Report to:

PACIFIC BOOKER MINERALS INC.

Morrison Copper/Gold Project
Feasibility Study
Volume 1 – Process Plant, Mining and Infrastructure

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PACIFIC BOOKER MINERALS INC.

MORRISON COPPER/GOLD PROJECT FEASIBILITY STUDY VOLUME 1 – PROCESS PLANT, MINING AND INFRASTRUCTURE

FEBRUARY 2009

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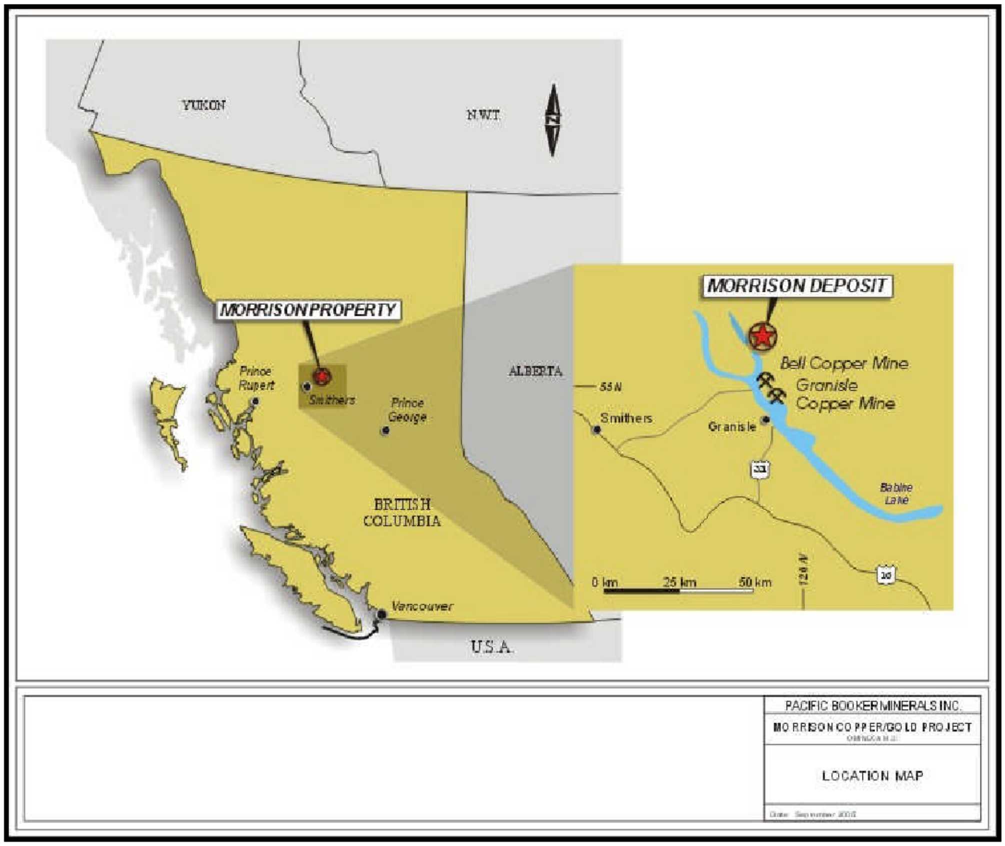
EXECUTIVE SUMMARY

Pacific Booker Minerals Inc. (PBM), a publicly traded company, owns the mineral rights to the Morrison property located in Central British Columbia, Canada. The property is approximately 65km Northeast of Smithers within 30km of two former copper/gold/silver producing mines, Bell and Granisle. Figure 1 shows the location of Morrison Property.

Figure 1 – Morrison Project Location Map 1



The Morrison Property has the advantage of existing regional infrastructure including a deep-sea shipping terminal at the port of Stewart, a high speed forestry road network, hard surface highways, nearby electrical high voltage power and full service communities within daily commuting distance from the Project site and a regional airport at Smithers.

The Morrison Property has a porphyry copper/gold/molybdenum deposit for which a 43-101 compliant mineral Resource Estimate was completed May 4, 2007. The measured/indicated mineral resource at a 0.30CuEq cut-off is 206,869,000 tonnes grading 0.46% Cu equivalent consisting of 0.39% Cu, 0.20g Au/t and 0.005% Mo. The contained metal is 1,787,780,000 lbs. Cu, 1,306,300 oz Au and 20,676,000 lbs. Mo.

In addition to the above, the inferred resource is 56,534,000 tonnes grading 0.47% Cu equivalent. This consists of 0.40% Cu, 0.21gAu/t and 0.005% Mo. The contained inferred metals are 494,720,000 lbs. Cu, 374,400 oz Au and 6,231,000 lbs. Mo.

The mineable reserves, using a 0.2% Cu mining grade cut-off, are estimated to be 224 million tonnes.

Project Conditions and Standards

The site climatic conditions are extreme with a record high temperature of 35.8°C and a record low temperature of -43.9°C. The humidex and wind chill temperatures have reached 37.1°C and -50.1°C respectively. Daily winter precipitation has been recorded as high as 60cm of snow, a daily rain fall of 60mm has also been recorded. The average relative humidity in the area is 85.9%.

The project site elevation ranges from approximately 736m above sea level at Morrison Lake to 1,372m above sea level at the top of the surrounding hills.

The proposed mine is an open pit mine utilizing conventional truck and shovel equipment. The ore production rate will be 30,000 tonnes per day or approximately 11 million tonnes of ore per year. The proposed treatment process is a conventional crushing, grinding and flotation system resulting in the production of approximately 155,000 tonnes of concentrate per year containing copper and gold. A separate molybdenum concentrate will be produced. Construction is expected to commence in 2009 with production in 2012.

Metallurgy / Processing

Metallurgical test-works carried out indicates that the metallurgy of the Morrison deposit is relatively straightforward and that good copper recoveries and acceptable concentrates can be achieved.

Ore will be processed through a conventional milling circuit consisting of a primary crusher, secondary cone crusher followed by High Pressure Grinding Rolls (HPGR), primary ball mills and flotation circuit including regrinding tower mills. Copper will be concentrated by flotation in large tank cells then cleaned and filtered to achieve acceptable shipping moistures without thermal drying. A molybdenum concentrate will be achieved from the ore zones containing significant amount of molybdenite.

The plant site will include the following components:

- A 30,000 tonne/day processing plant (mill) for production of copper/gold/molybdenum concentrate.
- Associated mine facilities including:
  - Lab/Assay building
  - Concentrate load out facilities
  - Mobile Equipment Shops, Wash and Tire Change
  - Plant Maintenance Shops
  - Warehouse
  - Equipment lay down areas
  - Mine dry – adequate for shift changes the facility will be designed for both men and women
  - Administration and security buildings – providing adequate space for the project offices of management, administration and engineering personnel
- Sewage and waste water management facilities.
- Explosives Storage and Mixing Plant – explosives will be stored at the site and the supply of explosives will be contracted out to an explosives supplier. Bulk explosives will be mixed on the site.
- Fuel Storage will consist of above ground tanks and containment. Access to the site is available at all times, thus the storage facilities will be minimized.

Overburden and Organic Bearing Material Storage

An estimated 15 million tonnes of overburden will be removed during mining. Overburden comprised of glacial till will be used in dam and road construction. Excess overburden and organic bearing materials will be stored for use in reclamation or permanent disposal.

Borrow Pits

Where haul distances are excessive, borrow pits will provide supplemental gravel and till for dam and road construction. Borrow pits will also be used to provide gravel for concrete.

Waste Rock Disposal

A total of 169 million tonnes of waste will be generated by mining activity over the mine life. The selected management strategy is that PAG waste rock will be disposed of immediately to the north and east of the open pit.

LOW GRADE ORE STORAGE

To optimize mill operations low grade ore will be stored in a stockpile for use during the mine life when sufficient newly mined ore is not available and for milling after mine closure. A maximum of 37 million tonnes of low-grade ore will be stored.

TAILINGS STORAGE FACILITY

Tailings will be stored in a tailings storage facility behind secure and fully engineered dams. Locations were investigated to determine the best location where tailings could be stored.

ROAD AND INTERCONNECTING CORRIDORS

Mine hauls roads will be required for the movement of ore and waste. Also, interconnecting corridors between the mill site and tailings storage facility will be used for tailings transport, process reclaim water, vehicle access road and power line.

OFF SITE INFRASTRUCTURE

The Morrison project off site infrastructure will integrate with the existing regional infrastructure as described below.

TELECOMMUNICATIONS

PBM will use multiple methods of communications to achieve redundancy for both operational effectiveness and emergency preparedness:

- Satellite Internet for Data and VoIP.
- Satellite Telephone.
- Radio and radio telephone (Towertel) services as are available from local suppliers.
- Cellular telephone (i.e., if available from the Village of Granisle).

PBM will also consider the use of new technology such as WiMax if and when it is available as a viable option.

ELECTRICAL POWER

Electrical power will be supplied by BC Hydro from the Babine Substation located on the west side of Babine Lake in the vicinity of the Village of Granisle. BC Hydro has completed a System Survey Study (SNC Lavelin) to investigate load interconnection options and identify facilities required. A transformer upgrade will be required at the Babine Substation in order to provide 30-35MW power at 138kV.

Power from BC Hydro will be delivered to the Morrison Mine Site via existing and new transmission lines. PBM will extend the line from the Bell Mine site, located on Newman Peninsula. The 138kV services, which was extended to the Bell Mine in 1971, is now energized at 25kV but has been tested to confirm that it can be re-energized to its design voltage.

ROADS AND HIGHWAYS

The Morrison Property has the advantage of existing regional infrastructure. The regional infrastructure includes a high speed forestry road network, an all-season barge and hard surface highways.

The forest service road network was established by forestry companies operating in the area. The selected road route for mine Pre-Production and Production use, including transportation of concentrate, will be via these forest service roads between Nose Bay and the mine site. PBM will enter into an agreement for shared use of the forest service road between Nose Bay and the Morrison Mine Site. Additionally, for some over-weight or oversize loads a forest service road may be utilized on a periodic basis; either:

- Between Michelle Bay and Houston to connect to the CNR Railhead at Houston.
- Between the mine site and CNR Railhead at Leo Creek.

Crossing of Babine Lake will be via an all-season barge, Nose Bay to Michelle Bay. PBM will enter into an agreement to use the existing Babine Lake barge and barge facilities to cross Babine Lake between Nose Bay and Michelle Bay.

During Pre-Production and Production traffic beyond Michelle Bay will normally be via public highways; south from Michelle Bay to Highway 16 at Topley via South Granisle Highway then east or west on Highway 16.

CONCENTRATE TRANSPORTATION

Concentrate will be hauled via tandem trucks west to the Port of Stewart, BC, where it will be loaded onto ocean going vessels for shipment to smelters in China, Korea, India or Japan.

WATER MANAGEMENT PLAN

The Tailings Storage Facility (TSF) is located at an elevation between 950m and 1,020m. The mill processing and TSF will be operated as a zero discharge system, with no releases to the outside environment under normal operating conditions. All free tailings transport water will be recycled back to the process plant by a reclaim pump from the tailings pond. Seepage water and construction water will be collected on the downstream side of the tailings dams and returned to the TSF. For flood management, the TSF will be designed to store the surface run-off from 2 week duration – 200 years return period precipitation event. Floods exceeding this return period may be discharged through an emergency spillway to maintain dam safety.

Scope of Feasibility Study

PBM commissioned the following consultants to prepare the feasibility study:

- Wardrop Engineering Inc. (Wardrop)
  - Processing, Mining, Infrastructure and Financial Analysis
- Geosim Services Inc. (Geosim)
  - Mineral Resource Estimate
- Nilsson Mining Services (NMS)
  - Mining
- Klohn Crippen Berger Ltd. (KCBL)
  - Tailings Handling, Water Management and Geotechnical Design
- Rescan Environmental (Rescan)
  - Environmental
- Kaehne Consulting Ltd.
  - Electrical Power Supply
- Chrisita Enterprises Ltd.
  - Haul Route Study
- Allnorth Consultants Ltd.
  - Haul Route Options Analysis

Conclusions and Recommendations

Mining

- Geophysical methods such as seismic or ground penetrating radar to be evaluated for use in better defining the overburden thickness and the hardrock – overburden interface location.
- Consideration to be given to contracting overburden removal ahead of drilling and blasting on production benches.
- Blasting practices to be part of a process of continuous improvement.
- An opportunity to reduce energy costs in the mine should be explored.

PROCESS

- The SGS test results showed that one stage of regrinding needed to achieve chalcopyrite liberation and separation of impurities contained in rougher flotation concentrates.
- The preliminary flotation work showed it is possible to obtain desirable Cu concentrate followed by molybdenite separation in order to produce saleable Mo concentrate.
- The potential benefit of the application of flash flotation in the primary grinding/cycloning circuit should be investigated.
- In reference to the mineralogical characterization results from the rougher/scavenger tailings study, a plant trial test of a contact cell installation on the tailings line is recommended during plant operation.
- The potential application of using of ISA mill or SMD mill in regrinding stages should be considered in further studies.

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GLOSSARY

Above mean sea level	amsl
Acre	ac
Annum (year)	a
Billion years ago	Ga
Centimetre	cm
Cubic centimetre	cm^3
Cubic feet per minute	cfm
Cubic feet per second	ft^3/s
Cubic foot	ft^3
Cubic inch	in^3
Cubic metre	m^3
Cubic yard	yd^3
Day	d
Days per week	d/wk
Days per year (annum)	d/a
Dead weight tonnes	DWT
Decibel adjusted	dBa
Decibel	dB
Degree	°
Degrees Celsius	°C
Diameter	ø
Dollar (American)	US$
Dollar (Canadian)	Cdn$
Dry metric ton	dmt
Foot	ft
Gallon	gal
Gallons per minute (US)	gpm
Gigajoule	GJ
Gigapascal	GPa
Gigawatt	GW
Gram	g
Grams per litre	g/L
Grams per tonne	g/t
Greater than	>
Hectare (10,000 m^2)	ha
Hertz	Hz
Horsepower	hp
Hour	h
Hours per day	h/d
Hours per week	h/wk

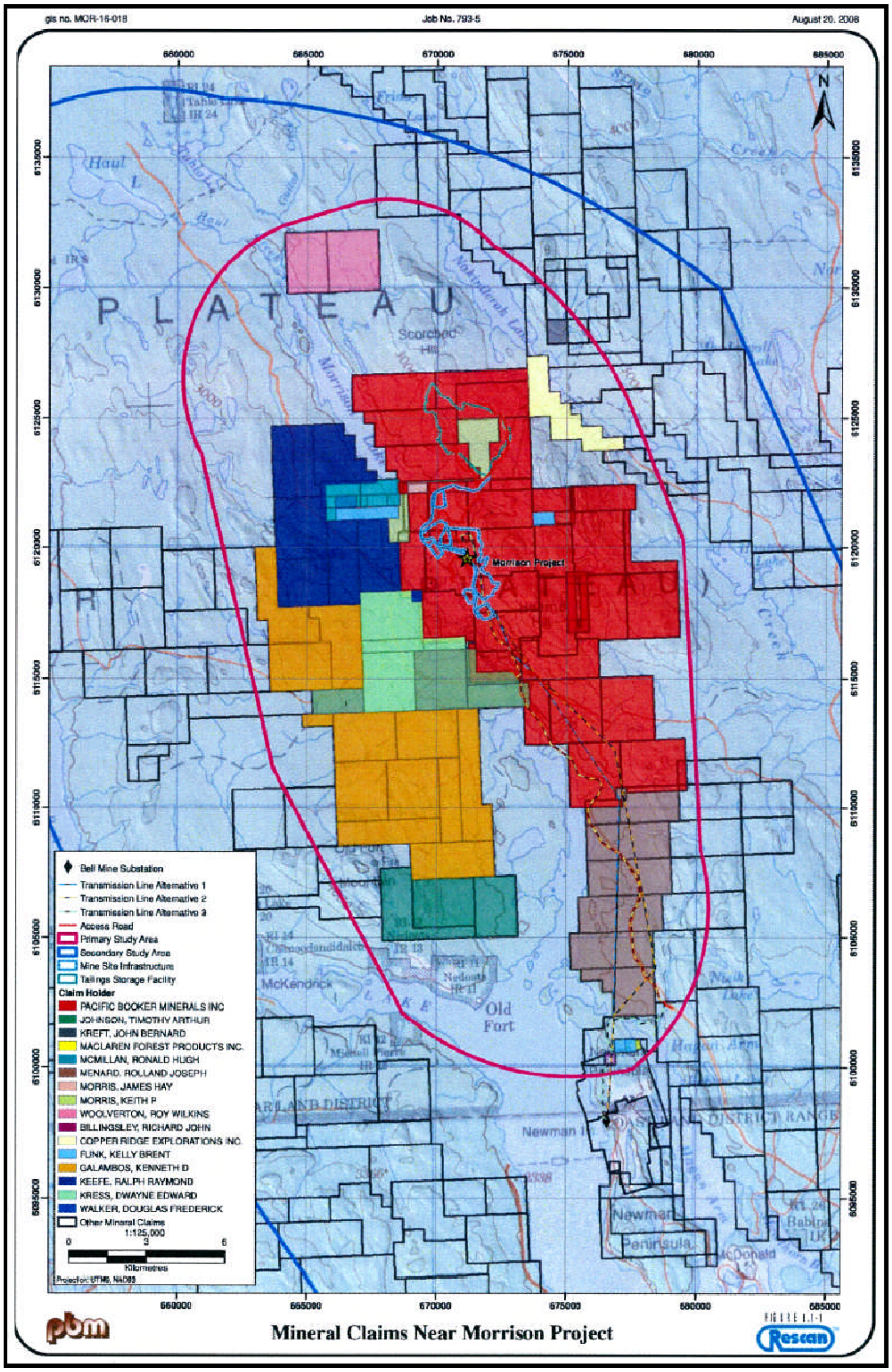
Hours per year	h/a
Inch	"
Kilo (thousand)	k
Kilogram	kg
Kilograms per cubic metre	kg/m^3
Kilograms per hour	kg/h
Kilograms per square metre	kg/m^2
Kilometre	km
Kilometres per hour	km/h
Kilopascal	kPa
Kilotonne	kt
Kilovolt	kV
Kilovolt-ampere	kVA
Kilovolts	kV
Kilowatt	kW
Kilowatt hour	kWh
Kilowatt hours per tonne (metric ton)	kWh/t
Kilowatt hours per year	kWh/a
Less than	<
Litre	L
Litres per minute	L/m
Megabytes per second	Mb/s
Megapascal	MPa
Megavolt-ampere	MVA
Megawatt	MW
Metre	m
Metres per minute	m/min
Metres per second	m/s
Metric ton (tonne)	t
Microns	µm
Milligram	mg
Milligrams per litre	mg/L
Millilitre	mL
Millimetre	mm
Million	M
Million bank cubic metres	Mbm^3
Million bank cubic metres per annum	Mbm^3/a
Million tonnes	Mt
Minute (time)	min
Month	mo
Ounce	oz
Pascal	Pa
Centipoise	mPa·s
Parts per million	ppm
Parts per billion	ppb
Percent	%

Pound(s)	lb
Pounds per square inch	psi
Revolutions per minute	rpm
Second (plane angle)	"
Second (time)	s
Specific gravity	SG
Square centimetre	cm^2
Square foot	ft^2
Square inch	in^2
Square kilometre	km^2
Square metre	m^2
Thousand tonnes	kt
Tonne (1,000 kg)	t
Tonnes per day	t/d
Tonnes per hour	t/h
Tonnes per year	t/a
Tonnes seconds per hour metre cubed	ts/hm^3
Volt	V
Week	wk
Weight/weight	w/w
Wet metric ton	wmt
Year (annum)	a

1.0 INTRODUCTION

PBM's land position consists of 45 contiguous claims totalling 12,027ha. All claims are located within the Omineca Mining Division in Central British Columbia, Canada. PBM is currently pursuing development of claims herein referred to as the Morrison Property. The following figure shows the Mineral Claims near Morrison Project.

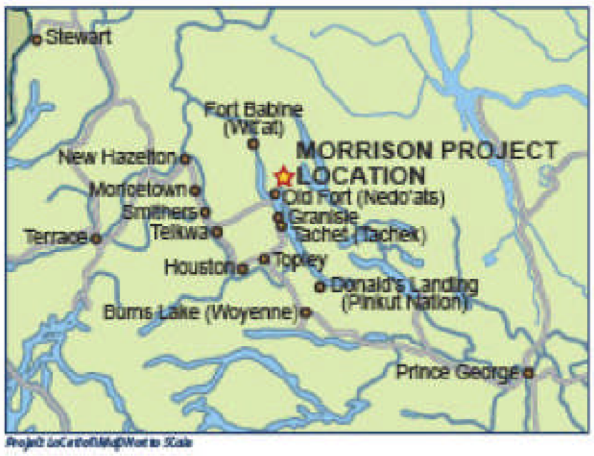
Figure 1.1 – Mineral Claims near Morrison Property



1.1 LOCATION

PBM owns the mineral rights to the Morrison Property located in Central British Columbia, Canada. Coordinates of the Morrison property at 55° 11' N Latitude and 126° 19' W Longitude and the property is approximately 65km northeast of Smithers and 35km north of the Village of Granisle (Figure 1.2 below). It is within 30km of two former copper/gold/silver producing mines, Bell and Granisle.

Figure 1.2 – Morrison Project Location Map 2



The Morrison Property has the advantage of existing regional infrastructure. The regional infrastructure includes a deep-sea shipping terminal at the Port of Stewart, a high speed forestry road network, hard surface highways, nearby electrical high voltage power (approximately 25km from project site) and full service communities (Village of Granisle, Communities of Topley, Houston and Smithers) within daily commuting distance from the Project site and a regional airport at Smithers.

1.2 HISTORY

The Morrison property was discovered and initially explored in the early 1960s during the initial rush of porphyry copper exploration in the Babine Lake region. Regional stream sediment sampling in 1962 by the Norex Group of Noranda led to the discovery of the Morrison deposit in 1963. Critical early work on the discovery was carried out by L. Saunders, R. Woolverton and D. A. Lowrie (Woolverton, 1964).

Noranda reports that in 1963, while following up on anomalous copper stream sediment results collected in 1962, copper-bearing biotite feldspar porphyry ("BFP") as float and outcrop were found in a stream that flows over the copper zone of the Morrison deposit. Trenching of the thin overburden uncovered large areas of relatively unweathered chalcopyrite-bearing bedrock on both sides of the stream

(650m by 250m on the west side and 250m by 250m on the east side), where a copper soil geochemical anomaly had been defined.

Further delineation of the deposit took space during the period 1963 to 1973 and included soil geochemical, electromagnetic ("EM"), magnetic and IP surveys together with trenching, geological mapping, alteration studies and 13,890m of diamond drilling. The drilling, which utilized the magnetic surveys as a guide in early programs, consisted of ninety-five diamond drill holes, most inclined at -45° and oriented east or west. The first 65 holes were AEX (27mm) diameter. The remaining 30 were 30 were BQ (36.5mm) diameter. By 1968 diamond drilling had defined two zones immediately northwest and southeast of a small central pond. The position of these zones corresponds closely to the strong copper geochemical and magnetic anomalies previously outlined during Noranda's earlier surface exploration.

Geological mapping in 1963 and 1967 indicated the possibility that the two zones might be offset segments of a single faulted deposit. Hydrothermal alteration studies initiated in 1967 showed that the deposit had well-defined biotite-chlorite zoning and that biotitization was very closely related to copper grades. Although data was sparse, biotitization in the large, poorly tested area between the two known zones appeared to be widespread and strong, indicating that this area had the potential to be mineralized. Drilling in 1970 to test this central area was successful in defining mineralization and better establishing the limits of the fault offset portions of the copper zone. This increased the known lateral extent of the deposit significantly.

Following the 1973 drill program, Noranda did no further field work at Morrison. In 1988 the company investigated the gold content of the deposit by assaying 477 composite samples. Noranda completed preliminary pit design and operating studies in 1988 and 1990. The purpose of the studies was to establish whether Morrison could supply feed to the Bell Mine; however, Noranda concluded that at that time, such an operation would not be economic.

No further drilling was done until PBM optioned the property in October, 1997. PBM conducted a National Instrument 43-10 1 compliant, three-phase drilling program, which commenced in January 1998 in order to:

- Establish grade and continuity of copper values;
- Establish gold grades; and
- Explore the depth potential of the copper/gold bearing system.

RECENT EXPLORATION WORK

PBM's work on the Morrison property has consisted of surface backhoe trenching, test-pitting and drilling for resource estimation, metallurgical testing, geotechnical engineering, hydrogeology and overburden estimation.

- Between 1998 and 2003 PBM completed surface backhoe trenching and 82 diamond drill holes totalling 25,245 metres within the limits of the Morrison deposit previously drilled by Noranda.
- In 2005, four additional exploration holes (957m) were completed and four large PQ holes (700m) were drilled for metallurgical samples twinning older holes.
- In 2006, seven geotechnical holes (1464m) were drilled but not assayed and 18 condemnation holes (643m) were drilled in outlying areas that were regarded as potential plant, waste and tailings sites. These holes were logged but not assayed as no visible mineralization was encountered. Several of these holes were subsequently used for water monitoring.
- In 2007, fifteen additional geotechnical and 16 ground water monitoring holes (1008m) were drilled in the proposed tailings storage facility impoundment area, the open pit and plant site. Prior to the drilling a resistivity survey was completed.

Snowden Mining Industry Consultants completed a report entitled “Morrison Copper/Gold Project Resource Estimation and Pit Optimization Study” in March 2003. This study indicated that under favourable economic conditions, an open pit mine at Morrison should generate an economic return.

In 2004 a Preliminary Assessment of the property was conducted by Beacon Hill Consultants (1988) Ltd. and Knight Piésold Ltd. The result of this study indicated that the project had the potential to be viable and that the property should be further developed and, subject to further study, be placed into production.

REGIONAL GEOLOGY

The Morrison deposit is on the northern edge of the Skeena Arch in a region underlain by volcanic, clastic and epiclastic rocks ranging in age from the Lower Jurassic to Lower Cretaceous. These rocks are correlative with the Takla Group, Hazelton Group, Bowser Lake Group, Skeena Group and Sustut Group. They have been block-faulted by a series of post-Eocene, north-westerly trending series of faults that have created a long linear sequence of horsts and grabens. Some of these structures have been traced over a distance of 100km. The younger Middle Jurassic to Cretaceous rock is often preserved in the down-dropped blocks, with the older Lower and Middle Jurassic rocks exposed in the Highlands.

Intrusive rocks in the area include the Early Jurassic diorite and granodiorite Topley intrusions, Eocene rhyolite and rhyodacite intrusions, and most importantly from an economic viewpoint, the Eocene Babine igneous suite which consists of quartz, hornblende, biotite and plagioclase phyric intrusions.

Geology of the Morrison Deposit

The Morrison deposit is a zoned annular porphyry copper-gold deposit largely within a multi-phased Eocene 'Babine type' biotite feldspar porphyry (BFP) body which intrudes Middle to Upper Jurassic Ashman Formation siltstone and greywackes. The lower part of this sequence is mostly marine pebble conglomerate, interbedded with maroon to greenish grey sandstone and siltstone, which change upwards to deeper water well-bedded shaley argillaceous siltstone and greywacke.

The lower marine sequence has abundant bivalves, ammonites, belemnites and fossil wood debris of Middle to Upper Jurassic age.

The intrusive BFP at Morrison is very similar to that at other Babine copper deposits. A complete description of the lithology including chemical and microprobe analysis is presented by Carson and Jambor (1975). The BFP intrusive at Morrison is a faulted plug with nearly vertical contacts, which occupies a north-westerly oriented elliptical area of 900 by 500m wide. Before block faulting, the plug was roughly circular in plan with a diameter of about 500m. Numerous offshoots of the plug, many of which are 1 to 500m wide northerly-trending dykes or sills, occur abundantly in the Ashman sedimentary rocks.

The unaltered BFP is speckled with abundant 0.25 to 5mm phenocrysts of plagioclase, biotite and hornblende in a fine-grained matrix of the same materials as well as quartz and K-feldspar. Apatite and magnetite are common accessory minerals.

Mineralization

The copper zone forms the central core of the Morrison deposit. The zone is predominantly hosted in a potassic altered BFP plug with intercalations of older siltstone. All copper sulphides are primary. Chalcopyrite is the main copper-bearing mineral. The copper mineralization occurs in three principal types; (a) fine-grained disseminated chalcopyrite mineralization probably related to microfractures; (b) chalcopyrite-bearing fractures commonly 1-3mm wide containing coarser chalcopyrite, and (c) late-stage fracture-filling and disseminated sulphides. Within this litho logic and structural framework, the copper zone is defined by the limits of well-developed copper mineralization with associated gold that consistently grades greater than 0.20% Cu. The peripheral limits of the copper zone are generally abrupt as the copper content declines outward to less than 0.10% Cu within a 40m-wide margin around the copper zone. The degree of structural development and hydrothermal alteration within the internal core of the copper zone are locally more intense, and these favourable elements contribute to the development of higher-grade zones of copper and gold mineralization. Although the copper to gold ratios may vary within these high grade zones, the copper grades locally are greater than 0.50% Cu, and gold grades frequently range from 0.40 to 0.60gAu/t and up to 1.00gAu/t over short intervals. Minor amounts of bornite occur in the higher grade copper zones as disseminations. Spotty occurrences of galena and sphalerite occur within carbonate-cemented veins within and near the East and West Faults.

MINERAL RESOURCE

The Morrison property has a porphyry copper/gold/molybdenum deposit for which a 43-10 1 compliant mineral Resource Estimate was completed by GeoSim Services Inc. in May 4, 2007.

Based on the classification categories measured, indicated and inferred the following Table lists the resources estimated:

Table 1.1 – Resource Estimate

Cut-off % Eq Cu	Measured + Indicated					Inferred				
	Tonnes > Cut-off	Average Grade				Tonnes > Cut-off	Average Grade			
		Cu EQ (%)	Cu (%)	Au (g/t)	Mo (%)		Cu EQ (%)	Cu (%)	Au (g/t)	Mo (%)
0.15	281,652,590	0.40	0.34	0.17	0.005	87,806,392	0.38	0.33	0.16	0.004
0.20	265,954,503	0.41	0.35	0.17	0.005	81,798,181	0.40	0.34	0.17	0.005
0.25	238,475,426	0.44	0.37	0.18	0.005	61,661,854	0.45	0.38	0.19	0.004
0.30	206,869,448	0.46	0.39	0.20	0.005	56,524,341	0.47	0.40	0.21	0.005
0.35	170,772,241	0.49	0.42	0.21	0.005	47,875,646	0.50	0.42	0.22	0.005
0.40	133,351,540	0.52	0.44	0.22	0.005	38,587,285	0.53	0.45	0.23	0.005

The measured/indicated mineral resource at a 0.30 Cu EQ cut-off is 206,869,000 tonnes grading 0.46% Cu equivalent consisting of 0.39% Cu, 0.20gAu/t and 0.005% Mo. The contained metal is 1,787,780,000 lbs Cu, 1,306,300 oz Au and 20,676,000 lbs Mo. In addition to the above, the inferred resource at a 0.30 Cu EQ cut-off is 56,534,000 tonnes grading 0.47% Cu equivalent. This consists of 0.40% Cu, 0.21gAu/t and 0.005% Mo. The contained metal is 494,720 lbs Cu, 374,400 oz Au and 6,231,000 lbs Mo.

The majority of the resources contained within the Morrison deposit can be categorized as measured and indicated.

In September 2006, PBM commissioned Wardrop to develop a feasibility study for the process plant and onsite facilities with the associated capital and operating costs. Wardrop reviewed the previous metallurgical work carried out by Noranda, IME and PRA and issued a new test program to PBM. In November 2006, PBM shipped the most recent representative sample package containing 82 drill core sub-samples for testwork and characterizations to support the feasibility study. The principal components of the testwork involved, mineralogy, comminution studies including Bond Abrasion, Bond Rod Mill, Bond Ball Mill and JK Tech Dropweight tests, flotation testwork, grinding and flotation circuit design. All test results are detailed in reports from SGS Lakefield.

For this project Wardrop utilized SGS Mineral services (SGS) completed test work (2006, 2007) and the previous work done by Process Research Associates (PRA) in 2005, International Metallurgical and Environmental Inc. (IME) in 2002 and Noranda in 1970.

A 1.7t representative sample was sent to Polysius, Germany for HPGR comminution testing. The High Pressure Grinding Roll pilot testing was completed by Polysius and the report received in December 2007. The favourable results obtained from this study confirmed incorporating HPGR into the Morrison comminution circuit.

2.0 SCOPE OF STUDY

Pacific Booker Minerals Incorporation (PBM) commissioned several consultants: Wardrop Engineering Inc. (Wardrop), Klohn Crippen Berger (KCBL), Rescan Environmental (Rescan) and Nilsson Mining Services Ltd. (NMS) to develop a feasibility study for the Morrison Copper/Gold Project complete with associated capital and operating costs.

- This report, as part of the feasibility, addresses the process plant, mining and infrastructure and has been prepared by Wardrop with input from the most recent metallurgical test results from SGS Canada (SGS) and Process Research Associates (PRA) and the high pressure comminution pilot testing results from Polysius.
- Wardrop has also used the supported documents from Morrison/Hearn Hill Preliminary Assessment study conducted by Beacon Hill Consultants Ltd. in 2004. Input on the mining was provided by NMS.
- Section 3.6 Tailing, Reclaim, Freshwater and Associated Systems is a summary of the report prepared by Klohn Crippen Berger Ltd. (KCBL)
- Section 5.1.1 Access Road is a summary of the reports prepared by Allnorth Consultants Ltd. and Chrisita Enterprises Ltd.
- Section 5.1.2 Electrical Power Supply is a summary of the report prepared by Kaehne Consulting Ltd.

3.0 PROCESS

3.1 INTRODUCTION

For this project Wardrop utilized SGS Mineral services (SGS) completed test work (2006, 2007) and the previous work done by Process Research Associates (PRA) in 2005, International Metallurgical and Environmental Inc. (IME) in 2002 and Noranda in 1970.

Noranda submitted three Morrison ore samples to its milling facilities in Quebec for initial flotation test work in 1970 and 1971.

IME completed a series of laboratory flotation tests on two composite samples (approximately 39kg) prepared from samples of drill core submitted by PBM from the Morrison deposit.

In March 2005, PRA was engaged by Beacon Hill Consultants on behalf of PBM to undertake metallurgical testing including locked cycle tests to form part of the basis for a prefeasibility study. Fresh samples from a limited drill program were assayed and grouped into three specific types, and various composites. The test program included sample characterization, grindability and flotation testwork followed by environmental and tailings characterization testing.

In November 2006, PBM appointed SGS to conduct grinding and flotation testwork followed by a circuit design. The objective of the project was to conduct a series of grinding and flotation tests that would provide metallurgical targets and lead to circuit design in support of a feasibility study. The SGS program involved feed and product samples characterization, mineralogy, comminution, and flotation test works followed by grinding and flotation circuit design.

The most recent phase of testing at SGS was on 1.7t of sample material (82 drill core samples) to confirm the initial results and bring the project up to a feasibility level, a report on tailings characterization was issued by SGS separately.

After discussions with all HPGR suppliers, Polysius was contracted by PBM to conduct test work on high pressure comminution. The 1.7t of Morrison material were shipped to Polysius test facilities in Beckum, Germany. After completion of the test work, a trade off study to evaluate the application of HPGR as an alternative technology to the conventional SAG milling technology was prepared by Wardrop. The favourable results obtained from this study confirmed the incorporation of HPGR into the Morrison comminution circuit.

A comparison study was conducted by SGS to evaluate the impact of high pressure comminution in flotation recovery.

Wardrop used all of the test results as a basis for developing the Morrison process flowsheet and completing the process plant and onsite facilities feasibility study.

3.2 PROCESS MINERALOGY AND METALLURGICAL TESTING

3.2.1 *INTRODUCTION*

PBM appointed IME, PRA and SGS Canada to conduct metallurgical testwork for different stages of studies between 2002 and 2007. The initial flotation testwork was done by IME on two composite samples. The results showed that a high grade copper concentrate could be achieved using a conventional flotation process.

For the prefeasibility, in March 2005 fresh samples were shipped to PRA for sample characterization and flotation testwork, including locked cycle tests. The locked cycle tests on composite MHM4, which is generated from various sample types to represent the deposit, produced a concentrate with 26% Cu and 6.8 g/t Au at recoveries of 85.7% Cu and 59.7% Au.

For the feasibility, in November 2006, approximately 1.7t of sample material were shipped to SGS Canada facilities for sample characterization and metallurgical testing to confirm the initial test results and provide a basis for circuit design. The metallurgical test results confirmed that a copper concentrate (25.1% Cu at 84.4% recovery) could be achieved from the mill feed grade of 0.45% Cu.

In September 2007, 1.7t of sample material were shipped to Polysius test facilities in Beckum, Germany. The results of conducted HPGR pilot testing showed that the Morrison ore is suited for high pressure comminution. This design element change was incorporated into the design following the favourable results obtained in the HPGR trade off study.

A comparison study on flotation recovery applying HPGR comminution versus conventional comminution was conducted and no remarkable improvement was achieved for copper recovery.

The results have been used as a basis for the feasibility study.

3.2.2 *PROCESS MINERALOGY*

MINERALIZATION

The copper zone forms the central core of the Morrison deposit. The zone is predominantly hosted in a potassic altered BFP (Biotite Feldspar Porphyry) plug with intercalations of older siltstone. All copper sulphides are primary. Chalcopyrite is the main copper-bearing mineral. The copper mineralization occurs in three principal types:

- Fine-grained disseminated chalcopyrite mineralization probably related to microfractures
- Chalcopyrite-bearing fractures commonly 1 to 3mm wide containing coarser chalcopyrite
- Late-stage fracture-filling and disseminated sulphides

Minor amounts of bornite occur in the higher grade copper zones as disseminations. Although the copper to gold ratios may vary within high grade copper zones, the copper grades locally are greater than 0.5% and gold grades frequently from 0.4 to 0.6 and up to 1 g/t over short intervals. An area of elevated molybdenum grade occurs in the south-eastern portion of the deposit.

SGS Mineralogical Study Results

SGS conducted a QEMSCAN mineralogical study on the Master Composite and lithology composites BFP-ARSE, BFP-KH, ZS-QZSE and SS.

The main value mineral present in all of the samples is chalcopyrite with minor amounts of bornite. Specific mineral search (SMS) analysis also detected trace amounts of covellite, chalcocite, enargite, stannite and tetrahedrite amongst the samples. Quartz and feldspar minerals are the most abundant gangue minerals present in all samples.

In all samples, un-liberated Cu-sulphide primarily occurs in complex particles, i.e. articles containing Cu-sulphide and two or more other mineral groups. The majority of these complexes were composed of non-sulphides (quartz-feldspar, mica-clays, and calcite) with lesser occurrences of pyrite.

SGS concluded that the primary grind would be located at the bottom inflection point, where the particles start to show liberation (a good rule of thumb is to use the 10% liberation point), which occurs close to 120-130µm for most of the composites. Similarly, the regrind size is taken at the upper inflection point, where 70-80% of the chalcopyrite is liberated and approximately 30µm in this case.

Based on this mineralogy, target primary grinding size should be much finer than 150µm and target regrind size should be less than 35µm. Initial size analysis and mineralogical examination on rougher flotation tailings by PRA indicated that major loss of copper minerals and other sulphides occurred as in locked forms with gangue in coarse particle size fractions.

A detailed description of samples and the mineralogical study is presented in an SGS report (QEMSCAN 2006) for the feasibility study.

3.2.3 METALLURGICAL TESTING

REVIEW AND SUMMARY OF METALLURGICAL TESTING

Table 3.1 presents a chronological summary of the test work reports reviewed in order to derive the process design criteria required for the Morrison process facilities. The table includes prefeasibility reports, as well as review reports, issued since 2002.

Table 3.1 - Chronological Summary of Testwork Reports

Author	Date	Report Title
SNC-Lavalin Engineering	21 June 2002	Technical Report on the Morrison Porphyry Copper-Gold Project
International Metallurgical and Environmental Inc.	17 June 2002	Laboratory Flotation Tests of Drill Core Samples from the Morrison Lake Property
Beacon Hill Consultants (1988) Ltd.	01 Aug. 2004	Morrison/Hearne Hill Project Preliminary Assessment
Process Research Associates Ltd.	10 Oct. 2005	Flotation Optimization and Variability Testing on Composites from the Morrison Project
SGS Lakefield Research Ltd	Aug. 2007	Ore Grindability Characterization and Feasibility Grinding Circuit Design for the Morrison Project
SGS Lakefield Research Ltd.	23 Oct. 2007	The Recovery of Copper, Gold and Molybdenum from Ore from the Morrison Copper Project
SGS Lakefield Research Ltd.	06 Dec. 2007	Morrison Project Flotation Testwork Report
Polysius Research Center	06 Dec. 2007	High-Pressure Grinding Test on Copper/Gold/Molybdenum Ore from the Morrison Project
SGS Lakefield Research Ltd.	17 Jan. 2008	The Flotation Response of HPGR-prepared versus Conventionally Crushed Flotation Feed from Morrison Deposit

3.2.4 TESTWORK PROGRAM COMPONENTS

The following test work components were selected from the historical studies and were used in the design of the flow sheet of the PBM plant. The main processes are the following:

- Head analysis
- Mineralogy
- Comminution testwork
- High-pressure comminution tests
- Copper and molybdenum flotation investigations
- Flash flotation
- De-sliming

3.2.5 NORANDA TESTWORK

Noranda submitted three samples of Morrison to its milling facilities in Quebec for initial flotation test work in 1970 and 1971. Table 3.2 shows the summary of the three samples' head grades.

Table 3.2 - Summary of the Composite Samples Head Grade

Sample	Weight (Lb)	Cu %	Au (g/t)
A 1970/1	60	0.68	-
B 1970/2	54	0.51	-
C 1971	355	0.52	0.38

Preliminary grinding and flotation tests have been carried out on the composite sample (mixing samples A and B in a one-to-one ratio). The work index for the composite sample is 18.0kWh/t. From the series of flotation tests, the attained copper recovery varied from 89.4 to 92.6%.

The work index for sample C was 17.2kWh/t. The flotation test carried out showed a copper recovery of 87.6%.

3.2.6 IME TESTWORK

Preliminary grinding and flotation tests have been carried out on two composite samples of drill core from the Morrison deposit in June 2002. Table 3.3 shows the summary of the two composite sample head grades.

Table 3.3 - Summary of the Composite Samples Head Grade

Sample	Cu %	Au %	Mo%
401/402	0.52	0.18	0.009
780/781	0.61	0.36	0.009

Both samples were shown to respond well to the flotation process. Copper and gold recoveries were expected to be in the range of 88 to 90% for copper and 50 to 70% for gold. Results indicate that a copper concentrate with grade of up to 27.6% can be produced. It did not appear the molybdenum recovery is expected to be high enough to allow for the production of a separate molybdenum concentrate.

For more details on the test work, see the report by IME entitled, "Laboratory Flotation Tests of Drill Core Samples from the Morrison Lake Property", June 2002.

3.2.7 PRA TESTWORK

HEAD ASSAYS

Summarizes the head assay analysis obtained for the various ore samples selected to reflect the variability of the ore deposit. Table 3.4 gives the assays obtained for the samples tested by PRA in October 2005. The samples used for Table 3.4 were sorted from 4 drill holes and represent 3 main mineral types and various horizons. The main constituents of interest from the multiple head assay results were from 0.1 g/t to 0.4 g/t Au and between 0.3% and 0.6% Cu.

Table 3.4 - Head Analysis for PRA Samples

Composite		Mineral Type	Hole ID/Comp ID	Intervals, m	Measured Head	
					Au, g/t	Cu, %
Individual Composites	MH1	1, BFP	MET 01	5.6 -93.8	0.26	0.48
	MH2	1, BFP	MET 02	7.9 -82.0	0.14	0.34
	MH3	1, BFP	MET 03	10.5 - 61.5	0.16	0.52
	MH4	1, BFP	MET 04	3.7 - 92.3	0.13	0.35
	MH5	1, BFP	MET 01	93.8 -194.7	0.21	0.62
	MH6	1, BFP	MET 02+04	115.7 - 181.2	0.22	0.43
	MH7	1, ZS	MET 02+03+04	2.7 - 81.8	0.13	0.35
	MH8	1, ZS	MET 01+04	107.0 -170.0	0.13	0.35
	MH9	2	MET 01+02+03	5.6 -80.0	0.21	0.51
	MH10	2	MET 01+04	92.3 -128.6	0.39	0.6
	MH11	2	MET 02	101.0 - 252.5	0.19	0.42
	MH12	3	MET 01+02+04	68.6 - 256.0	0.17	0.40
	MH13	3	MET 03	20.2 - 97.5	0.14	0.44
Master Composites	MHM1A	1, BFP	MH 1 to 6	All	0.19	0.45
	MHM1B	1, ZS	MH 7 to 8	All	0.12	0.37
	MHM1C	1	MHM 1A +1B	All	0.18	0.45
	MHM2	2	MH 9 to 11	All	0.21	0.43
	MHM3	3	MH 12 + 13	All	0.15	0.44
	MHM4	All	MHM 1C+2 +3	All	0.21	0.46

PRA COMMINUTION TESTING

PRA conducted comminution tests including Bond low-energy Impact, Bond rod mill work index, Bond ball mill work index and Bond abrasion tests as part of their "Flotation Optimization and Variability testing on composites from Morrison Project" study.

The test results showed that energy consumption for the comminution of that specified samples are intermediate or mildly intermediate. Low energy impact work indices range from 6.7 to 8.5kWh/t, bond rod mill work indices from 12.6 to 15.5kWh/t at a discharge particle size of 1.2mm, and Bond ball mill work indices from 15.4 to 17.4kWh/t at a closing screen size of 150µm.

The sample abrasiveness ranged from mildly abrasive to medium. The results from the grindability study are shown in Table 3.5.

Table 3.5 - Morrison Grindability Test Summary – PRA

Sample ID	Mineral Type	Abrasion Index (g)	Impact Index (kWh/t)	Rod Mill Index (kWh/t)	Bond Mill Index (kWh/t)
OT1	1	0.3804	8.5	15.9	15.4
OT2	2	0.1262	6.7	12.6	17.0
OT3	3	0.2078	8.5	15.5	17.4
Waste	Waste	-	6.8	-	-
MHM1C	1	-	-	-	15.4
MHM2	2	-	-	-	15.9

PRA Flotation Testing

The first flotation testwork of PBM samples was reported by Process Research Associates during 2005, when prefeasibility and variability testing were conducted on various interval individual and master composites, which were sorted out from 4 drill holes to represent three main mineral types and various horizons. Some of the locked cycle test results are reproduced in Table 3.6. The flotation flow sheet was mainly, as reported by PRA, developed on the type 1 sample (F46), which represents major mineralization characteristics. The locked cycle testing, as shown in Table 3.6 below confirmed that the type 1 sample (F46) had the best performance with recovering 86% Cu and 71% Au, while the type 2 sample (F47) showed lower recoveries of only 81% Cu and 44% Au. Tests 51 and 52, which were blended from various types of samples, produced a 26.0% Cu and 6.8 g/t Au concentrate with recoveries of 85.7% Cu and 59.7% Au. The results also indicated that the main value recoveries were inversely related to the copper grade of the final concentrate. The results quoted in Table 3.6 are reported directly from the respective reports.

Table 3.6 - Summary of Locked Cycle Test Results

Test ID	Ore Type	Conc. Grade		Conc. Recovery		Grind Size (Primary/Secondary)
		Au (g/t)	Cu (%)	Au (%)	Cu (%)	
F46	1	8.16	26.4	71.3	86.2	P80155µm/P90 29 µm
F47	2	7.30	26.1	43.7	80.6	P80167µm/P87 25 µm
F48	3	5.61	27.5	58.3	85.0	P80145µm/P89 25 µm
F51	1+2+3	7.77	27.8	54.7	83.8	P80156µm/P89 25 µm
F52	1+2+3	6.80	26.0	59.7	85.7	P80149µm/P80 27 µm

The flotation test results indicated that the various mineralization samples respond significantly different to the procedure developed for the main composite sample (MHM1C), indicating a substantial impact on the mineralization on the flotation. The type 1 samples show the best performance, while the type 2 samples register the poorest results.

The report also concluded that the pulp pH does not play a key role on the rougher flotation for copper, but pH over 10 should be avoided. Also, reagents screening tests show that the samples respond well to the reagent regime of PAX alone.

The test work conducted by PRA in 2005 has indicated that the following aspect should be investigated:

- The test results appear to show that some of the gold is closely associated with pyrite. Detailed mineralogical examination should be conducted to determine the gold deportment. The recovery and concentration of gold-bearing pyrite and gold recovery by gravity, leaching in cyanide and non-cyanide lixiviants, should be investigated.
- Further locked cycle tests are recommended to further optimize the flotation performance, including primary grind and regrind and reagent regime.
- A pilot plant scale test and more tests are recommended to collect more data for design and feasibility studies, and generate needed materials for smelter acceptance tests.

PRA Flotation Testwork Results

Flotation tests were conducted on various intervals, individual and master composites which were sorted out from four drill holes to represent three main mineral types and various horizons. Five locked-cycle tests were conducted.

The flotation test results indicated that the various mineralization samples respond significantly different. Baseline variability rougher flotation on the individual composites at P_{80} of 150µm yields recoveries between 63% and 90% for gold, and 70 to 93% for copper, on the samples with head grades of 0.1 to 0.4 g/t Au and 0.3 to 0.6% Cu.

The locked cycle tests used a composite generated from various sample types to present the whole ore body mineralization. This produced a copper concentrate with 26% Cu and 6.8g/t Au at recoveries of 85.7% Cu and 59.7% Au. Apart from the copper and gold, the other values in the concentrates are molybdenum and silver. For the composite, the grade value of Ag was approximately 100g/t.

For more details, see the report by PRA entitled, "Flotation Optimization and Variability Testing on Composites from the Morrison Project", October 10, 2005.

3.2.8 SGS Testwork

Head Assays

Table 3.7 presents analysis for samples used in a test work program by SGS in December 2007.

The copper and gold assay results reported in Table 3.7 show a wider degree of variation from sample to sample in accordance with the selection process used. The Master Composite and average over the 82 samples showed excellent agreement averaging about 0.45% Cu, 0.006% Mo and 0.21 g/t Au. The approximate chalcopyrite to pyrite ratio across the samples was 1:0.7 based on a Cu:S ratio.

Table 3.7 - Flotation Testwork Head Assays – SGS Lakefield Research

	Head Assay								
Composite	**Cu (%)**	**Au (g/t)**	**Ag (g/t)**	**Mo (%)**	**Fe (%)**	**S (%)**	**Cu seq H2SO4 (%)**	**Cu seq NaCN (%)**	**Cu seq. A/R (%)**
Master	0.45	0.21	1.40	0.006	3.53	0.89	0.009	0.024	0.39
Master 2	0.40	0.21	1.50	0.004		0.83			
ZS-QZSE	0.29	0.09	1.80	0.007	2.66	0.77	0.007	0.012	0.27
SS	0.30	0.14	0.70	0.002	2.62	0.52	0.004	0.018	0.26
BFP-ARSE	0.54	0.25	2.30	0.005	4.67	1.07	0.010	0.013	0.52
BFP-KH	0.45	0.23	1.90	0.004	3.57	0.83	0.009	0.032	0.41
High Mo	0.54	0.21	2.80	0.016		1.15			
Comp 1	0.26	0.10		0.003		0.73			
Comp 2	0.41	0.15		0.008		0.77			
Comp 3	0.55	0.30		0.001		1.07			
Comp 4	0.70	0.34		0.003		0.94			
82 Individual Samples									
Average	0.44	0.19	1.63	0.006	3.53	0.86			
Max	1.05	0.56	6.20	0.096	7.74	2.48			
MM	0.17	0.05	0.50	0.001	1.32	0.24			
Std dev	0.18	0.12	1.04	0.013	1.15	0.38			

Table 3.7 presents the head assay values obtained from the SGS test work program conducted during December 2007.

SGS Comminution Testing

SGS conducted grinding test work on PBM samples in 2007. Table 3.8 shows the results obtained.

Table 3.8 - Morrison Ore Grindability Test Summary – SGS

	Crusher Index	SPI (minutes)	BWI (kWh/t)
Average:	13.7	105.2	16.4
Standard Deviation:	10.2	36.1	2.8
Relative Standard Deviation (%):	75	34	17
Minimum:	58.5	36.5	10.8
Maximum:	1.5	207.9	23.5

The study suggested a circuit to produce an average of 1,359t/h at a P_{80} of 150µm consisting of a single SAG mill, a single Ball mill and a cone crusher for the pebbles. The test work reflects that the ore is relatively medium hard from the perspective of SAG milling with an SPI® of 105 minutes. From a perspective of ball milling, the samples were characterized as relatively hard with an average of 16.4kWh/t. In addition, some of the samples shown indicated to be very hard in excess of 20kWh/t.

SGS Flotation Testing

Several testwork programs were conducted using locked cycle testing of the PBM samples. The most comprehensive program was conducted by SGS Minerals Services and reported in December 2007. The initial flotation testwork was conducted by PRA and reported in October 2005. Comparison testwork was completed by SGS Minerals Services on HPGR feed prepared by Polysius and conventionally crushed flotation feed samples. The results obtained were reported in December 2007. The results obtained are discussed below.

The most recent flotation test work on the 82 Morrison samples were conducted by SGS Lakefield Research during 2007. The work was part of the feasibility study for grinding, flotation and circuit design and involved sample preparation / characterization, mineralogy, comminution studies, flotation testwork, grinding and flotation circuit design (CEET, JK SimMet and FLEET). A representative sample of the material had head grades of 0.45% Cu, 0.21g/t Au, 1.40g/t Ag, 0.006% Mo, 3.53% Fe and 0.89% S. Five composites were used to perform ore characterization tests, including batch flotation test development and confirmation, full QEMSCAN for mineralogical analysis, flotation calibration test work (including flotation locked cycle test and cleaner MFTs) as well as the general comminution test work (including the SPI, ModBond work index tests, Biwa tests, MinnovEX crusher index Ci for grinding circuit design). A portion of each drill core sample was used to perform variability test work that produced the information needed for the CEET and FLEET simulations, used for grinding and flotation circuit design.

