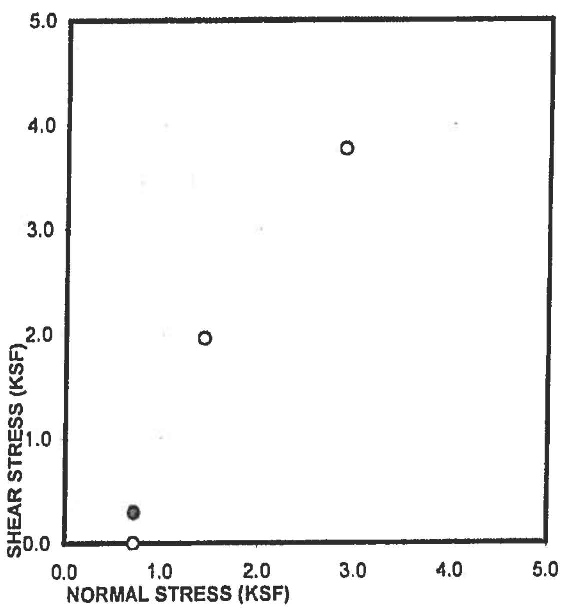


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	After	Dry Density (PCF)
1 ■	Tailings	0.00	1.6	28.9	64.2
2 ◆	Tailings	0.00	1.6	26.7	64.2
3 ▲	Tailings	0.00	1.6	25.8	64.2

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

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

Shearing Rate (in/min): 0.0063



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

Peak ϕ (DEG): 52

Large Displacement. ϕ (DEG): 51

Peak C (PSF): 0

Large Displacement C (PSF): 0

Sample Description: Tailings

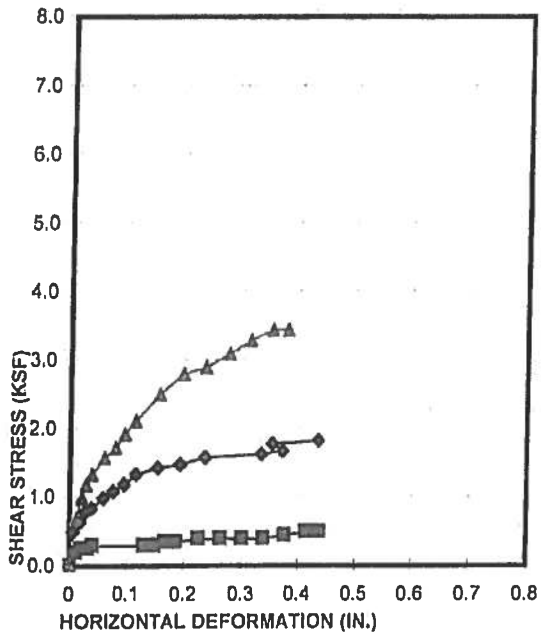
Sample Type: Placed in shear ring with no compaction prior to application of normal stress

Remarks: Silt and clay content reduced 12 percent.

Direct Shear Test Results

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

Fig. A - 9

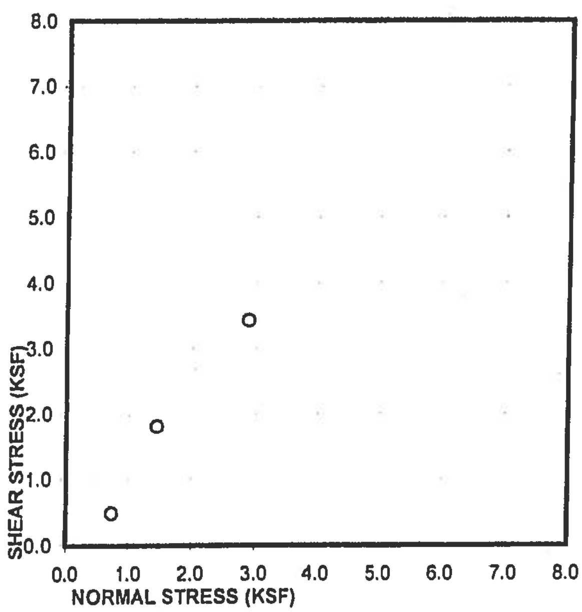


Sample No.	Boring No.	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1 ■	Tailings		1.8	31.3	66.9
2 ◆	Tailings		1.8	28.6	66.9
3 ▲	Tailings		1.8	27.6	66.9

