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**Calico Resources USA Corp.
Grassy Mountain Gold Project,
Malheur County, Oregon, USA**

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1 Introduction

Paramount Gold Nevada Corporation (Paramount), a gold mining company based in Nevada, USA, is continuing to develop the Grassy Mountain Project in Malheur County, Oregon. The site is located in eastern Oregon, approximately 70 miles west of Boise, Idaho and 22 miles south of Vale, Oregon.

The project includes an underground mine, process plant, and associated infrastructure, with a capacity to process 255,500 short tons of ore per year resulting in approximately 44,200 ounces of gold annually. The process plant will produce gold doré bars to be sold to local gold refiners.

The crushing plant consists of primary and secondary crushing producing a crushed ore product, which is then conveyed to feed the process plant. The carbon-in-leach (CIL) circuit cyanide is used to recover gold from the ore and activated carbon is used to adsorb the extracted gold from solution. Following the CIL circuit, the carbon is collected and treated in the elution circuit which separates the gold from the carbon. The carbon is regenerated and reused in the CIL circuit, while the gold is removed from solution in the integrated electrowinning plant. The stripped gold is then smelted in a gold room to produce gold doré bars. Leached tails are detoxified in an INCO™ Air/SO₂ cyanide destruction circuit. Detoxified tails are pumped to a tailings storage facility (TSF) for final deposition and recovery of decant water.

The crushing and process plant consists of:

- Crushing and screening plant
- Ball mill grinding circuit
- Gravity and intensive cyanidation circuit
- Pre-aeration & CIL circuit
- Elution circuit
- Gold room
- Carbon regeneration
- Cyanide detoxification
- Reagent and air services
- Water services (raw water, process water, potable water)

A depiction of the key unit operations involved in the process is shown in Figure 1.

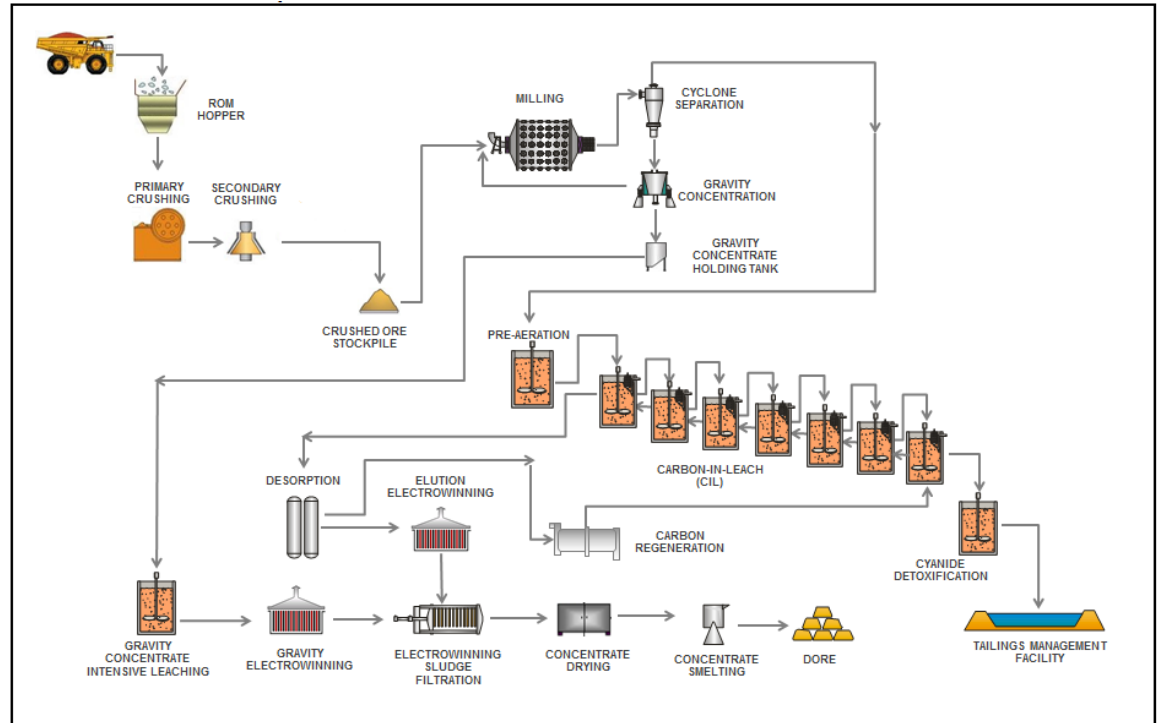


Figure 1: Grassy Mountain Process Flowsheet

The intent of the Mill Design Report is to address the following items from Chapter 340, Division 43 - Chemical Mining by the Department of Environmental Quality of the State of Oregon:

- Description of the facilities to be constructed, including tanks, pipes and other storage and conveyance means for processing chemicals, solutions, and wastewaters;
- Description of all chemical process and facilities for mixing, distribution, and application of chemicals associated with on-site mining operations, ore preparation, and beneficiation facilities;
- Description of all chemical conveyances (ditches, troughs, pipes, etc.) and the requisite equipment with secondary containment and leak detection means for preventing and detecting release of chemicals to surface water, groundwater and soils.

1.1 Plant Design Basis

The key criteria selected for the plant design are:

- Average plant treatment rate of 700 st/d on a solids basis
- Design crushing plant operating time of 70% (crushing / screening / conveying)
- Design process plant operating time of 91.3% (milling / leaching & adsorption / detoxification / elution / refining).

1.2 Throughput & Availability

An overall crushing plant availability of 70% and a process plant availability of 91.3% over the course of the year yield total crushing plant operating time of 6,132 h/y and a total process plant operating time of 7,998 h/y.

1.3 Key Design Criteria

The major process design criteria developed for the Grassy Mountain Project are outlined in Table 1.

Table 1: Grassy Mountain Process Design Criteria

Description	Units	Value
Ore Throughput	st/y	255,500
Design Grade - Au	oz/st	0.22
Design Grade - Ag	oz/st	0.35
Operating Schedule		
Crusher Availability	%	70
Plant Availability	%	91.3
Throughput, Daily - average	st/d	700
Plant capacity, Hourly	st/h	32
Crushing (Two Stage)		
Primary Crusher	type	Single Toggle Jaw Crusher
Secondary Crusher	type	Cone Crusher
Fine Ore Stockpile Residence Time - Live	d	1
Grinding		
Circuit Type		Ball mill
Bond Ball Mill Work Index	Hp/st	25.8
Ball Mill, Dimensions	ft x ft	11 x 14
Ball Mill Power	hp	1072
Feed Particle Size, F80	in	0.394
Product Particle Size, P80	U.S. mesh	100
Gravity Concentration		
Overall Gravity Gold Recovery	%	10
Carbon-in-Leach		
Total Leach Time	h	24
Number of Tanks	#	1 pre-aeration + 7 leach / adsorption
Cyanide Addition	lb/st	0.82
Lime Addition	lb/st	2
Carbon Concentration	lb/ft ³	1.56

Description	Units	Value
Carbon Loading (Au + Ag)	oz/st	175
Desorption		
Carbon batch size	st	3.3
Elution CIL strips per week	#	7
Gravity strips per week	#	7
Cyanide Destruction		
Method	-	Air / SO ₂
Residence time	h	2
CN _{WAD} not-to-exceed value	ppm	30

1.4 Overall Site Process Flow Diagram

Drawing Overall Site Process Flow Diagram (101768-0000-F-001) shows the basic process design circuits and the selection of major equipment for the process plant. This drawing can be found in Appendix A.

The descriptions in the following sections include references to Process Flow Diagrams (PFDs) which are included in Appendix B.

2 Area 3110 – Crushing

Overview:

Run-of-mine (ROM) ore is transported by haul truck from the underground mining operation to the crushing plant area, and fed either directly to the ROM hopper or to the coarse ore stockpile. Ore is received by the ROM hopper at the crushing plant before being discharged onto the vibrating grizzly feeder and fed to the primary crusher for the first crushing stage. The crushed ore is then collected onto the coarse ore conveyor which conveys the reduced ore to the coarse ore screen. The undersize from the screen is suitable for ball mill feed while the oversize is fed to the secondary crusher included in the crushing plant. The secondary crusher product is received by the coarse ore conveyor and is returned to the coarse ore screen along with new crushed product from the primary crusher, initiating the closed-circuit loop within the crushing plant. This process repeats itself to ensure that the ore has enough time to be reduced before moving on for further downstream processing.

Reference PFDs:

101768-0000-F-002 Crushing, Screening, and Reclaim Area

2.1 Crushing Plant

The crushing plant operates 7 days per week for the entire year with an availability of 70%. The nominal throughput is 42 short ton per hour. The crushing plant consists of one of each of the following: ROM hopper, vibrating grizzly feeder, primary crusher, coarse ore screen, and secondary crusher. The ROM ore is received at a ROM hopper having a capacity 353 ft³, filled either directly by

the dump truck or by using a front-end loader (FEL) that draws from the ROM ore stockpile. The ROM hopper is equipped with a static grizzly, and particles larger than the grizzly can be removed for individual breakage. The ore passes over a vibrating grizzly feeder leaving the ROM hopper before is fed to the primary crusher. The vibrating grizzly feeder allows for smaller material to pass directly through the feeder and onto the coarse ore conveyor, allowing for more efficient crushing in the primary crusher. The ore passing over the vibrating feeder then is reduced by a primary crusher and discharged onto the coarse ore conveyor as well.

The coarse ore conveyor transports the crushed ore to the coarse ore screen, where the undersize is collected and conveyed for mill feed, while the oversize is sent to the secondary crusher to be reduced further. The secondary crusher discharge is recirculated to the coarse ore screen to repeat the size classification step. A metal detector is included in the crushing plant to recognize any metal debris that could potentially cause damage to the crushing equipment.

The product from the crushing plant is conveyed to the crushed ore stockpile to be sent to the grinding circuit in the process plant. The stockpile conveyor is fitted with a weightometer to monitor crushing plant throughput and assist with operational and metallurgical accounting. The fine ore stockpile has a live capacity of 1 day, the equivalent of 750 short tons of live material. This material is collected with a front-end loader which deposits the fine ore into the fine ore reclaim hopper.

3 Area 3200 – Grinding

Overview:

The grinding circuit receives the fine ore product at the ball mill feed conveyor which then deposits the material at the mill feed chute. The ore is ground to a desired product size with the addition of process water and steel ball grinding media. The ground ore slurry is discharged to the cyclone feed pumpbox and pumped to the cyclone cluster pack to be classified into cyclone overflow stream, dominated by fine particles, and cyclone underflow stream, dominated by coarse particles. The overflow stream is sent to leaching process while the underflow is split into two streams, which one reports back to the ball mill and the other one reports to the gravity concentration and intensive leaching circuit.

Reference PFDs:

101768-0000-F-002 Crushing, Screening & Reclaim Area Process Flow Diagram

101768-0000-F-003 Grinding & Gravity Process Flow Diagram

3.1 Ball Mill

The fine ore stockpile allows for over 24 hours of continuous milling operation at the nominal feed rate of 31.9 short tons per hour. A front-end loader is used to transport the fine ore from the stockpile to the fine ore reclaim hopper, which has sufficient capacity to provide the grinding circuit with 1 hour of feed. The fine ore is fed to a 11.0 ft x 14.0 ft (d x EGL) overflow ball mill, which is operated at 75% of the critical speed and with a normal operating ball mill charge of 35% on a volumetric basis. Ore addition to the ball mill is supplemented with process water to achieve a milling density of 72% solids (by weight). The ball mill also receives a nominal circulating load of 350% from the underflow portion of the cyclone cluster. To avoid damage to the cyclone feed pumps and cyclone cluster, the ball mill

discharge is screened through a trommel to scalp off oversized particles and broken grinding media. The scalped off materials are then stored in the scats bunker. The aperture size of the ball mill trommel is the same as the product size leaving the crushing plant. The oversize material will be manually removed periodically.

The trommel screen undersize slurry from the ball mill is discharged to the cyclone feed pumpbox, diluted to 61% solids with process water, and pumped to two classification cyclones (1 duty / 1 standby).

3.2 Cyclone Classification

The cyclone cluster operates in a closed-circuit with the ball mill and is configured to achieve a target cyclone overflow product size. The cyclone cluster has one operating and one standby unit with pneumatically actuated valves that allow automated feed pressure control, as well as manually actuated isolation valves.

The slurry from the cyclone cluster underflow launder flows to the manual splitter box which splits approximately 33% of the cyclone underflow to the gravity concentrator via a scalping screen to remove particles larger than 10 mesh (0.08"). The remaining portion is recirculated back to the ball mill for further grinding.

The cyclone overflow slurry from the cyclone clusters gravity flows to a trash screen distributor where the slurry is distributed over the trash screen to remove any plastic, steel, wood and organic refuse coming from the mine. The overflow slurry density is nominally 42% solids.

A sump pump is installed in the grinding area to facilitate clean-up. The pump discharges into the cyclone pumpbox. Maintenance activities in the grinding and classification area are serviced by the mill area crane (33 st) and the grinding area hoist (3.3 st) which will be used for ball mill charging duties and minor lifts.

4 Area 3300 – Gravity Circuit and Intensive Cyanidation

Overview:

The gravity circuit included in the process plant receives a portion of the cyclone cluster underflow slurry that is passed through the gravity scalping screen. The slurry is treated by the gravity concentrator to recover free gold from the slurry into gravity concentrate. The concentrate is transported to the intensive leach reactor system by fluidization water. During this stage, the gravity concentrate is exposed to cyanide leaching resulting in high gold extraction. The pregnant solution is pumped to the electrowinning area while the tailings is recirculated back to the ball mill for further grinding.

Reference PFDs:

101768-0000-F-003 Grinding & Gravity Process Flow Diagram

101768-0000-F-004 Intensive Cyanidation Process Flow Diagram

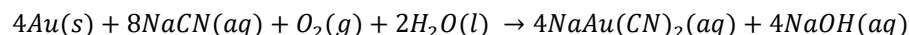
4.1 Process Background

The gravity concentration and intensive leaching reactor circuit offers several advantages by:

- Reducing the exposure and accumulation of gold in grinding equipment
- Reducing the quantity of loaded carbon to be eluted
- Reduces the chances of losing gold to tailings from the CIL circuit either from:
 - Incomplete leaching of gold, or
 - operational fluctuations causing inefficiencies in carbon adsorption.

The concentrating portion of the process allows for free gold to be separated from the gangue material through the principal of a centrifuge, where the heavier gold particles are collected in the bowl of the concentrator while the lighter gangue material overflows and are removed back to the ball mill. This allows the free gold to be recovered with minimal processing, reducing the risk of losing gold to tailings and grinding circuit. Once the gold concentrate has reached its specified loading, fresh water is used to move the concentrate to the intensive leaching area without exposing it to any contaminants in the process water. The size and number of gravity concentrators required depends on the throughput and rate at which free gold is collected.

The intensive leaching reactor circuit is typically a packaged system designed to receive a concentrated coarse gold bearing ore product from the gravity concentrator. These systems, as well as all other gold leaching circuits, rely on the fundamental leaching reaction seen below, known as the Elsner Equation.



From this equation it can be observed that the reaction relies heavily on sodium cyanide and oxygen to complete the gold leaching reaction. Dissolved oxygen oxidizes the gold resulting in the formation of the soluble gold complexes. Sodium hydroxide is added to provide a basic pH environment required to prevent cyanide ions from reacting with hydrogen cations to form hydrogen cyanide. As such the reagents and dosages supplied to the intensive leaching reactor must be able to satisfy these requirements. Oxygen is supplied through a hydrogen peroxide tote and dosing pump located in the ILR area. Adequate concentration of oxygen is essential for the cyanidation reaction, and its absence will prevent the reaction from occurring. Additional reagents can also be included depending on the specific process or a specific operational objective.

After the addition of the initial levels of reagents along with the required water and gravity concentrate, the agitator is started, and the leaching reaction begins. Dosing rates of reagents are calibrated to optimize the process, depending on the ore in question. The leaching reaction lasts several hours before the gold is leached into the pregnant leaching solution and transferred to the electrowinning area for gold plating. Tailings from the reactor typically are collected and recirculated to the grinding area. Gold recoveries using this process are typically above 95%.

4.2 Scalping Screen and Gravity Concentrator

A portion of the cyclone underflow slurry is directed to one gravity circuit scalping screen where oversized material is subsequently sent back to ball mill, while the undersize is supplied to a single gravity concentrator. Nominally 90% of the slurry received by the screen passes and is received by the gravity concentrator, while the remaining 10% is oversized and recirculated back to the ball mill. Process water is added to the screen feed stream to reduce the percent solids from 76% to 55%, allowing for improved screening efficiency.

The centrifugal gravity concentrator is an automated batch process. Feed is received from the cyclone underflow for a specified time. When one concentration cycle is finished, the feed stream is paused and the bowl stops spinning to allow the concentrate that has been built up in the bowl to be flushed to the concentrate holding tank. After the flushing, a new concentration cycle starts again. Gravity concentrator tails flow back to the ball mill during the feeding portion of the cycle. Cycle times are 45 minutes each and about 46lb of concentrate is expected from each cycle of the selected unit. Cycle time is manually adjusted based on the head grade and circuit performance.

Flushing water rinses the gravity concentrate to a gravity concentrate holding tank located beneath the concentrator. Water is continually decanted as the gravity recoverable gold concentrate accumulates in the hopper. Access to the gravity concentrator holding tank is restricted, and only authorized personnel are allowed access.

Once per day the concentrate accumulated in the gravity concentrate holding tank is pumped to the intensive leach reactor where it is dosed with sodium hydroxide and high levels of sodium cyanide.

4.3 Intensive Leach Reactor

Following gravity concentration, the concentrate is held by the gravity concentrate holding tank before being supplied to one intensive leach reactor. The agitated reactor is dosed with sodium hydroxide, sodium cyanide, hydrogen peroxide and flocculant/leach aid to facilitate the high-cyanide gold extraction reaction. A complete cycle for the concentrate to be fully leached will take 24 hours and is operated daily. The gold bearing pregnant solution is then pumped to the gravity electrolyte tank for the electrowinning process. Tailings from the reactor are collected and pumped back to the ball mill feed chute.

Given the nature of the process, cyanide specific design considerations are implemented for both personnel safety, equipment integrity and operational performance. Control valves and alarm interlocks are utilized to ensure the operation is performed within an acceptable pH range and will also monitor the presence of hydrogen cyanide, a toxic gas evolved from cyanide bearing solution when pH values are lowered out of the operating range. The area will be equipped with hydrogen cyanide monitors, and operators will wear hydrogen cyanide badges to alert them of any potential evolution of cyanide gas in the area. The sodium cyanide solution is monitored by operator titration, ensuring that the dosing concentration is suitable for the intensive leaching reaction. Piping providing cyanide solution is socket welded stainless-steel connection, with double block and bleed isolation valving. The area is also designed to account for complete containment of all process vessels. Standard operating procedures are developed to accurately describe the methods and equipment required to achieve these tasks safely.

5 Area 3400 – Carbon-in-Leach

Overview:

The overflow slurry from the cyclone cluster is initially screened by the trash screen to prevent any debris that could impact the gold extraction or recovery to reach the CIL circuit. After passing through the screen the slurry reports to the pre-aeration tank where the slurry is pre-treated with air to ensure optimal gold extraction and minimize cyanide consumption. Following pre-treatment, the slurry flows through the leaching tanks. During this stage the slurry and activated carbon flow counter-currently throughout the CIL tanks. Carbon is added to the last tank and sequentially pumped to the first tank, while slurry is added to the first tank and flows to the last. Most of the metal extraction from ore to solution occurs at the front end of the circuit, while adsorption from solution to the carbon primarily occurs towards the end of the circuit. The slurry exits the final tank and is sent to the carbon safety screen before being treated for tailings storage. The loaded carbon exiting the first CIL tank is pumped to the loaded carbon screen in the elution circuit to be prepared for acid washing and elution.

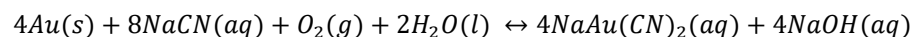
Reference PFDs: 101768-0000-F-005 Pre-Leach & CIL Area Process Flow Diagram

5.1 Process Background

The CIL circuit is responsible for the gold leaching and carbon adsorption of the main slurry stream coming from the grinding circuit. It utilizes a counter-current flow of activated carbon in reference to the slurry flow to optimize the gold extraction and recovery. After the grinding circuit the ore particle size should be sufficiently reduced so that the gold in the ore is exposed allowing for the leaching reaction to occur.

In the presence of sulphide species native to the ore, the leach rate of gold into solution can be influenced by the amount of dissolved sulphur and the oxygen concentration in solution. A pre-aeration tank is used to oxidize and precipitate soluble species such as sulphides to prevent them from consuming oxygen during the process. A pre-aeration tank can also prevent a passivation layer from forming over the ore that hinders the leaching process. This passivation layer is often caused due to sulphide species forming sulphur monolayers on the surface of the exposed gold in the ore.

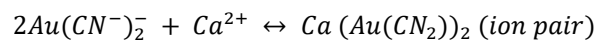
In this circuit the leaching reaction follows the same reaction shown in the intensive leaching reaction.



Sodium cyanide is dosed into the front end of the circuit along with air additions to facilitate the dissolution of gold into solution. The rate of the gold extraction is highest in the first tank where the reaction begins and rapidly decreases as the gold in the ore becomes scarcer. The extraction eventually reaches a plateau point where all the recoverable gold has been leached into solution in the form of a soluble and stable cyanide-gold species. With the gold in solution, the adsorption process will then recover the dissolved gold onto activated carbon to be recovered in the elution circuit.

The availability of free cyanide in solution is dependent on the pH of the solution. At a lower pH less cyanide ions are retained in solution while more are evolved as hydrogen cyanide molecules. From this relationship we can determine that the desired result is to have the free cyanide ions stay in solution at high pH. This is true for both safety and operation, as hydrogen cyanide gas is toxic to operators and cyanide must be in solution to perform the leaching reaction. For this reason, the CIL circuit is operated in a basic environment maintained through the addition of hydrated lime.

In solution the sodium-gold-cyanide complex dissociates into a negative gold-cyanide anion and a positive sodium cation. The negative gold-cyanide ion in solution preferentially pairs with a positive ion found in solution based on reduced activation energy. The addition of lime in the CIL circuit ensures sufficient calcium is available to produce an ionic pair between the gold-cyanide anion and the calcium cation resulting in a stable pair with neutral charge. The importance of this lies in the fact that the surface of activated carbon has a neutral charge and for species to adsorb to it they also require a neutral charge.



As both the ion-pair and the surface of the carbon are neutral, no reaction occurs between the two items and the adsorption process is dependent on process parameters. Key parameters include mixing efficiency, slurry density, particle size of carbon, cyanide concentration, slurry pH and gold concentration among others used to design the adsorption process of a specific operation.

With the activated carbon being introduced in the last tank and moving towards the first tank the greatest gold recovery occurs in the last tank of the CIL circuit and progressively diminishes as the carbon advances through the tanks with increasing gold loading. After the fully loaded carbon is reaches the first tank of the circuit, the final transfer pump transports the loaded carbon to the next stage for the acid wash and elution stages.

Testwork determined that the gold is leached to completion with a residence time of 24 hours. Carbon management modelling determined that 7 leach stages were required, the optimum carbon concentration is 1.56 lb/ft³ and advance rate to minimize solution losses is 3 tonnes per day.

5.2 Pre-Aeration and Carbon-in-Leach Tanks

The leach feed slurry from the cyclone cluster overflow reports to the pre-aeration and CIL circuit. The slurry will first reach one pre-aeration tank where low-pressure air addition is added prior to the introduction of cyanide. Lime is added to adjust the solution to a pH of 10-10.5. Following the pre-aeration step the slurry will then flow to a series of 7 open top CIL tanks.

In the CIL tank train, the gold bearing slurry is brought into contact with cyanide and dissolves the gold from the ore into solution by forming stable gold-cyanide complexes in the presence of sparging air. The pH of slurry in the tanks is monitored and lime is added as necessary at several points in the CIL circuit to maintain target (10-10.5 pH typical). Low pressure compressed air is blown into slurry in the tank through blowers and dispersed using dispersion cones located at the bottom of the agitator.

Slurry exiting each tank flows by gravity to the next through an up-comer inside the tank to an overflow launder. Each tank is connected to the next two tanks via overflow launders with knife gate valves for tank isolation on each discharge point. This arrangement will allow the slurry to bypass the next tank in the series if one of the downstream tanks must be taken out of service for maintenance. Once the slurry discharges at the final tank, the slurry gravity flows to the carbon safety screen.

The purpose of the activated carbon is to recover gold from leached slurry. The gold is recovered by bringing the leached slurry, containing gold in solution, in contact with the carbon so that the dissolved gold can be loaded onto it through the process of adsorption. Each CIL tank is equipped with an agitator, an inter-stage screen to retain the carbon and a carbon advance transfer pump. Slurry in the first tank flows through the inter-stage screen to the next tank via an overflow launder while the screen holds back the carbon from moving to the next tank. Each subsequent tank in the series sends slurry to the next tank until the slurry reaches the last tank which then gravity flows out to the cyanide

destruction circuit by the carbon safety screen. Carbon flows through the circuit in the opposite direction, through carbon advance pumps in a batch process. The carbon is transferred once per day and is retained in the tanks by the inter-stage screens. Once the carbon has been transferred through all CIL tanks to the first tank in the train, the loaded carbon recovery pump will transfer the loaded carbon to the loaded carbon screen before being treated in the elution circuit.