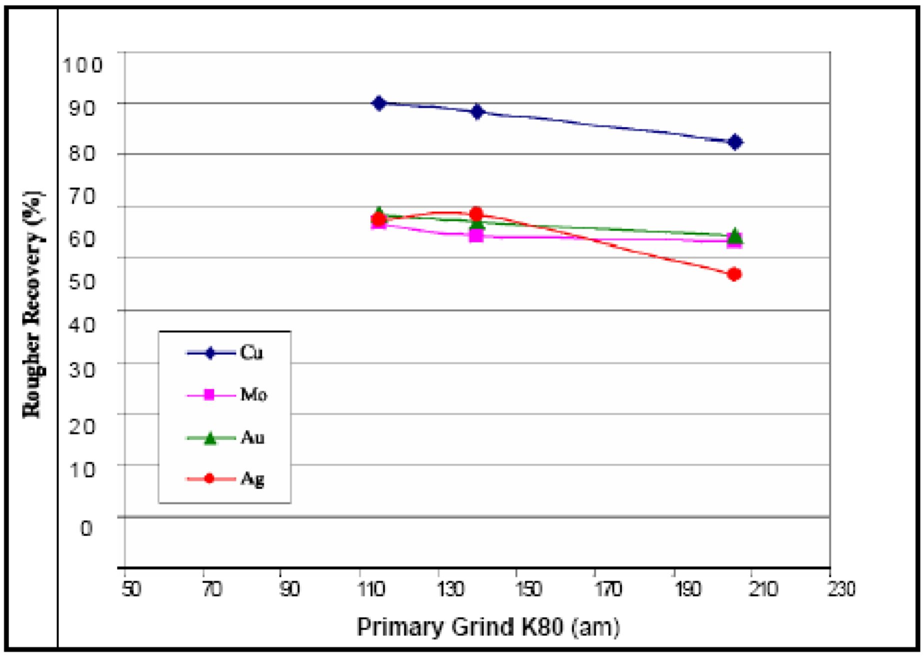
Effect on Grind

In the rougher circuits, three different primary grind sizes were investigated: 200µm, 140µm and 120µm. The results can be seen in Table 3.9 and Figure 3. A grind size between 140µm and 120µm yielded rougher recovery improvements of 6-8% for Cu over 200µm. Similar results were observed for Ag, with a lesser impact of grind size observed for Mo and Au.

Table 3.9 - Summary of Primary Grind Size Tests

Test #	Product	Wt. (%)	Assays (%, g/t)					Distribution (%)				
			Cu	Mo	S	Au	Ag	Cu	Mo	S	Au	Ag
FI	Rougher 1-7	6.80	5.01	0.050	9.88	1.97	14.8	88.2	64.4	82.8	67.2	68.3
K80 -140 µm	Rougher Tail	93.2	0.05	0.002	0.15	0.07	0.50	11.8	35.6	17.2	32.8	31.7
PEX/3418A/pH 7.7	Head (calc)	100.0	0.39	0.005	0.81	0.20	1.47	100.0	100.0	100.0	100.0	100.0
F5	Rougher 1-7	5.76	5.71	0.065	12.5	2.14	16.8	90.2	66.5	84.5	68.5	67.3
K80 =119µm	Rougher Tail	94.2	0.04	0.002	0.14	0.06	0.50	9.82	33.5	15.5	31.5	32.7
PEX/3418A	Head (calc)	100.0	0.36	0.006	0.85	0.18	1.44	100.0	100.0	100.0	100.0	100.0
F6	Rougher 1-7	6.31	4.78	0.051	10.9	1.87	13.7	82.4	63.1	77.8	64.2	56.8
K80 = 206 µm	Rougher Tail	93.7	0.07	0.002	0.21	0.07	0.70	17.6	36.9	22.2	35.8	43.2
PEX/3418A	Head (calc)	100.0	0.37	0.005	0.89	0.18	1.52	100.0	100.0	100.0	100.0	100.0

Figure 3.1 - Effect of Primary Grind Size on Rougher Recovery



The effect of regrind was tested and the test conditions and results of regrind size on Cu, Mo, Au and Ag grade and recovery (respectively) are shown at Table 3.9 and Figure 3.1.

The trends Figure 3.1 for all of the cleaner stage minerals show a decreasing recovery with increasing regrind size. In Figure 3.1, both Mo and Au recovery increase with increasing regrind size and the stage recovery of Cu and Ag both decrease with coarser grind size. The poor Mo recovery at finer regrind sizes could be due to insufficient collector in the cleaning stages.

COPPER-MOLYBDENUM SEPARATION

As part of the initial testwork conducted by SGS Lakefield Research, Copper-Molybdenum tests were run on high Mo composite and lithology composites (Table 3.10).

FLASH FLOTATION AND DE-SLIMING FLOTATION

Table 3.11 and Table 3.12 show results from SGS Lakefield Research of the test work, which included flash flotation and production of a low-sulphur and a high sulphur tailings stream.

The results indicated low combined flash cleaner and 2nd cleaner concentrate grades, which shows that flash flotation is not a potential option for the upstream recovery of Cu, Au, and Mo. The low flash cleaner concentrate grades are likely due to poor liberation at the 685µm flash flotation grind size.

Table 3.10 - Summary of Copper-Molybdenum Test Work Results

Test # Composite	Product	Overall Weight%	Assay (%)		Overall Distribution (%)		Stage Distribution (%)	
			Cu	Mo	Cu	Mo	Cu	Mo
F25 High Mo	Mo 2nd Cl Conc	0.013	0.83	53.6	0.020	51.6	0.02	69.3
	Combined Cu Conc	1.76	25.2	0.11	82.3	14.0	99.7	18.7
	Cu/Mo Conc	1.78	24.9	0.56	82.6	74.5	100.0	100.0
F26 Lithology	Mo 2nd Cl Conc	0.001	1.50	46.3	0.001	23.6	0.01	42.3
	Combined Cu Conc	2.17	18.5	0.07	86.8	31.8	99.7	56.9
	Cu/Mo Conc	2.18	18.5	0.13	87.1	55.9	100.0	100.0

Table 3.11 - Flash Flotation Summary

Test # / Conditions	Grind Size (µm)	Product	Wt. (%)	Grades (%, g/t)					Recovery (%)				
				Cu	Mo	S	Au	Ag	Cu	Mo	S	Au	Ag
	Flash	Cl Conc	0.53	16.5	0.440	34.1	6.54	35.6	21.3	33.3	20.6	17.5	12.6
F19	685	Cl + 2nd Cl Conc	1.73	18.2	0.315	31.7	6.40	43.9	77.0	78.1	62.6	56.0	51.0
55g/t PEX	Primary	Cl + 1st Cl Conc	2.25	14.3	0.253	26.2	5.20	36.2	78.6	81.5	67.5	59.3	54.9
17.5g/t 3302	147	Cl + 1st Cl + Sc. Conc	2.69	12.2	0.217	23.7	4.59	32.3	80.1	83.6	72.9	62.6	58.5
pH 11-11.5	Regrind	Cl + Ro Conc	11.2	3.03	0.054	6.34	1.28	9.25	83.3	87.2	81.7	73.0	70.1
Flash	22	Rougher Tail	88.8	0.08	0.001	0.18	0.06	0.50	16.7	12.8	18.3	27.0	29.9
		Head (calc.)	100.0	0.41	0.007	0.87	0.20	1.48	100	100	100	100	100

Table 3.12 - De-Sliming Flotation Summary

Test # / Conditions	Grind Size (µm)	Product	Wt. (%)	Grades (%, g/t)					Recovery (%)				
				Cu	Mo	S	Au	Ag	Cu	Mo	S	Au	Ag
F17	Primary	Cu 2nd Cl Conc	1.49	21.4	0.620	27.9	7.78	57.8	78.9	80.1	51.4	49.1	55.5
	158	Cu 1st Cl Conc	2.16	15.2	0.460	23.4	5.84	43.0	81.4	86.5	62.5	53.4	59.9
55 g/t PEX	Regrind	Cu 1st Cl Conc + Sc Conc	2.64	12.7	0.390	21.5	5.04	37.0	83.1	89.2	70.1	56.4	62.8
15 g/t 3302	29	Ro. Conc	11.7	2.97	0.091	5.69	1.34	9.5	86.3	92.4	82.6	66.4	71.6
		Combined Tails	97.4	0.070	0.001	0.25	0.11	0.6	16.9	10.8	29.9	43.6	37.2
pH 11-11.5		Rougher Tail	88.3	0.063	0.001	0.16	0.09	0.5	13.7	7.6	17.4	33.6	28.4
		Head (calc.)	100.0	0.40	0.012	0.81	0.24	1.6	100	100	100	100	100
F21	Primary	Cu 2nd Cl Conc	1.44	22.0	0.350	31.7	6.66	60.6	79.4	80.2	52.9	49.1	56.8
	147	Cu 1st Cl Conc	1.91	17.2	0.274	26.7	5.44	49.1	82.0	83.0	59.0	53.1	60.9
55 g/t PEX	Regrind	Cu 1st Cl Conc + Sc Conc	2.22	15.1	0.240	25.1	4.93	44.2	83.6	84.5	64.4	55.9	63.9
15 g/t 3302	31	Combined Tails	97.8	0.07	0.001	0.32	0.09	0.6	16.4	15.5	35.6	44.1	36.4
		Pyrite Tails	35.7	0.08	0.001	0.62	0.12	0.7	7.40	5.67	25.6	21.9	16.2
pH 11-11.5		Low 'S' Tail	62.1	0.06	0.001	0.14	0.07	0.5	9.00	9.86	10.1	22.2	20.2
		Head (calc.)	100.0	0.40	0.006	0.86	0.20	1.5	100	100	100	100	100

The test work also involved the hydrocyclone separation of the coarse tailings sands from the combined 1st cleaner scavenger tail and the rougher tail. Any pyrite reporting to the coarse fraction was recovered through flotation and combined with the cyclone slimes. Table 3.13 shows the comparison of modified ABA results for tests F17 and F21. The NP/AP value above 4 indicates that the sample is not acid generating. The removal of pyrite from the tailings increased the NP/AP ratio from 6.7 for the combined tailings to 38.1 for the low 'S' tails (cyclone sands). Although both tailings were neutral, in this case, the proposed tailings processing scheme would ensure that the low 'S' tailings generated are never acid generating regardless of the flotation feed pyrite content.

Table 3.13 - De-Sliming Flotation Summary

Sample ID		Test 17 Combined Tails	Test 21 Low 'S' Tails – Cyclone Sands
NP	t $CaCO_3$/1000t	50.0	47.7
AP	t $CaCO_3$/1000t	7.5	1.25
Net NP	t $CaCO_3$/1000t	42.5	46.4
NP/AP	**Ratio**	**6.7**	**38.1**
S	%	0.26	0.13
S^{2-}	%	0.24	0.04
SO_4	%	<0.4	<0.4
C	%	0.907	0.832
CO_3	%	1.54	2.25

The head assays of individual drill cores conducted by SGS Lakefield Research have been presented in Table 3.14.

Table 3.14 - Head Assays of Individual Drill Cores – SGS Lakefield Research

Sample ID	SPI Number	Cu (%)	Mo (%)	S (%)	Au (g/t)	Ag (g/t)	Fe (%)	Cu seq. H_2SO_4 (%)	Cu seq. NaCN (%)	Cu seq. A/R (%)
MO-01-46, 7.62 - 13.72m	1-950	0.35	0.017	0.77	0.10	2.40	2.15	0.028	0.023	0.27
MO-01-46, 13.72 -19.81m	1-951	0.28	0.073	1.21	0.09	320	2.21	0.005	0.009	0.26
MO-01-59, 4.57 - 10.67m	1-952	0.37	0.014	1.20	0.11	1.00	2.92	0.008	0.015	0.34
MO-01-59, 25.91 - 32.00m	1-953	0.46	0.018	1.25	0.13	1.00	2.43	0.005	0.011	0.43
MO-01-59, 50.29 - 56.39m	1-954	0.52	0.010	1.38	0.15	2.70	3.17	0.007	0.017	0.48
MO-01-59, 96.01 -102.11m	1-955	0.22	0.016	0.67	0.07	0.90	2.91	0.004	0.013	0.20
MO-02-67, 26.52 - 32.00m	1-956	0.59	0.003	0.96	0.17	1.50	5.41	0.009	0.020	0.55
MO-02-67, 38.10 - 44.20m	1-957	0.53	0.005	1.37	0.18	2.60	3.88	0.006	0.029	0.48
MO-02-67, 89.92 - 96.01m	1-958	0.54	<0.001	1.15	0.30	3.10	6.97	0.008	0.028	0.47
MO-02-67, 105.16 -111.25m	1-959	0.46	<0.001	1.35	0.28	3.10	6.24	0.008	0.023	0.42
MO-02-67, 117.35 -123.44m	1-960	1.05	<0.001	1.44	0.06	6.20	6.52	0.008	0.025	0.96
MO-02-68, 24.38 - 30.48m	1-961	0.36	0.021	2.48	0.12	4.30	7.74	0.005	0.018	0.31
MO-02-68, 36.58 - 42.67m	1-962	0.22	0.006	1.41	0.05	0.80	6.29	0.005	0.016	0.19
MO-02-68, 48.77 - 54.86m	1-963	0.35	0.003	1.59	0.11	2.00	3.87	0.010	0.036	0.29
MO-02-74, 24.38 - 30.48m	1-964	0.22	0.008	0.42	0.06	1.00	2.03	0.003	0.008	0.21
MO-02-74, 36.38 - 42.67m	1-965	0.24	0.009	0.61	0.05	1.10	2.68	0.003	0.008	0.22
MO-02-74, 57.91 - 64.01m	1-966	0.25	0.005	0.65	0.06	1.40	2.22	0.003	0.010	0.22
MO-02-74, 88.39 - 94.49m	1-967	0.28	0.010	1.05	0.07	1.40	3.48	0.004	0.014	0.27
MO-02-74, 103.63 -109.73m	1-968	0.24	0.002	0.52	0.11	0.60	2.84	0.005	0.014	0.21
MO-02-75, 4.57 -10.67m	1-969	0.22	0.007	0.37	0.05	2.80	2.03	0.008	0.010	0.18
MO-02-75, 38.10 - 44.20m	1-970	0.17	0.003	0.34	0.06	0.80	3.01	0.003	0.010	0.16
MO-02-75, 65.53 - 71.63m	1-971	0.22	<0.001	0.90	0.07	1.20	4.31	0.003	0.007	0.21
MO-02-75, 83.82 - 89.92m	1-972	0.24	0.004	1.07	0.07	1.10	2.42	0.005	0.013	0.21

Table continues…

Sample ID	SPI Number	Cu (%)	Mo (%)	S (%)	Au (g/t)	Ag (g/t)	Fe (%)	Cu seq. H_2SO_4 (%)	Cu seq. NaCN (%)	Cu seq. A/R (%)
MO-02-76, 4.57 - 10.67m	1-973	0.25	0.004	0.50	0.06	0.60	2.88	0.033	0.022	0.18
MO-02-76, 13.72 -19.81m	1-974	0.26	0.004	0.67	0.08	0.50	2.86	0.009	0.019	0.23
MO-02-76, 44.20 - 50.29m	1-975	0.33	0.002	0.86	0.12	2.40	2.60	0.004	0.014	0.29
MO-02-76, 80.77 - 86.87m	1-976	0.30	0.005	1.14	0.09	120	3.14	0.003	0.010	0.25
MO-02-76, 129.54 -135.64m	1-977	0.28	<0.001	0.74	0.09	0.50	3.52	0.004	0.011	0.26
MO-02-76, 160.02 -166.12m	1-978	0.24	0.005	0.86	0.06	0.50	1.85	0.004	0.008	0.21
MO-02-76, 184.40 -190.50m	1-979	0.41	0.002	0.63	0.15	0.80	2.81	0.008	0.039	0.37
MO-02-76, 205.74 -211.84m	1-980	0.50	0.002	0.45	0.18	1.10	2.62	0.016	0.083	0.37
MO-02-76, 239.27 -245.36m	1-981	0.35	<0.001	0.52	0.14	2.20	2.96	0.003	0.027	0.30
MO-02-79, 53.42 - 59.44m	1-982	0.52	<0.001	0.80	0.36	2.20	4.24	0.008	0.016	0.44
MO-02-79, 65.53 - 71.63m	1-983	0.50	<0.001	0.72	0.26	1.90	4.24	0.006	0.013	0.44
MO-02-79, 86.87 - 92.96m	1-984	0.57	<0.001	0.81	0.45	2.70	4.38	0.011	0.038	0.51
MO-02-79, 102.11 -108.20m	1-985	0.57	<0.001	0.62	0.41	1.80	4.39	0.012	0.053	0.46
MO-02-79, 120.40 -126.49m	1-986	0.56	<0.001	1.07	0.52	2.20	5.27	0.010	0.040	0.44
MO-02-79, 135.64 -141.73m	1-987	0.70	<0.001	0.90	0.48	1.80	4.43	0.009	0.038	0.62
MO-02-79, 153.92 -160.02m	1-988	0.59	0.001	0.68	0.33	1.70	3.69	0.006	0.017	0.50
MO-02-79, 190.50 -196.60m	1-989	0.34	0.006	0.56	0.16	1.30	2.21	0.003	0.009	0.32
MO-02-79, 224.03 -227.08m	1-990	0.69	0.002	0.80	0.25	2.30	3.24	0.006	0.016	0.60
MO-02-79, 251.51 -257.56m	1-991	0.64	0.004	0.91	0.24	2.00	2.39	0.003	0.015	0.61
MO-02-80, 13.72 - 19.81m	1-992	0.62	0.001	0.91	0.26	0.70	1.93	0.007	0.013	0.57
MO-02-80, 25.91 - 32.00m	1-993	0.46	<0.001	0.66	0.32	0.80	3.19	0.006	0.020	0.39
MO-02-80, 44.20 - 50.20m	1-994	0.53	0.001	0.64	0.21	1.10	2.89	0.006	0.019	0.44
MO-02-80, 68.58 - 74.68m	1-995	0.47	0.002	0.61	0.22	0.80	2.55	0.007	0.017	0.42
MO-02-80, 80.77 - 86.87m	1-996	0.28	0.002	0.35	0.11	1.00	2.67	0.004	0.016	0.24

Table continues…

Sample ID	SPI Number	Cu (%)	Mo (%)	S (%)	Au (g/t)	Ag (g/t)	Fe (%)	Cu seq. H_2SO_4 (%)	Cu seq. NaCN (%)	Cu seq. A/R (%)
MO-02-80, 114.30 -120.40m	1-998	0.63	0.001	1.21	0.23	1.10	3.61	0.006	0.014	0.61
MO-02-80, 135.64 -141.73m	1-999	0.56	0.001	0.78	0.24	1.20	3.59	0.021	0.057	0.45
MO-02-80, 147.83 -153.92m	1-1000	0.49	<0.001	0.56	0.22	1.10	3.59	0.016	0.052	0.37
MO-02-80, 156.97 -163.07m	1-1001	0.33	<0.001	0.67	0.19	2.30	3.66	0.015	0.059	0.23
MO-02-81, 19.81 -25.91m	1-1002	0.17	0.003	0.56	0.08	1.60	3.97	0.005	0.007	0.16
MO-02-81, 44.20 - 50.29m	1-1003	0.32	<0.001	0.39	0.31	1.30	4.31	0.014	0.046	0.25
MO-02-81 , 56.39 - 62.48m	1-1004	0.21	<0.001	0.60	0.13	1.20	3.86	0.009	0.026	0.17
MO-02-81, 86.87 - 92.96m	1-1005	0.27	<0.001	0.57	0.17	1.20	3.01	0.005	0.032	0.24
MO-02-81, 117.35 -123.44m	1-1006	0.26	0.001	0.46	0.13	0.50	2.84	0.004	0.023	0.23
MO-02-81, 138.68 -144.78m	1-1007	0.33	0.004	0.64	0.11	0.50	1.32	0.003	0.021	0.28
MO-02-81, 156.97 -163.07m	1-1008	0.24	0.002	0.24	0.07	0.50	3.20	0.004	0.026	0.21
MO-02-81, 187.45–193.55m	1-1009	0.45	0.004	1.13	0.12	1.20	3.53	0.003	0.024	0.39
MO-02-82, 82.30 - 88.39m	1-1010	0.66	<0.001	0.74	0.56	2.10	4.48	0.044	0.190	0.41
MO-02-82, 94.49 - 100.58m	1-1011	0.57	<0.001	0.78	0.44	2.80	3.83	0.019	0.093	0.43
MO-02-82, 106.68 -112.78m	1-1012	0.54	<0.001	0.44	0.37	1.10	3.74	0.014	0.096	0.39
MO-02-82, 121.92 -128.02m	1-1013	0.55	<0.001	0.70	0.27	1.00	3.51	0.014	0.079	0.44
MO-02-82, 152.40 -158.50m	1-1014	0.29	<0.001	0.31	0.18	0.50	3.28	0.005	0.040	0.22
MO-02-82, 173.74 -179.83m	1-1015	0.47	0.005	0.58	0.19	0.70	2.81	0.006	0.036	0.35
MO-02-82, 195.07 -201.19m	1-1016	0.67	0.003	0.66	0.24	0.80	3.62	0.005	0.029	0.59
MO-03-83, 13.72 - 19.81m	1-1017	0.51	0.005	1.37	0.15	1.70	3.96	0.008	0.016	0.44
MO-03-83, 28.96 – 35.05m	1-1018	0.47	0.005	1.18	0.17	1.20	3.83	0.005	0.012	0.43
MO-03-83, 47.24 – 53.34m	1-1019	0.41	0.007	0.68	0.12	1.10	3.31	0.006	0.018	0.37
MO-03-83, 62.48 - 68.58m	1-1020	0.32	0.006	0.71	0.08	0.90	2.87	0.010	0.010	0.30

Table continues…

Sample ID	SPI Number	Cu (%)	Mo (%)	S (%)	Au (g/t)	Ag (g/t)	Fe (%)	Cu seq. H_2SO_4 (%)	Cu seq. NaCN (%)	Cu seq. A/R (%)
MO-03-83, 102.11 -108.20m	1-1022	0.77	0.001	0.97	0.25	2.90	4.78	0.014	0.009	0.70
MO-03-83,123.44-129.54m	1-1023	0.86	0.004	1.10	0.30	3.30	3.95	0.007	0.016	0.77
MO-03-83, 144.78 -150.88m	1-1024	0.75	0.005	0.94	0.25	2.50	3.77	0.010	0.014	0.66
MO-03-83, 169.16 -175.26m	1-1025	0.69	0.003	1.07	0.42	4.50	4.23	0.008	0.020	0.65
MO-03-83, 193.55 -199.64m	1-1026	0.74	0.010	0.98	0.33	3.70	3.52	0.005	0.022	0.68
MO-03-89, 74.68 80.77m	1-1027	0.23	0.016	1.86	0.06	0.70	4.36	0.002	0.005	0.23
MO-03-89, 10211 - 108.20m	1-1028	0.34	0.096	1.24	0.07	1.40	3.65	0.003	0.009	0.33
MO-03-89 129.54 - 135.64m	1-1029	0.45	0.012	1.10	0.10	1.50	3.20	0.003	0.009	0.40
MO-03;891 47:83 - I53.92m	1-1030	0.74	0.010	1.13	0.20	1.70	3.01	0.007	0.013	0.68
MO-03-89, 193.55 -199.64m	1-1031	0.45	0.008	0.75	0.11	1.70	3.17	0.006	0.012	0.41

Calc Head g	0.44	0.006	0.85	0.19	1.64	3.50	0.008	0.026	0.38
flax	1.05	0.096	2.48	0.56	6.20	7.74	0.044	0.190	0.96
Ain	0.17	0.001	0.24	0.05	0.50	1.32	0.002	0.005	0.16
Average	0.44	0.006	0.86	0.19	1.63	3.53	0.008	0.026	0.38
Std dev	0.18	0.013	0.38	0.12	1.04	1.15	0.007	0.026	0.16

A review of the head assays indicates that the data is relatively consistent and that the metal contents of the different samples vary greatly.

3.2.9 SGS Flotation Test Work Results

A report was submitted by SGS Minerals Services to PBM as part of the requirements for a feasibility study for grinding, flotation and circuit design on the Morrison property.

The principle components of the test work involved, comminution studies, flotation test work, grinding and flotation circuit design.

An average Bond Ball Mill Work Index of 16.1kWh/t was observed for the 82 samples tested. This is indicative of medium-hard ore. Various composites were assembled from the 82 samples for development and confirmatory flotation test work. These included 2 Master composites, 4 lithology composites, and 4 grade variability composites. The Master composites prepared from the 82 variability samples had a head grade given in Table 3.15.

Table 3.15 - Head Assay – Master Composite Sample

Cu (%)	Au (g/t)	Ag (g/t)	Mo (%)	Fe (%)	S (%)
0.45	0.21	1.4	0.006	3.53	0.89

A mineralogical investigation of the Master composite indicated that the major Cu mineral is chalcopyrite with minor amounts of bornite. Analysis of particle liberation shows that Cu-sulphides are generally not well liberated above 1504µm that liberation significantly improves between 150 and 75µm. Liberation of Cu-sulphides is best in the -38grn range. Based on this mineralogy, target primary grind size should be much finer than 150µm and target regrind size should be in the range of 30gm. The mineralogy is typical of other porphyry systems tested at SGS, but is considered marginally finer grained.

Flotation testing outlined a conventional flow sheet targeting a primary grind size K_{80} of -130gm for natural pH rougher flotation using standard collectors PEX and AERO 3302 and MIBC as frother. The rougher concentrate is then reground to a K_{80} of -25µm and cleaned in two stages at a pH of 11.5 to 11.8, adjusted with lime to depress pyrite, with small additions of CMC to control flotable non-sulphide gangue. These conditions were used in locked cycle testing using recycled effluent water from lab testing. An average over two Master Composite locked cycle tests and four Grade Variability composites resulted in the following metallurgical projections (Table 3.16).

Table 3.16 - Average Master Composite Sample Test Results

Product	Mass %	Assays, %, g/t				Distribution %			
		Cu	Mo	Au	Ag *	Cu	Mo	Au	Ag *
3rd Cleaner Conc	1.51	25.1	0.28	8.37	65.3	84.4	79.0	59.4	55.6
Combined Tail	98.5	0.071	0.001	0.10	0.67	15.6	21.0	46.3	44.4
Head (calc)	100.0	0.45	0.005	0.21	1.48	100.0	100.0	100.0	100.0

** Based on Master Comp tests only*

The majority of the samples tested showed a good relationship between Cu head grade and recovery, and Au head grade and recovery. Flotation testing on the lithology composites has lead to the conclusion that composite ZS-QZSE performed much poorer than the other lithology Composites. It is recommended that the impact of grind size on Cu recovery be investigated for this lithology.

While not all ore samples tested contained significant amounts of molybdenum, when present, it recovered well into a bulk cleaner concentrate. Limited molybdenum flotation testing on bulk cleaner concentrate demonstrated that Mo concentrates in excess of 50% Mo could be achieved with reasonably high stage recovery.

For more details, see the report by SGS entitled, "Morrison Project Flotation Test Work Report as a part of the Feasibility Study Prepared for Pacific Booker Minerals Inc.", December 12, 2007.

3.2.10 HPGR Test Work and Results

After discussions were held with all HPGR manufacturers, in August 2007, Polysius was contracted by PBM to conduct test work on high pressure comminution. The 1.7t of molybdenum ore samples were shipped to Polysius test facility in Beckum,
12 Germany and tested in September 2007.

A series of pilot scale HPGR tests were carried out to demonstrate the ability of HPGR in processing of the Morrison material. The tests were conducted using stud linings.

The results from the test work are shown in Figure 3.2.

Figure 3.2 - Results of a Single Pass through the HPGR

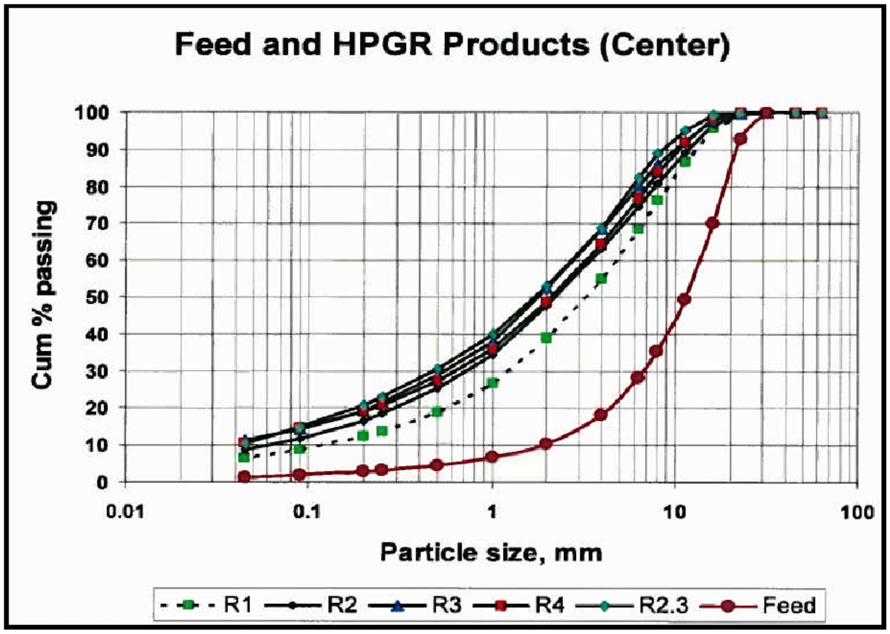


Figure 3.3 - Results of Closed Circuit Testing in the HPGR

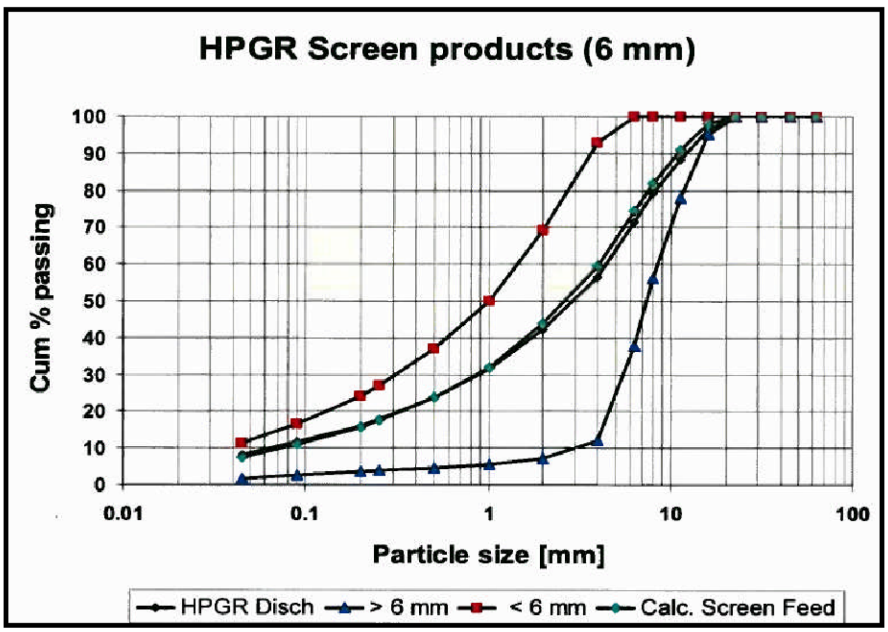


Figure 3.4 - Results of Locked Cycle Test, Test R2.3

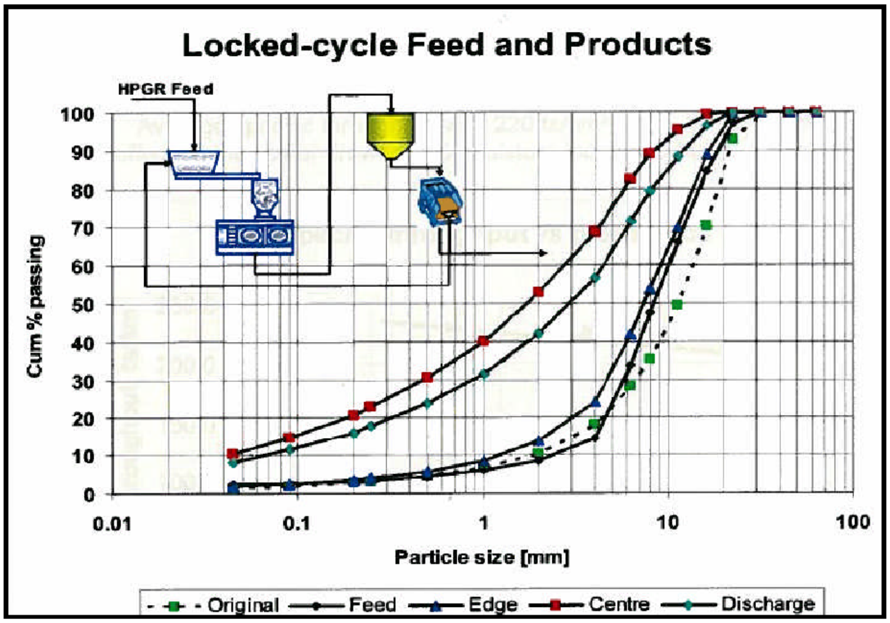
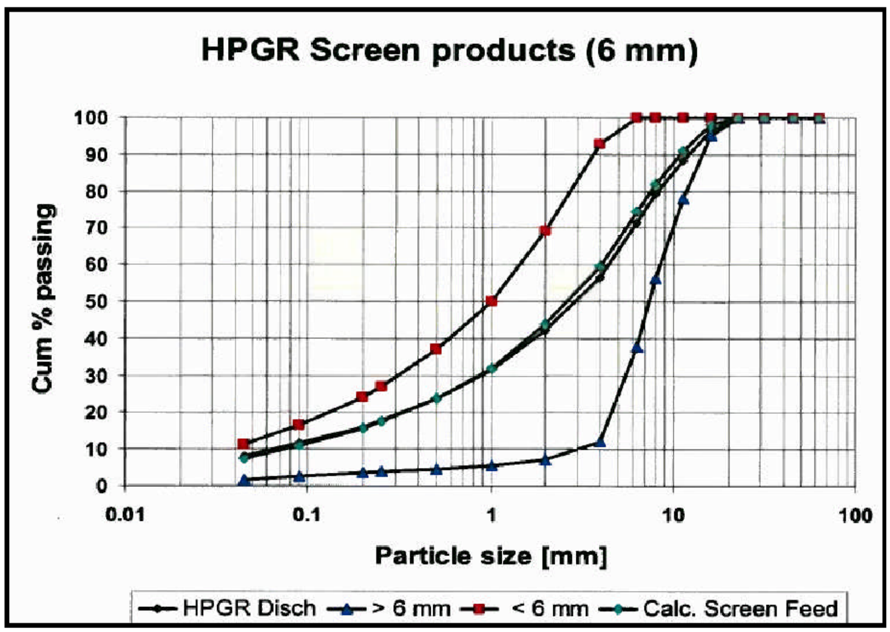


Figure 3.5 - Size Distributions Dry Screen Products, Test R2.3



In the comminution test series, the influence of the specific pressing force, the influence of the feed moisture and the influence of different roller wear linings were investigated. The Morrison material showed good response to high pressure comminution.

The high pressure grinding tests showed the following results:

- The material was found to be of low to medium abrasiveness, ATWI index 9-15g/t.
- The size reduction achieved was better than average for copper ores.
- Increasing pressure had a minimum effect. The maximum specific press force necessary was 3.5N/mm^2.
- The specific throughput for design purposes was 220ts/hm^3. Recycling of oversize in a close-circuit operation has no significant effect.
- The net specific energy consumption was 1.7kWh/t at a specific press force of 3.5N/mm^2 for dry material, and 2.0kWh/t for wet material with 4-5% moisture content.
- The material did not form competent flakes on pressing, and could be screened with relatively high efficiency.
- The Bond Work Index of the sample tested was 17.8kWh/t before and 16.1kWh/t after HPGR. Pressing in the HPGR resulted in a 10% weakening of the material, through the formation of micro-cracks.
- LABMILL tests indicated potential energy saving in the order of 14% at a P_{80} size of 200µm and 12% at 90µm from the greater amount of fines created by the HPGR.

The machine was sized and the 24/17 HPGR model was used for the circuit for the interim feasibility study. This machine is capable of processing 30,000t per day.

For more details on the HPGR, see the report by Polysius entitled “High Pressure Grinding Tests on Copper/Gold/Molybdenum Ore from the Morrison Project, Pacific Booker Minerals at the Polysius Research Centre, December 6, 2007”, attached as Appendix E.

3.2.11 HPGR versus SAG Milling – Effect on Flotation Recovery

A comparison study to evaluate the flotation response of HPGR prepared flotation feed versus standard prepared flotation feed was prepared by SGS in October 2007.

Table 3.17 shows the head assays for both sub-samples.

Table 3.17 - Head Assays – SGS Lakefield Research

Composite	Cu (%)	Mo (%)	Au (g/t)	S (%)
GT Comp	0.78	0.060	0.23	1.13
HPGR – GT Comp	0.79	0.044	0.24	1.26
Average	0.79	0.052	0.24	1.20
Std. Dev.	0.01	0.011	0.01	0.09

The SGS head assay results reported in Table 3.17 also shows that the GT composite is of relatively high Cu and Mo grade compared to the Master composite indicated at Table 3.15 (0.45% Cu, 0.006% Mo, 0.21g/t Au and 0.89% S).

The report stated that the HPGR-GT Comp had a finer size distribution than the GT Comp, requiring a shorter grind time in a laboratory mill to reach the target flotation feed primary grind size (suggesting a lower BWI). At the target primary grind, both composites had the same size distribution.

Both cleaner and locked cycle tests on both composites gave similar metallurgical results to those observed in previous test work conducted under 11474-001. The comparison study on flotation recovery applying HPGR comminution versus conventional comminution showed that no remarkable improvement for copper recovery can be achieved.

For more details on the HPGR, see the report by SGS entitled “The Flotation Response of HPGR versus Conventionally Crushed Flotation Feed from the Morrison Deposit Prepared for Pacific Booker Minerals Inc.”, January 17, 2008.

3.3 FLOWSHEET DEVELOPMENT

The mill flow sheet design is based on the results of crushing, grinding and flotation test work carried out by SGS in 2006 and 2007 and also takes into account Polysius HPGR pilot testing.

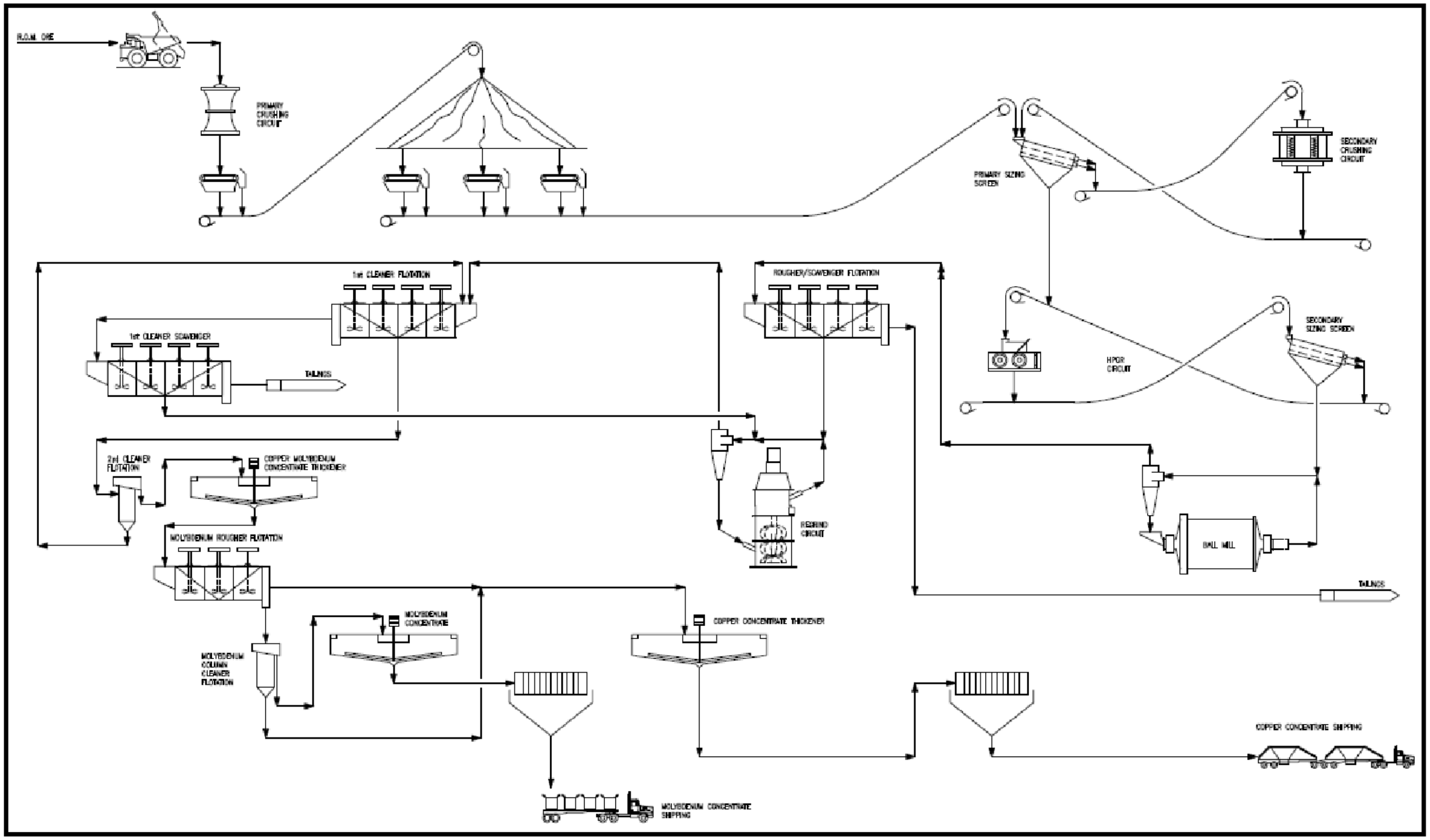
The following unit operations are included in the mill circuit:

- A single stage gyratory crusher
- Closed Circuit Cone Crusher
- High Pressure Grinding Rolls (as Tertiary crushing)
- Two parallel ball mills in closed circuit with cyclone classification
- Conventional tank cell configuration for rougher, scavenger and pyrite flotation
- Two stage cleaner circuit (combined with ore regrinding and classification)
- Molybdenum Flotation
- Copper concentrate dewatering, storage and shipment

- Molybdenum Concentrate dewatering, drying, packaging, storage and shipment
- Pyrite flotation (optional)
- Final tailings handling and cycloning for tailings facilities development
- Tailings disposal and reclaim process water

A simplified process circuit is shown in Figure 3.6 below.

Figure 3.6 - Simplified Process Circuit



The detailed process flow sheets including the mass and water balances are included in Appendix A.

3.4 PROCESS DESIGN CRITERIA

The process design criteria summary for the Morrison Project process is shown in Table 3.18. The design parameters selected have been based on metallurgical test work results which are detailed in subsequent pages of this section. Average annual throughput is 10.9Mt (30,000t/d).

Table 3.18 - Process Design Criteria – Morrison Project

Description	Unit	Value	Sources
General			
Type Of Deposit		Porphyry Copper Gold Ore	
Ore Characteristics			
Specific Gravity	g/cm³	2.7	6
Bulk Density	t/m3	1.6	2
Moisture Content	%	3.0	1
Abrasion Index (Average)	g	0.320	6
Operating Schedule			
Shift/Day		2	1
Crusher Plant Hours/Shift	h	8	1
Crusher Plant Hours/Day	h	16	1
Grinding and Flotation Hours/Shift	h	12	1
Grinding and Flotation Hours/Day	h	24	1
Days/Year	days	365	1
Plant Availability/Utilization			
Overall Plant Feed	t/y	10,950,000	2,1
Overall Plant Feed	t/d	30,000	1
Crushing Plant Availability	%	75.0	2
HPGR Availability	%	95.0	2
Grinding and Flotation Plant Availability	%	92.0	2
Crushing Rate	t/h	2,500.0	3
HPGR Rate	t/h	1,315.8	3
Grinding Rate	t/h	1,358.7	3
Flotation Rate	t/h	1,358.7	3
Head Grades	% Cu	0.40	6
	% Mo	0.006	6
	g/t Au	0.19	6
	g/t Ag	1.60	6

Table continues…

Description	Unit	Value	Sources
Recovery	Cu %	84.00	5,6
	Mo %	78.00	5,6
	Au %	56.00	5,6
	Ag %	56.00	5,6
Cu Concentrate Grade	% Cu	26.50	5,6
	% Mo	0.37	5,6
	g/t Au	9.00	5,6
	g/t Ag	75.00	5,6
Mo Concentrate Grade	% Cu	0.83	5,6
	% Mo	53.60	5,6
Cu Concentrate Mass Recovery	%	1.27	3
Mo Concentrate Mass Recovery	%	0.009	3
Cu Concentrate Production	t/y	138,838	3
Mo Concentrate Production	t/y	956	4

Notes:1. Client; 2. Industry/Experience; 3. Calculation; 4. Mass Balance; 5. PRA Met Lab; 6. SGS Met Lab

The process detailed design criteria is presented in Appendix D.

3.5 PROCESS DESCRIPTION

Processing of the ore will be performed on-site using crushing, grinding and flotation to recover copper and molybdenum concentrates. The crushing, grinding, and flotation test work was conducted by SGS Canada at Lakefield, Ontario during the years of 2006 and 2007. The high pressure grinding pilot testing was conducted by Polysius at Beckum, Germany in 2007.

The flow sheet design is based on 30,000t/d mill capacity with an overall mill availability of 92% which allows for scheduled and non-scheduled maintenance. The process facilities will operate 365 days per year, 24h/d for the whole of the comminution and processing system.

The facilities include the following unit operations:

3.5.1 PRIMARY CRUSHING AND COARSE ORE STORAGE

Run of Mine (ROM) material from the pit is delivered by 227t capacity haul trucks that dump directly to the 1,370 by 1,900mm primary gyratory crusher. The gyratory crusher discharge is collected by a 1,830mm apron feeder under the crusher. The feeder then transfers the crushed ore onto a 1,524mm conveyor, which in turn discharges onto the crushed ore stockpile. The total live capacity of the stockpile is 30,000t. A dust collection system is installed to minimize dust emissions.

Further details are provided in drawings A0-09-002 and A0-09-003 in Appendix A.

3.5.2 Secondary and Tertiary Crushing

Three 1,200mm x 5,500mm apron feeders withdraw ore from the stockpile onto the 1,372mm wide x 201,300mm long primary sizing screens feed conveyor at an average rate of 1,359t per operating hour. The primary sizing screens are 2,700mm wide x 8,000mm long with grate apertures of 75 and 45mm. The oversize material (+45mm) from both screens is feed to the two Cone Crushers powered with 750kW motor each (one cone crusher is on standby).

The undersize product from the primary sizing screens (-45mm) is fed to the High Pressure Grinding Rolls (HPGR) surge bin. The material then is fed to the HPGR powered (with 5.3MW motor) through a belt feeder and then to the secondary sizing screens. The secondary sizing screens are 4,000mm wide x 8,000mm long with grate apertures of 20 and 6mm.

The oversize product (+6mm) from the secondary sizing screens is returned to the HPGR surge bin through series of belts conveyors.

The undersize product (-6mm) is mixed with water before being fed to the grinding cyclones feed pump box. Water is added with the ore to form slurry in the cyclones feed at about 55% solids.

3.5.3 Primary Grinding

The two 6.1m x 10.2m ball mills are powered with 6,700kW motor. The ball mills are in closed circuit with a one stage cyclone package.

The flotation collector reagents, Aero 3302 and PEX, are added to the ball mill pumpbox. Other reagents if required may also be added to the pumpbox.

The pumpbox slurry is pumped to the two sets of 660mm primary cyclones (5 operating, one stand-by each), with the underflow returning to the ball mill. The primary cyclone overflow, at approximately 35% solids and a pH of about 8, is advanced to the copper flotation circuit for further recovery. The particle size range is 80% less than 150µm.

Further details are provided in drawing A0-09-004 in Appendix A.

3.5.4 Copper and Molybdenum Concentration and Regrinding

The circuit contains the following stages:

- Copper rougher/scavenger flotation
- Copper rougher/scavenger and first cleaner/scavenger concentrates regrinding
- Copper first and second cleaner flotation’s
- Molybdenum rougher flotation
- Molybdenum cleaner flotation

The primary grinding cyclone overflow (from the grinding section) is directed to copper rougher flotation. The slurry from the cyclones is fed to the four $200m^3$ mechanical cells. The copper rougher tailings are scavenged using four $200m^3$ mechanical cells prior to discharge to the tailings impoundment. MIBC (a frother) and possibly more reagents are added as required.

The copper rougher/scavenger concentrates are collected in a pump box and more reagents and makeup water are added as required. This is then sent to the regrind mills cyclopac. The underflow drops into the regrind mills feed chute and returns for regrinding. Each regrind mill processes about 140 to 150t/h. Lime is also added to the regrind mill to maintain a pH of about 11.5.

The regrind cyclone overflow, at approximately 25% solids, is directed to the first cleaner flotation cells. The particle size P_{80} is less than 25µm. The tailings of the first copper cleaner stage is scavenged using conventional mechanical cells with the concentrate being re-circulated to the regrinding mill feed. The tailings product is added to the copper rougher/scavenger tails as final tailings.

The concentrate from the first copper cleaner stage is then advanced to the copper second cleaner flotation. The second cleaner is using a 3.1m ø x 10.0m column cell with the concentrate advanced to the molybdenum flotation circuit and tailings recycled to the copper first flotation.

The concentrate from the copper second flotation is fed in an 11m ø copper-molybdenum concentrate thickener. The thickened concentrate is fed to the three $5m^3$ mechanical cells. The molybdenum rougher tailings together with the copper-molybdenum and final molybdenum concentrate thickeners overflows are advanced to the copper dewatering circuit. The molybdenum rougher concentrate is further processed to the single cleaner stage circuit (column cell). The final molybdenum cleaner concentrate is predicted to be achieved with a grade of 45 to 50% Mo.

Further details are provided in drawings A0-09-005, A0-09-006, and A0-09-007 in Appendix A.

3.5.5 Copper Concentrate Dewatering

The final copper concentrate is thickened in an 11.4m ø concentrate thickener with the aid of flocculent. The thickener overflow is recycled to the process water tank for reuse. The underflow, at 60% solids, is pumped to a pressure filter.

The copper concentrate filter cake is expected to have between 8 and 10% moisture. The cake is conveyed to a stockpile. The water discharged from the filter is recycled to the concentrate thickener to recover the fine solids in the water.

Further details are provided in drawings A0-09-007 and A0-09-008 in Appendix A.

3.5.6 MOLYBDENUM CONCENTRATE DEWATERING, DRYING, PACKING AND TRANSPORTING

The final molybdenum concentrate is thickened in a 2.5m ø thickener with the aid of flocculent. The thickener underflow at 60% solids is pumped to a filter. The molybdenum concentrate filter cake is expected to have between 10 and 15% moisture. The cake is conveyed to a standard rotary dryer to further reduce the moisture content to less than 5%. The final molybdenum concentrate product discharges into a bin prior to packaging.

An automated bagging machine will package the dried molybdenum concentrate into two-tonne tote bags at a rate of one bag per hour. These bags are weighed and sampled before moving them to a storage area. The molybdenum concentrate production is approximately 0.01% of the mill feed tonnage averaging 8t/d, as shown in drawing A0-09-007.

3.6 TAILINGS, RECLAIM, FRESHWATER AND ASSOCIATE SYSTEMS

The following is a summary of the report prepared by KCBL to develop a feasibility design for the following systems:

- Tailings dam
- Final Tailings Pump System
- Tailings Pond Reclaim System
- North and South Seepage Pond Water Reclaim System
- Fresh/Process Make-up Water System

3.6.1 TAILINGS STORAGE FACILITY (TSF)

The TSF covers an area of approximately 5km^2, with an uphill drainage area of approximately 5km^2. Current drainage from the TSF flows south into a small creek and into Morrison Lake and a small amount flows northward into Nakinilerak Lake. The Main Starter Dam will be constructed as a homogeneous fill dam using glacial till borrow material from the interior of the TSF and from stripping of the open pit. A sand and gravel blanket drain will be placed under the downstream tow of the dam to control seepage. The dams will be raised by the centerline method with a central glacial till core and cyclone sand on the downstream and upstream sides. The downstream slopes of the dams will be 3H:1V. Seepage collection systems, downstream of each dam will include a dam and water return system to recycle seepage and cyclone sand drainage water back to the impoundment. A pump barge will return water via a buried pipeline to the plantsite. The tailings delivery system includes 2 pump stations and an approximately 760mm ø HDPE and HDPE-lined-steel pipeline to crest of the dams. Cyclowash cyclones located on the dam crest will be used to cyclone sand for construction of the dams between March and October of each year.

3.6.2 *Tailings Pipeline Concept Design*

Final tailings from the crushing plant will feed into a tailings pump box. The tailings is then pumped to the tailings dam via two pump stations, each containing four (4) centrifugal slurry pumps. Pump Station No. 1 is located within the plant site. Pump Station No. 2 is located adjacent to the dam access road along the pipeline route.

The tailings pipeline is routed along the tailings dam access road, where possible, to reduce clearing and preparation of a right-of-way. Once at the tailings dam, the pipe is routed around the north and south side of the TSF via separate branches. Spigots spaced at regular intervals will provide connection for the hydrocyclone system, or discharge directly to the tailings pond. Underflow from the hydrocyclones will be dozed and compacted in “cells” constructed in the shells of the tailings dam. Excess water from the underflow will drain from the sand to the seepage reclaim pond.

3.6.3 *Pump Station Design*

The total dynamic head is provided by eight (8) centrifugal slurry pumps, four (4) located in each pump station. The pump station includes:

- A pump box with a live capacity of approximately 265m^3
- A train of four (4) centrifugal pumps connected in series
- Isolation valves, pressure safety valves, flush and drain valves (for pump maintenance), couplings and associated piping
- Flow, density and pressure instrumentation
- Pump control system
- Medium voltage (4,160kV) switchgear

Pump Station No. 1 is located within the plant site.

Pump Station No. 2 is a stand-alone pump station and, in addition to the above items, will also include:

- A structural pre-engineered steel building nominally 23m long and 13m wide, equipped with a travelling crane, floor drains, sump pump, oil/water separator, lighting, ventilation, heating, small power and welding outlets. All switchgear, power distribution equipment and controls will be housed in a separate electrical room.

Tailings Pipeline

The tailings pipeline will be surface run and anchored by dumping a load of fill on the line at regular intervals. No heat tracing is provided. In the event of a pump trip, the line will be automatically drained to emergency ponds and the TSF. The tailings will be left to settle, the water treated and released. Settled tailings will be excavated and trucked to the tailings dam on a periodic basis.

The tailings systems will be operated from a dedicated control panel installed in the process control room for the plant. The pipeline and the associated pump stations will include sufficient instrumentation to allow for unattended operation.

Hydrocyclone Operation

Two (2) hydrocyclones are required to process the tailings and provide the particle size distribution required for tailings dam construction.

3.6.4 *Tailings Pond Reclaim System*

The reclaim system consists of a reclaim barge with pumps, a reclaim line from the tailings pond to the fire water tank, then continuing to the plant site. The Cyclowash supply line tees off the reclaim line at the crest of the Main Dam. Reclaim water will be pumped from the tailings pond to the crest of the dam, where the water will the flow by gravity to the reclaim/fire water tank at El. 906m.

Cyclowash water will be sourced from a tee off the main reclaim line and pumped around the tailings dam crest via a separate set of pumps.

Gravity lines were sized so that pumping is not required and friction losses are less than the total static head available. Throttling will be required by a control valve at the discharge into the firewater tank and processing plant.

The reclaim pipeline is routed to reduce the amount of clearing required. The pipeline is routed along the seepage pond service road and then onto the reclaim barge via a direct overland route.

Pipeline Operation and Control

The reclaim system will be operated from a dedicated control panel installed in the process control room for the plant. Local controls will also be required. The pipeline and the associated pump stations will be designed for unattended operation and will include sufficient instrumentation for this to be undertaken.

3.6.5 *Cyclowash System*

The reclaim system will provide water to the Cyclowash water supply system. Two booster pump stations are required, Pump Station No. 1 located adjacent to the connection to the reclaim system and Pump Station No. 2 located at the east abutment of the Main Dam. Cyclowash Pump Station No. 1 supplies water to hydrocyclones located on the Main Dam and will supply water to Pump Station No. 2. Pump Station No. 1 can also supply water to the West Dam in the event hydrocyclones are used for dam construction.

