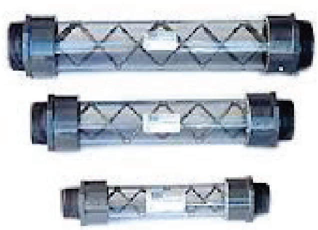
APPENDIX 4-P
TEMPORARY WATER TREATMENT PLANTS FOR KSM CONSTRUCTION PERIOD

Seabridge Gold Inc.

KSM PROJECT
Temporary Water Treatment Plants for Construction

SEABRIDGE GOLD



Rescan Engineers & Scientists

Rescan™ Environmental Services Ltd.
Rescan Building, Sixth Floor - 1111 West Hastings Street
Vancouver, BC Canada V6E 2J3
Tel: (604) 689-9460 Fax: (604) 687-4277

January 2013

Executive Summary

The KSM Project is a proposed large open pit and underground gold/copper mine linked to a processing and tailings storage facility through a 24 km twin tunnel. The project will include a comprehensive construction management plan spanning a five year period. Construction is renowned to be a period requiring particular attention to environmental management.

The mine area is located in a highly mineralized wet environment with very marked seasons requiring particular attention to water management. The plant area located some 25 km away is less mineralized but still in a high precipitation area. During the five year construction period approximately 75 km of access and water diversion tunnels will be built. These tunnels will require water discharge and temporary storage of potentially acid generating rock. To initiate the construction, the project will require permits to discharge water and store waste rock from the tunnel excavations and other construction activities.

The provincial permits will stipulate discharge parameters with concentration limitations which will require treatment to control pH, total suspended solids, dissolved metals and residual ammonia from drill and blasting. Procedures to test the ARD of the rock and the segregation of the PAG and NPAG rock will be an important component covered in the ARD Management Plan. This report presents the method proposed to control and treat the temporary water discharges to the receiving environment.

There are nine locations identified in the construction plan requiring water treatment. These locations are primarily at the tunnel development portals. Figures 3-1, 3-2 and 3-3 in this report depict the location of each water treatment facility. Each water treatment facility will require a grit pond to capture coarse material, a dissolved metal precipitation/circuit, as well as a flocculation step to enhance settling, a suspended solids settling pond, an aeration pond for volatilization of residual ammonia and a pH neutralization step prior to discharge to the receiving environment. The maximum design throughput flow rate is 80L/s with nominal base case flow rate of 50L/s. The grit pond located ahead of the treatment facility is sized with a potential surge capacity of 200L/s for 4 hours to cope with faults or fracture zone depressurization during tunnel construction. The flow rate determination was based on continuous grouting during the tunnel development to control excess water. The proposed treatment flow rate was vetted through a peer review be geotechnical experts during a recent project risk evaluation.

The reagent addition steps in the process will be housed in skid mounted prefabricated containers that would be built and equipped offsite and moved to specific sites by helicopter or road if available. Each site would consist of three ponds and three fully equipped prefabricated water treatment containers. The small buildings would include a lime mix and inline mixer container (8x20 feet); a flocculation mixer, inline mixer and a small laboratory space (8x20 feet); and a pH control /air compressor container (8x8 feet). Figure 5-1 in this report provides a Plot Plan of Typical Water Treatment Facility. Each site would have a stand-alone diesel generator (90 kW) or will be connected to the portal construction power. The site would have two areas for rock storage, one for non-acid generating (NPAG) rock and one lined for potentially acid generating

(PAG) rock. The drainage from the PAG rock pad will be directed to the water treatment plant if required. The reagents including lime, flocculent, acid and fuel will be transported to each location by helicopter or road where available. A small storage container will be included at each site to store reagents.

The plants will be operated and maintained by a construction environmental monitor and a helper at each construction site. The plants will be primarily automated but daily oversight will still be required. The cost of temporary water treatment for each site is estimated to be between $800,000 and $900,000, including all the earth works. The earth works will account for approximately 60% of the cost of each facility.

Temporary Water Treatment Plants for KSM Construction Period

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1. Objective

The purpose of this report is to summarize the design of the temporary portable water treatment plants to be used at KSM during the construction phase of the mine. The intent is to treat the water draining from various tunnels during construction to minimize water quality degradation in the receiving environment. The plan also includes treating water from PAG rock storage pads located adjacent to each tunnel portal. The system as designed is to meet discharge permits to be issued by the BC Ministry of Environment. Parameters regulated will be pH, total suspended solids, dissolved metals and ammonia.

2. Introduction

The temporary water treatment plants are required during the first five years of construction of the proposed KSM gold-copper mine located in north-western British Columbia. The water treatment plants will be required to treat water from the tunnel portals and temporary rock storage pads. The actual flow rates are difficult to predict and as such the water treatment plants could each have different average throughput. There are nine different locations that require these temporary plants around the mine site, near the portals and muck pads. The plants will each include a grit pond, lime addition, flocculent addition, settling pond, air sparger, sparging pond, and pH control.

The purpose of the grit pond is to remove particles with diameter greater than 0.1 mm from the water. The main treatment parameter at all locations will be total suspended solids (TSS). Once the flow leaves the grit pond, it will be pumped through the first containerised treatment unit where lime will be added to either increase the pH to 10.5 if required to precipitate dissolved metals or at a lower pH of 8.5 to provide a coagulant to supplement the flocculent to promote enhance settling. Lime will serve dual purposes; promoting metal precipitation and providing initial coagulation to enhance settling. The flocculent is then added in a second stage to further enhance settling. Suspended solids level will then settle in the pond before the flow is directed to the third pond equipped with air spargers to volatilize ammonia as a gas to the atmosphere if required. The final step is neutralisation with sulphuric acid prior to discharge if pH was raised to 10.5 to precipitate metals or if ammonia sparging is required . The lime, flocculent, and acid will each be located in separate container treatment units. The treatment units will be fully assembled at a fabrication shop and each unit will be tested prior to shipping for field installation.

3. Location

There are nine different temporary portable water treatment plant locations. Below is a list of where they are located (Table 3-1). For the locations on a map, see Figures 3-1, 3-2 and 3-3.

Table 3-1. Temporary Water Treatment Plant Locations

Rescan Water Treatment Plant Number	Location	UTM	Length of Tunnel Drainage (m)
Water Treatment Plant 1	Water Storage Dam Area	6 262 700N 416 900E	N/A
Water Treatment Plant 2	McTagg Diversion Tunnel Outlet	6 263 500N 416 500E	4300 x 2
Water Treatment Plant 3	Mitchell Diversion Tunnel Outlet	6 262 000N 420 100E	2800 x 2
Water Treatment Plant 4	Saddle Portal Tunnel Section MTT	6 276 000N 434 000E	3150 x 2
Water Treatment Plant 5	Mitchell Diversion Tunnel Inlet	6 265 500N 423 500E	2800 x 2
Water Treatment Plant 6	Mitchell Treaty Tunnel (MTT) - Mitchell	6 265 500N 421 200E	8750 x 2
Water Treatment Plant 7	Water Storage Dam Construction Diversion Tunnel	6 264 350N 418 000E	1300
Water Treatment Plant 8	Mitchell Treaty Tunnel (MTT) - TMF	6 280 200N 438 500E	3150 x 2
Water Treatment Plant 9	Mitchell Treaty Tunnel - Potential Construction Access Adit	6 274 500N 431 000E	1100 x 2

