Minto Mine

Mill Operations Plan

2018-01

Prepared by:

Minto Explorations Ltd.

Minto Mine

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1 Introduction

The Mill Operations Plan (MOP) is a requirement of Quartz Mining Licence QML-0001 (QML), which requires "*A plan that details the activities for the operation and monitoring of the mill.*" The content of this MOP is derived from the *Plan Requirement Guidance for Quartz Mining Projects* (Yukon Government, 2013).

The purpose of the MOP is to summarize mill design, milling and production rates, plans for and identification of stockpiles, details on reagent use and storage and the requirements for load-out and trucking. Typically, the MOP would include the development and construction details of the mill; however, as Minto Mine has been operating since 2007, this plan will only describe the operations and as-constructed details for the mill and associated facilities.

1.1 Project Description

Minto Mine is a high-grade copper and gold mine that is located 240 km north of Whitehorse, Yukon. Operations are ongoing at this time and began in October 2007. Minto processes both open-pit and underground ore using conventional crushing, grinding, and flotation to produce copper concentrates with significant gold and silver credits. Since commencement of commercial production in 2007, processing plant design throughput has increased from 1,563 tonnes per day (tpd) to the present throughput of 4,200 tpd. Concentrates are exported internationally via the Port of Skagway, Alaska for smelting and sale.

In July 2013, the Phase V/VI expansion project proposal was submitted to the Yukon Environmental and Socio-Economic Assessment Board (YESAB), which includes three new open pits and expansion of an existing, and additional underground reserves (Figure 1-1). As part of the Phase V/VI and Phase VII, Minto intends to continue operating the mill as it is currently being operated for Phase IV mining.

Figure 1-1: Minto Mine Area Overview at End of Mining Life.

2 Mill and Ancillary Facilities

The process plant at Minto has been operating since 2007 and has undergone several significant upgrades that have increased throughput and recoveries. Minto was authorized to process 1,800 tpd of ore containing copper, gold and silver to produce a copper concentrate in its Phase 1 plant design. In Phase 2, changes were made to the plant layout and design to accommodate the increased throughput to 2,400 tpd. The main changes included a new building extension to contain a second ball mill circuit, three additional rougher flotation cells, and also the use of the new re-cleaner cells in the main mill building. Other equipment initially installed in Phase 1 was sized to handle both Phase 1 and 2 tonnages; only minor modifications to the grinding circuit were required to increase the milling rate in Phase 2 to 2,400 tpd and then in Phase 3 to 3,200 tpd, involving grate sizes inside the SAG mill and trommel screen size. Minto is currently authorized to mill ore at a rate of up to 4,200 tpd.

2.1 Mill Facilities

The processing plant consists of the following main unit operations, a detailed arrangement of which provided in Appendix B:

- Two-stage grinding circuit comprised of a single SAG (semi-autogenous grinding) mill and two ball mills.
- Bulk flotation in rougher and scavenger stages, followed by cleaner flotation.
- Centrifugal gravity concentration of coarse gold.
- Concentrate thickening and pumping.
- Concentrate filtration.
- Concentrate storage (on-site).
- Tailings thickening and pumping to an in-pit deposition location. and,
- Water reclamation.

The primary crusher was originally designed to operate six hours per day, 365 days per year at 75% availability, but since June of 2016 the Minto crusher was shut down and the contractor crusher became the sole provider of the feed to the mill. The mill circuit operates 24 hours per day, 365 days per year at an availability of approximately 93%. Availability is defined as the operating hours in a 24-hour day.

2.2 Ore Stockpiles

Several ore stockpiles exist on the property. Southeast of the mill complex, three adjacent stockpile pads exist:

1. Mill Pond Pad – Blended and crushed mill feed
2. East Stockpile –Sulphide and partially oxidized run-of-mine (ROM) ore stockpiles
3. South Stockpile –Partially oxidized run-of-mine (ROM) ore stockpiles

West of the Main Pit, adjacent to the Main Waste Dump, the Top of the World stockpile consisting of partially oxidized run-of-mine (ROM) ore.

The stockpile areas are displayed in Figure 2-1.

Ore is segregated by copper grade and percentage of acid-soluble copper as shown in Table 2-1.

Figure 2-1: Minto Mine Area Overview with ore stockpiles

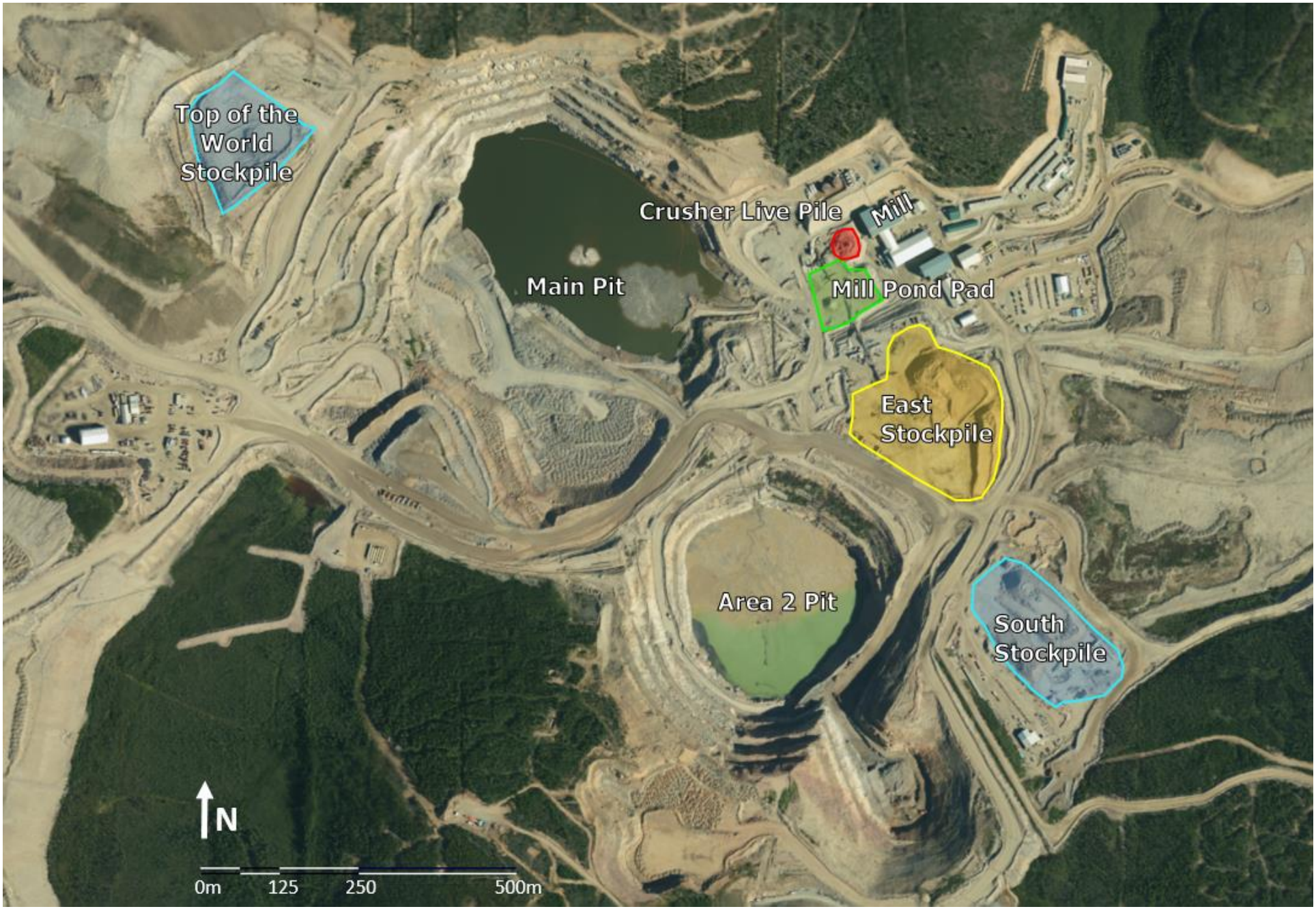


Table 2-1: Ore Stockpiles

Material Type	Copper Grade Range	Soluble Copper
Blue Sulfide Ore	0.50 – 1.00% Cu	<15.0%
Green Sulfide Ore	1.00 – 2.00% Cu	<15.0%
Yellow Sulfide Ore	>2.00% Cu	<15.0%
Partially Oxidized Ore (POX)	>1.50% Cu	>15.0%
Low-Grade Partially Oxidized Ore (LG POX)	0.80 – 1.50% Cu	>15.0%

The higher-grade ores are fed to the mill as they are mined to maintain the highest possible head grade while mining ore. The lower-grade and partially oxidized stockpiles are depleted gradually and are used to supplement mill feed during periods of waste stripping.

2.3 Tailings Facilities

Tailings produced in Phases I – III were filtered and dry-stacked in the Dry Stack Tailings Storage Facility (Figure 1-1). Tailings produced are thickened and then discharged as slurry to the Main pit and the Area 2 pit. Phase VII will use the Main Pit, the expanded Area 2 pit, and the Ridgetop North pit. Tailings may also be deposited in underground workings near the end of the mine life.

As discussed in the *2018 Minto Mine Tailings Management Plan*, waste rock with NP:AP<3 will be co-disposed with tailings in locations that will be saturated post-closure. Additional storage volume beyond the natural capacity of the existing and future pits is required. To increase the available storage capacity in the Main Pit, Minto intends construct a dam on the east side of the existing pit. Details of the tailings management facilities and processes are contained within the *2018 Minto Mine Tailings Management Plan*.

2.4 Water Management System

Water used for grinding and flotation is currently sourced from the Main Pit (Figure 1-1). After flotation is complete, water is returned to the Area 2 pit as part of the slurry tailings stream. A small amount of water remains as moisture content in concentrate.

Water from the Main Pit has been treated through the Water Treatment Plant for discharge to the receiving environment in 2012 - 2017. Treatment of water from the Area 2 pit is also likely to occur.

The Water Treatment Plant accepts feed water from the Main Pit or WSP and discharges treated water to the Main Pit, WSP or Minto Creek. Sludge and the reverse osmosis plant concentrate stream produced in the treatment process are pumped to the Main Pit. The first stage of the water treatment plant at Minto was constructed in 2010. The water treatment process included a ballasted lamella clarifier unit (Actiflo®) system for removal of TSS, total metals and dissolved copper.

In 2012, two reverse osmosis (RO) trains were added to the treatment process downstream of the existing clarification and filtration units to treat nitrate and selenium, based on water quality limits received in the Water Use Licence Amendment 7. Treated effluent from the RO units may also be amended, when necessary, with sodium bicarbonate to adjust the pH and add salinity and alkalinity.

The RO process removes 95–99% of all constituents in the feed water. The feed water for the RO unit is the effluent from clarification and filtration unit, which is operated as a pre-treatment step. The RO unit produces a clean effluent stream that consists of approximately 75% of the feed water (the RO permeate). The by-product of the process is a brine stream, which consists of about 25% of the feed water and 95–99% of constituent loadings. The brine stream is pumped to the Main Pit Tailings Management Facility or will be pumped to the Area 2 Pit Tailings Management Facility. Because of this brine by-product, RO cannot be considered a true water treatment process but is rather a process that concentrates mine water into a smaller volume with higher constituent concentrations.

A schematic of the water treatment plant is provided in Appendix A. More detail about the water management at the Minto mine is provided in the *2018 Minto Mine Water Management Plan.*

3 Milling Methods

The Minto Mine process plant design incorporates standard crushing, grinding, flotation, and dewatering circuits to produce a final copper concentrate product. Ore from the Phase VII deposits will be processed through the process plant as it currently operates.

The process schematic for the current Minto process plant is shown in Figure 3-1.