To allow for moving the pump stations as the Main Dam is raised, each pump station will be skid mounted. A dozer tractor will be able to move the pump skids as required.

3.6.6 Seepage Pond Reclaim System

There are two seepage ponds, the North Seepage Pond and the South Seepage Pond. Each pond has a dedicated seepage reclaim pump system that will return reclaimed seepage water to the tailings pond. Pumps will be located in a pumphouse adjacent to each seepage pond. Pumps will be vertical turbine pumps, drawing water from a precast concrete well. HDPE pipe will connect the well to the ponds.

Pipeline Operation and Control

The seepage pond reclaim system will be operated from a dedicated control panel installed in the process control room for the plant. Local control will also be required. The pipeline and the associated pump stations will be designed for unattended operation and will include sufficient instrumentation for this to be undertaken.

3.6.7 Fresh/Process Water Make-Up System

The fresh/process water make-up system consists of a pump house located on the shores of Morrison Lake and a discharge pipeline to the plant site. Two vertical turbine pumps will draw water from a well, connected to the lake by HDPE or steel pipe.

Pipeline Operation and Control

Freshwater pump control will be ON/OFF control. The pump control will be based on the Freshwater tank level. The pumps will operate on a duty/standby arrangement and automatic changeover control will cycle each pump through a duty cycle.

3.7 Process Equipment List

The detailed list of the main mechanical equipment, including descriptions of the major process items are presented in Appendix B.

3.8 Mill Services

The mill services generally consist of the following:

- Water distribution
- Air supply and distribution

- Building services

3.8.1 Water Distribution

Process Water System

Process Water is supplied from the process water tank, and comprises thickener overflow, tailings dam reclaim and fresh water make-up.

Process water distribution within the processing plant is shown on flow sheet drawing A0-09-009 in Appendix A.

Reclaim and Fire Water

There will be a combination Reclaim/Fire water tank located outdoors above the plant facilities at Elevation 904m above sea level.

The upper portion of the tank will be for Reclaim water supplied from the Tailings Pond and passing through to the Process water tank at the plant. The lower portion of the tank will hold a dedicated quantity of water for fighting fires. Both portions of the tank are sized for a retention time of 2 hours. This tank will be equipped with a vented roof and will be insulated on the roof and walls. The tank size is 16,000mm ø by 16,000mm high.

Fire water will be piped to all main facilities by gravity to connect with buried underground fire water ring mains around each of the facilities. Each of these buried ring mains will carry water to a network of yard fire hydrants located around the buildings; and to riser pipes feeding indoor wall hydrants, sprinkler systems and hose stations. The ring mains will include isolating valves strategically located such that any potential fire could be fought with water from more than one direction.

Fresh Water Systems

Fresh water is pumped from Morrison Lake to a Fresh water holding tank in an open top atmospheric tank size 6,000ø by 7,000m high. Fresh water is distributed by a pump for start-up and emergency purposes, gland seal water, reagents, flotation cleaning stages, process water make up and potable water. Gland seal water is pumped separately from the Fresh water tank to all the process slurry pumps inside the processing plant.

Potable Water System

Distributed fresh water is collected in a potable water storage tank. The water is pumped from this tank through a hydro chlorinator and into a distribution piping ring to serve all the potable water users in all facilities including the processing plant. The main users of potable water include the plant workshop, the administration building, and washrooms and safety showers in the processing area.

3.8.2 Air Supply and Distribution

Compressed air to the plant is supplied and distributed as follows:

- Plant air is supplied by a common compressor for utility and instrument air.
- Instrument air is provided from the plant air compressors, which is then dried and stored in the plant instrument air receiver.

Further details regarding the air supply and distribution are provided in drawing A0-03-012 in Appendix A.

3.8.3 Building Services

Heating & Ventilation

The primary heating source will be gaseous propane, distributed from a single propane storage tank farm located south west of the mill building.

The HPGR building will not be heated. Ventilation air will be provided to maintain air quality within the building. Multiple ventilation fans will be provided to enable different air change rates to be applied during different activities and outdoor air temperatures.

The primary crushing will be provided with localized "spot" heating, with electric heaters to ensure that during a shutdown the area is freeze protected. Ventilation will be provided to remove the hot air generated from equipment drives.

The mill building will be provided with perimeter propane unit heaters as well as ventilation fans to ensure air quality within the building. Make up air will be provided to offset exhaust air from dust collection systems.

The administration building will be provided with heating ventilation and air conditioning systems, as well as local exhaust systems.

The service areas of the truck shop will be provided with heating and ventilation systems, with propane fired radiant heaters, exhaust fans and make up air units. The warehouse area will be provided with propane fire units heaters and exhaust fans.

The assay laboratory will be provided with dust collection systems in the sample prep area, with propane fired make up air units and electric baseboard heaters as well as local lab exhaust systems.

The truck wash will be provided with propane fired radiant heaters and exhaust fans.

DUST CONTROL

Dust Control will be provided with aspirated systems, with dust hoods and ducting being connected to dry dust collectors at the following locations:

- Primary Crushing (below crusher)
- Stockpile Reclaim Area
- Secondary Crushing
- HPGR Building
- Concentrate Load out

Water sprays will be utilized at the truck dump pocket and at the feed to the coarse ore stockpile during non-freezing weather.

The fines from the dust collectors will be collected in separate tote bins for manual transportation back into the process.

FIRE PROTECTION

The plant site will be provided with a fire protection system comprised of the following:

General:

- There will be a combination Reclaim/Fire water tank located above the processing plant facilities at Elevation 904m above sea level.
- The upper portion of the tank will be for Reclaim water supplied from the Tailings Pond and passing through to the Process water tank at the plant. The lower portion of the tank will hold a dedicated quantity of water for fighting fires. Both portions of the tank are sized for a retention time of 2 hours. This tank will be equipped with a vented roof and will be insulated on the roof and walls. The tank size is 16,000mm ø by 16,000mm high.
- Fire water will be piped to all main facilities by gravity to connect with buried underground fire water ring mains around each of the facilities. Each of these buried ring mains will carry water to a network of year fire hydrants located around the buildings; and to riser pipes feeding indoor wall hydrants, sprinkler systems and hose stations. The ring mains will include isolating valves strategically located such that any potential fire could be fought with water from more than one direction.
- In addition, all buildings will be equipped with hand held fire extinguishers of two types. General purposes for inside plant areas and dry type for inside electrical and control rooms.

Specific fire protection systems will include the following:

MILL BUILDING

- Wet Class 2 standpipe hose systems
- Clean agent automatic suppression system in the control room
- Automatic Wet Sprinklers shall be provided to protect the following areas:
  - Reagents
  - Lube units
  - Compressors
  - Office areas

HPGR BUILDING

- Dry Class 2 standpipe hose systems (unheated building)
- Automatic Dry Sprinklers shall be provided to protect the following areas:
  - Conveyors within the building
  - Lube units
  - Compressors
  - Office areas

CONVEYORS

- Dry risers from grade up to walkway where walkway exceeds 12m above grade
- Crushed ore conveyor – portable fire extinguishers and access by fire truck along length of conveyor

TRUCK SHOP & WAREHOUSE COMPLEX / TIRE CHANGE & TRUCK WASH

- Wet Class 2 standpipe hose system shall be provided throughout the building
- Automatic Wet Sprinklers shall be provided throughout the building

ADMINISTRATION / DRY

- The IT room will be protected by an automatic clean agent suppression system.

ASSAY LABORATORY

- Automatic wet sprinklers will be provided throughout the building

It should be noted that the above is in addition to fire detection systems specified elsewhere.

3.9 Instrumentation and Process Control

3.9.1 Overview

The plant control system will consist of a Distributed Control System (DCS) with PC based Operator Interface Stations (OIS) located in two separate control rooms. The DCS, in conjunction with the OIS, will perform all equipment and process interlocking, control, alarming, trending, event logging, and report generation. DCS Input/Output (I/O) cabinets will be located in electrical rooms throughout the plant and interconnected via a plant wide fibre optic network.

Field instrumentation will consist of microprocessor based “smart” type devices. Instruments will be grouped into process areas and wired to local field instrument junction boxes located within those areas. Signal trunk cables will connect the field instrument junction boxes to DCS I/O cabinets.

3.9.2 Primary Crusher

A control room in the primary crushing building will be provided with a single OIS. Control and monitoring of all primary crushing, conveying, and stockpiling operations will be conducted from this location.

Control and monitoring functions will include, but are not limited to the following:

- Plugged chute detection at all transfer points
- Zero speed switches, side travel switches, emergency pull cords and belt rip detection of all conveyors
- Weightometers on selected conveyors to monitor crushing rates and quantities
- Equipment bearing temperatures and lubrication system status
- Vendors’ instrumentation packages

3.9.3 Mill

A central control room in the mill building will be provided with three OIS. Control and monitoring of all processes in the Mill Building, Secondary Crusher and HPGR will be conducted from this location.

Control and monitoring functions will include, but are not limited to the following:

- primary and secondary sizing conveyors (zero speed switches, side travel switches, emergency pull cords and plugged chute detection)
- cone crushers (bearing temperatures, lubrication systems, clutches and motors)
- HPGR (bearing temperatures, lubrication systems, rolls, motors)
- grinding mills (bearing temperatures, lubrication systems, clutches, motors, and feed rates)

- pump box, tank, and bin levels
- pump speeds
- cyclone feed density controls
- thickeners (drives, slurry interface levels, underflow density, and flocculants addition)
- flotation cells (level controls, reagent addition, and air flow rates)
- column cells (level controls and reagent addition)
- concentrate filter, dryer and load-out
- reagent handling and distribution systems
- tailings disposal
- water storage, reclamation, and distribution
- air compressors

All the plants interlocking, monitoring and control functions are implemented within the DCS. This will comprise graphical operator workstations in the control room, windows based hardware and software application and a system of manufactured Input/Output (I/O) cabinets to allow the control system to interface with the motor starter, valves and associated equipment that perform the actual plant control.

3.9.4 Specialty Systems

Optimization systems for grinding and flotation have been identified for inclusion in order to assist the facility in maximizing the recovery from and efficiency of its grinding operations. These "expert" systems operate on stand-alone computers but are able to interface with the plant DCS system in order to exchange data and control process equipment.

3.10 Reagents and Consumables

3.10.1 Reagent Handling and Storage

Reagents are added to the flotation circuit to enhance selective floatability. The reagent addition points are shown in the flow sheet drawings. The total reagent consumption is shown in Table 3.9 with further details on drawings A0-09-009/010 in Appendix A.

The main proposed reagents to be used for the Morrison project are: lime, PEX, Aero 3302, Kerosene, CMC, MIBC and flocculants. Most reagents will be received in bulk as in palletised bags, drums, or bulk bags.

All reagents will be prepared and stored in a separate, self-contained area within the concentrator building and delivered by individual metering pumps or centrifugal pumps to required addition points. All the reagents will be prepared using fresh water.

The covered and curbed reagent storage and preparation area will be located adjacent to the flotation area. A forklift with a drum handler attachment will be used for reagent handling, while the electric hoist servicing the concentrate load-out and reagent areas will lift the reagents to the respective reagent mixing area located above the mixed reagent storage area. The reagent system will include unloading and storage facilities, mixing tanks, transfer pumps, and feeding equipment.

Test reagents may be used periodically and a dedicated reagent mixing and storage system is included. Any unused test reagent will be returned to the supplier.

Each reagent line and addition point will be labelled according to Workplace Hazardous Materials Information Systems (WHMIS) standards. All operational personnel will receive WHMIS training and additional training in the safe handling and use of the reagents based on the best practice.

Reagents are added to the flotation circuit to enhance selective floatability. The reagent addition points are shown in the flowsheet drawings. The total reagent consumption is shown in table 3.19 with further details on drawings A0-09-009/010 in Appendix A.

3.10.2 CONSUMABLES

The major consumables for the comminution circuit are balls and liners. HPGR roll wearing was calculated by the vendor during recent high pressure comminution tests.

The type of reagents and major consumable consumption rates for the process plant are summarised in Table 3.19 below.

Table 3.19 - Reagents and Major Consumables Consumption

Reagent/Consumable	Consumption (g/t*)
Lime	500
Kerosene	6
Aero 3302	15
CMC	5
PEX	55
MIBC	55
Fuel Oil	6
Flocculent	10
Dryer Fuel Oil	1
Grinding Balls	923
Regrinding Balls	166
Liners, Crushing & Grindings	93
HPGR Rolls	42

*g/t = grams/tonne of mill feed

3.11 QUALITY CONTROL

There is an assay laboratory in the processing plant building to process routine samples of intermediate and final products for quality control (mill feed and flotation products). Samples from the mine are also analysed in this laboratory for grade control and mine planning.

The major items of laboratory equipment include:

- Laboratory jaw and cone crusher
- Dust collection system
- Laboratory ball mill
- Atomic Absorption Spectrophotometer
- Oven-style moisture determination equipment
- Particle size analysis including Rotap sieving
- Sedimentation devices and laser counting
- Denver D12 rougher flotation machine with the necessary cells for test work
- Laboratory cleaner flotation cells (2 and 5L)
- pH meter
- Convection oven
- Weighing devices
- Fume hoods with extraction fans

3.12 HPGR TRADE-OFF STUDY

As part of the feasibility study, a trade-off study to evaluate the application of HPGR as an alternative technology to the conventional SAG milling technology for the Morrison project was prepared.

Based on cost considerations, the HPGR grinding option has been determined to be favourable.

A significant savings in total operating costs (23%) indicated that it is favourable to use the HPGR option when compared with the more conventional SAG milling option. In addition, the HPGR option can provide increased revenue due to the increased availability and plant capacity.

Based on the results from the Polysius pilot testing and the evaluation of conducted trade-off study the design basis engineering proceeds to incorporate HPGR into the Morrison Project.

The detailed HPGR trade-off study report is shown in Appendix E.

4.0 MINING

4.1 INTRODUCTION

Mine design and planning for the Morrison Copper/Gold Project was undertaken in two phases by several groups of engineers. Pit optimization, design and scheduling were undertaken by NMS during 2006 through 2008. Equipment selection, operations planning, capital and operating cost estimation was undertaken by Wardrop in 2008.

NMS first visited the Morrison Property location in July 2006. Following the site visit, pit designs and production schedules were developed for a two phase open pit operation which required waste disposal a considerable distance from the pit within the tailings management facility. Preliminary economic analysis of this plan indicated that a revised plan and increased metal price assumptions would be required to improve overall projects economics.

As a result a revised mine plan was developed in 2008. A larger four phase pit design was developed and the mine waste disposal sites were relocated to areas immediately adjacent to the open pits. The overburden stockpiles were relocated south of the pits. These revisions together with increases in metal prices assumptions have resulted in increased mine operating life and improved project economics.

Wardrop used the production schedules for the four phase pit design developed by NMS to prepare the capital and operating cost estimates for the open pit mine.

This section of the report summarizes the design process, the mine schedule, the mine operations plan, operating and capital cost estimates for the open pit.

4.2 SUMMARY

4.2.1 *PROJECT DESCRIPTION*

The current project configuration consists of a 30,000tpd conventional copper concentrator and diesel powered open pit operation. The mineable reserve is estimated to be 224Mt with an average grade of 0.330% Cu, 0.163g/t Au and 0.004% Mo reported at a $5.60/t NSR cut-off grade.

The PBM Morrison Copper/Gold Project is an open pit mine; to be mined in four phases, which will require the removal of 15 million tonnes of overburden together with 169 million tonnes of waste, and 224 million tonnes of ore over a period of twenty-one years after the commencement of overburden stripping.

Ore and waste will be drilled by diesel powered rotary drills and blasted using ammonium nitrate and fuel oil or with emulsion as required in wet conditions. Ore, waste and overburden will be loaded into 227t end dump mine trucks by 22.0m^3 diesel hydraulic shovels. The mine will operate as a conventional truck shovel operation. The typical production cycle will be drill, blast, grade control, load and haul. Primary equipment will be diesel powered with support equipment providing access development, road maintenance, and equipment servicing capability. Overburden and waste dumps will be located in separate areas close to the open pit. Diesel hydraulic shovels will be used to load overburden, waste and broken ore into 227t diesel powered haul trucks. Waste will be placed in designated disposal sites adjacent to the pit and ore will be hauled to the primary crusher located northwest of the pit. Crushed ore will then be conveyed to the coarse ore stockpile and subsequently to the crushing, grinding and flotation sections of the process plant.

In general the concentrator design is conventional aside from the high pressure grinding rolls, producing a simple copper gold concentrate that will be dewatered on site and then transported by truck and ship to smelters overseas. Ore will be mined from the open pits and hauled directly to the crusher, or low grade ore stock pile. Initial de-capping will occur during pre-production (year -1). The mine will then operate to Year 19 and stockpile recovery will continue to Year 21. The implementation of a declining cut-off grade strategy results in a low grade stockpile containing 26.6Mt at the end of the open pit life. This material will be reclaimed and processed for another two years after active mining comes to a halt.

Tailings will be impounded behind a constructed dam some distance from the open pit. This dam construction is independent of mine operations. Waste rock will be placed in dumps adjacent to the open pit in a catchment area that drains into the final open pit.

4.2.2 Resources and Mineable Reserves

The resource model for the Morrison Copper/Gold Project was developed using conventional block modelling techniques. The model was developed by Geosim Services Ltd. and is described in Section 3 of the study. Measured and indicated resources have been used to develop the mine plan and to report proven and probable reserves.

Mineable reserves are summarized in Table 4.1 - Mineable Reserves. These reserves are reported at a cut-off of C$5.60/t NSR for the ultimate pit design used in this study. Inferred resources are tabulated for general information only.

Table 4.1 - Mineable Reserves

TOTAL	Cut-off $5.60 NSR ROM (TONNES)	Cu %	Au g/t	Mo %
Proven	115,121,000	0.355	0.173	0.004
Probable	109,130,000	0.304	0.152	0.004
Subtotal	**224,251,000**	**0.330**	**0.163**	**0.004**
Inferred	7,381,000	0.225	0.102	0.003

4.2.3 *Open Pit Mine Plan*

The mine production forecast is summarized in Table 4.2 - Mine Production Forecast. A variable cut-off grade has been employed over the life of the mine. Overall mine production has been scheduled on an annual basis. A series of grade bins were developed to simulate stockpile segregation and the best available material in any given year was directed to the primary crusher. The balance of the material above the internal cut-off was scheduled to stockpile for future recovery in years of lower ore production or for final reclaim after the open pit ceased operation.

The mine plan incorporates the following elements:

- 365 days/year with an allowance for ramping up of production in Year 1
- 30,000tpd to the crusher
- Minimal stockpile re-handle until the development of Phase II and Phase IV pit expansions

	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year
,000	21,340,000	19,104,000	8,943,000	10,328,000	7,533,000	3,188,000	-	-	-	-	-	-	-	-	-	-	-	-	
,000	7,860,000	4,621,000	1,793,000	1,301,000	75,000	-	-	-	-	-	-	-	-	-	-	-	-	-	
,000	**29,200,000**	**23,725,000**	**10,736,000**	**11,629,000**	**7,608,000**	**3,188,000**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
-	-	-	2,671,000	5,143,000	6,816,000	10,378,000	9,244,000	6,962,000	9,496,000	9,195,000	-	-	-	-	-	-	-	-	
-	-	-	10,318,000	6,953,000	7,476,000	8,334,000	3,732,000	1,111,000	393,000	-	-	-	-	-	-	-	-	-	
-	**-**	**-**	**12,989,000**	**12,096,000**	**14,292,000**	**18,712,000**	**12,976,000**	**8,072,000**	**9,889,000**	**9,195,000**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
-	-	-	-	-	-	-	673,000	1,910,000	1,832,000	3,856,000	7,969,000	9,709,000	8,030,000	7,839,000	5,180,000	1,867,000	-	-	
-	-	-	-	-	-	-	8,251,000	11,918,000	10,179,000	8,850,000	5,981,000	3,647,000	1,457,000	394,000	229,000	128,000	-	-	
-	**-**	**-**	**-**	**-**	**-**	**-**	**8,924,000**	**13,828,000**	**12,011,000**	**12,705,000**	**13,950,000**	**13,356,000**	**9,487,000**	**8,233,000**	**5,408,000**	**1,995,000**	**-**	**-**	
-	-	-	-	-	-	-	-	-	-	-	-	-	34,000	811,000	5,420,000	9,625,000	10,884,000	1,607,000	
-	-	-	-	-	-	-	-	-	-	-	7,950,000	8,544,000	12,379,000	12,856,000	11,071,000	2,880,000	616,000	289,000	
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**7,950,000**	**8,544,000**	**12,413,000**	**13,667,000**	**16,492,000**	**12,505,000**	**11,500,000**	**1,896,000**	
,000	21,340,000	19,104,000	11,614,000	15,471,000	14,349,000	13,566,000	9,917,000	8,872,000	11,328,000	13,051,000	7,969,000	9,709,000	8,064,000	8,650,000	10,600,000	11,492,000	10,884,000	1,607,000	
,000	7,860,000	4,621,000	12,111,000	8,254,000	7,551,000	8,334,000	11,983,000	13,029,000	10,572,000	8,850,000	13,931,000	12,191,000	13,836,000	13,250,000	11,300,000	3,008,000	616,000	289,000	
,000	**29,200,000**	**23,725,000**	**23,725,000**	**23,725,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**14,500,000**	**11,500,000**	**1,896,000**	
,000	**-**	**-**	**1,757,000**	**-**	**673,000**	**1,181,000**	**2,471,000**	**3,978,000**	**1,219,000**	**-**	**4,593,000**	**1,242,000**	**3,271,000**	**2,425,000**	**426,116**	**-**	**225,097**	**9,343,452**	**10,9**
90%																			
,000	10,950,000	10,950,000	8,727,000	7,580,000	5,414,000	3,912,000	-	1,931,000	1,219,000	-	2,025,000	1,242,000	3,271,000	2,420,000	426,116	-	-	-	10,8
363	0.395	0.427	0.386	0.415	0.420	0.352	-	0.277	0.238	-	0.237	0.237	0.237	0.225	0.194	-	-	-	
152	0.177	0.200	0.198	0.236	0.269	0.230	-	0.159	0.123	-	0.122	0.122	0.122	0.114	0.092	-	-	-	
005	0.004	0.003	0.003	0.003	0.002	0.002	-	0.002	0.003	-	0.003	0.003	0.003	0.003	0.003	-	-	-	
-	-	-	2,223,000	3,370,000	5,536,000	7,038,000	10,750,000	8,470,000	9,032,000	9,085,000	-	-	-	-	-	-	-	4,284,331	1
-	-	-	0.309	0.360	0.323	0.335	0.303	0.320	0.387	0.398	-	-	-	-	-	-	-	0.175	
-	-	-	0.119	0.145	0.135	0.148	0.142	0.155	0.202	0.246	-	-	-	-	-	-	-	0.087	
-	-	-	0.010	0.008	0.007	0.006	0.006	0.005	0.004	0.003	-	-	-	-	-	-	-	0.004	
-	-	-	-	-	-	-	200,278	548,785	698,671	1,865,349	8,925,066	9,707,773	7,651,056	7,743,729	5,146,613	1,866,583	-	4,510,601	
-	-	-	-	-	-	-	0.220	0.250	0.242	0.229	0.244	0.301	0.379	0.375	0.361	0.359	-	0.150	
-	-	-	-	-	-	-	0.054	0.081	0.087	0.097	0.098	0.122	0.178	0.204	0.215	0.227	-	0.047	
-	-	-	-	-	-	-	0.006	0.005	0.005	0.005	0.005	0.004	0.003	0.003	0.003	0.002	-	0.003	
-	-	-	-	-	-	-	-	-	-	-	-	-	27,935	786,565	5,377,271	9,083,417	10,950,000	2,155,068	
-	-	-	-	-	-	-	-	-	-	-	-	-	0.176	0.190	0.295	0.377	0.412	0.376	
-	-	-	-	-	-	-	-	-	-	-	-	-	0.095	0.088	0.124	0.171	0.224	0.238	
-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	0.009	0.007	0.006	0.004	0.003	
,000	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,9**
363	0.395	0.427	0.370	0.398	0.371	0.341	0.302	0.309	0.361	0.369	0.243	0.294	0.336	0.329	0.322	0.374	0.412	0.204	
152	0.177	0.200	0.182	0.208	0.201	0.177	0.141	0.152	0.186	0.220	0.102	0.122	0.161	0.176	0.166	0.181	0.224	0.100	
005	0.004	0.003	0.004	0.004	0.005	0.005	0.006	0.004	0.004	0.003	0.005	0.004	0.003	0.003	0.005	0.005	0.004	0.003	
.6%	82.4%	83.1%	81.8%	82.5%	81.8%	81.1%	79.9%	80.2%	81.6%	81.8%	78.0%	79.7%	80.9%	80.7%	80.5%	81.9%	82.8%	76.4%	
.8%	48.9%	49.8%	49.1%	50.1%	49.9%	48.9%	47.2%	47.8%	49.3%	50.5%	44.9%	46.2%	48.2%	48.9%	48.4%	49.1%	50.7%	44.7%	
.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	
32.0	78,653.0	85,734.7	73,068.1	79,222.0	73,369.4	66,702.3	58,243.9	59,740.6	71,203.4	72,852.5	45,751.7	56,547.9	65,608.3	64,075.9	62,593.8	73,975.4	82,299.1	37,684.0	3:
,990	30,410	35,100	31,393	36,697	35,334	30,511	23,356	25,562	32,243	39,204	16,158	19,837	27,318	30,195	28,238	31,187	39,907	15,783	
490	438	413	521	533	552	562	697	536	438	382	544	507	381	395	613	653	482	395	
,000	30,395,000	35,016,000	47,127,000	55,381,000	62,932,000	71,266,000	83,249,000	96,278,000	106,850,000	115,700,000	129,631,000	141,822,000	155,658,000	168,908,000	180,208,000	183,216,000	183,832,000	184,121,000	184,1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
,000	17,200,000	25,354,000	26,018,000	30,539,000	33,938,000	36,554,000	35,521,000	33,443,000	33,821,000	35,922,000	32,941,000	31,700,000	28,814,000	26,514,000	26,164,000	26,706,000	26,640,000	17,297,000	6,3

4.2.4 WASTE ROCK STORAGE AND STOCKPILE PLAN

Development of the open pit will require storage of approximately 170Mt of mine waste rock, of which approximately 17Mt is classified as non-potentially acid generating (NAG) and the remainder is potentially acid generating (PAG). When possible, NAG will be placed beneath the PAG rock to minimize groundwater flow through reactive waste rock. All waste rock with be placed northeast of the open pits and drainage from the dumps will be collected in the open pit and re-directed for treatment as required.

The low grade material mined during the life of the mine will be hauled to a stockpile west of the waste dump and east of the plant site.

4.2.5 MINING EQUIPMENT

The mine will operate conventional rotary drills, hydraulic shovels, end dump trucks, and a fleet of support equipment to maintain roads, dumps and stockpiles. The equipment fleet will incorporate large scale units which have been well proven in existing operations.

The life of mine equipment requirement has been summarized in Table 4.3 - Mine Equipment Fleet.

Table 4.3 - Mine Equipment Fleet

Item	Manufacturer	Model	Number
Skid Steer Loader	Caterpillar	216B	1
Fuel & Lube truck			1
Light plant/towers			6
Integrated Tool Carrier	Caterpillar	IT14G	1
Water Truck			1
Sand Truck			1
Skid Steer Loader	Caterpillar	216B	1
Integrated Tool Carrier	Caterpillar	IT14G	1
Mechanics Truck			2
Welding Truck			1
Rough Terrain Forklift			1
Light Vehicles			8
Utility 60t Rough Terrain Crane	Grove		1
Utility Backhoe Excavator	Caterpillar		2
Flatdeck and Tractor	Freightliner		1

Note: A fifth haul truck will be purchased in year 2 and trucks 6 and 7 will be needed at a later stage together with replacement purchases for the ageing fleet in the latter half of the project.

4.2.6 CAPITAL AND OPERATING COSTS

The capital costs are summarized in Table 4.4 - Summary of Initial Mine Capital Costs. The operating costs are summarized in Table 4.5 - Summary of Mine

Operating Costs $ / Tonne Material Milled. Mine mobile equipment is to be leased. These costs are stated in third quarter 2008 Canadian dollars.

Table 4.4 - Summary of Initial Mine Capital Costs

Item	Manufacturer	Model	#	Cost Ea. FOB Mine	Total ($)
Skid Steer Loader	Caterpillar	216B	1	41,000	41,000
Integrated Tool Carrier	Caterpillar	IT14G	1	175,000	175,000
Water Truck			1	150,000	150,000
Sand Truck			1	150,000	150,000
Crew-cabs/Suburban's			2	50,000	100,000
Fuel/Lube Truck			1	190,000	190,000
Mechanic's Truck			2	100,000	200,000
Welder's truck			1	110,000	110,000
Utility Crane (60t)	Grove	RT760E	1	600,000	600,000
Flatbed Truck 7.3t			1	135,000	135,000
Tractor and Lowboy	Freightliner		1	300,000	300,000
Rough Terrain Forklift	Sellick	SD-100	1	200,000	200,000
Utility Excavator			1	800,000	800,000
Sub-Total – Mobile Equipment					**$3,151,000**
Other Pit Equipment					
Mine Pumps, Piping				110,000	110,000
Shop Tools				200,000	200,000
Truck Dispatch System, No Depth Control				560,000	560,000
Mobile Radio Units				5,000	5,000
Lighting Units			6	30,000	180,000
10 Scott Airpacks and 30 masks				50,000	50,000
Rescue Clothing and Gear				30,000	30,000
Maintenance Management System			1	5,500	5,500
Explosives Facility Site Commissioning Fee				80,000	80,000
Safety Equipment				117,000	117,000
Eng.* & GIS Survey Equip. & Software				45,000	45,000
Computer Workstations			4	12,000	12,000
AutoCAD Software			4	35,000	35,000
Geology/Mining Software				25,000	25,000
Pump switchgear, cabling (lot)					200,000
Sub-Total – Other Pit Equipment					**$1,654,500**

Total Mine Capital Equipment	**$4,805,500**

**Note: Additional haul trucks added in subsequent years.*

Table 4.5 - Summary of Mine Operating Costs $ / Tonne Material Milled

	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Load/Haul	0.47	0.47	0.52	0.59	0.61	0.69	0.69	0.73
Drill/Blast & Explosives Preparation	0.22	0.18	0.22	0.23	0.22	0.22	0.23	0.23
Auxiliary Equipment	0.13	0.09	0.09	0.11	0.11	0.11	0.12	0.12
Mine Labour	0.38	0.32	0.34	0.39	0.39	0.40	0.44	0.44
Other Mine Costs	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total ($/Tonne Mined)	**1.21**	**1.07**	**1.18**	**1.33**	**1.33**	**1.44**	**1.48**	**1.52**
	Year 8	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Year 13**	**Year 14**	**Year 15**
Load/Haul	0.54	0.58	0.64	0.66	0.72	0.75	0.84	0.86
Drill/Blast & Explosives Preparation	0.21	0.21	0.23	0.23	0.22	0.23	0.23	0.23
Auxiliary Equipment	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Mine Labour	0.44	0.44	0.44	0.44	0.45	0.46	0.48	0.48
Other Mine Costs	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Total ($/Tonne Mined)	**1.32**	**1.36**	**1.44**	**1.47**	**1.53**	**1.57**	**1.67**	**1.71**
	Year 16	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Year 21**		
Load/Haul	0.61	0.63	0.97	3.10	n/a	n/a		
Drill/Blast & Explosives Preparation	0.23	0.25	0.27	0.57	n/a	n/a		
Auxiliary Equipment	0.12	0.13	0.08	0.24	n/a	n/a		
Mine Labour	0.44	0.61	0.72	2.04	n/a	n/a		
Other Mine Costs	0.02	0.03	0.04	0.04	n/a	n/a		
Total ($/Tonne Mined)	**1.42**	**1.71**	**2.07**	**6.00**	**n/a**	**n/a**		

**Note: Costs do not include contingency.*

4.3 OPEN PIT OPTIMIZATION

4.3.1 INTRODUCTION

The Morrison Copper/Gold Project pit optimization has been carried out using Minesight® mine planning software. A series of pit shells were created at varying discount levels for anticipated revenues and costs. These pit shells were then used as a basis to develop pit phase detailed designs to be used in production scheduling.

4.3.2 ECONOMIC PARAMETERS APPLIED TO MINE DESIGN

METAL PRICES

Pit optimization metal prices were based upon an April 1, 2008 - 4 year trailing average LME database. The copper price used was US$2.45/lb. The gold price used was US$570/oz. The molybdenum price used was US$28.00/lb for Mo contained in molybdenum tri-oxide. The exchange rate used was also based upon a 4 year trailing average that averaged US$0.87.

4.3.3 SMELTER TERMS AND OFFSITE COSTS

Copper and gold will report to a copper concentrate and molybdenum will be recovered to a molybdenum sulphide concentrate and roasted offsite. The basis for pit optimization was the potential net mine gate revenue per tonne calculated for each block in the resource model. Metal prices described above and offsite costs for concentrate transportation, treatment and refining have been used in the resource value determination. The net smelter return calculation, smelter terms and offsite costs are summarized in Table 4.6. The table shows the development of conversion factors for recoverable grades to net mine gate revenue for copper, gold and molybdenum.

CONCENTRATE TRANSPORT LOGICS

Concentrate from the mine site will be truck transported to the Port of Stewart. Transportation charges prepared by Chrisita Consulting for truck and by Wardrop for ocean freight have been based on concentrate tonnage of 155,000dmt/a is shown below:

- Truck transport to Port of Stewart – C$58.93/wmt.
- Stevedoring (port storage and handling) – C$13.00/wmt.
- Ocean transport to Asian port – US$48.00/wmt.
- Moisture content – 8%.

CONCENTRATE TRANSPORT INSURANCE

An insurance rate of 0.15% will be applied to the provisional invoice value of the concentrate to cover land-based and ocean transport from the mine site to the smelter.

OWNER'S REPRESENTATION

For a 10,000wmt shipment lot, a charge of US$5,000 would be applied for services provided by the owner's representative. Duties would include attendance during vessel unloading at the smelter port, supervising the taking of samples for assaying and determining moisture content.

CONCENTRATE LOSSES

Concentrate losses are estimated at 0.05% per handling during shipment from the mine to smelter. For deliveries to Asia, an overall loss of 0.25% should be applied to the provisional invoice value for five handlings.

TREATMENT AND REFINING CHARGES

RC Copper - pay 100% of content less 1.0 unit at the LME price for Grade A copper less a refining charge of US$0.085/accountable lb. The refining charge will be increased or decreased by 10% for any departure in the copper price from a fix of US$1.50 per pound (i.e., this means that if the price is $1.60 the refining charge is increased to US$0.095/accountable lb. and if the price is US$1.40 the refining charge is reduced to US$0.075/accounting lb. TC Copper - $85/dmt.

These offsite costs have been used to develop pit limits. Minor adjustments have been made subsequent to pit design and scheduling and are summarized in the financial analysis section of the report.

Table 4.6 - Net Smelter Return

Test Block NSR Calculation				
	Copper Head Grade	%		0.371
	Gold Head Grade	g/t		0.191
	Molybdenum Head Grade	%		0.004
	Recoverable Copper Head Grade	%		0.304
	Recoverable Gold Head Grade	g/t		0.095
	Recoverable Molybdenum Head Grade	%		0.002
Metallurgical Recovery				
	Copper Recovery			%
	Recovery	Recovery = 9.136 x ln (Cu%) + 90.89		81.83
	Gold Recovery			%
	Recovery	Recovery = 7.415 x ln (Au g/t) + 61.76		49.48
	Molybdenum Recovery			%
	Recovery			50.00
Metal Pricing				
	Copper Price Participation Level	US$/lb		$1.20
	Copper Price Participation	US$/lb		0%
	Copper Price Participation Cap	US$/lb		$1.80
	Copper Price	US$/lb		$2.45
	Copper Price Realized Net of PP	US$/lb		$2.45
	Gold Price	US$/ounce		$570.00
	Molybdenum Price ROB Minesite	US$/lb Mo	Price is Quoted for Mo in Tri-Oxide	$28.00
	USD:CDN Exchange			$0.87
Copper Concentrate				
	Copper Concentrate Grade			25.10
	Gold Concentrate Grade	g/dmt	Calculated from head grade, recovery and concentrate production	
	Silver Concentrate Grade	g/dmt		-
	Moisture Content	%		8.0%
	Contained Copper	lb/dmt		553.20
	Contained Gold	g/dmt		7.81
	Payable Copper	lb/dmt		531.16
	Payable Gold	g/dmt		7.42
	Concentrate – Recovery Based	dmt/t ore		0.01210
	Gross Value of Concentrate after Deductions			
	Gross Value Concentrate	C$/dmt		**$1,652.18**
		C$/wmt		**$1,520.01**

Table continues….

Copper Concentrate Treatment and Refining			
Truck Haul & Stevedoring FOB Stewart	C$/wmt		$73.00
Ocean Freight	C$/wmt		$68.97
Umpiring & Sampling	C$/wmt		$0.20
Marketing	C$/wmt		$0.00
Insurance	C$/wmt	0.15%	$2.28
Losses	C$/wmt	0.25%	$3.80
Total Concentrate Handling	C$/wmt		$148.25
Total	C$/dmt		**$161.14**
Copper Concentrate Treatment and Refining			
Deduction for Copper	Unit	96.0%	1.00
Treatment Charges	US$/dmt		$90.00
Gold Payment	%		95.0%
Copper Refining Cost	US$/payable lb		$0.090
Gold Refining Cost	US$/payable oz		$6.00
Total Treatment and Refining	C$/dmt		**$160.04**
Copper Net Smelter Return			
Net Smelter Return	C$/dmt		**$1,331.00**
	C$/payable lb Cu		$2.51
NSR Before Royalty	**NSR C$/t**		**$16.10**
Royalty	**CDN$/t**	0.0%	**$0.00**
NSR After Royalty	**NSR C$/t**		**$16.10**
NSR for Copper	**NSR C$/t**		**$14.33**
NSR for Gold	**NSR C$/t**		**$1.77**
Factor for Copper	**$/% Recoverable**		**$47.20**
Factor for Gold	**$/g Recoverable**		**$18.74**
Molybdenum Credit			
Molybdenum Concentrate Grade			53.60
Moisture Content	%		8.0%
Contained Molybdenum	lb/dmt		1,181.34
Recovered Molybdenum	lb/t ore		0.04
Concentrate – Recovery Based	dmt/t ore		0.00004
Gross Value of Concentrate			
Gross Value Concentrate	C$/dmt		**$38,020.27**
	C$/lb		1.42
	C$/wmt		**$34,978.65**
Molybdenum Concentrate Handling			
Truck Haul & Stevedoring FOB Stewart	C$/wmt		$73.00
Ocean Freight	C$/wmt		$68.97
Umpiring & Sampling	C$/wmt		$0.20
Marketing	C$/wmt		$0.00
Insurance	C$/wmt	0.15%	$52.47
Losses	C$/wmt	0.25%	$87.45
Total Concentrate Handling	C$/wmt		$282.08
Total	C$/dmt		**$306.61**
Molybdenum Roasting			
Roaster Loss	C$/dmt	1.5%	$570.30
Roasting Charges	C$/dmt		$1,337.50
Total Treatment and Refining	C$/dmt		**$1,907.80**

Table continues…

Molybdenum Net Return				
	Net Smelter Return	C$/dmt		**$35,805.86**
		C$/recovered lb Mo		$30.31
	NSR Before Royalty	NSR C$/t		**$1.34**
	Royalty	CDN$/t	0.0%	**$0.00**
	NSR After Royalty	NSR C$/t		**$1.34**
	Factor for Molybdenum	$/% Recoverable		**$668.02**

4.3.4 Onsite Operating Costs and Increments

The onsite operating costs used for pit limit analysis includes general and administration, processing and mining costs. The G&A and processing costs were estimated to be $0.66/t and $4.51/t milled respectively. Preliminary operating costs for mining were estimated to be $1.31/t mined for ore. Subsequent rationalization of the waste management plan has resulted in relocation of the waste dumps closer to the pit rim and some potential haulage cost savings.

4.3.5 Sustaining Capital Consideration

Sustaining capital consideration has been made for tailings and mining equipment. Tailings dam construction is an ongoing cost, related directly to waste and tailings placement in the tailings management facility. In a similar context, mining equipment is consumed in direct relationship to mined quantities. An allowance of $0.29/t ore was made for equipment sustaining capital and $0.43/t waste for equipment and dam construction sustaining capital. Subsequent rationalization of the waste management plan has resulted in relocation of the waste dumps closer to the pit rim and some potential sustaining capital cost savings.

4.3.6 Metallurgical Parameters

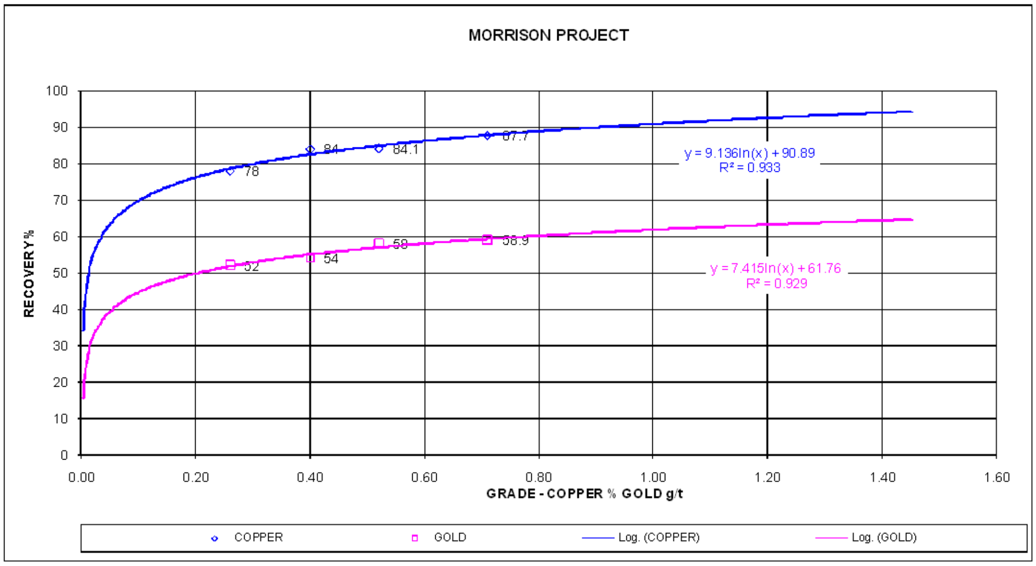
Process Selection

A single mineral processing option is considered at Morrison and this is primary crushing followed by grinding and conventional flotation of copper and molybdenum concentrates to be smelted and refined or roasted offsite.

Process Recovery

Metallurgical recovery estimates have been provided by SGS Minerals Services (SGS). The copper and gold recovery curves to copper concentrate are shown in the figure below. The equations shown in the graph have been used to calculate recovery and recoverable copper and gold for each block in the resource model. This is an intermediate step in the development of the mine plan. The final production schedule has been used to provide the basis for annual recovery estimates.

Figure 4.1 - Copper and Gold Metallurgical Recovery



Concentrate Grade

The copper concentrate grade for copper was estimated by SGS to be 25.1% Cu with 8.0% moisture content. Gold concentrate grade is calculated based upon the gold grade and gold recovery to concentrate.

4.3.7 Block Model

General

The resource block model was developed by Geosim using Surpac software. The block model and surfaces for topography and the hardrock/overburden interface were imported to a Minesight® mine planning system. The block model limits and block dimensions are shown in the table below.

Table 4.7 - Morrison Block Model Limits

Southwest Upper Block – Edge					
xorigin	metres	669,850.00			
yorigin	metres	6,118,500.00			
zorigin	metres	300.00			
blockx	metres	20.00			
blocky	metres	20.00			
blockz	metres	12.00			
nblockx	blocks	90			
nblocky	blocks	80			
nblockz	blocks	66			
Project Limits Meds					
minx	metres	669,850.00	maxx	M	671,650.0
miny	metres	6,118,500.00	maxy	M	6,120,100.0
minz	metres	300.00	maxz	M	1,092.0

Key block model items transferred from Geosim included Topography%, Bedrock%, Overburden%, Au g/t, Cu %, Mo %, CuEq %, Class, Rock Code, SG and Zone.

Additional items were provided in the Minesight® Model to assign potential acid generating waste rock – PAG, slope codes for design – SLOPE, net minegate revenue $/t – NET and block value – VAL. Metallurgical items were also included in the model as provided by SGS – t/hr Grinding and p80.

4.3.8 *Resource Classification*

Resource Class

The resource model includes measured, indicated and inferred resources. Measured and indicated resources have been used to define the pit limits and for reporting of reserves for scheduling. Inferred resources have not been used in the mine plan.

Mining Recovery

Mining Recovery is assumed to be 100%. No mining losses were applied to the ore reserves for the following reasons:

- The deposit shows good lateral and vertical continuity at the cut-off grades applied for scheduling
- There is a broad width to the ore zones on individual benches
- A detailed grade control program will be implemented

MINING DILUTION

Internal dilution is incorporated in the resource model by virtue of the compositing and interpolation method used to obtain the block grades. No additional dilution was applied in optimization.

4.3.9 *WALL SLOPE DESIGN SECTORS*

Knight Piésold Consulting has undertaken a geotechnical investigation program that has provided the basis for Feasibility Pit Slope Design recommendations. The current geotechnical model incorporates three major geological domains: Jurassic Sediments, Intrusives and Fault Zone. The intact rock strengths were found to be generally strong except for the Fault Zone which is slightly lower strength. Based on a combination of intact rock properties and the characteristics of observed discontinuities the rock mass quality has been summarized as fair to good, with poor quality rock encountered within the Fault Zone and the more altered Jurassic Sediments and Intrusive. A major vertical fault occurs in the middle of the intrusive unit. The groundwater table is near the surface and the permeability of the rock mass is low.

The Morrison open pit will be mined in four phases. Phase I is located to the northwest and Phase II is located in the southeast area of the deposit. The northwest pit will be expanded in Phase III and the southeast pit will be expanded in Phase IV. Knight Piésold identified five design sectors in the northwest pit and a total of seven hardrock design sectors for the ultimate combined phases of the open pit. These sectors accounted for the geological domains, wall orientations and major structures. Inter-ramp wall slope recommendations were typically 40° in broken ground and 48° in competent rock.

The overall stability of the pit slopes has been evaluated using conventional limit equilibrium analysis. The overall slope angles have been determined to achieve a minimum factor of safety of 1.3 for the various design sectors.

The final pit design sectors are shown below for the proposed pit development at Morrison.

Figure 4.2 - Pit Design Sector Location

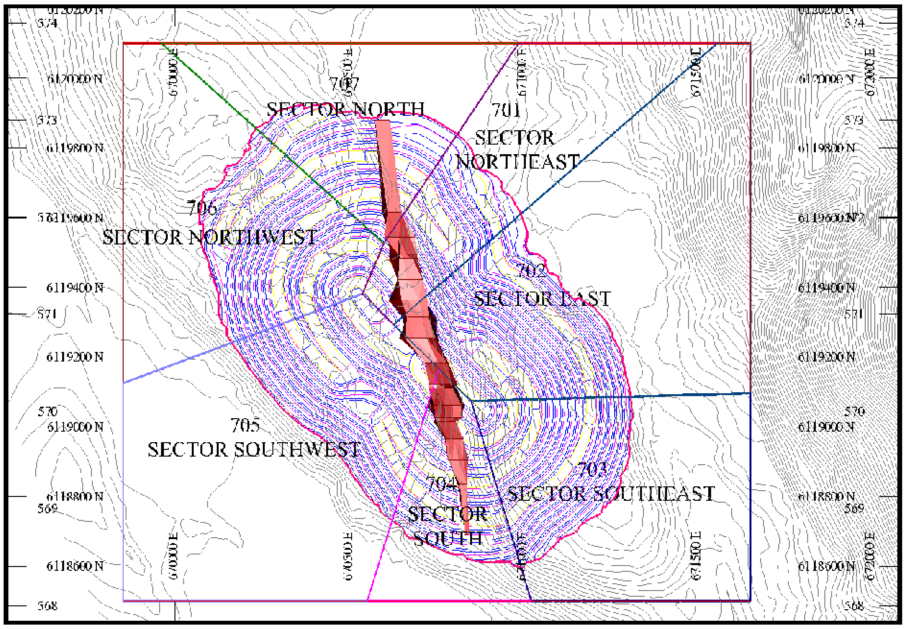


Table 4.8 - Pit Slope Design Sectors

	Sector	Inter-ramp degrees	Bench Face degrees	Bench Height metres	Single / Double	Berm Width metres
Northeast	701	48.0	65.0	30.0	Double	13.0
East	702	48.0	65.0	30.0	Double	13.0
Southeast	703	48.0	65.0	30.0	Double	13.0
South	704	41.0	60.0	15.0	Single	8.6
Southwest	705	48.0	65.0	30.0	Double	13.0
Northwest	706	48.0	65.0	30.0	Double	13.0
North	707	40.0	60.0	15.0	Single	9.2

The inter-ramp slopes of the design sectors shown above were used for the pit design. An additional design sector was included for the overburden where slopes were flattened to 2H:1V at the interface between hardrock to overburden and topography. Lerchs Grossman pit limits were developed using sectors by azimuth and overall slope constraints varying from 40° to 45° to provide allowance for haulage roads. The bench height in the current model is 12m and the design incorporates double benching in all sectors. Actual operating practice may vary.

4.3.10 Pit Limit Analysis

Pit Limits

Pit limits have been developed using a Minesight® variable slope Lerchs Grossman Algorithm. Several generations of pit optimization studies have been undertaken during the course of the feasibility study with increasing metal prices to reflect the current strong demand for base metals in general during the early part of 2008.

The preliminary net mine gate revenue and operating costs were used to estimate the value of each regular block in the model. The block values were then discounted to reflect a sinking rate of 5 benches per year per phase. A series of 7 discounted values were calculated from 10% to 70% in 10% increments. The undiscounted and discounted nested pit limits were used to guide pit design and are shown on the section and plan below.

Figure 4.3 - Section 670470 East Lerchs Grossman Pit Limits

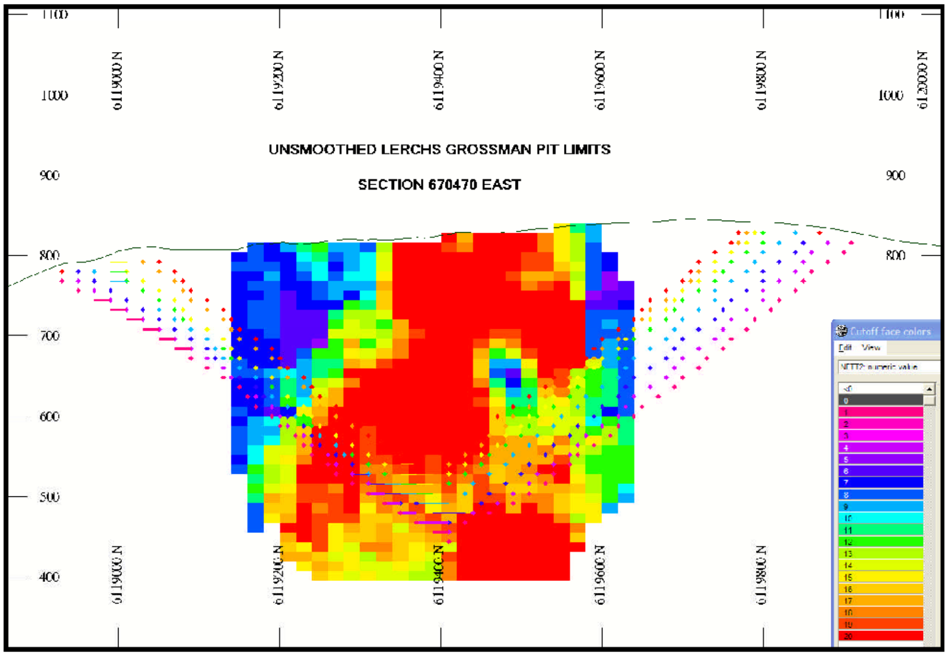
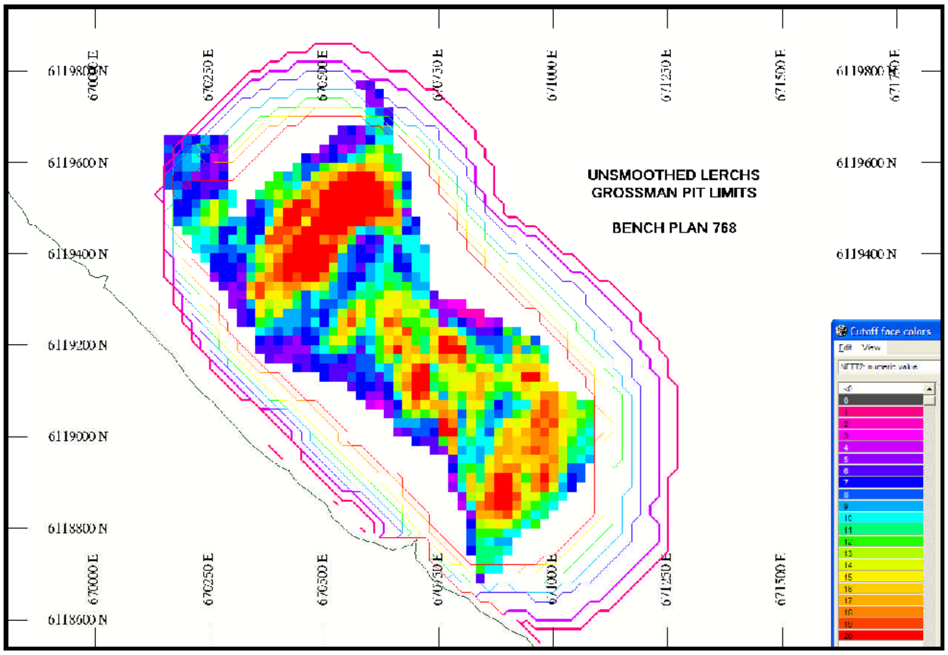


Figure 4.4 - Bench Plan 768 Lerchs Grossman Pit Limits



The resources within the unsmoothed 10% discount rate Lerchs Grossman pit limit are summarized in the table below at $5.60/t NSR cut-off. Waste types noted in the table include TYPE1 – Potential Acid Generating (PAG) and TYPE2 – Non Acid Generating (NAG) material. The unsmoothed pit contains a total of 248.9Mt 0.332% Cu 0.164 g/t Au and 0.004% Mo above a $5.60/t net mine gate revenue cut-off. Total material within the pit limits is 425.3Mt.