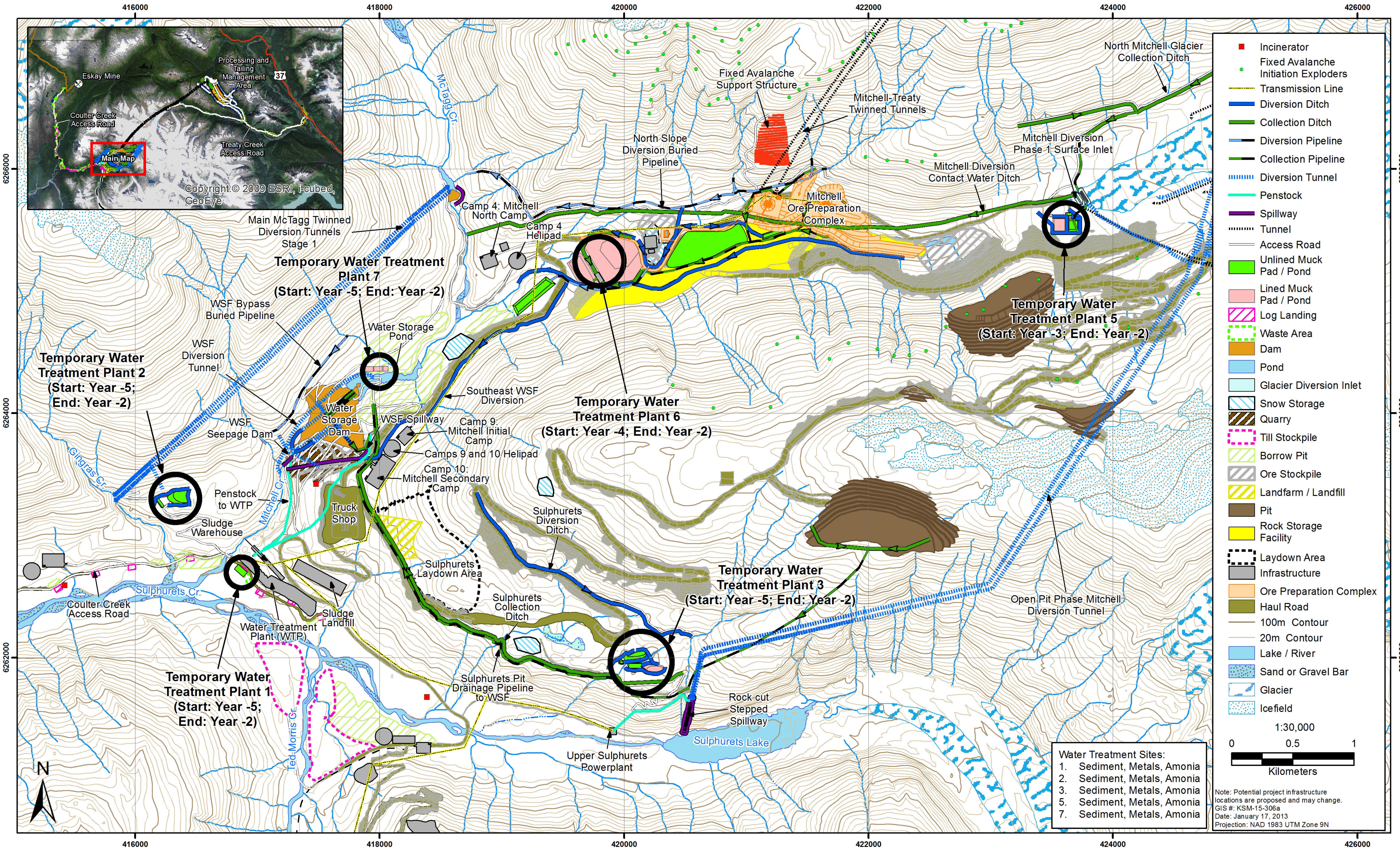

Figure 3-1

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Temporary Water Treatment Plant Locations Map - Mine Site

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PROJECT # 868-016-55 GIS No. KSM-15-306b_T January 16, 2013

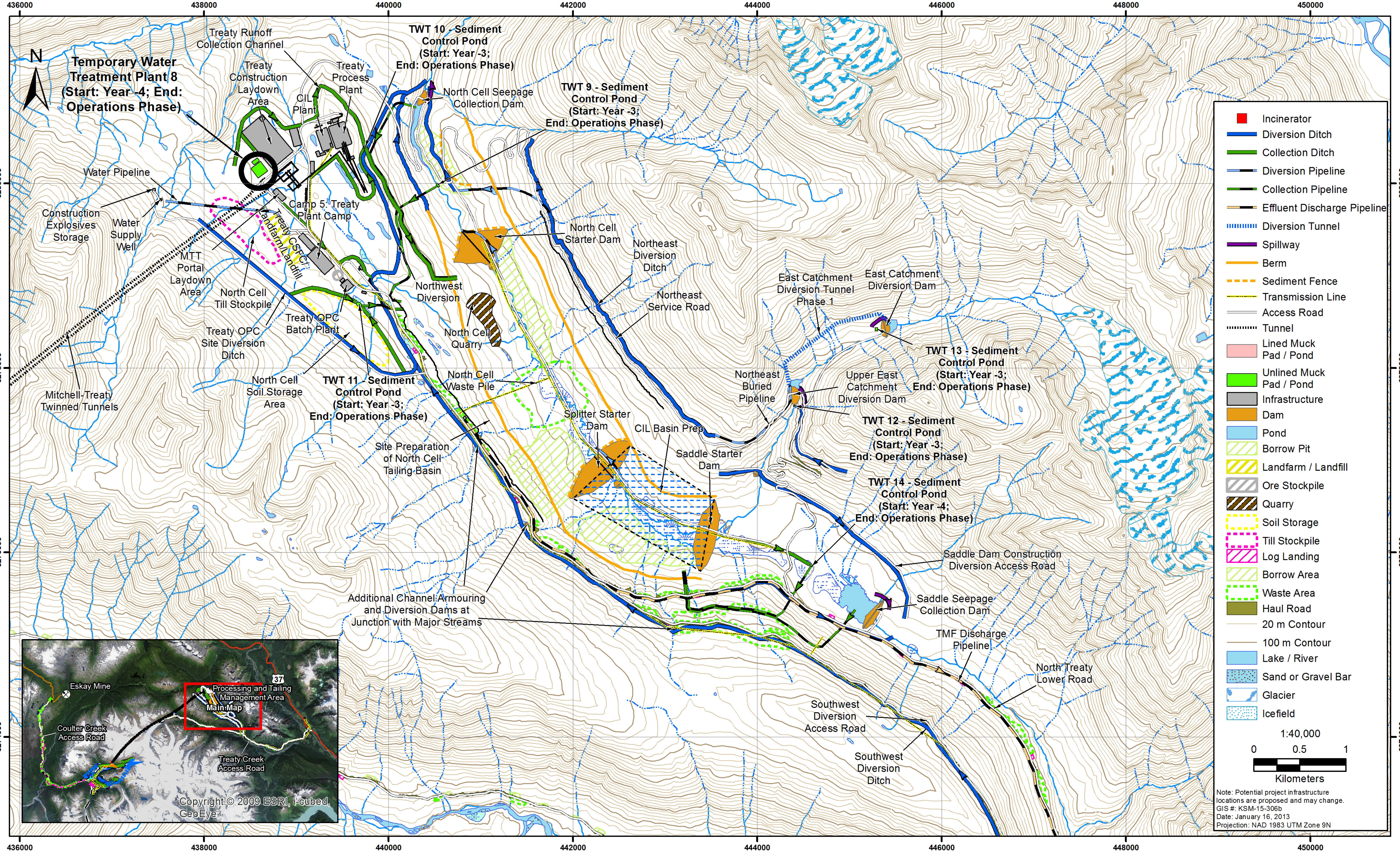

Figure 3-2

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Temporary Water Treatment Plant Locations Map - Tailing Management Facility