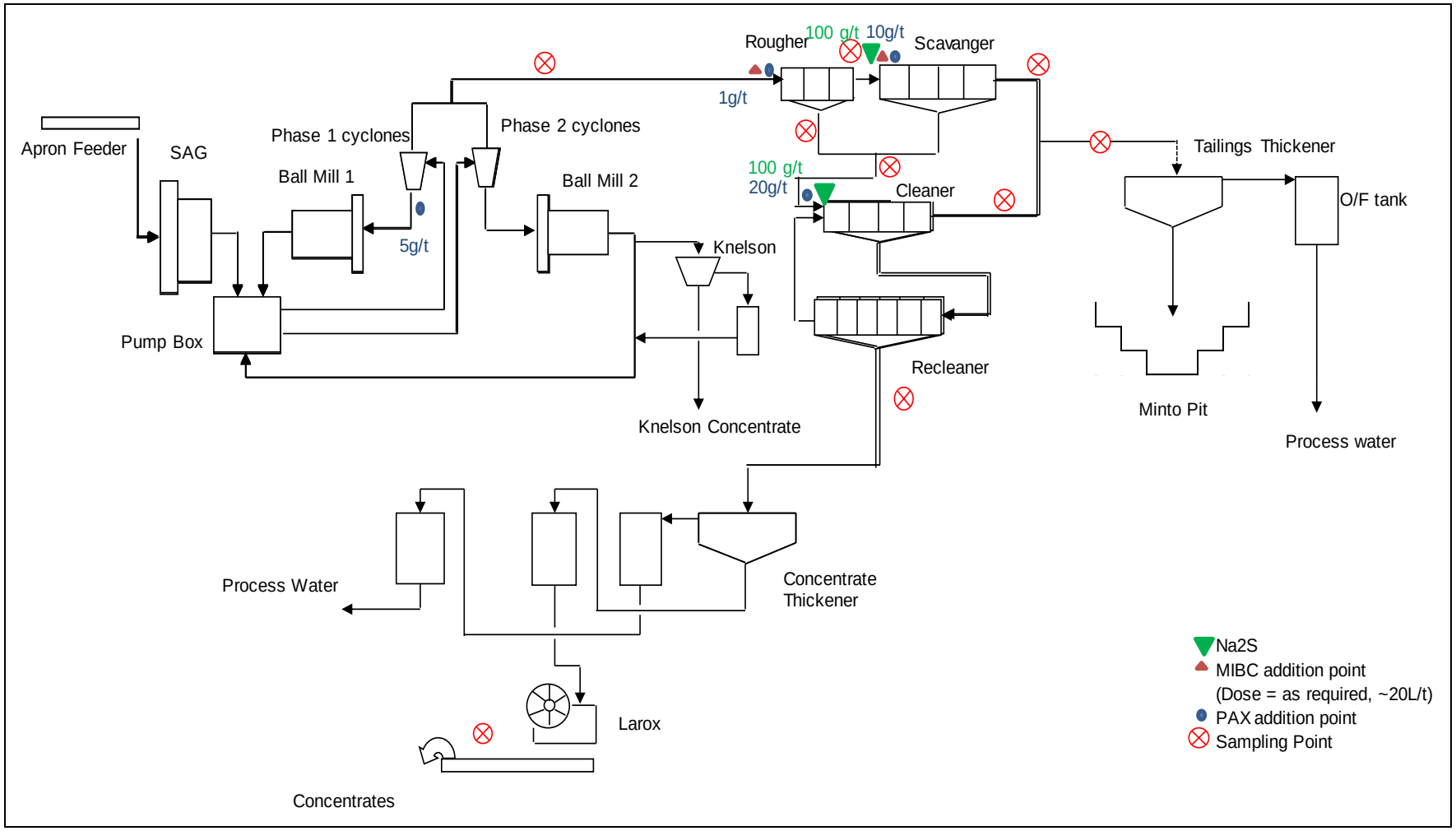


Figure 3-1: Minto Mill General Flow Sheet with Slurry Tailings

3.1 Plant Design

The plant design is well proven from historical operational data. Details of the crushing, grinding, flotation, concentrate, tailings and reagent circuits are provided below and process flowsheets are provided in Appendix B. The flow sheet incorporates the following unit process operations:

- Ore from the open pit and underground is crushed using the contractor's primary jaw crusher to a crushed product size of nominally 80% passing (P80) 115 mm. The jaw crusher product is fed to a gyratory crusher that reduces the ore down to P100 60 mm, P80 32 mm. The gyratory crusher discharge is screened and the oversize sent to the second gyratory crusher. The crusher product is returned to the screen, putting the gyratory crusher in closed circuit with the screen.
- Crushing generates a P100 of 30 mm to support the SAG mill feed rate of 185 dmt/hr. Crushed ore is conveyed to a conical stockpile, which feeds the mill via a single reclaim apron feeder.
- 670 kW SAG mill, 5.03 m diameter with 1.52 m EGL.
- Twin 670 kW ball mills each 3.20 m diameter with 3.66 m EGL, in closed circuit with hydrocyclones, grinding to a product size of nominally 80% passing (P80) 250 µm.
- Ball Mill 2 feeds a Knelson concentrator to concentrate any free gold.
- Bulk rougher/scavenger flotation consisting of three 40 mÑ forced air tank flotation cells and four 15 m^3 cells retrofitted of tank cell 20 mechanisms.
- A rougher concentrate bypass system is available to divert a portion of the concentrate from the cleaner/scavenger cells to the concentrate thickener, thus increasing the capacity of the cleaner/scavenger cells and improving recovery.
- As part of Phase V/VI, a 220 kW vertical stirred mill rougher/scavenger concentrate regrinding system will be installed, grinding to a product size of nominally 80% passing (P80) 80 µm.
- Cleaner 1 flotation consisting of four 10 m^3 forced air tank flotation cells.
- Cleaner 2 flotation consisting of two 2.8 m^3 mechanical flotation cells.
- Cleaner 3 flotation consisting of four 2.8 m^3 mechanical flotation cells.
- Cleaner 2 flotation consisting of three 10 m^3 tank cells.
- Cleaner 3 flotation consisting of two, 10 m^3 cells to increase capacity.
- Final cleaner concentrate thickening in a 6 m diameter high-rate thickener.
- Concentrate thickened slurry filtration in a ceramic disk filter.
- Flotation tailings thickening in a 9.1 m diameter high-rate thickener to an underflow density of 50% solids.
- Tailings deposition, from the tailings thickener underflow, to the Main (subsequently Area 2) pit.

- Plant reagent preparation and distribution systems.
- Raw process plant water supply from the existing site water storage facility reticulated throughout the plant as required.
- Process water dam and distribution system for reticulation of process water throughout the plant as required per the existing facilities. Process water is supplied from water reclaimed from tailings deposition in the Minto Main pit, from process operations and site run-off with raw water used as make-up water as required.
- Plant, instrument and flotation air services and associated infrastructure.

3.1.1 Crushing Facilities and Sequence

Run-of-mine ore is first passed through a three-stage mobile crushing circuit located outdoors on a pad south of the main process plant and is operated by a contractor. Ore is first loaded into a hopper using a front-end loader. A grizzly screen over the hopper rejects boulders larger than the crusher opening; these are moved aside and broken using an excavator-mounted hydraulic rock-breaking tool.

The primary crusher is a 40' x 50' jaw crusher. 100% of the jaw crush product is then fed directly to the secondary gyratory crusher and crushed to a nominal 80% passing 32 mm. Undersize from the secondary crusher is fed onto a thrapple deck vibrating screen. The oversize from the screen reports to the secondary gyratory crusher which is in closed loop with the screen, and the undersize reports to the feed stockpile. Minto loader transfers the crushed feed to a feeder hopper which reports to the existing stockpile stacking conveyor.

Crusher performance has a marked effect on the SAG throughput and a fines content of 100% is needed to maximize throughput.

To ensure that dust from the two crushers is adequately managed, dust suppressants and other engineered mitigations are applied.

The contractor crusher circuit is equipped with nozzles to apply a dust suppressant (currently using water in warm days and a blend of water and glycerin in winter months) at various points of the crushing circuit. The stacker conveyor which feeds the live pile, was fitted with a telescoping chute in 2014 to decrease fugitive dust from the crushing sequence.

The crushed ore is transported into the mill by a conveyor underneath the live pile.

3.1.2 Grinding Circuit

The grinding circuit comprises of the SAG mill (16.5' D x 5.0' L), and two grate discharge ball mills (10.5' D x 12' L) in parallel. All three mills have 900 HP motors. The limiting factor in increasing tonnage is the SAG mill. The SAG has a reverse spiral and a trommel screen with 25mm openings. Minto has been able to increase tonnage thru the SAG mill by pre-crushing ore completed by a contractor on-site. To compensate for the coarser material feeding the ball mills, the steel charge is 50% 3" balls and 50% 2" balls. The power draw on the mills will also be increased to closer to maximum available power draw of 900HP.

Table 3-1: Grinding Media Consumption

Mill	Diameter	Type	Plant Consumption Rate (kg/t)
SAG Mill	76 mm	Forged	0.48
Ball Mill	76 mm	Forged	0.35
Ball Mill	50 mm	Forged	0.30

3.1.3 Flotation Circuit

The flotation circuit consists of three 40 cubic meter rougher flotation cells, four 14.4 cubic meter scavenger flotation cells, four 10 cubic meter first cleaner cells, and six 2.8 cubic meter final cleaner mechanical cells. Future opportunities include installing a Jamieson cell as a rougher-by pass system which will divert a portion of the concentrate from the cleaner/scavenger cells to the concentrate thickener thus increasing capacity of the cleaner/scavenger cells and improving recovery. Other plans include a second stage of cleaner flotation cells as well as replacing the final cleaners with two tanks cells.

3.1.4 Concentrate

The concentrate thickener is a 20 ft high rate thickener. The concentrate is dewatered using a Larox ceramic filter. Depending on slurry density, dewatering rate varies from 25-30 tonnes per hour with a moisture content of 8 - 11 %.

3.1.5 Tailings Disposal

At this time, the tailings are thickened to 58% solids in a 13.5 meter diameter thickener manufactured by Westpro. Tailings slurry is pumped from the bottom of the thickener out to the Main Pit for final deposition. Supernatant water off the top of tails thickener overflows into a process water tank to be recycled through the mill flowsheet. Supernatant water at the Main Pit is pumped backed to the mill to be recycled as both process water and fresh water.

Prior to November 2012, tailings slurry from the bottom of the tails thickener was pumped to a stock tank for temporary storage. Five Lasta 1500x1500 pressure filters were used to dewater the tailings. The filters are fully automatic and produce an average of 6.5 tonnes tailings per cycle at 16% moisture. Cycle times are between 8.5 and 9 minutes, giving each filter a capacity near 1,000 tonnes per day. Filtered tails were conveyed to the dry stack tailings storage facility and trucked to the dry stacked tailings area.

Minto discontinued dry stacking of tailings in 2012 and has since followed an in-pit tailings deposition plan.

While Minto does not intend to dry stack tailings as part of the Phase V/VI plan, the facilities will remain in place for consideration in future tailings disposal options.

3.1.6 Reagent Handling and Preparation

Reagent consumptions vary according to metallurgical and production parameters. Handling and preparation are done in accordance with the MSDS (material safety data sheets) and other guidance by the supplier. Reagents are appropriately stored and handled to ensure a low potential for an environmental or health and safety risk. Processing reagents are provided in Table 3-2.

Table 3-2: Processing Reagents

Reagent
Flotation Collector (PAX or KAX
Flotation Frother (MIBC)
Filtration Nitric Acid
Flotation PPG
Flocculant (AE4270)
Concentrate Flocculant (AE4330)
Sodium Sulphide
Hydrated Lime
Concentrate dewatering aid (Polyclear 3180C)

4 Concentrate Production

Daily, monthly and annual production rates, metal recoveries and concentrate grades for 2016 are summarized in Table 4-1. Rates similar to those summarized are expected in subsequent years of milling.