Table 4.9 - Lerchs Grossman Pit 812 Resources

	CUTOFF CUTOT	INSITU ORE BCM	INSITU ORE TONNES	RUN MINE TONNES	CUTOT %	AUTOT G/T	MO %	NETT $/T
Measured								
>=	-							
>=	0.050							
>=	0.100	44,712,000	120,597,792	120,597,792	0.356	0.17	0.004	16.76
>=	0.150	44,270,400	119,396,640	119,396,640	0.358	0.18	0.004	16.87
>=	0.200	41,107,200	110,864,832	110,864,832	0.372	0.18	0.004	17.55
>=	0.250	35,904,000	96,802,272	96,802,272	0.394	0.19	0.004	18.59
>=	0.300	29,515,200	79,690,176	79,690,176	0.421	0.20	0.004	19.87
>=	0.350	22,233,600	60,112,128	60,112,128	0.454	0.22	0.004	21.47
>=	0.400	15,912,000	43,095,072	43,095,072	0.487	0.23	0.005	23.15
>=	0.450	10,080,000	27,325,152	27,325,152	0.526	0.25	0.005	25.15
>=	0.500	5,774,400	15,659,616	15,659,616	0.570	0.27	0.005	27.39
>=	0.550	3,369,600	9,148,032	9,148,032	0.608	0.29	0.005	29.33
>=	0.600	1,593,600	4,328,256	4,328,256	0.652	0.31	0.005	31.58
>=	0.650	609,600	1,658,112	1,658,112	0.709	0.36	0.004	34.45
>=	0.700	278,400	757,248	757,248	0.761	0.38	0.003	36.83
>=	0.750	134,400	365,568	365,568	0.808	0.36	0.004	38.89
Indicated								
>=	-							
>=	0.050							
>=	0.100	47,755,200	128,308,800	128,308,800	0.311	0.16	0.004	14.67
>=	0.150	45,729,600	122,824,800	122,824,800	0.318	0.16	0.004	15.03
>=	0.200	38,664,000	103,678,560	103,678,560	0.346	0.18	0.004	16.30
>=	0.250	30,950,400	82,911,072	82,911,072	0.377	0.19	0.004	17.78
>=	0.300	23,596,800	63,290,304	63,290,304	0.410	0.21	0.004	19.40
>=	0.350	16,958,400	45,613,344	45,613,344	0.445	0.22	0.004	21.18
>=	0.400	11,500,800	31,022,112	31,022,112	0.481	0.24	0.005	22.93
>=	0.450	7,104,000	19,176,576	19,176,576	0.519	0.25	0.005	24.86
>=	0.500	3,739,200	10,101,792	10,101,792	0.565	0.27	0.005	27.23
>=	0.550	2,016,000	5,456,352	5,456,352	0.604	0.28	0.006	29.24
>=	0.600	964,800	2,615,040	2,615,040	0.643	0.31	0.006	31.31
>=	0.650	292,800	795,264	795,264	0.707	0.37	0.005	34.66
>=	0.700	105,600	287,232	287,232	0.782	0.42	0.003	38.01
>=	0.750	62,400	169,728	169,728	0.825	0.43	0.001	39.62
Total								
>=	-	92,467,200	248,906,592	248,906,592	0.332	0.16	0.004	15.68
>=	0.050	92,467,200	248,906,592	248,906,592	0.332	0.16	0.004	15.68
>=	0.100	92,467,200	248,906,592	248,609,592	0.332	0.16	0.004	15.68
>=	0.150	90,000,000	242,221,440	242,221,440	0.338	0.17	0.004	15.94
>=	0.200	79,771,200	214,543,392	214,543,392	0.359	0.18	0.004	16.95
>=	0.250	66,854,400	179,713,344	179,713,344	0.386	0.19	0.004	18.22
>=	0.300	53,112,000	142,980,480	142,980,480	0.416	0.21	0.004	19.66
>=	0.350	39,192,000	105,725,472	105,725,472	0.450	0.22	0.004	21.35
>=	0.400	27,412,800	74,117,184	74,117,184	0.484	0.23	0.005	23.06
>=	0.450	17,184,000	46,501,728	46,501,728	0.523	0.25	0.005	25.03
>=	0.500	9,513,600	25,761,408	25,761,408	0.568	0.27	0.005	27.33
>=	0.550	5,385,600	14,604,384	14,604,384	0.607	0.29	0.005	29.30
>=	0.600	2,558,400	6,943,296	6,943,296	0.649	0.31	0.005	31.48
>=	0.650	902,400	2,453,376	2,453,376	0.709	0.37	0.004	34.52
>=	0.700	384,000	1,044,480	1,044,480	0.767	0.39	0.003	37.15
>=	0.750	196,800	535,296	535,296	0.813	0.38	0.003	39.12
	WASTE	173,393,666	(TONNES)	**ROM**	**S/R=**	0-71		
	TYP01	162,290,785	**TYP02**	13,302,240				

4.4 Open Pit Design

4.4.1 General

This section of the report describes the basis for the open pit design including the design parameter basis, design summary, mineable reserve, waste material types and storage method.

The open pit design has been based upon the following key considerations:

- Inter-ramp slope recommendations provided by Knight Piésold Ltd. Consulting Engineers (KP)
- Waste dump footprint limits and final slopes provided by KBCL
- Operating constraints of the equipment selected for mining:
  - Minimum mining width defined by shovel double side loading of trucks with allowance for an access ramp
  - Bench height achievable and within the safe operating reach of the primary loading units
  - Minimum haulage road operating width and maximum effective grade within the operating limitations of the primary haulage units
- Logical and efficient scheduling of material movement from multiple phases of pit expansion to the crusher, the stockpiles and to final waste material placement sites
- Minimum footprint for disturbance of the surrounding area

4.4.2 Design Parameters

Geotechnical Site Investigation for Waste Dumps

KBCL have characterized the waste materials and undertaken geotechnical site investigation studies in the areas under the proposed waste dumps.

The rock in the open pit consists of igneous and sedimentary rocks with moderate fracture density. The material is estimated to have a relatively high shear strength (40°) and will be well drained. However, low permeability layers will form on surfaces of fills where there is truck traffic.

The proposed waste dump locations are underlain by glacial till. This till is clayey sand to sandy clay with some fine gravel with low to intermediate plasticity. A more detailed description of their investigations can be found in the KCBL report “2008 Geotechnical Site Investigation” (2008) and in the Geotechnical Section of this study.

Geotechnical Site Investigation for Slope Design

A geotechnical investigation program was completed at the Morrison Property site during 2006. The results of this investigation are included in Knight Piésold Ltd. (KP) Report – 2006 Open Pit Geotechnical Investigations (Ref. No. VA101-102/8-1, May 8, 2006). Specific recommendations for design are provided in the KP Report – Feasibility Pit Slope Design (Ref. No. VA101-102/8-2 June 30, 2006).

Wall Slope Geotechnical Parameters

General

In general open pit wall slope stability is dependent upon the following factors, some of which are discussed in more detail in the sections below:

- Geological Lithology & Alteration
- Geological structure
- Intact rock strength
- Rock stress
- Groundwater conditions
- Discontinuity strength and orientation
- Pit geometry
- Blasting practices
- Climatic conditions
- Time

Geological Lithology & Alteration

Copper mineralization is associated with a Biotite Feldspar Porphyry intrusive within Jurassic sedimentary rocks. A sub-vertical fault zone striking 348° bisects the deposit. Classic porphyry alteration assemblages occur at the Morrison Property including potassic, phyllic and propylitic types.

Geological Structure

The current geotechnical model incorporates three major geological domains. These three domains are Jurassic Sediments, Intrusives and Fault Zone. The Fault Zones and the Intrusives are shown in the figures below.

The primary large scale structure is the East Fault. The East Fault is sub-vertical and is composed of a linear zone of parallel shears and fractures that vary in width. Intense clay carbonate alteration is associated with the fault. Displacement along the fault is unknown.

The West Fault is similar to the East fault only smaller. The fault has an impact on slope stability at the west side of the pit.

Discontinuity data were collected from drill holes to obtain specific information on small scale structures that can control stability of pit benches and inter-ramp slopes. This data indicated that most discontinuity surfaces did not have any infill and were of moderate roughness. This data was used in combination with intact rock properties to determine rock mass classification.

Figure 4.5 - Feasibility Study Pit Slope Design Domains

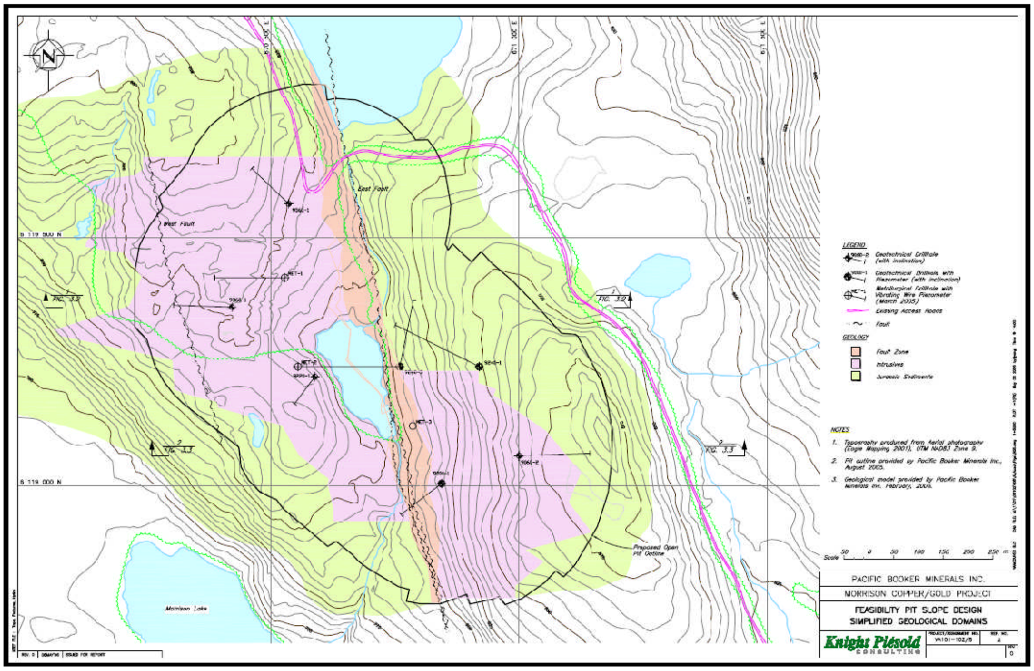
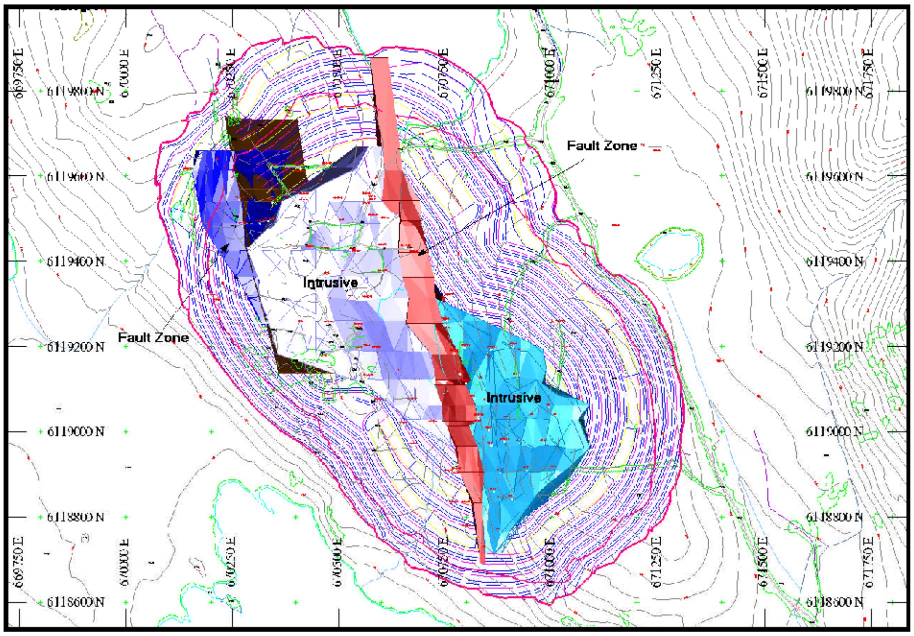


Figure 4.6 - Design Domain Solids Models



The first figure above shows the domains relative to the 2006 pit crest and the geotechnical drilling. The second figure shows the intrusive and fault solids relative to the current design limits.

INTACT ROCK STRENGTH

Intact rock strengths were generally found to be strong except for in the Fault Zones. Combining the intact rock properties and characteristics of the observed discontinuities allowed the rock mass quality to be summarized as being generally FAIR to GOOD, with POOR quality rock encountered in the Fault Zone and more altered Jurassic Sediments and Intrusive.

Generally the intact rock strengths UCS values for the deposit range from 60 to 100MPa. Joint friction angles average 35° for all rock types the purposes of stability analysis.

PIT WATER MANAGEMENT AND GROUNDWATER CONDITIONS

The groundwater table is near the surface. The limited groundwater monitoring conducted by KP indicated levels range from 6 to 52m below the ground surface. Overall the groundwater is expected to be in a steady state condition with only minor fluctuations the water table level throughout the year.

The permeability of the competent rockmass is low. The competent rockmass shows a hydraulic conductivity in the order of 10^{-7} cm/sec, while the broken rock along fault zones has a higher permeability of 10^{-5} cm/sec.

Pit water management for the open pit will require surface water interception and diversion, slope depressurization and a pit dewatering system. Surface water diversions are discussed in the site geotechnical section of the study. KP recommends locating perimeter depressurization wells to approximately mid-depth of the final open pit. They also recommend sub-horizontal drains be installed in both interim and final pit walls. Drain lengths should be 50 to 100m depending on ground water depressurization requirements.

PIT GEOMETRY

When completed the Morrison open pit will be approximately 375m deep, 1480m in length and 825m wide. The pit crest will be 90m away from the shores of Morrison Lake.

BLASTING PRACTICES

Production blasting can cause considerable damage to pit walls. The increased disturbance at the walls due to blasting is typically accounted for with a reduction in the effective strength of the rockmass. Disturbance factors are applied based upon the wall control blasting practices. A value of 1.0 is assigned to NORMAL production blasting. GOOD controlled production blasting practice is assigned a value of 0.85. EXCELLENT controlled blasting practice is assigned a value of 0.70.

KP has recommended incorporation of control blasting methods in the mine operating plan to facilitate steeper final wall slopes by reducing face damage from blasting. Typical control blasting strategies utilize small diameter blast holes detonated as a pre-shear line in harder massive rock or as a post-shear (cushion) line in weak fractured rock.

CLIMATIC CONDITIONS

The climatic conditions at the Morrison Property are typical of the Lakes District of the Central Interior with annual average of 500mm of rain equivalent precipitation. The seasons are well defined with relatively predictable periods of "***freeze up***" in the fall and "***break up***" in the spring. The "***break up***" period is characterized by increased water flow from melting snow and cyclical thawing of surface materials on slopes. This action results in decreased slope stability particularly at the smaller bench scale where there will be a marked increase in small face failures and ravelling of rock.

TIME

The Phase I pit will be mined Year 1 to Year 7. Phase II will be mined Year 4 to Year 11. Phase III, an expansion of the Phase I pit will be mined Year 8 to Year 17 and Phase IV, an expansion of the Phase II pit will be mined Year 12 to Year 19. A typical wall will be exposed in an active mining area approximately 7-9 years.

DESIGN SECTORS

The geotechnical design sectors were discussed briefly in Section 4.3.5 as they related to pit optimization. These sectors were defined to group areas of the proposed mine with similar mine geometry, geology and rock mass characteristics. Overburden within each sector was treated as a separate domain.

SLOPE STABILITY ANALYSIS

Kinematically possible modes of failure include planar failure, wedge and toppling. These failure modes can be identified using stereographic analysis of peak pole concentrations of the discontinuity data. A stereographic analysis was carried out for each failure mode for all the competent units sing DIPS program (Rocscience Inc. 2001). This analysis indicated that the kinematically possible failure modes at the Morrison Property include planar and wedge failures. Toppling failure is not an expected failure mode at the Morrison Property. These analyses were used to guide selection of appropriate bench face angles. An inter-ramp slope of 40° with single benches was recommended in broken material and 48° with double benches was recommended for the rest of the walls.

Slope stability analysis was undertaken using a Geological Strength Index (GSI) based on the RMR rock mass rating system. Limit equilibrium stability analysis was performed using SLOPEW computer program (Krahn, Geo-Slope International Ltd.) for the seven pit design sectors. The design concept applied to the overall pit slope was to ensure that for the majority of the mine life the walls will have a factor of safety against large scale instability of at least 1.3. The limit equilibrium analysis demonstrated that steeper slopes can be achieved if EXCELLENT blasting practices and effective groundwater depressurization measures are implemented.

4.4.3 *GENERAL DESIGN*

DESIGN SUMMARY

The mining equipment will operate on a 12m bench in overburden and hardrock. Berms will be left on every bench in overburden and alternate benches in hardrock. Berm width will vary as the overall wall slope and face slope are achieved in each design sector.

The open pit mine has been designed for four phases of pit development by conventional truck and shovel methods. The overall life of mine strip ratio is relatively low at 0.82:1.0 waste to ore. However the production will typically average 29.2 million tpa or approximately 80,000tpd for the first two years declining to 65,000tpd and then 60,000tpd. The mine has been designed for operations with shovels in the 18m^3 to 32m^3 range and trucks in 150t to 220t capacity range with the typical support equipment associated with this type of primary mining equipment.

Phase I and Phase II pits are typically 600m in diameter on the upper benches decreasing as the phases are mine to depth. When the pit bottom of Phase I and Phase II are mined the pit bottom will be approximately 40m wide.

Phase III and Phase IV pit expansion phases are typically 100m to 150m wide locally narrowing to no less than 60m width which should provide adequate room for efficient mine operations.

4.4.4 *Mineable Reserve*

The mineable reserves were reported for each pit phase and summarized by pit phase and bench for a range of NSR cut-offs for scheduling. These summaries are included in the Appendices of the study. Reserves are summarized in Table 4.10 - Mineable Reserves and Table 4.11 - Mineable Reserves by Pit Phase. The material quantities included in these tables are classified as proven and probable reserves. Inferred resources are not included in the mine plan production schedule. The total mineable reserve at $C5.60/t NSR cut-off is 224.25Mt with an average grade of 0.330% Cu, 0.163g/t Au and 0.004%Mo. The overburden and waste total 184.12Mt for a strip ratio of 0.82:1.

Table 4.10 - Mineable Reserves

	COG $5.60 NETT			
Phase I	**ROM (Tonnes)**	**Cu %**	**Au g/t**	**Mo %**
Measured	52,474,097	0.348	0.175	0.003
Indicated	34,628,081	0.303	0.152	0.003
Subtotal	**84,102,178**	**0.330**	**0.166**	**0.003**
Inferred	823,859	0.204	0.074	0.002

	COG $5.60 NETT			
Phase II	**ROM (Tonnes)**	**Cu %**	**Au g/t**	**Mo %**
Measured	42,396,417	0.347	0.169	0.005
Indicated	17,507,612	0.297	0.150	0.006
Subtotal	**59,904,029**	**0.332**	**0.163**	**0.005**
Inferred	421,308	0.186	0.082	0.004

Table continues....

COG $5.60 NETT				
Phase III	**ROM (Tonnes)**	**Cu %**	**Au g/t**	**Mo %**
Measured	10,292,734	0.381	0.181	0.004
Indicated	38,571,773	0.284	0.134	0.004
Subtotal	**48,864,507**	**0.304**	**0.144**	**0.004**
Inferred	4,382,964	0.219	0.089	0.003

COG $5.60 NETT				
Phase IV	**ROM (Tonnes)**	**Cu %**	**Au g/t**	**Mo %**
Measured	9,958,236	0.400	0.175	0.007
Indicated	18,422,020	0.353	0.191	0.005
Subtotal	**28,380,256**	**0.369**	**0.185**	**0.005**
Inferred	1,752,847	0.261	0.152	0.003

COG $5.60 NETT				
Total	**ROM (Tonnes)**	**Cu %**	**Au g/t**	**Mo %**
Measured	115,121,484	0.355	0.173	0.004
Indicated	109,129,486	0.304	0.152	0.004
Subtotal	**224,250,970**	**0.330**	**0.163**	**0.004**
Inferred	7,381,005	0.225	0.102	0.003

Table 4.11 - Mineable Reserves by Pit Phase

PHASE	OVB (TONNES)	WASTE				COG $5.60 NETT		Au g/t	Mo %	NETT C$/t	Total	Strip Ratio
		UNKNOWN (TONNES)	PAG (TONNES)	NAG (TONNES)	Total (TONNES)	ROM (TONNES)	Cu %					
Phase I	8,363,000	8,000	28,286,000	1,527,000	29,821,000	87,102,000	0.330	0.166	0.003	15.25	125,286,000	0.44
Phase II	1,820,000	---	33,618,000	2,879,000	36,497,000	59,904,000	0.332	0.164	0.005	15.95	98,221,000	0.64
Phase III	3,885,000	46,000	40,755,000	6,347,000	47,148,000	48,865,000	0.305	0.144	0.004	14.18	99,898,000	1.04
Phase IV	1,076,000	---	49,020,000	6,490,000	55,510,000	28,380,000	0.369	0.185	0.005	17.86	84,966,000	1.99
TOTAL	**15,144,000**	**54,000**	**151,679,000**	**17,243,000**	**168,976,000**	**224,251,000**	**0.330**	**0.163**	**0.004**	**15.53**	**408,371,000**	**0.82**

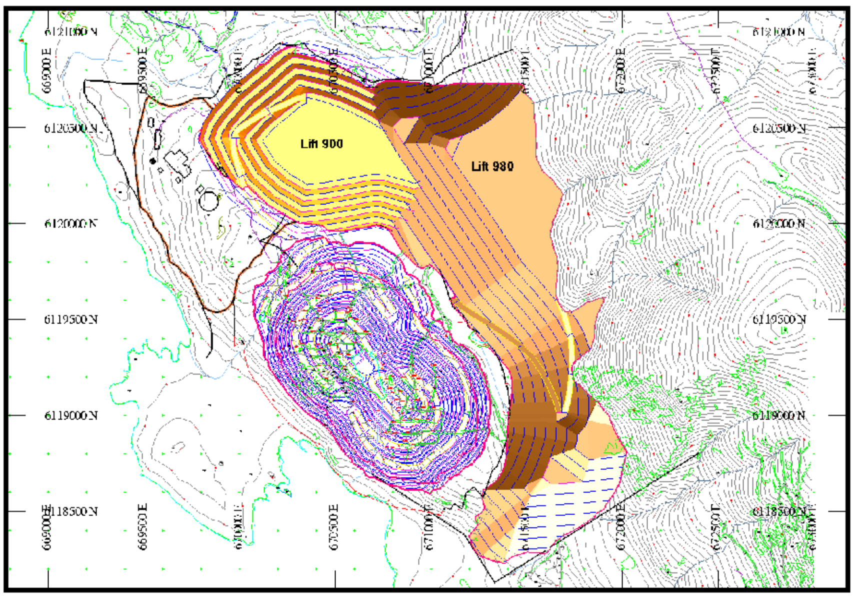
4.4.5 WASTE MATERIAL TYPES

The material types included in the mine material movement schedule are subdivided into overburden, waste rock, low grade ore and ore. Low grade is simply material that is not routed directly to the primary crusher and is therefore placed in stockpile since higher grade material happens to be available for processing. The waste rock is further subdivided into reactive or potential acid generating (PAG) rock and non-reactive or non-acid generating (NAG) rock proportions. A minor proportion is unclassified due to uncertain model coding.

4.4.6 WASTE AND LOW GRADE STORAGE

A waste dump and low grade stockpile design has been developed according to the guidelines provided by KCBL for footprint limits working and reclamation slopes. This design is shown below. The current mine plan will generate enough material to take the low grade stockpile to the 880m elevation while the waste dump will likely reach 980m elevation.

Figure 4.7 - Waste Dump Configuration



4.4.7 HAULAGE ROADS

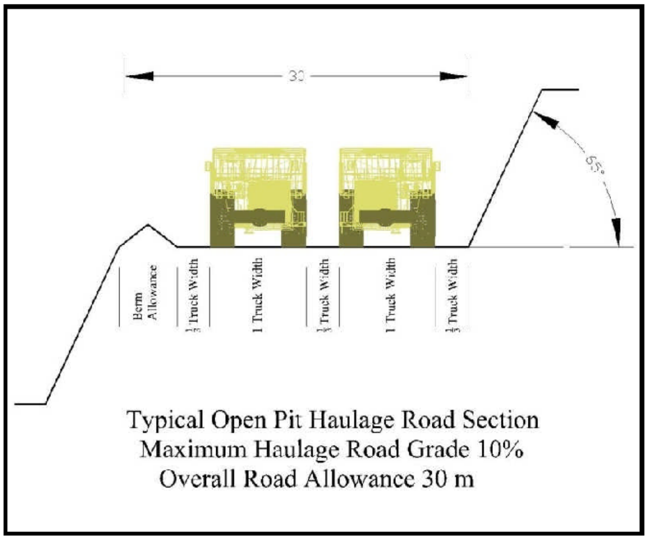
In the pit designs allowances have been made for 30m wide roads including ditches and berms. Roads will have a maximum gradient of 10%. The West Pit roads commence counterclockwise and switch back as required to reach the pit bottom.

The East Pit roads commence clockwise and switchback as required to the pit bottom.

Surface haulage roads will connect the pit ramps to the crusher, low grade stockpile and waste dumps. These roads will be constructed using overburden and non acid generating waste rock when available. As in the pit, roads will have a running surface three times the width of the largest haulage truck with allowance for ditches and berms. Roads will have a maximum grade of 10% but may be constructed to 8% to improve haulage cycle times and reduce truck component wear.

A typical haulage road cross section is shown in the figure below.

Figure 4.8 - Haulage Road Section



4.5 MINE PRODUCTION SCHEDULE

4.5.1 *SUMMARY*

The open pit mine development plan consists of four pit development phases expanding to a single large open pit on the edge of Morrison Lake. A waste dump and a low grade stockpile will be located 100m north of the open pit. Overburden will be stockpiled south of the open pit. The plant site will be located west of the open pit with an active access corridor between the dump and stockpile area and the open pit crest.

The mine will operate as a conventional truck shovel operation. The typical production cycle will be drill, blast, grade control, load and haul. Primary equipment will be diesel powered with support equipment providing access development access, road maintenance and equipment servicing capability.

The mine will operate to Year 19 and stockpile recovery will continue to Year 21. The mill will process 224.25Mt of ore with an average grade of 0.33% Cu 0.16g/t Au and 0.004% Mo. The total waste including overburden will be 184.12Mt. The effective overall strip ratio will be 0.82:1.

4.5.2 CUT-OFF GRADE SELECTION

The pit limit analysis has been used to define a series of pit shells that indicate maximum mining limits and potential high value starter pit areas. These limits are based upon maximizing gross operating surplus. Pit development phases have been established for sequencing to provide a basis for smoothing the overall mine plan waste stripping requirements. Stockpile strategies can be developed to improve the production schedule from the point of view of elevating head grades in the early years of the mine plan and to provide a stable production rate for the equipment fleet.

A series of grade bins for material above the marginal cut-off grade were established based upon net mine gate revenue. Material movement thresholds were set and a number of schedules were developed with a view to providing adequate quantities of material to the process facility. Initial mining rates were varied from 60,000tpd through 90,000tpd, declining with time, with the highest possible grade material directed towards the process facility. The best schedule for four phases of development resulted in an 80,000tpd overall material movement schedule during the first two years declining to 65,000tpd and then 60,000tpd until waste quantities diminish at the pit bottom. Total material moved to stockpile was approximately 50Mt. Peak stockpile level was approximately 35Mt.

4.5.3 PIT SEQUENCING

Pit development requires a series of pit phases for the purposes of scheduling. Earlier preliminary pit optimization at $1.78/lb copper and $465/oz gold provided a design concept for two phases of pit development that were used for initial scheduling. Some of the observations made in the early work and then later in light of the current pit limit expansion are as follows:

- A single ramp ultimate pit increased final wall slopes but would result in radial expansions from low grade starter pits. Radial expansions are difficult to implement operationally as access and spillage onto working areas may create safety issues and delays in production.
- Pit development for a two phase open pit logically should move from an initial west pit to a second phase at the east pit followed by scavenging of the combined pit bottom.
- Stockpiling of low grade material in the early years improves the project economics as measured by discounted cashflow net present value and internal rate of return.

- Metal price increases to $2.45/lb copper and $570/oz gold expanded the potential pit limits so that additional west and east push-backs were possible.
- Mine life at reduced cut-off grade and expanded pit limits will be in the order of 21 years, excluding pre-production, at 30,000tpd.

The current development concept for the mine is as follows:

- Phase I – West pit starter pit with a ramp that commences on the north side counterclockwise
- Phase II – East pit with stand alone access road from the north clockwise
- Phase III – West pit expansion with multiple switch backs
- Phase IV– East pit expansion

A typical cross section and a plan of the pit design are shown in the figures below locating the Lerchs Grossman pit limits and the design phases indicated on the plan.

Figure 4.9 - Section 670450 Pit Limits

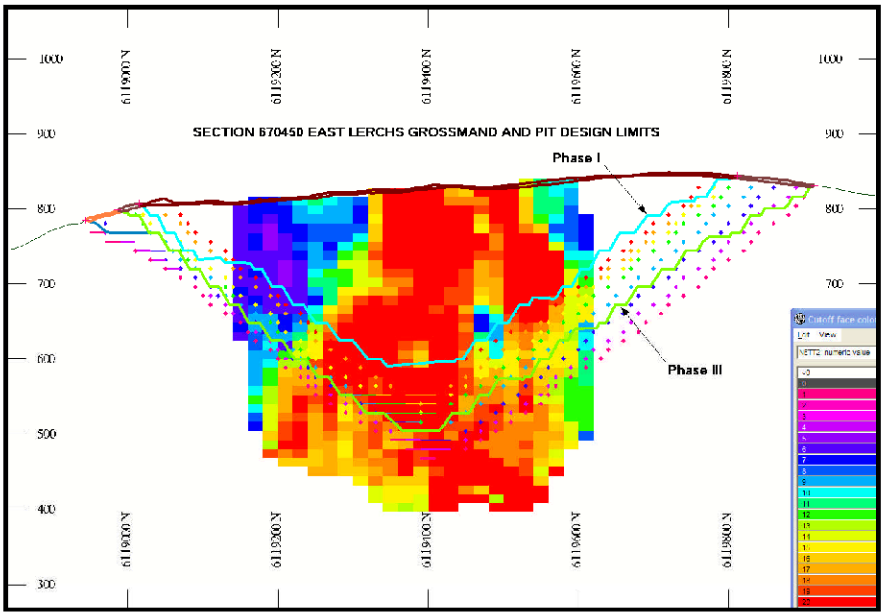
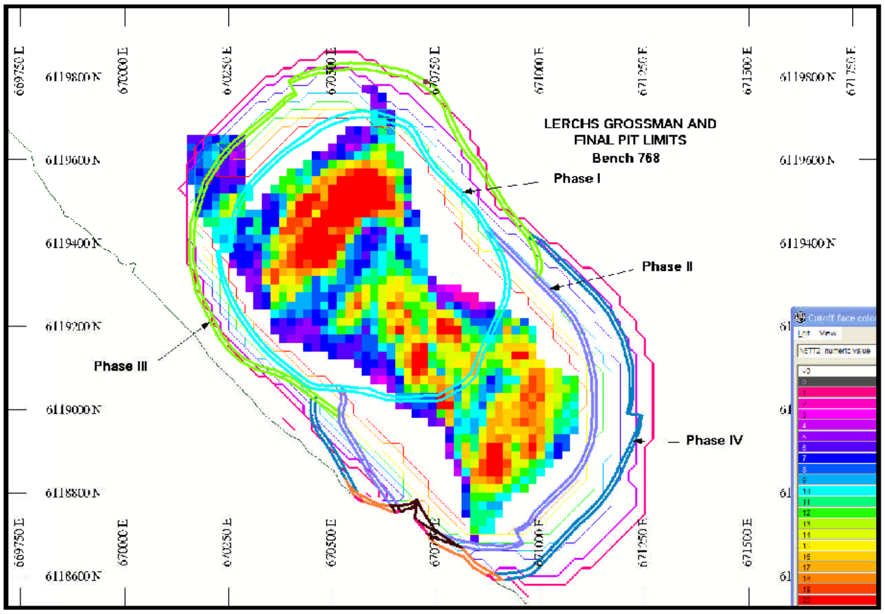


Figure 4.10 - Bench Plan 768 Pit Limits



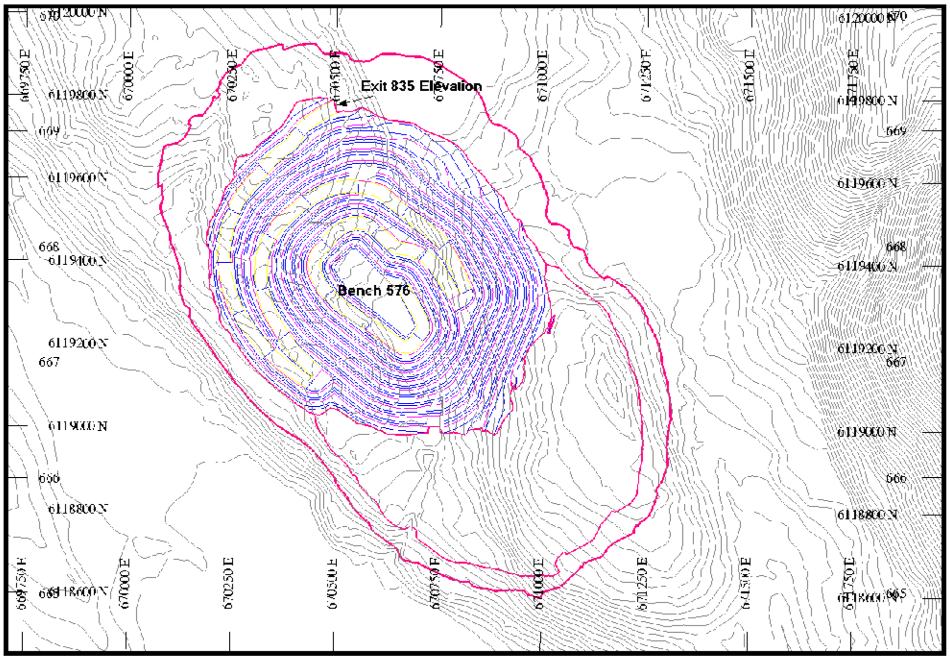
4.5.4 MINE DEVELOPMENT AND ACCESS

PHASE I OPEN PIT

The Phase I pit is located in the northwest area of the deposit. The top bench will be 876 Bench and the bottom bench will be Bench 576 for an overall wall height of 288m. The overall length of the pit will be 860m in the northwest – southeast direction by 720m in the southwest – northeast direction. Overburden thickens to the north approaching Booker Lake north of the pit. This small lake will require drainage and excavation to a stable surface. The pit crest on the southern side is approximately 210m from Morrison Lake.

The access ramp to the Phase I pit exits at the north side of the pit at 835m elevation above the small lake. This exit location provides direct access to the crusher; low grade stockpile and waste dump haulage roads. The ramp switches back twice at the 756 Bench and the 660 Bench before reaching the pit bottom. Switchbacks were located to minimize interference from spillage off the Phase II Pit upper benches. Overburden will be hauled on temporary roads constructed within the pit limits exiting off contour to the south of the pit.

Figure 4.11 - Phase I Pit Design

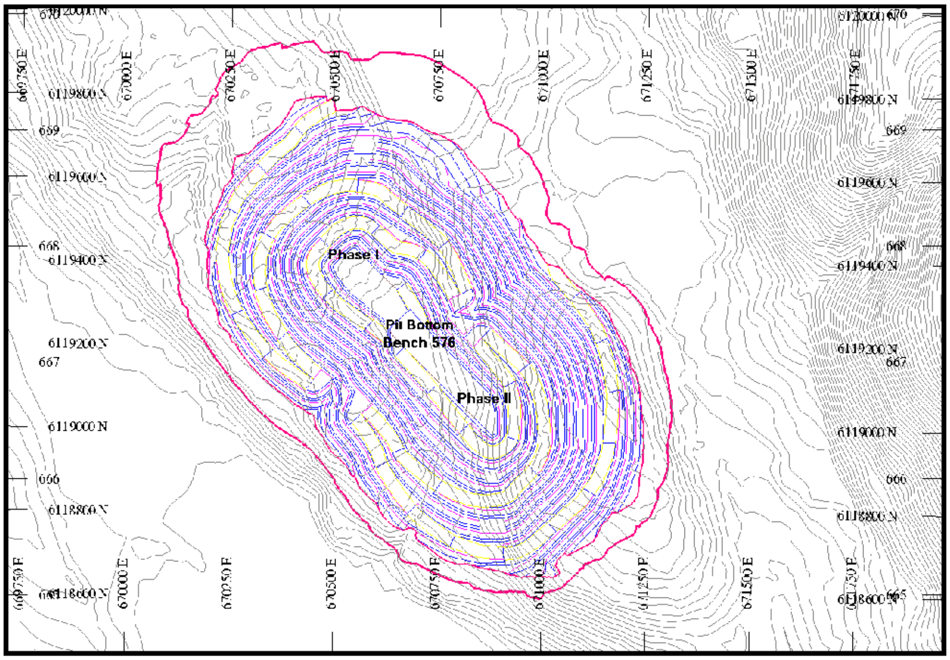


Phase II Open Pit

The Phase II pit is located in the southeast area of the deposit. The top bench will be 888 Bench and the bottom bench will be Bench 576 for an overall wall height of 312m. The overall length of the pit will be 350m in the northwest – southeast direction by 710m in the southwest – northeast direction. The pit crest on the southern side is approximately 140m from Morrison Lake.

The access ramp to the Phase II pit exits at the north side of the pit at 850m elevation. This exit location also provides direct access to the crusher; low grade stockpile and waste dump haulage roads. The ramp switches back twice at the 720 Bench and the 636 Bench before reaching the pit bottom. Switchbacks were located as required to avoid breaking out into the Phase I as built pit. Overburden will also be hauled on temporary roads constructed within the pit limits exiting off contour to the south of the pit.

Figure 4.12 - Phase I and Phase II Pit Design

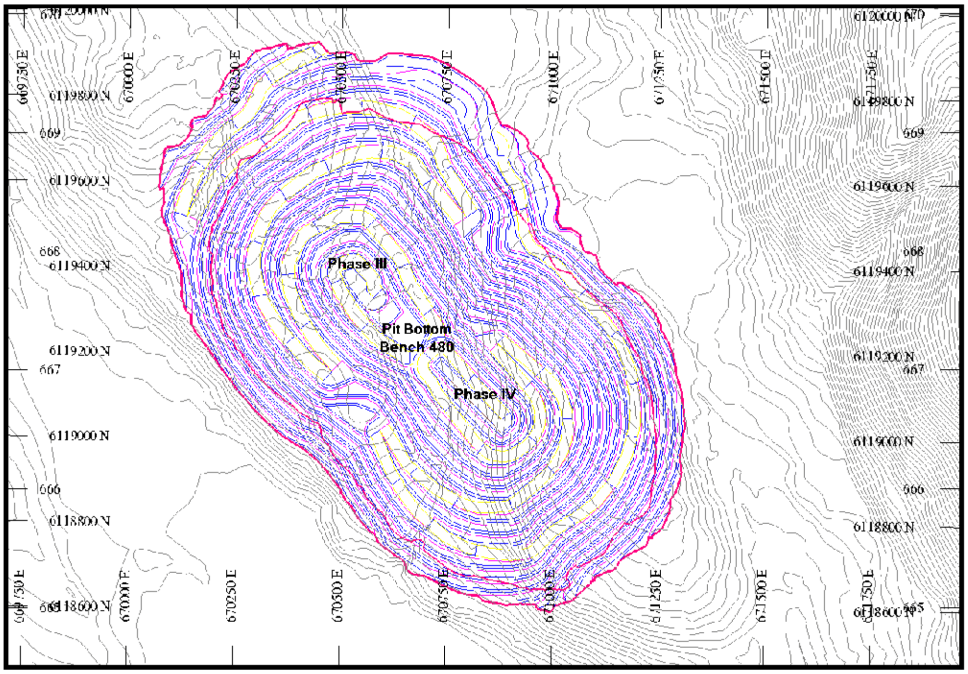


PHASE III & PHASE IV OPEN PITS

The Phase III and Phase IV pits are expansions of Phase I and Phase II pits respectively. The bottom bench will be Bench 480 for an overall wall height of 372m. The overall length of the final pit will be 1470m in the northwest – southeast direction by 900m in the southwest – northeast direction. The pit crest on the southern side is approximately 85m from Morrison Lake.

The access ramp to the Phase III and Phase IV pits exit at the north side of the pit at 850m and 840m elevation respectively. The ramps switch back twice as required before reaching the pit bottom. Overburden will also be hauled on temporary roads constructed within the pit limits exiting off contour to the south of the pit. However, given the advanced development stage of the waste dump some of this overburden could be hauled directly to the waste dump for use in ongoing reclamation programs capping the waste dump.

Figure 4.13 - Phase III and Phase IV Pit Designs



4.5.5 *Production Forecast*

General

A mine plan has been developed to provide 10.95Mt per year of mill feed to the primary crusher at the concentrator. The mine will operate 365 days/year with an allowance for ramping up of production in Year 1 to 90% of capacity or 9.85Mt of mill feed.

The mine production forecast is summarized in Table 4.12 - Mine Production Forecast. A variable cut-off grade for mill feed has been employed over the life of the mine. Overall mine production has been scheduled on an annual basis. A series of grade bins were developed to simulate stockpile segregation and the best available material in any given year was directed to the primary crusher. The balance of the material above the internal cut-off was scheduled to be stockpiled for future recovery in years of lower ore production or for final reclaim after the open pit ceased operation.

A total of four development phases will be mined during the 19 year open pit mine life. Low grade stockpiles will continue to be recovered and processed for nearly three years after the mine ceases operation early in Year 19 of the plan. A total of 408.4Mt will be mined. A total of 224.3Mt of ore will be processed. A total of

172.7Mt of ore will be hauled directly to the primary crusher from the open pit operations. A total of 51.5Mt will be stockpiled and recovered for processing. Waste will be placed in dumps northeast of the open pit. Low grade ore will be placed north of the pit between the plant site and the waste dump. Overburden will be placed southwest of the pit and used as required for reclamation of the waste dumps.

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	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year
,000	21,340,000	19,104,000	8,943,000	10,328,000	7,533,000	3,188,000	-	-	-	-	-	-	-	-	-	-	-	-	
,000	7,860,000	4,621,000	1,793,000	1,301,000	75,000	-	-	-	-	-	-	-	-	-	-	-	-	-	
,000	**29,200,000**	**23,725,000**	**10,736,000**	**11,629,000**	**7,608,000**	**3,188,000**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
-	-	-	2,671,000	5,143,000	6,816,000	10,378,000	9,244,000	6,962,000	9,496,000	9,195,000	-	-	-	-	-	-	-	-	
-	-	-	10,318,000	6,953,000	7,476,000	8,334,000	3,732,000	1,111,000	393,000	-	-	-	-	-	-	-	-	-	
-	**-**	**-**	**12,989,000**	**12,096,000**	**14,292,000**	**18,712,000**	**12,976,000**	**8,072,000**	**9,889,000**	**9,195,000**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
-	-	-	-	-	-	-	673,000	1,910,000	1,832,000	3,856,000	7,969,000	9,709,000	8,030,000	7,839,000	5,180,000	1,867,000	-	-	
-	-	-	-	-	-	-	8,251,000	11,918,000	10,179,000	8,850,000	5,981,000	3,647,000	1,457,000	394,000	229,000	128,000	-	-	
-	**-**	**-**	**-**	**-**	**-**	**-**	**8,924,000**	**13,828,000**	**12,011,000**	**12,705,000**	**13,950,000**	**13,356,000**	**9,487,000**	**8,233,000**	**5,408,000**	**1,995,000**	**-**	**-**	
-	-	-	-	-	-	-	-	-	-	-	-	-	34,000	811,000	5,420,000	9,625,000	10,884,000	1,607,000	
-	-	-	-	-	-	-	-	-	-	-	7,950,000	8,544,000	12,379,000	12,856,000	11,071,000	2,880,000	616,000	289,000	
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**7,950,000**	**8,544,000**	**12,413,000**	**13,667,000**	**16,492,000**	**12,505,000**	**11,500,000**	**1,896,000**	
,000	21,340,000	19,104,000	11,614,000	15,471,000	14,349,000	13,566,000	9,917,000	8,872,000	11,328,000	13,051,000	7,969,000	9,709,000	8,064,000	8,650,000	10,600,000	11,492,000	10,884,000	1,607,000	
,000	7,860,000	4,621,000	12,111,000	8,254,000	7,551,000	8,334,000	11,983,000	13,029,000	10,572,000	8,850,000	13,931,000	12,191,000	13,836,000	13,250,000	11,300,000	3,008,000	616,000	289,000	
,000	**29,200,000**	**23,725,000**	**23,725,000**	**23,725,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**21,900,000**	**14,500,000**	**11,500,000**	**1,896,000**	
,000	**-**	**-**	**1,757,000**	**-**	**673,000**	**1,181,000**	**2,471,000**	**3,978,000**	**1,219,000**	**-**	**4,593,000**	**1,242,000**	**3,271,000**	**2,425,000**	**426,116**	**-**	**225,097**	**9,343,452**	**10,9**
	90%																		
,000	10,950,000	10,950,000	8,727,000	7,580,000	5,414,000	3,912,000	-	1,931,000	1,219,000	-	2,025,000	1,242,000	3,271,000	2,420,000	426,116	-	-	-	10,8
363	0.395	0.427	0.386	0.415	0.420	0.352	-	0.277	0.238	-	0.237	0.237	0.237	0.225	0.194	-	-	-	
152	0.177	0.200	0.198	0.236	0.269	0.230	-	0.159	0.123	-	0.122	0.122	0.122	0.114	0.092	-	-	-	
005	0.004	0.003	0.003	0.003	0.002	0.002	-	0.002	0.003	-	0.003	0.003	0.003	0.003	0.003	-	-	-	
-	-	-	2,223,000	3,370,000	5,536,000	7,038,000	10,750,000	8,470,000	9,032,000	9,085,000	-	-	-	-	-	-	-	4,284,331	1
-	-	-	0.309	0.360	0.323	0.335	0.303	0.320	0.387	0.398	-	-	-	-	-	-	-	0.175	
-	-	-	0.119	0.145	0.135	0.148	0.142	0.155	0.202	0.246	-	-	-	-	-	-	-	0.087	
-	-	-	0.010	0.008	0.007	0.006	0.006	0.005	0.004	0.003	-	-	-	-	-	-	-	0.004	
-	-	-	-	-	-	-	200,278	548,785	698,671	1,865,349	8,925,066	9,707,773	7,651,056	7,743,729	5,146,613	1,866,583	-	4,510,601	
-	-	-	-	-	-	-	0.220	0.250	0.242	0.229	0.244	0.301	0.379	0.375	0.361	0.359	-	0.150	
-	-	-	-	-	-	-	0.054	0.081	0.087	0.097	0.098	0.122	0.178	0.204	0.215	0.227	-	0.047	
-	-	-	-	-	-	-	0.006	0.005	0.005	0.005	0.005	0.004	0.003	0.003	0.003	0.002	-	0.003	
-	-	-	-	-	-	-	-	-	-	-	-	-	27,935	786,565	5,377,271	9,083,417	10,950,000	2,155,068	
-	-	-	-	-	-	-	-	-	-	-	-	-	0.176	0.190	0.295	0.377	0.412	0.376	
-	-	-	-	-	-	-	-	-	-	-	-	-	0.095	0.088	0.124	0.171	0.224	0.238	
-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	0.009	0.007	0.006	0.004	0.003	
,000	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,950,000**	**10,9**
363	0.395	0.427	0.370	0.398	0.371	0.341	0.302	0.309	0.361	0.369	0.243	0.294	0.336	0.329	0.322	0.374	0.412	0.204	
152	0.177	0.200	0.182	0.208	0.201	0.177	0.141	0.152	0.186	0.220	0.102	0.122	0.161	0.176	0.166	0.181	0.224	0.100	
005	0.004	0.003	0.004	0.004	0.005	0.005	0.006	0.004	0.004	0.003	0.005	0.004	0.003	0.003	0.005	0.005	0.004	0.003	
.6%	82.4%	83.1%	81.8%	82.5%	81.8%	81.1%	79.9%	80.2%	81.6%	81.8%	78.0%	79.7%	80.9%	80.7%	80.5%	81.9%	82.8%	76.4%	
.8%	48.9%	49.8%	49.1%	50.1%	49.9%	48.9%	47.2%	47.8%	49.3%	50.5%	44.9%	46.2%	48.2%	48.9%	48.4%	49.1%	50.7%	44.7%	
.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	
32.0	78,653.0	85,734.7	73,068.1	79,222.0	73,369.4	66,702.3	58,243.9	59,740.6	71,203.4	72,852.5	45,751.7	56,547.9	65,608.3	64,075.9	62,593.8	73,975.4	82,299.1	37,684.0	3:
,990	30,410	35,100	31,393	36,697	35,334	30,511	23,356	25,562	32,243	39,204	16,158	19,837	27,318	30,195	28,238	31,187	39,907	15,783	
490	438	413	521	533	552	562	697	536	438	382	544	507	381	395	613	653	482	395	
,000	30,395,000	35,016,000	47,127,000	55,381,000	62,932,000	71,266,000	83,249,000	96,278,000	106,850,000	115,700,000	129,631,000	141,822,000	155,658,000	168,908,000	180,208,000	183,216,000	183,832,000	184,121,000	184,1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
,000	17,200,000	25,354,000	26,018,000	30,539,000	33,938,000	36,554,000	35,521,000	33,443,000	33,821,000	35,922,000	32,941,000	31,700,000	28,814,000	26,514,000	26,164,000	26,706,000	26,640,000	17,297,000	6,3

Figure 4.14 - Material Movement Schedule

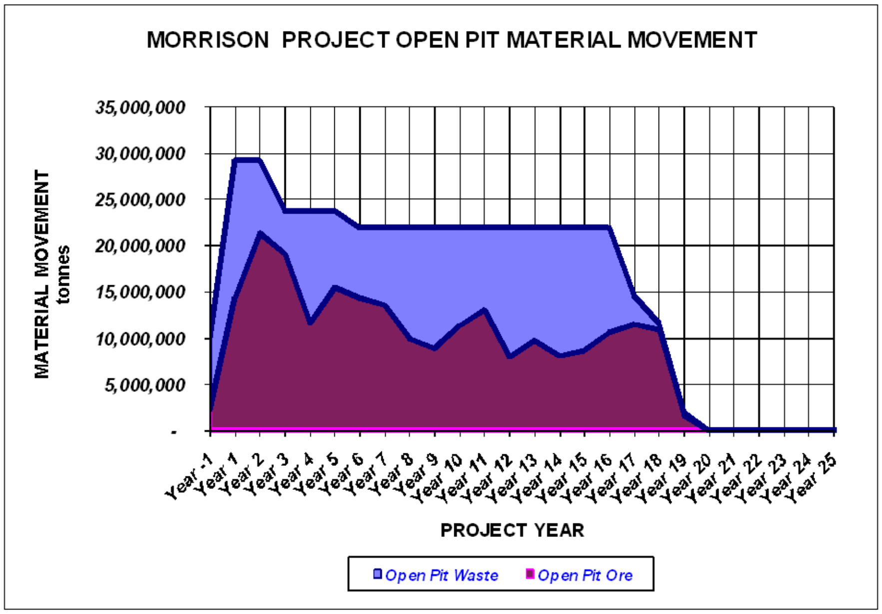


Figure 4.15 - Cumulative Potential Mill Feed Released

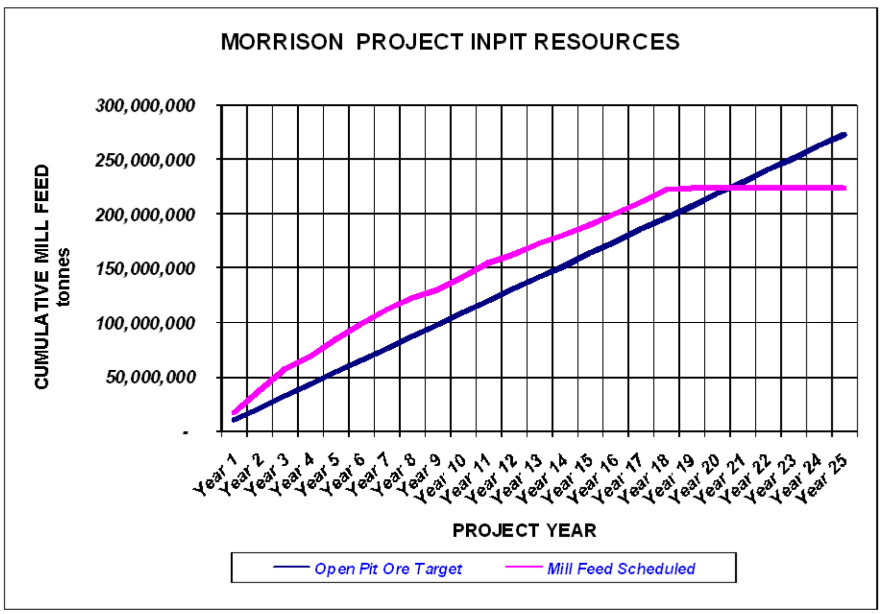
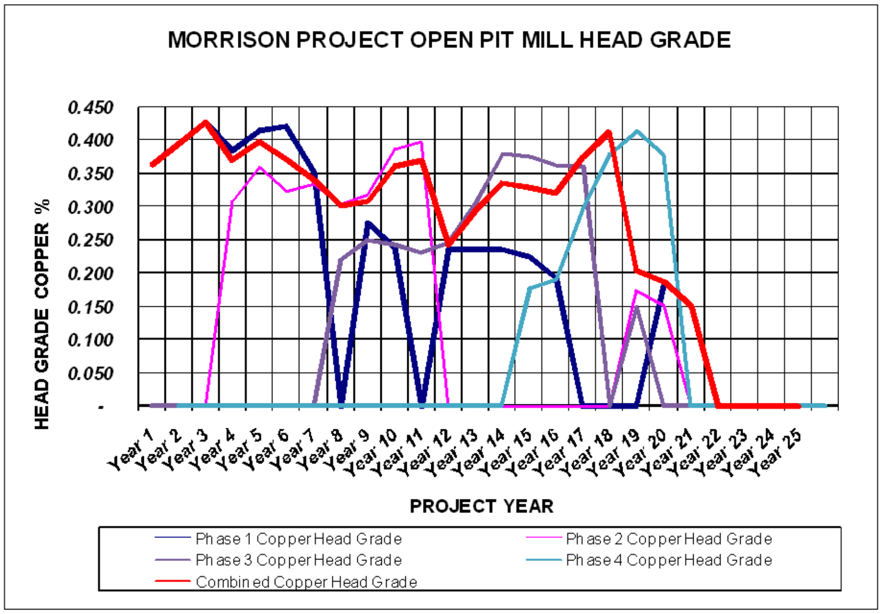


Figure 4.16 - Mill Feed Head Grades



A series of drawings are shown in the figures of the sections below illustrating the sequence of mine development as defined in the detailed and summary production schedules.