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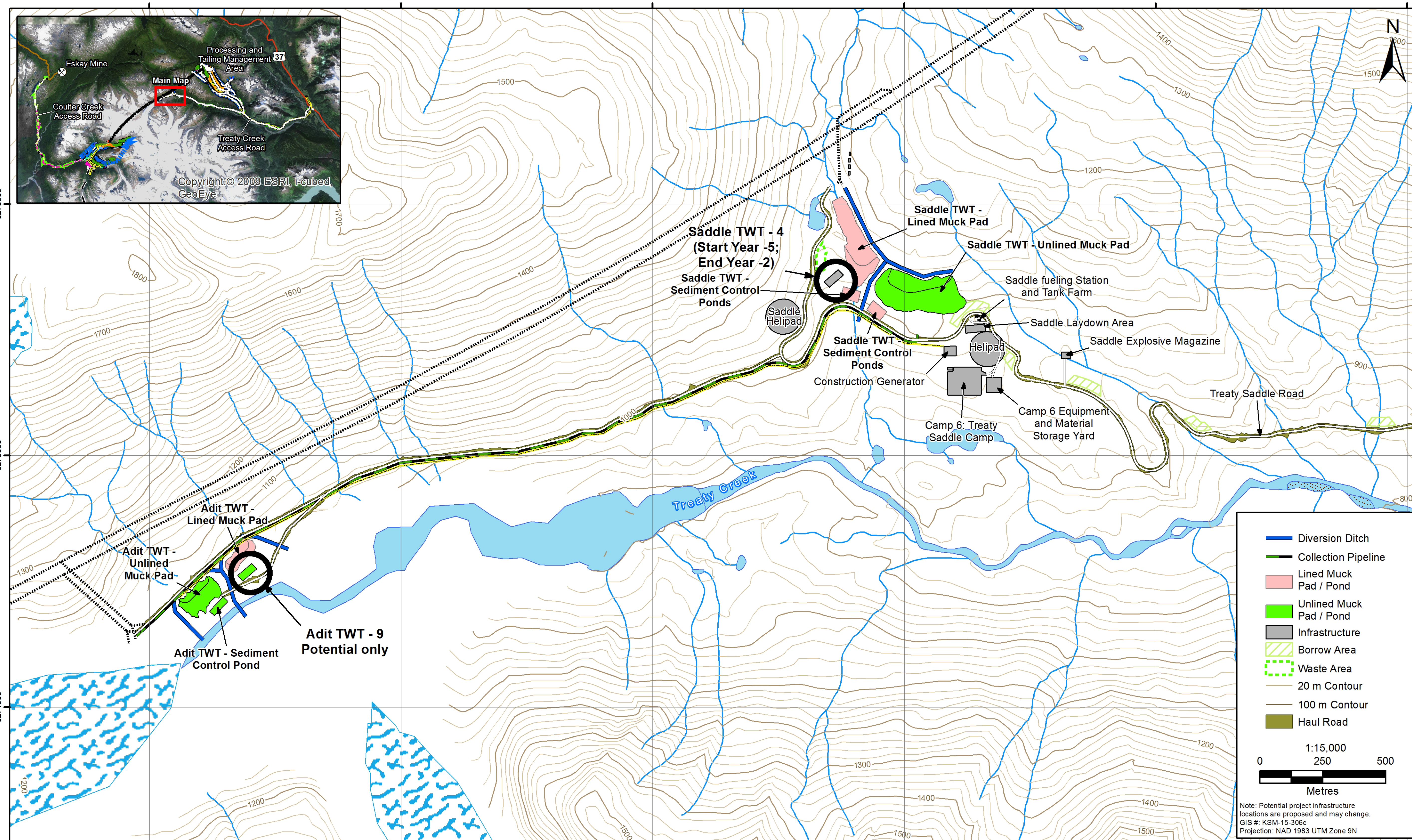

Figure 3-3

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Temporary Water Treatment Plant Locations Map - Treaty Saddle Camp

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KSM PROJECT

4. Design

The design of the temporary water plants was completed based on water flows of 50-80 L/s with four hour excursions of 200 L/s. Because actual requirements will to differ from the mean, each plant will be designed to the same specifications and based on a rational “worst case scenario”. The flow rates were estimated based on recorded and predicted precipitation rates, the tunnel sizes, expected fault zones, regional geology and geotechnical site investigations. This information was supplemented with experience from Galore, Granduc and Brucejack tunnels and vetted through a group of experts who participated in a two day Failure Modes and Effects Analysis Risk Assessment. The assumed water treatment rate was deemed to be reasonable. It is expected that in most areas, the water will be neutral to slightly basic but there are a few locations that may intercept elevated sulphide mineralization with potential to produce acidic water. In these areas, the water may be slightly acidic and the tunnel rock may generate elevated metals requiring treatment. Every site will be equipped to handle high suspended solids, elevated metals and elevated ammonia.

The annual snowfall in the area is high and the majority of the equipment will be located in heated containers to protect the system from the elements. The process assumptions and sizing information are summarized in Table 4-1.

4.1 Parameter Limits

The objectives of the temporary water treatment plants were based on the previously accepted standards from Galore Creek water treatment permit for tunnel development. The assumed discharge limits are:

- Total suspended solids discharge should be no more than 25 mg/L above the background concentration when the background is less than or equal to 250 mg/L, or no more than 10% above the background concentration when the background is greater than 250 mg/L
- Dissolved Copper – 0.05 mg/L
- Dissolved Iron – 0.50 mg/L
- Dissolved Lead – 0.1 mg/L
- Dissolved Zinc – 0.5 mg/L
- pH – 6.5 to 9.0
- Total ammonia – 10 mg/L

Table 4-1. Process Summary Table

Rescan Water Treatment Plant Number	Location	UTM	Length of Tunnel Drainage (m)	Purpose	Design Flow[6] (Nominal / Design) (L/s)	Grit Pond [1]		Settling Pond[5]		Sparging Pond[8]	
						Length (m)	Width (m)	Length (m)	Width (m)	Length (m)	Width (m)
Water Treatment Plant 1	Water Treatment Plant / Water Storage Dam Area	6 262 700N 416 900E	N/A	Treatment for TSS, Metals	50/80	50	35	50	20	20	20
Water Treatment Plant 2	McTagg Diversion Tunnel Outlet	6 263 500N 416 500E	8600	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 3	Mitchell Diversion Tunnel Outlet	6 262 000N 420 100E	5600	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 4	Treaty Saddle Portal Tunnel Section	6 276 000N 434 000E	6300	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 5	Mitchell Diversion Tunnel Inlet	6 265 500N 423 500E	5600	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 6	Mitchell Treaty Tunnel - Mitchell	6 265 500N 421 200E	17500	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 7	Water Storage Dam Construction Diversion Tunnel	6 264 500N 417 800E	1300	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 8	Mitchel Treaty Tunnel - TMF	6 280 200N 438 500E	6300	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20
Water Treatment Plant 9	Treaty Saddle Construction Access Adit - Potential Only	6 274 500N 431 000E	2200	Treatment for TSS, Metals & Ammonia	50/80	50	35	50	20	20	20

Notes:

[1] Grit pond is 4m in depth and is sized for a peak flow of 200L/s for 4 hours in the event of significant water interception during tunneling. Water draw 1m from bottom to include surge capacity of 3,000m^3

[2]$Ca(OH)_2$ is 20 % by weight. Flow rate is based on the largest muck pond ARD water rate of 20.5 L/s.

[3]Flocculent is assumed to be BASF Magnafloc 351 and 0.1% by weight. Flow rate based on design flow.

[4]Sulfuric acid is assumed to be 98% by volume

[5]Assumed TSS initally 100 mg/L with a particle S.G. of 2.7, settling pond will remove 30% of the mass of TSS. The maximum depth of the water and solids togther is assumed to be 1.75m.

[6] Design flow based nominal workface area excluding shotcreted sections.

[7] Mass rate is based on quicklime being 70% pure CaO and an ARD water flow rate based on the largest muck pond of 20.5 L/s.

[8] Sparging rate is assumed as 54 L/min/m3

4.2 Grit Pond

The purpose of the grit pond is to remove particles larger than 0.1 mm from the water. It is expected that any particles larger than 0.1 mm in diameter will settle in the grit pond. The grit ponds are 50 m x 35 m x 4 m deep but may be adjusted slightly depending on the area available at each location. In addition to holding 1750 m^3 of deposited solids, the grit ponds will provide a surge capacity of 3000 m^3 to accommodate a flow rate of 200 L/s for 4 hours. This would cope with a significant water interception during tunnelling. The normal flow rate is expected to be between 50 and 80 L/s based on tunnelling water and precipitation estimates. The pond will be compacted but not lined and the settled material will be left in the pond until completion of construction. The sites will be reclaimed after construction.