As the nature of the process is similar to that of intensive leaching, similar safety considerations are implemented. Cyanide monitors will be installed at the top of the tanks and at ground level. Control valves, and alarm interlocks are utilized to ensure the operation is performed within an acceptable pH range and will monitor the presence of hydrogen cyanide. Operators are also equipped with hydrogen cyanide badges to alert them of any potential generation of cyanide gas. The sodium cyanide solution will be monitored by operator titration, ensuring that the dosing concentration is suitable for the leaching and adsorption reactions. Standard operating procedures are developed to accurately describe the methods and equipment required to achieve these tasks safely.

6 Area 3500 – Acid Wash and Elution

Overview:

Carbon containing slurry from the CIL circuit is transferred by the loaded carbon recovery pump to the loaded carbon screen in preparation for the acid wash and elution steps. The undersize slurry from the screen is sent back to the pre-aeration tank while the carbon retained in the oversize fraction reports to the acid wash column. During the acid wash stage, acid soluble contaminants that were adsorbed onto the surface of the loaded carbon are removed using a dilute hydrochloric acid stream followed by a rinse water cycle to clean the acid washed carbon before moving onto the elution step. The acid rinsed carbon is then transferred from the acid wash column to the elution column. During this step a strip solution of sodium hydroxide and cyanide is heated and is passed through the carbon in the elution column. This process reverses the kinetics of the gold loading onto the carbon and brings the gold into solution. The gold bearing solution also known as the pregnant solution then flows to the gold room where the gold will be recovered in the electrowinning process. Once the loaded carbon has been stripped of gold it is considered barren carbon and is transferred to the carbon regeneration area.

Reference PFDs:

101768-0000-F-006 – Desorption Area Process Flow Diagram

6.1 Process Background – Elution

Loaded carbon will undergo the desorption process where the loaded carbon is acid washed and eluted. The underlying principle during these stages is that the stable gold complexes loaded on the carbon must be changed so that they separate from the carbon.

The loaded carbon is initially received from the adsorption stage to a loaded carbon screen, where the carbon and slurry are separated. The carbon is then fed to one acid wash tank where a dilute hydrochloric acid solution is passed through. This process removes undesirable contaminants such as calcium carbonate from the surface of the carbon that would otherwise move forward to the elution column. The acid wash cycle is done at ambient conditions. Rinse water is passed through to remove residual acid and protect downstream equipment from low pH conditions.

Once the loaded carbon is acid washed it is transferred from the acid wash column to one elution column. In the elution stage a solution of sodium hydroxide and sodium cyanide, called the strip solution, is heated under pressure and flows up through the elution column. During elution the adsorption kinetics that initially bonded the gold complexes to the carbon are reversed and the gold is brought back into solution. This solution flows from the elution column to the electrowinning cells.

After the stripping of the pregnant solution by the electrowinning cell, the solution has trace amounts of gold remaining that will not be recoverable in electrowinning. Due to need for new reagent additions and water top ups, a certain portion of the barren solution will be bled to the CIL circuit, where the gold has the potential to be re-adsorbed.

6.2 Loaded Carbon Screening

Once the carbon in the first CIL tank is completely loaded, carbon slurry is pumped to the loaded carbon screen where the loaded carbon is screened and separated from the slurry under water spray. Water sprays on the vibrating screen decks wash off process slurry from the loaded carbon. The loaded carbon gravity flows to the acid wash column ahead of the elution cycle, and the slurry returns to the pre-aeration tank.

6.3 Acid Wash

The loaded carbon from CIL tanks recovered on the loaded carbon screen is directed to an acid wash column. Acid soluble foulants which have loaded onto the carbon are dissolved during the acid washing stage. Hydrochloric (HCl) acid is diluted with fresh water to provide the required acid wash solution concentration of 3% HCl and injected into the acid wash column. The solution will soak in the acidic solution for 30 minutes.

Following acid solution contact, the carbon is rinsed with fresh water to remove residual acid of the liquor in the carbon column at a rate of two bed volumes (BVs) per hour. The neutralized acid solution is drained back to the acid solution circulation tank. Washed carbon is then hydraulically transferred to the elution column using pressurised transport water supplied by a transport water pump.

6.4 Elution

The elution system comprises an elution column, strip solution tank, strip solution pump and an elution heater package. Strip solution (eluate) is made up in the strip solution tank using raw water dosed with 2% sodium hydroxide and 0.2% cyanide to form an electrolyte for the electrowinning process. The eluate flows upwards through a stationary bed of loaded carbon at a flow rate of about two BVs per hour at 275°F. The elution system is pressurized to keep the solution from flashing to steam in the heater or elution column. At this temperature gold that was previously adsorbed on the carbon is desorbed from the carbon by a reversal of the adsorption kinetics.

The direct electric strip solution heater is designed to increase the temperature of the strip solution up to 275°F (135°C) for the stripping cycle. Additionally, an elution recovery heat exchanger ensures that the nominal temperature of the pregnant solution directed to the electrowinning cells is below boiling to prevent flashing.

Following the elution process, gold is recovered from the pregnant strip solution with a single electrowinning cell located inside the gold room (the gravity circuit has its own electrowinning cell). The pregnant and barren solution streams will be pumped between the elution plant and electrowinning cell in a dual contained pipe with flow meters positioned at both ends for leak detection.

The gold depleted solution from electrowinning is then re-heated and recycled to the elution column for additional stripping.

Given the use of sodium cyanide during the elution of the loaded carbon, additional steps are included to ensure safe and efficient operation. The pH of the solution will be properly buffered using sodium hydroxide, utilizing control valve interlocks to ensure the process is operating at the designed operating parameters.

7 Area 3500 – Carbon Regeneration and Management

Overview:

After the completion of the elution stage, the barren carbon is transported to the carbon regeneration area to treat the used carbon to be recycled for the adsorption process. The carbon is first screened through the kiln dewatering screen, where the oversize will report to the horizontal kiln while the undersize carbon and water are collected in the carbon fines clarifier. The carbon in the kiln is exposed to elevated temperatures to remove any remaining foulants that could impact the adsorption process. The carbon is then received by the quench tank for cooling before being sent to the carbon sizing screen in the CIL circuit. The fine carbon reporting to the clarifier is collected with the use of a filter press for further off-site processing, while the process water from the clarifier overflow is received by the transfer water tank for application in the elution circuit.

Reference PFDs: 101768-0000-F-007 Carbon Regeneration Process Flow Diagram

7.1 Carbon Regeneration

After completion of the elution process, barren carbon is hydraulically transferred from the elution column to a kiln dewatering screen. The screened carbon is fed into the kiln feed hopper then metered into a carbon regeneration kiln. The carbon regeneration kiln is a horizontal, rotary, electrically heated unit and reaches a temperature of at least 1400°F (750°C) to regenerate the stripped carbon.

Regenerated carbon discharges by gravity from the kiln to a quench tank to cool down and is then transferred via recessed impeller transfer pump to the carbon sizing screen. The barren carbon is then screened and reports to the last tank in the CIL adsorption train.

Fine carbon is received by the carbon fines clarifier, which then settles to the bottom of the tank while water overflows out of the top. The underflow of the clarifier is batch fed to the carbon fines filter, which removes additional water allowing the fines to be bagged and may be sold for further gold recovery at an offsite location.

7.2 Carbon Pre-attrition

Bags of new carbon are processed in a pre-attrition tank before being sent to the leach circuit. This process breaks off the corners of the angular coconut shell-based carbon particles, and the fine particles are collected. The fine particles are too small to be retained by the leach tank inter-stage screens and would therefore pass through to leach tails. Without this step the sharp corners of the loaded carbon particles would be broken off in the leach circuit and these carbon fines would flow to tails carrying the gold they had adsorbed causing gold losses.

The new carbon is charged to the pre-attrition tank via a bag breaker where water is added to produce an effective solids density of about 50% carbon. A high intensity agitator stirs the carbon slurry vigorously to break off the sharp corners, reducing the angular particles to a more rounded shape. Once complete, the new carbon is pumped to the regeneration kiln quench hopper where it is stored before being added to the leach circuit. Fresh and regenerated carbon passes over a barren carbon sizing screen, which also separates and removes fines.

7.3 Carbon Transport Water

All carbon movements in the elution and regeneration circuits are accomplished using carbon transport water. A transport water tank and pump are provided to supply transport water to carbon movement demands as needed.

As an example; when moving carbon from the acid wash column to the elution column, the carbon is drained into a venturi with transport water passing through it in sufficient quantity and velocity to carry it to the next destination at an effective solids density of about 20%. As the carbon arrives at the elution column, strainers in the column discharge ports allow the transport water to exit the column while retaining the carbon.

Transport water picks up fines when moving carbon from one place to another as a result of both the previous process and the attrition associated with the carbon movement itself. Once the movement is complete, strained or decanted transport water reports to a carbon fines clarifier where flocculant settles the fines and the overflow water recharges the transport water tank. Process water is added as necessary to maintain the level in this tank. The carbon fines are removed from the clarifier underflow periodically and shipped to the refinery to recover contained precious metal values.

8 Area 3650 – Electrowinning and Gold Room

Overview:

The elution circuit and the intensive leach reactor circuit both produce a gold bearing solution that will flow through electrowinning cells to remove the gold from solution and onto cathodes. The flow of pregnant solution and the electrical current is controlled for operation under optimal gold plating parameters. The plated gold is removed from the cathodes with the use of a high-pressure cleaner and the gold sludge is collected in the electrowinning sludge filter feed tank. The sludge is pumped through a filter and then moved by hand to the drying oven. The smelting of the dried sludge is then completed by hand and ultimately produces the final doré bars.

Reference PFDs:

101768-0000-F-008 Gold Room Process Flow Diagram

The gold room houses the electrowinning cells, smelting furnace, and associated support equipment within a security envelope which limits access to authorized gold room personnel only. Access and egress are controlled by security personnel at both a man door and a vehicle access roll up door for the armoured car. The armoured car door is enclosed by a fence with an automated gate controlled by security personnel. The exception to this is an emergency exit door which sets off alarms when opened from the inside.

8.1 Electrowinning

Two electrowinning sludging cells are located on the upper floor within the gold room. One electrowinning cell is dedicated to the intensive cyanidation circuit and the other to the elution circuit. The rectifiers associated with the electrowinning cells back onto the gold room wall, allowing easy access for operations and maintenance outside the secure area of the gold room.

The electrowinning cell dedicated to the intensive cyanidation circuit is fed eluate via a fixed speed centrifugal pump from the gravity eluate storage tank. Eluate is pumped to the electrowinning cell and then gravitates back into the gravity eluate storage tank in a closed loop until suitable gold recovery is achieved. The electrowinning cell dedicated to the elution circuit operates in a closed loop with the elution column and associated equipment. Eluate flows directly from the top of the elution column to the electrowinning cell after cooling through heat exchangers. The eluate flows through the electrowinning cell and then gravitates back to the strip solution tank and is pumped to the elution column in a continuous closed loop. Both cells extract gold by passing a current through the liquid solution, resulting in metal extraction through electroplating onto the cathodes within the cell.

Periodically, high pressure spray dislodges sludge from the cathodes and cell floor to a sludge hopper. A positive displacement pump feeds a plate and frame filter from the sludge hopper where the moisture content of the sludge is reduced. The pressed filter cake (gold sludge) is loaded from the plate and frame filter into trays on the electrowinning sludge trolley. The trays slide into the gold room drying oven, which heats the sludge to remove the entrained moisture.

8.2 Smelting

The dried and cooled sludge is combined with fluxes (silica, nitre, borax and sodium carbonate) in the flux mixer. The fluxes are manually added to the flux mixer after they are weighed. The sludge-flux mix is direct smelted in an electric furnace. The fluxes react with base metal oxides to form a low viscosity, free flowing slag, whilst the gold and silver remains as a molten metal.

The gold doré is poured into a cascade pouring table of doré moulds. The slag (non-precious metal compounds) is separated from the precious metal and collected in slag trays at the bottom of the cascade tables. The doré bars solidify and are quenched in water, cleaned to remove slag, weighed, stamped for identification, sampled for analysis and stored in a safe while awaiting dispatch.

9 Area 3600 – Cyanide Detoxification

Overview:

Tailings from the CIL circuit that no longer contains economically recoverable gold will flow to the carbon safety screen prior to reaching the cyanide detoxification stage. The slurry contains cyanide species that are not suitable for release from the process plant, and therefore a detoxification process is completed. In this circuit reagents are added to facilitate the breakdown of cyanide species to acceptable levels before reporting to the tailings pumpbox and sent to the TSF.

Reference PFDs:

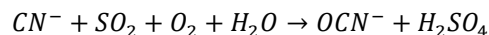
101768-0000-F-009 Cyanide Detoxification & Tailings Disposal Area Process Flow Diagram.

9.1 Process Background

The cyanide detoxification stage of a gold processing operation is the location where the process slurry reports prior to tailings storage to reduce the level of Weak Acid Dissociable (WAD) cyanide and in turn the total cyanide released from the plant.

WAD cyanides are described as weak metal complexes that form during the leaching stage of the operation. Typical metals seen in these complexes include copper, zinc and nickel. The concern with these complexes is that they dissociate in solution to produce an environmentally significant concentration of free cyanide that could pose a risk to the environment and wildlife, or persist on a longer term basis due to a resistance to natural degradation.

The detoxification circuit receives all of the slurry from the upstream processes with the addition of acid rinse solution from the elution circuit and sump slurry on an intermittent basis from several areas within the plant. During the detoxification process the reaction will convert the free cyanide in solution to the less toxic cyanate ion. This is achieved through the SO_2/Air reaction utilizing a copper catalyst, and the reaction is shown below.



The free cyanide and WAD cyanide are oxidized during the reaction to form cyanate and sulphuric acid. The reaction typically operates in the pH range of 8 to 9 therefore requires the addition of lime to counteract the acid production.

Sodium metabisulphite ($\text{Na}_2\text{S}_2\text{O}_5$), also known as SMBS, is the source for SO_2 in the Air/ SO_2 process. The reaction also requires a soluble copper catalyst to achieve the cyanide reduction. The copper is typically administered in the form of a soluble copper sulphate pentahydrate solution.

Iron cyanide removal is initiated by the reduction of iron from the ferric to the ferrous state. Following this step, the reaction will then react with a soluble metal cation to produce a precipitate. The same will be the case for trace metals that will be precipitated as their hydroxides. The remaining thiocyanate and cyanate are reduced by means of oxidation and hydrolysis respectively.

Through this process the key cyanide species of interest are converted into chemical species acceptable for discharge to the tailing's storage facility.

Once in the tailing's management facility processes such as photodegradation by UV light and biodegradation will also contribute to the minimization of cyanide species in a lined TSF where precautions are implemented to minimize the impact to wildlife.

9.2 Carbon Safety Screen

Tailings from the CIL circuit flows by gravity to a carbon safety screen. The safety screen retains any carbon that has reported with the slurry due to a leak in inter-stage screen mesh or seals in the CIL circuit. Water sprays are used on the vibrating screen deck to wash off process slurry from the carbon particles before reporting to a tote box. Screen underflow flows to the cyanide detoxification tanks.

9.3 Cyanide Detoxification Tanks

The cyanide detoxification circuit provides sufficient residence time for the detoxification reaction. In addition to leach tails, the tanks receive acid wash effluent from the acid wash column and the area sump pump discharge on an intermittent basis.

The cyanide detoxification circuit reduces weak acid dissociable cyanide (CN_{WAD}) to a target value. Air supply for the detoxification reaction is supplied to each cyanide destruction tank via a dispersion cone mounted to the bottom of each tank to maintain a high redox potential, maximizing oxidation of cyanide. The tanks utilize dual-impeller high shear agitators to enhance air dispersion and dissolution in the slurry to meet the oxygen demand of the cyanide destruction process. A sodium metabisulphite solution (the source of SO₂) is added to the slurry in the tanks. Copper sulphate solution, when needed, is dosed as catalyst for the cyanide detoxification process while lime slurry is added from a ring main into each tank to maintain a desired pH between 7.0 and 9.0. pH monitoring and HCN gas monitors will be interlocked with control valves to prevent detect the evolution of HCN gas. Operators will also wear personal HCN badges or monitors. The slurry will be reduced from a CN_{WAD} concentration of 100 ppm from the CIL circuit to below the not-to-exceed limit of 30 ppm. The final CN concentration will be monitored by operator titration to ensure compliance with the target discharge limit and the not-to-exceed regulatory limit of 30 ppm.

9.4 Tailings Discharge

Detoxified slurry overflows the second detoxification tank to the final tailings pump box, where it is then pumped to the TSF by two final tailings pumps (1 duty / 1 standby). The tailing slurry flows through a tailings discharge pipeline and will have dual containment initially provided through a buried pipe-in-pipe configuration, before daylighting to an HDPE lined containment trench. At the TSF the tailings are deposited using spigotting manifolds positioned along the rim of the impoundment to create low angle deposition beaches.

The position of the spigotting manifolds are moved periodically to produce an even beach head and push decant water towards the decant water pool. A pontoon mounted decant return water pump is provided to pump decant water back to the process water tank plant for re-use in the plant.

10 Area 3800 – Reagents and Services

Overview:

Given the properties of the reagents and their interactions with each other, design of the reagent preparation area will largely focus on the isolation of the cyanide. The cyanide preparation area is located away from incompatible reagents and in a low traffic area of the process plant. The cyanide preparation area will also be separated from the acidic reagents preparation area by the alkaline reagents. In this configuration the basic chemicals act as a buffer to prevent the exposure of acidic reagents and sodium cyanide, which would lead to the generation of cyanide gas.

Reference PFDs:

101768-0000-F-010 Alkaline Reagents Process Flow Diagram

101768-0000-F-011 Acidic Reagents Process Flow Diagram

101768-0000-F-012 Reagents General Process Flow Diagram

101768-0000-F-013 Plant Services – Air Process Flow Diagram

10.1 Hydrated Lime

Preparation of the hydrated lime will require:

- A bulk storage silo
- A mixing tank
- Dosing pumps feeding a ring main
- Automatically controlled dosing points from the ring main.

Hydrated lime is used in leaching and detoxification for pH control. The hydrated lime is delivered to site by bulk tanker and blown into a bulk storage silo.

When the mixing tank level is low, hydrated lime is added to the tank via a rotary valve and screw feeder. Process water is added at the same time to maintain the mixture strength of 20% forming a milk-of-lime suspension.

Milk-of-lime is distributed to the various dosing points using a ring main that provides constant flow to various destinations. Dosing is accomplished with drop lines off the ring main with automated on-off valves that open when pH is low and close when the operator specified target is reached.

10.2 Sodium Hydroxide

Preparation of Sodium hydroxide will require:

- Dosing pumps.

Sodium hydroxide (NaOH), also known as caustic soda, is used as a pH modifier in the intensive cyanidation and in the elution circuit to prepare the stripping solution used to recover the gold from

the loaded carbon. The reagent will be delivered in a 1,000 L tote received by truck and unloaded near sodium hydroxide area. The solution is supplied at a concentration of 50 percent by weight basis. Three positive displacement pumps will then each provide the required dosages of sodium hydroxide to their dedicated area. These areas include the intensive leach area, the elution circuit and the sodium cyanide preparation area.

10.3 Sodium Cyanide

Preparation of sodium cyanide will require:

- A bulk handling system
- Mixing and holding tanks
- Dosing pumps.

Sodium cyanide is used in leaching as a lixiviant and in elution as a carbon stripping aid. Cyanide is delivered to site in 1-ton bulk bags contained within wooden boxes and is stored in a separate area of the plant from the other chemicals.

When the storage tank level is low, a cyanide mix batch is started by removing a cyanide bulk bag from its box and dropping it onto a bag breaker, which discharges cyanide into the mix tank. The mix tank has been previously filled with sufficient raw water and buffered with sodium hydroxide to pH 12 to produce a cyanide mixture strength of 28%. Once mixing is complete and there is sufficient room in the holding tank, the mixed cyanide solution is pumped to the holding tank by a sodium cyanide transfer pump.

Sodium cyanide is dosed from the storage tank to dosing points via dedicated positive displacement metering pumps. The discharge piping is arranged such that the infrequently utilized pumps can be used as back-up spares for the leach dosing pump. For additional information on the equipment and procedures for the handling of cyanide, reference the Cyanide Management Plan in Appendix F of the Consolidated Permit Application.

10.4 Sodium Metabisulphite

Preparation of Sodium metabisulphite (SMBS) will require:

- A bulk handling system
- Mixing and holding tanks
- Dosing pumps.

Sodium metabisulphite ($\text{Na}_2\text{S}_2\text{O}_5$), also known as SMBS, is the source for SO_2 in the Air/ SO_2 process and will be supplied in 2000 lb bulk bags with a minimum quality of 67 percent SO_2 . It will be shipped by road to site, offloaded by forklift, and stored in the reagents storage area.

When the storage tank level is low a SMBS mix is started by dropping a bulk bag of SMBS onto a bag breaker which discharges SMBS into the mix tank. The mix tank has been previously filled with sufficient process water to produce a mixture strength of 20%. Once mixing is complete, and there is sufficient room in the holding tank, the mixed SMBS solution is pumped to the holding tank by a sodium metabisulphite transfer pump.

SMBS is dosed from the storage tank to the detoxification circuit via dedicated positive displacement metering pumps for each stage. A third pump is provided as an installed spare for the detoxification dosing pumps.

10.5 Copper Sulphate (Pentahydrate)

Preparation of Copper Sulphate will require:

- A bulk handling system
- A combined mixing/storage tank
- Dosing pumps.

Copper sulphate (pentahydrate) ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is supplied in 2000lb bulk bags at a purity of 98 percent on a weight basis. It will be shipped by road to site, offloaded by forklift and stored in the reagents storage area adjacent to the reagents mixing facility. Copper sulphate is mixed and stored in a combined mixing/storage tank laid out such that the mixing tank is directly above the storage tank and mixed solution drops by gravity into the storage tank.

When the storage tank level is low copper sulphate is added to the mixing tank by dropping a bulk bag of onto a bag breaker which discharges copper sulphate into the mix tank. The mix tank has been previously filled with sufficient process water to produce a mixture strength of 15%. Once mixing is complete, and there is sufficient room in the holding tank, the mixed copper sulphate solution is transferred by gravity to the holding tank.

Copper sulphate is dosed from the storage tank to the detoxification circuit via duty / standby positive displacement metering pumps.

10.6 Hydrochloric Acid

Hydrochloric Acid (HCl) is used in the elution circuit and is supplied in 275-gallon totes in liquid form at 32 percent concentration on a weight basis. The acid will be dosed directly to the acid wash column through the use of a metering pump.

10.7 Flocculant

Flocculant will be used in the carbon fines clarifier and intensive leach reactor to assist in solids settling. The flocculant will be supplied in 1,000L totes and dosed directly through two metering pumps.

10.8 Blower Air

The blowers will supply low pressure process air to the CIL tanks and the cyanide detoxification circuits. Both the CIL and cyanide detoxification trains will have a dedicated blower fan, with one common standby fan, able to supply process air to any of the four usage points.

10.9 Plant & Instrument Air

An air compressor will provide high pressure compressed air operating in lead-lag mode, to meet the demand for plant and instrument air requirements.

Plant air will be stored in the plant air receivers to account for variations in demand prior to being distributed throughout the plant. Instrument air will be dried in an instrument air dryer before being stored in the instrument air receivers and distributed throughout the plant.

10.10 Assay and Metallurgical Laboratory and Quality Control

The plant is equipped with automatic samplers to collect shift and routine samples for aqua regia digestion, atomic absorption, and fire assays. Those samples include plant feed, intermediate products, tailings, and final products. The data obtained will be used for product quality control and routine process optimization.

The metallurgical laboratory will perform metallurgical tests for quality control and process flowsheet optimization. The laboratory will include equipment such as laboratory crushers, ball mill, sieve screens, laboratory flotation cells, balances, and pH meters.

11 Area 3920 – Water Services

Overview:

The overall process has a negative water balance and requires raw water makeup from site wells. The raw water is used for gland water, makeup water, and treated to produce potable water. Raw water that has entered the process becomes part of the process water circuit and may be eventually discharged to the TSF. Decanted water from the TSF is recycled back to the process plant for reuse in the process water circuit.

Reference PFDs:

101768-0000-F-014 Plant Services – Water (Sheet 1 of 2)

101768-0000-F-015 Plant Services – Water (Sheet 2 of 2)

11.1 Tailings Storage Facility

The TSF receives the treated tails from the process plant and allows for material to settle while water is decanted and recovered at the process water tank for re-use in the process plant. Two centrifugal pumps (1 duty / 1 standby) located on a barge at the TSF return water through a decant water pipeline, which runs in the same containment trench used for the tailings discharge pipeline.

The TSF also allows for the natural degradation of remaining trace cyanide. Degradation is achieved through exposure to ultraviolet light received from the sun and metabolic processes from micro-organisms native to the environment in the water of the tailings pond.

11.2 Raw Water

Raw water will be pumped from site wells to the raw water tank for distribution throughout the operation.

Raw water in the tank is used to supply the following services:

- Reagent preparation water
- Slurry pumps gland seal water
- Intensive cyanidation
- Make-up water for the process water system
- Fire Water
- Potable water treatment plant, potable water is then sent to the potable water tank for safety showers and eyewash stations.

11.3 Gland Water

Water for the gland water system is supplied by fresh water from the raw water tank and distributed to each slurry pump by the gland seal water pumps in a duty/standby configuration.