4.5.6 *MINE DEVELOPMENT PRE-PRODUCTION*

The production activities prior to mill startup include the following:

- Drain Booker Lake, Ore Pond and Pond X
- Clear & grub dump and stockpile footprint
- Clear Phase I open pit
- Establish sumps and drainage diversion ditches
- Build roads to access plantsite & shop areas, temporary fuel storage areas, magazines and dump & stockpile areas
- Strip overburden and waste rock to release ore for Year 1 milling

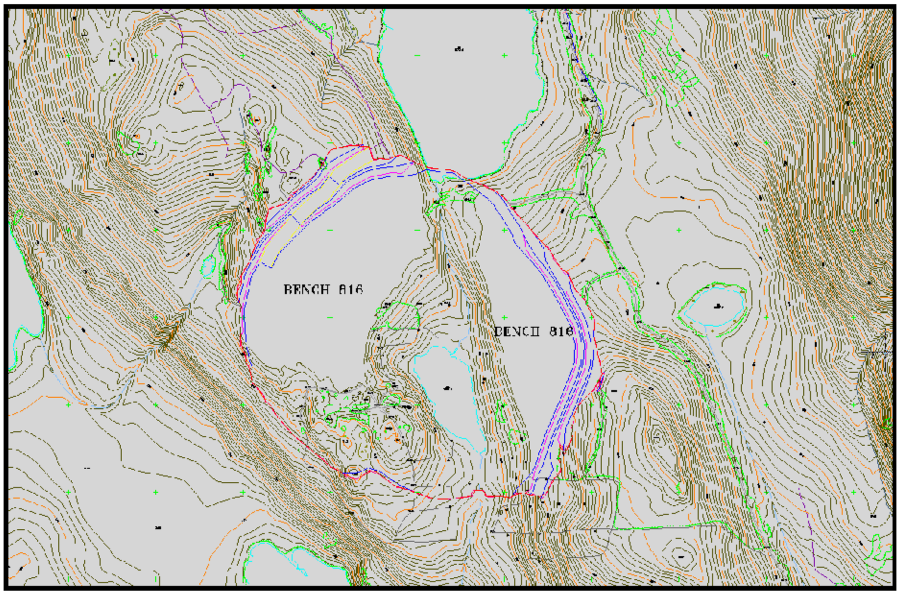
KCBL has prepared estimates for site preparation and water management.

Mine development of the Phase I pit during pre-production includes mining of 10Mt of overburden, waste rock and potential mill feed to stockpile. The pit will be developed to the bottom of Bench 816 with partial mining of Bench 804. This level of development exposes ore on Bench 804. However, the total overburden removed is only 2.5Mt or 30% of the total required to open up the total open pit surface of Phase I. The pre-production schedule should be developed in more detail at Basic

Engineering when start-up schedules are better defined in the context of seasonal weather issues, contractor forces and Year 1 short range planning definition. There may be a case for moving additional overburden stripping forward into pre-production.

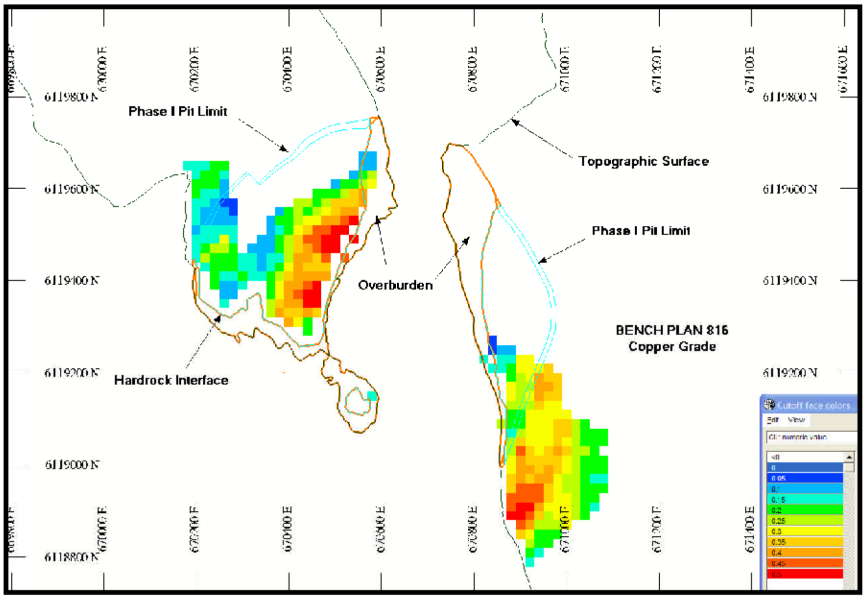
During pre-production the access ramp to the Phase I pit is established and mining progresses to Bench 816 on both the east and west sides of the pit. This scenario represents the minimum amount of pre-stripping to release ore in Year 1.

Figure 4.17 - Mine Development Year -1



The ore distribution on the Bench 816 is shown in the figure below. Blocks are colour coded by copper grade – blue is low grade and red is high grade.

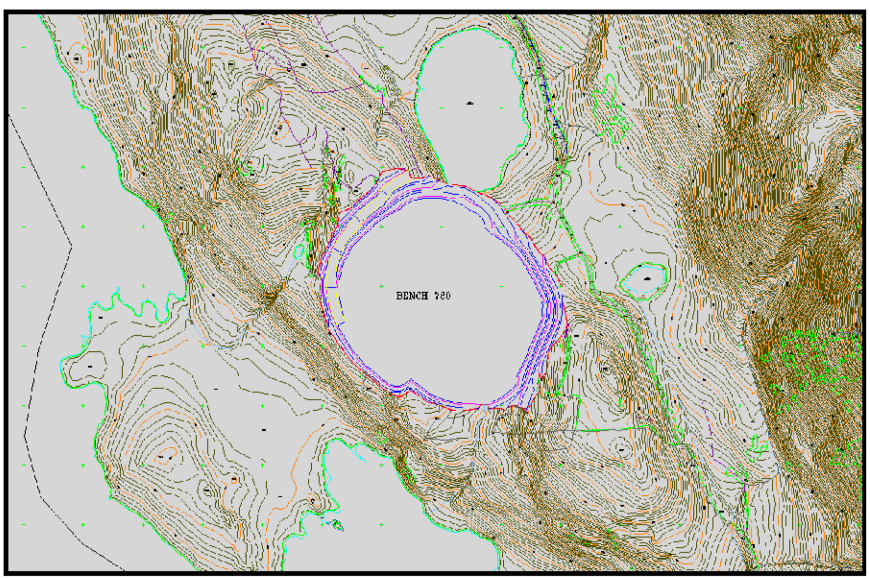
Figure 4.18 - Bench Plan 816 - Pre-Production



4.5.7 Mine Development Year 1

Mining during Year 1 continues in the Phase I Pit. Active benches include Bench 804 through 780 Bench. Total material mined in Year 1 will be 29.2Mt.

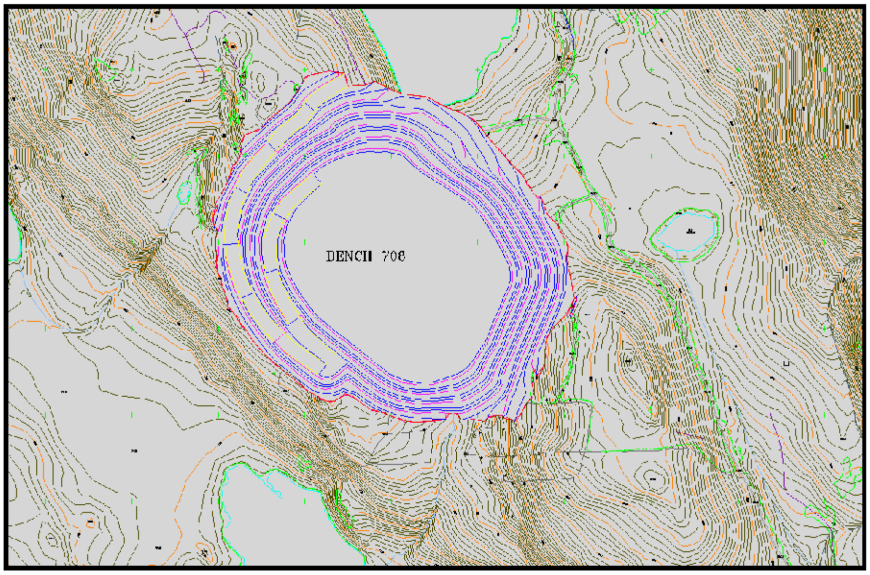
Figure 4.19 - Mine Development Year 1



4.5.8 MINE DEVELOPMENT YEAR 2 TO YEAR 3

Mining during Year 2 through Year 3 continues in the Phase I Pit. Active benches include Bench 780 through 708 Bench. Total material mined in Year 2 will be 29Mt and in Year 3, 24Mt.

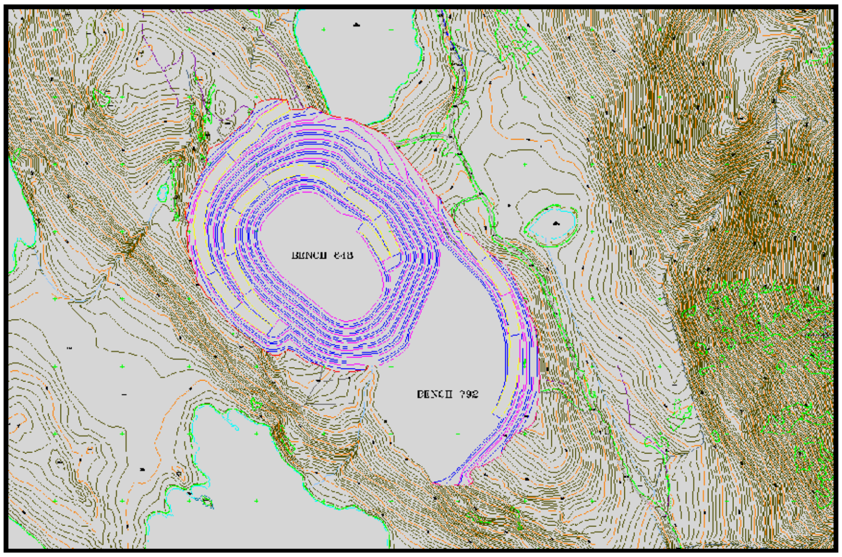
Figure 4.20 - Mine Development Year 3



4.5.9 MINE DEVELOPMENT YEAR 4 TO YEAR 5

Mining during Year 4 through Year 5 continues in the Phase I Pit and commences in the Phase II Pit. Active benches in Phase I include Bench 696 through 648 Bench. Phase II pit development commences in Year 4 on Bench 888 through Bench 828 and by Year 5 the pit has reached Bench 792. Total material mined in Year 4 and in Year 5 will be 24Mt.

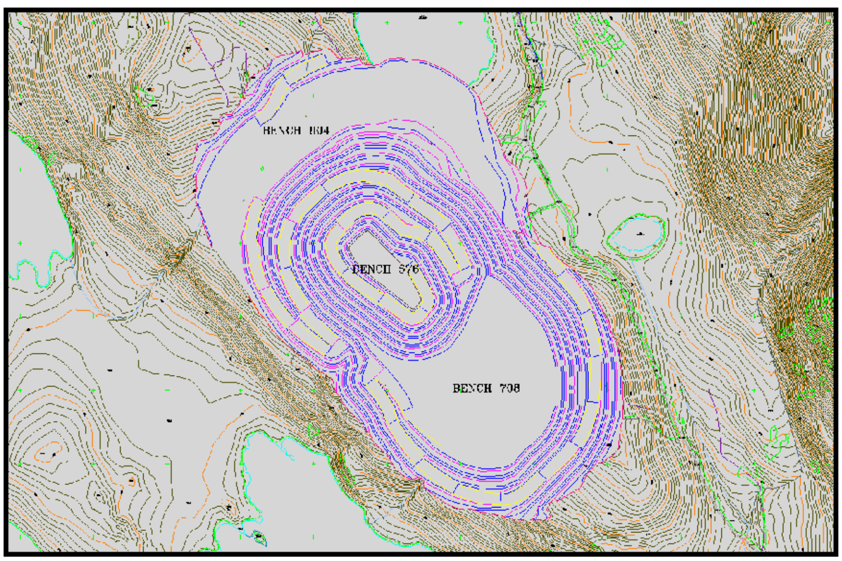
Figure 4.21 - Mine Development Year 5



4.5.10 MINE DEVELOPMENT YEAR 6 TO YEAR 8

Mining during Year 6 through Year 8 continues in the Phase I and Phase II Pits and commences in the Phase III Pit. Phase I is completed in Year 7 at Bench 576. By Year 8 Phase II reached 708 Bench. Phase III pit development commences in Year 8 on Bench 852 through Bench 804. Total material mined in Year 6 through Year 8 will be 22Mt annually.

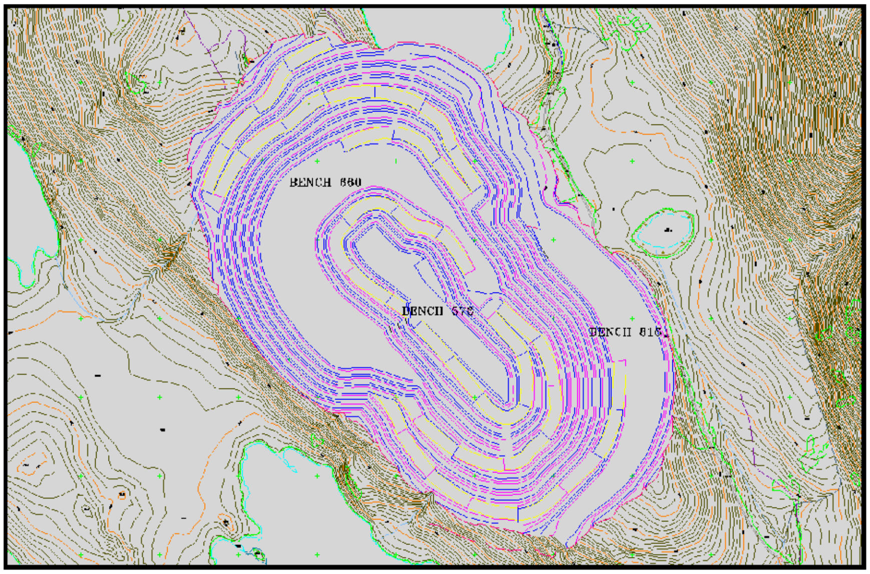
Figure 4.22 - Mine Development Year 8



4.5.11 MINE DEVELOPMENT YEAR 9 TO YEAR 12

Mining during Year 9 through Year 12 continues in the Phase II and Phase III Pits. Phase II is completed in Year 11 at Bench 576. Phase III reaches Bench 660 by Year 12. Phase IV development commences in Year 12 and reaches Bench 816. Total material mined in Year 9 through Year 12 will be 22Mt annually.

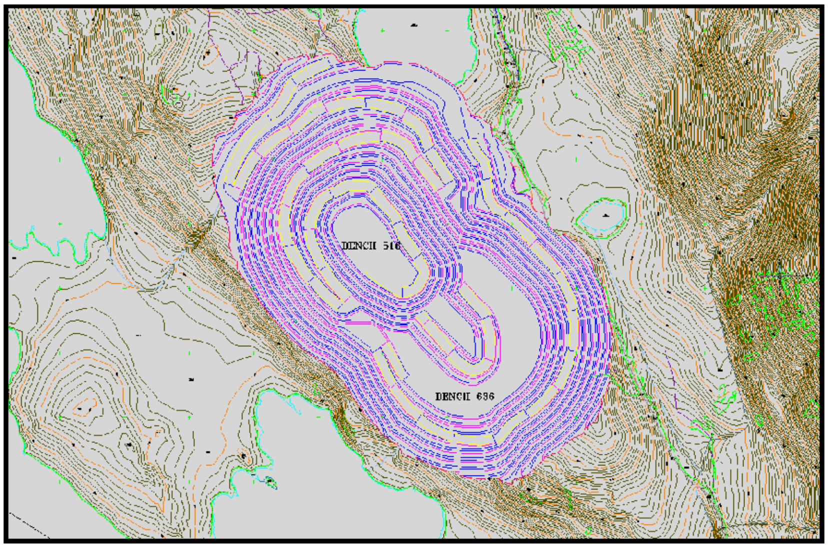
Figure 4.23 - Mine Development Year 12



4.5.12 MINE DEVELOPMENT YEAR 13 TO YEAR 16

Mining during Year 13 through Year 16 continues in the Phase III and Phase IV Pits. By Year 16 Phase III will have reached 636 Bench. Phase IV reaches Bench 636 by Year 16. Total material mined in Year 13 through Year 16 will be 22Mt.

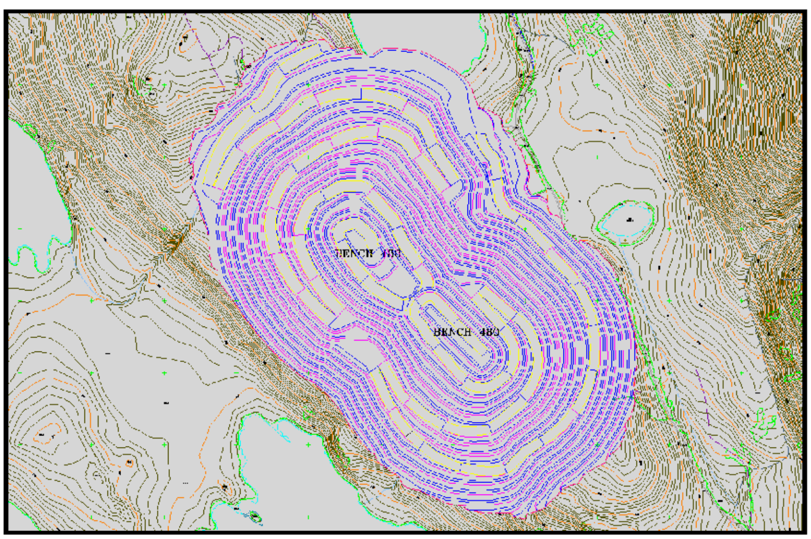
Figure 4.24 - Mine Development Year 16



4.5.13 *MINE DEVELOPMENT YEAR 16 TO YEAR 19*

Mining during Year 16 through Year 19 continues in the Phase III and Phase IV Pits. By Year 17 Phase III is completed. Phase IV reaches Bench 480 by Year 19. Total material mined in Year 17 will be 15Mt and in Year 18 will be 22Mt. The final year will only see 2Mt moved in the pit but stockpile recovery and processing will continue.

Figure 4.25 - Mine Development End of Mine



4.6 ENGINEERING AND GRADE CONTROL

The mine engineering group will be responsible for short, medium and long range planning as well as day to day grade control functions and maintenance and monitoring of the dispatch system which will control the movement of trucks, shovels and drills.

Geotechnical engineers will monitor slopes and collect information on structure, material characteristics, hydrology and waste characterization on an ongoing basis as the mine is developed in order to improve the mine design criteria and ensure operational efficiency. They will also be involved in optimizing the blasting procedures to minimize wall damage while maximizing fragmentation.

Geologists and grade control technicians will be responsible for blasthole sampling, assaying and grade control. Grade control will be focused on copper and gold. However, waste characterization will also be important as there will be requirements for non-acid generating waste identification so that this material can be used for construction, and placement in environmentally sensitive areas such as peripheral areas of dumps and as under liner on stockpile areas.

Planning engineers will update mine plans at the short, intermediate and long range scale as required and determine stockpiling and milling cut-off grades to meet the mine plans as they evolve with time and improved updated databases. They will also collect and evaluate mine operations equipment productivity and cost data to optimize ongoing operations.

Modern mine planning and geostatistical packages will be required for use in the engineering department to integrate the information coming from ongoing exploration, long range models, short range production plans and operational production data.

4.7 MINE EQUIPMENT

4.7.1 SUMMARY

Mine equipment has been selected given the following considerations:

- The simultaneous distribution of multiple operating faces at several locations determined by the long range plan
- The necessity to minimize unit operating costs by using large scale mining equipment
- Use of well proven equipment technology and coordination of operating machines using advanced systems

The mine will operate using diesel hydraulic shovels and drills. Off road end dump trucks and support equipment fleet will gradually be increased to match the requirements of the production schedule. In terms of total production the peak is in first 2 years at 80,000tpd. The equipment fleet requirements peak in Year 12 to 15 due to a combination of moderately long haulage profiles and material movement quantity combined with an aging fleet that will be operating at low availability. The annual equipment requirements for the mine are summarized in Table 4.13 - Production Fleet Requirement.

Table 4.13 - Production Fleet Requirement

Item	Manufacturer	Model	No.
Shovel	Komatsu	PC4000	2
Bench Drills	Sandvik	D90KS	1
Secondary Drill	Sandvik	Pantera	1
Haul Trucks	Caterpillar	793C	4*

**Note: Additional haul trucks will be purchased at the start of milling year 2 and in subsequent years.*

4.7.2 Major Mine Equipment Operating Parameters

The mine will operate 24 hours per day 365 days per year. Shift employees will work 12 hour shifts on a 28 day cycle.

The annual hours available for work are summarized in Table 4.14 – Auxiliary Equipment List Hours Available. The effective operating time is summarized in Table 4.15 - Effective Operating Time. In general it is expected that major equipment will have an effective operating time of 50 minutes per hour. Equipment is expected to have an initial 95% availability, declining with the number operating hours the equipment has run. Equipment utilization is expected to be in the range of 85%. The anticipated equipment life and availability assumptions are summarized in Table 4.14 – Effective Operating Time and used to provide estimates of sustaining capital requirements.

Detailed equipment productivity calculations have been made on an annual basis for drills, shovels, and trucks. Support equipment operating time has been factored on an annual basis according to material movement.

Auxiliary Pit Mobile Equipment Requirements:

Table 4.14 –Auxiliary Equipment List Hours Available

Item	Manufacturer	Model	No.	Cost each$	Fob mine$.	Annual Hours
Track Type Dozer	Caterpillar	D10T	2	2,000,000	4,000,000	11,000
Track Type Dozer	Caterpillar	D9T	1	1,350,000	1,350,000	5,000
Rubber Tire Dozer	Caterpillar	834B	1	1,950,000	1,950,000	4,000
Motor Grader	Caterpillar	16M	2	875,000	1,750,000	3,500
Skid Steer Loader	Caterpillar	216B	1	41,000	41,000	1,500

Table continues.....

Item	Manufacturer	Model	No.	Cost each$	Fob mine$.	Annual Hours
Integrated Tool Carrier	Caterpillar	IT14G	1	175,000	175,000	350
Water Truck			1	150,000	150,000	3,000
Utility Haul Truck	Caterpillar	773E	2	750,000	1,500,000	5,000
Sand Truck			1	150,000	150,000	2,000
Pick-up Trucks			6			8,000
Crew-cabs			2			1,100
Fuel and Lube Truck			1			1,400
Mechanic's Truck			1			1,000
Welding Truck			1			700
Utility 60t crane			1			800
Flatbed truck 7.3t			1			700
Tractor and lowboy	Freightliner		1			350
Rough terrain forklift	Sellick	SD-100	1			1,350
Utility Excavator			2			900

Table 4.15 – Effective Operating Time

Item	Minutes
Scheduled time per 12 hour shift	720
Scheduled Non-Productive Time:	
Deduct Meal Time	60
Job efficiency @ 50 minutes per operating hour	
Net Operating Time per shift:	**550 minutes**

**Note: Assumption is maintenance crew do fuelling and lube during operator's meal break.*

4.8 Drilling & Blasting

4.8.1 Drilling

The primary blasthole drills will be diesel powered rotary machines capable of drilling 269mm holes.

These drills are capable of single pass drilling holes to 15m. Pre-splitting will be practiced and off-vertical holes will be drilled as required.

The fleet will consist of two units. These units will drill the production blastholes and the secondary drill will be used for buffer rows. Re-drilling is included in contingency.

It is expected cycle times per hole drilled will average approximately 27 minutes per hole when drilling ore and 22 minutes per hole in waste. Drilling hours for the project are expected to be within the capability of two bench drills. Towards the end of the mine life the two drills will be approaching the end of their usefulness and the operator will be prudent to have an identified source for a machine which could be rented in emergency situations.

A smaller hydraulic drill will be purchased for blasting oversize, wall control angle holes, wall water relief holes and other special applications.

The rotary bench drills will have the capability to drill 269mm diameter holes. A system of double benching will be employed and the drills will be capable of drilling the 12m bench height plus 1.5m sub-grade in a single pass without adding drill rods.

A 6.3m x 6.3m blast pattern has been selected for blasting in ore and the less dense waste will require a 7m x 7m drill hole pattern.

4.8.2 PRODUCTION BLASTING

Ore will be drilled on a 12m bench using on a 6.3m x 6.3m pattern. Waste will be drilled with on a 7.3m x 7.3m pattern. Sub-grade drilling will be 1.5m to allow even breakage to the design bench elevation. Blasthole cuttings will be sampled and assayed for grade control. In general overburden will not be drilled and blasted.

Blasting will be done with ammonium nitrate and fuel oil (ANFO) when conditions are dry or if the hole can be pumped and lined. It is anticipated that approximately 5% of the holes will be “wet” where emulsion explosives will be used. An alternative explosive is a 70/30 Anfo-Emulsion blend which can be used in wet or dry holes. The overall production blasting agent consumption is expected to be 0.24kg per tonne of ore and waste.

Blast holes will be single primed and initiated using non-electric methods. An explosive supply contractor will deliver bulk explosives to the borehole. The mine blasting crew will be supervised by the Drill & Blast Foreman who will work closely with the Drill & Blast Engineer.

4.8.3 WALL CONTROL BLASTING

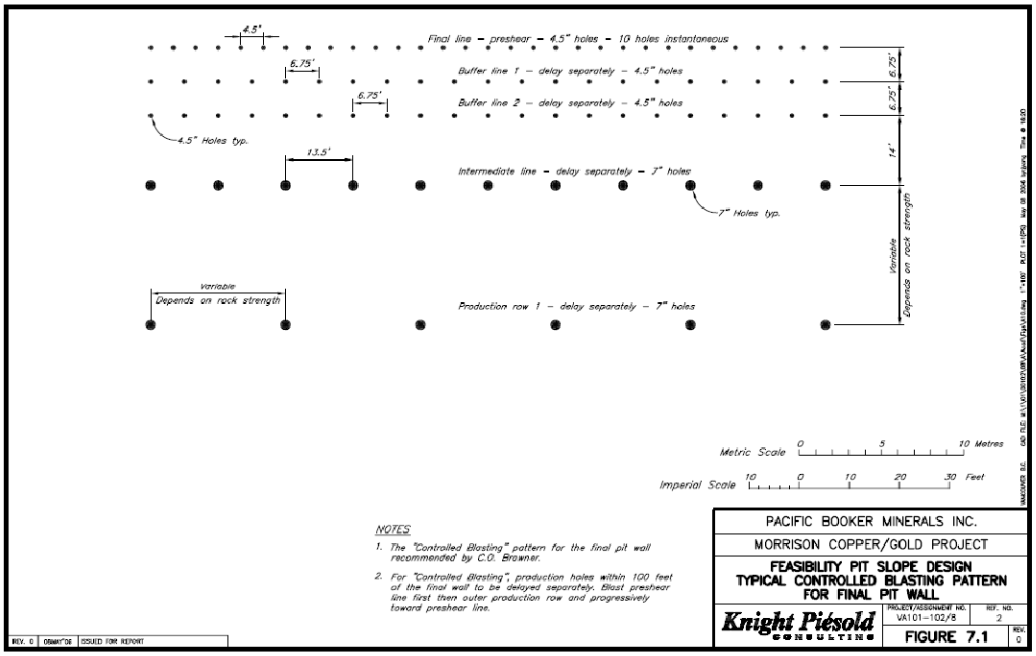
In general it is expected adequate wall control will be achievable using the smaller secondary hydraulic drill drilling 112mm angle holes.

A single row of inclined blastholes will be used initially using dynamite for explosive. If this does not produce satisfactory pre-shearing results a more elaborate pattern such as that described below will be used.

Knight Piésold recommended the pattern below:

The wall control blasting will consist of two buffer rows at reduced spacing of the production pattern. These will be drilled with the production drill. The sub-grade drilling depth will be reduced in areas of final berm locations. A small diameter hole pre-shear row will be used along final walls. The specified pattern is shown in Figure 4.26.

Figure 4.26 - Knight Piésold recommended Wall Control Blast Pattern



4.8.4 Oversize Reduction

A small hydraulic drill will be available for secondary blasting. This drill can also be used for drilling sub-horizontal drain holes for wall slope depressurization and could if required be used for perimeter pre-splitting.

From time to time situations may arise where drainage holes drilled into the pit sidewall may be desirable to prevent wall deterioration. These holes would typically be drilled at a slight upward angle using the smaller hydraulic drill and hole lengths up to 20m may be required.

4.8.5 Explosives Storage (Drawing A0-10-002)

Emulsion is likely to be shipped from an Orica Canada Inc. facility at Gibraltar, McLeese Lake and stored in a 60t heated silo on site. The facility is approximately 555km from the mine site. Ammonium nitrate in dry prill form will be delivered to site in 40t B-Train loads and stored in a 100t silo. The explosives will be mixed on site using a process vehicle. The process vehicle will be a 20t custom built unit which can be configured to hold either dry hole product, wet hole product or a combination depending on current conditions. The onsite facility will have equipment wash facilities, parking for the process truck and fuel storage. Explosives will be delivered to the borehole by the process vehicle, where the mine blasting crew will install primers, stem the holes and initiate the blast. Explosives storage on site will consist of a magazine for packaged explosives and primers plus a cap magazine, containing primers, boosters and detonators, which will be located at a distance from the emulsion silo and with distances between the containers which comply with the Table of Distances. Two 8' x 20' (2.4m x 6.1m) pre-manufactured container type magazines complete with remote surveillance provided by the explosives supplier will separately store up to 1t of boosters, detonating cord and packaged explosives and the second container will be used for detonators, delays and caps. The magazine will be enclosed by a 1.8m high fence with warning signs visible from all sides. The exact type of boosters and caps to be stored has not been finalized. The location of the magazines and explosives manufacturing facilities are shown on the general arrangement plan A0-10-002 Overall Site General Arrangement.

Components will be brought on site as:

- Ammonium Nitrate (AN) in bulk (big bags)
- Fuel-false (specially for the emulsion)
- Emulsifier in drums

Stored separately will be:

- Primers (Explosives)
- Detonators (Explosives)

4.8.6 LOADING

The loading fleet will consist of two 22m^3 diesel hydraulic shovels. One shovel will be allocated to loading waste and the other will load ore.

The wheel loaders will be available to work in stockpile areas, low face conditions, and where required to meet production during periods of unscheduled shovel downtime.

The diesel hydraulic shovels will operate two twelve hour shifts per day. Equipment will be shut down for one hour per shift for operator lunch breaks. Operating times of 50 minutes per remaining hour are anticipated. Equipment availability is expected to be over 90% when operations start and this is expected to deteriorate as equipment ages. Utilization is expected to exceed 80%.

The productivity calculations assume good digging conditions; four pass loading of the 227t trucks and a cycle time of 3.00 minutes. The theoretical maximum production of the selected diesel hydraulic shovels is 4,395t per fifty minute hour. When expected availability and utilization are considered loading capacity averaging 3,425t per hour can be expected when the equipment is new, decreasing to approximately 2,750t per hour near the end of the project.

Total loading hours for the project are not expected to be of a magnitude which could result in major wear related breakdowns of the shovels. The shovels will be overhauled as required and are expected to have a useful life of 60,000 hours.

Potential advantages of using the Komatsu PC4000 units as backhoes rather than shovels were investigated. The cycle times were found to be almost identical.

4.8.7 HAULAGE

Mechanical drive rear dump haul trucks of 227t capacity will be used to haul ore to the crusher. The same trucks will be used to haul overburden to the overburden stockpile located immediately south of the pit and waste to the waste disposal area on the opposite site of the pit. Pit ore and waste haulage requirements will remain relatively constant for 18 ¼ years. A reduced crew and equipment fleet will then move low grade material from the stockpile to the mill. Milling operations will be completed during the 21st year after start of operations.

The 227t capacity haul trucks will operate two twelve hour shifts per day. Equipment will be shut down for one hour per shift for operator lunch breaks. Operating times of 50 minutes per remaining hour are anticipated. Equipment availability is expected to be over 95% when operations start and this is likely to deteriorate as equipment ages. Utilization is expected to exceed 85%.

It is normal industry practice to start replacing haul trucks when they have operated for more than approximately 60,000 hours.

The cycle times for ore or waste were calculated for each year of production and were based on haul distances and haul road grades. These were then used to calculate haul truck productivities and fleet requirements. A summary of the cycle time assumptions, including truck speeds and load & dump times, are shown in Table 4.16 - Haulage Truck Cycle Factors.

A total of 4 haulage units are required during pre-production with an additional truck added in year 2.

Table 4.16 - Haulage Truck Cycle Factors

Item	Time in minutes
Load	4.25
Dump and Manoeuvre	0.50
Hauler exchange time	0.70

4.8.8 MINE SUPPORT EQUIPMENT

The mining support equipment includes track dozers, wheel dozers, graders, a water truck, and a sand truck required for road, bench and dump maintenance. Miscellaneous ancillary equipment is also required to service, maintain the major equipment and support ongoing pit operations.

Track dozers will operate on active benches pushing back – break and performing heavy dozer operations around operating shovels. In the pit they will also build roads, clean berms and rip hard toes. On waste dumps and stockpiles the track dozers will maintain positive grades on the bench surfaces near the crest and create safety berms.

Road graders and rubber tire dozers will maintain road, dump and bench surfaces to provide level running surfaces and move snow.

Water trucks and sand trucks will be used in the road maintenance program to provide dust control and safe winter running conditions. The units specified for these tasks are machines with relatively low utilization.

A complement of ancillary equipment as listed in Table 4.13 - Production Fleet Requirement will also be available to perform service functions including fuelling, provide work area lighting, excavation capability for ditching etc. as required to ensure a safe self sufficient mine operation.

Pick-up trucks and crew-cabs will be required for transportation of supervisors, technical staff and maintenance personnel.

Explosives will be delivered to the blast hole. The blasting crew will require support equipment to pump wet holes, deliver blasting accessories and stem holes. The bulk delivery truck and storage facilities will be provided by the explosives contractor

4.8.9 EQUIPMENT REPLACEMENT

The detailed schedules for equipment additions and replacements are shown in Table 4.17 and Table 4.18.

Table 4.17 - Equipment Additions

The following additional equipment will be required during the mine life:

Item	Manufacturer	Model	Year of Purchase
One haul truck 227t	Caterpillar	793D	Start of second milling year.

Table 4.18 - Equipment Replacements

The following equipment will require replacement during the mine life:

Item	Manufacturer	Model	Year of Replacement
Haul trucks 227t	Caterpillar	793D	1 in Year 13,1 in Year 14
Bench Drill	Sandvik	D90KS	1 unit Year 10
Light Vehicles			3 per year start Year 5
Grader	Caterpillar	16M	2 units Year 10

4.9 MINE ANCILLARY FACILITIES

TRUCK SHOP AND WAREHOUSE

Refer to Section 5.2.6 of this report.

MINE DISPATCH

A mine dispatch system will be installed at Morrison to maximize equipment utilization productivity. The dispatch base station and central control will be located in the service complex. Units will be mounted on drills, shovels, loader, shovel, truck and crusher. The conceptual configuration would include GPS ground reference stations and repeaters. The system would interface with the mine planning system and survey system on drills.

4.9.1 MINE WATER MANAGEMENT

Refer to KCBL report "Geotechnical Feasibility Study", December 7, 2008.

It has been assumed no major pumping will be required from the pits due to the low permeability of the country rock. Modest allowances have been made for pumps and their operation.

4.9.2 FUEL STORAGE

The annual quantity requirement varies from approximately 2.8 million litres per year in Year -1 to 7.6 million litres per year in Year 2 of the mine plan. Additional fuel is also required for preparation of ANFO for blasting. Approximately 6% fuel oil by weight is added to the ammonium nitrate prills. The mine will provide fuel oil to the blasting supply contractor. This volume will also vary on an annual basis. Fuel storage tanks have been provided and are located adjacent to the truck shop and warehouse.

4.10 MINE OPERATING COST ESTIMATE

4.10.1 SUMMARY

The forecast operating costs for the open pit are divided into the following areas:

- General Mine Expense
- Drilling & Blasting
- Loading & Hauling
- Auxiliary Equipment – Roads & Dumps

Operating costs are further subdivided within these cost centers as follows:

- Salaries & Wages
- Fuel & Power
- Consumables & Maintenance Parts and Outside Services

Operating cost estimates have been developed on the basis of the following:

- Material Movement Schedule
- Budget quotes from suppliers for the delivery of consumable items such as fuel, lubricants and explosives
- Equipment productivity calculations
- Local salary levels
- Local union labour rates
- Etc.

4.10.2 Basis of Operating Cost Estimate

General Mine Expense

The total cost for General Mine Expense includes the following items:

- Salaries and wages for supervisory personnel in engineering and operations as well as some unallocated maintenance wages
- Maintenance and fuel for pit services auxiliary support equipment
- Mine dewatering costs
- Mine electrical distribution for lighting and pumps
- Limited budgets for road surfacing material
- Engineering consumables and assays

Drilling

- Production drilling will be done with large diameter blasthole drills drilling 269mm diameter holes 13.5m deep.
- An effective operating time of 550 minutes per shift takes into account scheduled and non-scheduled delays, operator inefficiency and weather.

Blasting

An explosive supplier will set up a mixing and blending plant on site and will move explosives to blasthole locations. Loading, stemming and coupling up holes ready for blasting will be done by operator's personnel. All of these activities will be supervised in the pit by the operator's blasting engineers.

Loading

- Loading of ore and waste will be carried out by two diesel hydraulic shovels. Four shovel bucket loads will be required to load a 227t haul truck.
- Effective operating time for these units is expected to be 550 minutes per shift which takes into account scheduled and non-scheduled delays, operator inefficiency and weather.
- Fuelling and lubricant topping-up of the shovels will be carried out by maintenance personnel during the shovel operator's meal break.

Hauling

The bulk of the ore, waste and overburden haulage will be done by 227t rear dump haul trucks. Four trucks will be purchased initially with a fifth truck purchased with sustaining capital funds at the start of the second mill operating year.

Effective operating time for these units is expected to be 550 minutes per shift which takes into account scheduled and non-scheduled delays, operator inefficiency and weather.

Truck fuelling is expected to be carried out during the operator's meal break.

4.10.3 *Mine Workforce*

Organization

The Mine Superintendent will have overall responsibility for all open pit activities.

Reporting directly to the Mine Superintendent will be the Mine Chief Supervisor, Chief Mine Engineer and Mine Maintenance Supervisor.

Reporting to the Mine Chief Supervisor will be four Mine Supervisors and two drill and blast engineers.

Reporting to the Chief Mine Engineer will be the Chief Production Geologist, two Mine Engineers, and the Surveyor.

Reporting to the Mine Maintenance Supervisor will be two Mine Maintenance Shift Supervisors and a Maintenance Planner.

The Mine Superintendent will schedule the activities of all of the above staff to ensure effective continuous supervision of the operation.

The Morrison Project mine personnel requirements are set out in Tables.

There is a skeleton crew required for 2 additional years as stockpiled ore is reclaimed for mill feed.

The number of employees that will be required in the mine department varies over time due to the varying haul distances associated with the four phase mine development plan.

No camp will be required at site. A schedule involving four operating crews will be utilized.

Table 4.19 - Personnel Requirements – Pit Phases II and II

		Year										
	-1	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Mine Superintendent	1	1	1	1	1	1	1	1	1	1	1	1
Mine Chief Supervisor	1	1	1	1	1	1	1	1	1	1	1	1
Clerks	2	2	2	2	2	2	2	2	2	2	2	2
Chief Production Geologist	1	1	1	1	1	1	1	1	1	1	1	1
Chief Engineer	1	1	1	1	1	1	1	1	1	1	1	1
Mine Engineers, Short- and Mid-Term	2	2	2	2	2	2	2	2	2	2	2	2
Geology/Grade Controllers	2	2	2	2	2	2	2	2	2	2	2	2
Surveyors	2	2	2	2	2	2	2	2	2	2	2	2
Survey Helpers	2	2	2	2	2	2	2	2	2	2	2	2
Mine Supervisors	4	4	4	4	4	4	4	4	4	4	4	4
Drill & Blast Supervisors	2	2	2	2	2	2	2	2	2	2	2	2
Lube/Fuel Operators & Helpers	4	4	4	4	4	4	4	4	4	4	4	4
Equipment Operators*	34	47	51	47	47	51	51	51	51	51	51	51
Drillers	4	4	8	4	4	4	4	4	4	4	4	4
Drill Helpers	4	4	8	4	4	4	4	4	4	4	4	4
Blasters	2	2	2	2	2	2	2	2	2	2	2	2
Blaster Helpers	4	4	4	4	4	4	4	4	4	4	4	4
Mine Maintenance Supervisor	1	1	1	1	1	1	1	1	1	1	1	1
Mine Maint. Shift Supervisor	4	4	4	4	4	4	4	4	4	4	4	4
Mine Maintenance Planners	2	2	2	2	2	2	2	2	2	2	2	2
Light Vehicle Mechanics	2	2	2	2	2	2	2	2	2	2	2	2
Mine Maintenance Mechanics	12	16	16	16	16	16	16	16	16	16	16	16
Mine Maintenance Helpers	8	12	12	12	12	12	12	12	12	12	12	12
Welders	4	8	8	8	8	8	8	8	8	8	8	8
Total Personnel	**105**	**130**	**142**	**130**	**130**	**134**	**134**	**134**	**134**	**134**	**134**	**134**

**One operator per shift is included to cover vacations and sick leave*

Table 4.20 - Personnel Requirements – Pit Phases III and IV

	Year									
	12	13	14	15	16	17	18	19	20	21
Mine Superintendent	1	1	1	1	1	1	1	0.5	0	0
Mine Chief Supervisor	1	1	1	1	1	1	1	1	0	0
Clerks	2	2	2	2	2	1	1	0.5	0.5	0.29
Chief Production Geologist	1	1	1	1	1	1	1	0	0	0
Chief Engineer	1	1	1	1	1	1	1	0.5	0	0
Mine Engineers, Short- and Mid-Term	2	2	2	2	2	2	2	0.5	0	0
Geology/Grade Controllers	2	2	2	2	2	2	2	0.5	0	0
Surveyors	2	2	2	2	2	2	2	1	1	1
Survey Helpers	2	2	2	2	2	2	2	1	0	0
Mine Supervisors	4	4	4	4	4	4	4	2	4	2
Drill & Blast Supervisors	2	2	2	2	2	2	2	1	0	0
Lube/Fuel Operators & Helpers	4	4	4	4	4	4	4	2	1	1
Equipment Operators*	55	59	63	63	51	42	34	19	13	12
Drillers	4	4	4	4	4	4	4	4	0	0
Drill Helpers	4	4	4	4	4	4	4	4	0	0
Blasters	2	2	2	2	2	2	2	1	0	0
Blaster Helpers	4	4	4	4	4	4	4	1	0	0
Mine Maintenance Superintendent	1	1	1	1	1	1	1	0.5	0	0
Mine Maintenance Shift Supervisor	4	4	4	4	4	4	4	1	0	0
Mine Maintenance Planners	2	2	2	2	2	2	2	1	0	0
Light Vehicle Mechanics	2	2	2	2	2	2	2	1	1	0.58
Mine Maintenance Mechanics	16	16	16	16	16	16	16	4	4	2.32
Mine Maintenance Helpers	12	12	12	12	12	12	12	4	3	3
Welders	8	8	8	8	8	8	8	4	1	0.58
Total Personnel	**138**	**142**	**146**	**146**	**134**	**124**	**116**	**55**	**29**	**23**

**One operator per shift is included to cover vacations and sick leave. Year 19 part year only for most employees.*

TRAINING

The operator will endeavour to hire personnel with relevant experience. This will be augmented by training to ensure good practice is being followed resulting in a safe, productive operation.

Training on individual items of equipment has been included in the capital costs.

Safety and company procedural training will supplement that provided by suppliers.

PRE-PRODUCTION STAFFING REQUIREMENTS

Hiring will concentrate on filling key supervisory and operating positions first and gradually building up the workforce to match operational requirements.

Wages and Salaries

Local union rates were used.

Typical salary rates for the industry were used for salaried positions.

Table 4.21 - Salaries

Title	Hourly Rate	Hours Per Year	Gross Annual $
Mine Superintendent	66.55	2,080	138,424.00
Chief Mine Supervisor	48.40	2,080	100,672.00
Clerk	24.20	2,080	50,336.00
Chief Prod. Geologist	42.35	2,080	88,088.00
Chief Engineer	45.98	2,080	95,638.00
Mine Engineers	44.77	2,080	93,122.00
Geol./Grade Control	30.25	2,080	62,920.00
Surveyor	39.93	2,080	83,054.00
Survey Helper	29.04	2,080	60,403.00
Mine Sh. Supervisors	39.93	2,007.5	80,159.00
Drill/ Blast Engineers	38.12	2,080	79,290.00
Lube/Fuel Operators	28.44	2,007.5	57,093.00
Equipment Operators	36.30	2,007.5	72,872.00
Drillers	33.88	2,007.5	68,014.00
Drill Helpers	26.62	2,007.5	53,440.00
Blasters	33.88	2,007.5	68,014.00
Blaster Helpers	28.44	2,007.5	57,093.00
Mine Mnt. Supervisor	48.40	2,080	100,672.00
Maint. Shift Supervisor	39.93	2,007.5	80,160.00
Mine Maint. Planner	37.51	2,007.5	75,301.00
Light Vehicle Mech.	39.51	2,007.5	75,301.00
Mine Maint. Mechs.	37.51	2,007.5	75,301.00
Mine Maint. Helpers	26.62	2,007.5	53,440.00
Welders	37.51	2,007.5	75,301.00

Wardrop incorporated the Pacific Booker Minerals Inc. Manpower Plan for Morrison Mine in the Mine Operating Cost calculations.

Mine Personnel – Supervisory, Technical, Operating, Maintenance

The objective in hiring is to ensure adequate direction for the workforce so that a safe and effective operation results.

A Chief Engineer plus two other engineers will be required to handle short and longer term mine planning and to cover other pit related engineering functions.

Three geologists will be hired to deal with grade control functions and advise the engineers regarding mine planning.

While the major pieces of pit equipment such as shovels and drills will have dedicated operators, multi-skilled personnel will be required to operate the many pieces of auxiliary equipment.

A good maintenance planning program is essential for a relatively long life mine, so a full time maintenance planner will be required.

The mine maintenance department will mainly be based in the mine service facility which will have the capability to perform major overhaul work on all of the auxiliary equipment plus haul trucks and bench drills. Major rebuilds of items such as haul truck engines will be carried out by others off-site. Shovel maintenance will largely be carried out in the pit.

4.11 Mine Capital Costs

4.11.1 Capital Cost Estimate Summary

Refer to the Wardrop Report "Volume 3 – Capital Cost Estimate", February 2009.

4.11.2 Basis of Estimate

The capital cost estimate was based on:

- Pre-production development costs as a combination of mine operating costs and contractor rates for various activities related to developing the mine for production
- Equipment fleet requirements based upon productivity calculations attached in the Appendices
- Budget quotations for major equipment
- Existing quotations and generic costs for ancillary equipment
- Engineered quantities for mine water management (see KCBL Sections for Details)
- Indirects, EPCM and Contingency to be added as part of the overall total Feasibility Study Estimate

NMS was responsible for the mine planning and Wardrop was responsible for the overall capital cost estimates. KCBL provided portions of the estimates for pre-production development and water management and closure.

The estimate, prepared using a combination of quoted, estimated and factored costs.

4.11.3 PRE-STRIPPING & ROAD CONSTRUCTION

Refer to KCBL report "Morrison Copper/Gold Project – Geotechnical Feasibility Study", December 2008.

4.11.4 MOBILE EQUIPMENT

Capital cost for mobile mine equipment is estimated to total $52.537 million. Mobile Equipment will be leased. A further $1.655 million will be required for other pit equipment. These totals include freight, assembly, and commissioning. Only new equipment has been included.

Capital required for the mine is shown in Table 4.22.

Table 4.22 - Mine Capital Cost – Mobile Equipment

Item	Manufacturer	Model	#	Cost Ea. FOB Mine	Total ($)
Shovel	Komatsu	PC4000	2	7,300,000	14,600,000
Wheel Loader	Caterpillar	992G	2	2,400,000	4,800,000
Off Highway Trucks	Caterpillar	793C	4	3,990,000	15,960,000
Track Type Tractor	Caterpillar	D10T	2	2,000,000	4,000,000
Track Type Tractor	Caterpillar	D9T	1	1,350,000	1,350,000
Rubber Tire Dozer	Caterpillar	834B	1	1,950,000	1,950,000
Motor Grader	Caterpillar	16M	2	875,000	1,750,000
Skid Steer Loader	Caterpillar	216B	1	41,000	41,000
Integrated Tool Carrier	Caterpillar	IT14G	1	175,000	175,000
Water Truck			1	150,000	150,000
Utility Haul Truck	Caterpillar	773E	2	750,000	1,500,000
Sand Truck			1	150,000	150,000
Bench Drill	Sandvik	D90KS	1	2,583,274	2,583,274
Secondary Drill	Sandvik	Pantera	1	605,0000	605,000
Pick-up trucks			6	48,000	288,000
Crew-cabs/Suburban's			2	50,000	100,000
Fuel/Lube Truck			1	190,000	190,000
Mechanic's Truck			2	100,000	200,000
Welder's truck			1	110,000	110,000
Utility Crane (60t)	Grove	RT760E	1	600,000	600,000
Flatbed Truck 7.3t			1	135,000	135,000
Tractor and Lowboy	Freightliner		1	300,000	300,000
Rough Terrain Forklift	Sellick	SD-100	1	200,000	200,000
Utility Excavator			1	800,000	800,000
Sub-Total – Mobile Equipment					**$52,537,274**

Table 4.23 - Mine Capital Cost – Other Pit Equipment

Other Pit Equipment	#	Cost ea. FOB Mine	Total ($)
Mine Pumps, Piping		110,000	110,000
Shop Tools		200,000	200,000
Truck Dispatch System, No Depth Control		560,000	560,000
Mobile Radio Units		5,000	5,000
Lighting Units	6	30,000	180,000
10 Scott Airpacks and 30 masks		50,000	50,000
Rescue Clothing and Gear		30,000	30,000
Maintenance Management System	1	5,500	5,500
Explosives Facility Site Commissioning Fee		80,000	80,000
Safety Equipment		117,000	117,000
Engineering* & GIS Survey Equipment & Software		45,000	45,000
Computer Workstations	4	12,000	12,000
AutoCAD Software	4	35,000	35,000
Geology/Mining Software		25,000	25,000
Pump switchgear, cabling (lot)			200,000
Sub-Total – Other Pit Equipment			**$1,654,500**
Total Mine Capital Equipment			**$54,191,774**

4.11.5 PROJECT INDIRECT COSTS

Indirect costs have not been included in the mining cost estimate as in general they will determined and included as part of the overall estimate. Items to be considered for inclusion in the mining related Project Indirect Costs are as follows:

- Additional Mine Engineering and Surveying during Basic Engineering and Pre-production
- Construction Support
- Purchasing and Vendor Interface
- Additional Permitting

4.11.6 CONTINGENCY

Refer to Wardrop Report "Volume 3 – Capital Cost Estimate", February 2009.

4.11.7 SPARE PARTS AND INVENTORY

Mine equipment will be maintained by mine employees. It is expected that to some degree vendors will provide some spares and consumables on a consignment basis but the details will be subject to negotiation at the basic engineering stage of project development.

4.11.8 Capital Cost Exclusions

The following costs were not included in the mining capital cost estimate:

- Scope changes
- Project financing costs
- Interest during construction
- Schedule delays and associated costs
- Owners costs
- Exploration expenses
- Schedule acceleration costs
- Sunk costs
- License fees
- Taxes and duties

4.12 Recommendations

The current mine plan calls for pit expansion into areas peripheral to the well drilled areas above the mineralized zone. In these areas the overburden thickness is not well modelled. It is recommended that geophysical methods such as seismic or ground penetrating radar be evaluated for use in better defining the overburden thickness and the hardrock – overburden interface location.

Overburden removal has been scheduled on an as required basis to release ore for processing. It is recommended that consideration be given to contracting overburden removal ahead of drilling and blasting on production benches. Economic considerations, equipment requirements and logistics with respect to seasonal operation and start-up are all factors to be considered at “Basic Engineering”.

Blast optimization should be undertaken to minimize costs and to establish wall control operational practices. It is recommended that blasting practices be part of a process of continuous improvement.

Energy is a major cost in the mine. Any opportunity to reduce energy costs in the mine should be explored.

5.0 INFRASTRUCTURE

5.1 OFF SITE INFRASTRUCTURE

5.1.1 ACCESS ROAD

In April 2008 a study was prepared by Allnorth Consultants Ltd. to evaluate potential routes as access into the plant site.

A further study was prepared in August 2008 by Chrisita Enterprises Ltd. to estimate the capital and operating and maintenance costs for the recommended route.

Excerpts from the Allnorth Consultants report:

METHODOLOGY

The study was based on a desk top review approach to determine the potential least cost route. In particular to determine how the various route options compare to each other in a relative ranking based on the total cost per tonne of ore concentrate delivered to port.

Information was requested from various government agencies and corporations responsible for the management of existing infrastructure. Input was gathered from sources that have local knowledge and experience. Not all of the responses to those requests have been received at date of publication and some interpolation and assumptions have been included herein.

It should be noted that due to the overview nature and assumptions included in this study, it is expected that the relative ranking of options is reasonably accurate. However the accuracy of any single number or calculation should b assumed to be only within plus or minus approximately 50%.

Further detailed analysis of all the components of this study are required to bring the reliability of the values to a higher confidence level. This would include obtaining quotes or detailed estimates from contractors or suppliers and by conducting a field review of the routes.

The recommended route is 2C comprised of the following major infrastructure components:

- Forest Service Roads (FSR) which meets or exceed forest service specifications. Depending on the section of road, PBM anticipates 33% to 50% of these costs will be paid by the forest companies.
- Babine Barge to be utilized by PBM during pre-production and production is an existing barge service owned by Babine Barge Ltd.
- Public Highway section of Route 2C are considered to be acceptable for use by PBM. These are major highways not subject to seasonal load restrictions.

Although parts of Route 2C are to be used for Pre-Production and Production transportation concentrate hauling comprises the single largest use of the route. Planning for efficient use of equipment and employees, the concentrate hauling via Route 2C is segmented into 3 legs.

- Leg 1 Mine site to Nose Bay via Forest Service Roads then via barge across Babine Lake to Michelle Bay
- Leg 2 Michelle Bay to Smithers via public highways
- Leg 3 Smithers to Stewart via public highways

5.1.2 Electrical Power Supply

This portion of the project feasibility study prepared by Kaehne Consulting Ltd., covers electrical power supply to the project up to the secondary terminals of the main power transformers at the Morrison Substation. It includes preliminary design, capital and operating costs. Power supply is designed for a plant processing 30,000t per day of ore.

There is only one practical and economical source of power supply to the project and that is from BC Hydro via a connection to the transmission system at Babine Substation location on the west side of Babine Lake in the vicinity of the Granisle township. For the Preliminary Assessment of the project which was completed in 2004, two main power line routes from Babine Substation were considered, namely a new 138kV transmission line extending north along the western shore of Babine Lake, crossing the west arm of the lake, then extending in a northerly direction to a new substation at the Morrison project site, or a much shorter route from an existing 138kV installation at the Bell Mine extending approximately 25km to the Morrison site, also via a new 138kV overhead line. The shorter route is preferred and is the basis of the study.