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

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

Shearing Rate (in/min): 0.0063



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

Peak ϕ (DEG): 50

Large Displacement. ϕ (DEG): 50

Peak C (PSF): 0

Large Displacement C (PSF): 0

Sample Description: Tailings

Sample Type: Slightly tamped prior to application of normal stress

Remarks: Silt and clay content reduced 12 percent

Direct Shear Test Results

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

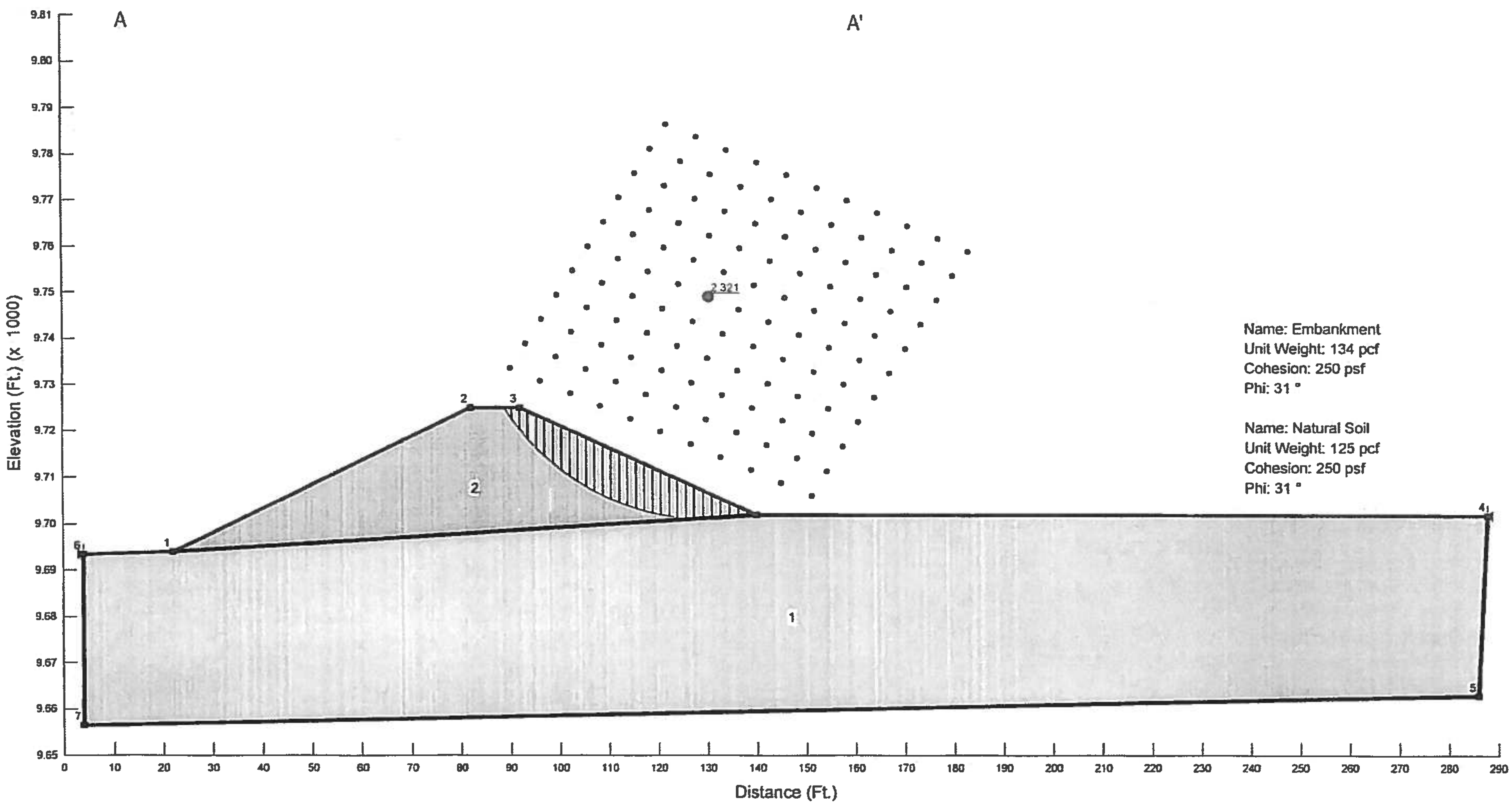
Fig. A-10

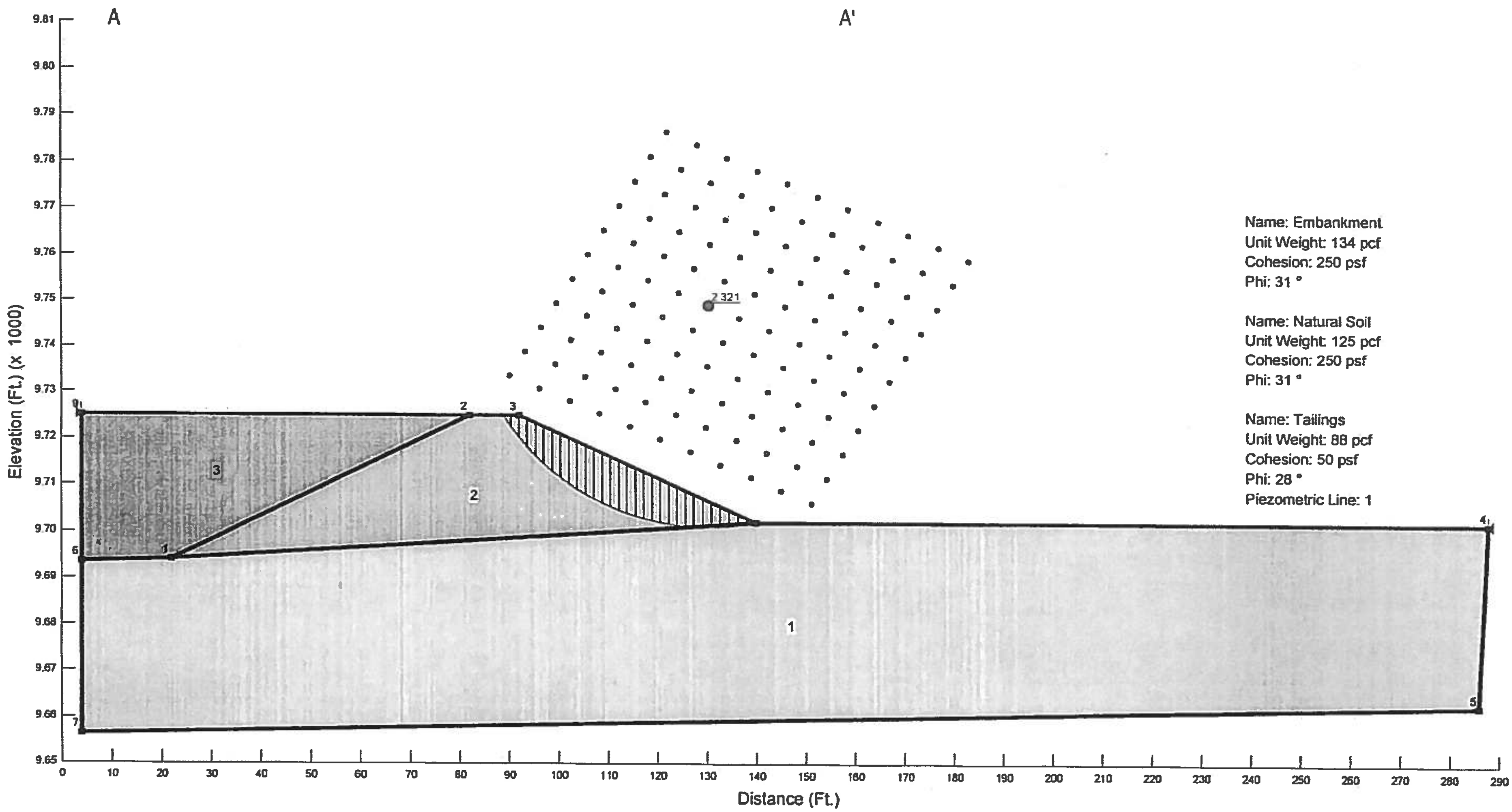
TABLE I

SUMMARY OF LABORATORY TEST RESULTS

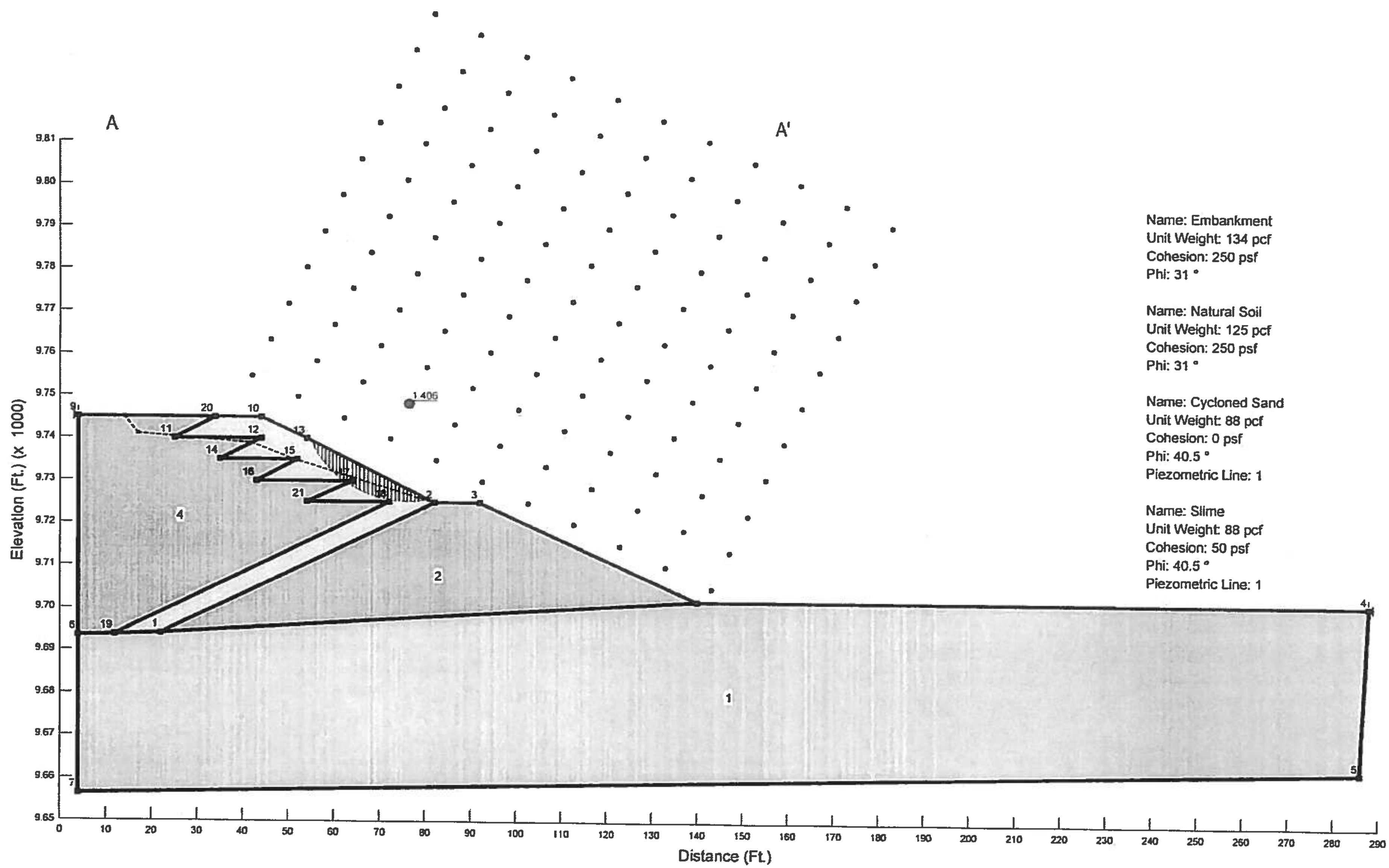
BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
TH-1	4	13.4		58	CLAY, SANDY (CL)
TH-1	4	13.1	117		CLAY, SANDY (CL)
TH-1	9	7.8			SAND, CLAYEY (SC)
TH-2	1	18.2		58	CLAY, SANDY (CL)
TH-2	4	6.9			CLAY, SANDY (CL)
TH-2	6	8.6		52	CLAY, SANDY (CL)
TH-2	11	4.6		23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