11.4 Process Water

Process water is comprised of decant water from the TSF and raw water additions. Process water is stored in the process water storage tank and distributed by the Process Water Pumps, in a duty/standby configuration, to the circuits throughout the process plant, select reagent preparation areas and the truck washing station.

12 Process Solution Containment

The containment strategy associated with the process plant can be divided between the containment of process flows and reagents, and the collection and containment of surface contact water.

12.1 Process Flows and Reagents

There are eight primary areas which require containment at the plant site. Each area is located on a cast in-situ concrete slab, which will have curbs providing the required containment volume. The required volume is determined by the equipment located in the area, and in each case this has been determined to be 110% of the volume of the largest vessel plus allowance for adequate freeboard for precipitation. Adequate precipitation freeboard is defined as the height required to provide a volume capable to contain a 25-year 24-hour storm event. The containment areas have been summarized in the following table:

Location	Required Containment Volume (m ³)	Total Containment Volume (m ³)	Reference Drawing
Grinding Area	18.1	21.9	101768-1200-C-101
CIL Area	324.2	326.5	101768-1200-C-102
Goldroom – Refining Area	0.8	5.5	101768-1200-C-103
Goldroom – ILR Area	6.6	9.5	101768-1200-C-103

Location	Required Containment Volume (m ³)	Total Containment Volume (m ²)	Reference Drawing
Desorption and Regeneration – Acid Wash Area	13.3	13.7	101768-1200-C-104
Desorption and Regeneration – Elution Area	27.2	76.3	101768-1200-C-104
Reagents Area – Alkaline Containment	12.7	16.4	101768-1200-C-105
Reagents Area – Acidic Containment	12.7	15.5	101768-1200-C-105
Air Services Area	3.2	16.1	101768-1200-C-106

The concrete bund for the air services area is mainly for housekeeping purposes, and the required volume is only related to the 25-year 24-hour storm event for the catchment area.

12.2 Surface Contact Water

For a detailed description of contact water management and the design of water management structures, reference Appendix Y of the Consolidated Permit Application.

Diversion ditches will be constructed above plant infrastructure where required to prevent runoff from entering the process plant areas. Precipitation that falls directly on the pad will be collected in a system of ditches and culverts and directed by gravity towards the collection pond.

The contact collection pond is sized to contain the runoff from a 100-year 24-hour storm event and includes other allowances such as sediment deposition and freeboard. The pond will be double lined with a fluid evacuation zone between the liners.

13 Dust Suppression and Collection

Considerations for the design of the dust suppression and collection facilities is intended to comply with applicable federal and state regulations for air quality, including the Cleaner Air Oregon objectives.

13.1 Summary of Applicable Regulations

Regulations applicable to the Grassy Mountain project include, but are not limited to:

Table 2 - Applicable Air Quality Regulations

Regulation	#	Description
Oregon Permitting Rules	OAR 340-216	Air Contaminant Discharge Permits
	OAR 340-218	Title V Operating Permits

Oregon Air Quality Standards	OAR 340-202	Ambient Air Quality Standards and Prevention of Significant Deterioration
	OAR 340-245	Cleaner Air Oregon
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 63 Subpart EEEEEEE	Gold Ore Processing
	40 CFR Part 63 Subpart CCCCCC	Gasoline Tanks
New Source Performance Standards (NSPS)	40 CFR Part 60 Subpart LL	Metallic Mineral Processing Plants
	40 CFR Part 60 Subpart OOO	Non-Metallic Mineral Processing
	40 CFR Part 60 Subpart IIII	Emergency Generators

13.2 Dust Generating Sources and Controls

The key dust generating sources and identified control methods for the plant site are identified as follows:

Table 3 - Selected Air Quality Controls

Dust Source	Control Method
Unpaved Roads	Dust suppression chemicals and water application
Stockpiles (ROM and Crushed Ore)	Inherent moisture content of the ore
Primary and Secondary Crushing Unit	Inherent moisture content of the ore
Ball Mill Feed Conveyor	Inherent moisture content of the ore
Carbon Kiln	Wet dust scrubber
Barring Furnace	Baghouse
Lime Silo	Bin ventilation baghouse

Additional information pertaining to the identification and control of air emissions can be found in Appendix M of the Consolidated Permit Application.

14 Reclamation Plan

The reclamation of the process facilities and ancillary infrastructure is described below. The reclamation of the entire project (including these facilities) will be described in other sections of the DOGAMI Consolidated Permit Application and associated documents.

14.1 Reclamation Objective

The goal of this reclamation plan is to minimize environmental damage through the use of best available, practicable, and necessary technology and provide protection measures that are consistent with the policies of the permitting agencies.

14.1.1 Scope of Reclamation

The scope of this reclamation plan includes the process plant and facilities, ancillary infrastructure, and water management structures including the water collection pond.

14.1.2 Conceptual Plan

The general concept for reclaiming the project site is to remove all buildings and facilities that can be dismantled. Non-movable physical aspects such as the plant site itself will be contoured to match the original site topography and re-vegetated.

Removal of facilities and remediation of the site, including re-vegetation, will take approximately two years. Monitoring of site conditions will be undertaken on a quarterly and annual basis for the first five years with maintenance and remedial action taken on an as-required basis to ensure that the results of reclamation are sustainable.

14.1.3 Final Topography

All man-made slopes on the project site will be reduced to 3:1 (h:v) or less as required. Re-sloping is intended to create contours in disturbed areas that blend into the surrounding terrain, flatten the landscape as much as possible to prevent erosion and enable easy access by wildlife and humans. Where exceptions to the above grade are required, they will comply with the requirements of OAR 632-030-0027.

14.2 Reclamation Requirements

The reclamation plan is designed to satisfy the requirements of The Mined Land Reclamation Act of 1971, comply with OAR 632-030-0025 Requirements for an Operating Permit and Reclamation Plan, and OAR 632-030-0027 Minimum Standards for a Reclamation Plan. Reclamation performance standards as stated by the State of Oregon Department of Geology and Mineral Industries include:

- Ensure protection of human health and safety (also livestock, fish, and wildlife)
- Ensure environmental protection
- Require certification to the Oregon Department of Fish and Wildlife and Oregon Department of Agriculture of a self-sustaining ecosystem comparable to undamaged ecosystems in the area
- Include backfilling or partial backfilling on a case-by-case basis
- Ensure adequate, long-term environmental monitoring
- Provide adequate financial security

14.3 Removal of Infrastructure

The majority of buildings and structures erected on site during the mining operation will be decommissioned and removed as part of the reclamation process, unless otherwise agreed to remain after the mine's closure.

14.3.1 Buildings

Buildings at the plant site will be dismantled during the first year of reclamation and sold or re-used elsewhere. These buildings will include:

- Administration building
- Laboratory
- Plant Workshop/Warehouse
- Mine Offices
- Truck Workshop/Warehouse
- Mill Building and Structures

The administration, laboratory, and mine office buildings will be modular structures that will break down into their component parts and can be hauled away and re-used. The Plant and Truck Workshop/Warehouses are steel frame, fabric covered structures that can be similarly dismantled and re-used elsewhere. The process facility is a steel frame non-enclosed structure containing process equipment, which will be removed before the frame is dismantled and removed.

14.3.2 Surface Water Management Structures

The reclamation of the contact water collection pond will be in accordance with the Water Pollution Control Facility (WPCF) permit as required by the Oregon Department of Environmental Quality.

Reclamation of lined ditches and other water management structures will be in accordance with the Stormwater Management Plan in Appendix Y of the Consolidated Permit Application.

14.3.3 Other Infrastructure

Other structures to be remediated and removed include:

- Truck Wash Pad
- Crushing Area

The Truck Wash Pad is a concrete slab that will be broken up, have the rebar removed, and disposed of offsite. The crushing area consists of a series of portable units mounted on chassis that can be towed away for use elsewhere.

14.3.4 Electrical Infrastructure

Electrical infrastructure that will be removed or disconnected includes:

- Plant site distribution powerlines
- Main substation

14.3.5 Pipelines

Pipelines will be removed and disposed of offsite:

- Tailings distribution pipeline
- Tailings reclaim water pipeline

14.3.6 Roads

Roads that will be reclaimed include:

- Plant site roads

All road surfaces will be ripped and then capped with overburden, topsoil, and seeded. The timing to reclaim roads will depend on the necessity to access a particular area during reclamation. For example, plant site roads will be reclaimed once the process plant area is dismantled and removed.

14.3.7 Removal/Burial of Foundations

All foundations remaining from decommissioned structures, made from inert materials such as concrete, will be broken up and removed to an approved construction material disposal facility or another approved site. This includes concrete slabs. Any broken concrete or complete foundations (below 0.5m grade) left on the reclaimed site will be buried a minimum of 0.5m below the final site grade. Before burial, all exposed rebar, that has a potential to protrude through the completed backfill, will be cut off level with the remaining concrete.

Concrete that may be contaminated through exposure to process reagents will be excavated and disposed of in the TSF.

14.4 Material Management

14.4.1 Topsoil and Overburden

Refer to Section 3.5.3.3 and 4.1 of the Consolidated Permit Application.

14.4.2 Waste Rock

Refer to Section 3.3.4 and Section 4.6.3 of the Consolidated Permit Application.

14.4.3 Contaminated Materials

Soil, waste rock, or concrete that have been exposed to hydrocarbons or process reagents on a frequent basis during the life of the project may have become contaminated. Hydrocarbon contaminated soils will be excavated and transported to an approved dump site. This procedure also applies to any soil contaminated with hydrocarbons from leaking fuel oil storage tanks discovered during the removal from site.

Soil, rock, or concrete contaminated by process reagents will be excavated and disposed of in the TSF. Pre-existing soil contamination, resulting from historic mining activity, will be further delineated by sampling, either through drilling or the digging of test pits. Risk assessment based on the degree of contamination and likelihood of remobilization of contaminants will determine if the material is left in place or excavated and disposed of in the TSF or offsite.

14.5 Re-Vegetation

Refer to Section 4.2 of the Consolidated Permit Application.

14.6 Site Drainage

Site drainage will be managed with the objective of:

1. Preventing contamination of surface and groundwater flows
2. Preventing erosion and sedimentation
3. Protection of natural watercourses and wetlands

Site grading will facilitate drainage such that runoff disperses from the area in a manner which reflects natural flows. Ditches will be rip-rapped where necessary to prevent erosion. All slopes will be reduced to 3:1 (h:v) or less to minimize the velocity of runoff.

14.7 Monitoring

The primary goal of post-mining monitoring activities will be to determine the progress being made in restoring the site and to make adjustments, if required, that lead to a successful conclusion of site reclamation.

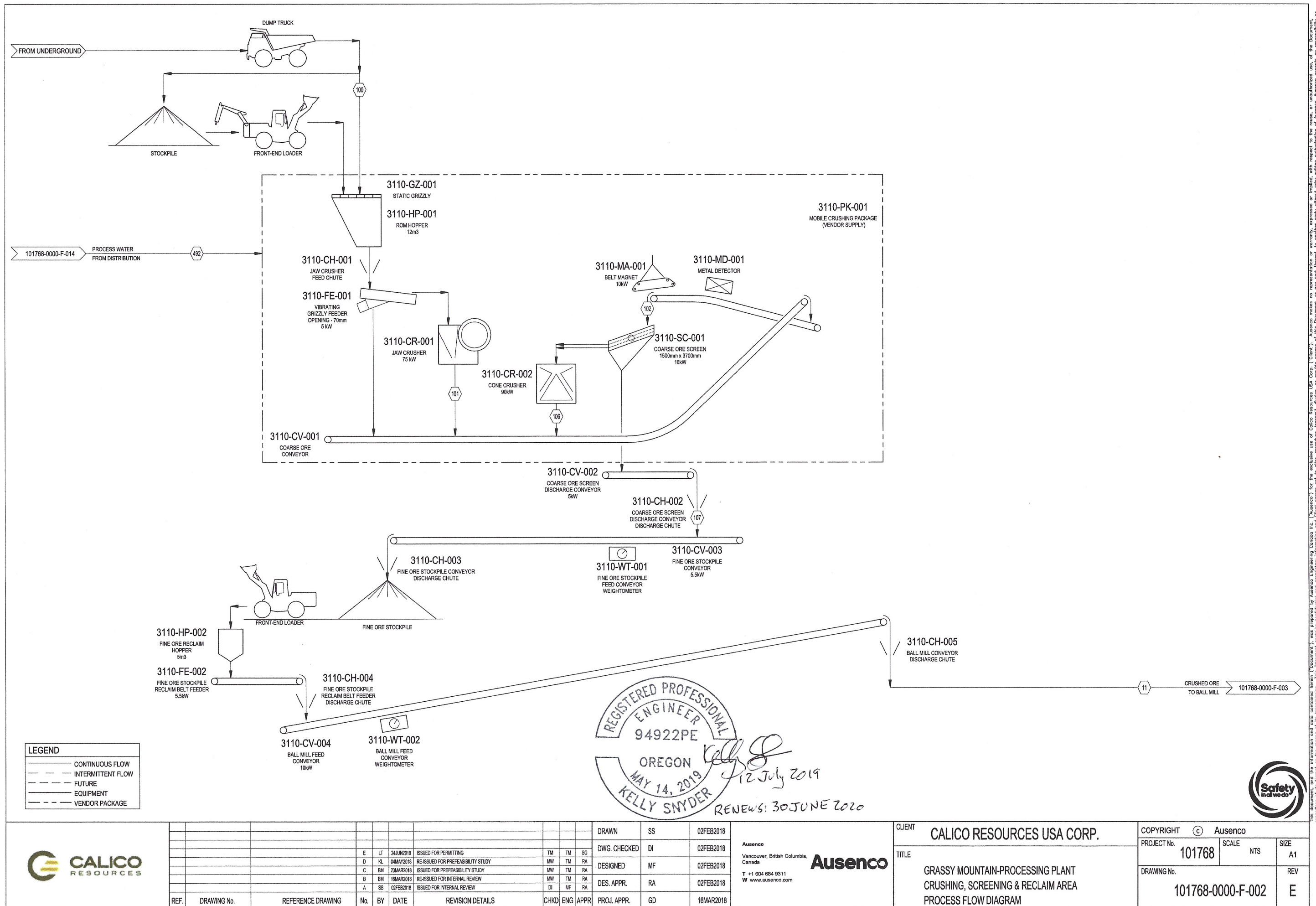
Monitoring after mining ceases will initially be an extension of the monitoring programs that were used to support production activities. These will include monitoring physical and chemical parameters for air, surface and ground water, soil and sediments. In addition, routine surveys and field observations will be conducted with regard to flora and fauna on and around site. The status of various VECs (valued ecological components) such as woodlands, wetlands, and watercourses will be assessed.

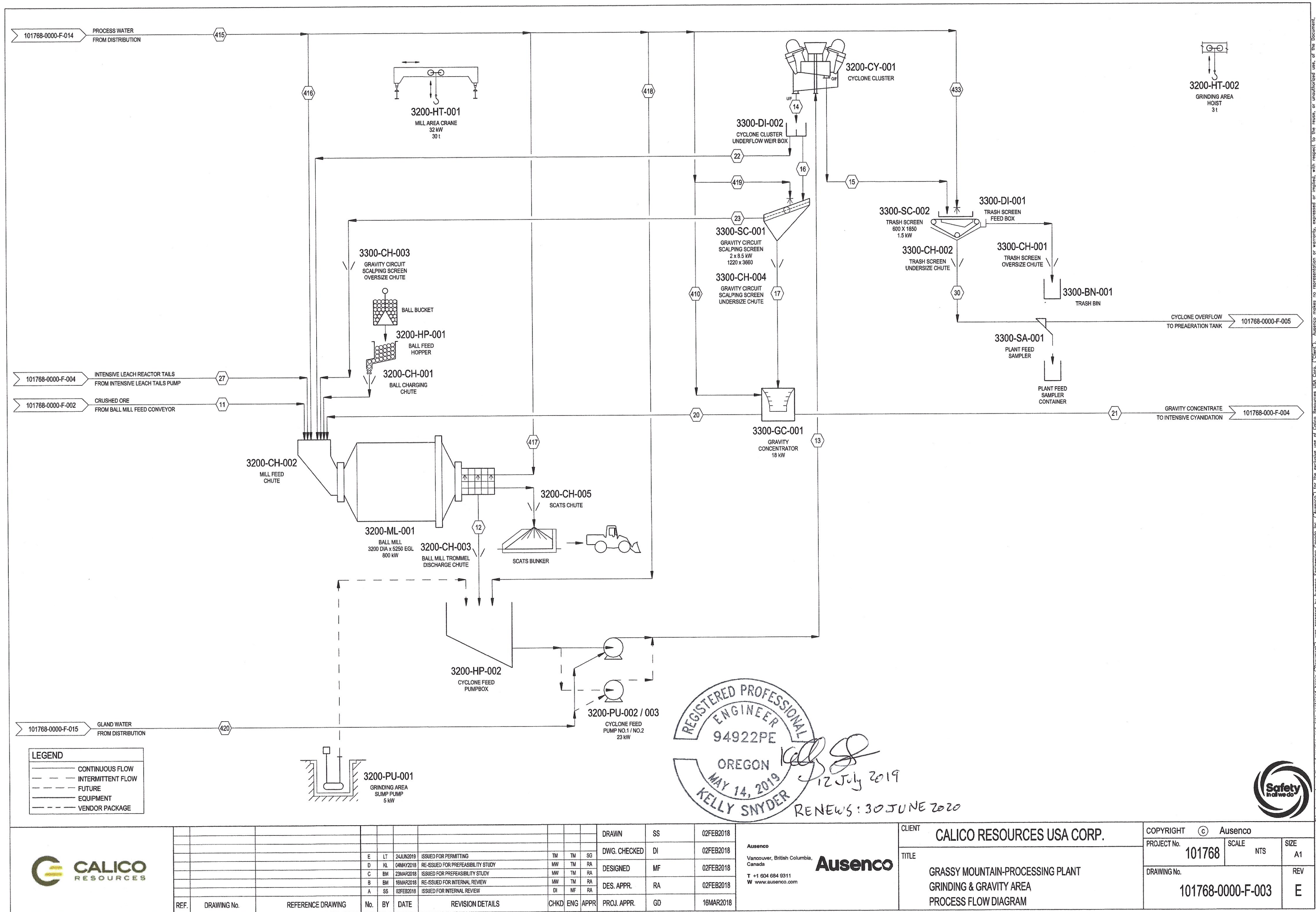
Post-mining monitoring will ensure, through inspection, that decommissioned structures such as the re-contoured plant pad are not subject to damage from erosion or settlement and that spillways and ditches remain functional. The monitoring program will be linked to remedial action plans in the event that reclamation measures require enhancement.

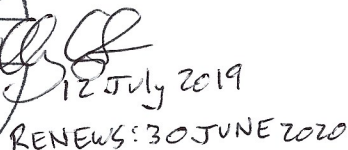
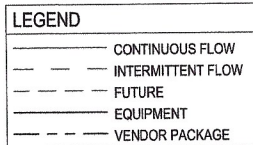
The specific monitoring requirements will be defined and described in the Water Pollution Control Facility Permit (WPCF) which is required under OAR 340-043 and will be submitted as part of the DOGAMI Consolidated Permit Application.