Water decanted from the grit pond will be pumped through the lime and flocculent addition treatment units. The pump suction will draw through a surface decant to allow settling in the grit pond and reduce suspended solids load moving through the treatment system.

4.3 Lime Addition

Hydrated lime will be added to the water through an inline mixer to increase pH to 10.5 if dissolved metals are elevated and precipitation is required. The primary indicator will be pH of the incoming water. Ammonia concentration will be checked with a HACH field kit and if elevated, pH will be adjusted to 10.5 with lime. In normal operations, hydrated limed will be added to increase pH to 8.5 as a coagulant to enhance the effectiveness of the flocculent.

Quick lime (CaO) will be stored in typical 20 kilogram bags on pellets and hydrated as required. The quick lime will be hydrated in batches in a 2000 gallon open tank. The mix tank will be located outside the container for safety reasons. Lime hydration is an exothermic reaction and fine lime dust is hazardous to inhalation. Proper safety protocols will be followed. Quick lime will be added to water and hydrated to produce a 20% by weigh solution of $Ca(OH)_2$. The slurry will be continually mixed with an agitator and then pumped into a 2000 gallon tank also equipped with an agitator located inside the heated containerized lime treatment unit. The hydrated lime storage tank will feed through an inline mixer at a rate to be determined by the target pH requirement. Based on the maximum flow rate of 80 L/s for pH water brought to pH 10.5, lime mixing would be required every 8 to 10 days.

4.4 Flocculent Addition

Bench scale test work was completed to select a flocculent. Based on initial tests, the concentration required is approximately 0.1% by weight of BASF Magnafloc 351. A bulk dry flocculent would be added manually by transferring 25 kg bags into a hopper and metered into the water stream using a screw conveyor and educator. This would then flow through a small static mixer before combining with the water stream to make a final flocculent concentration of 2 mg/L. The total flow will then go through another larger static mixer to ensure proper gentle mixing before being discharged into the settling pond. The flocculent promotes smaller particles to form larger aggregates that settle more readily in the settling pond. The base case design is a flow rate of 80 L/s of water requiring a flocculent addition rate of 0.16 L/s. At the design rate, one 25 kg bag of dry flocculent will last 43 hours. The actual flocculent rate will depend on the composition of the suspended solids and quality of the source water. The flocculent requirement will be optimized in the field. The type of suspended solids and size distribution may vary from location to location.

4.5 Settling Pond

After lime and flocculent addition, water will flow by gravity into the settling pond to further reduce suspended solids. The settling pond is 50 m x 20 m which has enough volume that dredging should not be required for the duration of the construction period. This system would provide a hydraulic residence time of over five hours at a flow rate of 80 L/s. The initial total suspended solids concentration after the grit pond is assumed to be 100 mg/L with a particle density of 2700 kg/m^3. The settling pond is compacted but no lined and will remain until the end of construction when the area will be reclaimed.

4.6 Sparging Pond

An air sparger will be located in a separate pond located after the settling pond to reduce ammonia present in the water. At high pH, dissolved ammonia is amendable to air stripping from the water and volatilized as a gas into the atmosphere. The ammonia concentration in the vapour will be very low due to the large surface area and natural dispersion off the surface of the pond. The pond size is 20 m x 20 m and the required air is dependent on the volume of water in the pond, ammonia concentration and water temperature. The air sparger rate is 54 L/min/m^3. A mobile compressor located adjacent to the container and close to the sparger manifold system will be used to generate the air required.

4.7 pH Control

The pH of the water needs to be basic (high pH) for both metal precipitation and ammonia removal. However, the water must be neutralized before it can be discharged. After the sparging pond, the water is pumped through a neutralization treatment step located in a containerised unit. Sulphuric acid will be added through an inline mixer to control pH between 7 and 8. The maximum required acid flow rate is less than 5 L/hr at the nominal 50 L/s design flow rate, which will require refilling the bulk acid vessel every 8 days. The pH of the effluent will be monitored with an inline pH probe to ensure the discharge requirements are met.

5. Container Unit Details

Typical General Arrangement of the ponds and Containerised Treatment Units are shown on Figures 5-1 and 5-2. Process and control information is indicated on Figures 5-3 and 5-4 which includes P&ID and Flow diagrams. An electrical single line diagram is also provided as Figure 5-5 to illustrate the power distribution within each system.

5.1 Lime Treatment Container Unit (20 ft x 8 ft)

The water for treatment will be supplied by a pump and the rate of flow will be varied by a VFD based on the water level in the grit pond. There will be a pressure sensor in the pond that will send a signal to the pump to speed up or slow down depending on the head level of the pond. The lime mix tank will be outside on a stand with stairs to carry the bags of lime for hydration. The water required for the batch will come from a slip stream off the grit pond discharge line and will be manually added. The batch of lime will be thoroughly mixed before being pumped into the hydrated lime storage tank. There will be a low level alarm on the hydrated lime tank to give operator warning to indicate a new batch is needed. The hydrated lime is then pumped into the treatment water stream. The flow rate will be based on predetermined pH setting. The flow will go through a static mixer and then through the pH sensor.

The container will be heated with a propane or electric heater.

5.2 Flocculent Treatment Container Unit (20 ft x 8 ft)

The treatment water stream flow will be monitored at the entrance of the flocculation treatment unit and the flocculent rate will be varied based on the inlet flow rate. The flocculent will be a dry powder that will be manually transferred into a hopper and then screw conveyed, pre-wetted and injected into the main flow line. There will be a low level alarm on the hopper to remind the operator to add more flocculent to the hopper. A static mixer will be located downstream to ensure there is proper mixing of the water and flocculent. The unit will contain a small operator laboratory bench with necessary laboratory equipment such as oven, scale, pH meter, turbidity meter and a HACH field kit to measure compliance. A heated emergency shower/eyewash station and first aid supplies will also be contained at this treatment unit. The treatment unit will be heated with a propane or electric heater.

5.3 pH Control Container Unit (8 ft x 8 ft)

Sulphuric acid will be used to adjust the pH to between 7 and 8. The sulphuric acid will be pumped into the water stream and controlled by a pH probe in the pipe at the outlet of the unit. After the acid is added, it will go through a static mixer. A flow meter will be installed at the exit so that operations can record water being discharged to the environment. There will be a low level alarm on the acid tank to remind operators when more acid is required. There will be a small transfer pump allowing for acid from one tote to be pumped into the small vessel feeding the water stream. The air blower/compressor will be located adjacent to the container and close to the sparger manifold system.

5.4 Generator

There will be one 90 kW generator required per water treatment plant that will supply the power for all the container units. Alternatively, the system can by powered from the construction power installed at each portal where available.