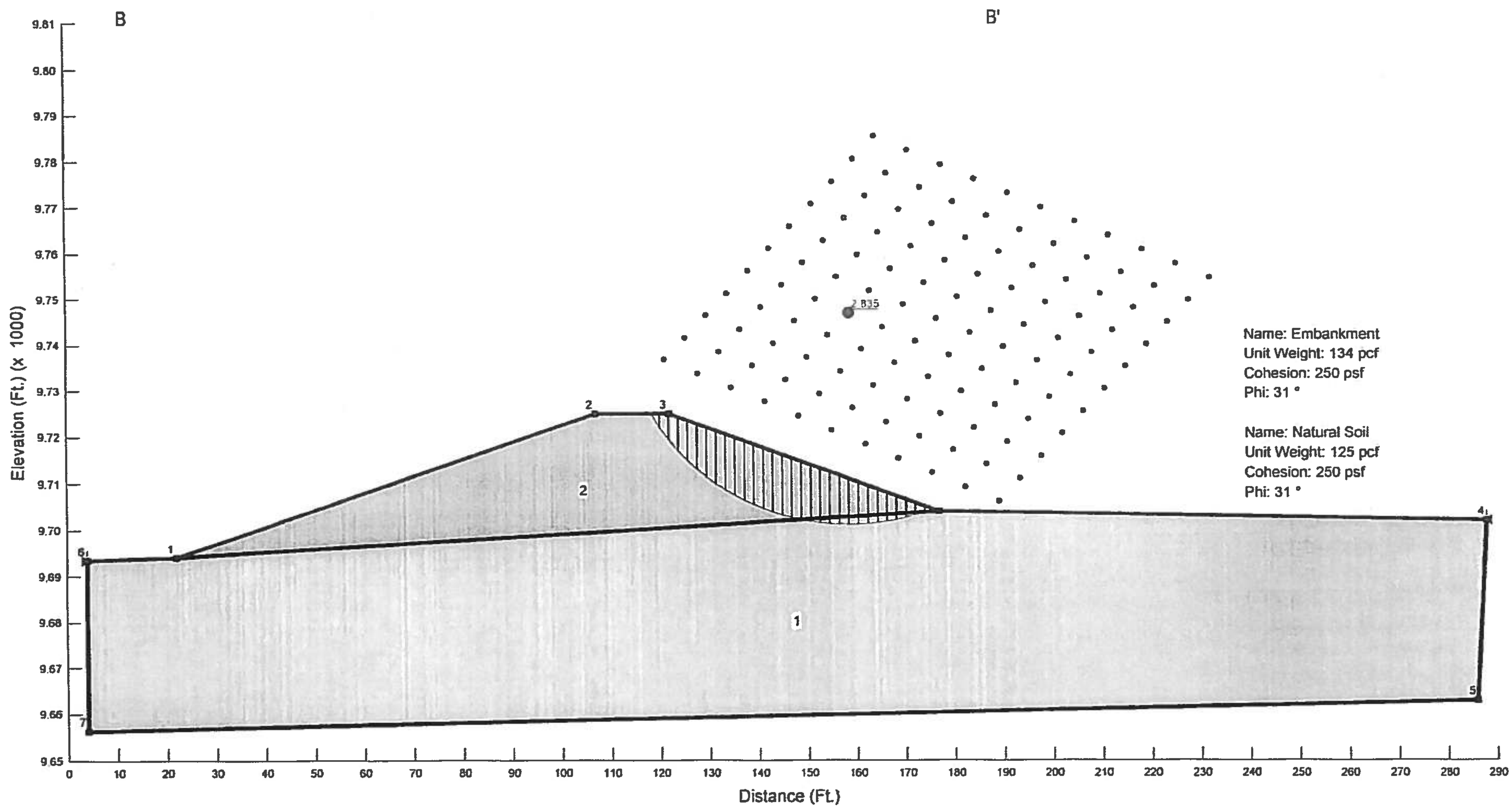
APPENDI□ B
SLOPE STABILITY ANALYSIS

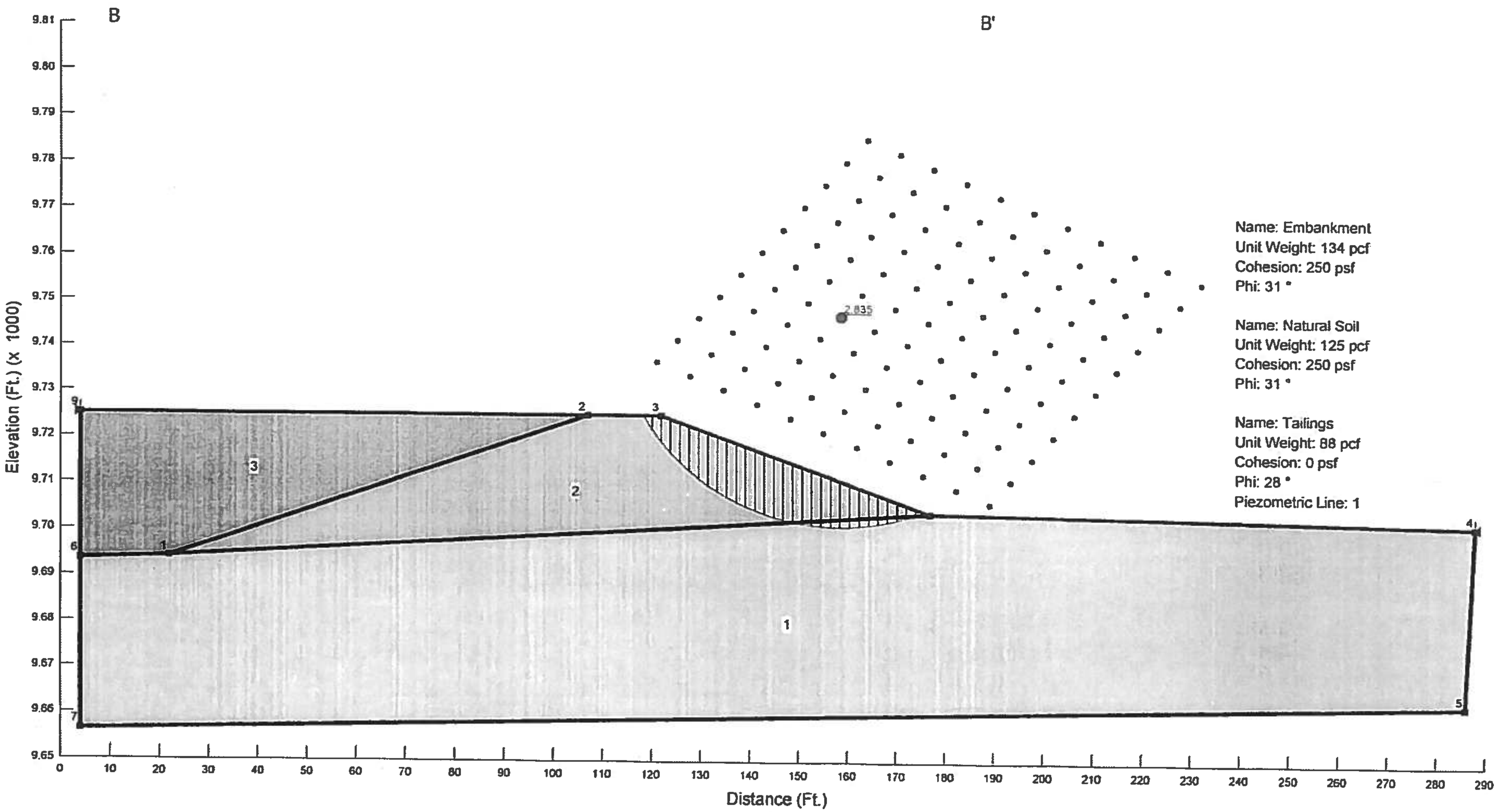

A
A'
2.321
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °
Elevation (Ft.) (x 1000)
Distance (Ft.)