Appendix A – Overall Process Flow Diagram

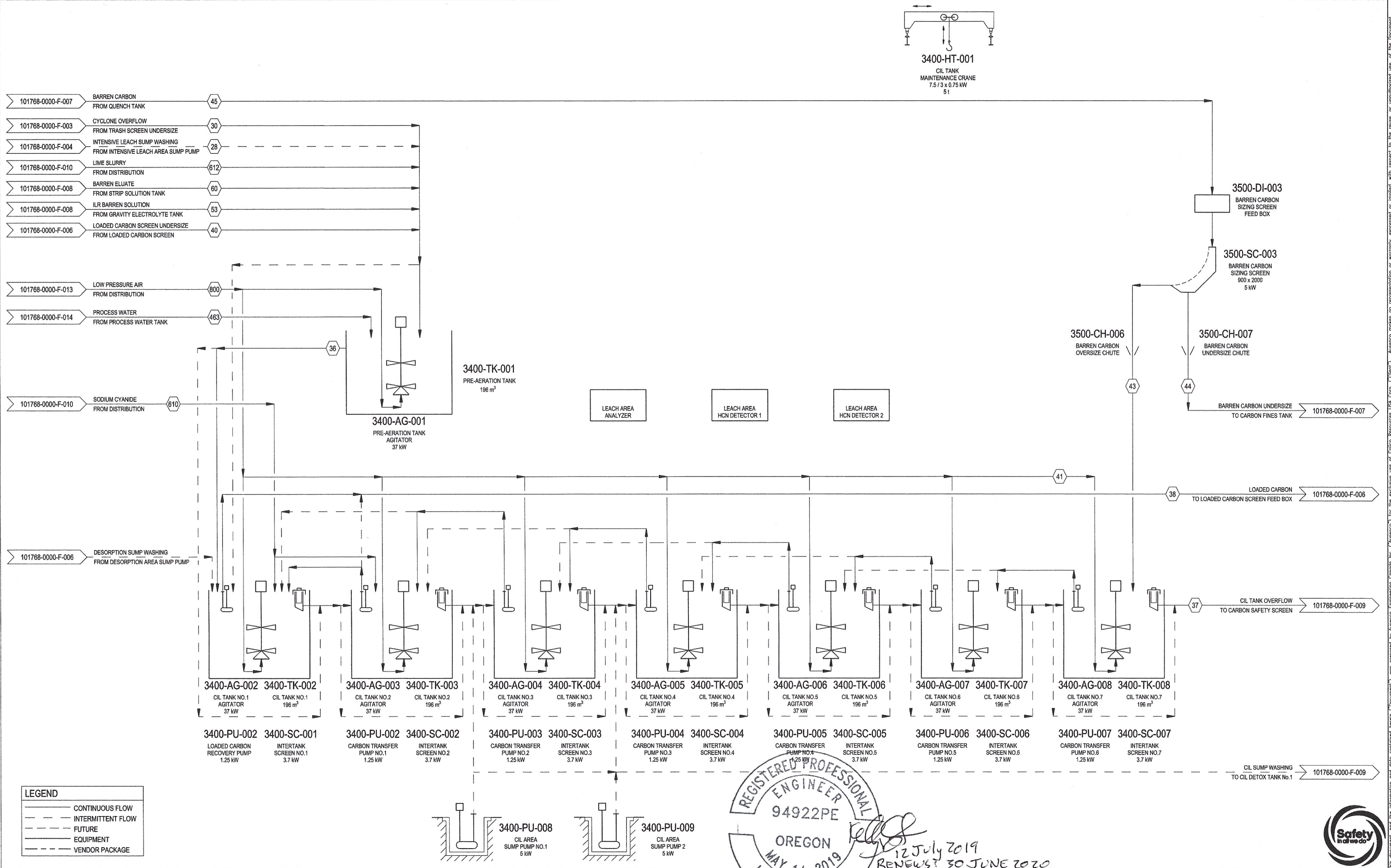
Appendix B – Process Flow Diagrams





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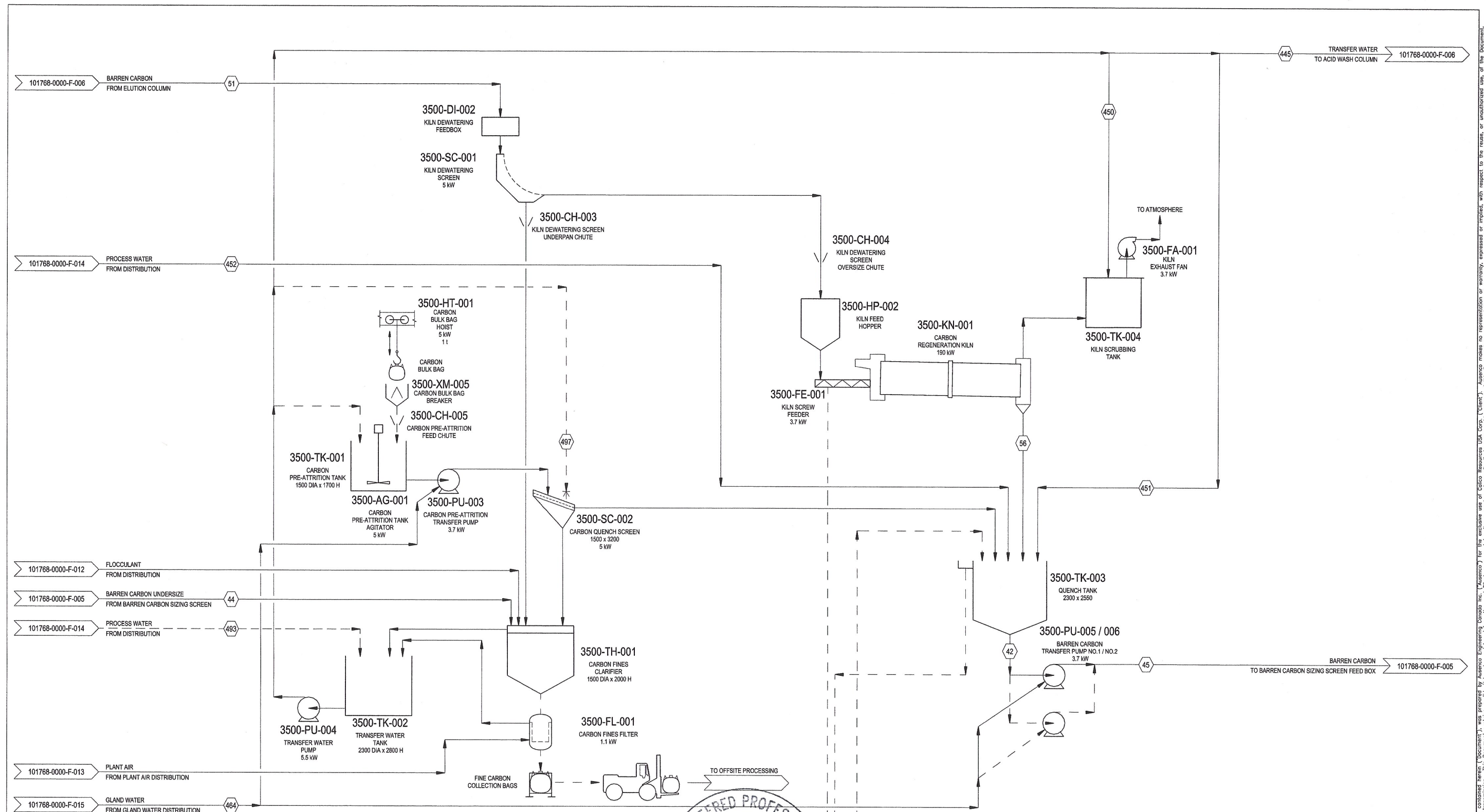
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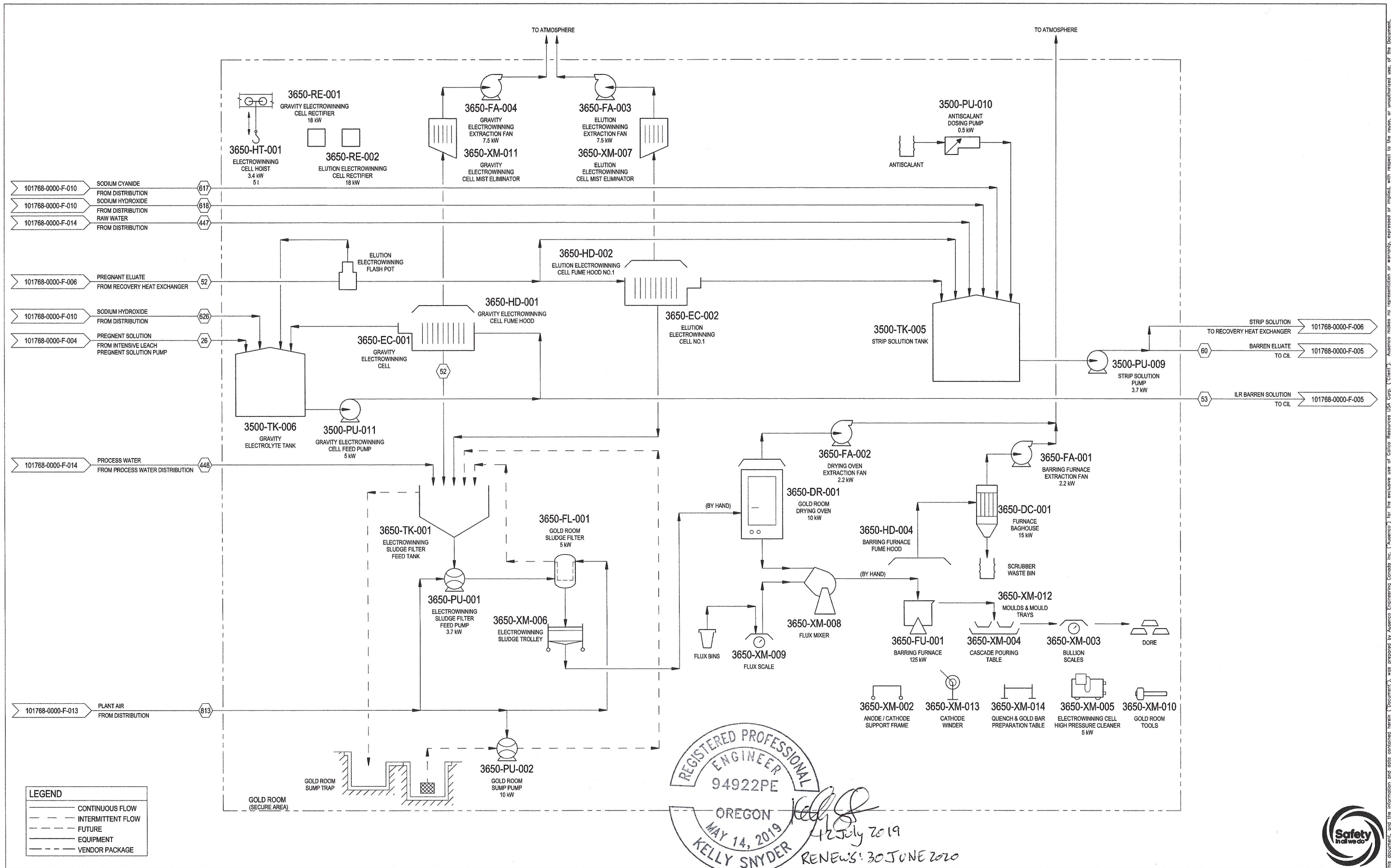
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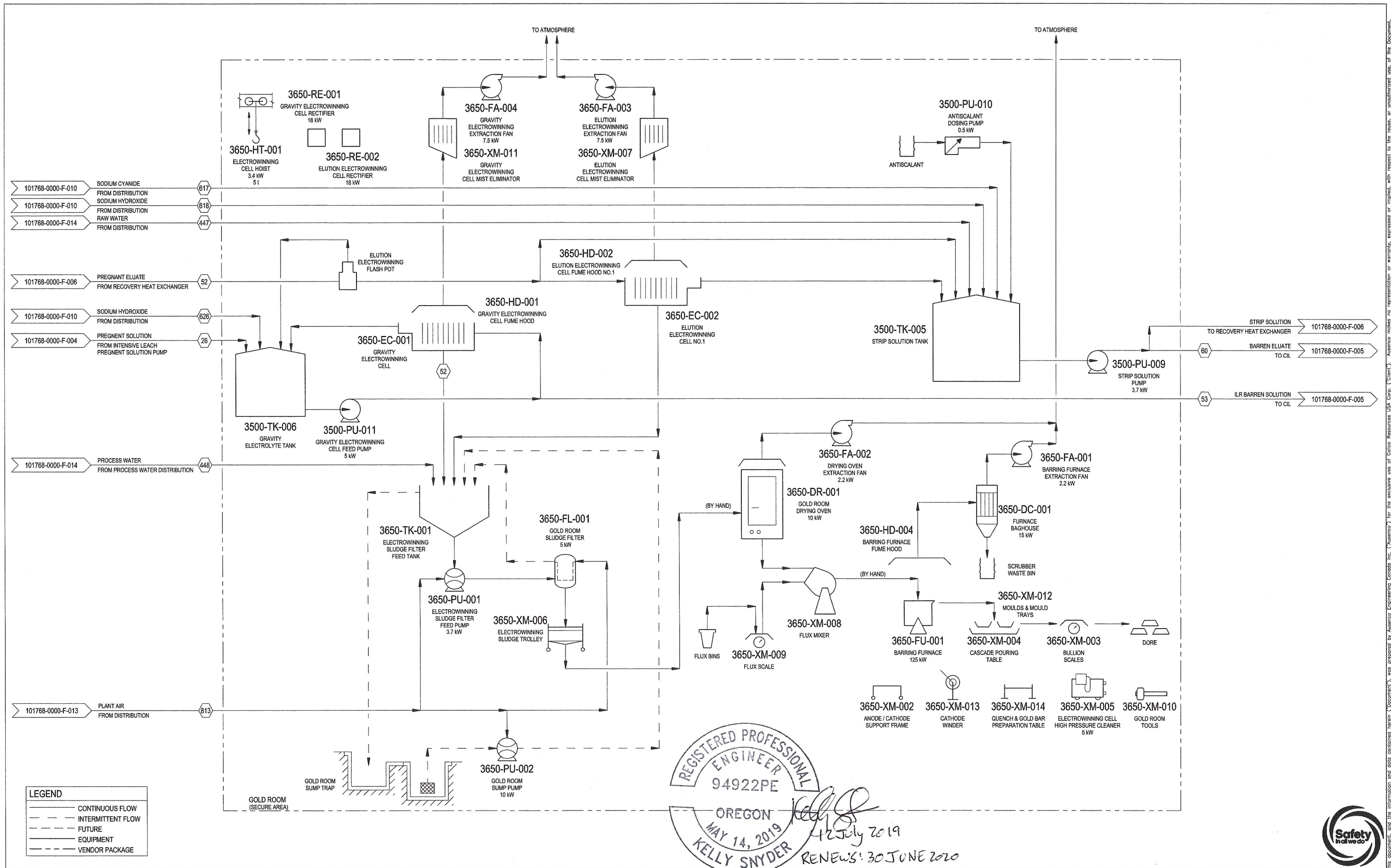
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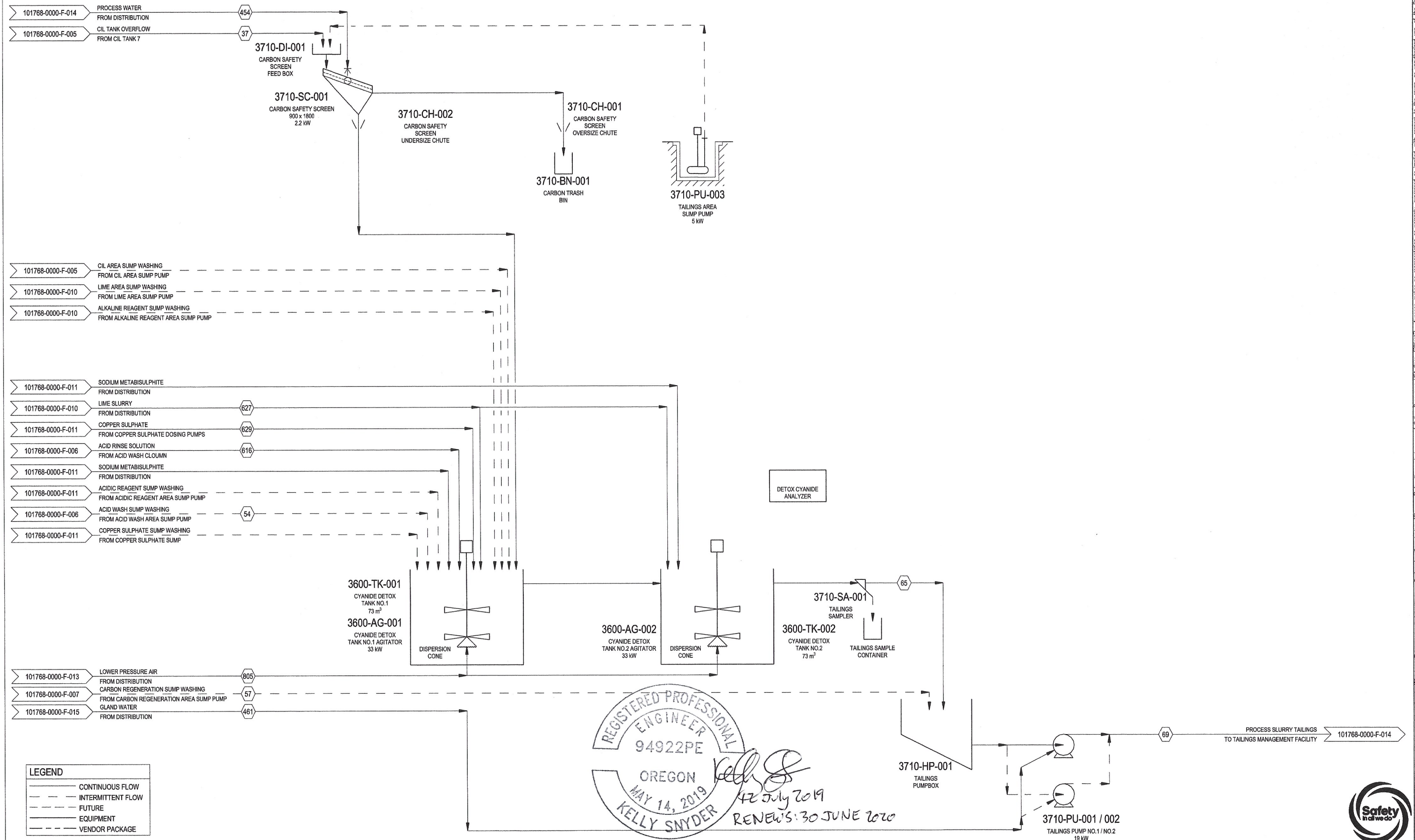
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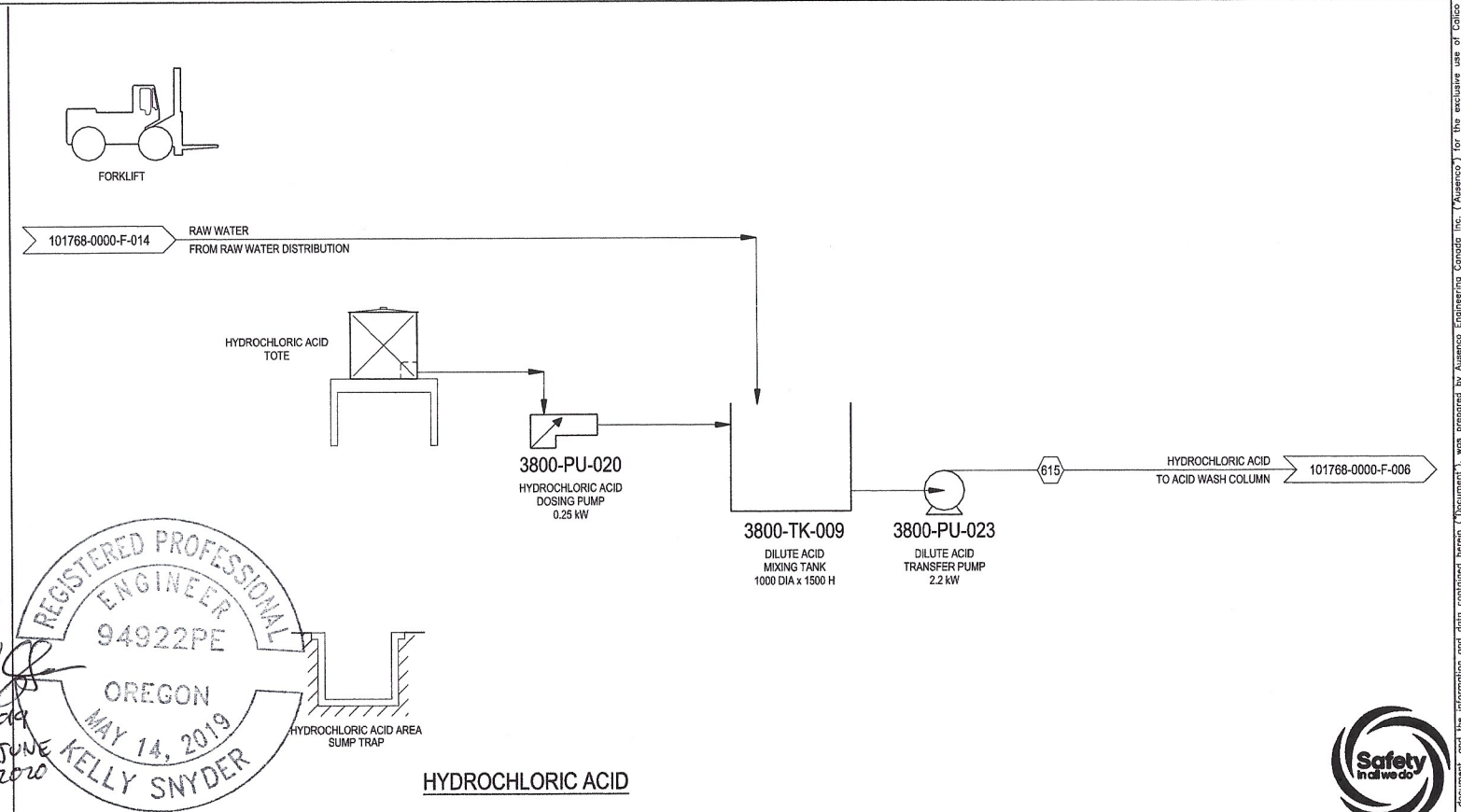
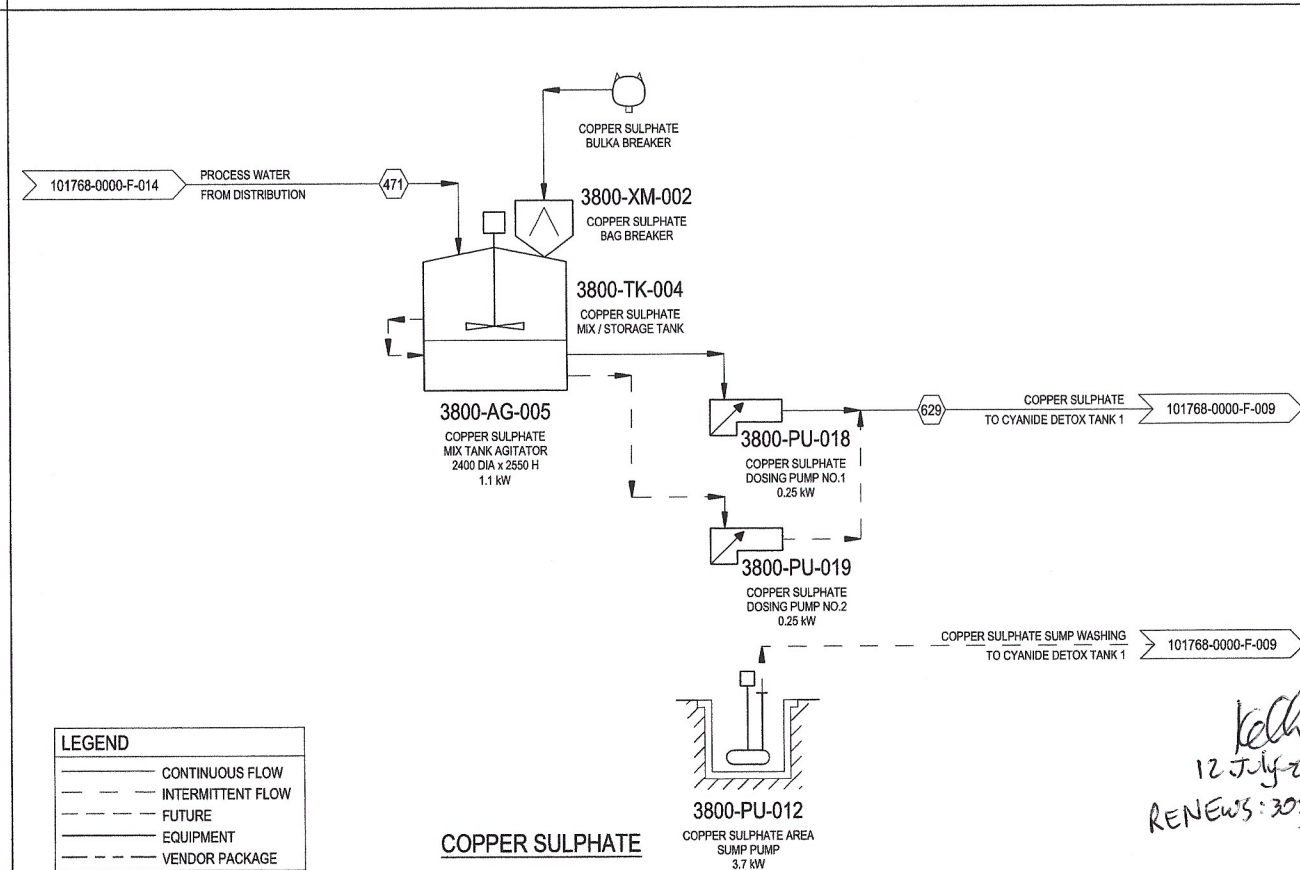
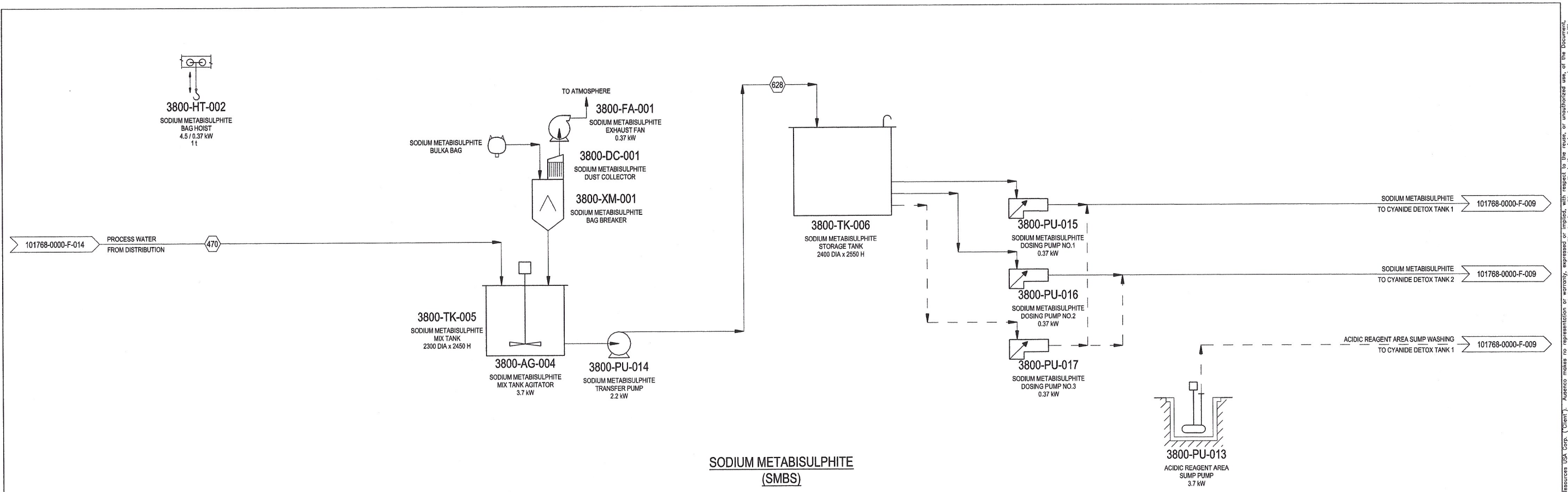
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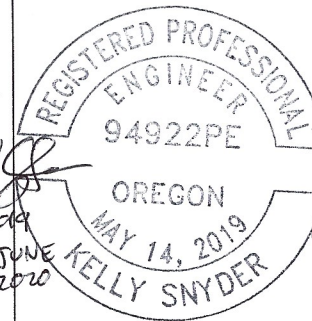
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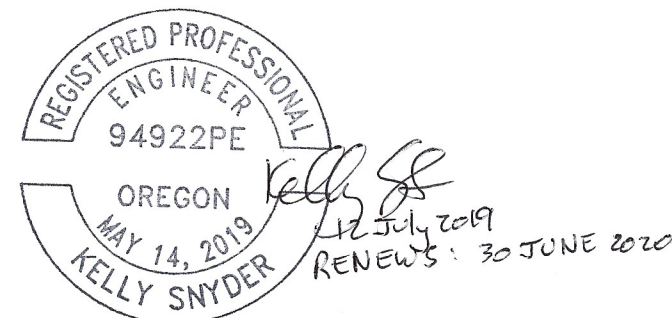
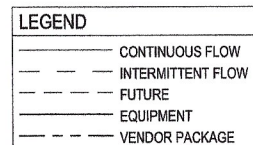
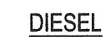
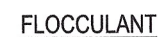
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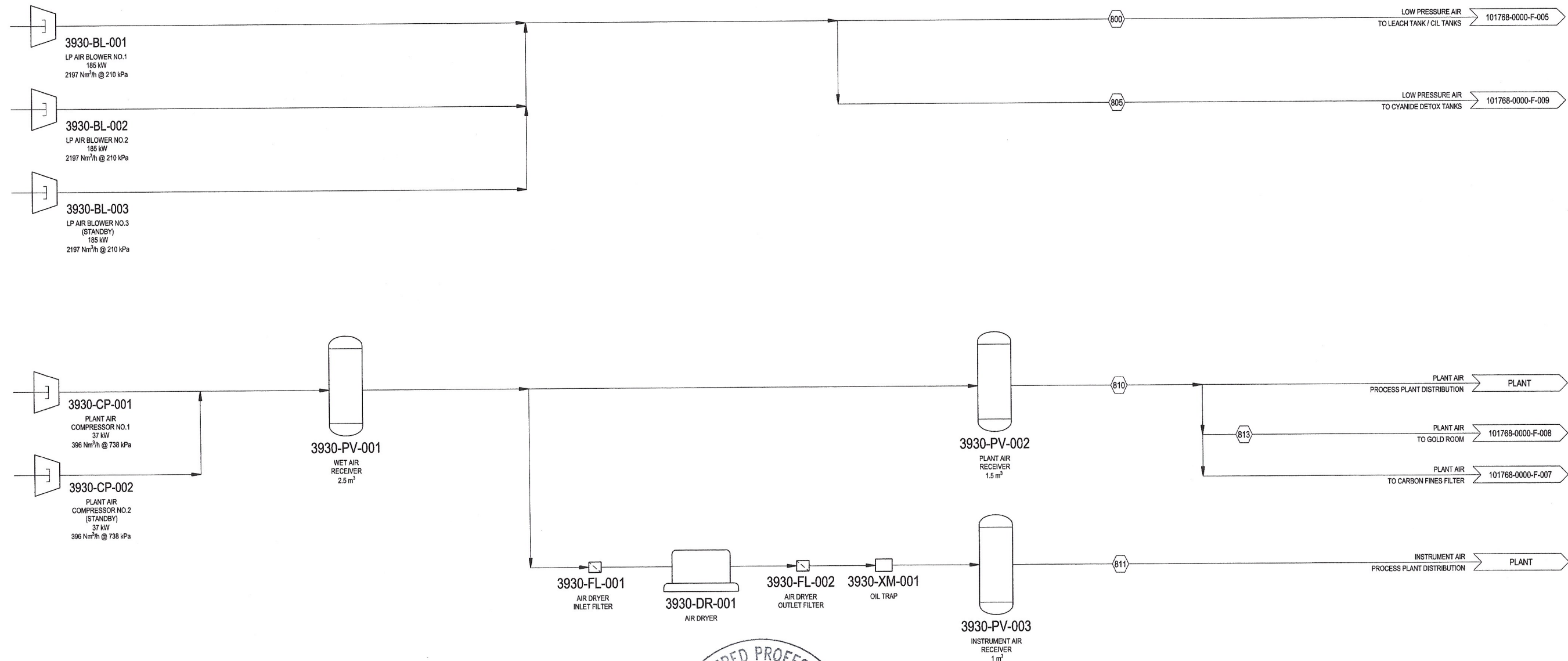
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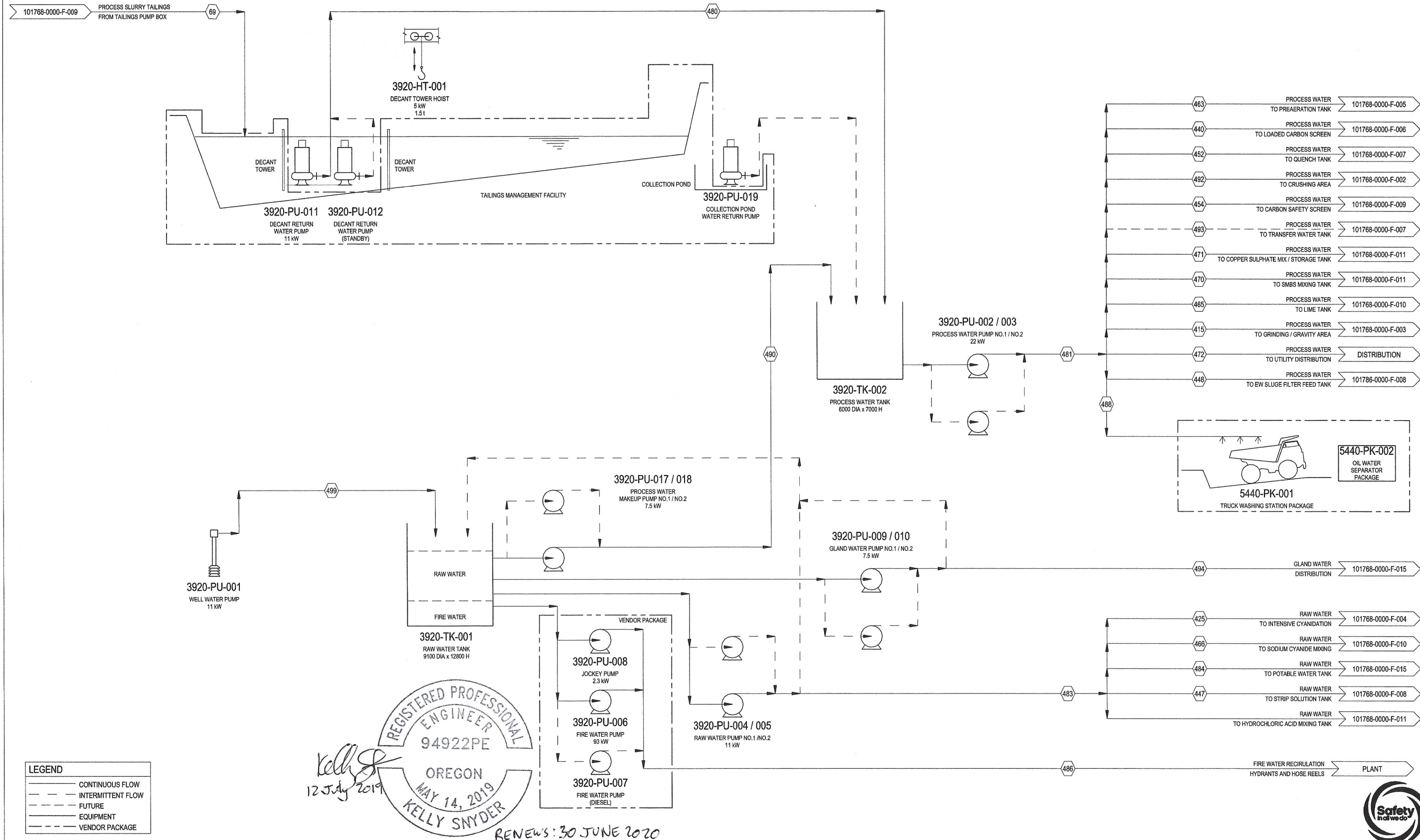
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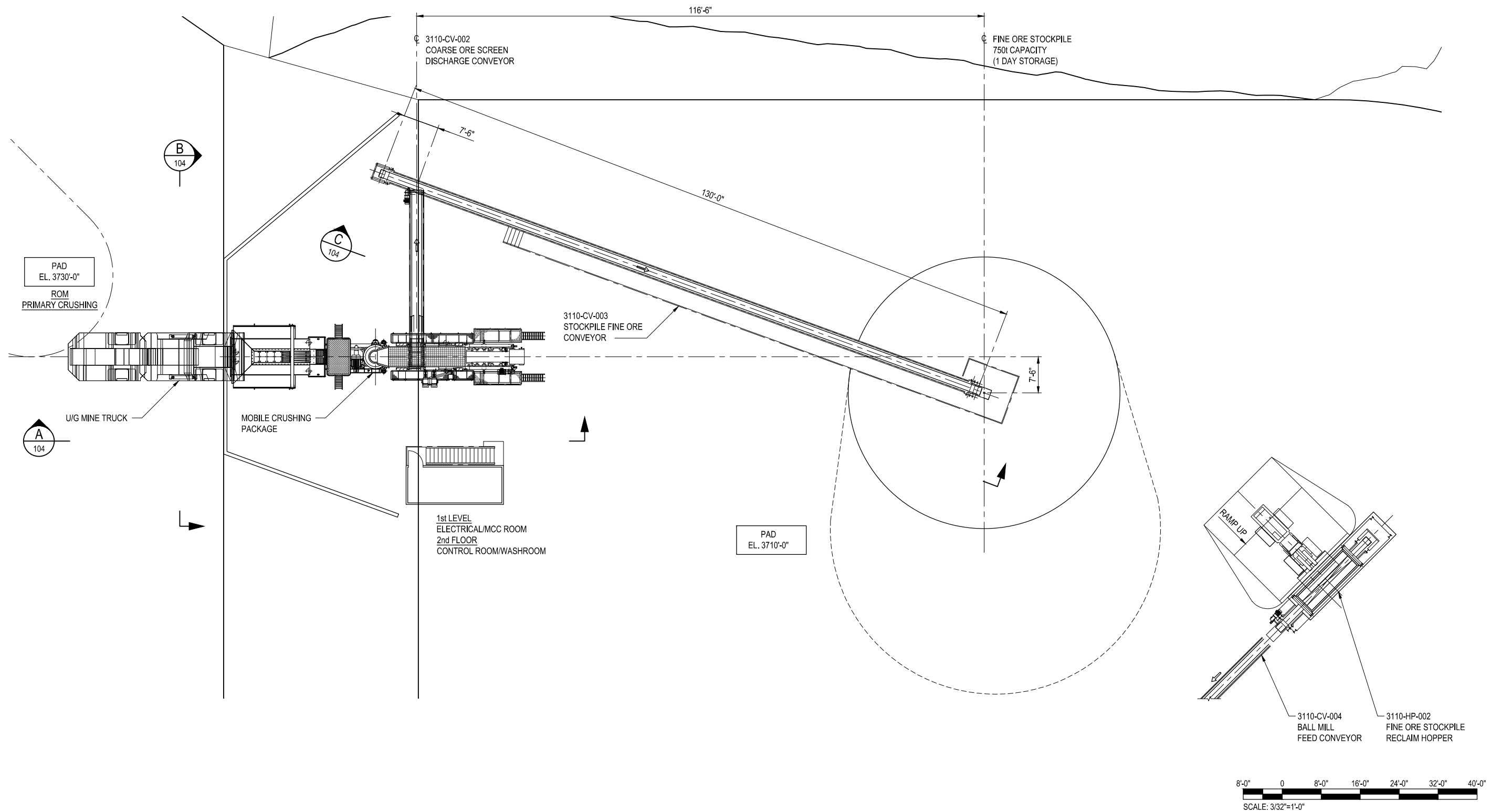
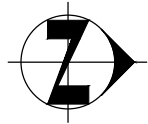
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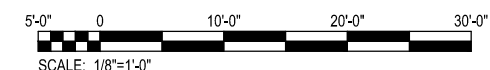
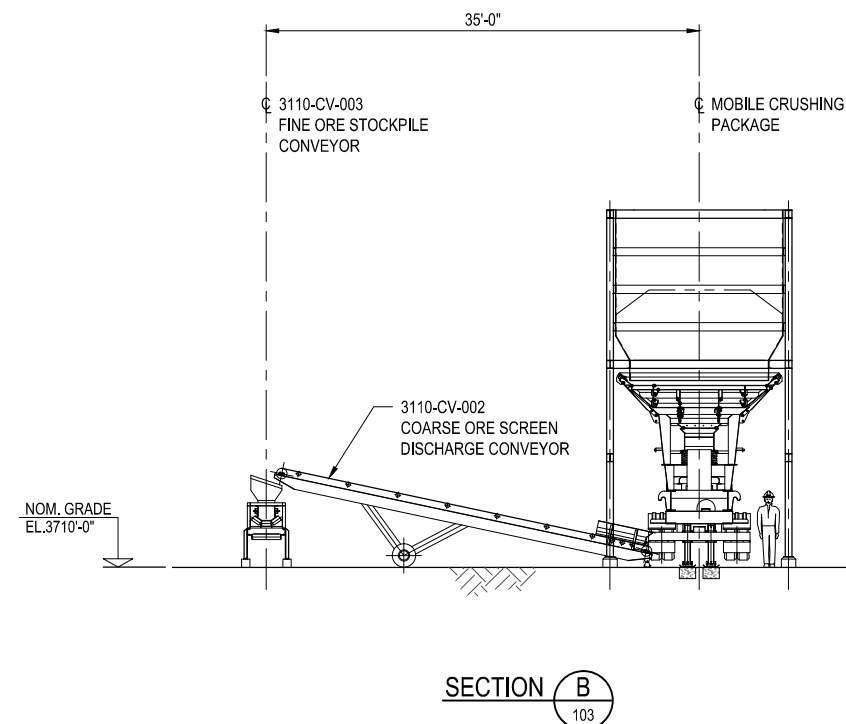
																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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Appendix C – General Arrangements