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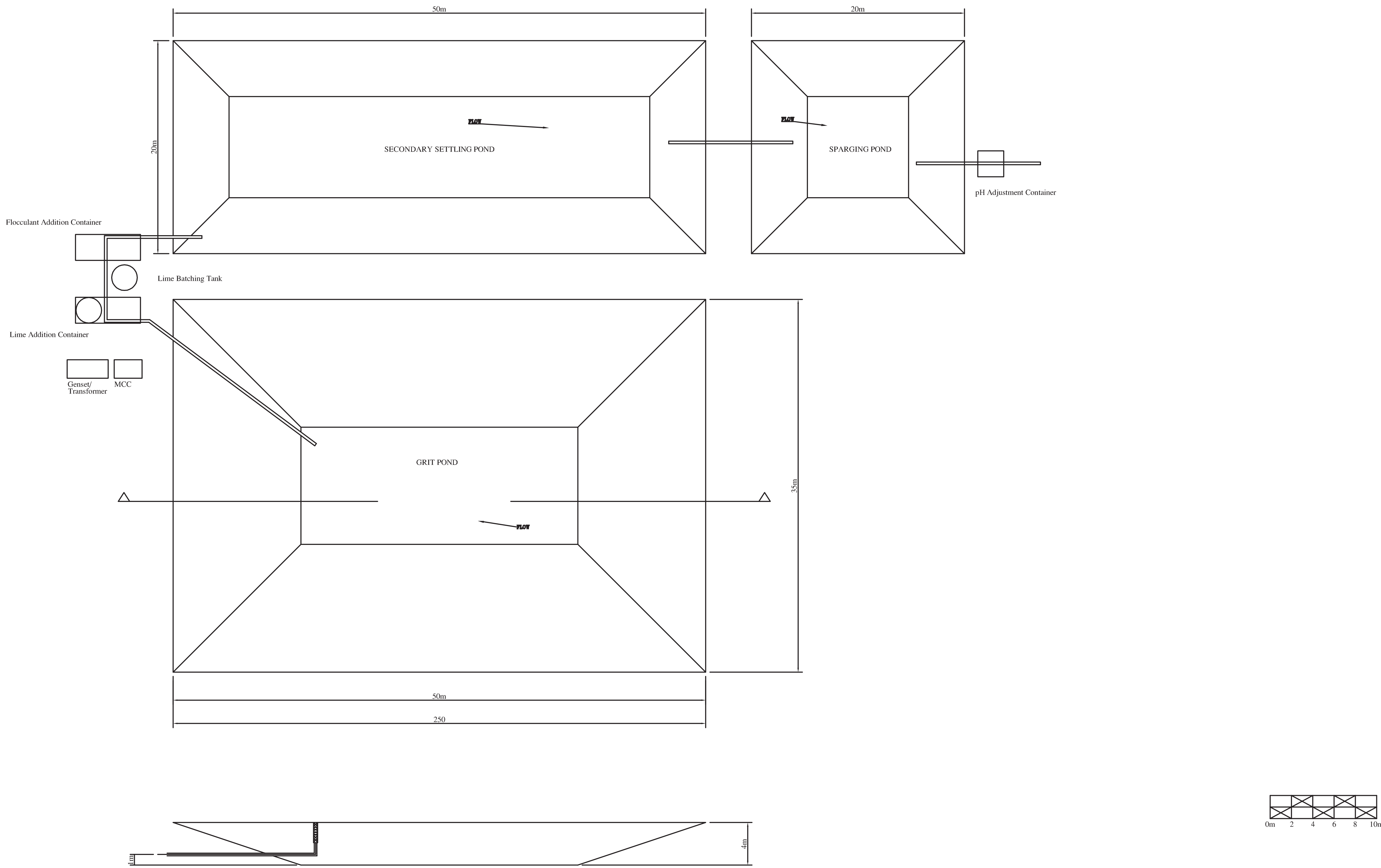

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TITLE TEMPORARY WATER TREATMENT PLANT PLOT PLAN

DRAWING NUMBER **Figure 5-1**

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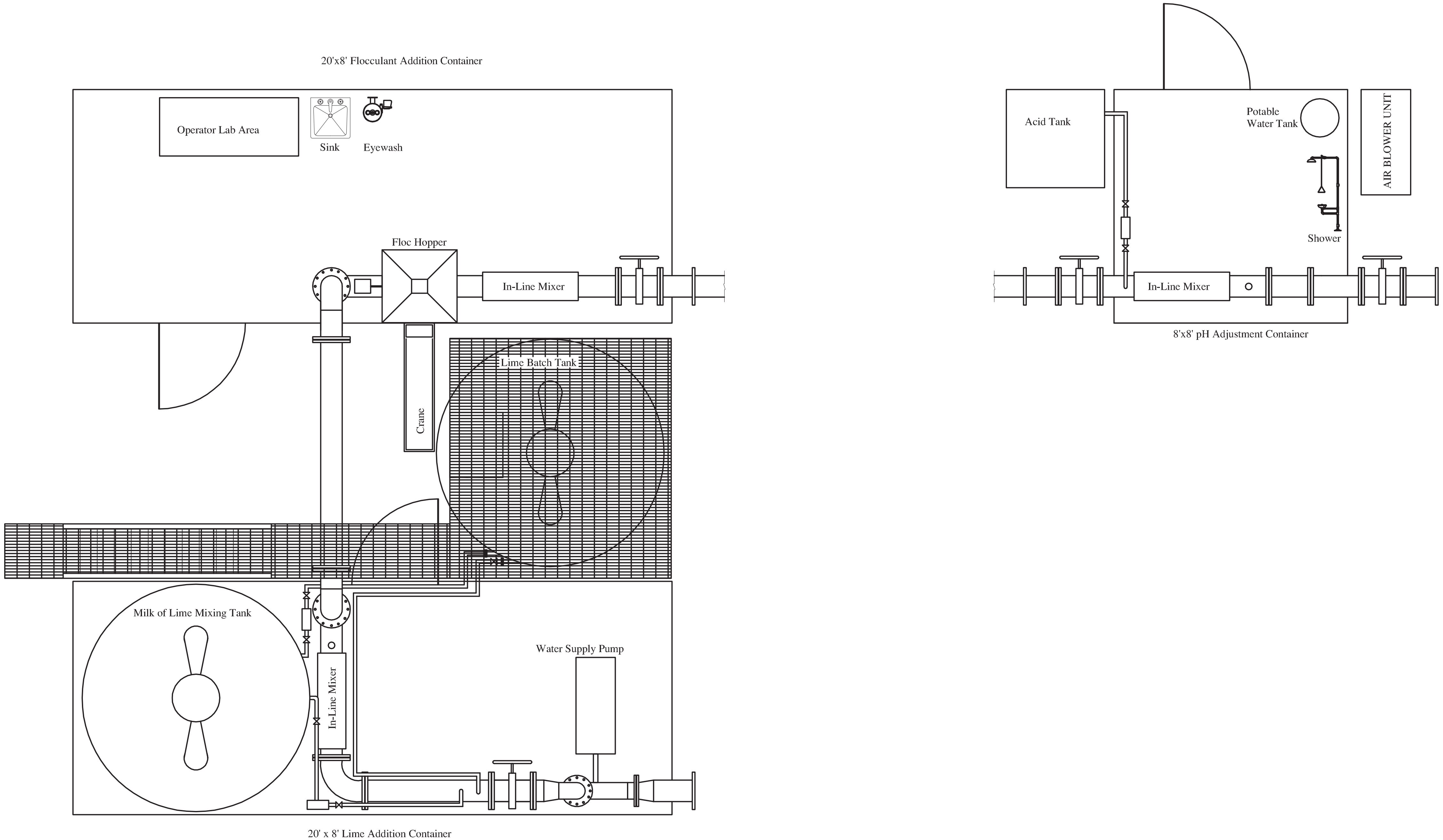