Table 4-1: Expected Recoveries and concentrate grades (example based on 2016 results)

Description	Units		Units		Units	
Year		2016		2016		2016
Period		Daily		Monthly		Annually
Tonnes Milled	Dmt	4200	Dmt	124272.2	Dmt	1491266
Mill Feed Rate	Dmt/cd	4200	Dmt/cd	4200	Dmt/cd	4200
Operating Time	%	79.6	%	79.6	%	79.6
Mill Feed Rate	Dmt/h	175	Dmt/h	175	Dmt/h	175
Copper Head Grade	%	2.17	%	2.17	%	2.17
Copper Recovery	%	90.3	%	91.3	%	90.3
Gold Recovery	%	66.4	%	66.4	%	66.4
Silver Recovery	%	99.4	%	99.4	%	99.4
Copper Grade	%	49.6	%	49.6	%	49.6
Gold Grade	g/t	19.9	g/t	19.9	g/t	19.9

Silver Grade	g/t	174.5	g/t	174.5	g/t	174.5
Copper Concentrate						
Concentrate mass	Dmt	245	Dmt	6935	Dmt	70349
Copper Recovered	Dmt	108.4	Dmt	1837.04	Dmt	31426
Copper Recovered	Klb	239	Mlb	4.1	Mlb	69.3
Gold Recovered	Kg	4.2	Kg	77.9	Kg	1229
Silver Recovered	Kg	38.1	Kg	683	Kg	11048
Knelson Concentrate						
Concentrate Mass	Kg	334.6	Mt	6.8	Mt	81.6
Gold Grade	g/t	4404	g/t	4404	g/t	4404
Gold Mass	g	1450	kg	30	kg	359.5

5 Concentrate Storage and Haulage

The Minto Mine is accessible from Whitehorse, Yukon Territory, by means of the Klondike Highway (YG Highway No. 2) to Minto Crossing (240 km). Passage across the Yukon River can be made by barge in the summer or by ice bridge in the winter. A 28 km long, 10 m wide gravel access road provides access from the west side of the Yukon River to the project site. The highway, river crossing and gravel access road are suitable for heavy transport traffic. The barge has a 75,000 kg (165,000 lb) net capacity. B-train transport trailers are transported across the river one at a time.

The concentrate storage shed on site is capable of holding 18,000 tonnes of concentrate. Shipping from site stops in the fourth quarter, while the Yukon River freezes up and the ice bridge is built, and in the second quarter, for spring thaw.

Concentrate trucks are covered with tarps after loading at the mine to ensure concentrate dust does not escape during transport. An average of three to five concentrate trucks leave the mine site daily when the barge or ice bridge is operational. During the four to six week winter ‘freeze-up’ and spring ‘break-up’ periods on the Yukon River, when the barge and ice bride are not operational, concentrate is stored to be transported later. Gold concentrate is packaged in 1 cubic meter supersacs and shipped offsite in 20 foot sea containers. All concentrate produced at the mine is shipped to a port in Skagway, Alaska for further transport by ship.

6 References

Minto Explorations Ltd. . (2018a). Recl*amation and Closure Plan 2018-01.* Minto Mine.

Minto Explorations Ltd. (2018b). Minto Mine Water Management Pan.

Minto Explorations Ltd. (2018c). Tailings Management Plan.

Yukon Government. (2013, August). *Plan Requirement Guidance for Quartz Mining Projects.* From http://www.yukonwaterboard.ca/forms/quartz/Plan%20Requirement%20Guideline%20for%20Quartz%20Mining%20Projects%20-%20August%202013-kh.pdf

Yukon Government. (2003, March 25). Quartz Mining Land Use Regulations O.I.C. 2003/64. Whitehorse, Yukon.

Appendix A

Mill Facility Schematics (Water Storage Pond, Water Treatment Plant)

LOCATION	NORTHING	EASTING
A1	6945624.1	386524.3
A2	6945616.5	386526.5
A3	6945589.0	386534.5
A4	6945573.8	386538.9
A5	6945558.7	386543.3
A6	6945514.0	386556.2
A7	6945567.6	386527.8
A8	6945580.7	386551.3
A9	6945607.6	386599.4
A10	6945646.5	386669.0
A11	6945641.1	386672.0
A12	6945651.8	386666.0
A13	6945635.1	386661.3
A14	6945645.9	386655.3
A15	6945603.7	386637.3
A16	6945643.4	386627.7
A17	6945572.3	386608.7
A18	6945631.2	386590.9
A19	6945565.2	386594.1
A20	6945618.9	386578.5
A21	6945514.9	386560.8
A22	6945619.2	386530.6
A23	6945614.4	386522.3
A24	6945512.1	386552.0
A25	6945517.5	386506.5
A26	6945561.5	386485.8
A27	6945537.5	386487.0
A28	6945598.7	386600.6
A29	6945612.8	386594.0
A30	6945526.4	386565.5
A31	6945613.7	386540.1

NOTES:
ALL COORDINATES ARE ZONE 8 NAD83.
DRAWING IS IN METRIC UNITS.

EXTENT OF FINE, INTERMEDIATE AND COARSE FILTERS

APPROXIMATE LOCATION OF ACCESS ROAD

STILLING BASIN (SEE DETAILS ON FIG 4)

SPILLWAY

TOE BERM

TOE OF DOWNSTREAM SHEEL

CREST OF DAM

EXTENT OF FINE, INTERMEDIATE AND COARSE FILTERS

SCALE 1:750 (METRIC)

LEGEND
BOREHOLE LOCATION

ISSUED FOR CONSTRUCTION

PERMIT
PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
SIGNATURE
Date Sept 7/06
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

SEAL
PROFESSIONAL ENGINEER
YUKON
J. RICHARD TRIMBLE
TERRITORY

EBA Engineering Consultants Ltd.

CLIENT: Minto Explorations Ltd.

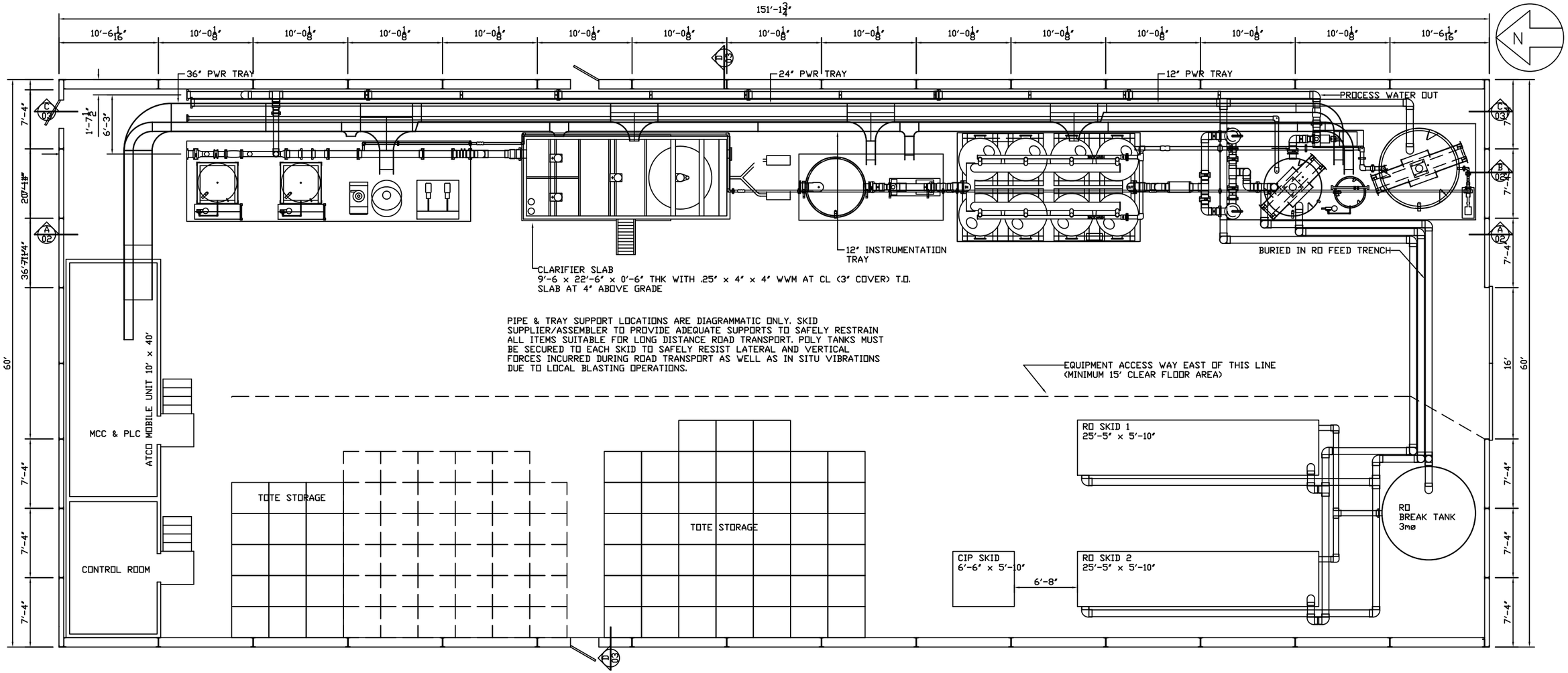
PROJECT: MINTO PROJECT
NORTHWEST OF CARMACKS, YUKON

TITLE: PLAN OF WATER DAM AND SPILLWAY

DWN. JSB/CPC | CHKD. JRT

EBA JOB NO. 1200173 | FILE: 1200173 Figure 2 Dam IFC.dwg | REVISION NO.: 6 | DATE: September 2006

Figure WD2



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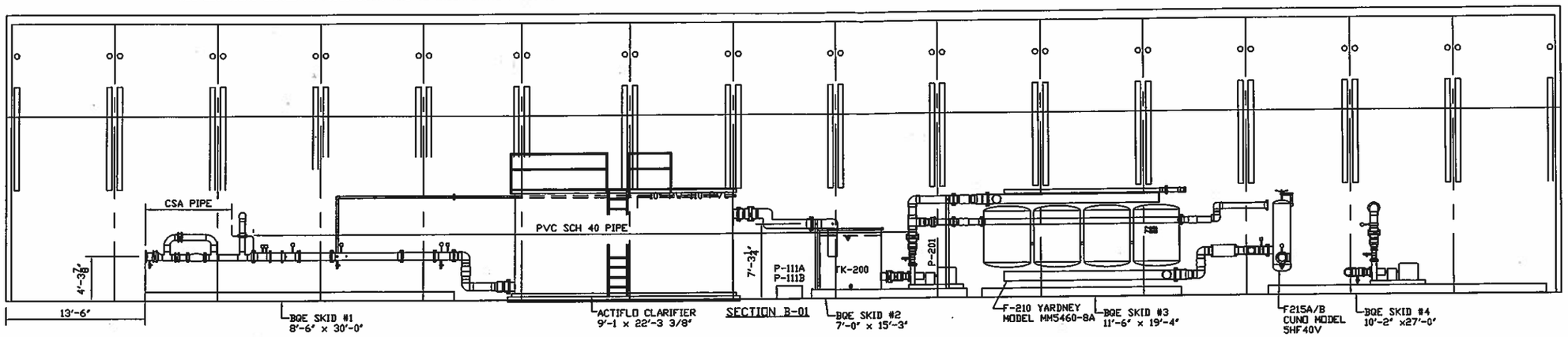
1	ISSUED REVISED FOR CONTRUCTION	06 NOV 09	RZ	
0	ISSUED FOR CONTRUCTION	31 OCT 09	RZ	

APPROVED:	PROJECT TITLE: MINTO MINE – WATER TREATMENT PLANT			
DESIGNED:	DRAWING TITLE: STAGE 1 & 2 – LAYOUT PLAN			
CHECKED:	DIM: IMPERIAL	SIZE: 11X17	DWG. No. MIN-000-GA-01	
DRAWN: RZ	SCALE: 1:135	DATED: 15 SEP 09	SHEET NO: 1/3	REVISION: 2

ALL ELEVATION DIMENSIONS ARE BASED ON 10 1/4" OVERAL SKID DEPTH. ANY VARIATION MUST BE ADJUSTED TO SUIT PROVIDED SKIDS
ALL LOCATIONS LISTED AS FIELD LINKS ARE TO INCORPORATE A SECTION OF FLEXIBLE PIPE ALLOWING MINOR DISPLAEMENT DUE TO SETTLING AND BLASTING