The 138kV service which was extended to the Bell Mine in 1971 is now energized at 25kV and will be re-energized to its design voltage. The submarine cable across Babine Lake owned by Xstrata has been inspected, repaired and tested by Allteck, a specialist BC Hydro approved contractor and pronounced suitable for re-energizing at its former operating voltage of 138kV. PBM will take over operating and maintenance responsibility for the submarine cable and overhead line to Bell mine based on the terms of a Memorandum of Understanding (MOU) signed on June 5, 2008. The MOU allows PBM to utilize these facilities for supply to Morrison in return for providing power supply to the Bell Mine at no charge. Final agreements for shared use with Xstrata are expected to be signed based on the principles of the MOU. Approval of these arrangements by the British Columbia Utilities Commission (BCUC) will also be required.

Based on a aerial visual inspection of the 138kV overhead line from Babine Substation to the Bell Mine an allowance has been made for remedial work which will include resetting or replacement of leaning poles, replacement of damage crossarms and line hardware and inspection and repair of the conductors. The new 138kV line will utilize the same construction standards as the existing line, namely single wooden poles with wishbone crossarms and suspension disk insulators on line poles and three pole brace assemblies.

The Morrison Substation will consist of two identical primary transformers, each with the capacity to serve the load alone on a standby rating. The site distribution voltage will be 13.8kV which will transmit power to the grinding mills and various load centers around the site via a combination of buried cables and overhead lines.

MAIN SITE SUBSTATION

At the Morrison plant site a substation will be established consisting of two identical three phase outdoor power transformers complete with primary isolation and protective devices. Check metering may be installed if desired. Each of the main transformers will have sufficient capacity to carry the plant load at its forced cooling rating. A main secondary outdoor bus will transfer power to the main 13.8kV switchgear line-up, located indoors in an adjacent electrical room. This switchgear will also distribute power to the various plant loads. Refer to the Plant Single Line diagrams included in Appendix A.

5.2 ON SITE INFRASTRUCTURE

5.2.1 *HAUL AND ACCESS ROADS (DRAWING A0-10-002)*

All roads will be serviceable on a year round basis.

ACCESS ROADS

All on site access roads are gravel surfaced and are 12m wide (except the Mined Ore Haul and Waste Roads) with ditches on both sides for drainage. The main access road travels from the entrance gate towards the North West, passing the Open Pit Mine and Overburden Stockpile, past the Ore Treatment Plant and on to the Explosive Magazine facility and then on to the Ammonium Nitrate & Emulsion Silos. Berms will be installed along the road side where necessary to prevent rocks and earth sliding down onto the road (e.g. from the Overburden Stockpile). From there the road splits into two secondary roads that make their way up to the Tailings

Pond – one follows the Tailings pipeline towards the East end of the Pond and the other follows the Reclaim Water pipeline towards the West end of the pond. The main entrance road is approximately 6km long from the entrance gate to the split.

There are several short secondary road off shoots from the main access way to service each of the different facilities. Some of these off shoot roads include:

- A road to the North end of the Ore treatment plant for load out of Concentrate Product to side dump truck-trailers, each carrying a payload of approximately 40t;
- The continuation of this road around the Ore Treatment Plant and on up to the Open Pit Mine area to join up with the Mined Ore Haul Road;
- A road to the west down to the Administration, Truck Shop, Truck Wash and other miscellaneous buildings West of the Ore Treatment Plant.

In addition there are several off shoot roads from the secondary roads to the Pond area. These include a road to each of the Tailings Pumps Booster Stations, a road to the Cyclowash Pump Station; and a road to the Reclaim/Fire water Tank area.

HAUL ROAD

The Mined Ore Haul Road is a short gravel surfaced road made up of three sections linked together (approximately 2.4km total length) running between the Open Pit Mine and the Primary Crusher. The road will be 30m wide with drainage ditches on both sides. This road is a heavy duty design to carry loaded ore trucks and will run from the Southeast towards the Northwest and traffic will be two way.

CONCENTRATE PRODUCT HAUL ROADS

On site, the concentrate Product will be loaded out from the Ore Treatment plant by belt conveyors into 40t capacity truck trailers for hauling to a port near Stewart, BC. The loaded truck trailers will travel along the main plant entrance road to exit the site through the main gate.

Off site, based on two in-depth studies carried out in 2008, (one by Allnorth Consultants Limited and the other by Chrisita Enterprises Ltd.) it was decided that the haul trucks/trailers will travel route 2C to the port near Stewart, BC. After unloading, the truck trailers will return to site via the same route in reverse. It is expected that all roads on this route will be serviceable 24/7 all year round.

5.2.2 *POWER DISTRIBUTION*

Power from the electrical utility will be provided to a main substation located to the north of the main process building. The subject of the power line access, suitability of supply, cost and substation technical details are described in a report by Kaehne Consulting Ltd. (KCL).

Electrical power is supplied from the secondary of two 13.8kV transformers and delivered to a 13.8kV switchgear (circuit breaker) line up located in a prefabricated metal building on the substation site.

Power from that location is delivered at 13.8kV via a combination of overhead lines and underground power cables. The main feeders are:

- Overhead power line to primary crushing then via underground cable to pit perimeter.
- Overhead power line to smaller process plant area facilities including: cold storage, sewage treatment, administration building, maintenance shop, truck wash, and fuel storage. A tap and feeder cable to the lake fresh water make up station is also located along this power line.
- Overhead power line to explosives storage and ammonium nitrate emulsion storage.
- Underground feeder cables to tailings pumping station #2 then extending past the fire/reclaim water holding tank, to the south seepage pond and tailings pond. This arrangement suits the design input from the tailings designers KCBL. Two main underground cable feeds to the main process plant then via cable tray to process building electrical room.
- One underground feeder cable to the HPGR building by way of the process building and conveyor systems.

The electrical distribution design is developed based on the items entered in the project mechanical equipment list. This list includes process and mechanical design data including required equipment motor sizes (kW), information taken from proposed equipment proposals and estimates of electrical power requirements for non-process based loads. To this basic kW list are applied:

- demand factors
- use factors
- typical reactive power ratings (relating load kW to KVA)
- typical motor efficiency factors

Application of these factors refine the basic connected kW loads into to running loads by area and development of the project single line diagrams.

Motors greater than 200hp will be 4.16kV with the exception of the ball mill systems and HPGR systems which will be fed at 13.8kV.

Smaller three phase motors up to 200hp will be 575V.

Motors up to 200hp are designated for full voltage starting. Larger motors at the 4.16kV level, unless otherwise indicated are intended at the time of this study to be full voltage start. There are no provisions for soft starts unless shown on the equipment list. Similarly, variable speed drives are provided only for equipment so indicated on the equipment list.

The two fixed speed 6700kW ball mills are provided with a 50% voltage reactor starter for each mill low speed synchronous motor. This allowance is made with the knowledge that an air clutch exists for the selected ball mills and therefore the ball mill motors start with no mechanical load. (Note that the final selection of starting methods for ball mills is a separate pre-engineering task when complete modelling of the utility system and ball mill motors is practical.)

The other major drive system is for the HPGR package. The Variable Speed Drives are provided as part of the vendor package selected.

The remaining fixed speed medium voltage motors will be fed from a 4.16kV motor control centres located in the closest electrical room.

For ease of maintenance, most electrical equipment will be located in indoor ventilated electrical rooms wherever practical. Where the electrical rooms are not designed into the footprint of the main building, allowances for pre-manufactured (equipment installed and prewired) buildings has been included.

The HPGR facility has a separate electrical room housing its electrical distribution as part of the building. The final size of this room will be determined by the final equipment selection.

Allowance for a pre-engineered, modular electrical room is included for the primary crushing facility. Other general buildings will be planned and ordered with sufficient electrical room space included.

Within the process plant, a double ended 600V switchboard will provide power feeds to the 600V motor control centres located in the central electrical rook area.

Low voltage volt motor control centres are provided, complete with a communication link such that the plant control system (Distributed Control System – DCS) can communicate and control the motors without hardwiring of I/O points from MCC's to the DCS.

EMERGENCY POWER

Critical Power

Items are identified on the equipment list as critical equipment are those loads which cannot remain stopped for significant amounts of time without the plant incurring restarting costs (agitators). The associated infrastructure loads needed to operate the critical equipment (control room power, lights and similar items) is also included as critical equipment.

The total critical power for this area has been assessed at this stage to approximate a 1.3MW running load and is primarily located within the main process building. The ability of the power system to meet this requirement will be met by manual transfer scheme such that, upon loss of normal utility power, operation and electrician actions will start one diesel generator unit located adjacent to the main process plant and power the critical power loads. During operation in this manner, operator control will be required to limit the electrical load applied to the diesel generator.

This process plant diesel generator will be interlocked with the plant 600V distribution system to prevent inadvertent paralleling of sources of energy. A fuel tank for this emergency generator will be provided to allow for 5 days of operation at full load.

Other remote areas such as primary crushing, HPGR building and as identified on the single line diagram will have local backup generators to provide power upon normal power failure for small, local loads.

EQUIPMENT TYPE AND RATINGS

Wiring Materials & Installation

Power and Control Cables

Other than the 13.8kV transmission lines which are ACSR type, electrical power will be distributed at the various voltage levels via armoured cables in cable tray or, in some instances, via buried duct systems.

Generally, all power cabling will use copper conductor Teck type cables in underground non-metallic ducts or above ground in ladder type cable trays, and have interlocking aluminum armour with a PVC FT4 rated, UV resistant jacket, suitable for -40°C. Voltage, insulation class colour and spacing will be as needed for the application.

Standard power cable ampacities are used for quantity derivation on motor wiring. Generally these cables are derated by at least 30% to account for proximity derating rules.

Underground Cable Ducts

Where underground cabling is required, cables will be installed in minimum 100mm ø schedule 40 rigid PVC ducts. Ducts will be buried typically to 1,200mm below final grade. Concrete pull boxes will be provided where required for number of bend limitations and sized to suit existing cable fill plus minimum 25% spare capacity. "Danger – Buried Cable" marker tape will be installed at both sides of trench during backfilling. A 50mm thick concrete layer may be added above the ducts in selected areas where heavy vehicle traffic is expected.

LIGHTING

Illumination levels within the plant facility shall meet the requirements of all relevant codes and standards. The minimum illumination levels will be:

Electrical Room	300 lux
Control Room	500 lux
Offices	600 lux
Loading	30 lux
Yard	10 lux

Lighting for process area and exterior will be via 347V, high efficiency HID type industrial fixtures.

Battery powered emergency lights and exit signs allowances are included to illuminate stairways and other interior egress routes within major buildings.

FIRE ALARM SYSTEM

Provision for a digital fire alarm system has been included for the main process plant facilities.

This system will include a central, password protected operator interface terminal, graphic display of all operating zones, trouble and alarm logging historian and control panel. The system will have the ability to incorporate a single alarm and trouble dry contact type signals from other stand alone and pre-manufactured buildings into a centralized facility. Each separate facility will be tracked as a separate zone only.

5.2.3 *DIESEL FUEL STORAGE AND DISTRIBUTION*

Diesel fuel requirements for the mining equipment and process and ancillary facilities will be supplied from above ground diesel fuel storage tanks located near the truck shop. The diesel fuel storage tank will have a capacity sufficient for approximately three days of operation. Diesel storage will consist of above ground tanks and containment pad; and will be complete with loading and dispensing equipment conforming to regulations. A fuel dedicated service truck will transport diesel to the mining equipment.

5.2.4 *SEWAGE COLLECTION AND TREATMENT*

The sewage disposal system will comprise of a buried gravity collection system from the process and ancillary facilities to the sewage treatment plant located to the west of the maintenance building. The plant site layout allows for gravity sewage collection throughout.

The sewage treatment plant will be a pre-packaged Rotating Biological Contactor (RBC). The plant will be manufactured off site and containerized for simple connection to the collection system on site. Once treated, the sewage treatment plant effluent will be discharged into the environment in accordance with the requirements of the Environmental Impact Assessment.

5.2.5 PROPANE DISTRIBUTION

The process plant and ancillary buildings will be heated mainly with propane furnaces and unit heaters.

Propane will be transported to site from Smithers in tanker trucks and stored in propane tanks located beside the northwest corner of the process plant. Tanks will be sized to hold a 7 day supply of propane required during winter months.

5.2.6 BUILDINGS

ADMINISTRATION COMPLEX (DRAWING NO. J1-11-001)

The Administration and Complex is a two level building will be provided in fully complete modular type buildings and comprises of the following:

- Assay laboratory
- Sample preparation area
- Wet laboratory
- Mechanical room
- Men's/Woman's dry facilities
- Work stations to accommodate 34 personnel
- Offices and training room

The Administration Complex is located to the West of the process plant.

TRUCK SHOP AND WAREHOUSE (DRAWING NO. J2-11-001)

The Truck Shop and Warehouse will be comprised of the following facilities:

- Two Heavy Duty Repair Bays
- One Weld Bay
- One Light Vehicle Repair Bay
- Maintenance Workshops
- Emergency Response Facility
- Warehouse
- Offices

- Lube Storage

The following Section outlines the design basis and describes the function and key features of the Maintenance Complex Facilities.

Design Basis and Facilities Description

The principal function of the Maintenance Complex is to provide servicing facilities for mine equipment and heated warehousing. The complex will be 100m long by 22m wide.

The main floor comprises equipment services bays, maintenance shops, warehousing, Emergency Response Vehicle garage, Lube storage and offices.

The Facility will be constructed of structural steel with metal cladding wall and roof systems. Foundations will consist of conventional concrete perimeter walls, and strip/spread footings bearing on bedrock. Grade level floor construction will be a reinforced concrete slab, including concrete approach aprons at all service bay locations.

The following describes functions and key features of the Maintenance Complex Facilities:

Heavy Duty Repair Bays

Two heavy duty repair bays for large haul trucks will be sized to provide ample access space around the vehicle. A lubrication rack will be provided at the interior end of the bay. These repair bays will be designed to accommodate 227t trucks with the truck body in the full dumping position and each bay is provided with 75/15t cranes.

One bay for repair and maintenance of light vehicles. This bay can also serve as an assembly shop for new hydraulic shovels of large sizes.

Repair bays will be sized and equipped with all facilities such that major overhauls and component replacements can be carried out conveniently. Access will be provided on one side of the building only.

Heavy Duty Welding Bay

One bay properly equipped for welding and rebuilding large components of heavy equipment will be provided. The welding bay floor will be provided with rail protection so that work can be carried out on excavator parts, truck bodies, track frames of Dozers and large buckets of excavator and wheel loaders.

The welding shop work area is provided and equipped with welding machines and welding fume ventilation. The shop will be equipped with AC/DC arc welding equipment (Electrical and Diesel engine driven), Miller MIG welding machines and Submerged Arc welding equipment for tract and large bucket rebuilding.

A similar set up will be provided in the smaller welding shop but with smaller capacity welding sets which will include AC/DC arc welding, MIG and TIG welding equipment and Gas welding equipment.

Light Vehicle Repair Bay

One 11m wide repair bay will be provided for servicing light vehicles and is equipped with a 30/5t crane. This bay will also be used for vehicle tune-ups and tire changes. All required small tools and equipment will be provided.

Emergency Response Facility

The Emergency Response Facility will be located on the Main Floor. This Facility will incorporate garages for fire truck, and ambulances.

Warehouse

The Warehouse area will be sized to accommodate process materials and the maintenance shop supplies. The mine maintenance central store facility will occupy the main floor level so that forklifts can supply parts to the shop area, along the service corridor. The main level will also have a tool crib and an area to store large shop tools.

Cold Storage Warehouse

For items that need to be stored under cover, but not heated, an exterior unheated storage facility will be provided.

Pallet racking bins and carousels will be provided in the warehouse.

Truck Wash / Tire Change (Drawing No. J6-11-001)

The facility will be constructed of pre-engineered steel frames with metal cladding wall and roof systems. The foundation will be constructed of conventional concrete perimeter walls with spread footings bearing on suitable ground. Grade level construction will be a reinforced concrete slab with sumps and trenches to facilitate truck washing operation.

The Truck Wash/Tire Change building consists of the following:

Tire Bay

A tire change area.

Lubrication Bay

One lubrication area equipped with automatic lube racks for dispensing all types of lubricants and coolants with facilities for waste oil and waste coolant recovery systems will be provided. Storage tanks will be provided in the building to accommodate a minimum reserve of 12 months. The lubricant storage requirements will be based on the fleet size of mining equipment and support vehicles.

Lubrication racks with hose reels will be provided at three other locations in the shop so that dispensing can be carried out during component change-out, repairs or preventative maintenance.

Specialty lubricants including special greases will be stored in containers or cartridges, in the warehouse. Secondary containment for spill control will be provided.

Wash Bay

The Wash Bay is sized to accommodate Haul trucks, with the truck body in the full dumping position. A catwalk and monitors (water cannons) are provided at truck mid-height for access to wash the truck box. Equipment is provided for a biodegradable soap application, an ultra high pressure hydroblast and a high pressure rinse.

Water is collected in a large sump in the floor where heavy solids settle out. This acts as a water source for the re-circulated wash system.

A side stream oil separation system is provided to remove suspended oil. This oil will be disposed of by sending it to the waste oil tank. In addition, a plate separator will be used to remove fine solids and residual oil. This sludge from the operation will be collected and disposed of on site in an appropriate manner.

READY LINE

A Ready Line will be constructed, remote from the Maintenance Complex. It will provide outdoor parking for 7 vehicles. Each stall will be sized to accommodate the haul truck.

The stalls will be sloped towards a berm, so that in the case of brake failure, the vehicles will roll into the berm rather than across the site.

5.2.7 EXPLOSIVES

GENERAL CONCEPT

The general concept is based on the Site Mixed Emulsion (SME) solution.

The components are brought to site as:

1. Ammonium Nitrate (AN) in bulk (Big Bags)
2. Fuel-false (Special for the emulsion)
3. Emulsifier in drums
4. Primers (Explosives)
5. Detonators (Explosives)

The components are mixed on site in a purpose built explosive mixing facility and transported to the mine site in purpose build mixing trucks.

It should be noted that the capital cost includes the buildings – civil, structural steel, and electrics only. The concept is that the mixing plant, storage containers, trucks, spares etc. (and consumables 1-5) are covered by an agreement with a subcontractor supplying the hardware, know-how, manpower etc. This aspect is covered under operating costs.

All explosives to be delivered mixed and handled accordingly.

STORAGE AREAS

The explosives storage areas are located to the north/west of the open pit as indicated on drawing A0-10-002.

The requirement for storage is mainly for the ammonium nitrate. The AN is brought to the port site in 20ft containers and left at a storage area at the port. Two-week buffer storage is place closer to the mixing facility.

Primers and detonators are placed in special explosive storage containers close to the mixing facility. For safety reasons the explosive storage area is divided into two.

The fuel-base and emulsifier is placed in heated storage at the mixing facility.

The production facility building based on a building concept of steel frames per 4.2m, each with a span of 16m. The building is insulated with 150mm mineral wool and covered with trapezoid metal sheets.

The power supply allows for 100kW electrical heating and 200kW for lighting and small power, 400/230V through 3,000m medium voltage supply cable, run in T-179 conduit on ground.

- Two transformer huts with switchgear. The huts will be furnished with 6.9/0.4kV transformers of 315kVA
- Lighting and power installation for classified areas Zone 2 according to local specifications
- Electrical radiators and installation

The mixing equipment consists of:

- Two tanks for production of the mixture
- Two storage tanks for the mixture
- Two tanks for oil preparation
- Heating equipment

The sewage system will be a dry-closet type and fresh water will be supplied in small containers.

5.2.8 COMMUNICATIONS

The project telecommunications design will incorporate proven, reliable and state-of-the-art systems to ensure that personnel at the mine site will have adequate data, voice and other communications channels available. The Telecommunications System will be supplied as a design-build package.

The base system will be installed during the construction period then expanded to encompass the operating plant.

The major features of the communication system will include:

- A satellite communications for voice and data
- Ethernet cabling for site infrastructure
- Provision for 2 Way Radio communications at site

A variety of communications media (copper and wireless during the construction phase and fibre optic during the operating phase) will be incorporated in the overall design.

The requirements for communications, particularly satellite bandwidth, are a function of the voice and data requirements of the active participants in the Project. The expectation is that the need for satellite bandwidth will build to a peak during the plant construction phase, and then taper off slightly as the initial construction crew yields to plant operations.

6.0 DESIGN CRITERIA AND SITE CONDITIONS

6.1 INTRODUCTION

The purpose of this section is to provide the basis for the design of the Process, and Plant on-site facilities for the Morrison Copper/Gold Project. The design criteria / design basis presented in this section addresses the following facilities:

- Primary Crushing Plant
- Crushed Ore Stockpile and Reclaim
- Secondary and Tertiary Crushing
- Process Plant
- Power Plant
- Electrical Power Distribution
- Sewage Treatment Plant
- Explosives Facilities
- Civil Earthworks

6.2 LIST OF DESIGN BASIS MEMORANDUM

The design criteria for the above referenced facilities are included in Table 6.1 below. For details of the design criteria refer to Appendix D.

Table 6.1 - List of Design Criteria

List Design Criteria		
Document No.	**Rev. No.**	**Document Titles**
0652720100-TS-G0001-00	00	Project Conditions & Standards
0652720100-DBM-P0001-00	L	Process Design Criteria
0652720100-DBM-R0005-01	01	Mechanical Design Criteria
0652720100-DBM-R0011-01	00	Piping Design Criteria
0652720100-DBM-R0002-01	01	Dust Control Design Criteria
0652720100-DBM-R0003-01	01	Fire Protection Design Criteria
0652720100-DBM-R0004-01	01	HVAC Design Criteria
0652720100-DBM-R0001-03	03	Civil Design Criteria
0652720100-DBM-R0006-02	02	Instrumentation Design Criteria
0652720100-DBM-R0007-03	03	Electrical Design Criteria

7.0 CONCLUSIONS

This feasibility study has expanded the preliminary Assessment conducted by Beacon Hill Consultants in August 2004.

SGS Canada's extensive batch comminution tests have established the data characterizing the hardness/grindability of the Morrison material together with their flotation work. In order to confirm the flowsheet and metallurgy in a plant environment and to provide design-quality in support of feasibility study a comprehensive testing program was conducted on 1.7t representative sample. The results showed it is possible to obtain higher Cu recovery by going to a primary grinding of 80% passing 150µm.

The SGS test results showed that one stage of regrinding needed to achieve chalcopyrite liberation and separation of impurities contained in rougher flotation concentrates. The final particle size was recommended by SGS to be 80% less than 25µm. The potential application of alternative regrinding technologies (such as an ISA mill and Stirred Media Detritor) in regrinding stages will be studied in further stages.

The preliminary flotation work showed it is possible to obtain desirable Cu concentrate followed by molybdenite separation in order to produce saleable Mo concentrate. For molybdenum recovery circuit detail design further tests will be conducted during first years of plant operation. Based on SGS test results, there are no elements in the detailed smelter package that might be considered detrimental to marketability of copper concentrate.

A trade-off study to evaluate the application of High Pressure Grinding Rolls (HPGR) as an alternative technology to the conventional SAG milling technology indicated significant benefits in reduced power and consumables for the Morrison project. In addition, the HPGR can provide increased revenue due to the increased availability and plant capacity compared to SAG. In this regard a 1.7t representative sample was shipped to Polysius facilities in Germany for HPGR comminution tests. The HPGR test results were used for this feasibility comminution circuit design.

In order to reduce the manpower and operating cost and make the plant reliable, an advanced control system for the processing plant operation was applied in feasibility design.

8.0 RECOMMENDATIONS

The following recommendations are made based on the findings of this feasibility study:

- The potential benefit of the application of flash flotation in the primary grinding/cycloning circuit should be investigated in further studies to determine the possibility of recovering coarse copper and molybdenum bearing minerals prior to the rougher flotation feed, and the impact of these findings in the overall copper and molybdenum recovery.
- In reference to the mineralogical characterization results from the rougher/scavenger tailings study, a plant trial test of a contact cell installation on the tailings line is recommended during plant operation. This test would be focused on recovering a small percentage of tailings product containing middlings and insufficient flotable sulphides using either a flash flotation or a continuous centrifugal gravity concentrator. The product can be recycled for further grinding to improve mineral liberation prior to re-floting. This can have a positive impact on the overall plant recovery.
- The potential application of using of ISA mill or SMD mill in regrinding stages with an objective to reduce both capital and operating costs and improving Cu grade and recovery should be considered in further studies.
- Perform a detailed HAZOPs review during the early phase of detailed engineering.

9.0 REFERENCES

- Omineca Mining Division; “Geological and Manual Resource Estimation Report on Morison Copper/Gold Porphyry Deposit at Morrison Lake”, February 2003
- Knight Piésold Consulting; “Geotechnical Site investigation report for Morrison Project (REF. NO. VA101-102/7-1)”, July 2006
- Beacon Hill Consultants Ltd.; “Morrison Hearn Hill Project Preliminary Assessment”, August 2004
- Geosim Services Inc.; “Mineral Resource Update Morrison Project, Omineca Mining Division”, May 2007
- SNC-Lavalin Engineering; “Technical Report on the Morrison Porphyry Copper/Gold Project”, June 2002
- International Metallurgical and Environmental Inc.; “Laboratory Flotation Tests of Drill Core Samples from the Morrison Lake Property”, June 2002
- Process Research Associates Ltd.; “Flotation Optimization and Variability Testing on Composites from the Morrison Project”, October 2005
- SGS Minerals Services Ltd.; “The Flotation Response of HPGR-prepared versus Conventionally Crushed Flotation Feed from Morrison Deposit”, January 2008
- SGS Minerals Services Ltd.; “Ore Grindability Characterization and Feasibility Grinding Circuit Design for the Morrison Project.”, August 2007
- SGS Minerals Services Ltd.; “The Grindability Characterization of Samples from the Morrison Deposit Prepared for Pacific Booker Minerals Inc.”, May 2007
- SGS Minerals Services Ltd.; “The Recovery of Copper, Gold and Molybdenum from Ore from the Morrison Copper Project”, October 2007
- SGS Minerals Services; “Morrison Project Flotation Testwork Report as a Part of the Feasibility Study prepared for Pacific Booker Minerals Inc.”, December 2007
- SGS Minerals Services; “Metallurgical Variability in the Morrison Deposit Prepared for Pacific Booker Minerals Inc.”, November 2007
- SGS Minerals Services; “Tailings Characterization for Morrison Project Prepared for Pacific Booker Minerals Inc.”, November 2007
- Polysius; “High Pressure Grinding Tests on Copper/Gold/Molybdenum Ore from the Morrison Project for Pacific Booker Minerals inc. at the Polysius Research Center”, December 2007
- Neil S. Seldon & Associates Ltd.; “Comments on Long Term Smelter Charges Prepared for Pacific Booker Minerals Inc.”, April 2007

- Nilsson Mine Services Ltd.; "Morrison Pit Optimization and Production Schedule", October 2007
- Chrisita Enterprises Ltd.; "Morrison Project Haul Route Study", August 2008
- Allnorth Consultants Ltd.; "Morrison Project Haul Route Study Options Analysis", April 2008
- Klohn Crippen Berger Ltd.; "Morrison Copper/Gold Project – Plantsite Foundation Report", December 7, 2008
- Klohn Crippen Berger Ltd.; "Morrison Copper/Gold Project – Geotechnical Feasibility Report", December 7, 2008
- Klohn Crippen Berger Ltd.; "Morrison Copper/Gold Project – Tailings, Reclaim and Associated Pumping Systems – Feasibility Design Report", December 7, 2008
- Kaehne Consulting Ltd.; "Morrison Copper/Gold Project – Electrical Power Supply – Report and Cost Estimate", December 2008
- Wardrop; "Morrison Copper/Gold Project – Volume 2 – Project Execution Plan", February 2009
- Wardrop; "Morrison Copper/Gold Project – Volume 3 – Capital Cost Estimate", February 2009
- Wardrop; "Morrison Copper/Gold Project – Volume 4 – Operating Cost Estimate", February 2009
- Wardrop; "Morrison Copper/Gold Project – Volume 5 – Financial Analysis", February 2009
- Pacific Booker Minerals Inc.; "Morrison Copper/Gold Project – Project Description", September 2008

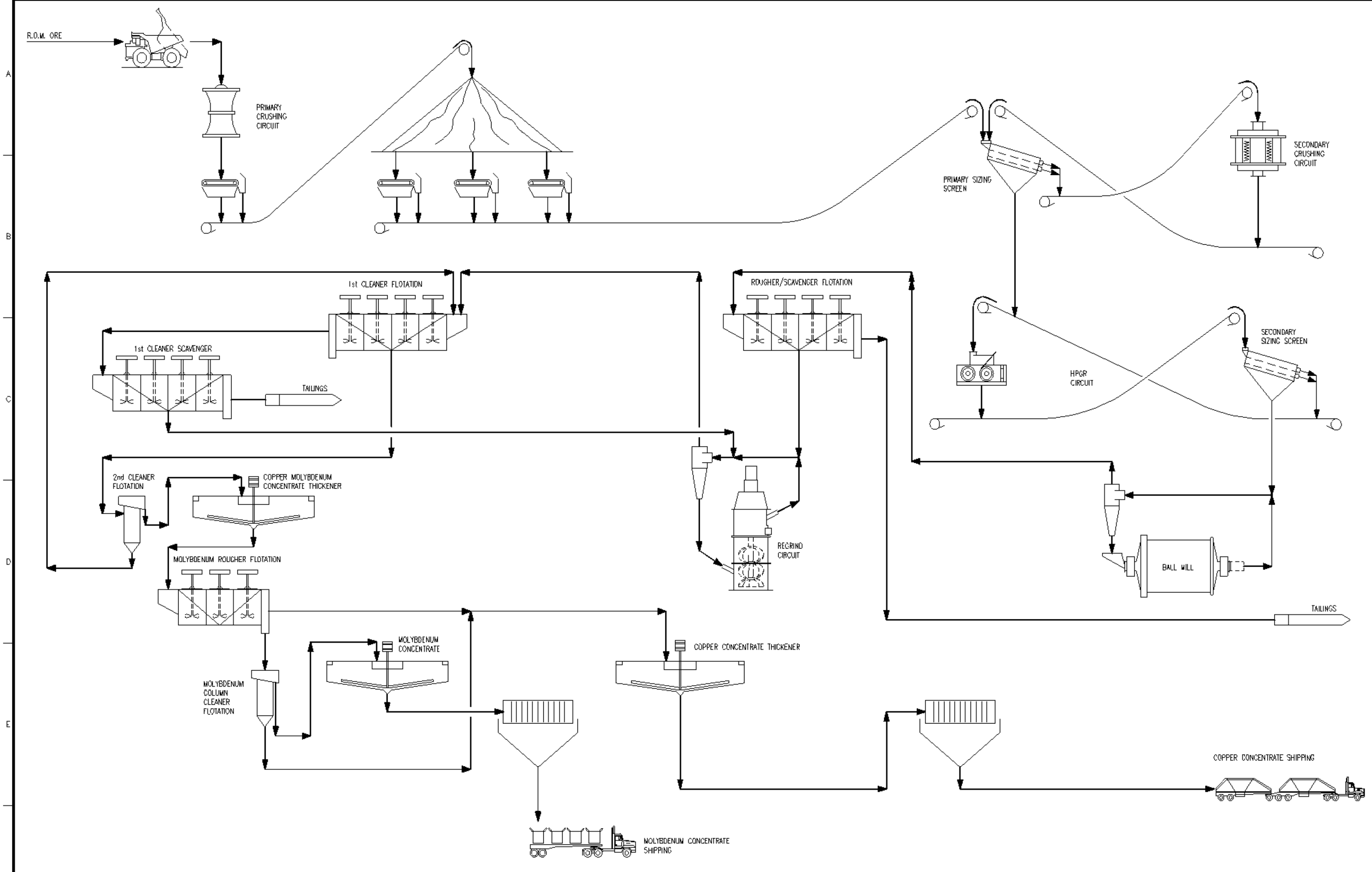
APPENDIX A

DRAWINGS

DRAWINGS

WARDROP DRAWINGS LIST – SORTED BY DISCIPLINE		
DRAWING NO.	**REV. NO.**	**DESCRIPTION**
Disciplines: 09 – Process Flow Diagram		
A0-09-001	G	Simplified Flow Diagram
A0-09-002	E	Primary Crusher, Stockpile & Reclaim, Process Flow Diagram No. 1
A0-09-003	E	Secondary & Tertiary Crushing, Process Flow Diagram No. 2
A0-09-004	F	Grinding Area, Process Flow Diagram No. 3
A0-09-005	E	Rougher/Scavenger Flotation and 1st Regrind, Process Flow Diagram No. 4
A0-09-006	E	Cleaner / Scavenger Flotation, Process Flow Diagram No. 5
A0-09-007	E	Cleaner Flotation Molybdenum, Process Flow Diagram No. 6
A0-09-008	E	Concentrate Thickening and Dewatering, Process Flow Diagram No. 7
A0-09-009	F	Tailings Handling and Water Distribution, Process Flow Diagram No. 8
A0-09-010	E	Reagents, Process Flow Diagram No. 9
A0-09-011	E	Reagents, Process Flow Diagram No. 10
A0-09-012	E	Air Services, Process Flow Diagram No. 11
A0-09-013	H	Water Balance, Process Flow Diagram No. 12
Discipline: 10 – Layouts And General Arrangement		
A0-10-001	D	Site Location General Arrangement Plan
A0-10-002	J	Overall Site General Arrangement Plan
A0-10-003	J	Plant Site General Arrangement Plan
C0-10-001	E	Primary Crushing, General Arrangement, Plan Sheet 1 of 2
C0-10-002	D	Primary Crushing, General Arrangement, Plan Sheet 2 of 2
C0-10-003	E	Primary Crushing, General Arrangement, Sections A & B
D0-10-001	D	Coarse Ore Stockpile & Reclaim, General Arrangement, Plan & Sections
E0-10-001	F	Mill Building, General Arrangement, Overall Plan
E0-10-002	F	HPGR Building, General Arrangement, Operating Floor Plan
E0-10-003	D	Mill Building, General Arrangement, Sections
E0-10-004	D	HPGR Building, General Arrangement, Sections
E0-10-005	D	Mill Building, General Arrangement, Sections
E0-10-006	E	Mill Building, General Arrangement, Sections
Discipline: 11 – Architectural		
J1-11-001	E	Administration & Mine Dry Building, General Arrangement, Plans
J1-11-002	E	Administration & Mine Dry Building, General Arrangement, Elevations Sheet 1 of 2
J1-11-003	E	Administration & Mine Dry Building, General Arrangement, Elevations Sheet 2 of 2
J2-11-001	E	Truckshop and Warehouse General Arrangement Elevations Plan
J2-11-002	E	Truckshop and Warehouse General Arrangement Sections
J2-11-003	E	Truckshop and Warehouse General Arrangement Elevations
J6-11-001	D	Truck Wash, Plan and Sections
J6-11-002	D	Truck Wash, Elevations

WARDROP DRAWINGS LIST – SORTED BY DISCIPLINE		
DRAWING NO.	REV. NO.	DESCRIPTION
Discipline: 13 – Piping		
A0-13-001	D	Legends and Symbols, Piping & Instrumentation, Diagram No. 1
A0-13-002	D	Instrumentation Details, Piping & Instrumentation, Diagram No. 2
A0-13-003	D	Primary Crushing, Piping & Instrumentation, Diagram No. 3
A0-13-004	E	Coarse Ore Stockpile & Reclaim, Piping & Instrumentation, Diagram No. 4
A0-13-005	D	Grinding – HPGR, Piping & Instrumentation, Diagram No. 5
A0-13-006	E	Grinding – Ball Mill No. 1, Piping & Instrumentation, Diagram No. 6
A0-13-007	D	Grinding – Ball Mill No. 2, Piping & Instrumentation, Diagram No. 7
A0-13-008	D	Flotation – Rougher/Scavenger, Piping & Instrumentation, Diagram No. 8
A0-13-009	D	Flotation – 1st Regrind, Piping & Instrumentation, Diagram No. 9
A0-13-010	D	Flotation – 1st Cleaner, Piping & Instrumentation, Diagram No. 10
A0-13-011	D	Flotation – 1st Cleaner Scavenger, Piping & Instrumentation, Diagram No. 11
A0-13-012	D	Flotation – 2nd Cleaner, Piping & Instrumentation, Diagram No. 12
A0-13-013	D	Cu/Mo Concentrate Thickening, Piping & Instrumentation, Diagram No. 13
A0-13-014	D	Mo Flotation/Thickening, Piping & Instrumentation, Diagram No. 14
A0-13-015	D	Mo Flotation, Piping & Instrumentation, Diagram No. 15
A0-13-016	D	Cu Thickening/Filtration, Piping & Instrumentation, Diagram No. 16
A0-13-018	D	Reagents Sheet 1 of 3, Piping & Instrumentation, Diagram No. 18
A0-13-019	D	Reagents Sheet 2 of 3, Piping & Instrumentation, Diagram No. 19
A0-13-020	E	Reagents Sheet 3 of 3, Piping & Instrumentation, Diagram No. 20
A0-13-021	D	Air Distribution, Piping & Instrumentation, Diagram No. 21
A0-13-022	E	Process Water Distribution, Piping & Instrumentation, Diagram No. 22
A0-13-023	E	Fresh/Fire Water Distribution, Piping & Instrumentation, Diagram No. 23
A0-13-024	E	Potable Water Distribution, Piping & Instrumentation, Diagram No. 24
Discipline: 17 – Instrumentation and Controls		
A3-17-001	E	Process Control System, Block Diagram
Discipline: 18 – Electrical		
A0-18-001	D	Overall Site, Single Line Diagram, Sheet 1 of 3
A0-18-002	D	Overall Site, Single Line Diagram, Sheet 2 of 3
A0-18-003	B	Overall Site, Single Line Diagram, Sheet 3 of 3



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F	1	ISSUED FOR CLIENT APPROVAL	23DEC08	AR

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PROCESS
SCALE: NONE
DESIGN. BY: HG — FEB07
DRAWN BY: FH — AUG07
CHECK. BY:
APP. BY:

PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
SIMPLIFIED FLOW DIAGRAM

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
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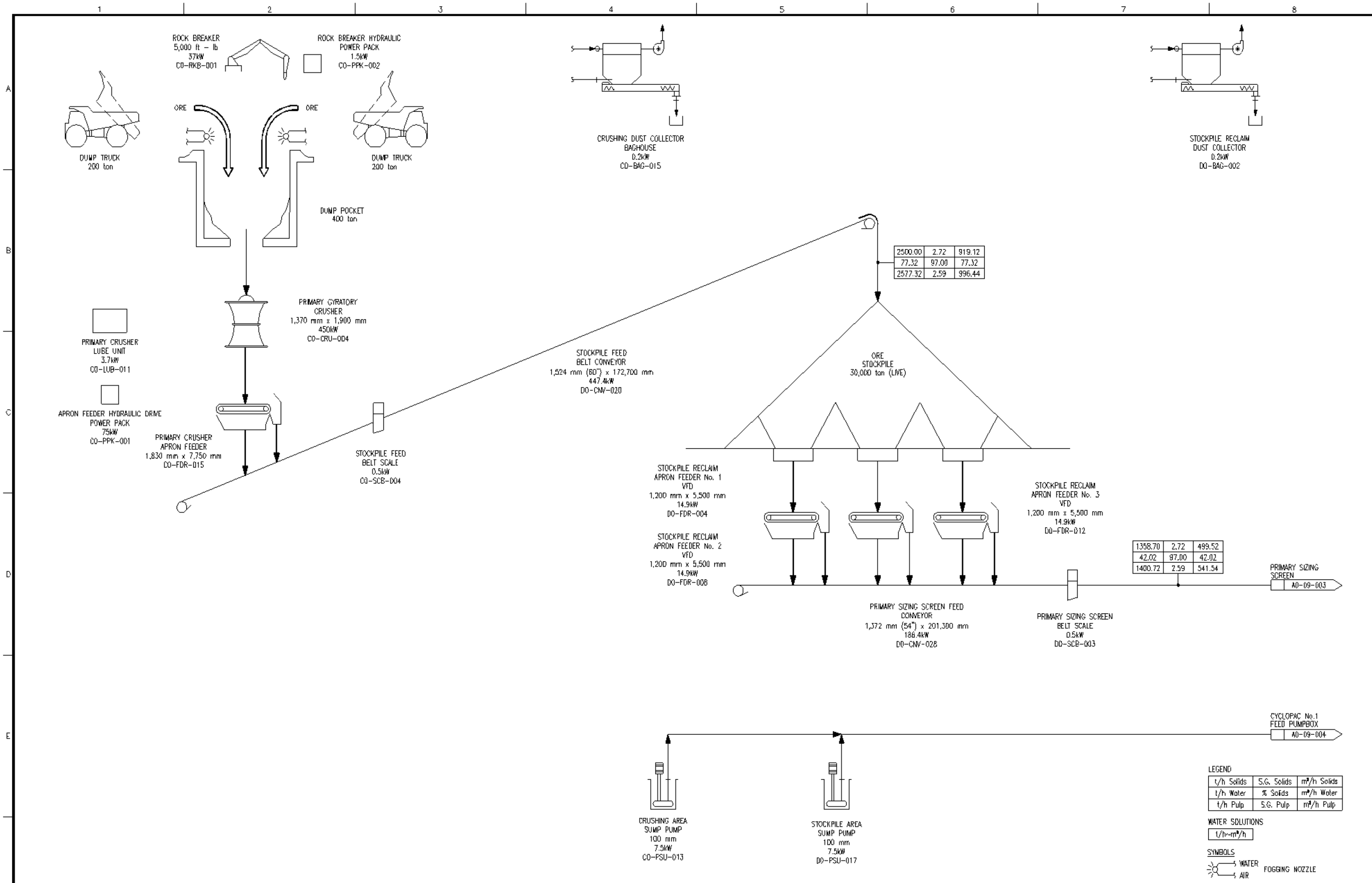

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E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO.	REFERENCE DRAWINGS

SECTION: PROCESS
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CHECK. BY:
APP BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
PRIMARY CRUSHER
STOCKPILE & RECLAIM
PROCESS FLOW DIAGRAM No. 1

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009002.DWG	06527201.00	A0-09-002	E

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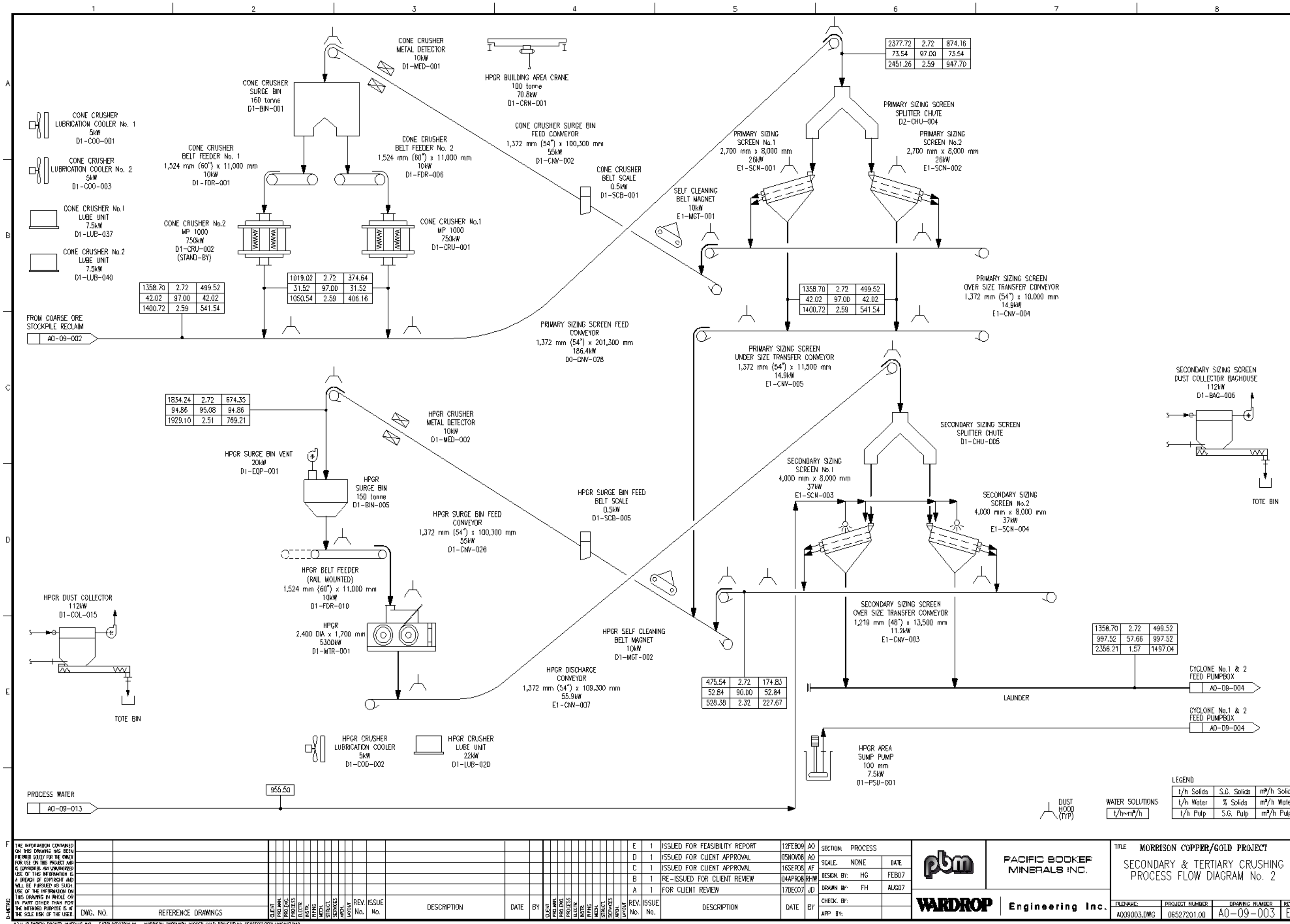

CONE CRUSHER METAL DETECTOR 10kW D1-MED-001
HPGR BUILDING AREA CRANE 100 tonne 70.8kW D1-CRN-001
CONE CRUSHER SURGE BIN 160 tonne D1-BIN-001
CONE CRUSHER LUBRICATION COOLER No. 1 5kW D1-COO-001
CONE CRUSHER LUBRICATION COOLER No. 2 5kW D1-COO-003
CONE CRUSHER No.1 LUBE UNIT 7.5kW D1-LUB-037
CONE CRUSHER No.2 LUBE UNIT 7.5kW D1-LUB-040
CONE CRUSHER BELT FEEDER No. 1 1,524 mm (60") x 11,000 mm 10kW D1-FDR-001
CONE CRUSHER BELT FEEDER No. 2 1,524 mm (60") x 11,000 mm 10kW D1-FDR-006
CONE CRUSHER No.2 MP 1000 750kW D1-CRU-002 (STAND-BY)
CONE CRUSHER No.1 MP 1000 750kW D1-CRU-001
CONE CRUSHER SURGE BIN FEED CONVEYOR 1,372 mm (54") x 100,300 mm 55kW D1-CNV-002
CONE CRUSHER BELT SCALE 0.5kW D1-SCB-001
SELF CLEANING BELT MAGNET 10kW E1-MGT-001
FROM COARSE ORE STOCKPILE RECLAIM A0-09-002
1358.70 2.72 499.52
42.02 97.00 42.02
1400.72 2.59 541.54
1019.02 2.72 374.64
31.52 97.00 31.52
1050.54 2.59 406.16
PRIMARY SIZING SCREEN FEED CONVEYOR 1,372 mm (54") x 201,300 mm 186.4kW D0-CNV-028
2377.72 2.72 874.16
73.54 97.00 73.54
2451.26 2.59 947.70
PRIMARY SIZING SCREEN SPLITTER CHUTE D2-CHU-004
PRIMARY SIZING SCREEN No.1 2,700 mm x 8,000 mm 26kW E1-SCN-001
PRIMARY SIZING SCREEN No.2 2,700 mm x 8,000 mm 26kW E1-SCN-002
1358.70 2.72 499.52
42.02 97.00 42.02
1400.72 2.59 541.54
PRIMARY SIZING SCREEN OVER SIZE TRANSFER CONVEYOR 1,372 mm (54") x 10,000 mm 14.9kW E1-CNV-004
PRIMARY SIZING SCREEN UNDER SIZE TRANSFER CONVEYOR 1,372 mm (54") x 11,500 mm 14.9kW E1-CNV-005
SECONDARY SIZING SCREEN DUST COLLECTOR BAGHOUSE 112kW D1-BAG-006
TOTE BIN
SECONDARY SIZING SCREEN SPLITTER CHUTE D1-CHU-005
SECONDARY SIZING SCREEN No.1 4,000 mm x 8,000 mm 37kW E1-SCN-003
SECONDARY SIZING SCREEN No.2 4,000 mm x 8,000 mm 37kW E1-SCN-004
1834.24 2.72 674.35
94.86 95.08 94.86
1929.10 2.51 769.21
HPGR CRUSHER METAL DETECTOR 10kW D1-MED-002
HPGR SURGE BIN VENT 20kW D1-EQP-001
HPGR SURGE BIN 150 tonne D1-BIN-005
HPGR SURGE BIN FEED CONVEYOR 1,372 mm (54") x 100,300 mm 55kW D1-CNV-026
HPGR SURGE BIN FEED BELT SCALE 0.5kW D1-SCB-005
HPGR BELT FEEDER (RAIL MOUNTED) 1,524 mm (60") x 11,000 mm 10kW D1-FDR-010
HPGR 2,400 DIA x 1,700 mm 5300kW D1-MTR-001
HPGR DUST COLLECTOR 112kW D1-COL-015
TOTE BIN
HPGR SELF CLEANING BELT MAGNET 10kW D1-MGT-002
HPGR DISCHARGE CONVEYOR 1,372 mm (54") x 109,300 mm 55.9kW E1-CNV-007
SECONDARY SIZING SCREEN OVER SIZE TRANSFER CONVEYOR 1,219 mm (48") x 13,500 mm 11.2kW E1-CNV-003
475.54 2.72 174.83
52.84 90.00 52.84
528.38 2.32 227.67
1358.70 2.72 499.52
997.52 57.66 997.52
2356.21 1.57 1497.04
LAUNDER
CYCLONE No.1 & 2 FEED PUMPBOX A0-09-004
CYCLONE No.1 & 2 FEED PUMPBOX A0-09-004
HPGR CRUSHER LUBRICATION COOLER 5kW D1-COO-002
HPGR CRUSHER LUBE UNIT 22kW D1-LUB-020
HPGR AREA SUMP PUMP 100 mm 7.5kW D1-PSU-001
955.50
PROCESS WATER A0-09-013
DUST HOOD (TYP)
WATER SOLUTIONS t/h=m³/h
LEGEND
t/h Solids | S.G. Solids | m³/h Solids
t/h Water | % Solids | m³/h Water
t/h Pulp | S.G. Pulp | m³/h Pulp
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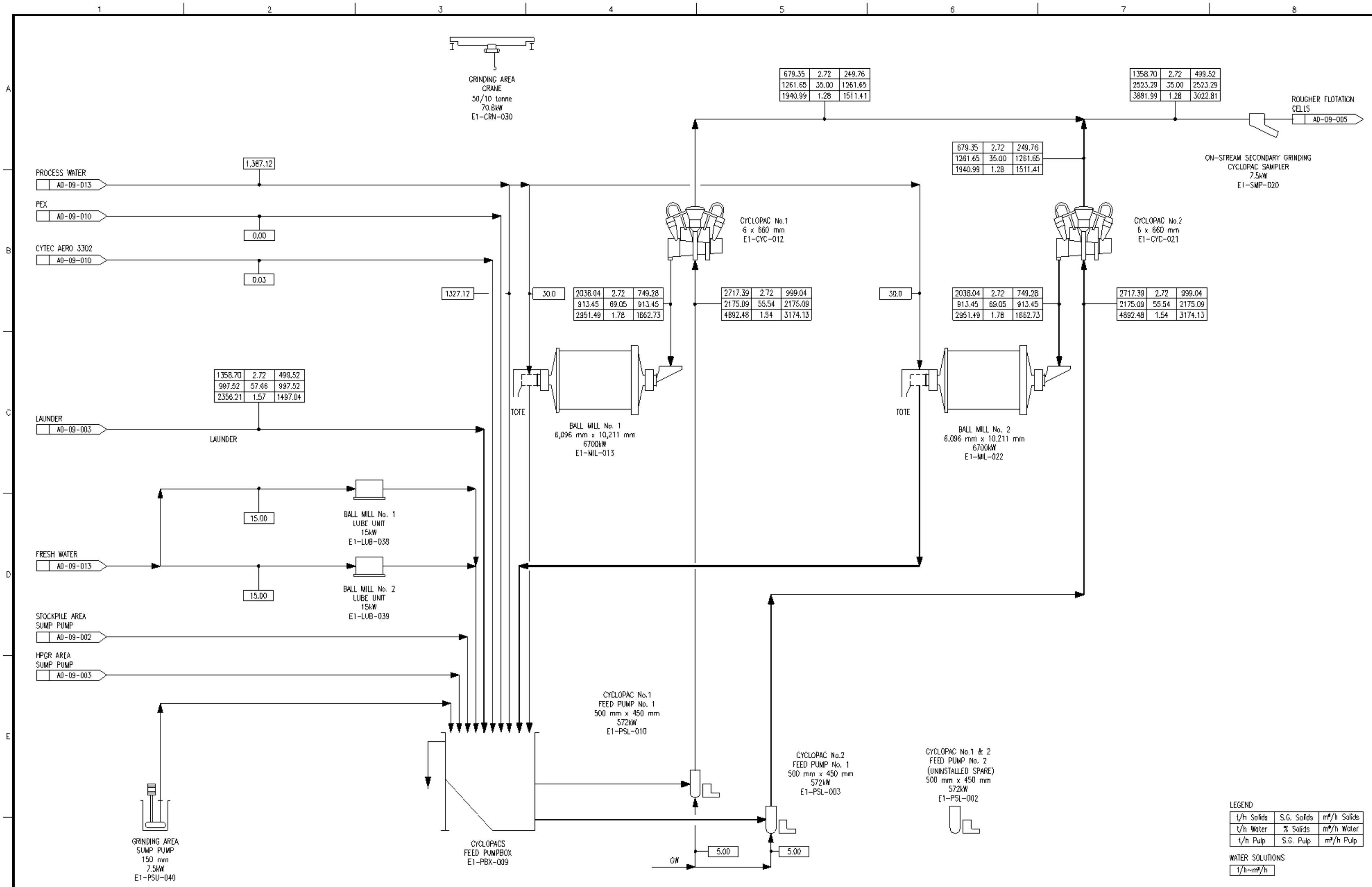
DWG. NO. | REFERENCE DRAWINGS
E 1 ISSUED FOR FEASIBILITY REPORT 12FEB09 AO
D 1 ISSUED FOR CLIENT APPROVAL 05NOV08 AO
C 1 ISSUED FOR CLIENT APPROVAL 16SEP08 AF
B 1 RE-ISSUED FOR CLIENT REVIEW 04APR08 RHW
A 1 FOR CLIENT REVIEW 17DEC07 JD
REV. No. | ISSUE No. | DESCRIPTION | DATE | BY
SECTION: PROCESS
SCALE: NONE | DATE
DESIGN. BY: HG FEB07
DRAWN BY: FH AUG07
CHECK. BY:
APP BY:
PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.
TITLE MORRISON COPPER/GOLD PROJECT
SECONDARY & TERTIARY CRUSHING PROCESS FLOW DIAGRAM No. 2
FILENAME: A009003.DWG
PROJECT NUMBER 06527201.00
DRAWING NUMBER A0-09-003
REV. E