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TITLE TEMPORARY WATER TREATMENT PLANT
TYPICAL SKID LAYOUT

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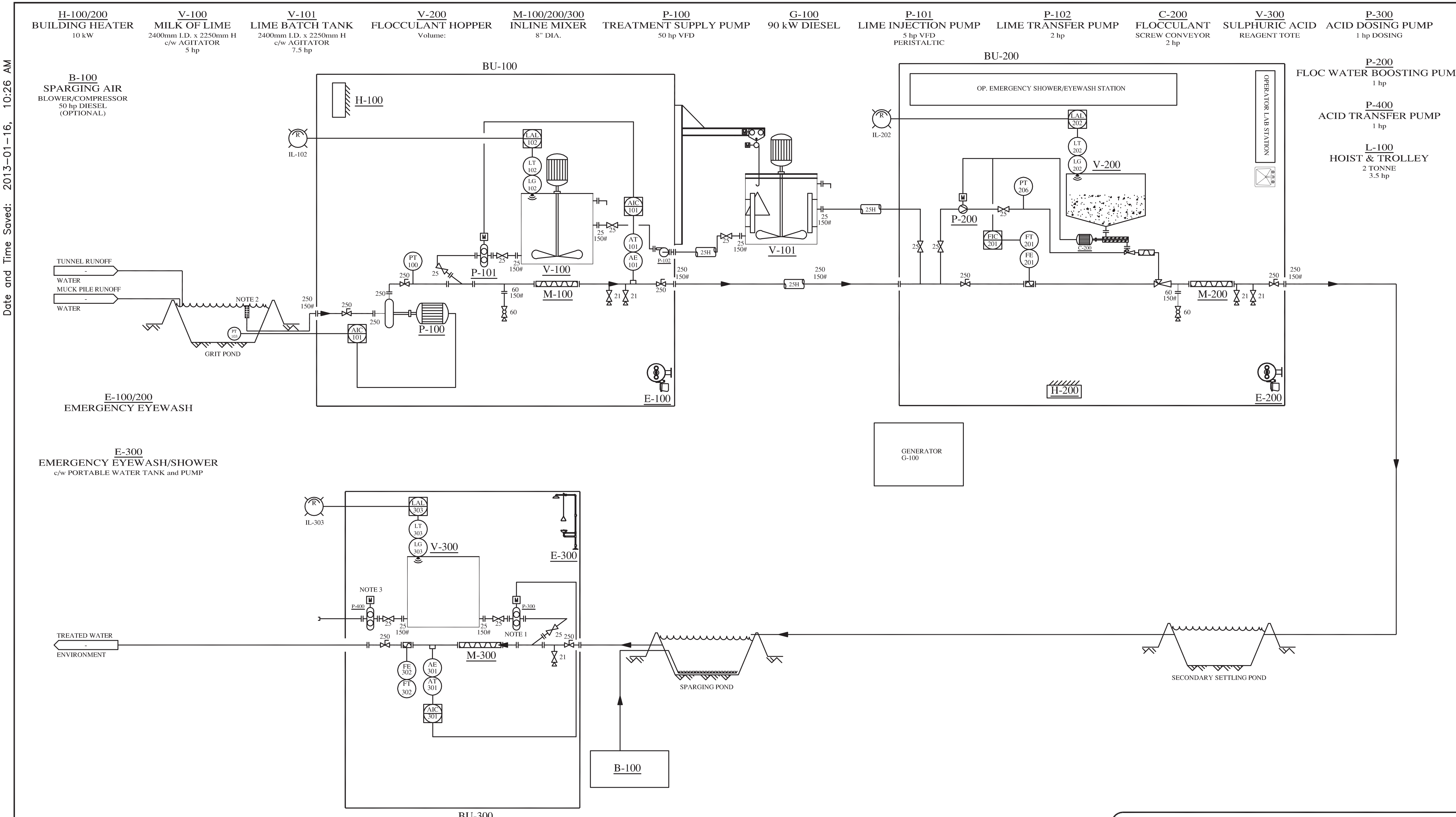

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TITLE TEMPORARY WATER TREATMENT PLANT P&ID

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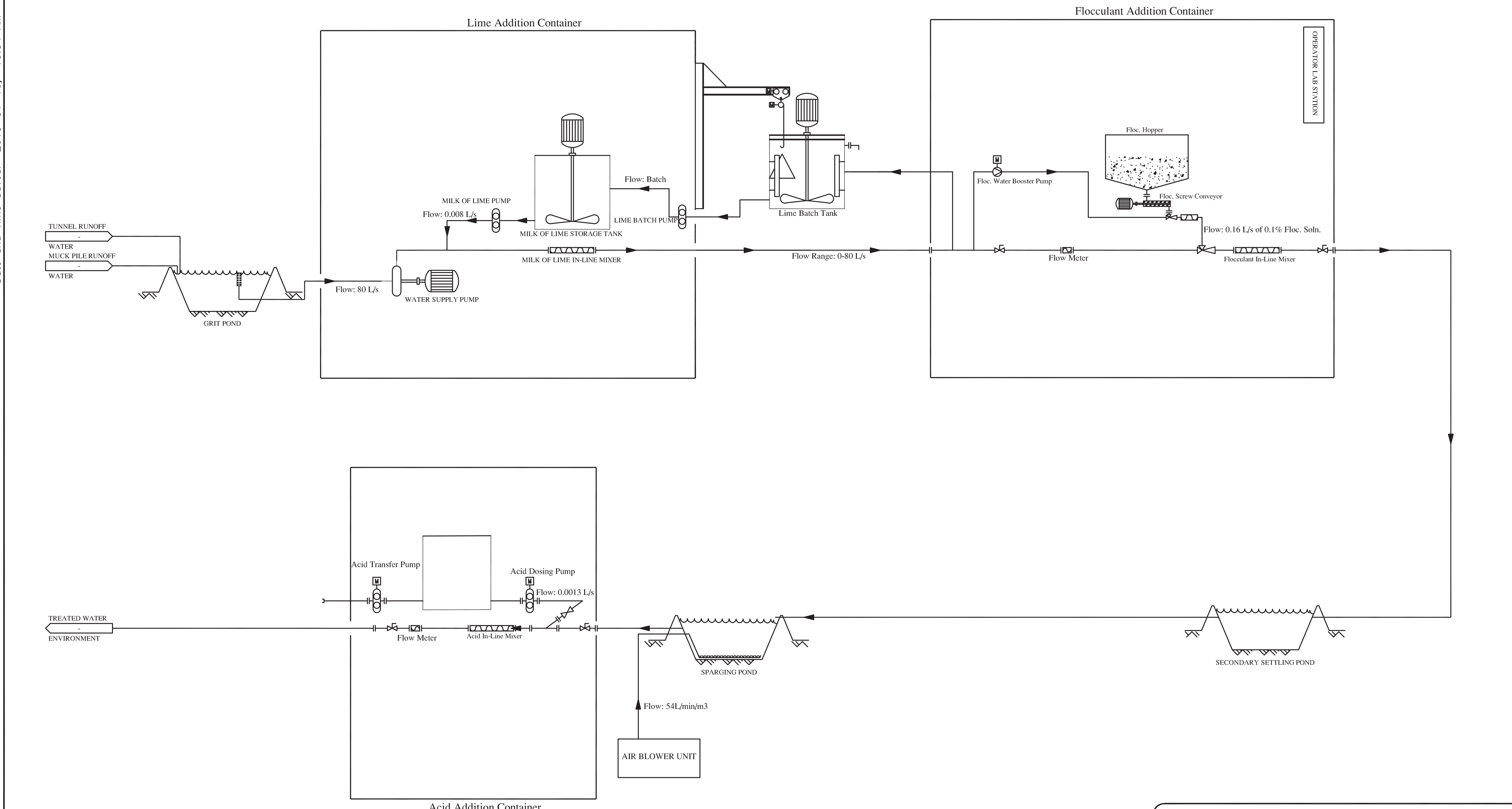

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TITLE TEMPORARY WATER TREATMENT PLANT PROCESS FLOW DIAGRAM

DRAWING NUMBER **Figure 5-4**

FILE NO.