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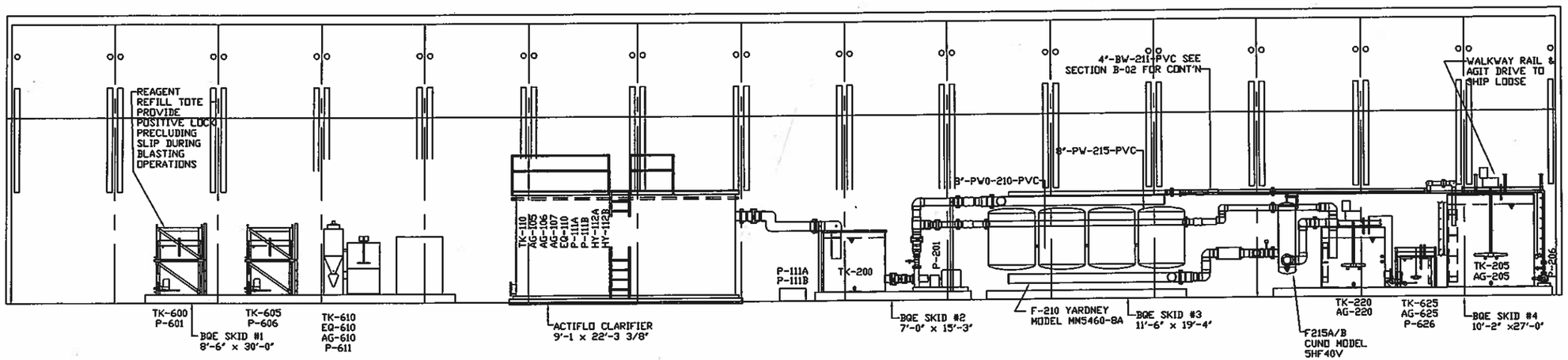

SECTION A-01

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0	ISSUED FOR CONSTRUCTION	31 OCT 09	RZ	

APPROVED
DESIGNED
CHECKED
DRAWN: RZ

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DRAWING TITLE: STAGE 1 & 2 PLANT SECTIONS

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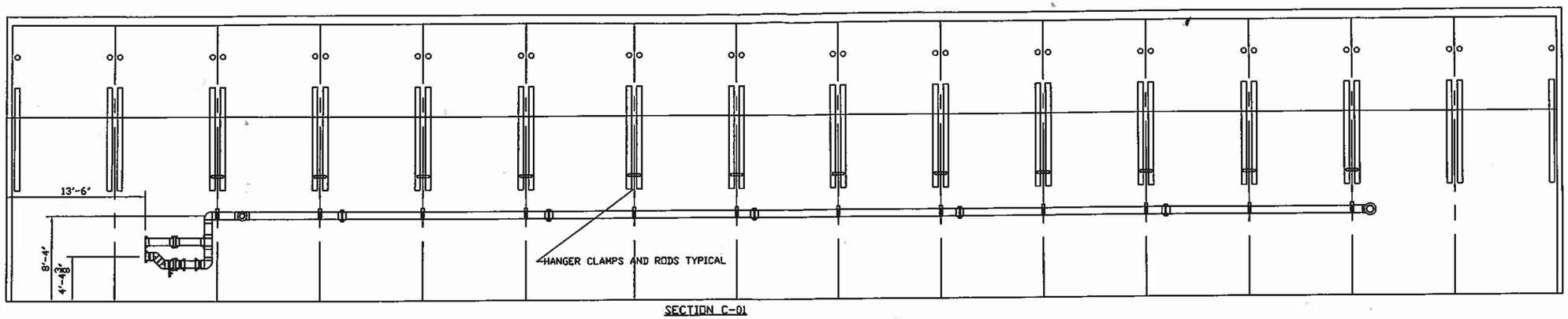

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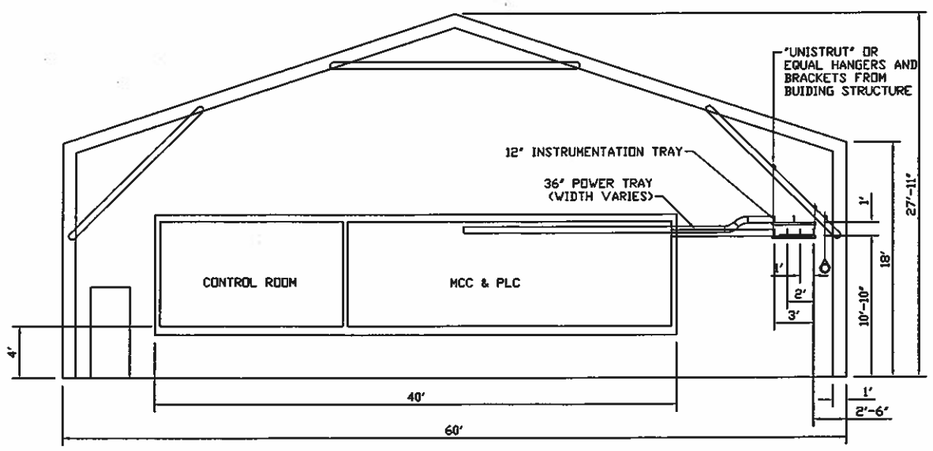

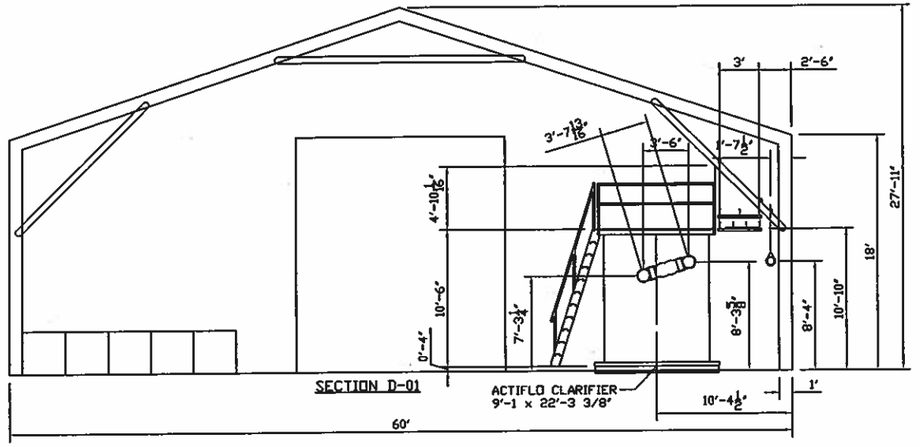

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0	ISSUED FOR CONSTRUCTION	31 OCT 09	RZ	

APPROVED
DESIGNED
CHECKED
DRAWN: RZ

PROJECT TITLE: MINTO MINE – WATER TREATMENT PLANT

DRAWING TITLE: STAGE 1 & 2 PLANT SECTIONS

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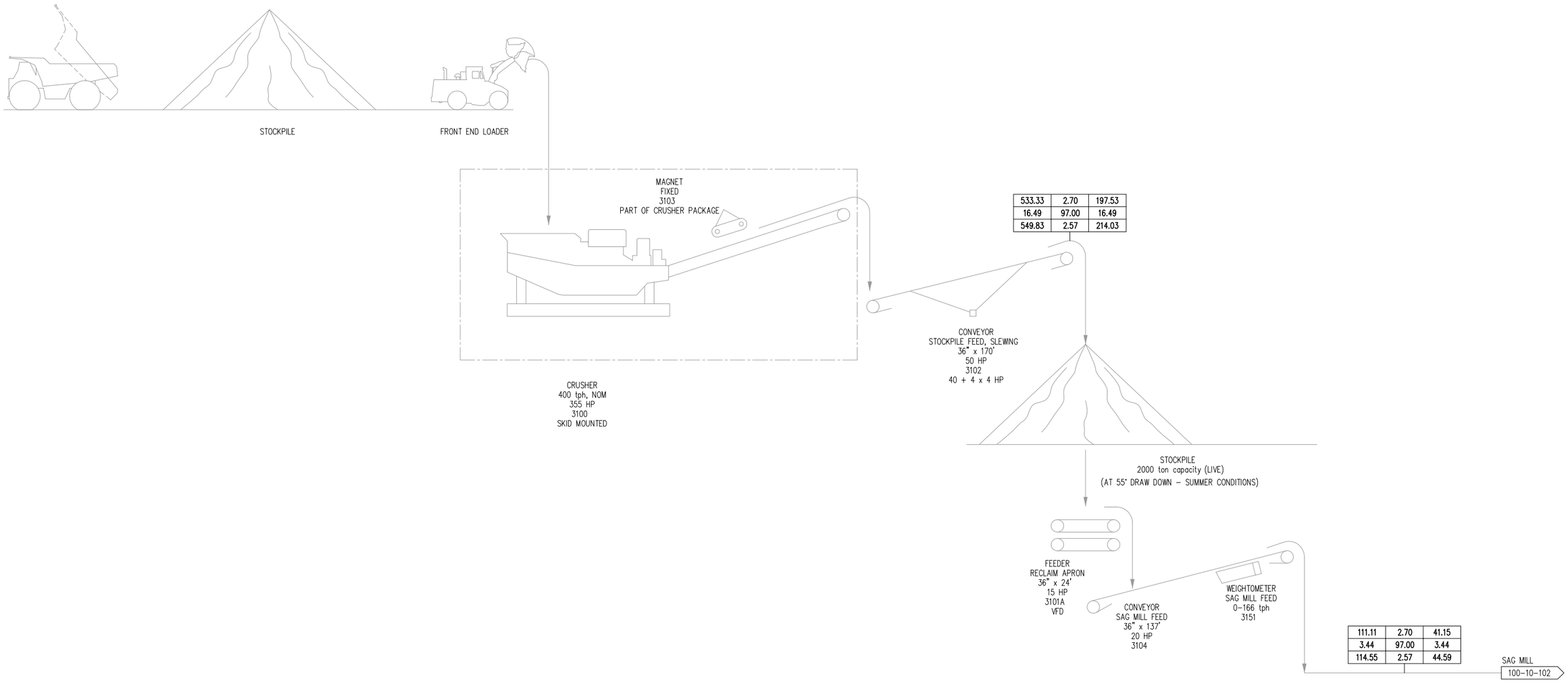
Appendix B

Crushing, Grinding, Flotation, Concentrate, Tailings and Reagent Process Flowsheets



NOTES:

THE FEED RATE TO THE STOCKPILE IS BASED ON 533.3 DRY METRIC TONS PER HOUR OVER A 6 HOUR DAY

THE FEED RATE TO THE SAG MILL IS BASED ON 111.11 DRY METRIC TONS PER HOUR OVER A 24 HOUR DAY

FADED ITEMS ARE EXISTING

LEGEND

t/HR solids	S.G. solids	m^3/HR solids
t/HR water	% solids	m^3/HR water
t/HR pulp	S.G. pulp	m^3/HR pulp

2,646 stpd = 2,400 mtpd

FOR REFERENCE

JUNE 12, 2007

PROJECT BORDER No. BORDER-E 2007/06/13 11:08

DWG. NO. | REFERENCE DRAWINGS

ISSUE

NO	DESCRIPTION	BY	DATE

REVISIONS

NO	DESCRIPTION	BY	DATE
1	RE-ISSUED FOR REFERENCE	JB	07/06/12
0	ISSUED FOR REFERENCE	DB	07/04/20
B	ISSUED FOR REVIEW	JSL	07/03/21
A	ISSUED FOR COMMENT	JSL	07/02/28

PROJECT: RS | PROCESS: AS | CIVIL: | MECH.: BW | STRUCT.: | PIPING: | SERVICES: | ELECT.: | INSTR.:
PROJECT: RS | PROCESS: | CIVIL: LR | MECH.: | STRUCT.: | PIPING: | SERVICES: | ELECT.: | INSTR.:

		DATE
SECTION:	GENERAL	
SCALE:	NONE	
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