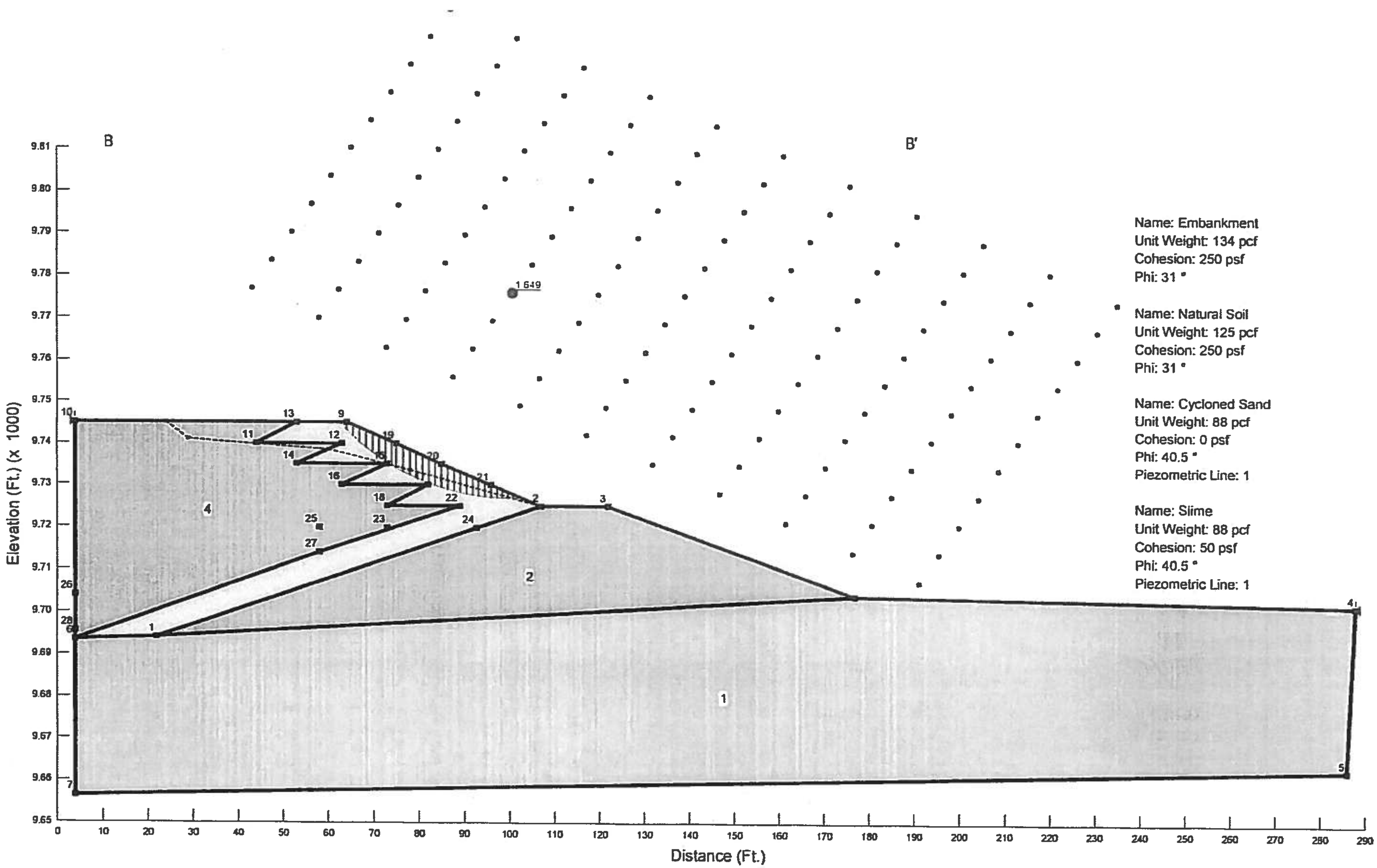
A
A'
2.321
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °
Name: Tailings
Unit Weight: 88 pcf
Cohesion: 50 psf
Phi: 28 °
Piezometric Line: 1
Elevation (Ft.) (x 1000)
Distance (Ft.)


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


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



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


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

APPENDI□ C

PREVIOUS □ ORK

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

March 9, 1990

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

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

Gentlemen:

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

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

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

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

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

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

Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holiday, P. E.
Principal Engineer

FJH:tl
(3 copies sent)

1cc: Mr. Don Wilson
Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

April 10, 1990

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

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

Dear Mr. Wilson:

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

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

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

Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:dd
1 copy sent w/enclosures

1971 WEST 12TH AVENUE • DENVER, COLORADO [illegible] • [illegible] 0777

CTL/THOMPSON, INC.
CONSULTING GEOTECHNICAL AND MATERIALS ENGINEERS

April 10, 1990

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

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

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

Gentlemen:

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

Please call the undersigned with questions.

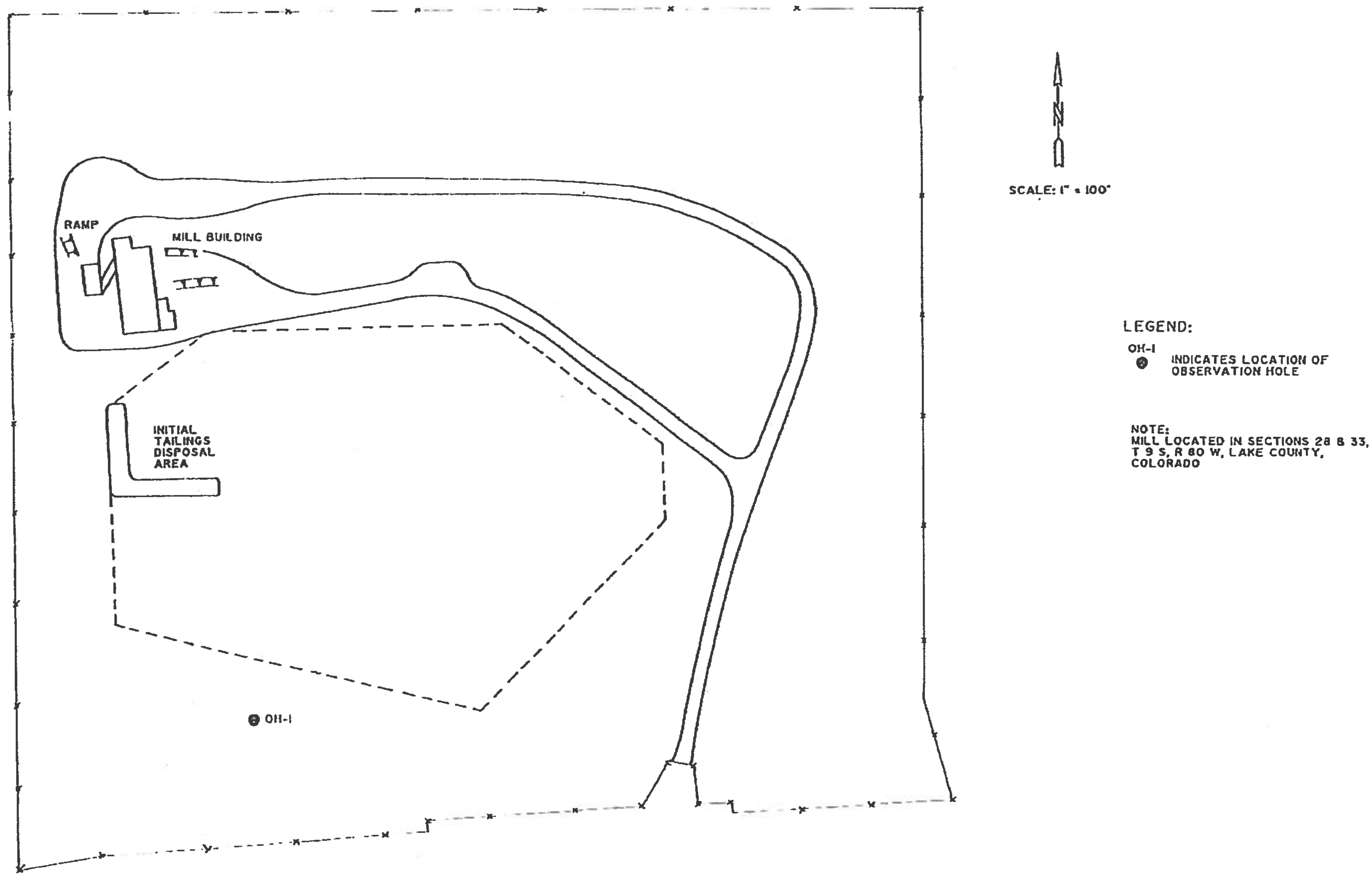
Very truly yours,

CTL/THOMPSON, INC.