																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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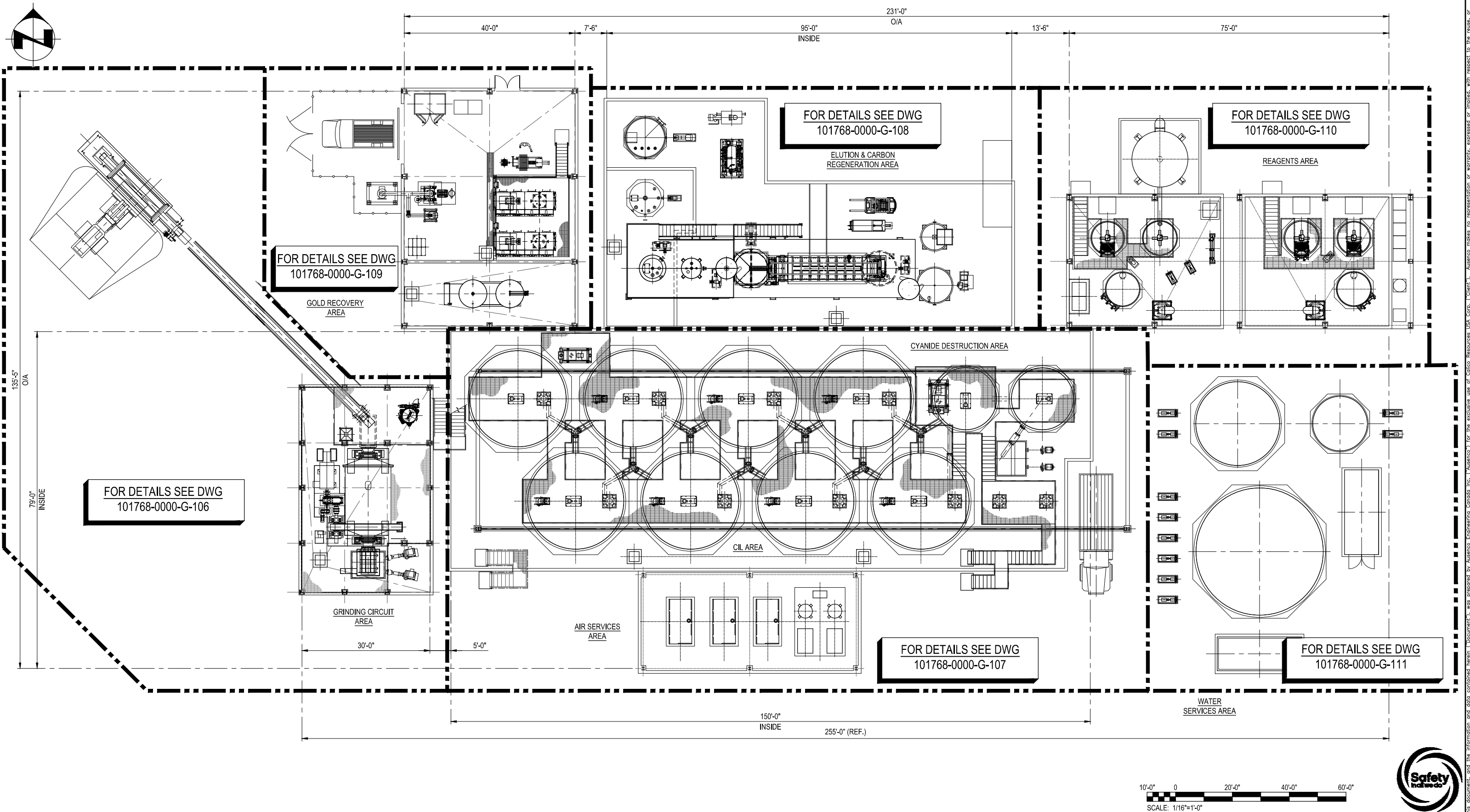
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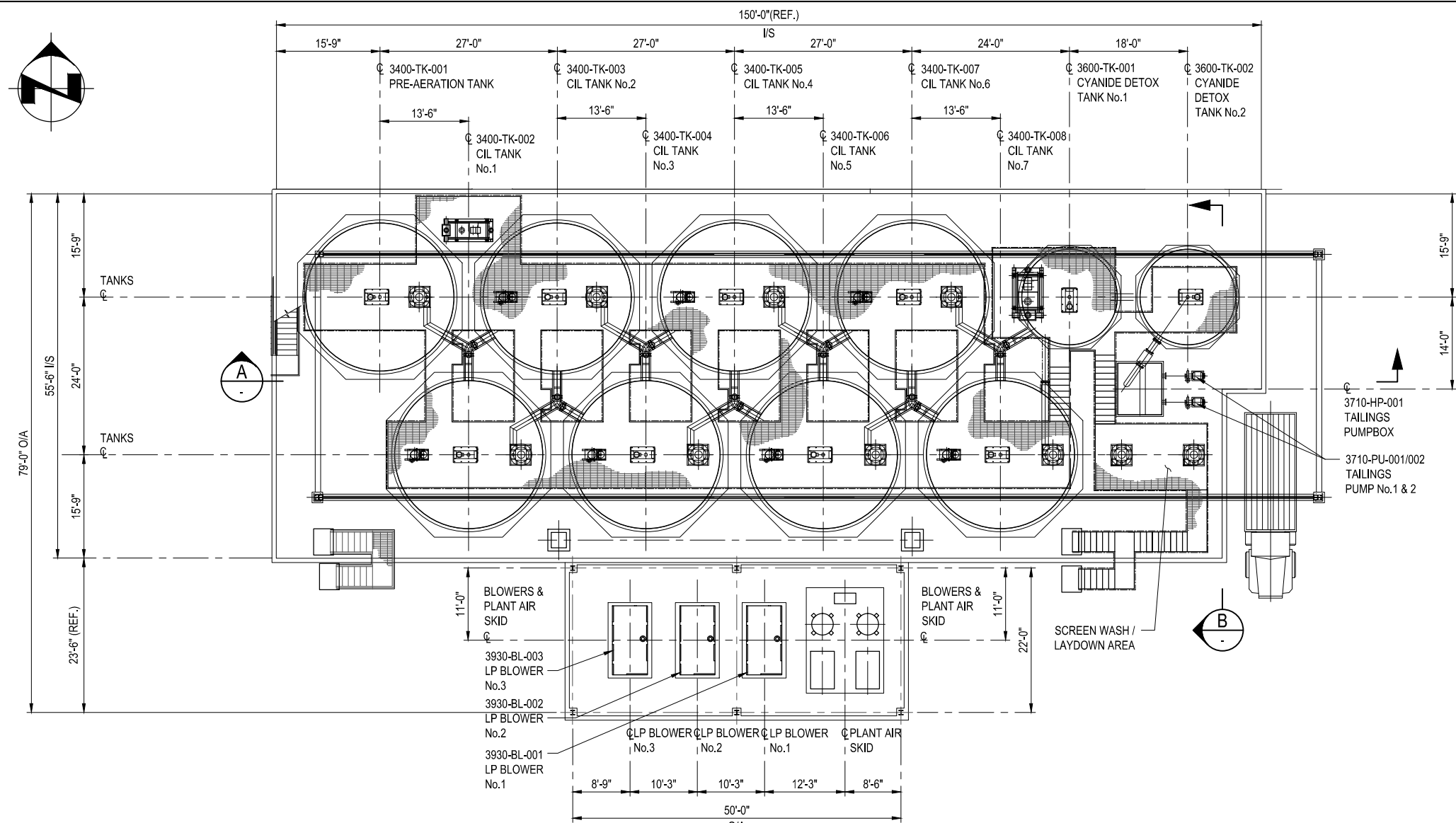
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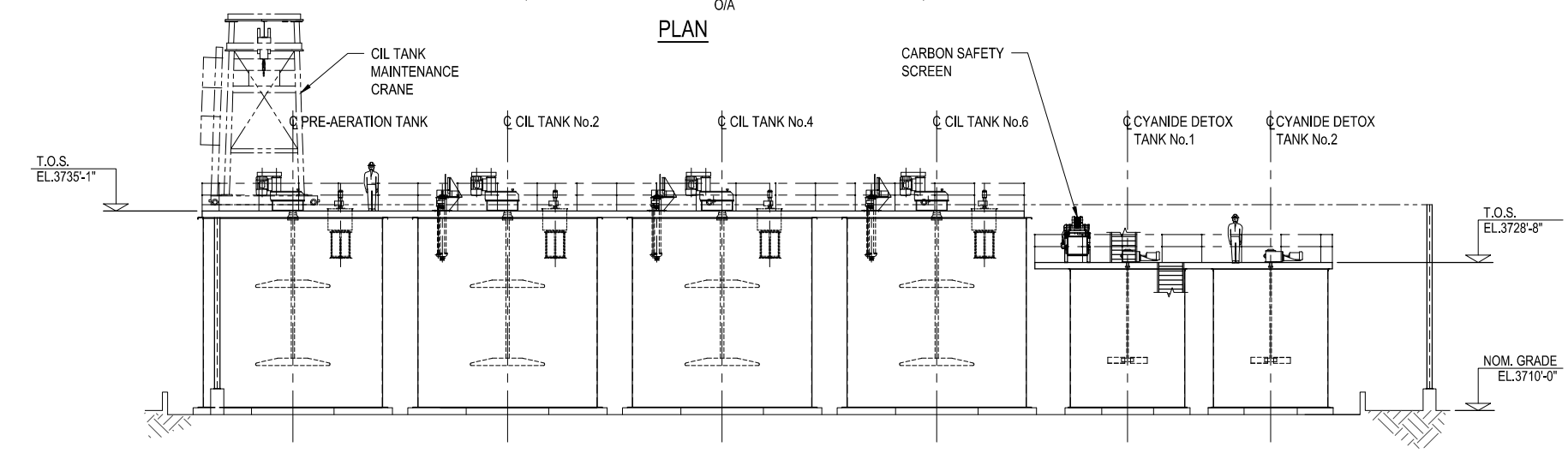
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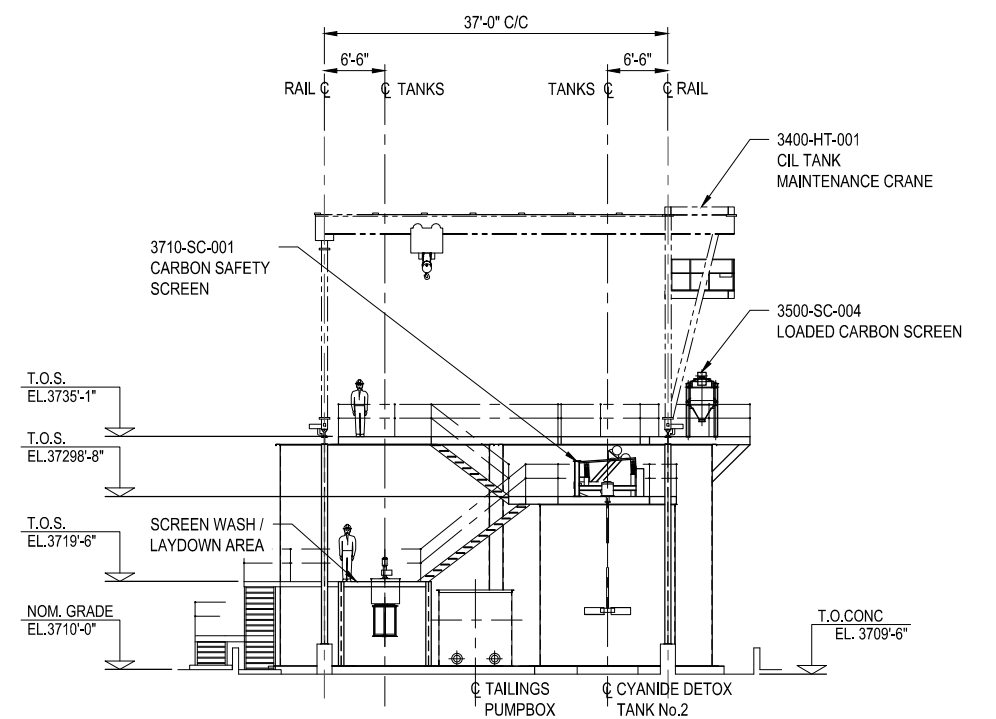
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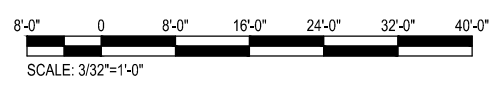
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SECTION A