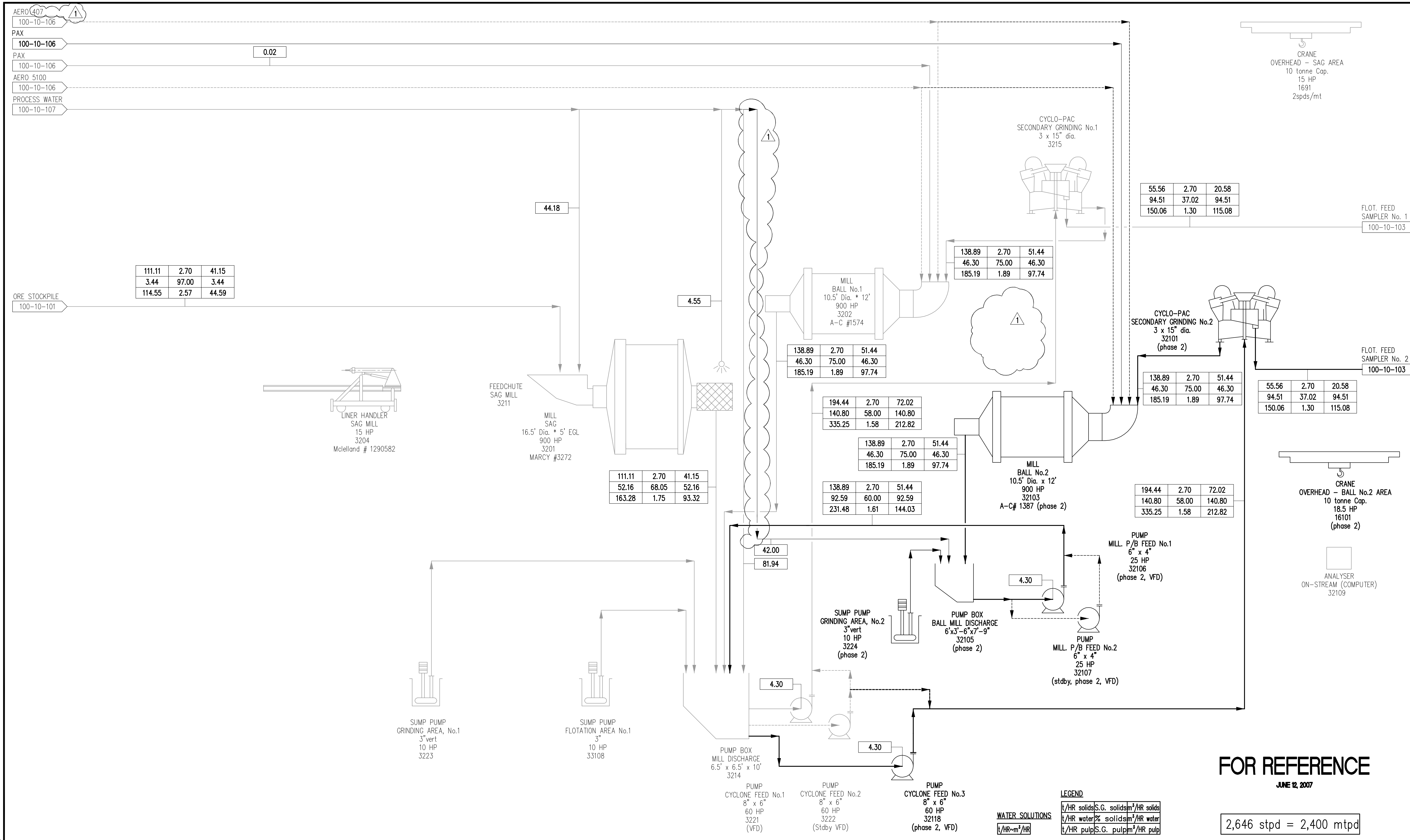
SHERWOOD COPPER CORP.
MINTO EXPLORATIONS Ltd.

HATCH™

MINTO PROJECT

GENERAL – PHASE 2 ORE STOCKPILE AND RECLAIM PROCESS FLOWSHEET No.1

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010101.DWG	320256	100–10–101	1



AERO 407
100-10-106
PAX
100-10-106
0.02
PAX
100-10-106
AERO 5100
100-10-106
PROCESS WATER
100-10-107
CRANE
OVERHEAD - SAG AREA
10 tonne Cap.
15 HP
1691
2spds/mt
CYCLO-PAC
SECONDARY GRINDING No.1
3 x 15" dia.
3215
55.56 2.70 20.58
94.51 37.02 94.51
150.06 1.30 115.08
FLOT. FEED
SAMPLER No. 1
100-10-103
44.18
138.89 2.70 51.44
46.30 75.00 46.30
185.19 1.89 97.74
111.11 2.70 41.15
3.44 97.00 3.44
114.55 2.57 44.59
ORE STOCKPILE
100-10-101
4.55
MILL
BALL No.1
10.5' Dia. * 12'
900 HP
3202
A-C #1574
CYCLO-PAC
SECONDARY GRINDING No.2
3 x 15" dia.
32101
(phase 2)
FLOT. FEED
SAMPLER No. 2
100-10-103
138.89 2.70 51.44
46.30 75.00 46.30
185.19 1.89 97.74
138.89 2.70 51.44
46.30 75.00 46.30
185.19 1.89 97.74
55.56 2.70 20.58
94.51 37.02 94.51
150.06 1.30 115.08
FEEDCHUTE
SAG MILL
3211
194.44 2.70 72.02
140.80 58.00 140.80
335.25 1.58 212.82
LINER HANDLER
SAG MILL
15 HP
3204
Mclelland # 1290582
MILL
SAG
16.5' Dia. * 5' EGL
900 HP
3201
MARCY #3272
138.89 2.70 51.44
46.30 75.00 46.30
185.19 1.89 97.74
MILL
BALL No.2
10.5' Dia. x 12'
900 HP
32103
A-C# 1387 (phase 2)
111.11 2.70 41.15
52.16 68.05 52.16
163.28 1.75 93.32
138.89 2.70 51.44
92.59 60.00 92.59
231.48 1.61 144.03
194.44 2.70 72.02
140.80 58.00 140.80
335.25 1.58 212.82
CRANE
OVERHEAD - BALL No.2 AREA
10 tonne Cap.
18.5 HP
16101
(phase 2)
42.00
81.94
PUMP
MILL. P/B FEED No.1
6" x 4"
25 HP
32106
(phase 2, VFD)
4.30
ANALYSER
ON-STREAM (COMPUTER)
32109
SUMP PUMP
GRINDING AREA, No.2
3"vert
10 HP
3224
(phase 2)
PUMP BOX
BALL MILL DISCHARGE
6'x3'-6"x7'-9"
32105
(phase 2)
PUMP
MILL. P/B FEED No.2
6" x 4"
25 HP
32107
(stdby, phase 2, VFD)
4.30
SUMP PUMP
GRINDING AREA, No.1
3"vert
10 HP
3223
SUMP PUMP
FLOTATION AREA No.1
3"
10 HP
33108
PUMP BOX
MILL DISCHARGE
6.5' x 6.5' x 10'
3214
4.30
PUMP
CYCLONE FEED No.1
8" x 6"
60 HP
3221
(VFD)
PUMP
CYCLONE FEED No.2
8" x 6"
60 HP
3222
(Stdby VFD)
PUMP
CYCLONE FEED No.3
8" x 6"
60 HP
32118
(phase 2, VFD)
LEGEND
t/HR solids S.G. solids m³/HR solids
t/HR water % solids m³/HR water
t/HR pulp S.G. pulp m³/HR pulp
WATER SOLUTIONS
t/HR~m³/HR
FOR REFERENCE
JUNE 12, 2007
2,646 stpd = 2,400 mtpd

THIS DRAWING HAS NOT BEEN PUBLISHED BUT RATHER HAS BEEN PREPARED BY HATCH FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK AND SHALL NOT BE USED FOR ANY OTHER PURPOSE OR FURNISHED TO ANY OTHER PARTY WITHOUT THE EXPRESS CONSENT OF HATCH

3172BSTD.DWG BORREV-0 2007/06/13 11:06

DWG. NO.	REFERENCE DRAWINGS

NO	DESCRIPTION	BY	DATE
	ISSUE		

PROJECT PROCESS CIVIL MECH. STRUCT. PIPING SERVICES ELECT. INSTR.

			NO	DESCRIPTION	BY	DATE
RS AS	BW		1	PW LINE ADDED, PARTICLE SIZE MON. REMOVED	JB	07/06/12
RS	LR		0	ISSUED FOR REFERENCE	DB	07/04/20
			B	ISSUED FOR REVIEW	JSL	07/03/21
			A	ISSUED FOR COMMENT	JSL	07/02/28
				REVISIONS		

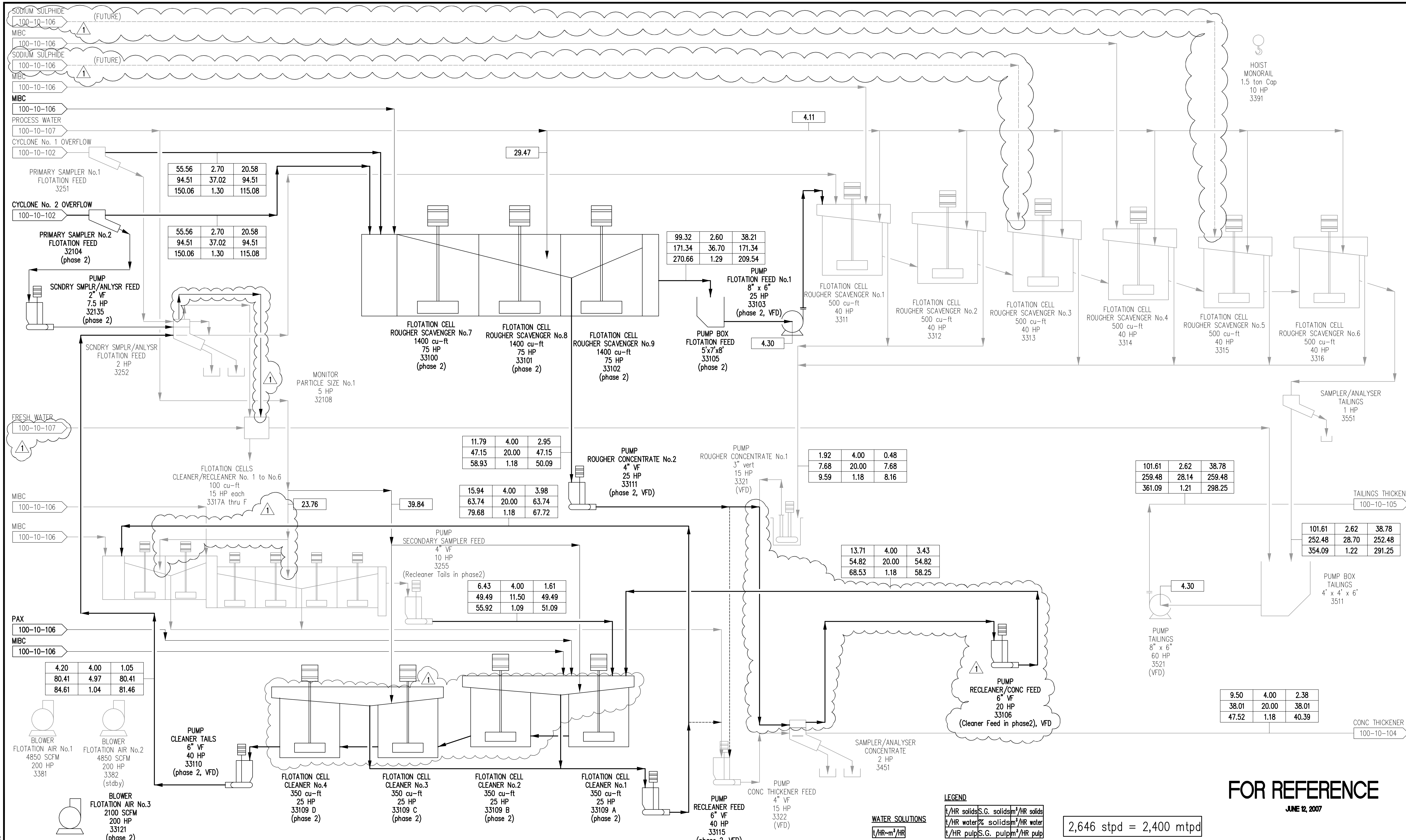
		DATE
SECTION:	GENERAL	
SCALE:	NONE	
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