Frank J. Holliday, P. E.
Principal Engineer

FJH:dd
(1 copy sent)

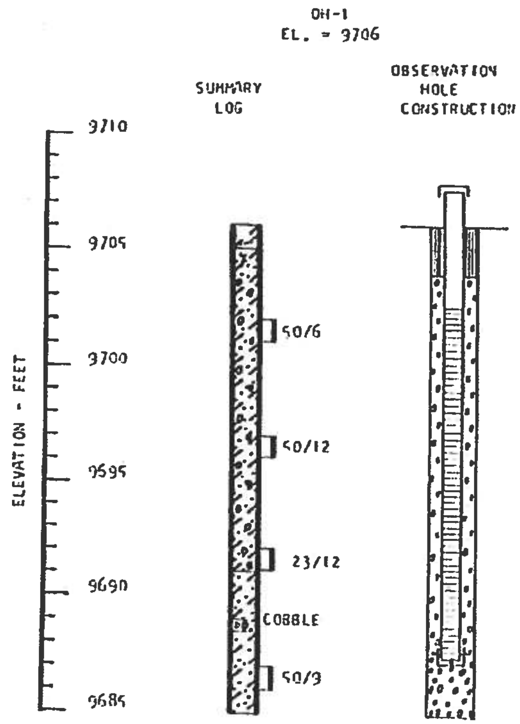
1 cc: Mr. Don Wilson
Leadville Mining & Milling Corporation
700 Carr Street
Lakewood, Colorado 80215



LOCATION OF OBSERVATION HOLE

JOB NO. 16,768

FIG. 1



NOTES:

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

LEGEND - SUMMARY LOG:

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

LEGEND - OBSERVATION HOLE CONSTRUCTION:

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

SUMMARY LOG OF OBSERVATION HOLE AND OBSERVATION HOLE CONSTRUCTION

JOB NO. 16,768

FIG. 2

CTL | THOMPSON

August 17, 2011

The Union Milling Company
PO Box 36099
Denver, Colorado 80236

Attention: Mike Elder
John Danio

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

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

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

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

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

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

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

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

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

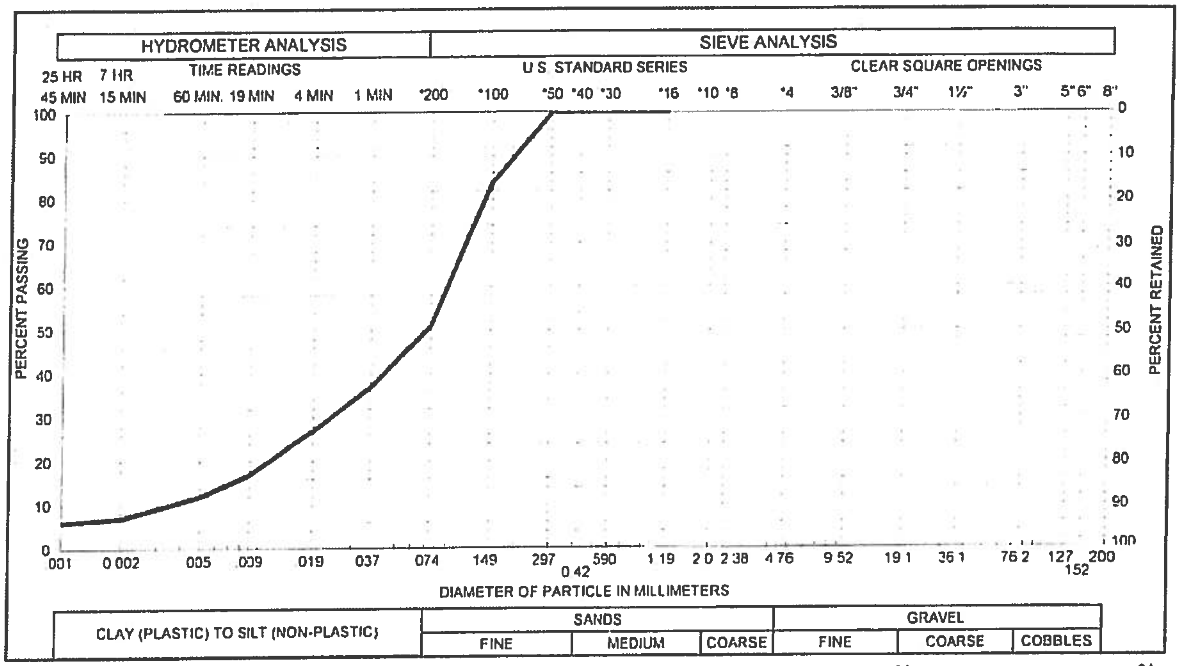
Very truly yours,

CTL | THOMPSON, INC.

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

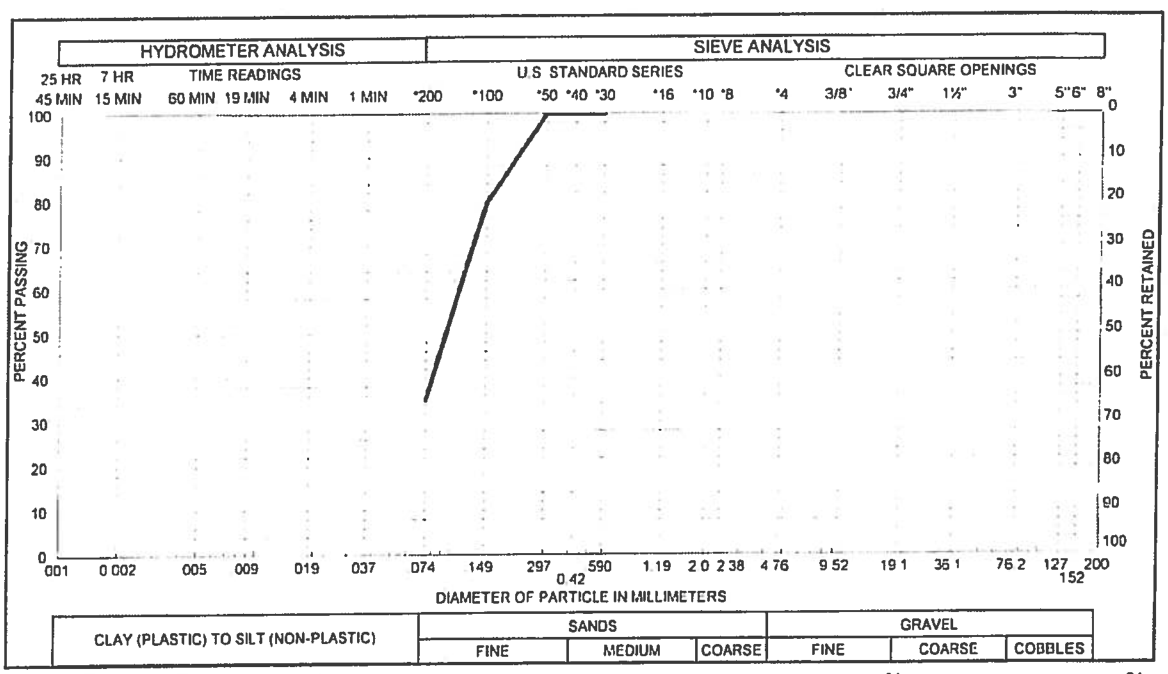
RMM/nt
(3 copies)