PLOTTED: 1/16/2013 10:35:12 AM, BY: DOUG GRIFFIN
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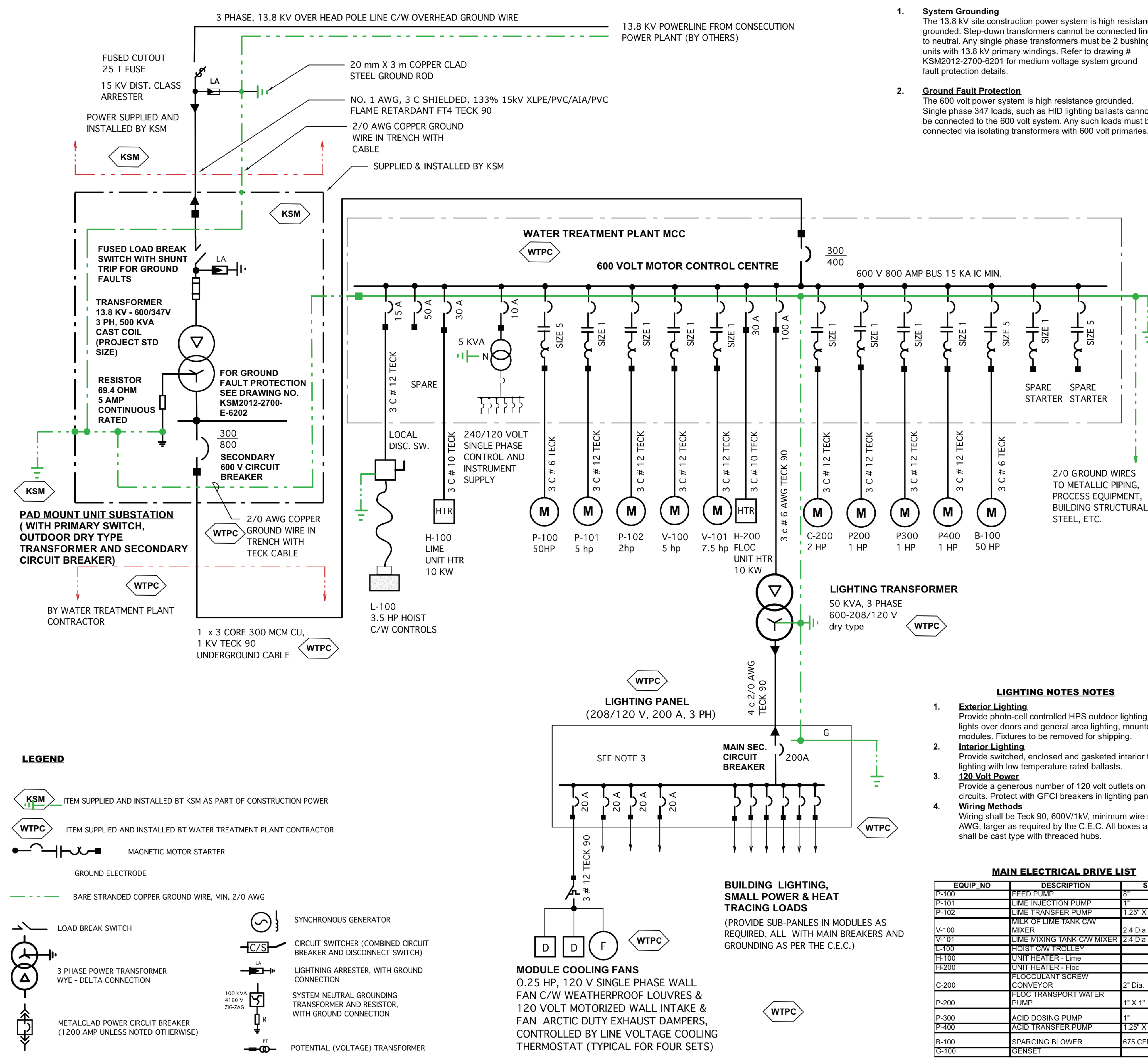

SYSTEM GROUNDING NOTES

1. **System Grounding**
   The 13.8 kV site construction power system is high resistance grounded. Step-down transformers cannot be connected line to neutral. Any single phase transformers must be 2 bushing units with 13.8 kV primary windings. Refer to drawing # KSM2012-2700-6201 for medium voltage system ground fault protection details.
2. **Ground Fault Protection**
   The 600 volt power system is high resistance grounded. Single phase 347 loads, such as HID lighting ballasts cannot be connected to the 600 volt system. Any such loads must be connected via isolating transformers with 600 volt primaries.

ELECTRICAL INSTALLATION NOTES

1. **Electrical Codes**
   The entire electrical system will be installed in accordance with:
   - The British Columbia Mines Act and Regulations.
   - BC Mines "Health, Safety and Reclamation Code for Mines in British Columbia."
   - CSA Standard M421-11, Use Of Electricity In Mines.
   - C22.1 -12, The Canadian Electrical Code Part 1, as Adopted for Use in B.C. (Referred to as the C.E.C.).
2. **Electrical Equipment**
   All equipment will be CSA approved, where standards have been established by that agency, and shall also be designed to meet the requirements of CSA Standard M421, "Use Of Electricity In Mines."
3. **Ground Fault Protection**
   All conductors shall be stranded copper with XLPE insulation, unless noted otherwise. The 600 volt power system within water treatment areas will be high resistance grounded, 3 phase, 600/347 volt. Any three phase 208/120 volt systems shall be solidly grounded as per the C.E.C. All 240/120 volt single phase systems shall be solidly grounded as per the C.E.C. All outdoor receptacles and indoor receptacles in wet or damp locations shall be provided with CSA Certified Class A GFCI ground fault interruptor protection. All submersible pumps shall be provided with ground fault protection as required by the C.E.C.
4. **Grounding**
   In addition to ground electrodes installed at each Water treatment Plant (WTP), separate ground wires, including full size ground wires on all overhead pole lines shall bond all sites together to form one ground grid back to the pertinent construction power plant. Bond all metallic piping, process equipment, building structures and similar to ground as required by the C.E.C. All cable sized for minimum 1 cable diameter free air space between cables in ladder tray. If random fill cable size must be increased as per C.E.C.
5. **Cable & Connectors**
   All cable shall be Teck 90 type, CSA approved and in accordance with CSA Standard C22.2 No. 131 , XLPE insulated, copper conductors, jacketed with aluminum armour. Cable shall be flame retardant to CSA specification FT4 and shall also be low acid gas emission.
   Teck connectors shall be CSA approved, malleable iron, watertight, as manufactured by T&B. Provide mechanical protection for Teck cable as per the C.E.C. where subject to mechanical damage. Increase cable size to account for voltage drop as may be required for long runs.
6. **Boxes & Fittings**
   All boxes and fittings shall be corrosion resistant, plated, malleable iron with threaded hubs or shall be stainless steel with T&B Bullet hubs or sealing "O" rings at all cable or conduit connections.
7. **Control Stations**
   All local control stations shall be Allen-Bradley 800H heavy duty watertight type in stainless steel enclosures.
8. **Motor Control**
   All motor control equipment, 600 volts and below, shall be CSA approved complying with CSA Standard C22.2, No. 254-05. All starters shall be of the combination circuit breaker type using MCP circuit breakers of adequate interrupting capacity and three phase solid state overload relay protection with ground fault protection.
   Any outdoor motor control equipment shall be in watertight stainless steel enclosures, rated NEMA 4X. All MCC breakers to be lockable type. Install local safety HP rated disconnects where safety considerations, beyond C.E.C. and B.C. Mines Act requirements dictate.
9. **VFDs**
   All VFDs shall be of the pulse width modulated type utilizing IGBTs power electronic modules. The drives shall be capable of open loop or closed loop vector control. The drives shall be complete with digital operator interfaces, communications card and an on-board processor capable of doing logic and PID control. The drives shall have line and load side reactors.
10. **Electric Motors**
    All process and building services motors shall be 3 phase 575 volts , cast iron T frame, TEFC. All motors shall be IEEE 841 High Efficiency Mill and Chemical Duty Motors and shall be CSA approved. All belt drive motors of 100 HP and over shall have drive end roller bearings. All motors shall have regreasible bearings with labyrinth seals. All motor insulation shall be rated for VFD operation (NEMA Standard MG1). All motors shall have over sized cast iron connection boxes. Motors 100 HP and above shall be equipped with six stator RTDs (PT100) with separate terminal box. 3600 rpm motor are not allowed. provide slide rails for belt drive motors where required.

LIGHTING NOTES NOTES

1. **Exterior Lighting**
   Provide photo-cell controlled HPS outdoor lighting including lights over doors and general area lighting, mounted on modules. Fixtures to be removed for shipping.
2. **Interior Lighting**
   Provide switched, enclosed and gasketed interior fluorescent lighting with low temperature rated ballasts.
3. **120 Volt Power**
   Provide a generous number of 120 volt outlets on most circuits. Protect with GFCI breakers in lighting panels.
4. **Wiring Methods**
   Wiring shall be Teck 90, 600V/1kV, minimum wire size # 12 AWG, larger as required by the C.E.C. All boxes and fittings shall be cast type with threaded hubs.