SHERWOOD COPPER CORP.
MINTO EXPLORATIONS Ltd.
HATCH™

MINTO PROJECT

GENERAL - PHASE 2
GRINDING
PROCESS FLOWSHEET No.2

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010102.DWG	320256	100-10-102	1


SODIUM SULPHIDE
100-10-106
(FUTURE)
MIBC
100-10-106
SODIUM SULPHIDE
100-10-106
(FUTURE)
MIBC
100-10-106
MIBC
100-10-106
PROCESS WATER
100-10-107
CYCLONE No. 1 OVERFLOW
100-10-102
PRIMARY SAMPLER No.1
FLOTATION FEED
3251
CYCLONE No. 2 OVERFLOW
100-10-102
PRIMARY SAMPLER No.2
FLOTATION FEED
32104
(phase 2)
PUMP
SCNDRY SMPLR/ANLYSR FEED
2" VF
7.5 HP
32135
(phase 2)
SCNDRY SMPLR/ANLYSR
FLOTATION FEED
2 HP
3252
MONITOR
PARTICLE SIZE No.1
5 HP
32108
FRESH WATER
100-10-107
55.56 2.70 20.58
94.51 37.02 94.51
150.06 1.30 115.08
55.56 2.70 20.58
94.51 37.02 94.51
150.06 1.30 115.08
29.47
4.11
FLOTATION CELL
ROUGHER SCAVENGER No.7
1400 cu-ft
75 HP
33100
(phase 2)
FLOTATION CELL
ROUGHER SCAVENGER No.8
1400 cu-ft
75 HP
33101
(phase 2)
FLOTATION CELL
ROUGHER SCAVENGER No.9
1400 cu-ft
75 HP
33102
(phase 2)
99.32 2.60 38.21
171.34 36.70 171.34
270.66 1.29 209.54
PUMP
FLOTATION FEED No.1
8" x 6"
25 HP
33103
(phase 2, VFD)
PUMP BOX
FLOTATION FEED
5'x7'x8'
33105
(phase 2)
4.30
FLOTATION CELL
ROUGHER SCAVENGER No.1
500 cu-ft
40 HP
3311
FLOTATION CELL
ROUGHER SCAVENGER No.2
500 cu-ft
40 HP
3312
FLOTATION CELL
ROUGHER SCAVENGER No.3
500 cu-ft
40 HP
3313
FLOTATION CELL
ROUGHER SCAVENGER No.4
500 cu-ft
40 HP
3314
FLOTATION CELL
ROUGHER SCAVENGER No.5
500 cu-ft
40 HP
3315
FLOTATION CELL
ROUGHER SCAVENGER No.6
500 cu-ft
40 HP
3316
HOIST
MONORAIL
1.5 ton Cap
10 HP
3391
SAMPLER/ANALYSER
TAILINGS
1 HP
3551
FLOTATION CELLS
CLEANER/RECLEANER No. 1 to No.6
100 cu-ft
15 HP each
3317A thru F
11.79 4.00 2.95
47.15 20.00 47.15
58.93 1.18 50.09
PUMP
ROUGHER CONCENTRATE No.2
4" VF
25 HP
33111
(phase 2, VFD)
PUMP
ROUGHER CONCENTRATE No.1
3" vert
15 HP
3321
(VFD)
1.92 4.00 0.48
7.68 20.00 7.68
9.59 1.18 8.16
101.61 2.62 38.78
259.48 28.14 259.48
361.09 1.21 298.25
TAILINGS THICKENER
100-10-105
MIBC
100-10-106
MIBC
100-10-106
23.76
39.84
15.94 4.00 3.98
63.74 20.00 63.74
79.68 1.18 67.72
PUMP
SECONDARY SAMPLER FEED
4" VF
10 HP
3255
(Recleaner Tails in phase2)
6.43 4.00 1.61
49.49 11.50 49.49
55.92 1.09 51.09
13.71 4.00 3.43
54.82 20.00 54.82
68.53 1.18 58.25
101.61 2.62 38.78
252.48 28.70 252.48
354.09 1.22 291.25
4.30
PUMP BOX
TAILINGS
4' x 4' x 6'
3511
PUMP
TAILINGS
8" x 6"
60 HP
3521
(VFD)
PAX
100-10-106
MIBC
100-10-106
4.20 4.00 1.05
80.41 4.97 80.41
84.61 1.04 81.46
BLOWER
FLOTATION AIR No.1
4850 SCFM
200 HP
3381
BLOWER
FLOTATION AIR No.2
4850 SCFM
200 HP
3382
(stdby)
BLOWER
FLOTATION AIR No.3
2100 SCFM
200 HP
33121
(phase 2)
PUMP
CLEANER TAILS
6" VF
40 HP
33110
(phase 2, VFD)
FLOTATION CELL
CLEANER No.4
350 cu-ft
25 HP
33109 D
(phase 2)
FLOTATION CELL
CLEANER No.3
350 cu-ft
25 HP
33109 C
(phase 2)
FLOTATION CELL
CLEANER No.2
350 cu-ft
25 HP
33109 B
(phase 2)
FLOTATION CELL
CLEANER No.1
350 cu-ft
25 HP
33109 A
(phase 2)
PUMP
RECLEANER FEED
6" VF
40 HP
33115
(phase 2, VFD)
PUMP
CONC THICKENER FEED
4" VF
15 HP
3322
(VFD)
SAMPLER/ANALYSER
CONCENTRATE
2 HP
3451
PUMP
RECLEANER/CONC FEED
6" VF
20 HP
33106
(Cleaner Feed in phase2), VFD
9.50 4.00 2.38
38.01 20.00 38.01
47.52 1.18 40.39
CONC THICKENER
100-10-104
WATER SOLUTIONS
t/HR~m³/HR
LEGEND
t/HR solids S.G. solids m³/HR solids
t/HR water % solids m³/HR water
t/HR pulp S.G. pulp m³/HR pulp
2,646 stpd = 2,400 mtpd
FOR REFERENCE
JUNE 12, 2007

THIS DRAWING HAS NOT BEEN PUBLISHED BUT RATHER HAS BEEN PREPARED BY HATCH FOR USE BY THE CLIENT SOLELY IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK AND SHALL NOT BE USED FOR ANY OTHER PURPOSE OR FURNISHED TO ANY OTHER PARTY WITHOUT THE EXPRESS CONSENT OF HATCH

PROJECT BORDER No. 2007/06/13 11:06 BORREV-0

DWG. NO.	REFERENCE DRAWINGS

NO	DESCRIPTION	BY	DATE
	ISSUE		

			NO	DESCRIPTION	BY	DATE
RS AS	BW		1	PUMP 33106 ADDED, FLOAT CELL ARR. UPDATED, FUTURE REAGENT AND SAMPLER LINES ADDED	TRN	07/06/12
RS	LR		0	ISSUED FOR REFERENCE	DB	07/04/20
			B	ISSUED FOR REVIEW	JSL	07/03/21
			A	ISSUED FOR COMMENT	JSL	07/02/28
				REVISIONS		

SECTION:	GENERAL	
SCALE:	NONE	DATE
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

SHERWOOD COPPER CORP.
MINTO EXPLORATIONS Ltd.
HATCH™

MINTO PROJECT

GENERAL – PHASE 2 FLOTATION PROCESS FLOWSHEET No.3

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010103.DWG	320256	100-10-103	1

FRESH WATER
100-10-107

NITRIC ACID
100-10-106

DISC FILTER PROCESS WATER
100-10-107

CONCENTRATE
100-10-103

PROCESS WATER
100-10-107

FLOCCULANT
100-10-106

VENDOR PKG

0.42 *

1.67 *

0.17

0.04

0.21

15.8 **

5.22

40.19

PROCESS WATER TANK
100-10-107

9.50	4.00	2.38
38.01	20.00	38.01
47.52	1.18	40.39

THICKENER
CONCENTRATE HIGH RATE
20' dia
5 HP
3411
2
Emerg. Power, hydraulic drive

9.50	4.00	2.38
5.12	65.00	5.12
14.62	1.95	7.49

39.99

9.50	4.00	2.38
5.32	64.12	5.32
14.82	1.93	7.69

SUMP PUMP
CONCENTRATE AREA
3" vert
10 HP
3423

0.20

PUMP
CONCENTRATE THICKENER U'FLOW
3"x2"
5 HP
3421
VFD

STANDPIPE
CONCENTRATE THICKENER O'FLOW
36" dia x 14'-6"
3413

0.20

PUMP
CONCENTRATE THICKENER O'FLOW
3"x2"
5 HP
3424
VFD

FILTER
CONCENTRATE 'CERAMEC' DISC
30 sq. m.
40 HP
3401

TO ATMOS

VENDOR PACKAGE

9.50	4.00	2.38
5.52	63.27	5.52
15.02	1.90	7.89

9.50	4.00	2.38
0.72	93.00	0.72
10.22	3.31	3.09

1.67 *

0.42 *

AGITATOR
CONC STOCK TANK
40 HP
3462
Emerg. Power

TANK
CONCENTRATE STOCK
13.5' dia.x 13.5'
3412

0.20

PUMP
CONCENTRATE FILTER FEED
3"x2"
5 HP
3422
VFD

CONVEYOR
CONCENTRATE DISCHARGE
24" x 38'
15 HP
3402

WEIGHTOMETER
CONCENTRATE
0-15 tph
3491

SURGE PILE

TANK
FILTER DRAIN
7' diax 9'
3495

0.20

PUMP
FILTER DRAIN
3" x 2"
5 HP
3496

FRONT END LOADER

TRUCK SCALE
CONCENTRATE
3490

15,000 tonnes

CONCENTRATE STORAGE

* DENOTES AVERAGE OVER 24 HOURS
** DENOTES FOR FEED DILUTION PURPOSES

WATER SOLUTIONS
t/HR-m^3/HR

LEGEND

t/HR solids	S.G. solids	m^3/HR solids
t/HR water	% solids	m^3/HR water
t/HR pulp	S.G. pulp	m^3/HR pulp

2,646 stpd = 2,400 mtpd

FOR REFERENCE

JUNE 18, 2007

DWG. NO. | REFERENCE DRAWINGS

ISSUE

NO	DESCRIPTION	BY	DATE

REVISIONS

NO	DESCRIPTION	BY	DATE
2	EQUIPMENT DESCRIPTION UPDATED	JB	07/06/18
1	REFERENCES AND FLOWS REVISED AS NOTED	TRN	07/06/12
0	ISSUED FOR REFERENCE	DB	07/04/20

SECTION:	GENERAL	
SCALE:	NONE	DATE
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

SHERWOOD COPPER CORP.
MINTO EXPLORATIONS Ltd.