via email: melder@unionmilling.com



Sample of TAILINGS
From

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



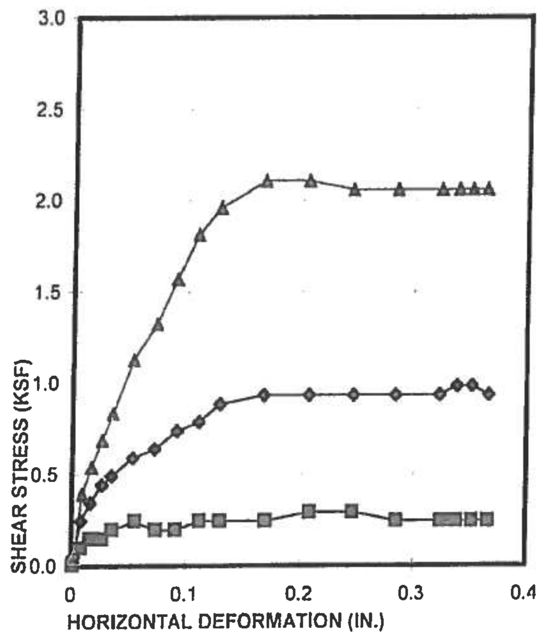
Sample of MODIFIED TAILINGS
From

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

Gradation Test Results

FIG. 1

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

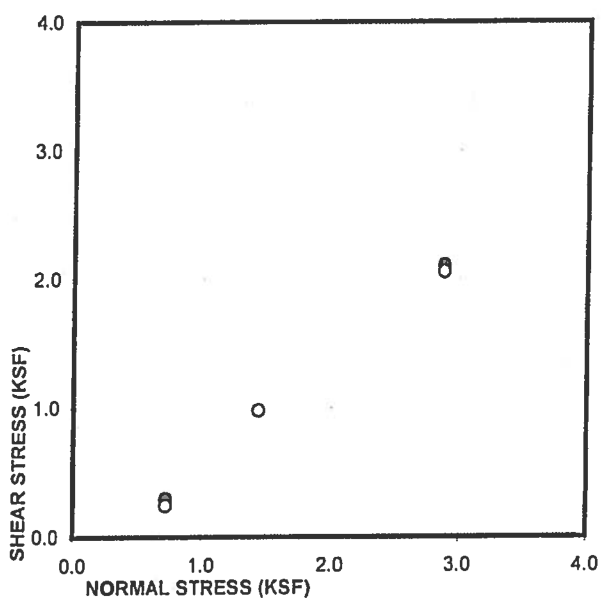


Sample No.		Description	Depth (FT)	Moisture Content (%) Before	Moisture Content (%) After	Dry Density (PCF)
1	■	Tailings	0.00	0.6	31.4	68.6
2	◆	Tailings	0.00	0.6	29.8	68.6
3	▲	Tailings	0.00	0.6	28.4	68.6

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

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

Shearing Rate (in/min): 0.019



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

Peak ϕ (DEG):	35
Large Displacement. ϕ (DEG):	35
Peak C (PSF):	0
Large Displacement C (PSF):	0

Sample Description: Tailings

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

Remarks: Silt and clay content reduced 30 percent.

Direct Shear Test Results

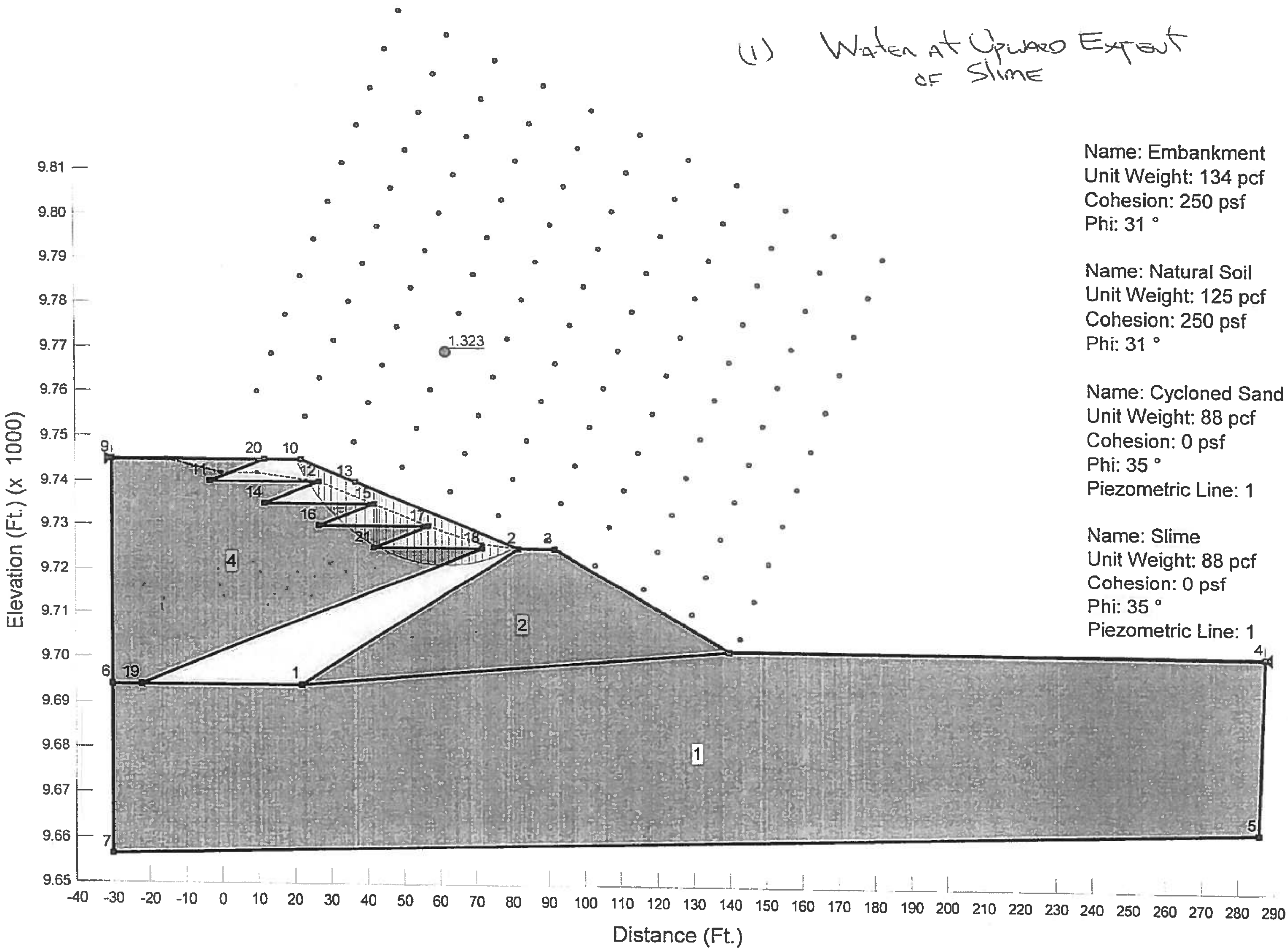
THE UNION MILLING COMPANY
UNION MILL
PROJECT NO. DN45,584-130
S:\PROJECTS\45500\DN45584 000\130\3 Letters\L2\dn-45584tailings reduced to 35% fines