SECTION B



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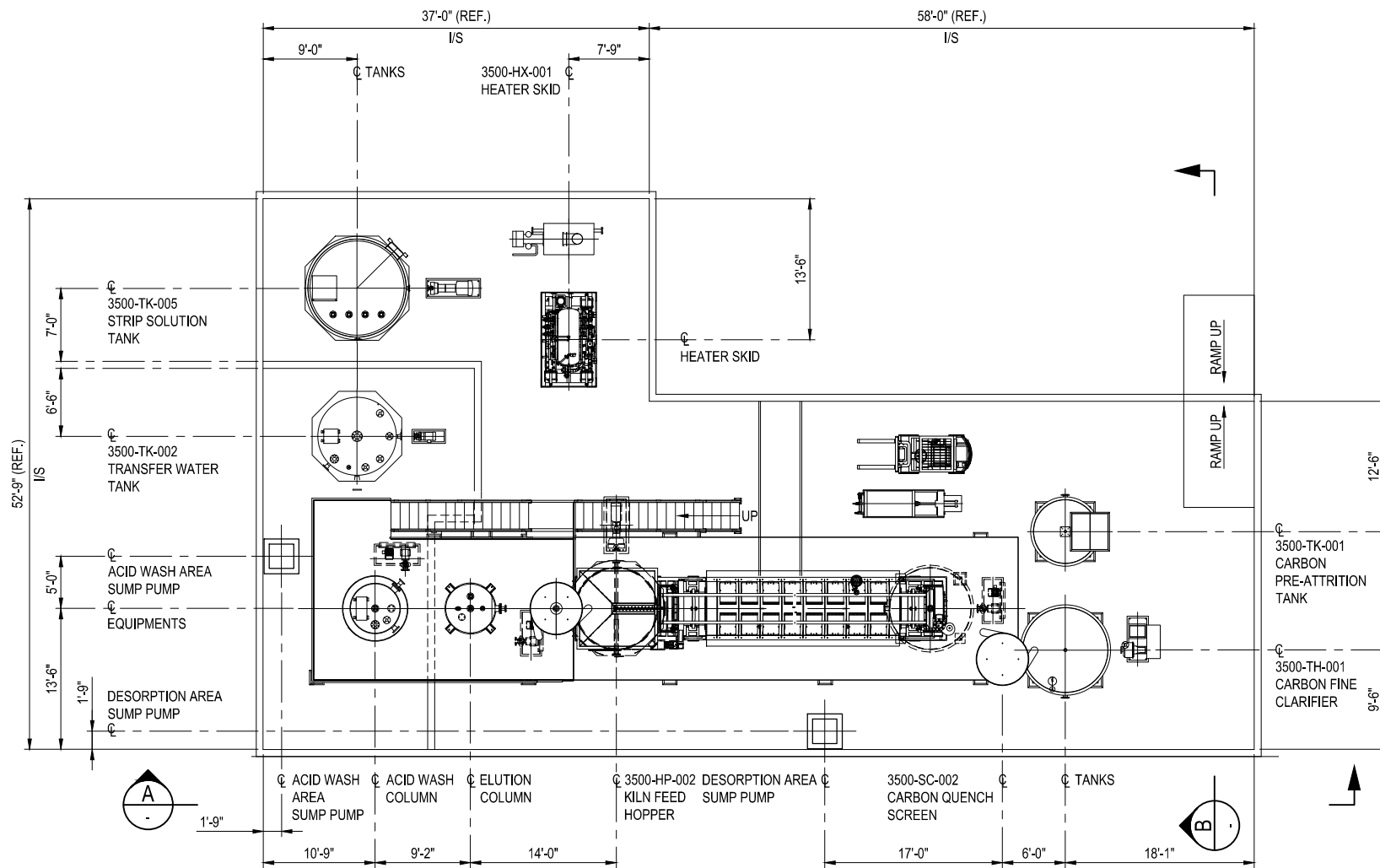
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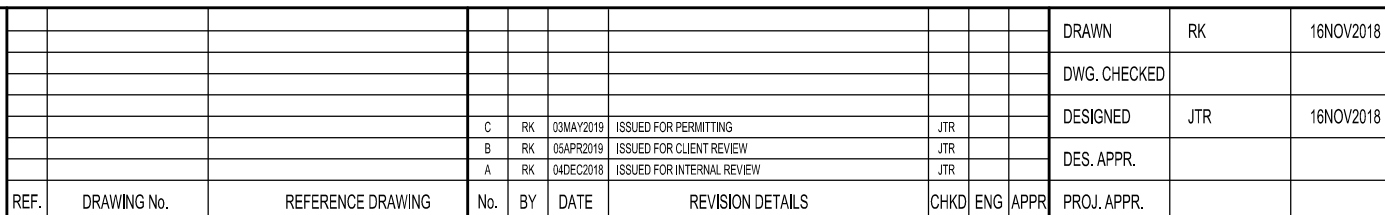
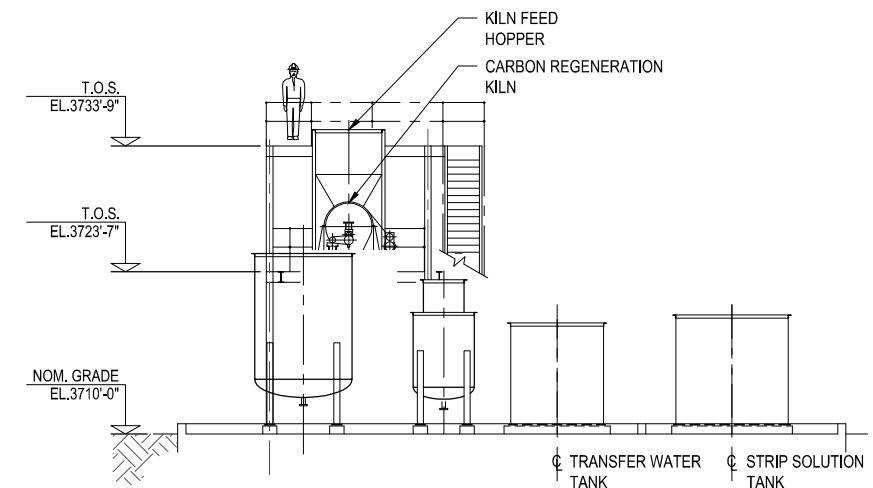
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The diagram illustrates the Carbon Regeneration System process flow. It begins with a **3500-SC-001 KILN DEWATERING SCREEN** at the top center, which feeds into a **KILN FEED HOPPER**. The material then enters the **3500-KN-001 CARBON REGENERATION KILN**, a long horizontal cylindrical vessel. The output of the kiln passes through a **CARBON QUENCH SCREEN** and falls into a **3500-TK-003 QUENCH TANK**. From the quench tank, the material is transferred to a **CARBON FINES CLARIFIER & CARBON PRE-ATTRITION** unit. The final product is then sent to a **TRANSFER WATER TANK**. The system also includes two vertical **ACID WASH COLUMNS** and an **ELUTION COLUMN** (labeled 3500-CM-001 and 3500-CM-002) for pre-treatment. The diagram shows the flow of material through these units, with various pipes, valves, and structural supports. Elevation markers on the left indicate **T.O.S. EL.3733'-9"**, **T.O.S. EL.3723'-7"**, and **NOM. GRADE EL.3710'-0"**.



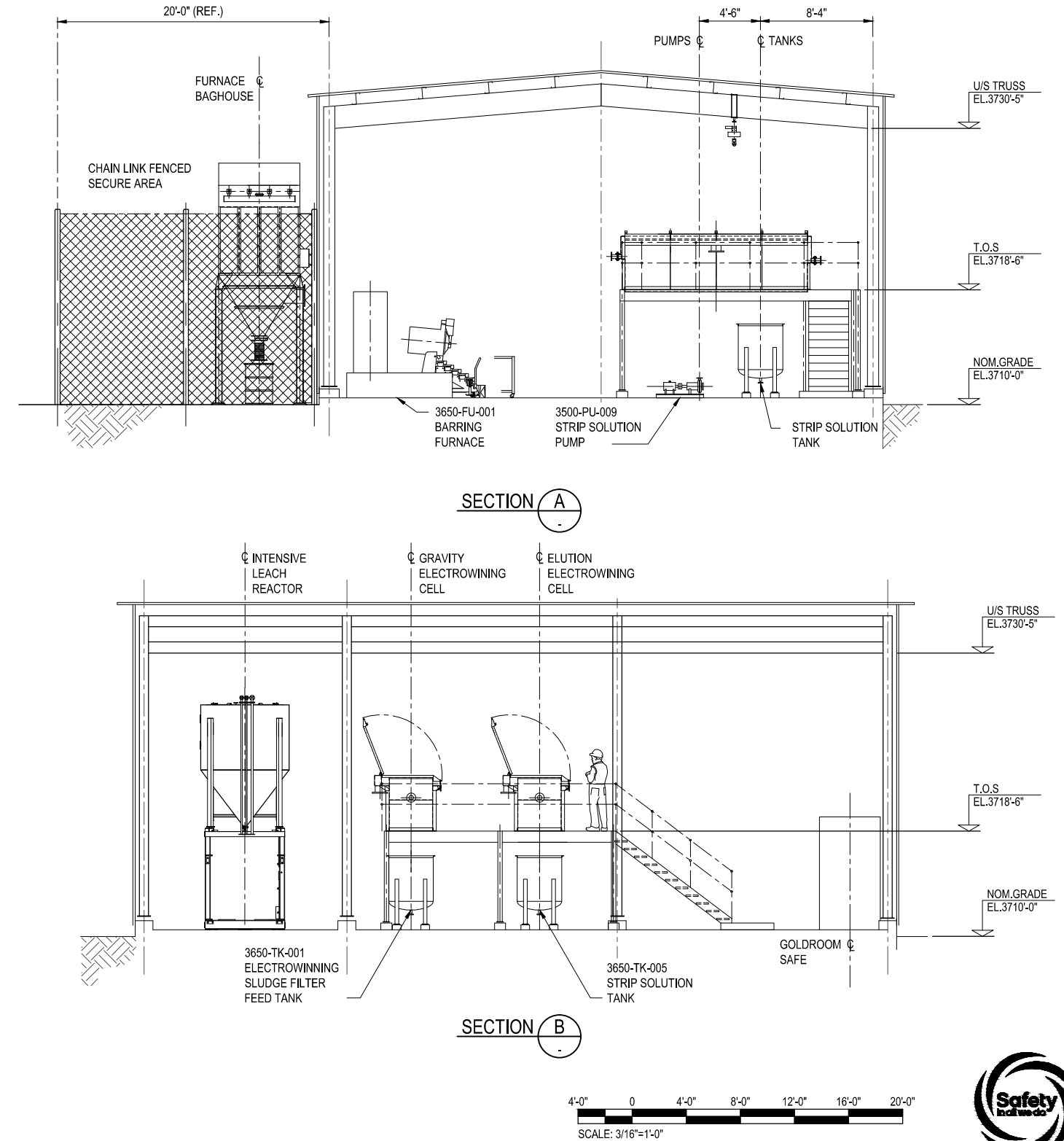
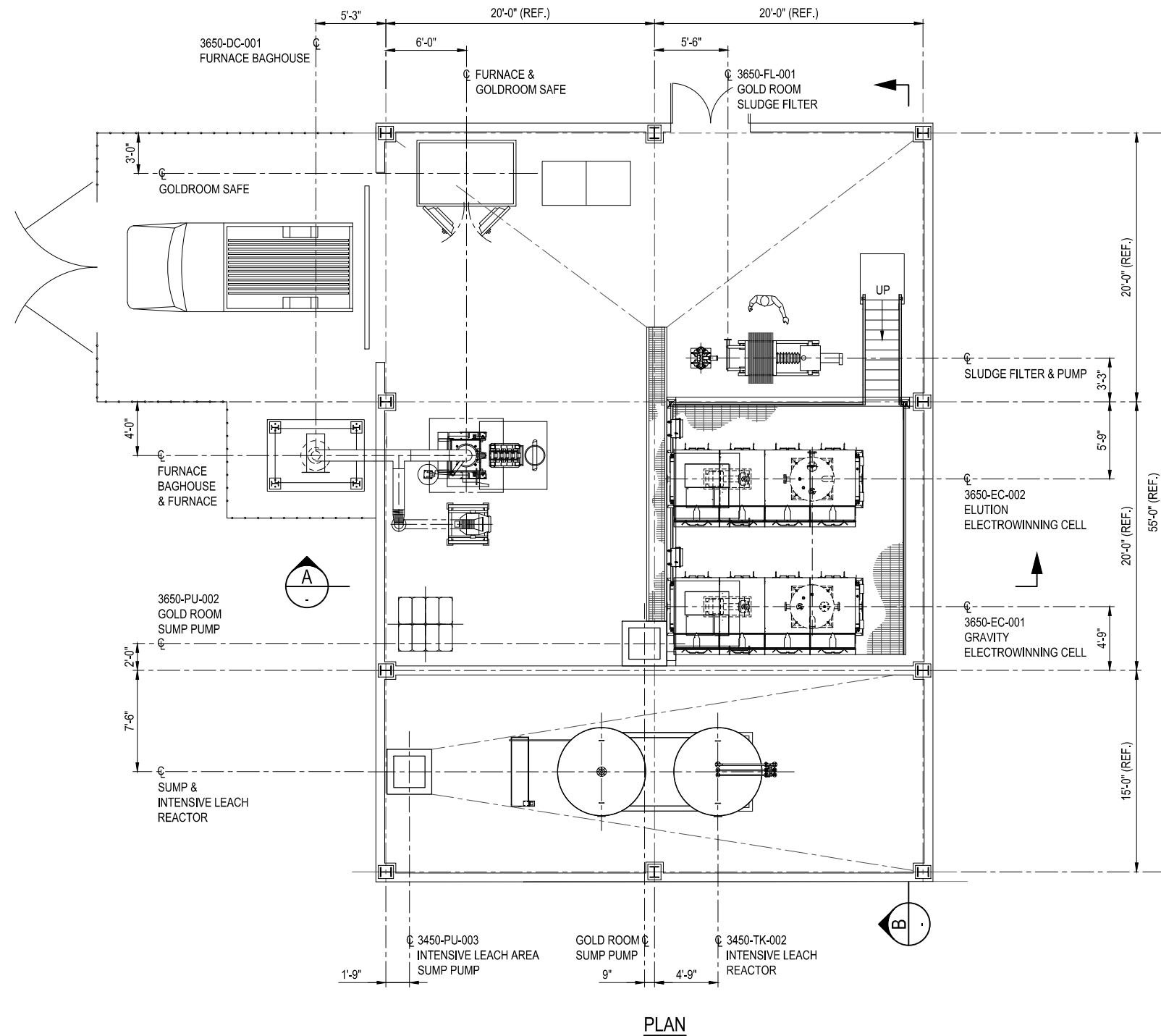
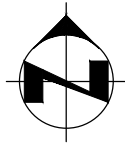
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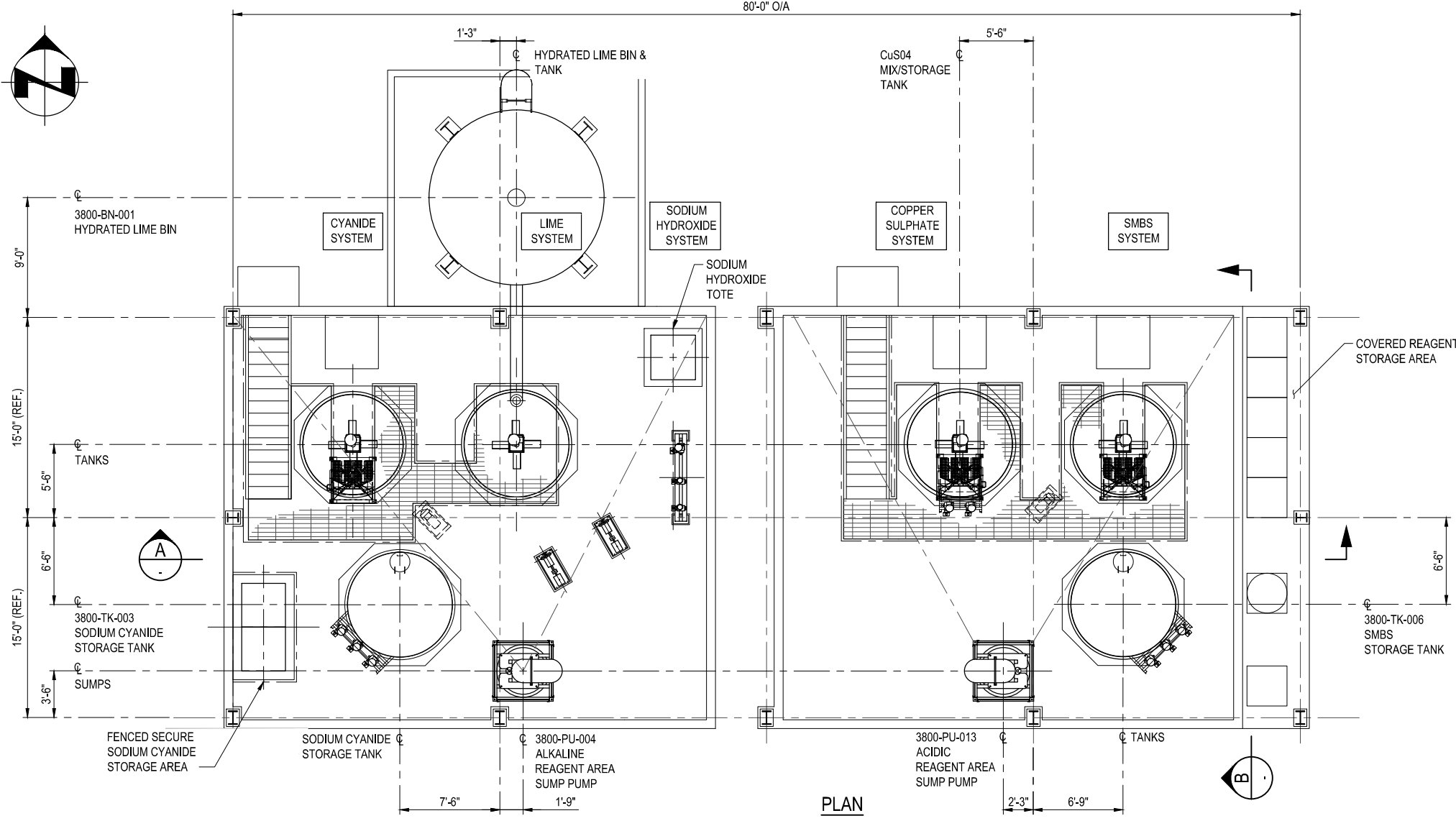
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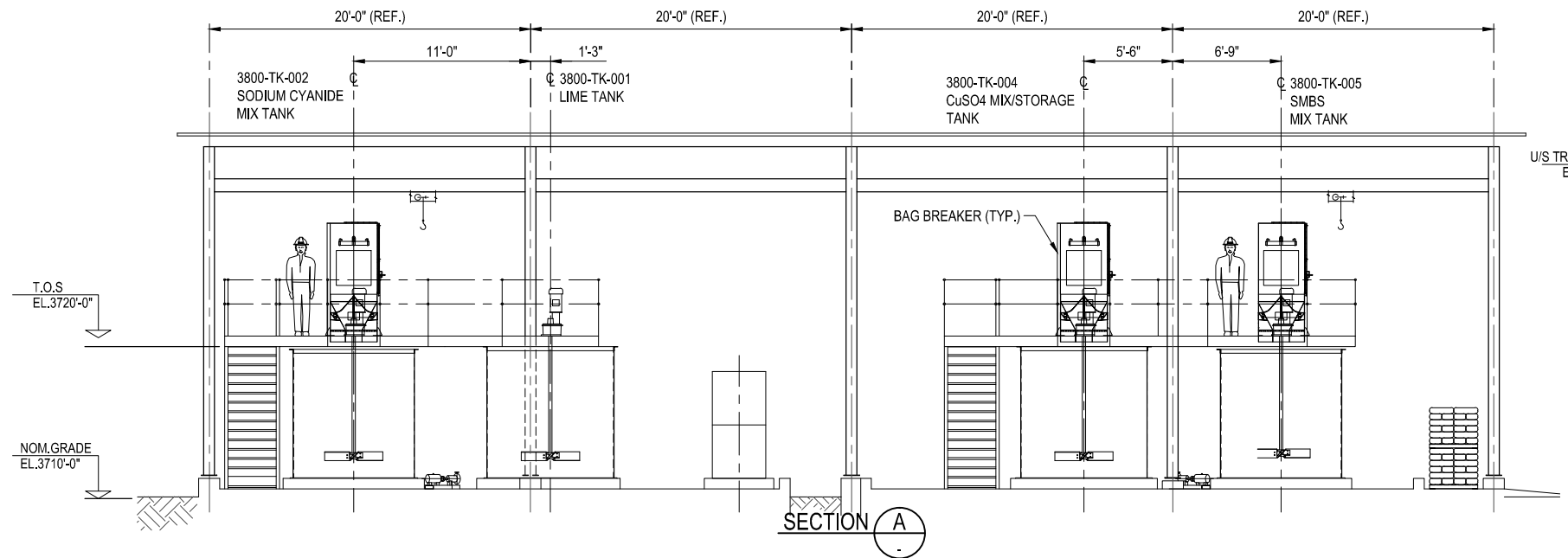
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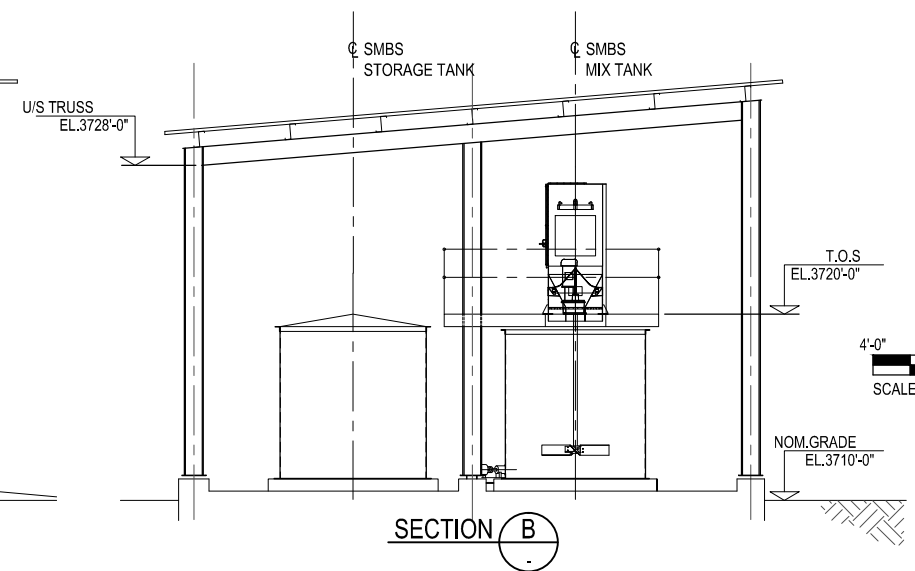
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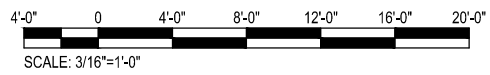
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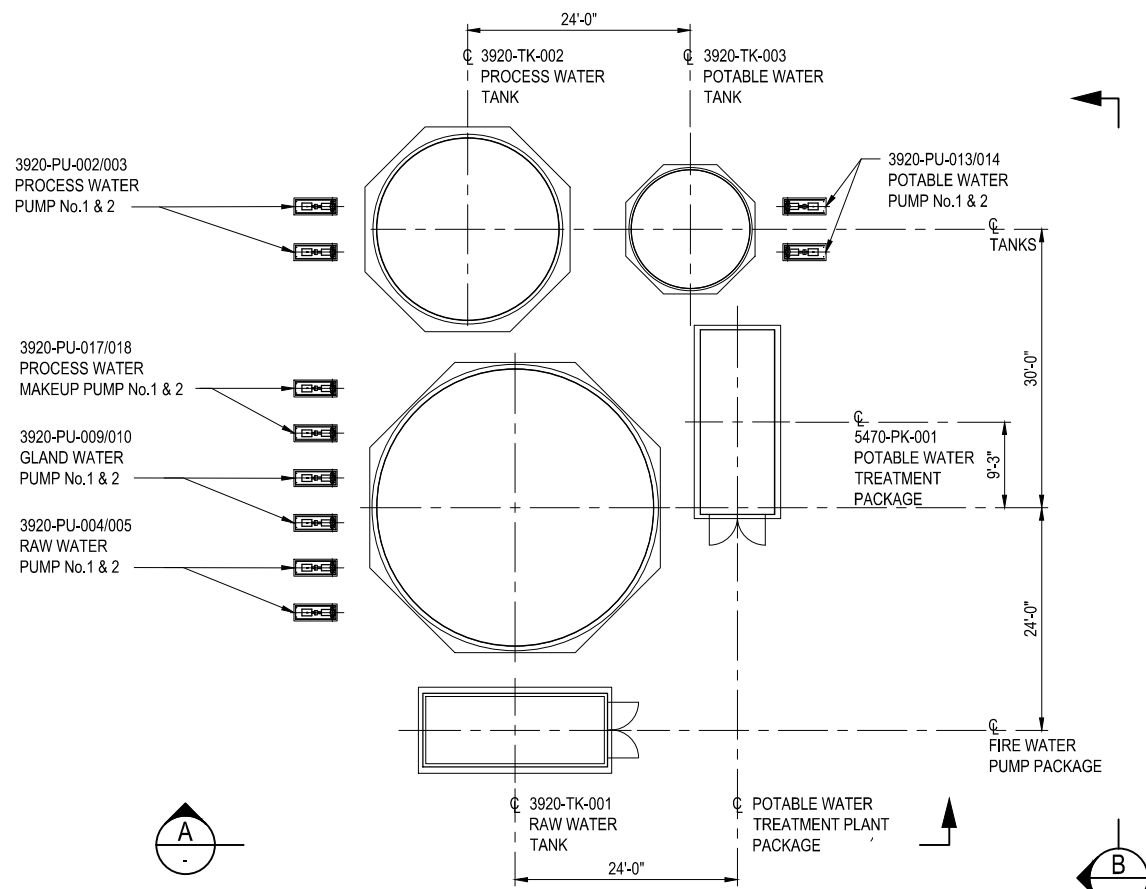