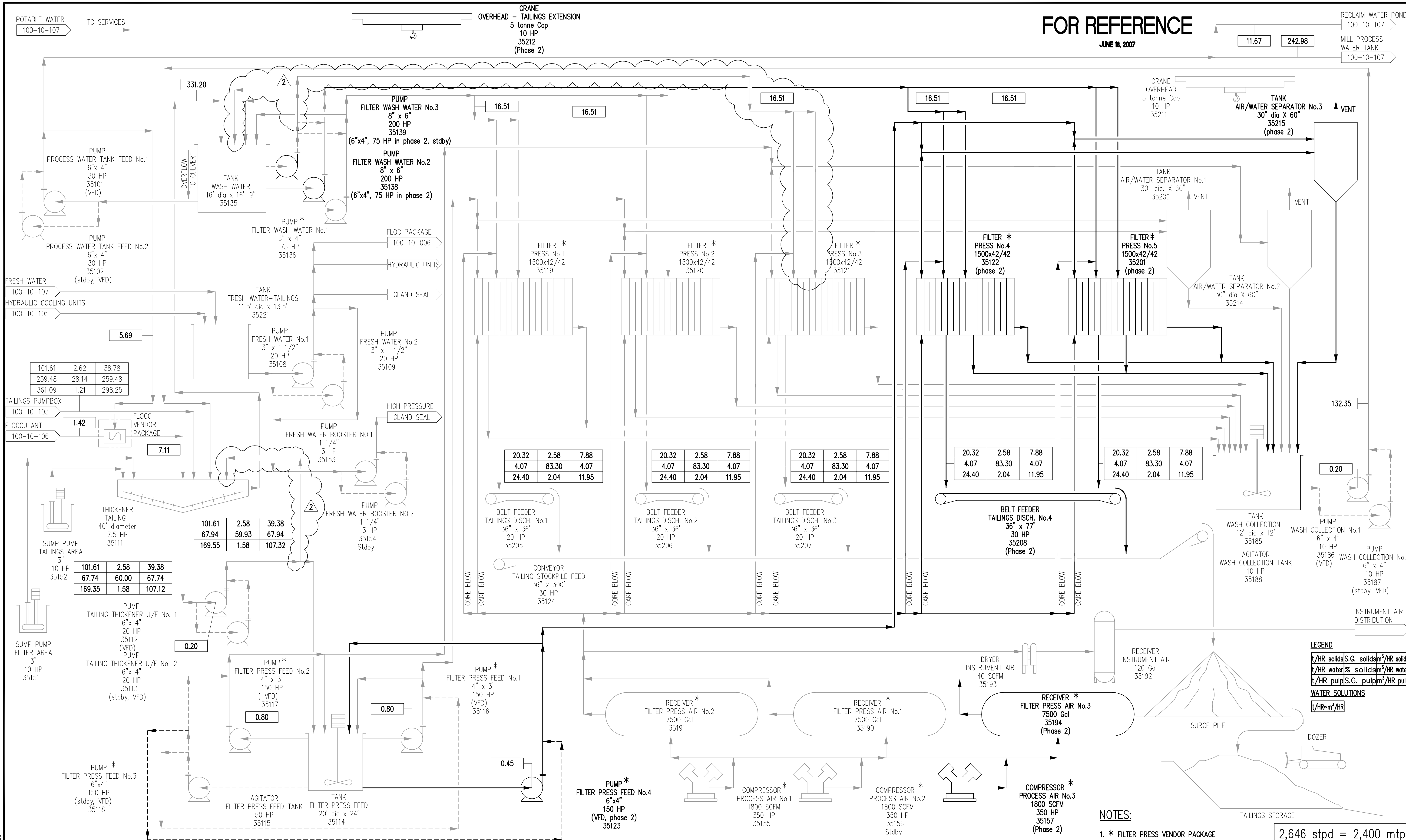
HATCH™

MINTO PROJECT

GENERAL – PHASE 2
DEWATERING, FILT. & CONC. STOR.
PROCESS FLOWSHEET No.4

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010104.DWG	320256	100-10-104	2

PROJECT BORDER No. 2007/05/19 07.26



NOTES:

1. * FILTER PRESS VENDOR PACKAGE

2,646 stpd = 2,400 mtpd

PROJECT BORDER No. 2007/06/19 07:25 BORREV-0

DWG. NO.	REFERENCE DRAWINGS

NO	DESCRIPTION	BY	DATE
	ISSUE		

			NO	DESCRIPTION	BY	DATE
RS AS	BW		2	RECIRC. & PUMPED LINE TO FILTER 3 UPDATED	JB	07/06/18
RS AS	BW		1	FLOWS REVISED AS NOTED, CRANE WAS 5HP	TRN	07/06/12
RS	LR		0	ISSUED FOR REFERENCE	DB	07/04/20
				REVISIONS		

		DATE
SECTION:	GENERAL	
SCALE:	NONE	
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

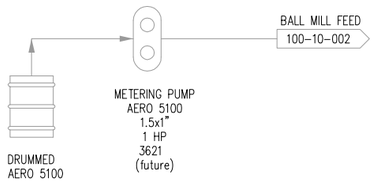
SHERWOOD COPPER CORP.
MINTO EXPLORATIONS Ltd.

HATCH™

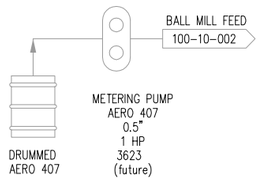
MINTO PROJECT

GENERAL – PHASE 2
TAILINGS
PROCESS FLOWSHEET No.5

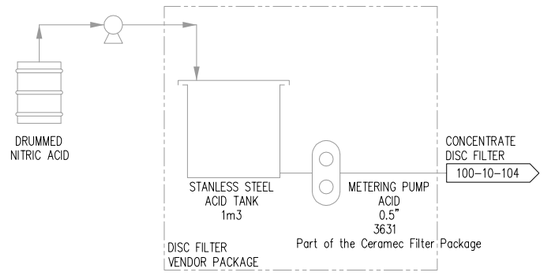
FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010105.DWG	320256	100-10-105	2



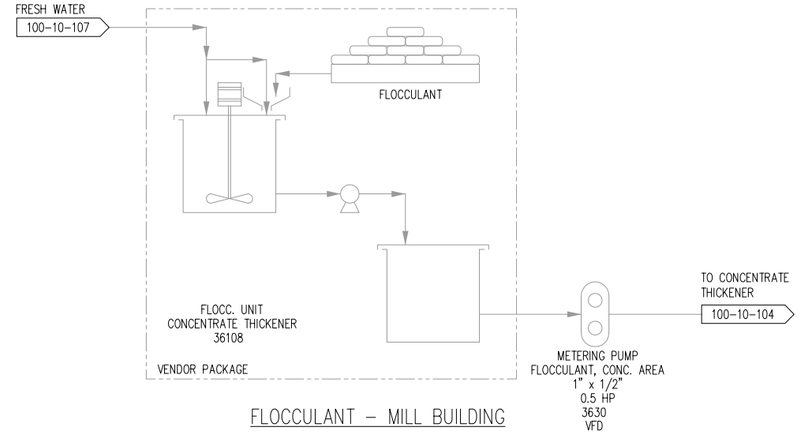
AERO 5100 PROMOTER
(FUTURE)



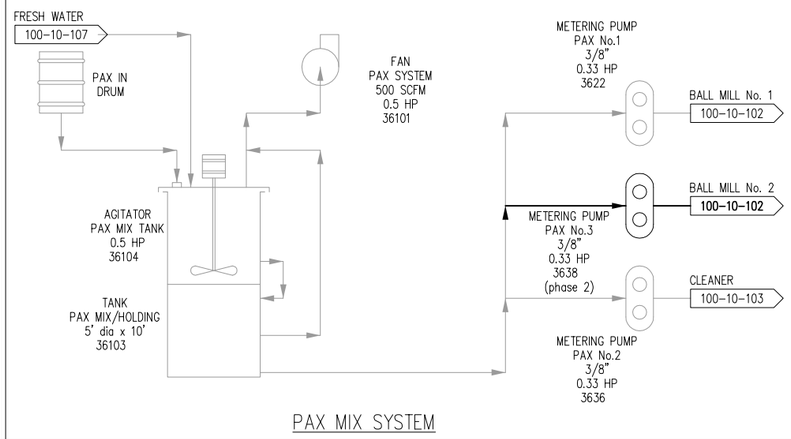
AERO 407 PROMOTER
(FUTURE)



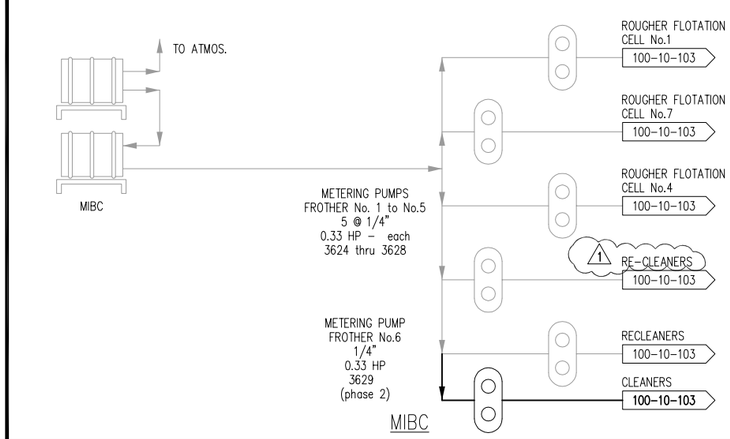
NITRIC ACID



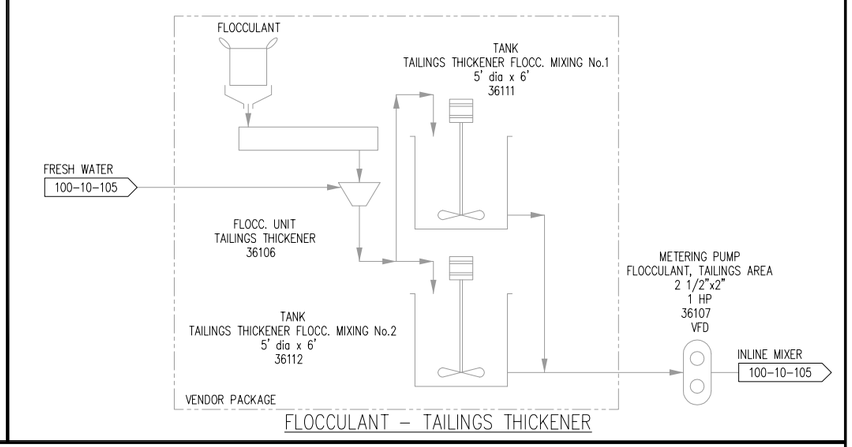
FLOCCULANT – MILL BUILDING



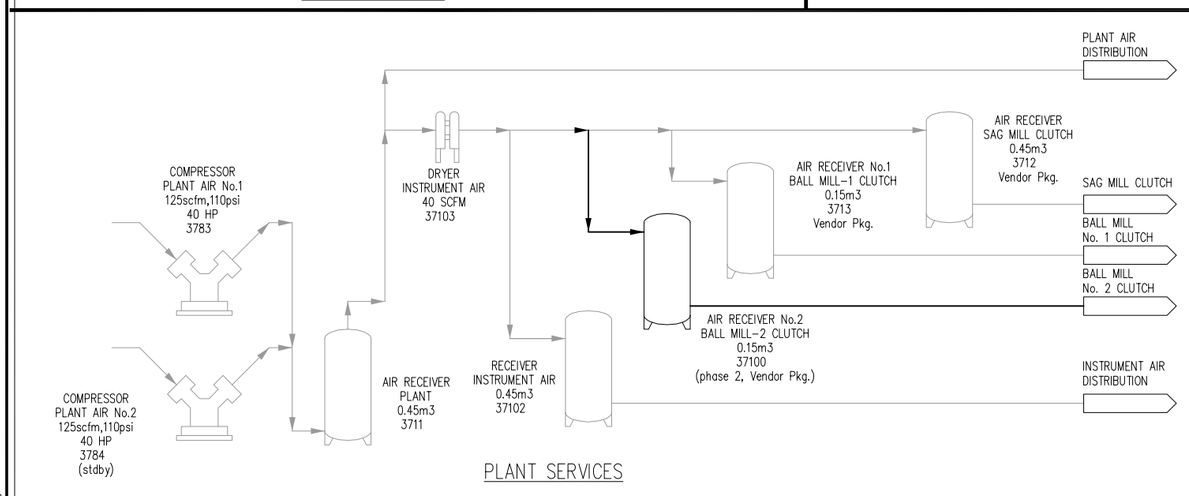
PAX MIX SYSTEM



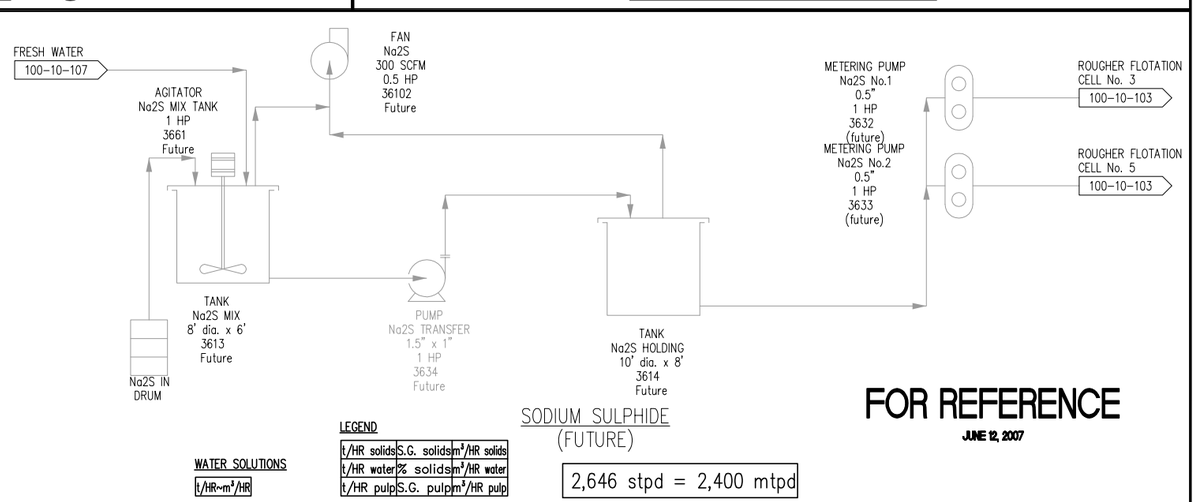
MIBC



FLOCCULANT – TAILINGS THICKENER



PLANT SERVICES



SODIUM SULPHIDE
(FUTURE)