Fig. 2

APPENDI□ A

STABILITY ANALYSIS RESULTS

(1) Water at Upward Extent of Slime



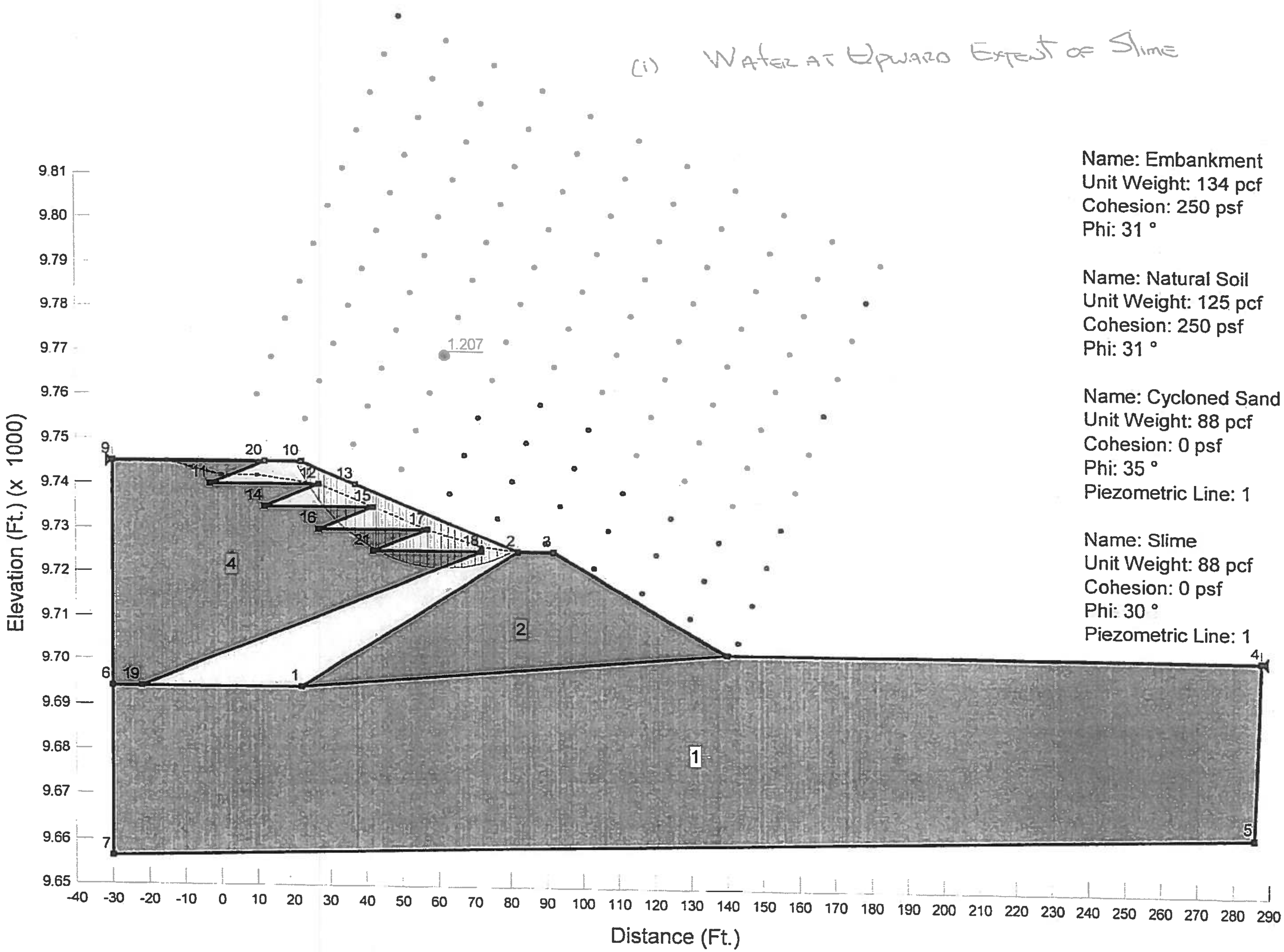
Name: Embankment
Unit Weight: 134 pcf
Cohesion: 250 psf
Phi: 31 °

Name: Natural Soil
Unit Weight: 125 pcf
Cohesion: 250 psf
Phi: 31 °

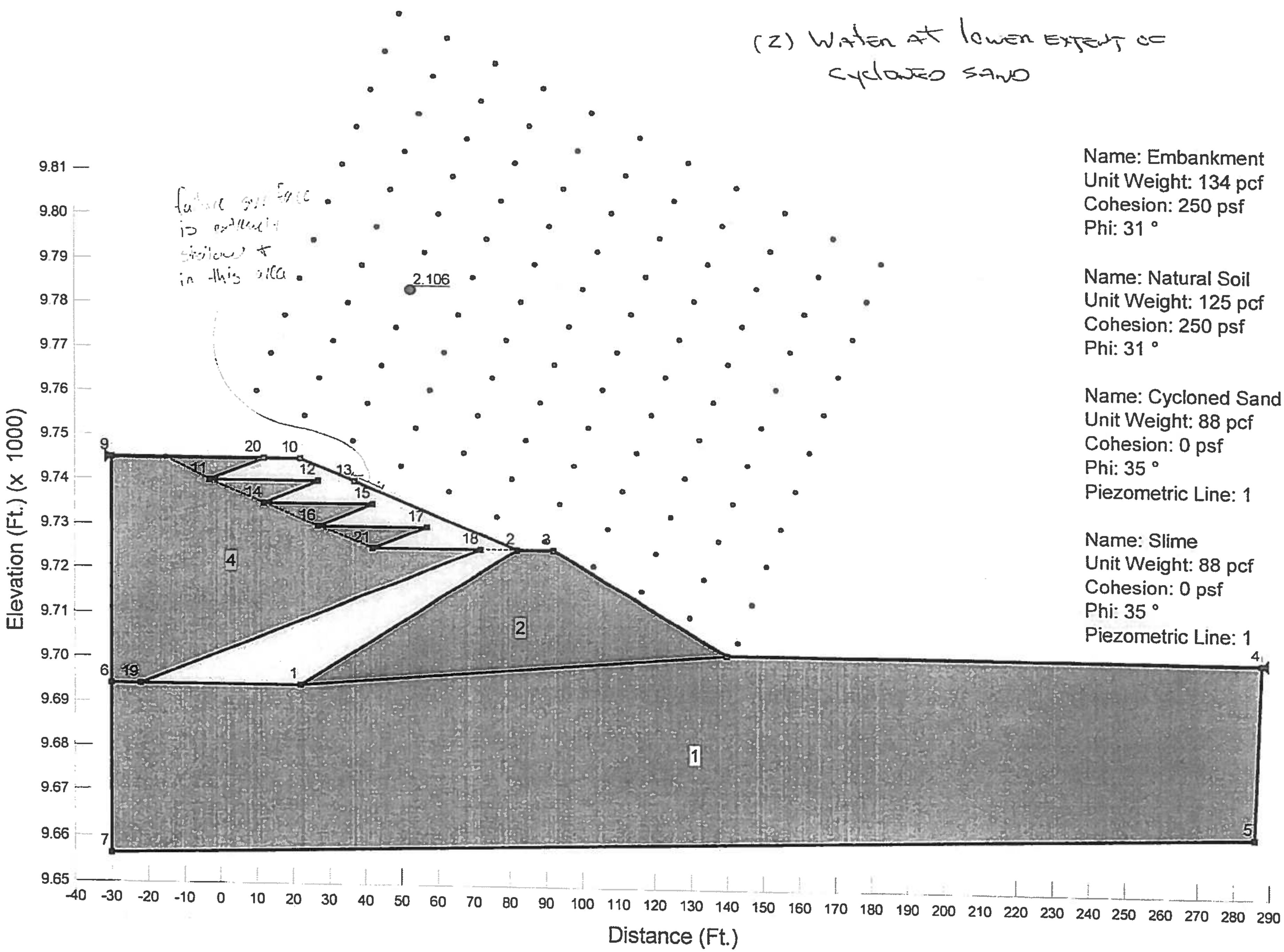
Name: Cycloned Sand
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 35 °
Piezometric Line: 1