MAIN ELECTRICAL DRIVE LIST

EQUIP_NO	DESCRIPTION	SIZE	HP
P-100	FEED PUMP	8"	50
P-101	LIME INJECTION PUMP	1"	5
P-102	LIME TRANSFER PUMP	1.25" X 1"	2
V-100	MILK OF LIME TANK C/W MIXER	2.4 Dia X 2.25 H	5
V-101	LIME MIXING TANK C/W MIXER	2.4 Dia X 2.25 H	7.5
L-100	HOIST C/W TROLLEY		3.5
H-100	UNIT HEATER - Lime		10
H-200	UNIT HEATER - Floc		10
C-200	FLOCCULANT SCREW CONVEYOR	2" Dia.	2
P-200	FLOC TRANSPORT WATER PUMP	1" X 1"	1
P-300	ACID DOSING PUMP	1"	1
P-400	ACID TRANSFER PUMP	1.25" X 1"	1
B-100	SPARGING BLOWER	675 CFM	50
G-100	GENSET		75

Figure 5-5

REV	ISSUED FOR	DESCRIPTION OF REVISION	DATE
	-	-	-
0	PERMITTING	CHECKED	JAN. 16/2013
B	2ND DRAFT	ADD MOTOR HP, REVISE DRAWING NUMBER	JAN. 14/2013
A	FIRST DRAFT		JAN. /2013

RESCAN ENVIRONMENTAL SERVICES LTD.

KSM PROJECT

TITLE:

WATER TREATMENT PLANT ELECTRICAL PLANTS SUPPLIED FROM KSM PORTAL GENSETS SINGLE LINE DIAGRAM SH 1 OF 1

W.N. Brazier Associates Inc.

NOT FOR CONSTRUCTION

SCALE: NTS			
DRAWN:	WNB	DATE:	DEC 28/12
CHECKED:	WNB	DATE:	JAN 16/13
APPROVED:		DATE:	
DRAWING NO:	0868 - 16 - 55		0

6. Cost Estimate

The cost estimate was prepared by engineers based on experience obtained during the operation of the Galore tunnel water treatment plant and others. The various material costs were based on supplier discussion and not on firm written quotes. The estimates are preliminary and require detailed engineering and firm supplier quotes to bring the cost to ± 10%. The arrangement as outlined will work and is within an order of magnitude cost estimate. Not included in the cost is transportation to the site and set-up. The water treatment pre-fabricated unit set-up should not take more than a week to ten days per site. The units will be completely assembled and tested at the fabrication shop. Table 6-1 represents an order magnitude capital cost estimate for each system. The cost estimate for the treatment units is approximately $375,000 for each site. The earth works at each site is being handled by others. The assumed earth works cost is $425,000 to $525,000 for each site. The total average cost for each treatment site is estimated at $800,000 to $900,000.

Table 6-1. Capital Cost Estimate

This cost estimate does not include any site installation or civil works.

Item Description	Quantity	Unit	$/Unit	Cost	Notes
Lime Addition Container					
Material Costs					
Item Description	**Quantity**	**Unit**	**$/Unit**	**Cost**	**Notes**
20ft x 8ft Steel Container	1	ea	$ 5,000	$ 5,000	
16ft x 8ft Steel Container	1	ea	$ 3,000	$ 3,000	Chemical storage, 1 per plant
50Hp Feed Pump	1	ea	$ 20,000	$ 20,000	
In-Line Mixer	1	ea	$ 7,000	$ 7,000	
Agitator	2	ea	$ 6,000	$ 12,000	
Transfer Pump	2	ea	$ 2,500	$ 5,000	
Metering Pump - Peristaltic	2	ea	$ 5,000	$ 10,000	
Misc. Pipe and Fittings	1	ea	$ 7,000	$ 7,000	
Batch Tank	1	ea	$ 12,500	$ 12,500	
Milk of Lime Tank	1	ea	$ 10,000	$ 10,000	
Building Cata-dyne Heater	1	ea	$ 600	$ 600	
Eyewash Set-up	1	ea	$ 1,500	$ 1,500	
Hoist on monorail	1	ea	$ 5,000	$ 5,000	
pH Analyzer	1	ea	$ 6,000	$ 6,000	
90kW Generator and Wiring	1	ea	$ 25,000	$ 25,000	
MCC and Wiring	1	ea	$ 25,000	$ 25,000	
Propane Tank	1	ea	$ 4,500	$ 4,500	
Instrumentation	1	lot	$ 3,000	$ 3,000	
Subtotal				**$ 162,100**	
Unit Fabrication and Installation Labour					
Item Description	**Quantity**	**Unit**	**$/Unit**	**Cost**	**Notes**
Manufacturing Engineer/Designer	120	hr	$ 100	$ 12,000	1 Person for 15 days @ $100/hr, 8 hr Day
Manufacturer Crew	480	hr	$ 50	$ 24,000	3 Persons for 4 weeks, 8 hr Day
Subtotal				**$ 36,000**	
Flocculant Addition Container					
Material Costs					
Item Description	**Quantity**	**Unit**	**$/Unit**	**Cost**	**Notes**
20ft x 8ft Steel Container	1	ea	$ 5,000	$ 5,000	
Floc water Booster Pump	1	ea	$ 1,000	$ 1,000	
In-Line Mixer	1	ea	$ 7,000	$ 7,000	
Hopper	1	ea	$ 1,500	$ 1,500	
Transfer Screw Conveyor	2	ea	$ 3,500	$ 7,000	
Misc. Pipe & Fittings	1	ea	$ 7,000	$ 7,000	
Building Cata-dyne Heater	1	ea	$ 600	$ 600	
Eductor	1	ea	$ 2,000	$ 2,000	
Flow Meter	1	ea	$ 5,500	$ 5,500	
Eyewash Set-up	1	ea	$ 1,500	$ 1,500	
Process Water Supply Pipe	1	ea	$ 4,300	$ 4,300	
Lab set-up	1	lot	$ 5,000	$ 5,000	
Instrumentation	1	lot	$ 2,000	$ 2,000	
Subtotal				**$ 49,400**	
Unit Fabrication and Installation Labour					
Item Description	**Quantity**	**Unit**	**$/Unit**	**Cost**	**Notes**
Manufacturing Engineer/Designer	120	hr	$ 100	$ 12,000	1 Person for 15 days @ $100/hr, 8 hr Day
Manufacturer Crew	480	hr	$ 50	$ 24,000	3 Persons for 4 weeks, 8 hr Day
Subtotal				**$ 36,000**	
pH Adjustment Container					
Material Costs					
Item Description	**Quantity**	**Unit**	**$/Unit**	**Cost**	**Notes**
8ft x 8ft Steel Container	1	m	$ 1,500	$ 1,500	
In-Line Mixer	1	ea	$ 7,000	$ 7,000	
IBC Container Acid	1	ea	$ 3,000	$ 3,000	
pH Analyzer	1	ea	$ 6,000	$ 6,000	
Misc. Pipe & Fittings	1	ea	$ 7,000	$ 7,000	
Building Cata-dyne Heater	1	ea	$ 600	$ 600	
Flow Meter	1	ea	$ 5,500	$ 5,500	
Transfer Pump	1	ea	$ 2,500	$ 2,500	
Metering Pump	1	ea	$ 2,500	$ 2,500	
Shower Set-up	1	ea	$ 5,000	$ 5,000	
Air Blower for Sparging	1	ea	$ 25,000	$ 25,000	Contingency only. May be 50 HP
Instrumentation	1	lot	$ 1,500	$ 1,500	
Subtotal				**$ 67,100**	
Unit Fabrication and Installation Labour					
Item Description	**Quantity**	**Unit**	**$/Unit**	**Cost**	**Notes**
Manufacturing Engineer/Designer	120	hr	$ 100	$ 12,000	1 Person for 15 days @ $100/hr, 8 hr Day
Manufacturer Crew	240	hr	$ 50	$ 12,000	3 Persons for 2 weeks, 8 hr Day
Subtotal				**$ 24,000**	
Overall Estimated Containers Cost (+/- 50%)				**$ 375,000**	