2,646 stpd = 2,400 mtpd

FOR REFERENCE
JUNE 12, 2007

PROJECT BORDER No. 2007/06/13 11:03
PROJECT BORDER 6

DWG. NO. | REFERENCE DRAWINGS

ISSUE

NO	DESCRIPTION	BY	DATE

REVISIONS

NO	DESCRIPTION	BY	DATE
1	REFERENCE REVISED	TRN	07/06/12
0	ISSUED FOR REFERENCE	DB	07/04/20
B	ISSUED FOR REVIEW	JSL	07/03/21
A	ISSUED FOR COMMENT	JSL	07/02/28

PROJECT | PROCESS | CIVIL | MECH. | STRUCT. | PIPING | SERVICES | ELECT. | INSTR.
RS AS BW
RS LR

SECTION:	GENERAL	
SCALE:	NONE	DATE
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

SHERWOOD COPPER CORP.
MINTO EXPLORATIONS Ltd.
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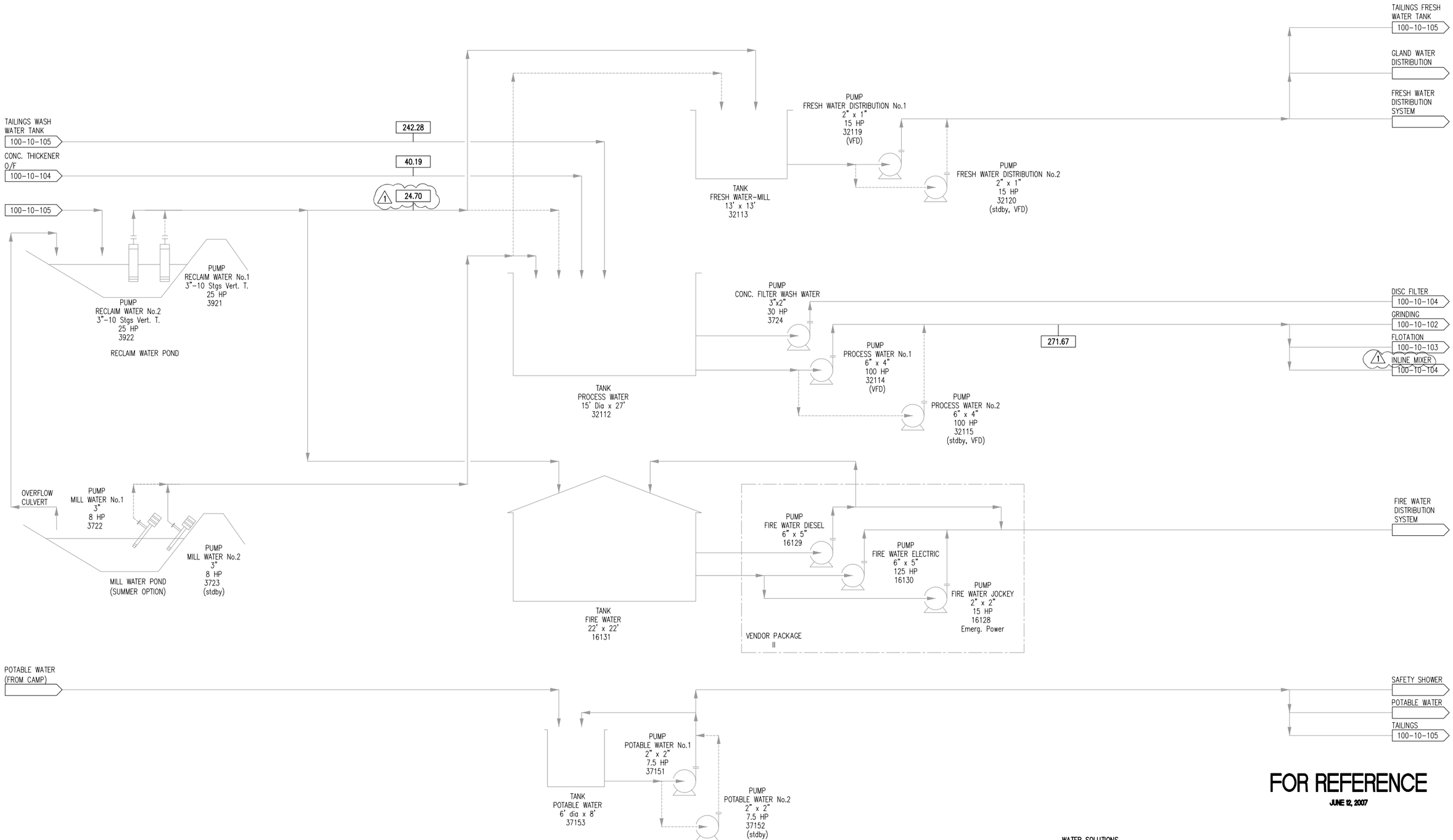
MINTO PROJECT

GENERAL – PHASE 2
REAGENTS AND UTILITIES
PROCESS FLOWSHEET No.6

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010106.DWG	320256	100-10-106	1



FOR REFERENCE

JUNE 12, 2007

WATER SOLUTIONS

t/HR~m³/HR

2,646 stpd = 2,400 mtpd

PROJECT BORDER No. BORDER 6-9 2007/06/13 11:03

DWG. NO. | REFERENCE DRAWINGS

ISSUE

NO	DESCRIPTION	BY	DATE

REVISIONS

NO	DESCRIPTION	BY	DATE
1	REFERENCE WAS FILTRATION, FLOW REVISED	TRN	07/06/12
0	ISSUED FOR REFERENCE	DB	07/04/20
B	ISSUED FOR REVIEW	JSL	07/03/21
A	ISSUED FOR COMMENT	JSL	07/02/28

SECTION:	GENERAL	
SCALE:	NONE	DATE
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

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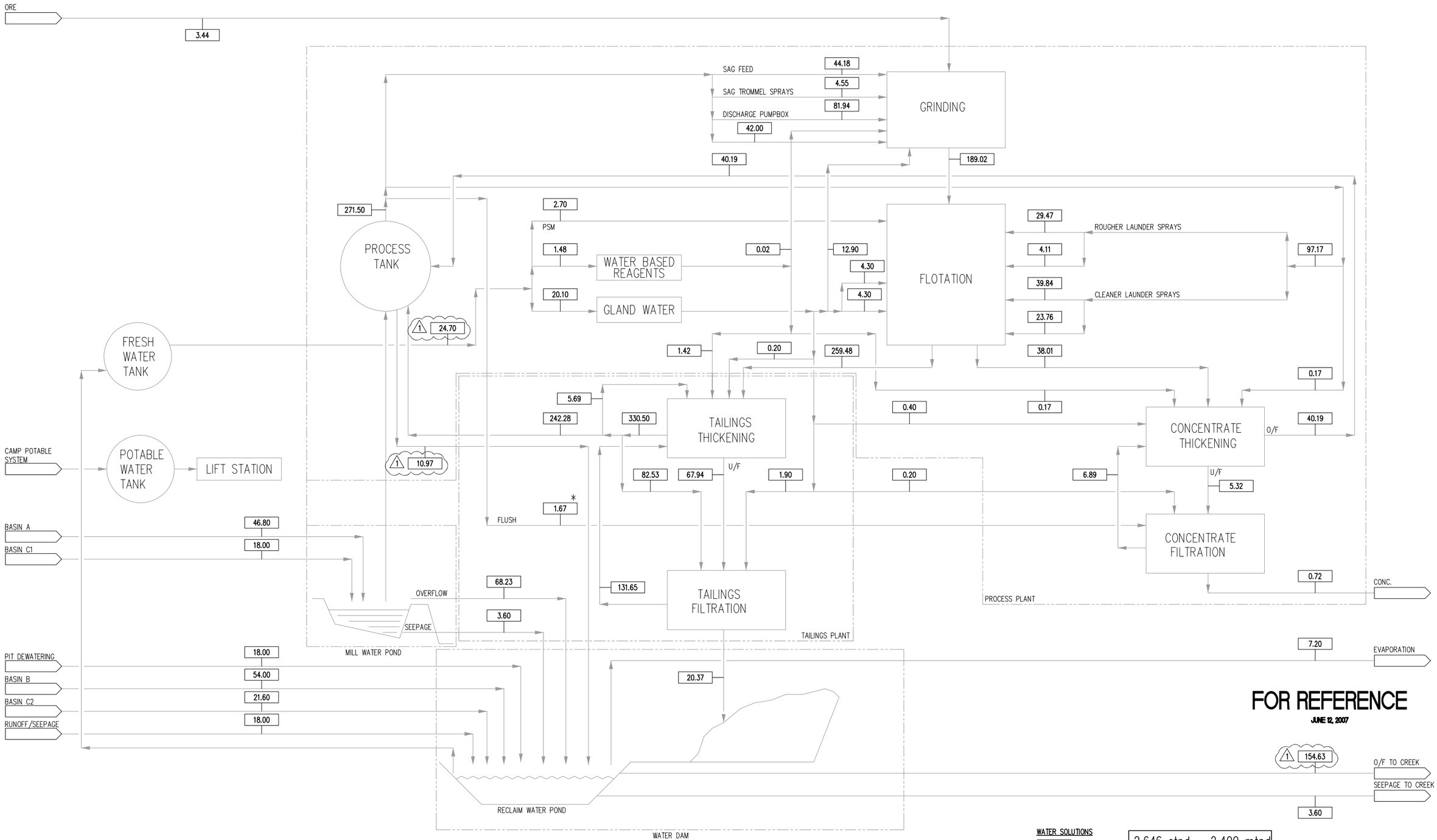
MINTO PROJECT

GENERAL- PHASE 2 WATER SYSTEM PROCESS FLOWSHEET No.7

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010107.DWG	320256	100-10-107	1



FOR REFERENCE

JUNE 12, 2007

WATER SOLUTIONS

t/HR~m³/HR

2,646 stpd = 2,400 mtpd

PROJECT BORDER No. 2007/06/13 11:02

DWG. NO. | REFERENCE DRAWINGS

PROJECT | PROCESS | CIVIL | MECH. | STRUCT. | PIPING | SERVICES | ELECT. | INSTR.

NO	DESCRIPTION	BY	DATE
	ISSUE		

NO	DESCRIPTION	BY	DATE
1	FLOWS UPDATED AS NOTED	TRN	07/06/12
0	ISSUED FOR REFERENCE	DB	07/04/20
B	ISSUED FOR REVIEW	JSL	07/03/21
A	ISSUED FOR COMMENT	JSL	07/02/28

REVISIONS

SECTION:	GENERAL	
SCALE:	NONE	DATE
DESIGN. BY	HT	FEB/07
DRAWN BY:	JSL	FEB/07
CHECK. BY	AS	FEB/07
APP. BY:	RS	APR/07

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MINTO PROJECT

GENERAL WATER BALANCE PROCESS FLOWSHEET No.8

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
10010108.DWG	320256	100-10-108	1