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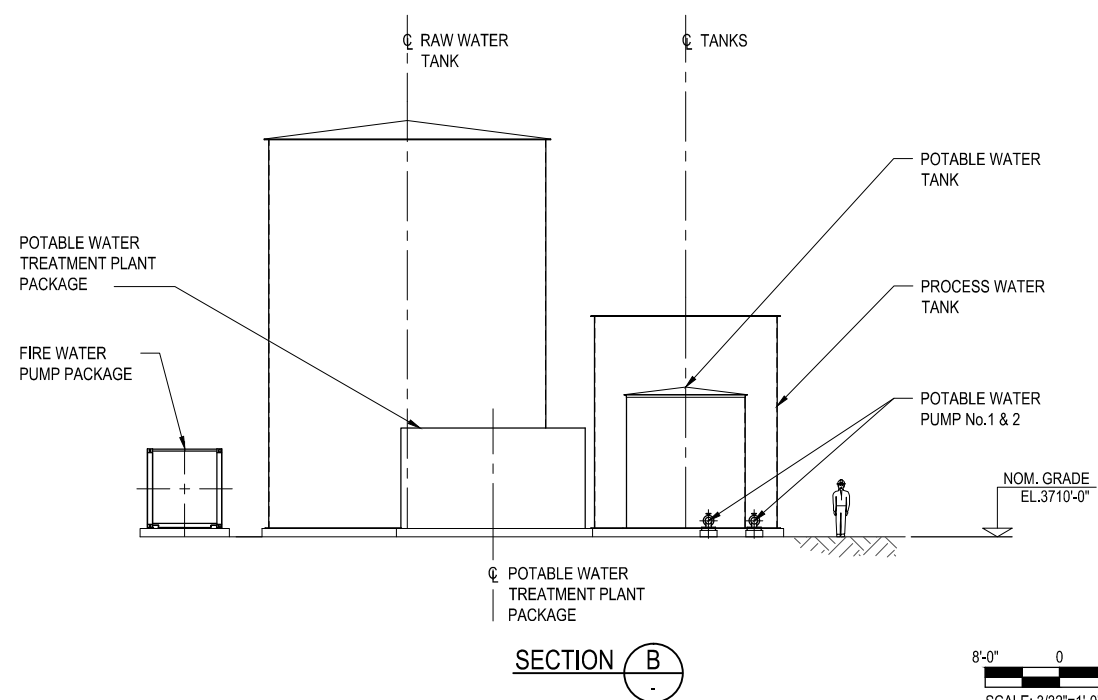


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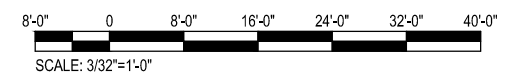


SECTION A

SECTION A



SECTION B



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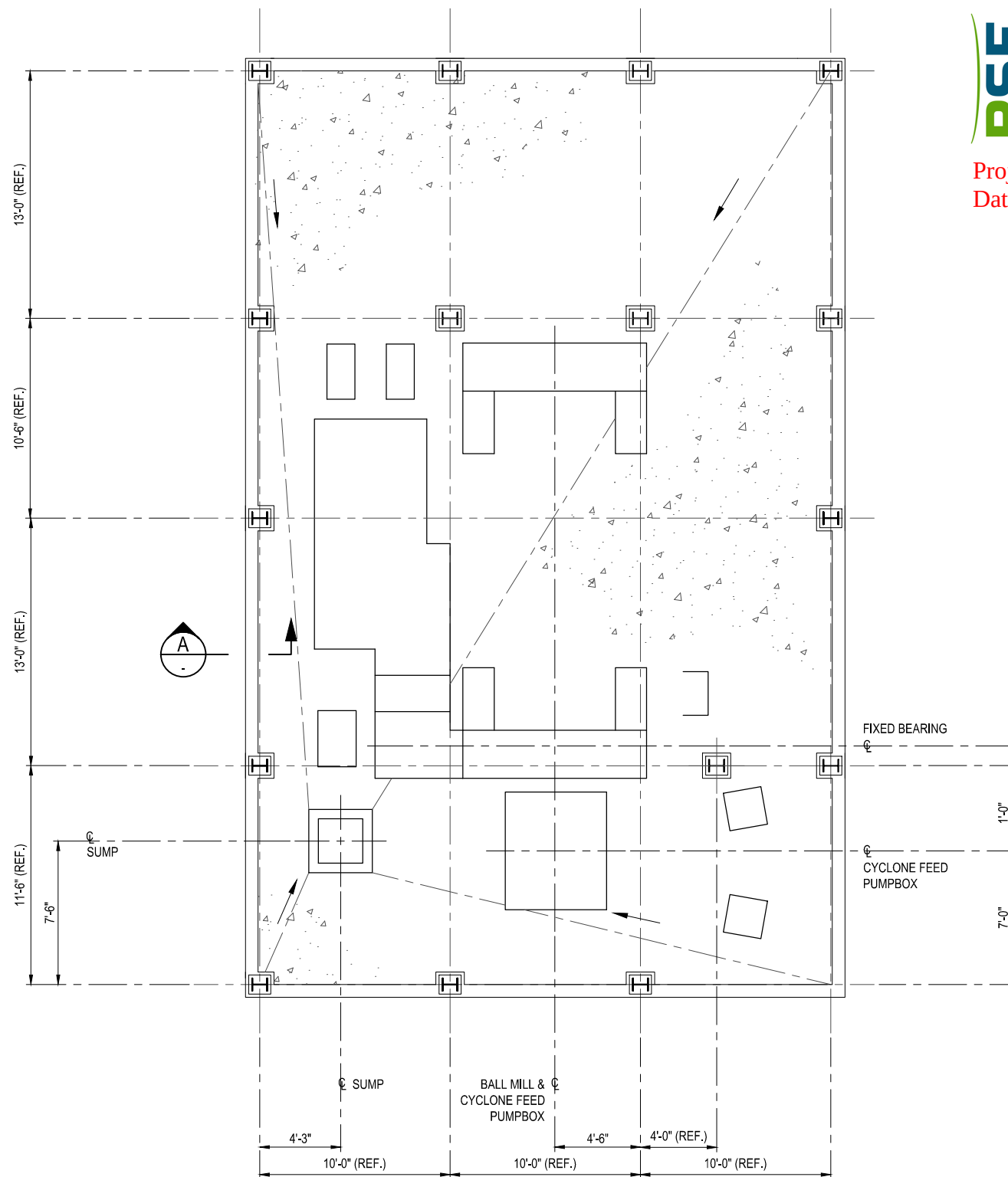
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Appendix D – Concrete Containment Drawings



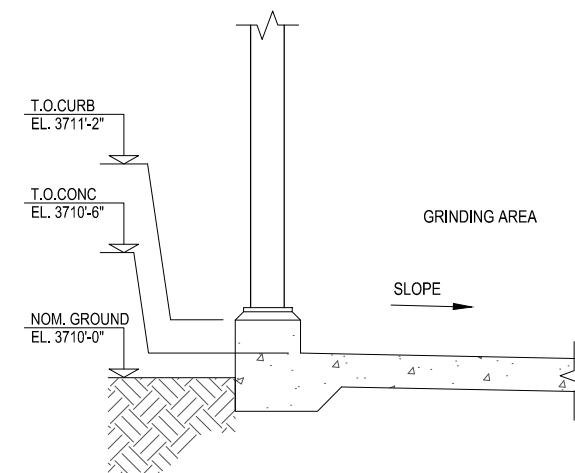
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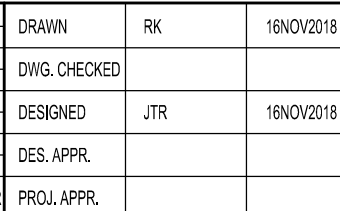
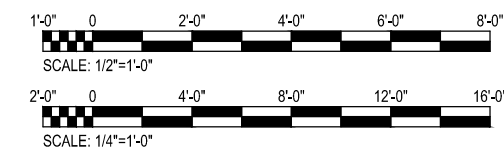
Seal applies to sizing of secondary containment volumes for compliance with International Cyanide Management Code only.

1. TOTAL CONTAINMENT VOLUME: 773ft³.
2. VOLUME OF LARGEST VESSEL (110%): 493ft³.
3. DESIGN CURB HEIGHT: 8".
4. THE BUNDED AREA IS SIZED TO CONTAIN 110% OF THE LARGEST TANK VOLUME PLUS A 25 YEAR 24 HOUR STORM EVENT.
5. REFERENCE CALCULATION: 101768-0000-MX-CALC-0004.



SECTION (A)

1/2"=1'-0"



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TITLE	GRASSY MOUNTAIN PROJECT PROCESS PLANT GRINDING AREA CONTAINMENT-GENERAL ARRANGEMENT

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3 SCALE AS SHOWN

DRAWING No.

101768-1200-C-101



PETERSON STRUCTURAL ENGINEERS
9400 SW BARNES RD., SUITE 100
PORTLAND, OR 97225
PHONE: 503-292-1635

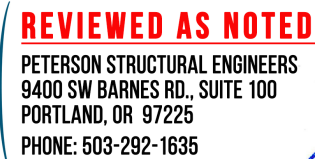
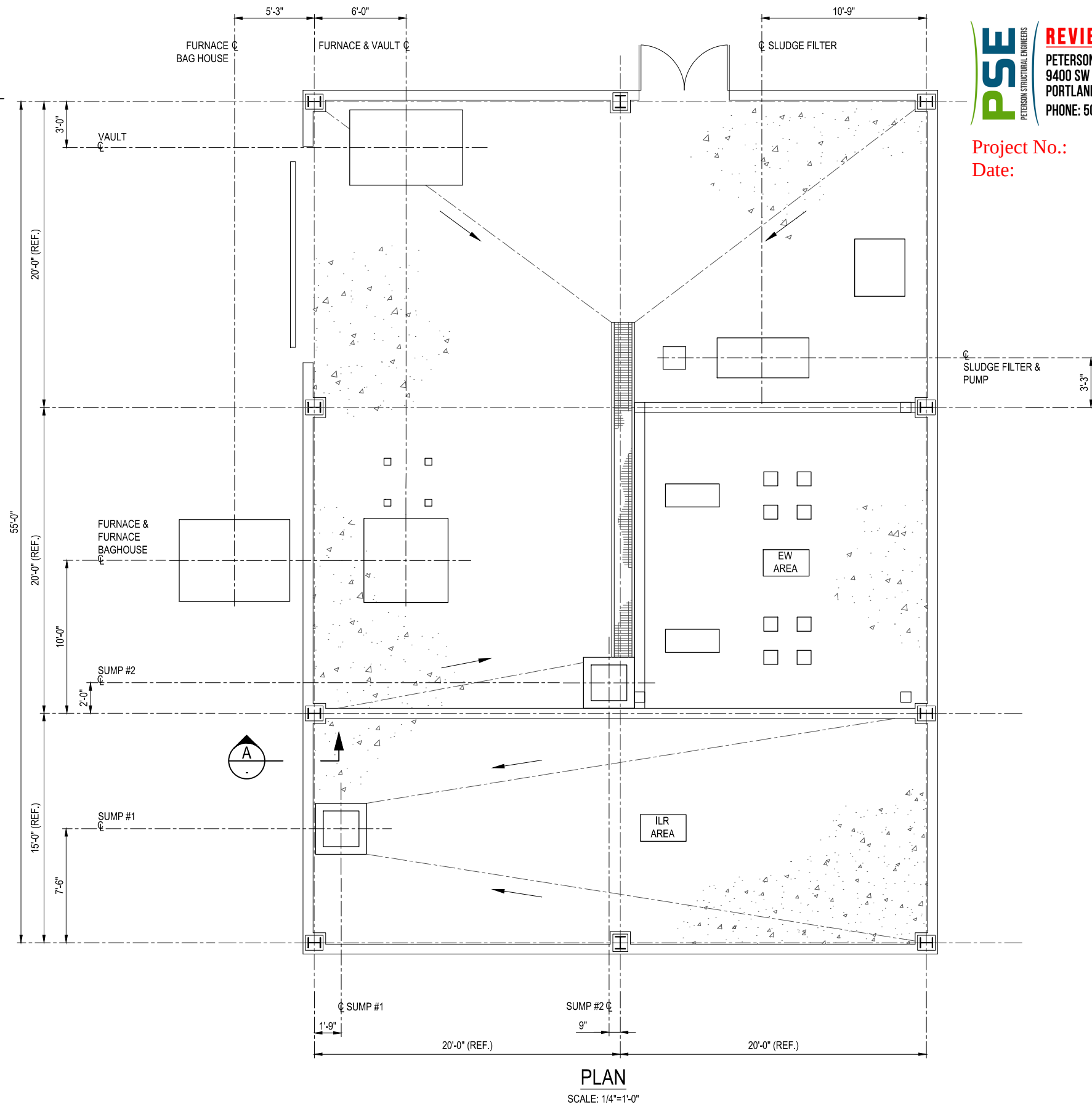
REGISTERED PROFESSIONAL
ENGINEER
82232PPE
OREGON
EDWARD LING
JAN. 15, 2016

Seal applies to sizing of secondary containment volumes for compliance with International Cyanide Management Code only.

1. TOTAL CONTAINMENT VOLUME: 11548ft³
2. VOLUME OF LARGEST VESSEL (110%) : 10605ft³
3. DESIGN CURB HEIGHT: 34"
4. THE BONDED AREA IS SIZED TO CONTAIN 110% OF THE LARGEST TANK VOLUME PLUS A 25 YEAR 24 HOUR STORM EVENT.
5. REFERENCE CALCULATION: 101768-0000-MX-CALC-0001



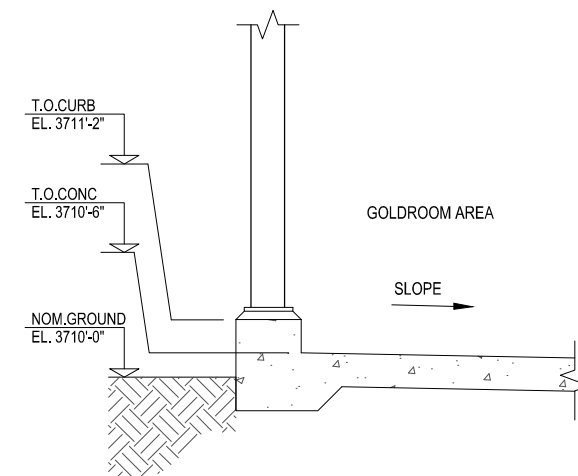
																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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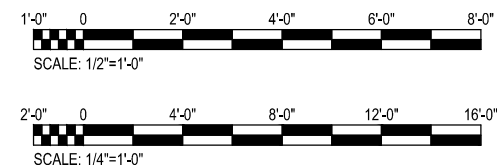
EDWARD FONG-HON LING
REGISTERED PROFESSIONAL ENGINEER
82232PE
OREGON
JAN. 15, 2015

Seal applies to sizing of secondary containment volumes for compliance with International Cyanide Management Code only.

1. TOTAL CONTAINMENT VOLUME FOR ILR AREA: 335ft³.
2. VOLUME OF LARGEST VESSEL IN ILR AREA (110%): 233ft³.
3. TOTAL CONTAINMENT VOLUME FOR EW AREA: 195ft³.
4. VOLUME OF LARGEST VESSEL IN EW AREA (110%): 30ft³.
5. DESIGN CURB HEIGHT: 8".
6. THE BUNDED AREA IS SIZED TO CONTAIN 110% OF THE LARGEST TANK VOLUME.
7. REFERENCE CALCULATION: 101768-0000-MX-CALC-0005.



SECTION A
1/2"=1'-0"



									DRAWN	RK	16NOV2018
									DWG. CHECKED		
			C	RK	03MAY2019	ISSUED FOR PERMITTING	JTR		DESIGNED	JTR	16NOV2018
			B	RK	06APR2019	ISSUED FOR CLIENT REVIEW	JTR		DES. APPR.		
			A	RK	04DEC2018	ISSUED FOR INTERNAL REVIEW	JTR				
REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR	PROJ. APPR.	

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CLIENT	CALICO RESOURCES USA CORP.
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TITLE	GRASSY MOUNTAIN PROJECT PROCESS PLANT GOLDROOM AREA CONTAINMENT-GENERAL ARRANGEMENT
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PROJECT No.	101768
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DRAWING No.

101768-1200-C-103

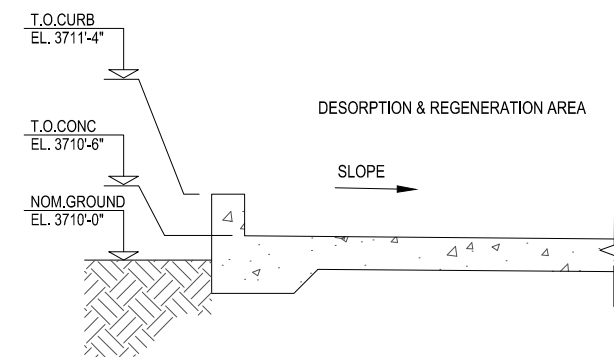


PETERSON STRUCTURAL ENGINEERS
9400 SW BARNES RD., SUITE 100
PORTLAND, OR 97225
PHONE: 503-292-1635

REGISTERED PROFESSIONAL
ENGINEER
82232PE
OREGON
JAN. 15, 2019
EDWARD FONG-HON LING

Seal applies to sizing of secondary containment volumes for compliance with International Cyanide Management Code only.

1. TOTAL CONTAINMENT VOLUME FOR ELUTION AREA: 2622ft³.
2. VOLUME OF LARGEST VESSEL IN ELUTION AREA (110%): 633ft³.
3. TOTAL CONTAINMENT VOLUME FOR ACID WASH AREA: 484ft³.
4. VOLUME OF LARGEST VESSEL IN ACID WASH AREA (110%): 404ft³.
5. DESIGN CURB HEIGHT: 10".
6. THE BUNDED AREA IS SIZED TO CONTAIN 110% OF THE LARGEST TANK VOLUME PLUS A 25 YEAR 24 HOUR STORM EVENT.
7. REFERENCE CALCULATION: 101768-0000-MX-CALC-0003.



SECTION A
1/2"=1'-0"



Vancouver, British Columbia
Canada

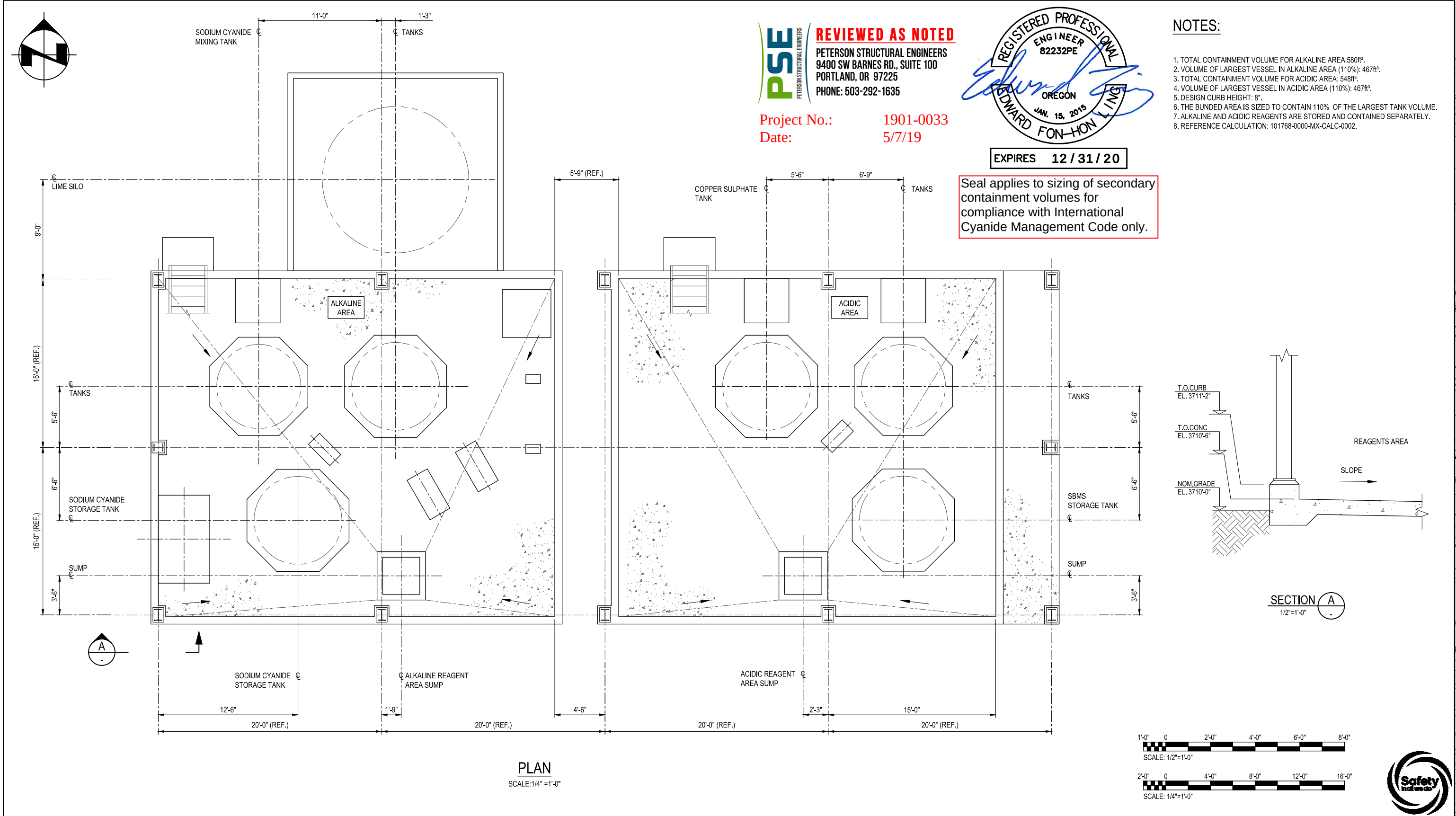
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TITLE	GRASSY MOUNTAIN PROJECT PROCESS PLANT DESORPTION & REGENERATION AREA CONTAINMENT-GENERAL ARRANGEMENT
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PROJECT No.	101768	SCALE	AS SHOWN	SIZE	D
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DRAWING No.	REVISION
101768-1200-C-104	C

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									DWG. CHECKED		
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			B	RK	05APR2019	ISSUED FOR CLIENT REVIEW	JTR		DES. APPR.		
			A	RK	04DEC2018	ISSUED FOR INTERNAL REVIEW	JTR				
REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR	PROJ. APPR.	



																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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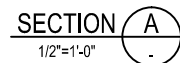
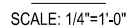


PETERSON STRUCTURAL ENGINEERS
9400 SW BARNES RD., SUITE 100
PORTLAND, OR 97225
PHONE: 503-292-1635

REGISTERED PROFESSIONAL
ENGINEER
82232PE
OREGON
JAN. 15, 2018
EDWARD FONG-HON LING

Seal applies to sizing of secondary containment volumes for compliance with International Cyanide Management Code only.

1. TOTAL CONTAINMENT VOLUME FOR AIR SERVICE AREA: 4596³
2. VOLUME OF LARGEST VESSEL IN AIR SERVICE AREA (110%): THERE ARE NO TANKS IN AIR SERVICE AREA
3. DESIGN CURB HEIGHT: 8"
4. THE AIR SERVICE AREA HAS SUFFICIENT VOLUME TO CONTAIN A SINGLE 25 YEAR STORM EVENT
5. REFERENCE CALCULATION: 101768-0000-MX-CALC-0006



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									DRAWN	RK	16NOV2018
									DWG. CHECKED		
			C	RK	03MAY2019	ISSUED FOR PERMITTING	JTR		DESIGNED	JTR	16NOV2018
			B	RK	05APR2019	ISSUED FOR CLIENT REVIEW	JTR		DES. APPR.		
			A	RK	04DEC2018	ISSUED FOR INTERNAL REVIEW	JTR				
REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR	PROJ. APPR.	

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a, **Ausenco**

TITLE	GRASSY MOUNTAIN PRE-FEASIBILITY STUDY
	PROCESS PLANT
	AIR SERVICE AREA
	CONTAINMENT-GENERAL ARRANGEMENT

PROJECT No.	101768
-------------	--------

DRAWING No.

101768-1200-C-106



PORTLAND OFFICE

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Phone: 503.292.1635

CIL Area Containment Calculations

Grassy Mountain Mine Containment
Malheur County, OR

Client Information

Thomas Mills
Ausenco Minerals and Metals
Vancouver, British Columbia
Canada

Project Site

Grassy Mountain
Malheur County, OR

Scope: Review of containment volume calculations for conformance with applicable cyanide codes. Sealing of documents for volume calculations only. All other elements including construction of containment curbs are by others. Review based on tank and equipment volumes provided by client.

Review By:

Peterson Structural Engineers
May 7, 2019
Job No. 1901-0033

Endorsement



Calculation

1200 - CIL Area Containment	Calculation No: 101768-0000-MX-CALC-0001
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Project Title:	Grassy Mountain	Project No:	101768-01
Area/Code:			
Equipment Description:	Containment of CIL area to cyanide code requirements		
Equipment No:			

Design Inputs	References
Containment Volume Requirement = 110% Volume of largest tank + one design storm event	International Cyanide Code of Practice Section 4.7
25 Yr Storm event = 31mm (1.22 inches)	Boise, Idaho - Record Rainfall - 1.22in https://www.wunderground.com/history/daily/KBOI/date/2009-5-12
Containment Area	from 101768-1200-C-102

Design Assumptions and Basis
Assumes process plant containment pond is suitably lined

Calculation Summary and Outcome
The CIL containment area will require a minimum curb height of 864mm (34 inches).