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
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D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
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B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION:	PROCESS	
SCALE:	NONE	
DESIGN. BY:	HG	FEB07
DRAWN BY:	FH	AUG07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

GRINDING AREA
PROCESS FLOW DIAGRAM No. 3

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009004.DWG	06527201.00	A0-09-004	F

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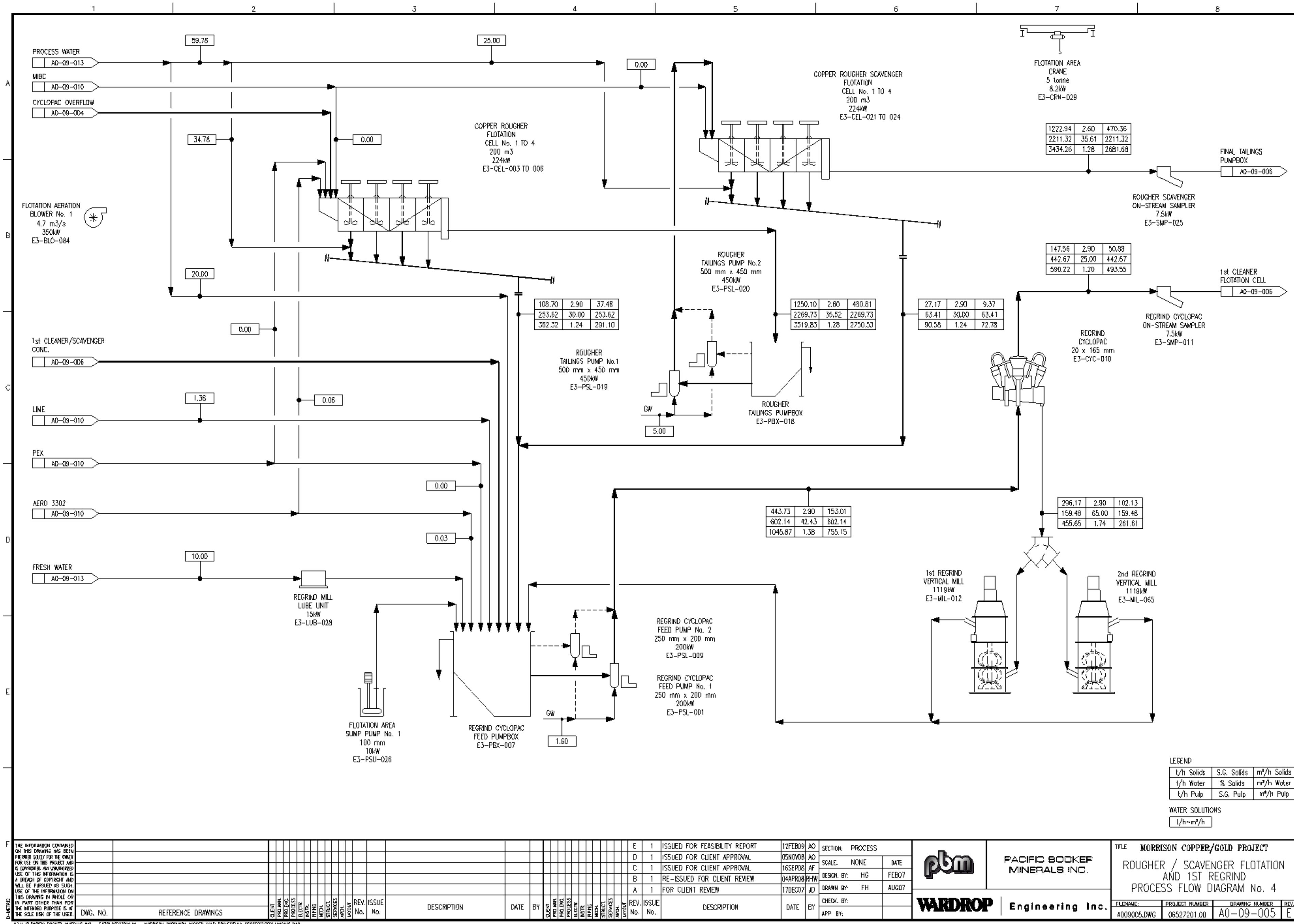
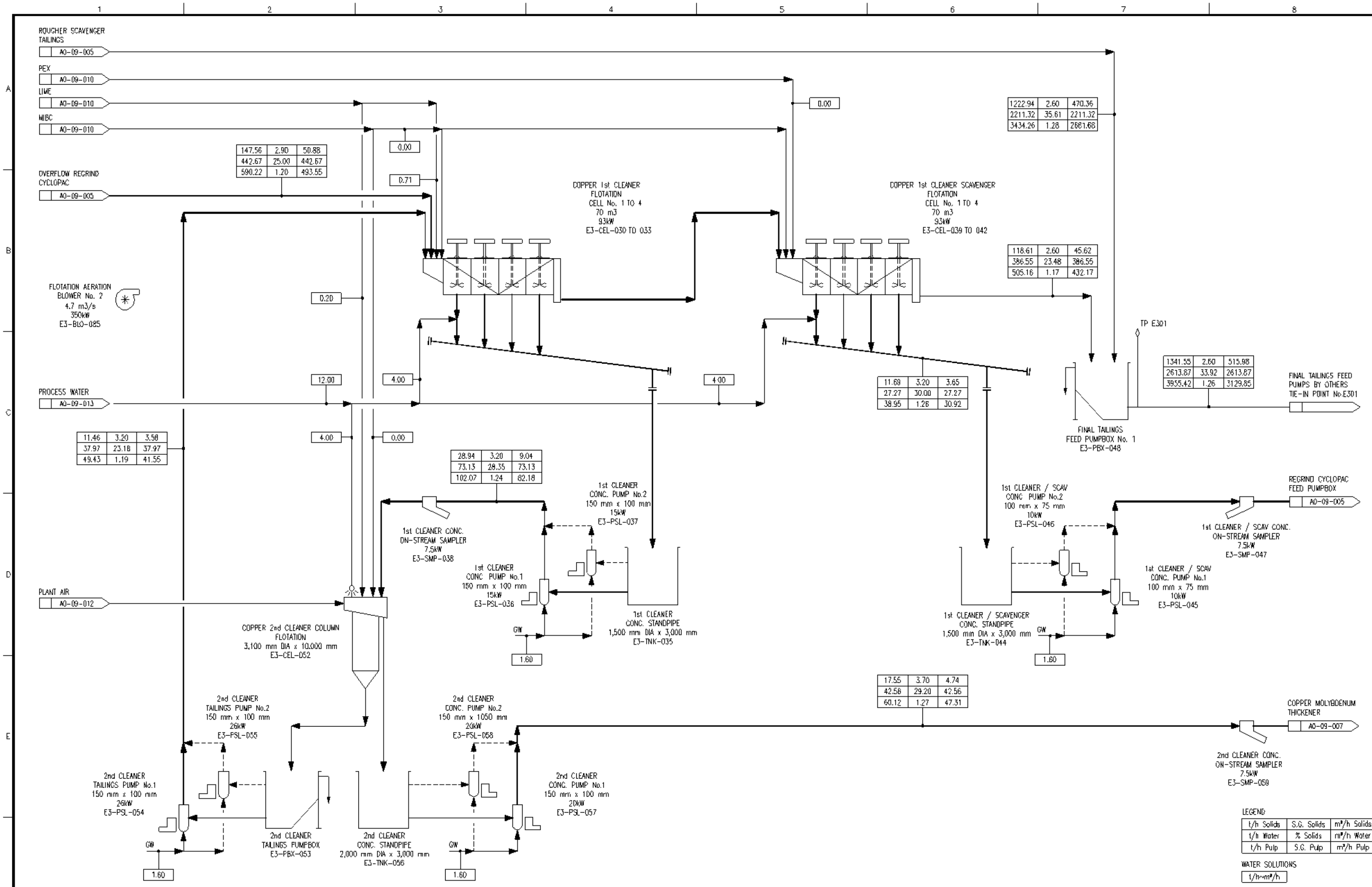


PROCESS WATER
AO-09-013
MIBC
AO-09-010
CYCLOPAC OVERFLOW
AO-09-004
59.78
25.00
34.78
20.00
0.00
0.06
1.36
10.00
0.03
FLOTATION AERATION
BLOWER No. 1
4.7 m3/s
350kW
E3-BLO-084
COPPER ROUGHER
FLOTATION
CELL No. 1 TO 4
200 m3
224kW
E3-CEL-003 TO 006
COPPER ROUGHER SCAVENGER
FLOTATION
CELL No. 1 TO 4
200 m3
224kW
E3-CEL-021 TO 024
FLOTATION AREA
CRANE
5 tonne
8.2kW
E3-CRN-029
1222.94 | 2.60 | 470.36
2211.32 | 35.61 | 2211.32
3434.26 | 1.28 | 2681.68
FINAL TAILINGS
PUMPBOX
AO-09-006
ROUGHER SCAVENGER
ON-STREAM SAMPLER
7.5kW
E3-SMP-025
147.56 | 2.90 | 50.88
442.67 | 25.00 | 442.67
590.22 | 1.20 | 493.55
1st CLEANER
FLOTATION CELL
AO-09-006
REGRIND CYCLOPAC
ON-STREAM SAMPLER
7.5kW
E3-SMP-011
1st CLEANER/SCAVENGER
CONC.
AO-09-006
108.70 | 2.90 | 37.48
253.62 | 30.00 | 253.62
362.32 | 1.24 | 291.10
ROUGHER
TAILINGS PUMP No.1
500 mm x 450 mm
450kW
E3-PSL-019
ROUGHER
TAILINGS PUMP No.2
500 mm x 450 mm
450kW
E3-PSL-020
1250.10 | 2.60 | 480.81
2269.73 | 35.52 | 2269.73
3519.83 | 1.28 | 2750.53
27.17 | 2.90 | 9.37
63.41 | 30.00 | 63.41
90.58 | 1.24 | 72.78
REGRIND
CYCLOPAC
20 x 165 mm
E3-CYC-010
ROUGHER
TAILINGS PUMPBOX
E3-PBX-018
GW
5.00
LIME
AO-09-010
PEX
AO-09-010
AERO 3302
AO-09-010
FRESH WATER
AO-09-013
443.73 | 2.90 | 153.01
602.14 | 42.43 | 602.14
1045.87 | 1.38 | 755.15
296.17 | 2.90 | 102.13
159.48 | 65.00 | 159.48
455.65 | 1.74 | 261.61
REGRIND MILL
LUBE UNIT
15kW
E3-LUB-028
1st REGRIND
VERTICAL MILL
1119kW
E3-MIL-012
2nd REGRIND
VERTICAL MILL
1119kW
E3-MIL-065
REGRIND CYCLOPAC
FEED PUMP No. 2
250 mm x 200 mm
200kW
E3-PSL-009
REGRIND CYCLOPAC
FEED PUMP No. 1
250 mm x 200 mm
200kW
E3-PSL-001
GW
1.60
FLOTATION AREA
SUMP PUMP No. 1
100 mm
10kW
E3-PSU-026
REGRIND CYCLOPAC
FEED PUMPBOX
E3-PBX-007
LEGEND
t/h Solids | S.G. Solids | m³/h Solids
t/h Water | % Solids | m³/h Water
t/h Pulp | S.G. Pulp | m³/h Pulp
WATER SOLUTIONS
l/h-m³/h
E 1 ISSUED FOR FEASIBILITY REPORT 12FEB09 AO
D 1 ISSUED FOR CLIENT APPROVAL 05NOV08 AO
C 1 ISSUED FOR CLIENT APPROVAL 16SEP08 AF
B 1 RE-ISSUED FOR CLIENT REVIEW 04APR08 RHW
A 1 FOR CLIENT REVIEW 17DEC07 JD
REV. No. ISSUE No. DESCRIPTION DATE BY
DWG. NO. REFERENCE DRAWINGS
SECTION: PROCESS
SCALE: NONE
DESIGN BY: HG FEB07
DRAWN BY: FH AUG07
CHECK. BY:
APP BY:
PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.
TITLE MORRISON COPPER/GOLD PROJECT
ROUGHER / SCAVENGER FLOTATION
AND 1ST REGRIND
PROCESS FLOW DIAGRAM No. 4
FILENAME: A009005.DWG
PROJECT NUMBER 06527201.00
DRAWING NUMBER A0-09-005
REV. E



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E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	REISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PROCESS		
SCALE: NONE		DATE
DESIGN. BY:	HG	AUG07
DRAWN BY:	FH	AUG07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

CLEANER / SCAVENGER FLOTATION PROCESS FLOW DIAGRAM No. 5

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009006.DWG	06527201.00	A0-09-006	E

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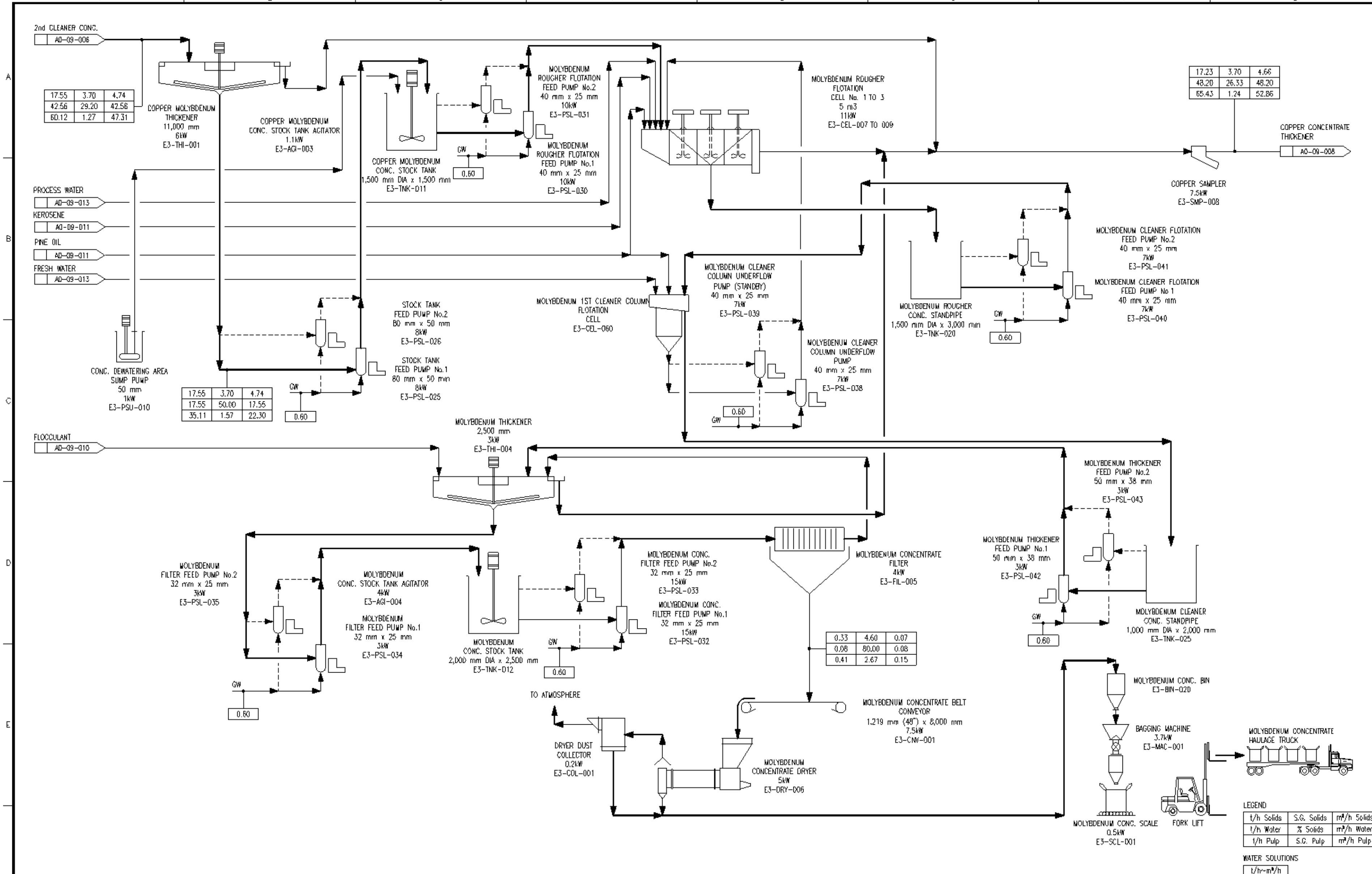

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
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D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO.	REFERENCE DRAWINGS

SECTION: PROCESS
SCALE: NONE
DESIGN. BY: HG — AUG07
DRAWN BY: FH — AUG07
CHECK. BY:
APP. BY:

PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.

TITLE
MORRISON COPPER/GOLD PROJECT
CLEANER FLOTATION
MOLYBDENUM
PROCESS FLOW DIAGRAM No. 6

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009007.DWG	06527201.00	A0-09-007	E

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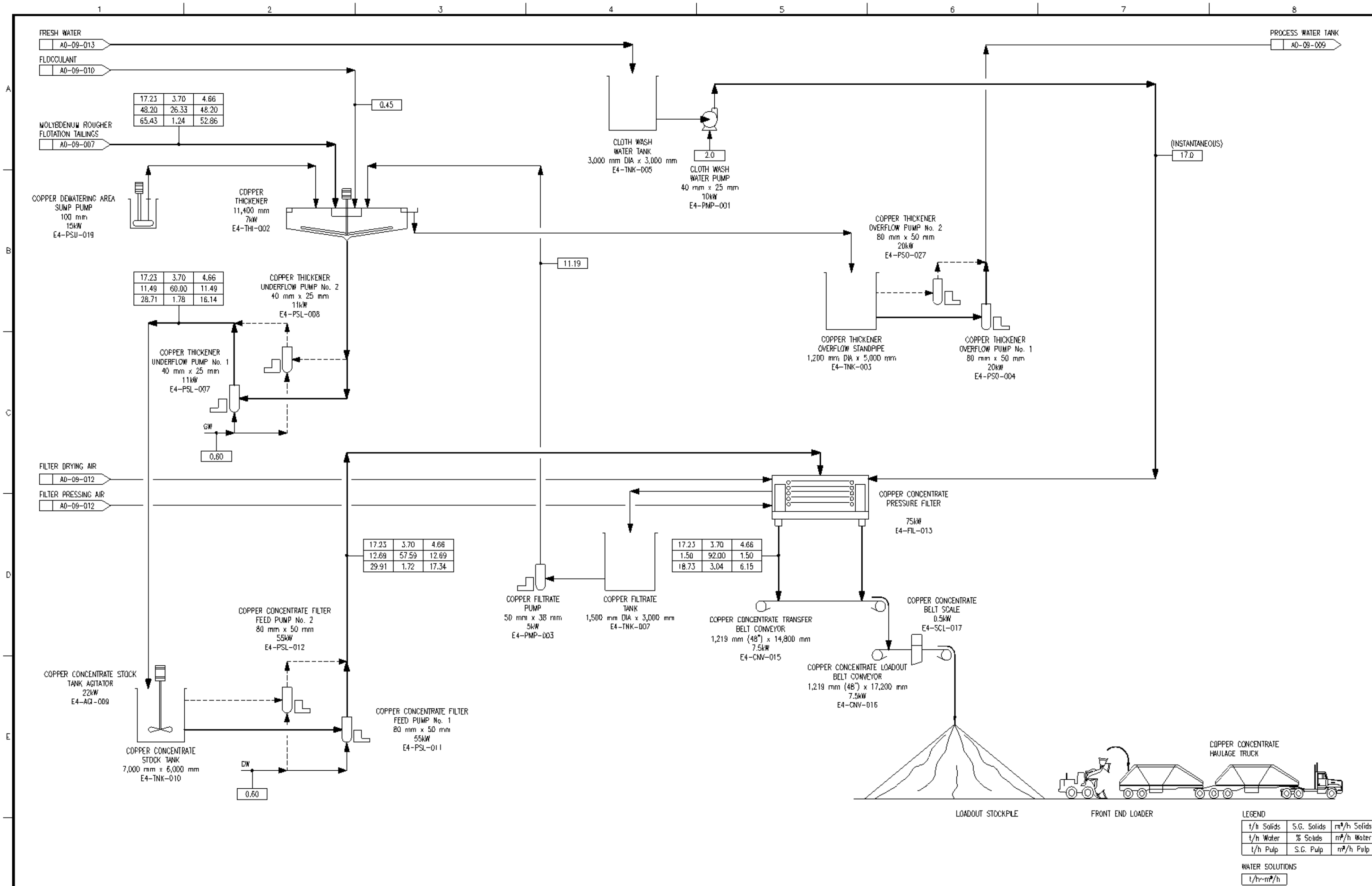

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
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C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

SECTION: PROCESS
SCALE: NONE
DESIGN. BY: HG AUG07
DRAWN BY: FH AUG07
CHECK. BY:
APP BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

CONCENTRATE THICKENING AND DEWATERING PROCESS FLOW DIAGRAM No. 7

FILENAME: A009008.DWG | PROJECT NUMBER 06527201.00 | DRAWING NUMBER A0-09-008 | REV. E

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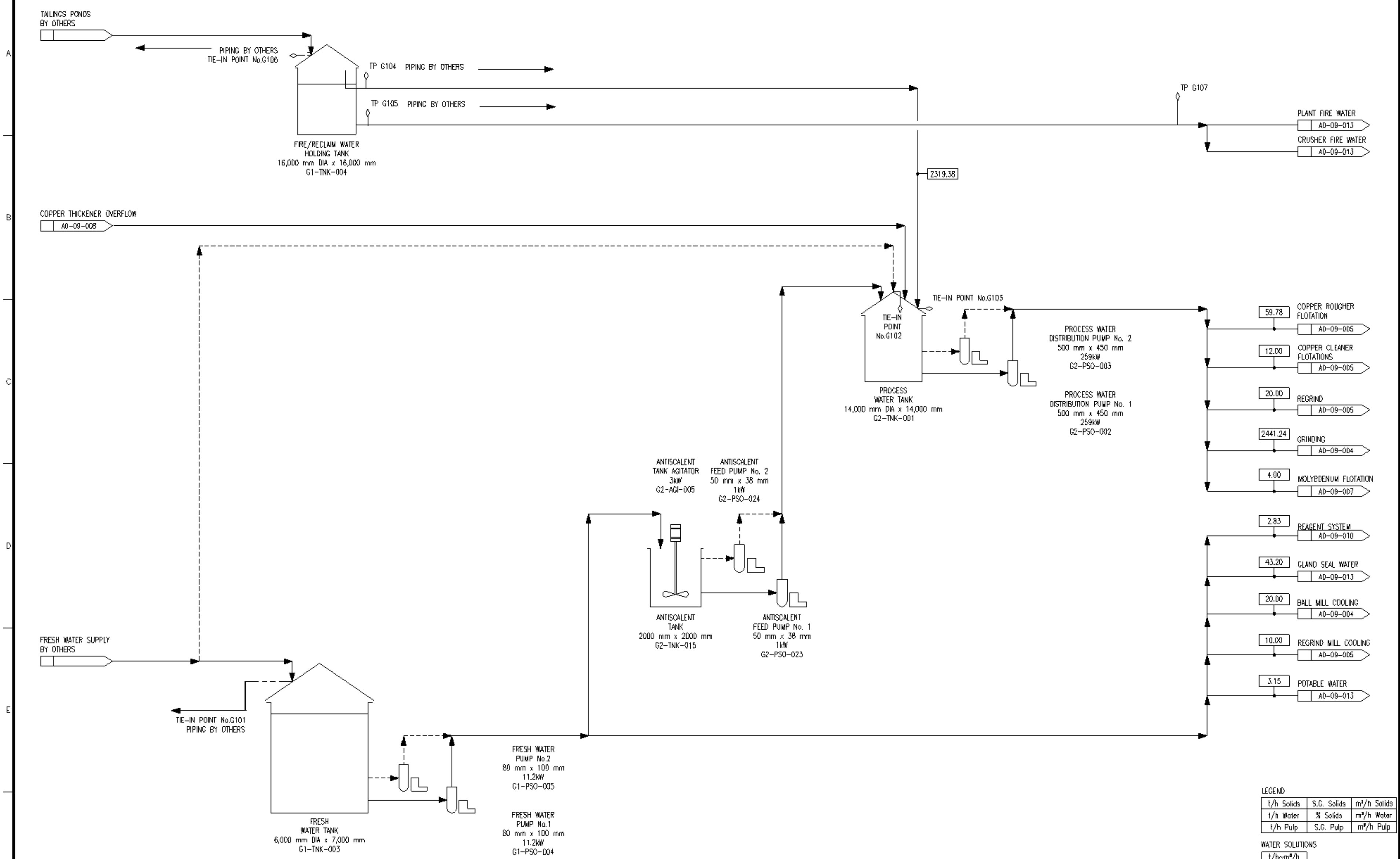

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F	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
E	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PROCESS
SCALE: NONE | DATE
DESIGN. BY: JR/EA | NOV07
DRAWN BY: FH | NOV07
CHECK. BY:
APP. BY:

pbm PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
TAILINGS HANDLING AND WATER DISTRIBUTION PROCESS FLOW DIAGRAM No. 8

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009009.DWG	06527201.00	A0-09-009	F

09/02/12 08:34

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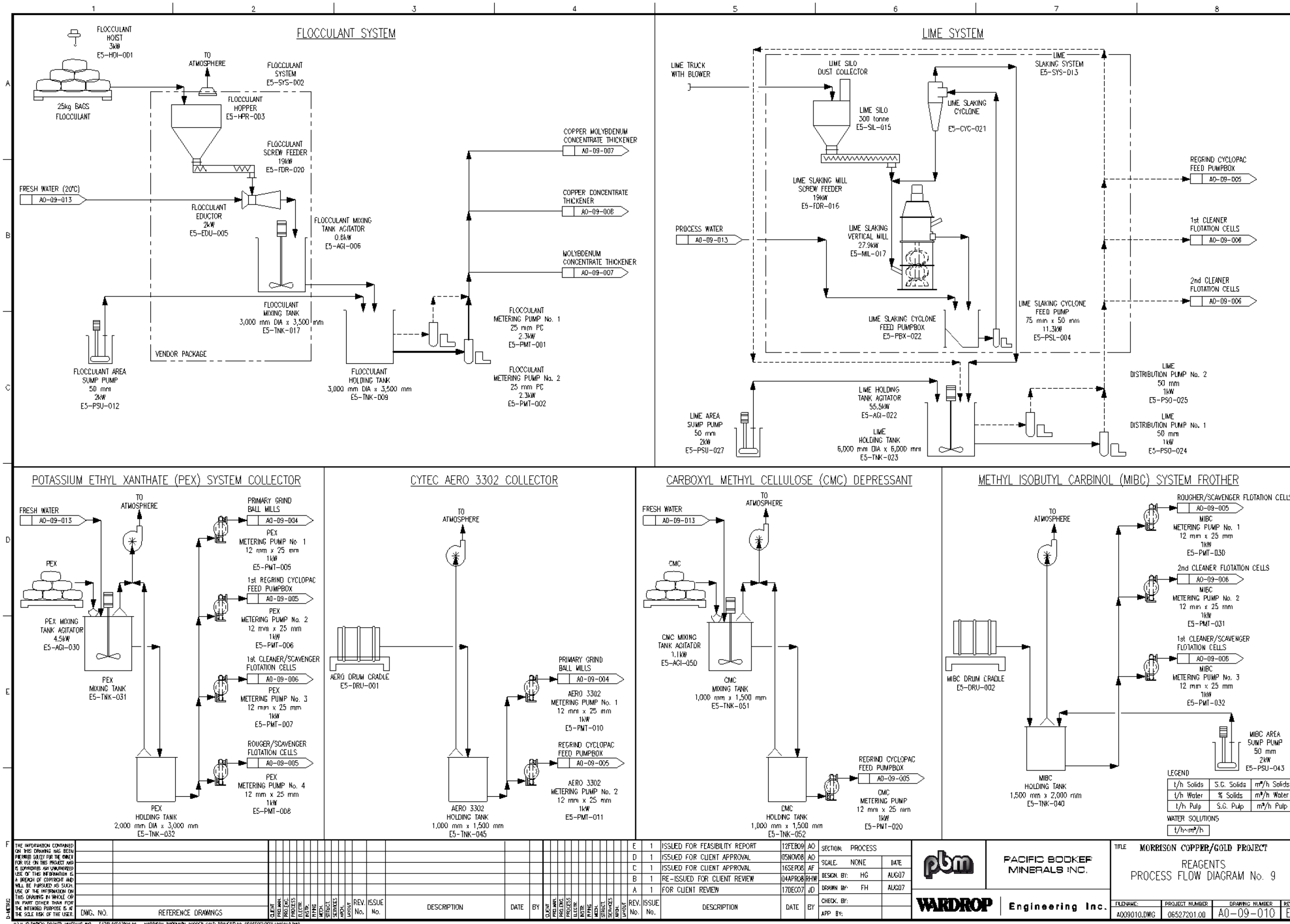
FLOCCULANT SYSTEM
FLOCCULANT HOIST 3kW E5-HOI-001
25kg BAGS FLOCCULANT
TO ATMOSPHERE
FLOCCULANT SYSTEM E5-SYS-002
FLOCCULANT HOPPER E5-HPR-003
FLOCCULANT SCREW FEEDER 19kW E5-FDR-020
FRESH WATER (20°C) A0-09-013
FLOCCULANT EDUCTOR 2kW E5-EDU-005
FLOCCULANT MIXING TANK AGITATOR 0.6kW E5-AGI-006
FLOCCULANT MIXING TANK 3,000 mm DIA x 3,500 mm E5-TNK-017
VENDOR PACKAGE
FLOCCULANT AREA SUMP PUMP 50 mm 2kW E5-PSU-012
FLOCCULANT HOLDING TANK 3,000 mm DIA x 3,500 mm E5-TNK-009
COPPER MOLYBDENUM CONCENTRATE THICKENER A0-09-007
COPPER CONCENTRATE THICKENER A0-09-008
MOLYBDENUM CONCENTRATE THICKENER A0-09-007
FLOCCULANT METERING PUMP No. 1 25 mm PC 2.3kW E5-PMT-001
FLOCCULANT METERING PUMP No. 2 25 mm PC 2.3kW E5-PMT-002
LIME SYSTEM
LIME TRUCK WITH BLOWER
LIME SILO DUST COLLECTOR
LIME SILO 300 tonne E5-SIL-015
LIME SLAKING CYCLONE E5-CYC-021
LIME SLAKING SYSTEM E5-SYS-013
LIME SLAKING MILL SCREW FEEDER 19kW E5-FDR-016
PROCESS WATER A0-09-013
LIME SLAKING VERTICAL MILL 27.9kW E5-MIL-017
LIME SLAKING CYCLONE FEED PUMPBOX E5-PBX-022
LIME SLAKING CYCLONE FEED PUMP 75 mm x 50 mm 11.3kW E5-PSL-004
REGRIND CYCLOPAC FEED PUMPBOX A0-09-005
1st CLEANER FLOTATION CELLS A0-09-006
2nd CLEANER FLOTATION CELLS A0-09-006
LIME AREA SUMP PUMP 50 mm 2kW E5-PSU-027
LIME HOLDING TANK AGITATOR 55.5kW E5-AGI-022
LIME HOLDING TANK 6,000 mm DIA x 6,000 mm E5-TNK-023
LIME DISTRIBUTION PUMP No. 2 50 mm 1kW E5-PSO-025
LIME DISTRIBUTION PUMP No. 1 50 mm 1kW E5-PSO-024
POTASSIUM ETHYL XANTHATE (PEX) SYSTEM COLLECTOR
FRESH WATER A0-09-013
TO ATMOSPHERE
PEX
PEX MIXING TANK AGITATOR 4.5kW E5-AGI-030
PEX MIXING TANK E5-TNK-031
PEX HOLDING TANK 2,000 mm DIA x 3,000 mm E5-TNK-032
PRIMARY GRIND BALL MILLS A0-09-004
PEX METERING PUMP No 1 12 mm x 25 mm 1kW E5-PMT-005
1st REGRIND CYCLOPAC FEED PUMPBOX A0-09-005
PEX METERING PUMP No. 2 12 mm x 25 mm 1kW E5-PMT-006
1st CLEANER/SCAVENGER FLOTATION CELLS A0-09-006
PEX METERING PUMP No. 3 12 mm x 25 mm 1kW E5-PMT-007
ROUGER/SCAVENGER FLOTATION CELLS A0-09-005
PEX METERING PUMP No. 4 12 mm x 25 mm 1kW E5-PMT-008
CYTEC AERO 3302 COLLECTOR
TO ATMOSPHERE
AERO DRUM CRADLE E5-DRU-001
AERO 3302 HOLDING TANK 1,000 mm x 1,500 mm E5-TNK-045
PRIMARY GRIND BALL MILLS A0-09-004
AERO 3302 METERING PUMP No. 1 12 mm x 25 mm 1kW E5-PMT-010
REGRIND CYCLOPAC FEED PUMPBOX A0-09-005
AERO 3302 METERING PUMP No. 2 12 mm x 25 mm 1kW E5-PMT-011
CARBOXYL METHYL CELLULOSE (CMC) DEPRESSANT
FRESH WATER A0-09-013
TO ATMOSPHERE
CMC
CMC MIXING TANK AGITATOR 1.1kW E5-AGI-050
CMC MIXING TANK 1,000 mm x 1,500 mm E5-TNK-051
CMC HOLDING TANK 1,000 mm x 1,500 mm E5-TNK-052
REGRIND CYCLOPAC FEED PUMPBOX A0-09-005
CMC METERING PUMP 12 mm x 25 mm 1kW E5-PMT-020
METHYL ISOBUTYL CARBINOL (MIBC) SYSTEM FROTHER
TO ATMOSPHERE
MIBC DRUM CRADLE E5-DRU-002
MIBC HOLDING TANK 1,500 mm x 2,000 mm E5-TNK-040
ROUGHER/SCAVENGER FLOTATION CELLS A0-09-005
MIBC METERING PUMP No. 1 12 mm x 25 mm 1kW E5-PMT-030
2nd CLEANER FLOTATION CELLS A0-09-006
MIBC METERING PUMP No. 2 12 mm x 25 mm 1kW E5-PMT-031
1st CLEANER/SCAVENGER FLOTATION CELLS A0-09-006
MIBC METERING PUMP No. 3 12 mm x 25 mm 1kW E5-PMT-032
MIBC AREA SUMP PUMP 50 mm 2kW E5-PSU-043
LEGEND
t/h Solids | S.G. Solids | m³/h Solids
t/h Water | % Solids | m³/h Water
t/h Pulp | S.G. Pulp | m³/h Pulp
WATER SOLUTIONS
t/h-m³/h
THE INFORMATION CONTAINED ON THIS DRAWING HAS BEEN PREPARED SOLELY FOR THE OWNER FOR USE ON THIS PROJECT AND IS COPYRIGHTED. ANY UNAUTHORIZED USE OF THIS INFORMATION IS A BREACH OF COPYRIGHT AND WILL BE PURSUED AS SUCH. USE OF THE INFORMATION ON THIS DRAWING IN WHOLE OR IN PART OTHER THAN FOR THE INTENDED PURPOSE IS AT THE SOLE RISK OF THE USER.
DWG. NO. | REFERENCE DRAWINGS
REV. No. | ISSUE No. | DESCRIPTION | DATE | BY
E | 1 | ISSUED FOR FEASIBILITY REPORT | 12FEB09 | AO
D | 1 | ISSUED FOR CLIENT APPROVAL | 05NOV08 | AO
C | 1 | ISSUED FOR CLIENT APPROVAL | 16SEP08 | AF
B | 1 | RE-ISSUED FOR CLIENT REVIEW | 04APR08 | RHW
A | 1 | FOR CLIENT REVIEW | 17DEC07 | JD
SECTION: PROCESS
SCALE: NONE | DATE
DESIGN. BY: HG | AUG07
DRAWN BY: FH | AUG07
CHECK. BY:
APP. BY:
PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.
TITLE MORRISON COPPER/GOLD PROJECT
REAGENTS
PROCESS FLOW DIAGRAM No. 9
FILENAME: A009010.DWG
PROJECT NUMBER 06527201.00
DRAWING NUMBER A0-09-010
REV. E
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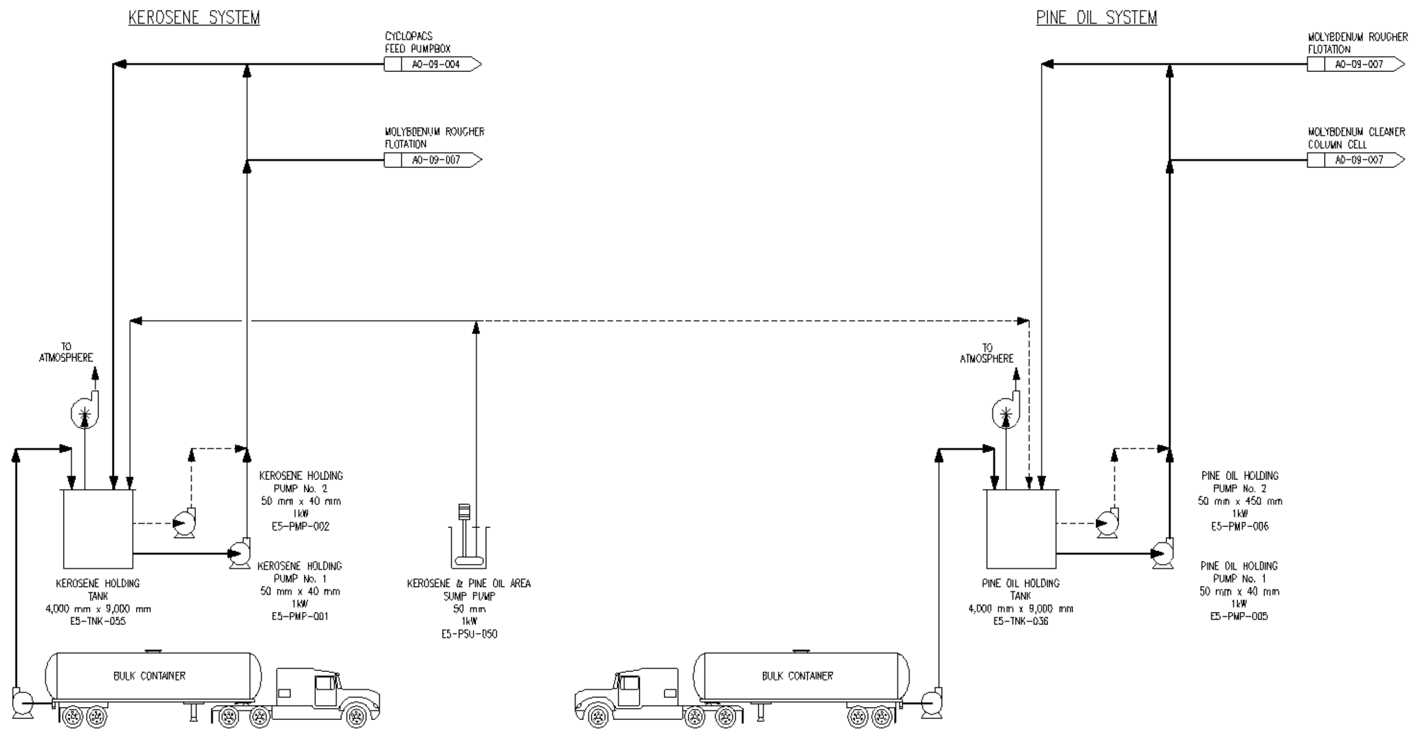


LEGEND

t/h Solids	S.G. Solids	m³/h Solids
t/h Water	% Solids	m³/h Water
t/h Pulp	S.G. Pulp	m³/h Pulp

WATER SOLUTIONS

t/h–m³/h

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

SECTION: PROCESS
SCALE: NONE
DESIGN. BY: HG — AUG07
DRAWN BY: FH — AUG07
CHECK. BY:
APP BY:

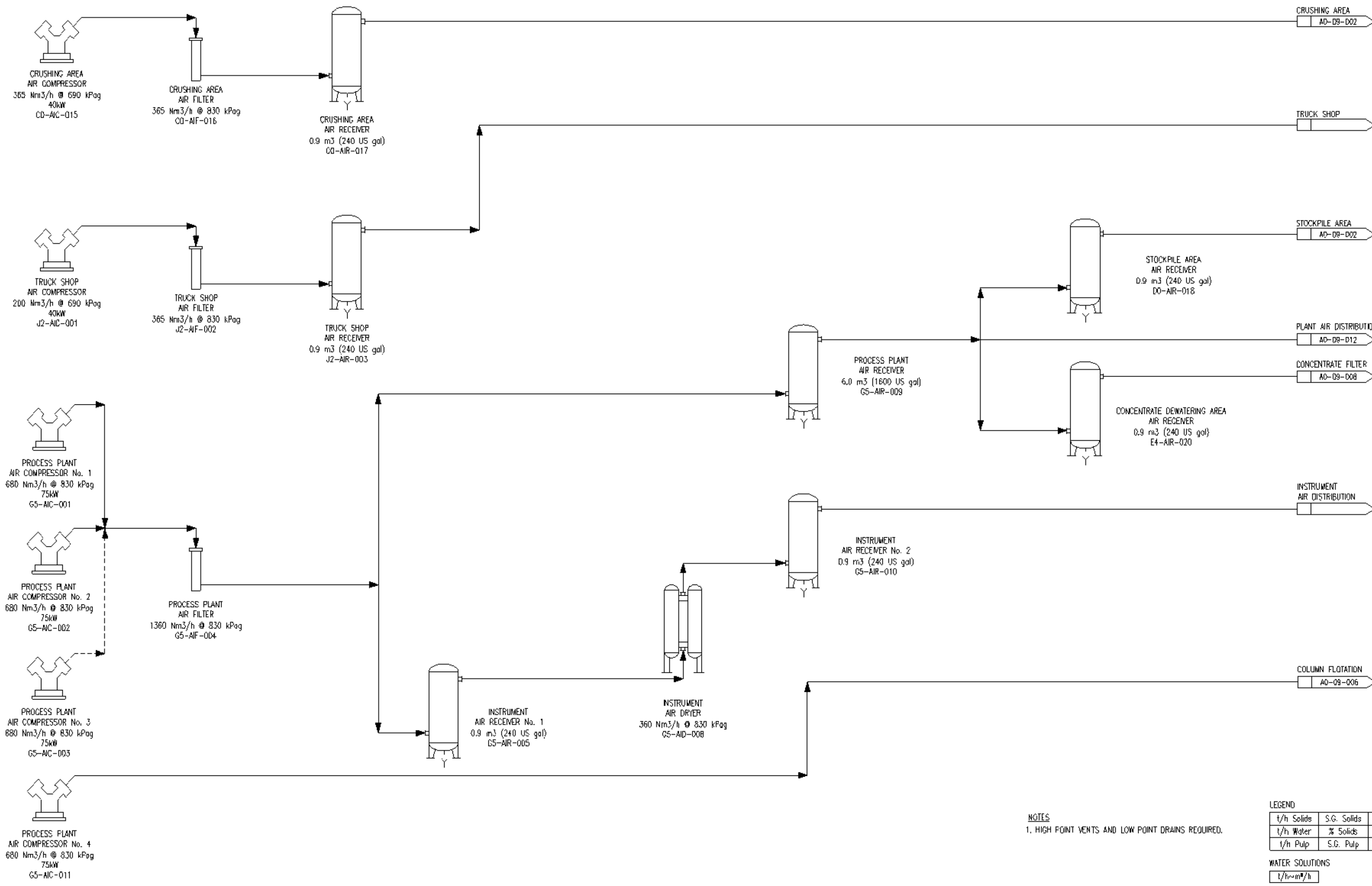
PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT

REAGENTS
PROCESS FLOW DIAGRAM No. 10

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009011.DWG	06527201.00	A0-09-011	E



NOTES
1. HIGH POINT VENTS AND LOW POINT DRAINS REQUIRED.

LEGEND

t/h Solids	S.G. Solids	m³/h Solids
t/h Water	% Solids	m³/h Water
t/h Pulp	S.G. Pulp	m³/h Pulp

WATER SOLUTIONS

t/h=m³/h

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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	05NOV08	AO
C	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PROCESS		
SCALE: NONE		DATE
DESIGN. BY:	HG	AUG07
DRAWN BY:	FH	AUG07
CHECK. BY:		
APP BY:		

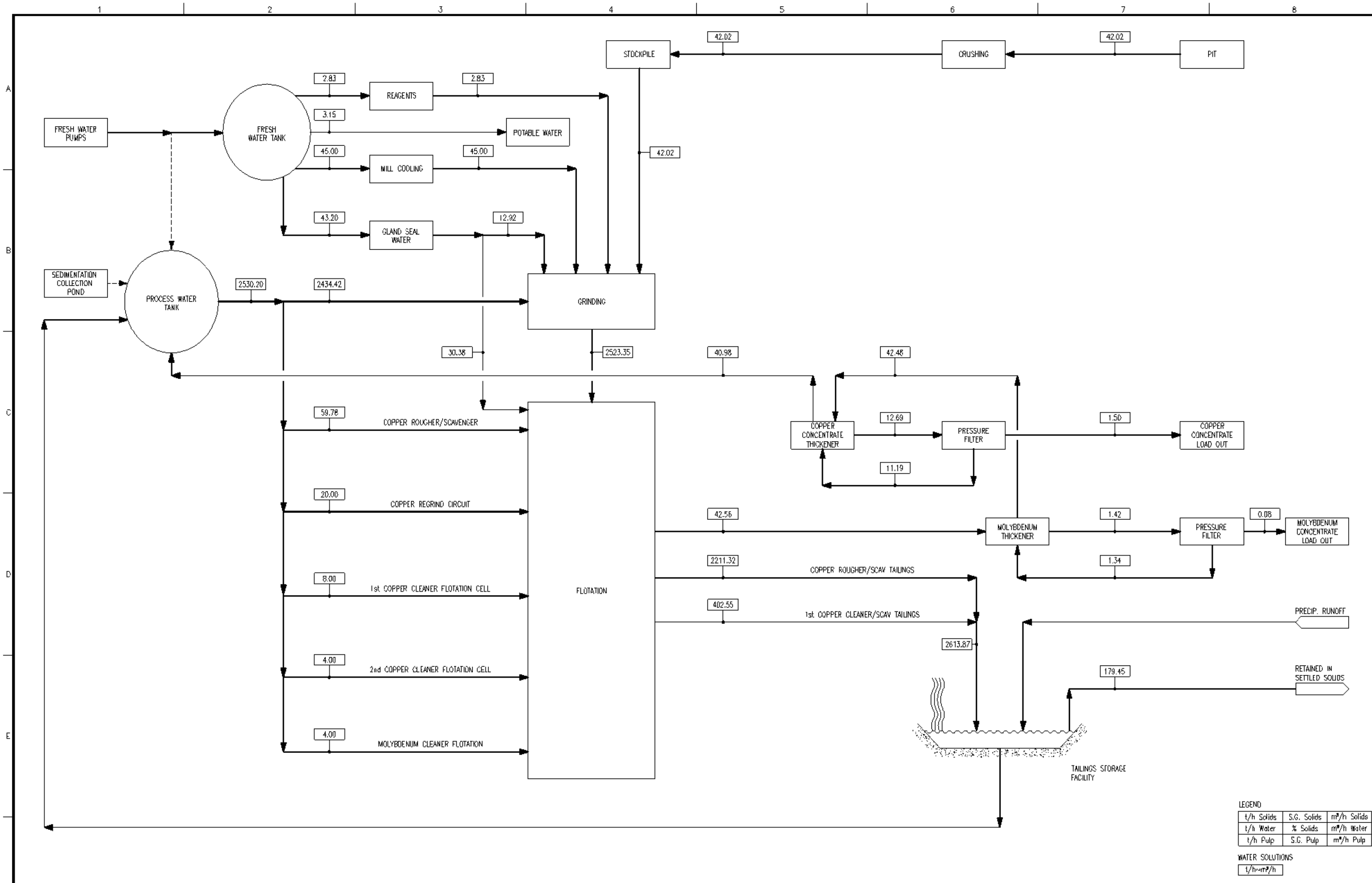
pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
AIR SERVICES
PROCESS FLOW DIAGRAM No. 11

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009012.DWG	06527201.00	A0-09-012	E

U:\W-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\09-PROCESS\PFD\A009012.DWG



DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
H	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
G	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
F	1	ISSUED FOR CLIENT APPROVAL	03NOV08	AO
E	1	ISSUED FOR CLIENT APPROVAL	16SEP08	AF
D	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
C	1	ISSUED FOR CLIENT REVIEW	14MAR08	RHW
B	1	ISSUED FOR INFORMATION	12MAR08	AJB
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION:	PROCESS	
SCALE:	NONE	
DESIGN. BY:	HG	FEB07
DRAWN BY:	FH	AUG07
CHECK. BY:		
APP BY:		

pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

WATER BALANCE
PROCESS FLOW DIAGRAM No. 12

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A009013.DWG	0652720100	A0-09-013	H

06/02/12 09:35

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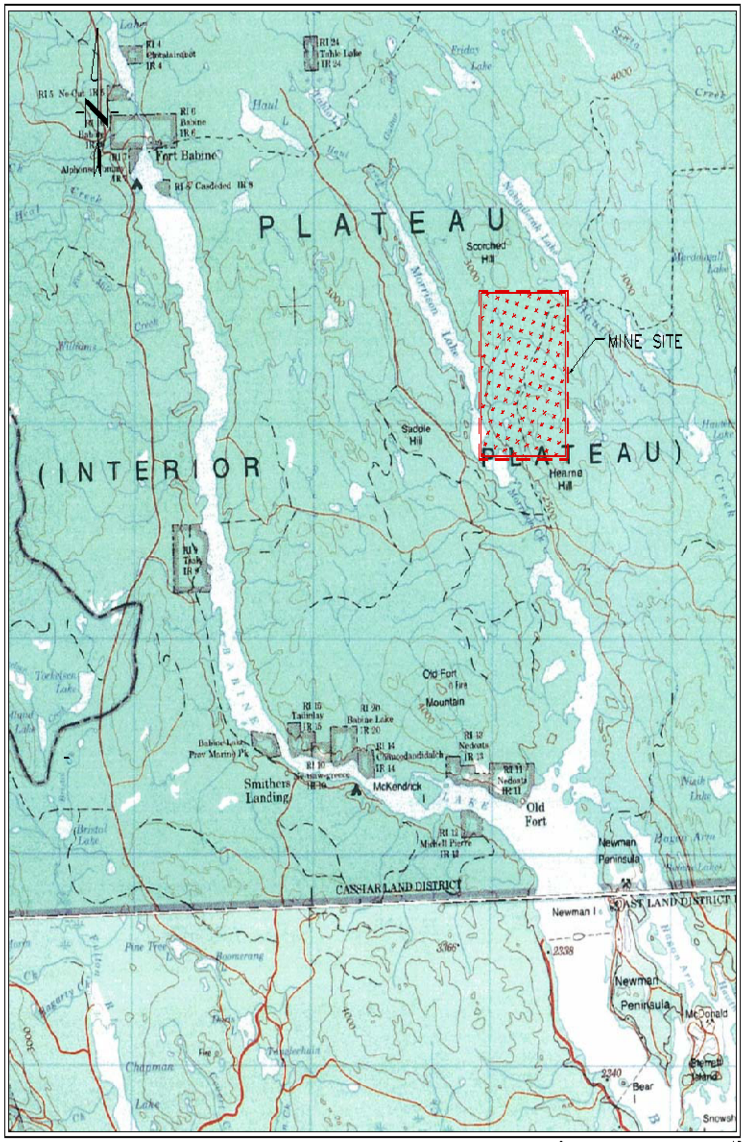

NOT FOR CONSTRUCTION

TOPOGRAPHY COURTESY OF SOFTMAP.

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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR STUDY	22DEC08	AR
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AO
B	1	REISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	ISSUED FOR CLIENT REVIEW	17DEC07	JO

SECTION: GENERAL		
SCALE: NONE		DATE
DESIGN. BY: AK/JD		19MAR07
DRAWN BY: AKK		19MAR07
CHECK. BY:		
APP. BY:		

PACIFIC BOOKER MINERALS INC.