Name: Slime
Unit Weight: 88 pcf
Cohesion: 0 psf
Phi: 35 °
Piezometric Line: 1

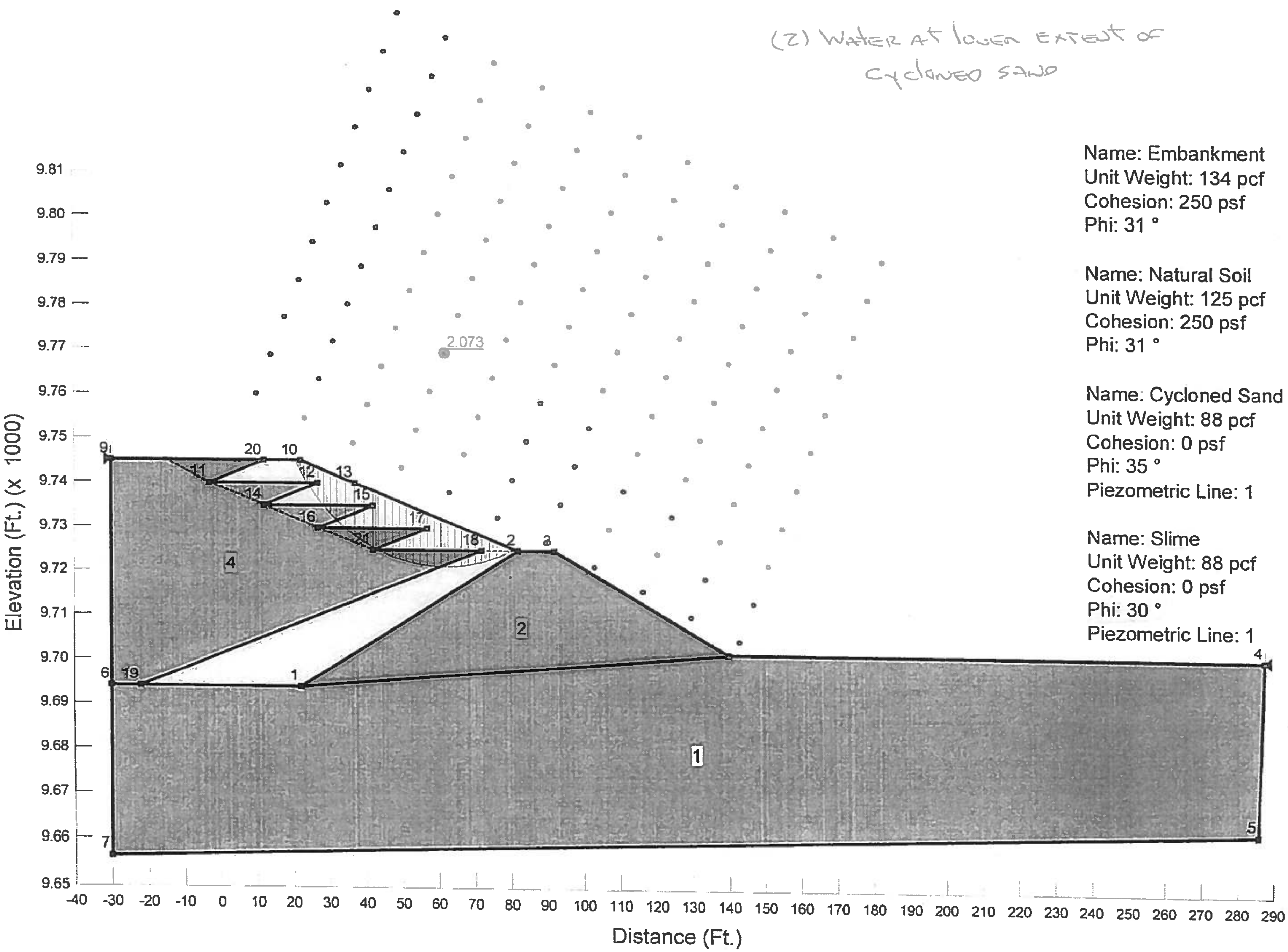
(i) Water at Upward Extent of Slime



(2) Water at lower extent of cycloned sand



(2) Water at lower extent of cycloned sand



Appendix A

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

CTL|THOMPSON

September 1, 2011

The Union Milling Company
PO Box 36099
Denver, Colorado 80236

Attention: Mike Elder
John Danio

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

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

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

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

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

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

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

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

6.

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

   b. See a.

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

If there are further comments, please contact me.

Very truly yours,

CTL | THOMPSON, INC.

COLORADO REGISTERED RONALD M. McOMBER 9/1/11 20243 PROFESSIONAL ENGINEER

Ronald M. McOmber, P.E., D.GE
Chairman & CEO
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RMM/nt
(3 copies)

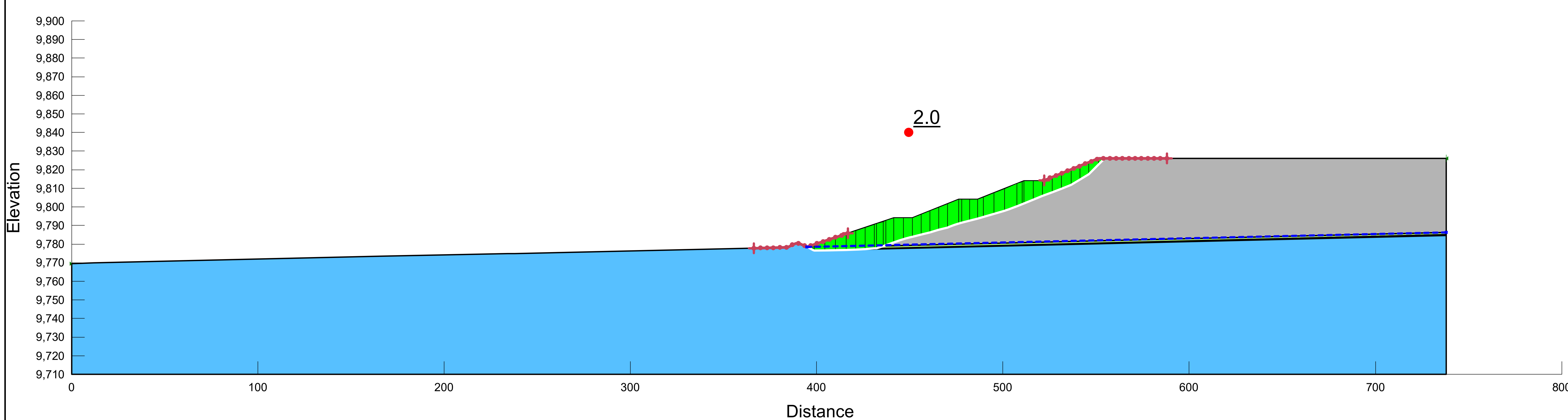
Attachment: Letter dated August 17, 2011

via email: melder@unionmilling.com

APPENDIX C – SLOPE STABILITY ANALYSIS OUTPUTS

Name: SectA
Kind: SLOPE/W
Method: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Composite Liner	Mohr-Coulomb	115	0	18	1
	Filtered Tailings	Mohr-Coulomb	115	0	32	1
	Glacial Deposit	Mohr-Coulomb	120	0	30	
	Sand	Mohr-Coulomb	118	0	35	1



Prepared by: GRE Global Resource Engineering

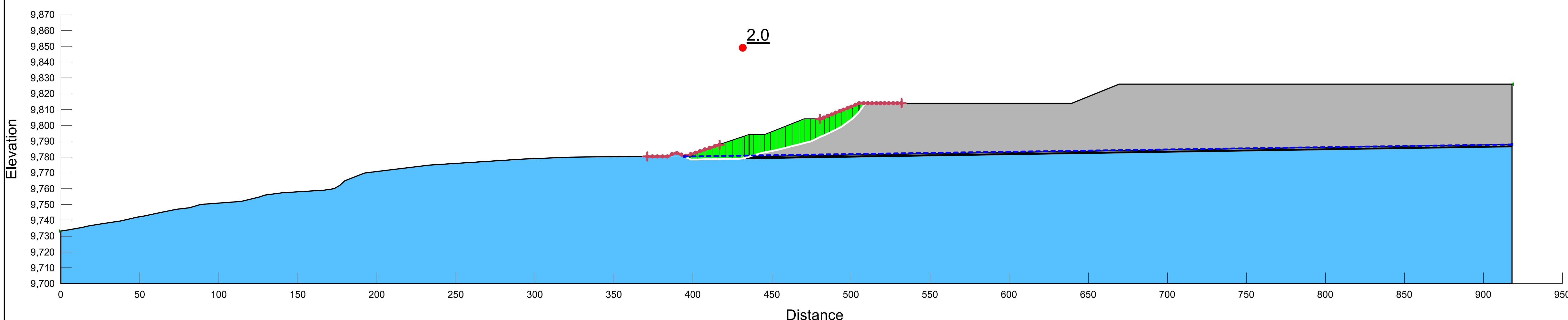
Prepared for: CJK Milling — Remove ▲ Reuse ▲ Restore

Option 6 Section A
Phreatic Level

Project: CJK Milling Company FTD Design	Project No.: 22-1382
Location: Lake County, Co.	Date: 29/12/2022
Revision: 0	Output: 1

Name: SectionB
Kind: SLOPE/W
Method: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
(pink)	Composite Liner	Mohr-Coulomb	115	0	18	1
(grey)	Filtered Tailings	Mohr-Coulomb	115	0	32	1
(blue)	Glacial Deposit	Mohr-Coulomb	120	0	30	
(light green)	Sand	Mohr-Coulomb	118	0	35	1



Prepared by: GRE Global Resource Engineering

Prepared for: CJK Milling — REMOVE ▲ REUSE ▲ RESTORE

Option 6 Section B
Phreatic Level

Project: CJK Milling Company FTD Design	Project No.: 22-1382
Location: Lake County, Co.	Date: 29/12/2022
Revision: 0	Output: 2

ANNEX 5
TEST RECORD SHEET

CJK MILLING COMPANY LLC
LEADVILLE MILL

TAILINGS SHEET AT FILTER PLANT						
No.	Date yymmdd	Time AM/PM	Moisture %	Accepted? Y/N	Tester Initials	COMMENTS
example	230117	10:15AM	22%	Y	NM	Include comments as appropriate
001						
002						
003						
004						
005						
006						
007						
008						
009						
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