Other calculations if this calculation is revised:

Rev	Date	Description	Prepared	Checked	Approved
A	2019-03-28	Issued for Internal Review	JT	TM	
B	2019-04-11	Issued for Peer Review	JT	JTR	
C	2019-04-22	Issued for Permitting	JT	TM	

Calculation

1200 - CIL Area Containment		Calculation No: 101768-0000-MX-CALC-0001	
Project Title:	Grassy Mountain	Project No:	101768-01
Rev: C			
GENERAL INPUTS			Comments
TANK SIZE AND VOLUME			
Leach Tank Diameter	n/a	m	
Leach Tank Plinth Diameter	n/a		
Leach Tank Height	n/a	m	
Number of Leach Tanks	n/a	No	
CIL Tank Diameter	6.9	m	
CIL Tank Plinth Diameter	7.2	m	
CIL Tank Height	7.3	m	
Number of CIL Tanks	8	No	
Detox Tank Diameter	4.7	m	
Detox Tank Plinth Diameter	4.9	m	
Detox Tank Height	5.3	m	
Number of Detox Tanks	2	No	
Volume of largest tank	273	m ³	
			CIL Tank
BUND DIMENSIONS			
CIL / Detox			
CIL Bund Length	45.7	m	
CIL Bund Width	16.9	m	
CIL Area for rainfall catchment	774	m ²	
CIL Tank Area	299	m ²	
Detox Tank Area	35	m ²	
CIL Area Tank Plinth Area (Divide is middle of detox tanks)	326	m ²	
Detox Area Tank Plinth Area (Divide is middle of detox tanks)	38	m ²	
Equipment Deductions	2	m ²	
Notched Area Deduction	49	m ²	SW corner of containment
CIL Containment Catchment Area below top of plinth	359	m ²	
CIL Containment Catchment Area above top of plinth	391	m ²	
Containment CALCULATION			
Bund Wall Height (from 101768-1200-C-102)	0.864	m	
CIL and Detox Average Tank Plinth height	0.35	m	
Volume below top of plinth	126	m ³	
Volume above top of plinth to Bund Wall	201	m ³	
Total Volume Designed	327	m ³	
STORMWATER			
24 Hour 25 Year Storm Event Cover	30.988	mm	1.22 in
CIL/Detox Stormwater Catchment	24	m ³	
Total Stormwater Catchment Volume	24	m ³	
CONTAINMENT REQUIRED			
110% One Largest Tank Volume + One Storm Event	324	m ³	



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Reagents Area Containment Calculations

Grassy Mountain Mine Containment
Malheur County, OR

Client Information

Thomas Mills
Ausenco Minerals and Metals
Vancouver, British Columbia
Canada

Project Site

Grassy Mountain
Malheur County, OR

Scope: Review of containment volume calculations for conformance with applicable cyanide codes. Sealing of documents for volume calculations only. All other elements including construction of containment curbs are by others. Review based on tank and equipment volumes provided by client.

Review By:

Peterson Structural Engineers
May 7, 2019
Job No. 1901-0033

Endorsement



Calculation

1200 - Reagents Area Containment	Calculation No: 101768-0000-MX-CALC-0002
----------------------------------	---

Project Title:	Grassy Mountain	Project No:	101768-01
Area/Code:			
Equipment Description:	Containment of Reagents Area		
Equipment No:			

Design Inputs	References
Containment Volume Requirement = 110% Volume of largest tank	International Cyanide Code of Practice Section 4.7
Largest tank volume = 12 m ³	101768-MEL-0001 Rev B
Containment General Arrangement	from 101768-1200-C-105

Design Assumptions and Basis
No storm containment required as this area is covered.

Calculation Summary and Outcome
The containment in the Alkaline area will require a minimum curb height of 160mm (6.3in) to satisfy the containment requirements, but has been raised to 203mm (8in) for consistency throughout the area.
The containment in the Acidic area will require a minimum curb height of 170mm (6.7in) to satisfy the containment requirements but has been raised to 203mm (8in) for consistency throughout the area.

Other calculations if this calculation is revised:

Rev	Date	Description	Prepared	Checked	Approved
A	2019-03-28	Issued for Internal Review	JT	TM	
B	2019-04-11	Issued for Peer Review	JT	JTR	
C	2019-04-22	Issued for Permitting	JT	TM	

Calculation - Alkaline Area

1200 - Reagents Area Containment			Calculation No: 101768-0000-MX-CALC-0002	
Project Title:	Grassy Mountain	Project No:	101768-01	
Rev: C				
GENERAL INPUTS				Comments
TANK SIZE AND VOLUME				
Lime Tank Diameter	2.4	m		
Lime Tank Plinth Diameter	2.8			
Lime Tank Height	2.55	m		
Number of Lime Tanks	1	No		
CN Mix Tank Diameter	2.4	m		
CN Mix Tank Plinth Diameter	2.8	m		
CN Mix Tank Height	2.55	m		
Number of CN Mix Tanks	1	No		
CN Storage Tank Diameter	2.4	m		
CN Storage Tank Plinth Diameter	2.8			
CN Storage Tank Height	2.55	m		
Number of CN Storage Tanks	1	No		
Volume of largest tank	12	m ³		
BUND DIMENSIONS				
Alkaline Area				
Bund Length	10.8	m		
Bund Width	9.1	m		
Area for rainfall catchment	99.0	m ²		
Lime Tank Area	4.5	m ²		
CN Mix Tank Area	4.5	m ²		
CN Storage Tank Area	4.5	m ²		
Lime Area Tank Plinth Area (Divide is middle of detox tanks)	6.2	m ²		
CN Mix Area Tank Plinth Area (Divide is middle of detox tanks)	6.2	m ²		
CN Storage Area Tank Plinth Area (Divide is middle of detox tanks)	6.2	m ²		
Containment Catchment Area below top of plinth	81	m ²		
Containment Catchment Area above top of plinth	85	m ²		
CONTAINMENT CALCULATION				
Bund Wall Height (from 101768-1200-C-105)	0.203	m		
Average Tank Plinth height	0.20	m		
Volume below top of plinth	16	m ³		
Volume above top of plinth to Bund Wall	0.02	m ³		
Total Volume Designed	16.4	m ³		
STORMWATER				
24 Hour 25 Year Storm Event Cover	0	mm		
Stormwater Catchment	0	m ³		
Total Stormwater Catchment Volume	0	m ³		
CONTAINMENT REQUIRED				
110% One Largest Tank Volume	12.7	m ³		

Calculation - Acidic Area

1200 - Reagents Area Containment	Calculation No: 101768-0000-MX-CALC-0002
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Project Title:	Grassy Mountain	Project No:	101768-01
Rev: B			
GENERAL INPUTS			Comments
TANK SIZE AND VOLUME			
SMBS Tank Diameter	2.4	m	
SMBS Tank Plinth Diameter	2.8		
SMBS Tank Level	2.55	m	
Number of SMBS Tanks	1	No	
SMBS Mix Tank Diameter	2.3	m	
SMBS Mix Tank Plinth Diameter	2.7	m	
SMBS Mix Tank Level	2.45	m	
Number of SMBS Mix Tanks	1	No	
CuSO4 Mix/Storage Tank Diameter	2.4	m	
CuSO4 Mix/Storage Tank Plinth Diameter	2.8		
CuSO4 Mix/Storage Tank Level	2.55	m	
Number of CuSO4 Mix/Storage Tanks	1	No	
Volume of largest tank	12	m ³	
BUND DIMENSIONS			
Acidic Area			
Bund Length	10.3	m	
Bund Width	9.1	m	
Area for rainfall catchment	94.1	m ²	
SMBS Storage Tank Area	4.2	m ²	
SMBS Mix Tank Area	4.5	m ²	
CuSO4 Mix/Storage Tank Area	4.5	m ²	
SMBS Storage Area Tank Plinth Area (Divide is middle of detox tanks)	5.7	m ²	
SMBS Mix Area Tank Plinth Area (Divide is middle of detox tanks)	6.2	m ²	
CuSO4 Storage Area Tank Plinth Area (Divide is middle of detox tanks)	6.2	m ²	
Containment Catchment Area below top of plinth	76	m ²	
Containment Catchment Area above top of plinth	81	m ²	
CONTAINMENT CALCULATION			
Bund Wall Height (from 101768-1200-C-105)	0.203	m	
Average Tank Plinth height	0.20	m	
Volume below top of plinth	15	m ³	
Volume above top of plinth to Bund Wall	0.02	m ³	
Total Volume Designed	15.5	m ³	
STORMWATER			
24 Hour 25 Year Storm Event Cover	0	mm	covered containment
Stormwater Catchment	0	m ³	
Total Stormwater Catchment Volume	0	m ³	
CONTAINMENT REQUIRED			
110% One Largest Tank Volume	12.7	m ³	



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Desorption and Regeneration Area Containment Calculations

Grassy Mountain Mine Containment
Malheur County, OR

Client Information

Thomas Mills
Ausenco Minerals and Metals
Vancouver, British Columbia
Canada

Project Site

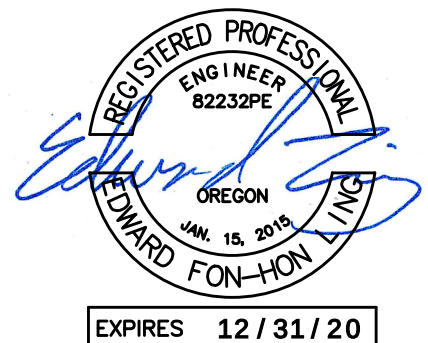
Grassy Mountain
Malheur County, OR

Scope: Review of containment volume calculations for conformance with applicable cyanide codes. Sealing of documents for volume calculations only. All other elements including construction of containment curbs are by others. Review based on tank and equipment volumes provided by client.

Review By:

Peterson Structural Engineers
May 7, 2019
Job No. 1901-0033

Endorsement



Calculation

1200 - Desorption and Regeneration Containment	Calculation No: 101768-0000-MX-CALC-0003
--	--

Project Title:	Grassy Mountain	Project No:	101768-01
Area/Code:			
Equipment Description:	Containment of Desorption and Regeneration Area		
Equipment No:			

Design Inputs	References
Containment Volume = 110% Volume of largest tank + 24hr Storm Event	International Cyanide Code of Practice Section 4.7
25 Yr Storm event = 31mm (1.22 inches)	Boise, Idaho - Record Rainfall - 1.22in https://www.wunderground.com/history/daily/KBOI/date/2009-5-12
Largest tank volume Acid Wash Area = 10 m ³	101768-0000-G-108
Largest tank volume Elution Area = 16 m ³	101768-0000-G-108
Containment General Arrangement	101768-1200-C-104

Design Assumptions and Basis

Calculation Summary and Outcome
The acid wash area will require a minimum curb height of 254mm (10in).
The elution area containment will require a minimum curb height of 86mm (3.4in) but will be raised to 254mm (10in) to match the curb height of the acid wash area.

Other calculations if this calculation is revised:

Rev	Date	Description	Prepared	Checked	Approved
A	2019-03-28	Issued for Internal Review	JT	TM	
B	2019-04-11	Issued for Peer Review	JT	JTR	
C	2019-04-22	Issued for Permitting	JT	TM	

Calculation - Acid Wash Area

1200 - Desorption and Regeneration Containment			Calculation No: 101768-0000-MX-CALC-0003	
Project Title:	Grassy Mountain	Project No:	101768-01	
Rev: C				
GENERAL INPUTS				Comments
TANK SIZE AND VOLUME				
Transfer Water Tank Diameter			2.3	m
Transfer Water Tank Plinth Diameter			2.7	
Transfer Water Tank Height			2.5	m
Number of Transfer Water Tanks			1	No
Acid Wash Column Tank Diameter			1.4	m
Acid Wash Column Tank Plinth Diameter			0.0	m
Acid Wash Column Tank Height			5.2	m
Number of Acid Wash Column Tanks			1.0	No
Volume of largest tank			10.4	m ³
BUND DIMENSIONS				
Acid Wash Area				
Bund Length			11.1	m
Bund Width			4.8	m
Additional Bund Length			4.0	m
Additional Bund Width			1.5	m
Area for rainfall catchment			59.5	m ²
Transfer Water Tank Area			4.2	m ²
Acid Wash Column Tank Area			0.0	m ²
Transfer Water Area Tank Plinth Area (Divide is middle of detox tanks)			5.7	m ²
Acid Wash Column Area Tank Plinth Area (Divide is middle of detox tanks)			0.0	m ²
Containment Catchment Area below top of plinth			54	m ²
Containment Catchment Area above top of plinth			55	m ²
CONTAINMENT CALCULATION				
Bund Wall Height (as designed)			0.254	m
Average Tank Plinth height			0.25	m
Volume below top of plinth			14	m ³
Volume above top of plinth to Bund Wall			0	m ³
Total Volume Designed			13.7	m ³
STORMWATER				
24 Hour 25 Year Storm Event Cover			30.988	mm
Stormwater Catchment			2	m ³
Total Stormwater Catchment Volume			2	m ³
CONTAINMENT REQUIRED				
110% One Largest Tank Volume + One Storm Event			13.3	m ³

Calculation - Elution Area

1200 - Desorption and Regeneration Containment			Calculation No: 101768-0000-MX-CALC-0003	
Project Title:	Grassy Mountain	Project No:	101768-01	
Rev: C				
GENERAL INPUTS				Comments
TANK SIZE AND VOLUME				
Strip Solution Tank Diameter	2.77	m	from GA drawing	
Strip Solution Tank Plinth Diameter	3.17			
Strip Solution Tank Height	2.71	m		
Number of Strip Solution Tanks	1	No		
Elution Column Tank Diameter	1.3	m		
Elution Column Tank Plinth Diameter	0.0		no plinths	
Elution Column Tank Height	4.8	m		
Number of Elution Column Tanks	1	No		
Carbon Fine Clarifier Diameter	2.4	m		
Carbon Fine Clarifier Plinth Diameter	0.0		no plinths	
Carbon Fine Clarifier Height	3.5	m		
Number of Carbon Fine Clarifiers	1	No		
Volume of largest tank	16.3	m ³		
BUND DIMENSIONS				
Elution Area				
Bund Length	24.0	m	small notches between the two rectangular areas assumed to be similar and cancelled out	
Bund Width	10.3	m		
Additional Bund Length	11.3	m		
Additional Bund Width	4.8	m		
Area for rainfall catchment	300.2	m ²		
Strip Solution Tank Area	0.0	m ²		
Carbon Fine Clarifier Area	0.0	m ²	not mounted on ground	
Strip Solution Tank Plinth Area (Divide is middle of detox tanks)	7.9	m ²		
Elution Column Area Tank Plinth Area (Divide is middle of detox tanks)	0.0	m ²		
Containment Catchment Area below top of plinth	292	m ²		
Containment Catchment Area above top of plinth	300	m ²		
CONTAINMENT CALCULATION				
Bund Wall Height (as designed)	0.254	m		
Average Tank Plinth height	0.254	m		
Volume below top of plinth	74.25	m ³		
Volume above top of plinth to Bund Wall	0.0	m ³		
Total Volume Designed	74.25	m ³		
STORMWATER				
24 Hour 25 Year Storm Event Cover	30.988	mm		
Stormwater Catchment	9	m ³		
Total Stormwater Catchment Volume	9	m ³		
CONTAINMENT REQUIRED				
110% One Largest Tank Volume + One Storm Event	27.2	m ³		



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Grinding Area Containment Calculations

Grassy Mountain Mine Containment
Malheur County, OR

Client Information

Thomas Mills
Ausenco Minerals and Metals
Vancouver, British Columbia
Canada

Project Site

Grassy Mountain
Malheur County, OR

Scope: Review of containment volume calculations for conformance with applicable cyanide codes. Sealing of documents for volume calculations only. All other elements including construction of containment curbs are by others. Review based on tank and equipment volumes provided by client.

Review By:

Peterson Structural Engineers
May 7, 2019
Job No. 1901-0033

Endorsement



Calculation

1200 - Grinding Area Containment	Calculation No: 101768-0000-MX-CALC-0004
----------------------------------	--

Project Title:	Grassy Mountain	Project No:	101768-01
Area/Code:			
Equipment Description:	Containment of Grinding Area		
Equipment No:			

Design Inputs	References
Containment Volume = 110% Volume of largest tank + one design storm event	International Cyanide Code of Practice Section 4.7
25 Yr Storm event = 31mm (1.22 inches)	Boise, Idaho - Record Rainfall - 1.22in https://www.wunderground.com/history/daily/KBOI/date/2009-5-12
30% of Mill Volume - 3.2m dia x 5.25 m EGL	
Containment General Arrangement	from 101768-1200-C-101

Design Assumptions and Basis

Calculation Summary and Outcome
The grinding area will require a minimum curb height of 168mm (6.6in) to satisfy the minimum containment requirements, but has been designed with 203mm (8in) curb height for consistency throughout the plant.

Other calculations if this calculation is revised:

Rev	Date	Description	Prepared	Checked	Approved
A	2019-03-28	Issued for Internal Review	JT	TM	
B	2019-04-11	Issued for Peer Review	JT	JTR	
C	2019-04-22	Issued for Permitting	JT	TM	

Calculation

1200 - Grinding Area Containment			Calculation No:	
			101768-0000-MX-CALC-0004	
Project Title:	Grassy Mountain	Project No:	101768-01	
Rev: C				
GENERAL INPUTS				Comments
TANK SIZE AND VOLUME				
Volume of Grinding Mill	12.7	m ³	30% of 3.2m x 5.25m EGL	
BUND DIMENSIONS				
Grinding Area				
Bund Length	14.6	m		
Bund Width	9.1	m		
Additional Bund Length	0.0	m		
Additional Bund Width	0.0	m		
Area for rainfall catchment	133.8	m ²		
Tank Area	0.0	m ²	no tanks	
Deductions for other equipment	26.0	m ²	mill foundations (20m ²) and cyclone feed hopper (6m ²)	
Tank Plinth Area (Divide is middle of detox tanks)	0.0	m ²		
Containment Catchment Area below top of plinth	0	m ²		
Containment Catchment Area above top of plinth	107.8	m ²		
CONTAINMENT CALCULATION				
Bund Wall Height (as designed)	0.203	m		
Average Tank Plinth height	0.00	m		
Volume below top of plinth	0	m ³		
Volume above top of plinth to Bund Wall	22	m ³		
Total Volume Designed	21.9	m ³		
STORMWATER				
24 Hour 25 Year Storm Event Cover	30.988	mm		
Stormwater Catchment	4	m ³		
Total Stormwater Catchment Volume	4	m ³		
CONTAINMENT REQUIRED				
110% One Largest Tank Volume + One Storm Event	18.1	m ³		



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Gold Room Containment Calculations

Grassy Mountain Mine Containment
Malheur County, OR

Client Information

Thomas Mills
Ausenco Minerals and Metals
Vancouver, British Columbia
Canada

Project Site

Grassy Mountain
Malheur County, OR

Scope: Review of containment volume calculations for conformance with applicable cyanide codes. Sealing of documents for volume calculations only. All other elements including construction of containment curbs are by others. Review based on tank and equipment volumes provided by client.

Review By:

Peterson Structural Engineers
May 7, 2019
Job No. 1901-0033

Endorsement



Calculation

1200 - Gold Room Containment	Calculation No: 101768-0000-MX-CALC-0005
------------------------------	--

Project Title:	Grassy Mountain	Project No:	101768-01
Area/Code:			
Equipment Description:	Containment of Gold Room		
Equipment No:			

Design Inputs	References
Containment Volume = 110% Volume of largest tank	International Cyanide Code of Practice Section 4.7
Largest Tank - ILR Area = 6m ³	from 101768-0000-G-109
Largest Tank - EW Area = 0.78m ³	from 101768-0000-G-109
Containment Area	from 101768-1200-C-103

Design Assumptions and Basis
Assumes process plant containment pond is suitably lined The gold room will be covered, so therefore no requirement to design for a 25 year storm event.

Calculation Summary and Outcome
The ILR area containment requires a minimum of 140mm (5.6in) to satisfy the minimum requirements. The EW Area requires a minimum of 30mm (1.25in). The area has been designed with curb height of 203mm (8in).

Other calculations if this calculation is revised:

Rev	Date	Description	Prepared	Checked	Approved
A	2019-03-28	Issued for Internal Review	JT	TM	
B	2019-04-11	Issued for Peer Review	JT	JTR	
C	2019-04-22	Issued for Permitting	JT	TM	

Calculation - ILR Area

1200 - Gold Room Containment			Calculation No: 101768-0000-MX-CALC-0005	
Project Title:	Grassy Mountain	Project No:	101768-01	
Rev: C				
GENERAL INPUTS				Comments
TANK SIZE AND VOLUME				
Intensive Leach Reactor Diameter	2.01	m		
Intensive Leach Reactor Plinth Length	4.27	m		
Intensive Leach Reactor Plinth Width	2.13	m		
Intensive Leach Reactor Height	1.88	m		
Number of Intensive Leach Vessels	2.00	No		
Volume of largest tank	5.98	m ³		
BUND DIMENSIONS				
ILR Tank Area				
Bund Length	12.20	m		
Bund Width	4.57	m		
Area for rainfall catchment	55.77	m ²		
ILR Plinth Area	9.11	m ²		
Total Catchment Area	46.66	m ²		ILR tanks at grade
CONTAINMENT CALCULATION				
Bund Wall Height (from 101768-1200-C-102)	0.20	m		
Average Plinth Height	0.25	m		
Volume around ILR below ILR Plinth	9.48	m ³		
Total Volume Designed	9.48	m ³		
STORMWATER				
24 Hour 25 Year Storm Event Cover	0.00	mm		area covered by a roof
CIL/Detox Stormwater Catchment	0.00	m ³		
Total Stormwater Catchment Volume	0.00	m ³		
CONTAINMENT REQUIRED				
110% One Largest Tank Volume	6.57	m ³		

Calculation - EW Area

1200 - Gold Room Containment			Calculation No: 101768-0000-MX-CALC-0005	
Project Title:	Grassy Mountain	Project No:	101768-01	
Rev: C				
GENERAL INPUTS				Comments
TANK SIZE AND VOLUME			N/A - old option	
Sludge Filter Feed Tank Diameter	0.99	m		
Sludge Filter Feed Tank Plinth Diameter	0.00			no plinths
Sludge Filter Feed Tank Level	0.99	m		
Number of Sludge Filter Feed Tanks	1.00	No		
Strip Solution Tank Diameter	0.99	m		
Strip Solution Tank Plinth Diameter	0.00			no plinths
Strip Solution Tank Level	0.99	m		
Number of Strip Solution Tanks	1.00	No		
Volume of largest tank	0.76	m ³		
BUND DIMENSIONS				
EW Area				
Bund Length	6.10	m		
Bund Width	6.10	m		
Area for rainfall catchment	37.18	m ²		
Sludge Filter Feed Tank Area	0.77	m ²		
Strip Solution Tank Area	0.77	m ²		
Sludge Filter Area Tank Plinth Area (Divide is middle of detox tanks)	0.00	m ²		no plinths
Strip Solution Area Tank Plinth Area (Divide is middle of detox tanks)	0.00	m ²		no plinths
Equipment Area Deductions	10.00	m ²		
Containment Catchment Area below top of plinth	27.18	m ²		
Containment Catchment Area above top of plinth	37.18	m ²		no plinths
CONTAINMENT CALCULATION				
Bund Wall Height (from 101768-1200-C-103)	0.20	m		
Volume floor to Bund Wall	5.52	m ³		
Total Volume Designed	5.52	m ³		
STORMWATER				
24 Hour 25 Year Storm Event Cover	0.00	mm		
CIL/Detox Stormwater Catchment	0.00	m ³		
Total Stormwater Catchment Volume	0.00	m ³		
CONTAINMENT REQUIRED				
110% One Largest Tank Volume	0.84	m ³		



PORTLAND OFFICE

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Air Services Area Containment Calculations

Grassy Mountain Mine Containment

Malheur County, OR

Client Information

Thomas Mills
Ausenco Minerals and Metals
Vancouver, British Columbia
Canada

Project Site

Grassy Mountain
Malheur County, OR

Scope: Review of containment volume calculations for conformance with applicable cyanide codes. Sealing of documents for volume calculations only. All other elements including construction of containment curbs are by others. Review based on tank and equipment volumes provided by client.

Review By:

Peterson Structural Engineers
May 7, 2019
Job No. 1901-0033

Endorsement



Calculation

1200 - Air Services Area Containment	Calculation No: 101768-0000-MX-CALC-0006
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Project Title:	Grassy Mountain	Project No:	101768-01
Area/Code:			
Equipment Description:	Containment of Air Services Area		
Equipment No:			

Design Inputs	References
Containment Volume Requirement = Volume of largest tank + one design storm event	International Cyanide Code of Practice Section 4.7
25 Yr Storm event = 31mm (1.22 inches)	Boise, Idaho - Record Rainfall - 1.22in https://www.wunderground.com/history/daily/KBOI/date/2009-5-12
Containment Area	101738-1200-C-106

Design Assumptions and Basis
There are no tanks in this area.

Calculation Summary and Outcome
The air services area has sufficient volume to contain a single 25 year storm event.

Other calculations if this calculation is revised:

Rev	Date	Description	Prepared	Checked	Approved
A	2019-03-28	Issued for Internal Review	JT	TM	
B	2019-04-11	Issued for Peer Review	JT	JTR	
C	2019-04-22	Issued for Permitting	JT	TM	

Calculation

1200 - Air Services Area Containment		Calculation No: 101768-0000-MX-CALC-0006	
Project Title:	Grassy Mountain	Project No:	101768-01
Rev: C			
GENERAL INPUTS			Comments
TANK SIZE AND VOLUME			
Tank Diameter	n/a	m	
Tank Plinth Diameter	n/a		
Tank Height	n/a	m	
Number of Tanks	n/a	No	
Volume of largest tank	n/a	m ³	no tanks in this area
BUND DIMENSIONS			
Air Service Bund Length	15.2	m	
Air Service Bund Width	6.7	m	
Air Service Area for rainfall catchment	102	m ²	
Equipment Deductions	39	m ²	3 Blowers + Air Skid
Air Service Area for containment volume	63	m ²	
Containment CALCULATION			
Bund Wall Height (from 101768-1200-C-106)	0.203	m	
Total Volume Designed	13	m ³	
STORMWATER			
24 Hour 25 Year Storm Event Cover	30.988	mm	1.22 in
Air Service Area Stormwater Volume	3.2	m ³	
CONTAINMENT REQUIRED			
One Storm Event	3.2	m ³	