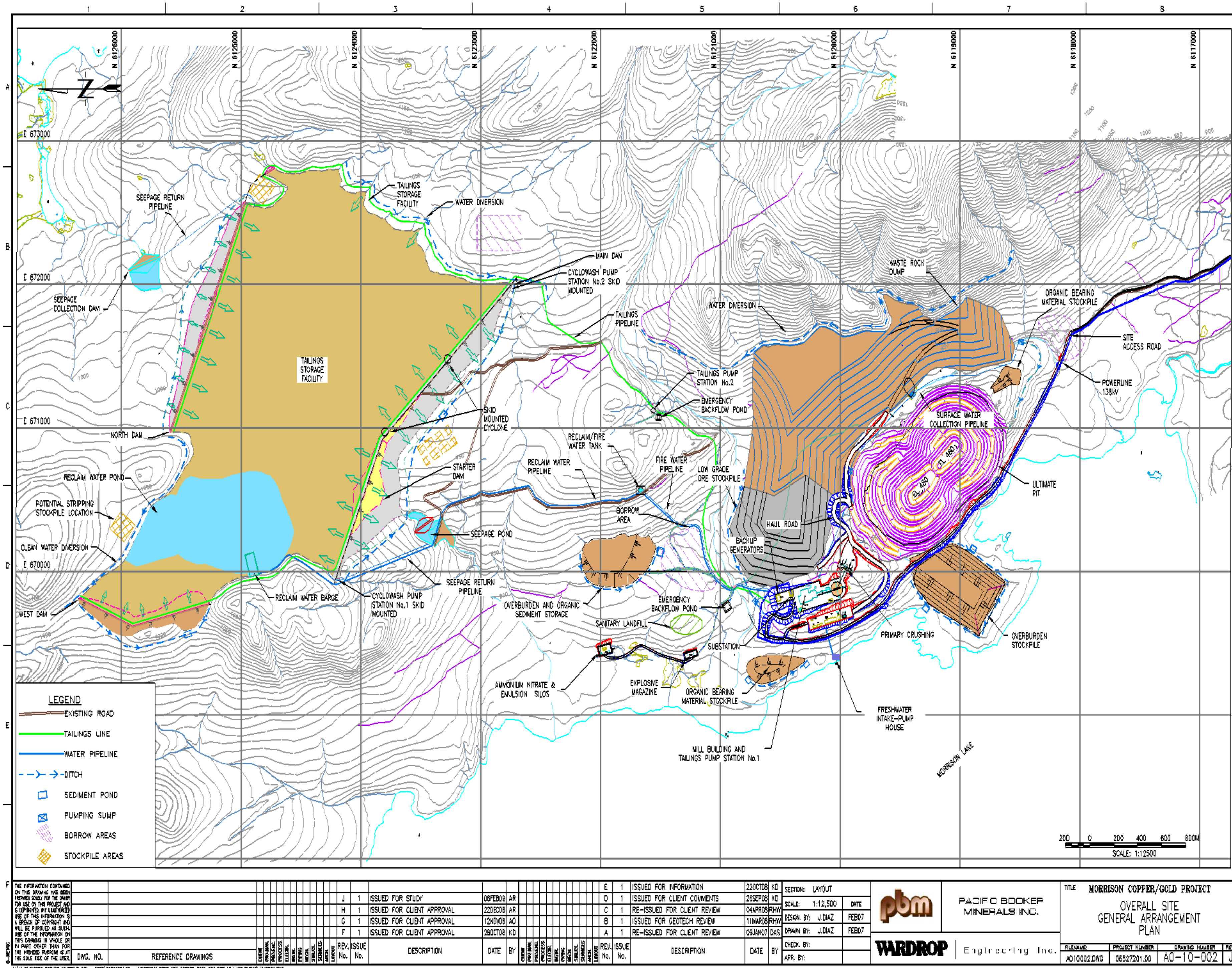
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

SITE LOCATION
GENERAL ARRANGEMENT
PLAN

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A010001.DWG	0652720100	AO-10-001	D

L:\H-5\PACIFIC BOOKER MINERALS INC - 3073\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\A010001.DWG


TAILINGS STORAGE FACILITY
SEEPAGE RETURN PIPELINE
SEEPAGE COLLECTION DAM
NORTH DAM
RECLAIM WATER POND
POTENTIAL STRIPPING STOCKPILE LOCATION
CLEAN WATER DIVERSION
WEST DAM
RECLAIM WATER BARGE
CYCLOWASH PUMP STATION No.1 SKID MOUNTED
SEEPAGE RETURN PIPELINE
SEEPAGE POND
STARTER DAM
SKID MOUNTED CYCLONE
MAIN DAM
CYCLOWASH PUMP STATION No.2 SKID MOUNTED
WATER DIVERSION
TAILINGS PIPELINE
RECLAIM WATER PIPELINE
RECLAIM/FIRE WATER TANK
FIRE WATER PIPELINE
BORROW AREA
OVERBURDEN AND ORGANIC SEDIMENT STORAGE
AMMONIUM NITRATE & EMULSION SILOS
EXPLOSIVE MAGAZINE
SANITARY LANDFILL
EMERGENCY BACKFLOW POND
TAILINGS PUMP STATION No.2
LOW GRADE ORE STOCKPILE
HAUL ROAD
BACKUP GENERATORS
SUBSTATION
ORGANIC BEARING MATERIAL STOCKPILE
MILL BUILDING AND TAILINGS PUMP STATION No.1
FRESHWATER INTAKE-PUMP HOUSE
PRIMARY CRUSHING
MORRISON LAKE
OVERBURDEN STOCKPILE
ULTIMATE PIT
SURFACE WATER COLLECTION PIPELINE
WASTE ROCK DUMP
SITE ACCESS ROAD
POWERLINE 138kV
EL 480
N 6126000
N 6125000
N 6124000
N 6123000
N 6122000
N 6121000
N 6120000
N 6119000
N 6118000
N 6117000
E 673000
E 672000
E 671000
E 670000
LEGEND
EXISTING ROAD
TAILINGS LINE
WATER PIPELINE
DITCH
SEDIMENT POND
PUMPING SUMP
BORROW AREAS
STOCKPILE AREAS
200 0 200 400 600 800M
SCALE: 1:12500
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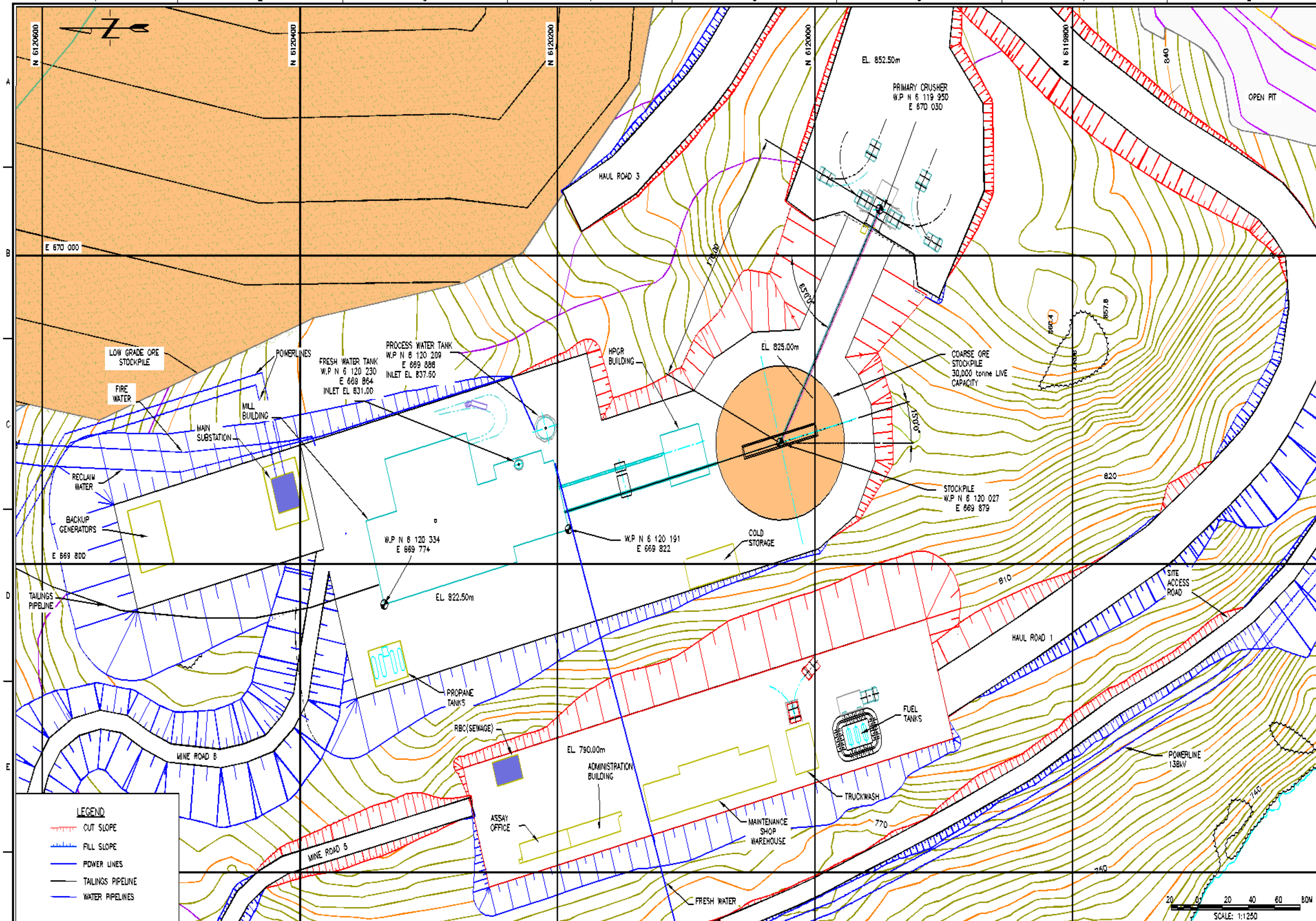
DWG. NO. | REFERENCE DRAWINGS
J | 1 | ISSUED FOR STUDY | 06FEB09 | AR
H | 1 | ISSUED FOR CLIENT APPROVAL | 22DEC08 | AR
G | 1 | ISSUED FOR CLIENT APPROVAL | 12NOV08 | AO
F | 1 | ISSUED FOR CLIENT APPROVAL | 28OCT08 | KD
E | 1 | ISSUED FOR INFORMATION | 22OCT08 | KD
D | 1 | ISSUED FOR CLIENT COMMENTS | 26SEP08 | KD
C | 1 | RE-ISSUED FOR CLIENT REVIEW | 04APR08 | RHW
B | 1 | ISSUED FOR GEOTECH REVIEW | 11MAR08 | RHW
A | 1 | RE-ISSUED FOR CLIENT REVIEW | 09JAN07 | DAS
REV. No. | ISSUE No. | DESCRIPTION | DATE | BY
SECTION: LAYOUT
SCALE: 1:12,500
DESIGN BY: J.DIAZ FEB07
DRAWN BY: J.DIAZ FEB07
CHECK. BY:
APP. BY:
PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.
TITLE MORRISON COPPER/GOLD PROJECT
OVERALL SITE GENERAL ARRANGEMENT PLAN
FILENAME: A010002.DWG
PROJECT NUMBER: 0652720100
DRAWING NUMBER: A0-10-002
REV. J



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
J	1	ISSUED FOR STUDY	06FEB09	AR
H	1	ISSUED FOR CLIENT APPROVAL	22DEC08	AR
G	1	ISSUED FOR CLIENT APPROVAL	12NOV08	KD
F	1	ISSUED FOR INFORMATION	22OCT08	KD
E	1	ISSUED FOR CLIENT COMMENTS	26SEP08	KD
D	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
C	1	ISSUED FOR INFORMATION	12MAR08	AJB
B	1	ISSUED FOR GEOTECH REVIEW	11MAR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION:	LAYOUT	
SCALE:	1:1250	DATE
DESIGN. BY:	J.DIAZ	FEB07
DRAWN BY:	J.DIAZ	FEB07
CHECK. BY:		
APP. BY:		

pbm

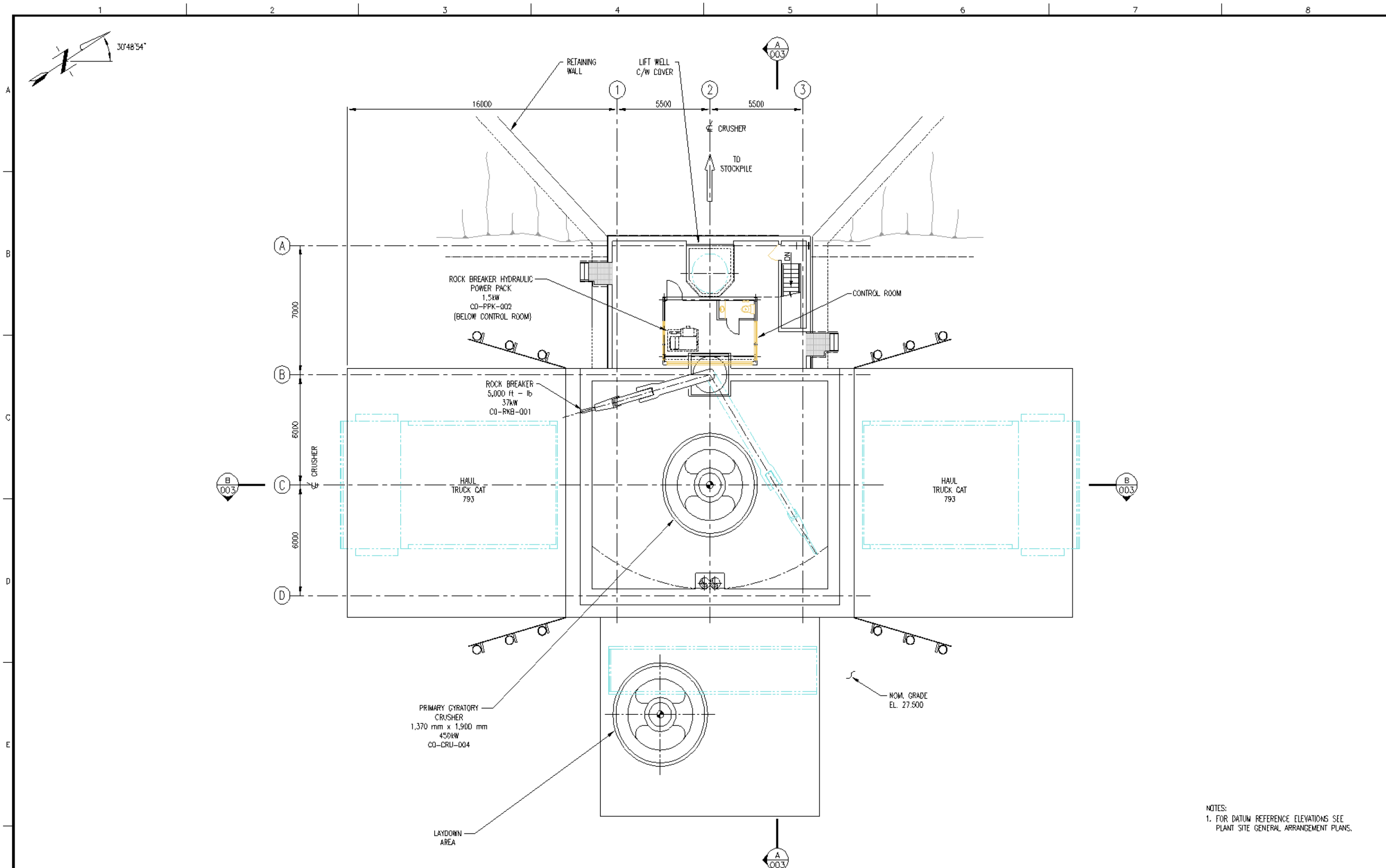
PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE **MORRISON COPPER/GOLD PROJECT**

PLANT SITE
GENERAL ARRANGEMENT
PLAN

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A010003.DWG	06527201.00	A0-10-003	J



PLAN @ ELEVATION 27.500

NOTES:
1. FOR DATUM REFERENCE ELEVATIONS SEE PLANT SITE GENERAL ARRANGEMENT PLANS.

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
D	1	ISSUED FOR CLIENT APPROVAL	19DEC08	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

SECTION: GENERAL
SCALE: 1:100
DESIGN BY: KAD 31JUL07
DRAWN BY: KAD 31JUL07
CHECK. BY:
APP BY:

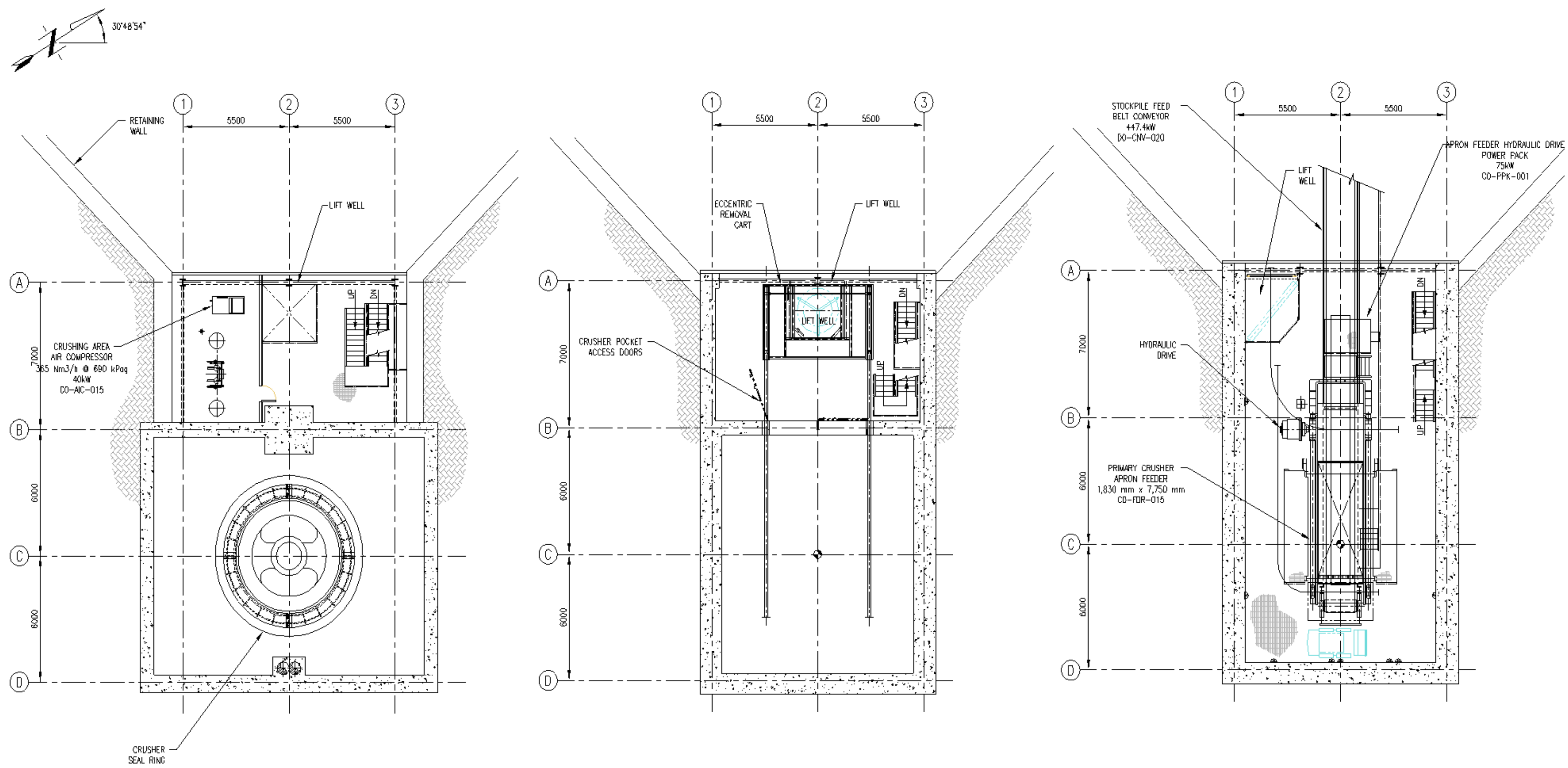
PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
PRIMARY CRUSHING
GENERAL ARRANGEMENT
PLAN SHEET 1 OF 2

FILENAME	PROJECT NUMBER	DRAWING NUMBER	REV.
C010001.DWG	0652720100	CO-10-001	E

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\C010001.DWG



PLAN @ ELEVATION 24,500

PLAN @ ELEVATION 14,800

PLAN @ ELEVATION 6,800

NOTES:
1. FOR DATUM REFERENCE ELEVATIONS SEE PLANT SITE GENERAL ARRANGEMENT PLANS.

SCALE: 1:100

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION	GENERAL	
SCALE:	1:100	DATE
DESIGN BY:	KAD	31JUL07
DRAWN BY:	KAD	31JUL07
CHECK. BY:		
APP BY:		

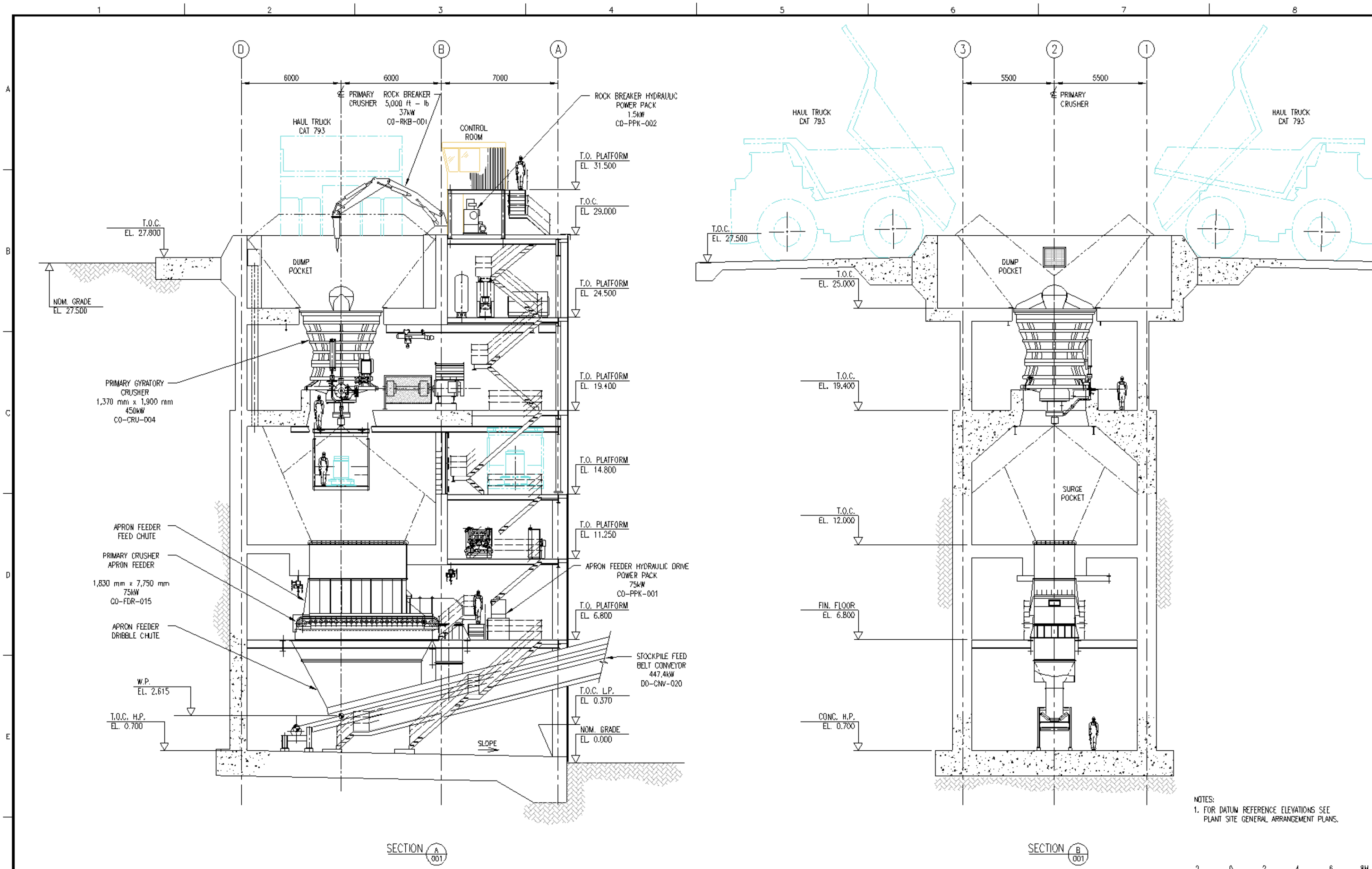
pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
PRIMARY CRUSHING
GENERAL ARRANGEMENT
PLAN SHEET 2 OF 2

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
C010002.DWG	0652720100	CO-10-002	D

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\C010002.DWG



NOTES:
1. FOR DATUM REFERENCE ELEVATIONS SEE PLANT SITE GENERAL ARRANGEMENT PLANS.

SCALE: 1:100

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
D	1	ISSUED FOR CLIENT APPROVAL	19DEC08	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: GENERAL		
SCALE: 1:100		DATE
DESIGN BY:	KAD	31JUL07
DRAWN BY:	KAD	31JUL07
CHECK BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

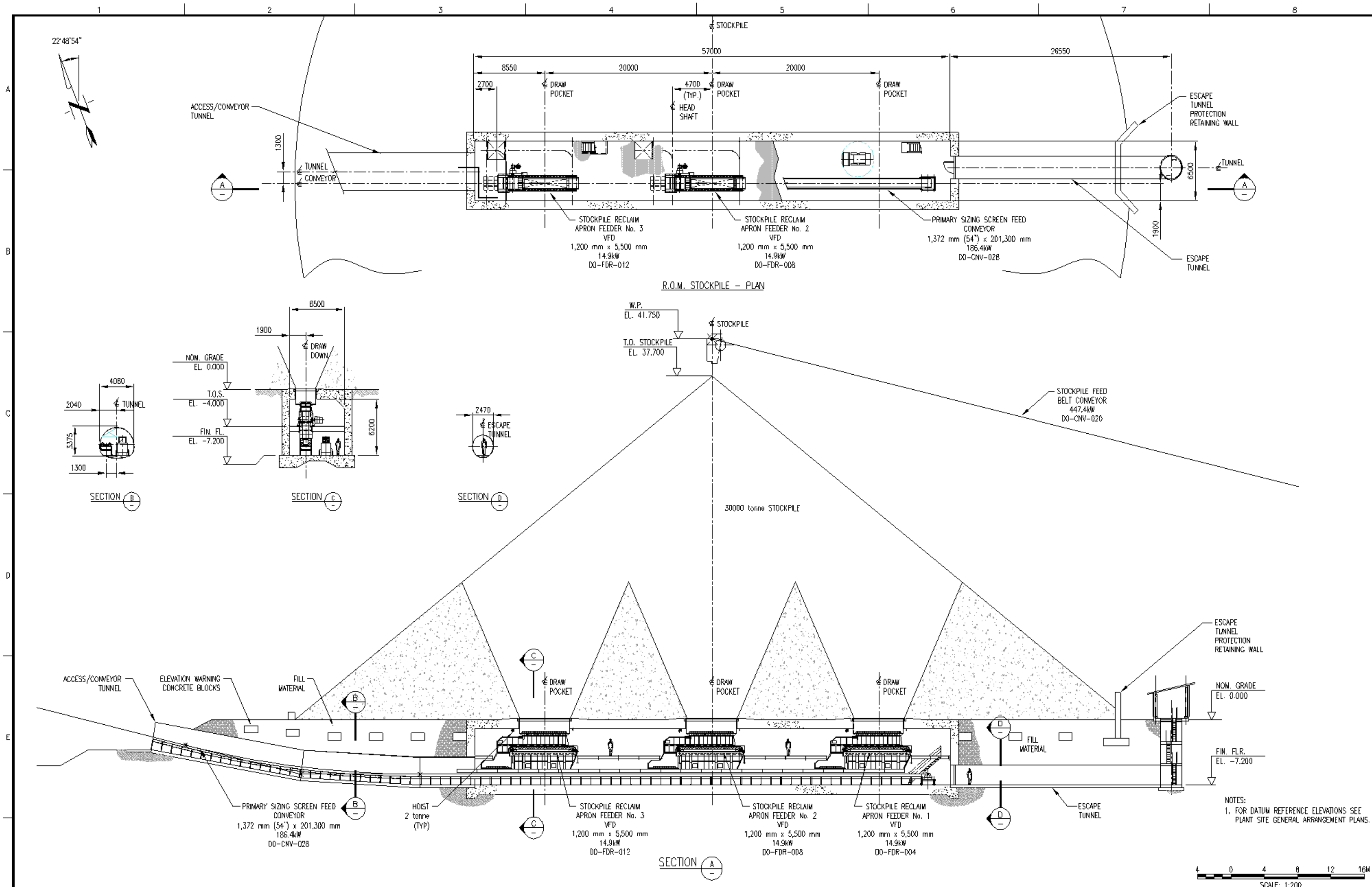
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

PRIMARY CRUSHING
GENERAL ARRANGEMENT
SECTIONS A AND B

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
C010003.DWG	0652720100	C0-10-003	E

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\C010003.DWG



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION:	GENERAL	
SCALE:	1:200	
DESIGN BY:	KAD	01AUG07
DRAWN BY:	KAD/JD	01AUG07
CHECK BY:		
APP BY:		

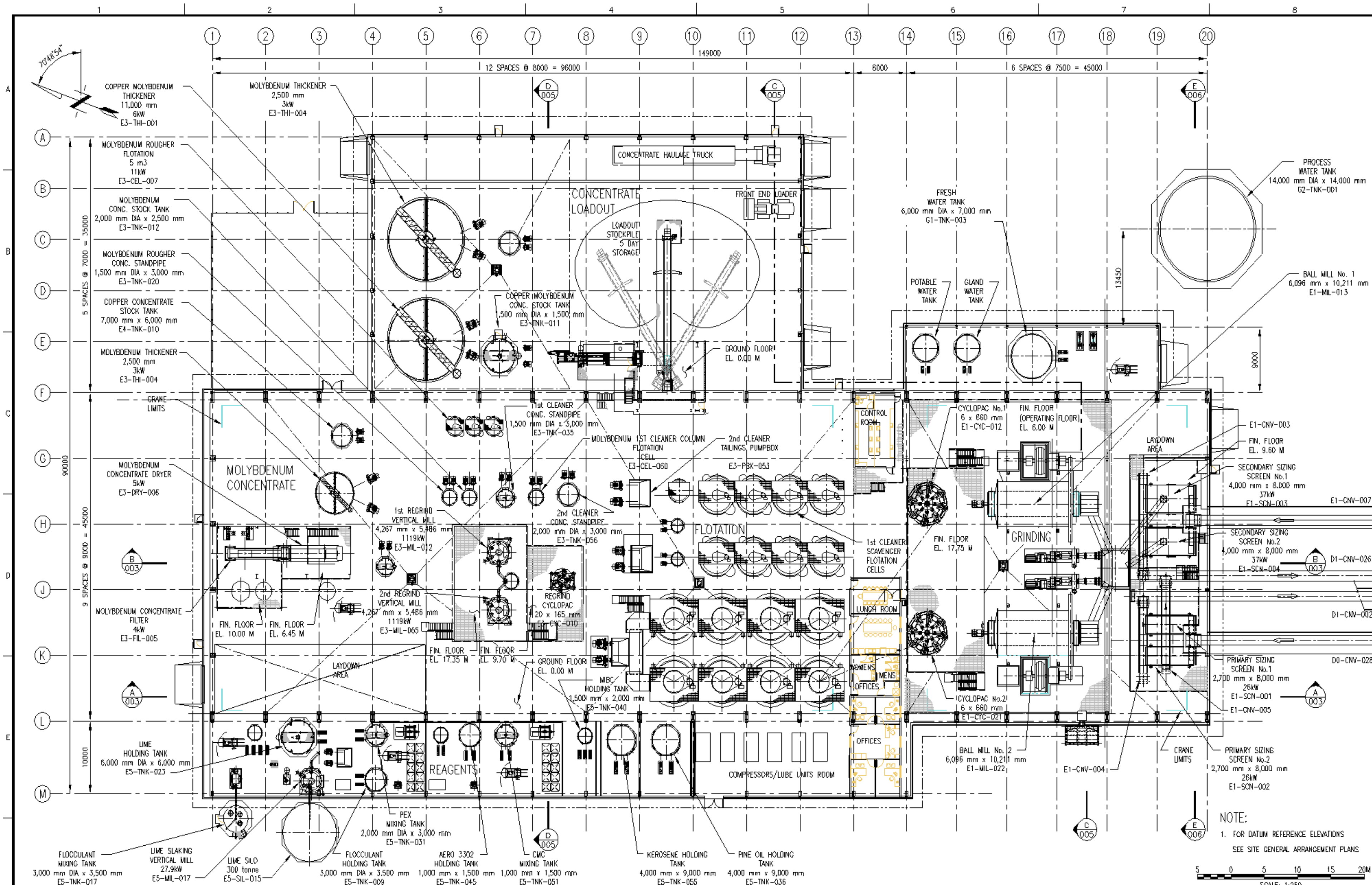
pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
COARSE ORE STOCKPILE & RECLAIM GENERAL ARRANGEMENT PLAN AND SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
D010001.DWG	0652720100	D0-10-001	D

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\D010001.DWG



NOTE:

1. FOR DATUM REFERENCE ELEVATIONS SEE SITE GENERAL ARRANGEMENT PLANS

SCALE: 1:250

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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
F	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR CLIENT APPROVAL	19DEC08	AO
D	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AO
C	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
B	1	ISSUED FOR INFORMATION	12MAR08	AJB
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: LAYOUT
SCALE: 1:250 | DATE
DESIGN BY: J.DIAZ | 08AUG07
DRAWN BY: J.DIAZ | AUG07
CHECK. BY:
APP. BY:

pbm PACIFIC BOOKER MINERALS INC.

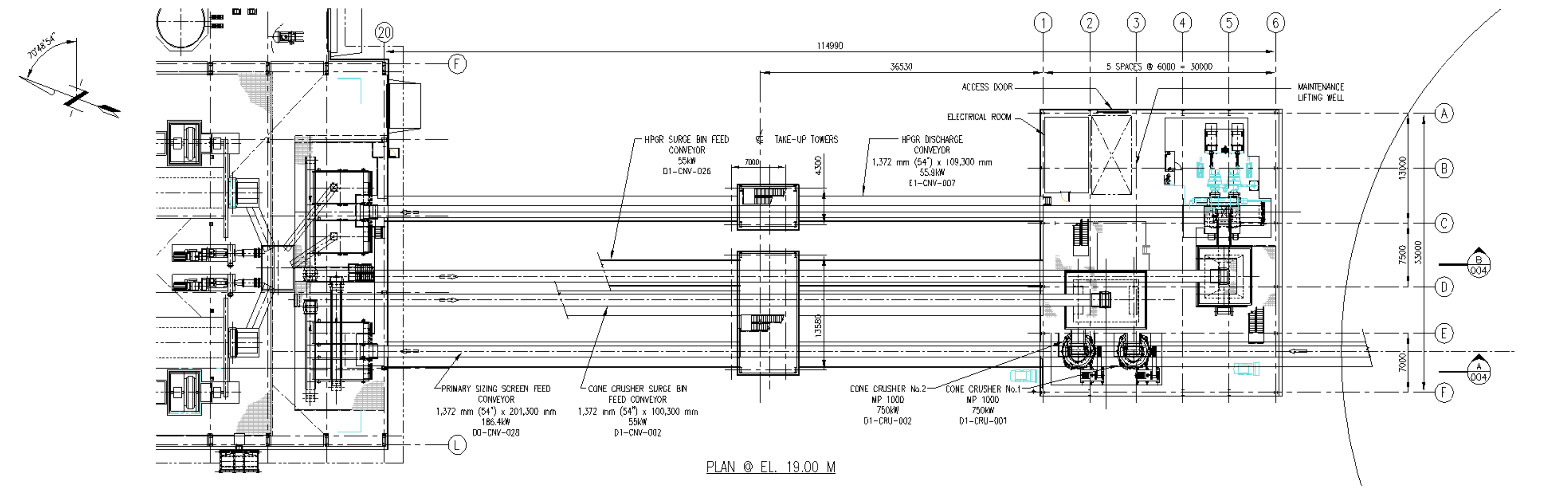
WARDROP Engineering Inc.

MORRISON COPPER/GOLD PROJECT

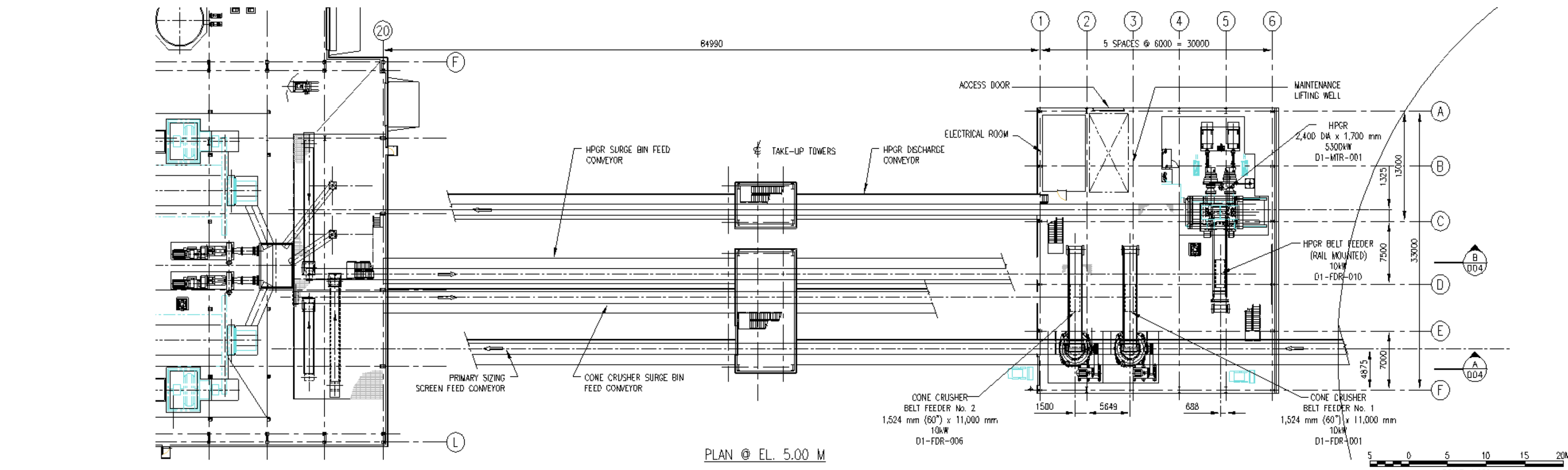
MILL BUILDING
GENERAL ARRANGEMENT
OVERALL PLAN

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
E010001.DWG	0652720100	E0-10-001	F

U:\4-5\PACIFIC BOOKER MINERALS INC - 527Z\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\E010001.DWG



PLAN @ EL. 19.00 M



PLAN @ EL. 5.00 M

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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
F	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
E	1	ISSUED FOR CLIENT APPROVAL	19DEC08	AO
D	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AO
C	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
B	1	ISSUED FOR GEOTECH REVIEW	11MAR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: LAYOUT
SCALE: 1:250
DESIGN BY: J.DIAZ 08AUG07
DRAWN BY: J.DIAZ AUG07
CHECK BY:
APP BY:

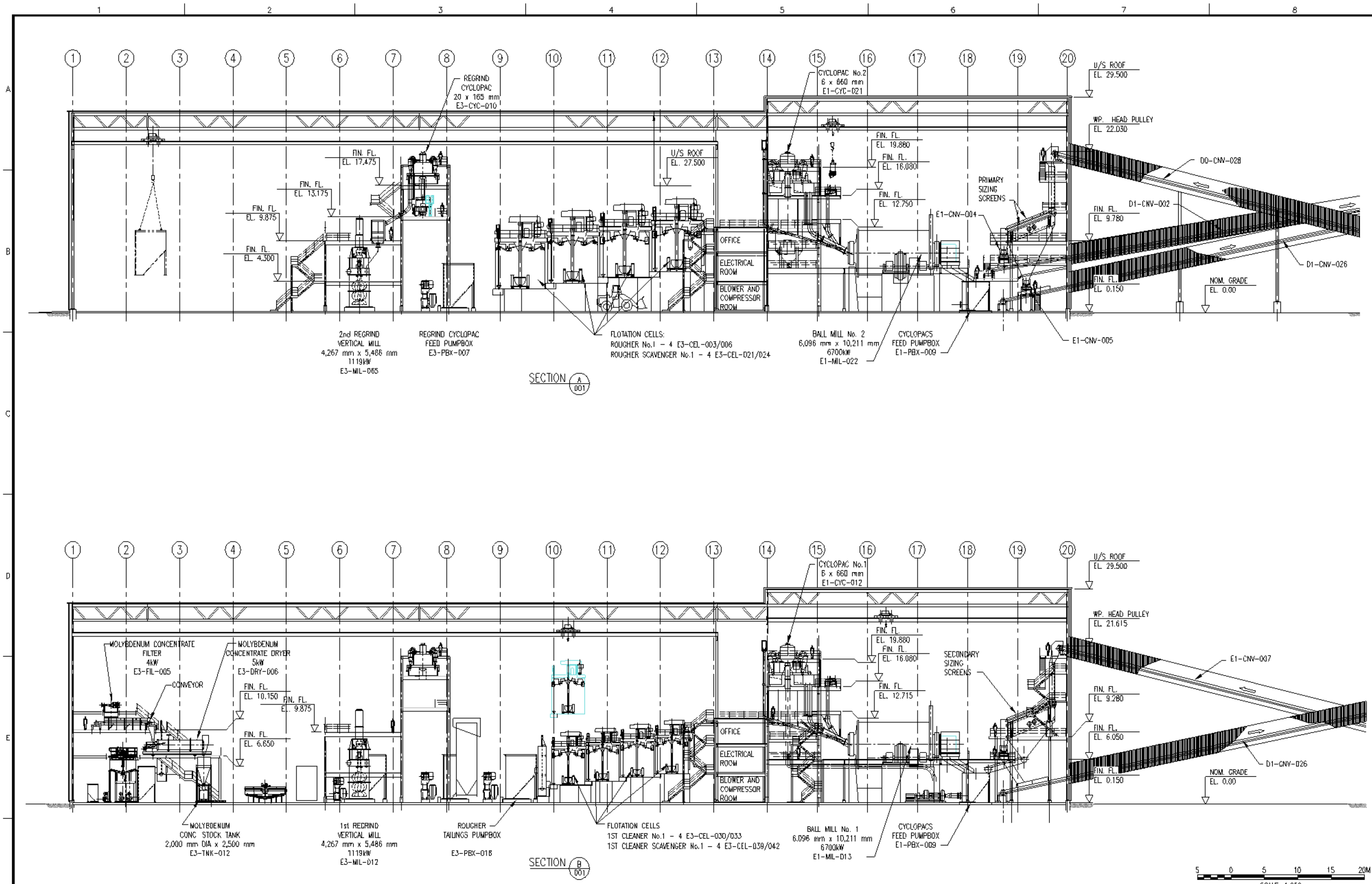
pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
HPGR BUILDING
GENERAL ARRANGEMENT
OPERATING FLOOR PLAN

FILENAME	PROJECT NUMBER	DRAWING NUMBER	REV.
E010002.DWG	06527201.00	E0-10-002	F

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\10-LAYOUT\DWG\E010002.DWG



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: LAYOUT
SCALE: 1:250 DATE
DESIGN BY: J.DIAZ 08AUG07
DRAWN BY: J.DIAZ AUG07
CHECK BY:
APP BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE **MORRISON COPPER/GOLD PROJECT**

MILL BUILDING
GENERAL ARRANGEMENT
SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
E010003.DWG	06527201.00	E0-10-003	D

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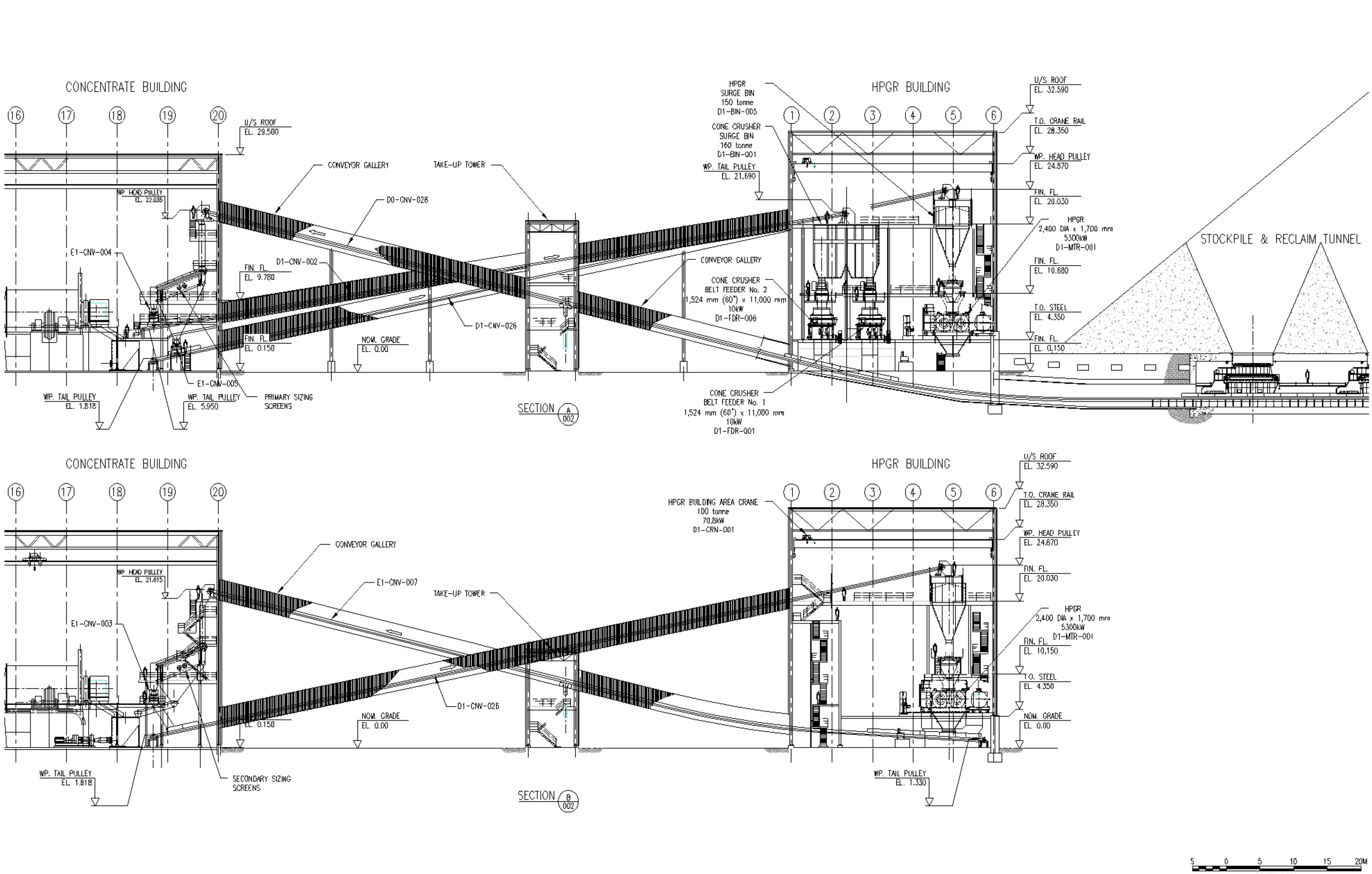

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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: LAYOUT
SCALE: 1:250 — DATE
DESIGN BY: J.DIAZ — 08AUG07
DRAWN BY: J.DIAZ — AUG07
CHECK BY:
APP BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
HPGR BUILDING
GENERAL ARRANGEMENT
SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
E010004.DWG	0652720100	E0-10-004	D

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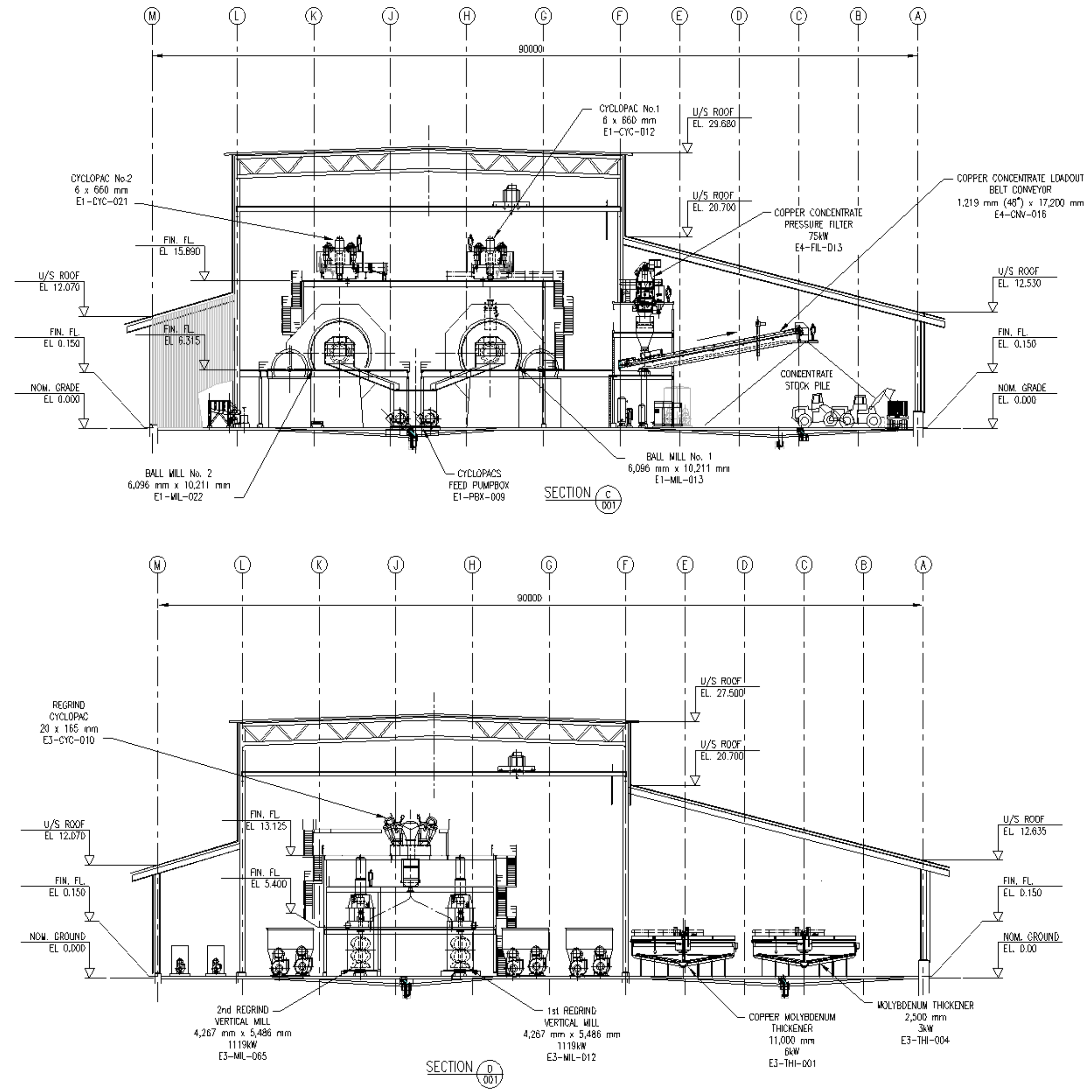

5 0 5 10 15 20M
SCALE: 1:250

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION	LAYOUT	
SCALE:	1:250	DATE
DESIGN BY:	J.DIAZ	08AUG07
DRAWN BY:	J.DIAZ	AUG07
CHECK BY:		
APP BY:		

pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

MILL BUILDING
GENERAL ARRANGEMENT
SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
E010005.DWG	0652720100	E0-10-005	D

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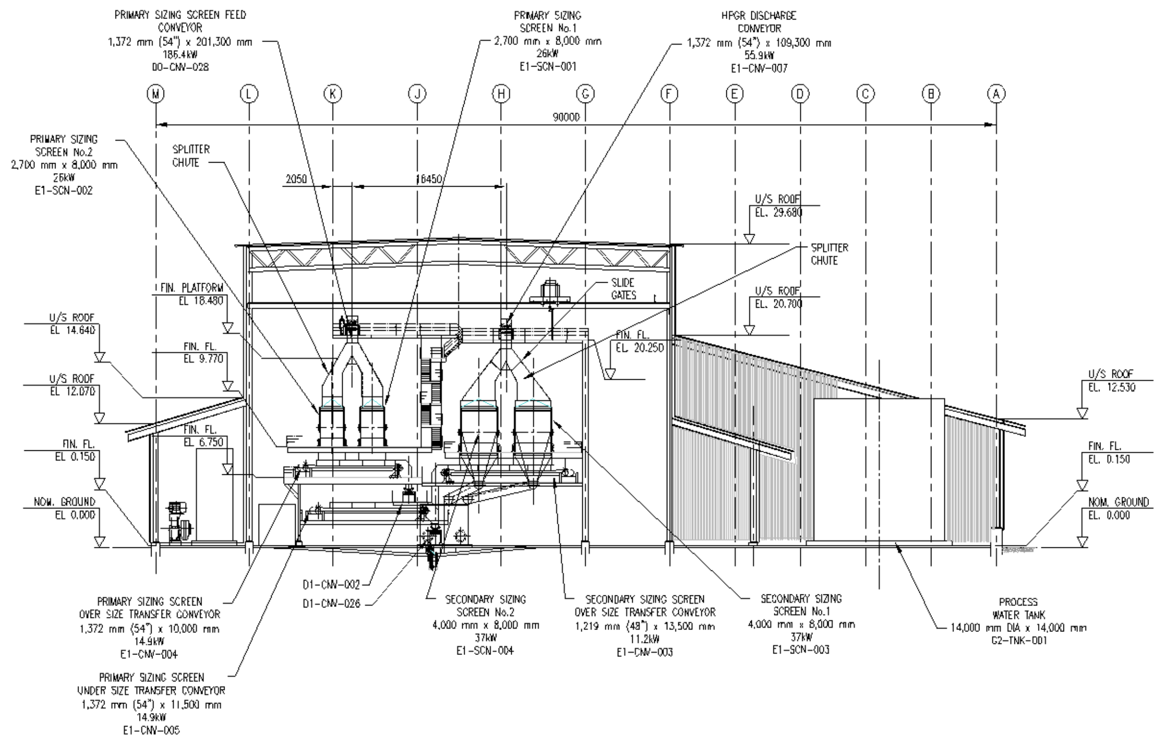

SECTION E/D01

5 0 5 10 15 20M
SCALE: 1:250

DWG. NO.	REFERENCE DRAWINGS

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D	1	ISSUED FOR CLIENT APPROVAL	19DEC08	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION:	LAYOUT	
SCALE:	1:250	
DESIGN. BY:	J.DIAZ	08AUG07
DRAWN BY:	J.DIAZ	08AUG07
CHECK. BY:		
APP. BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
MILL BUILDING
GENERAL ARRANGEMENT
SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
E010006.DWG	0652720100	E0-10-006	E

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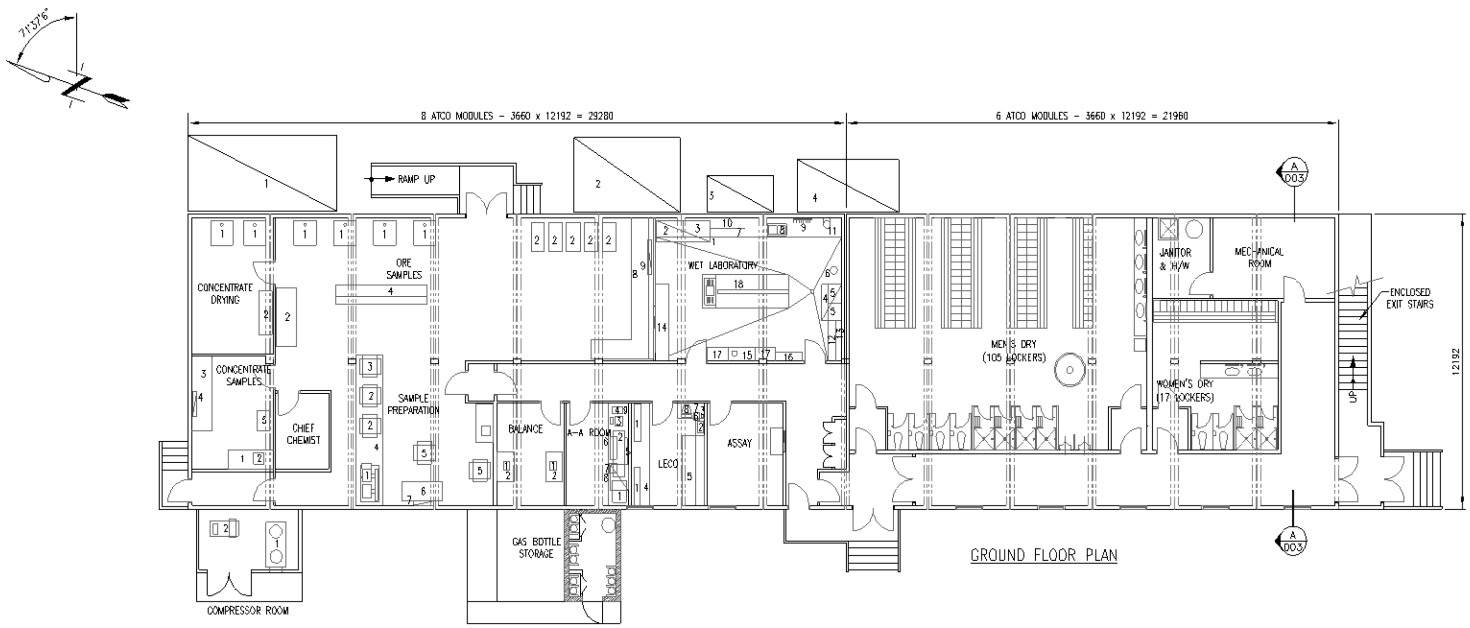
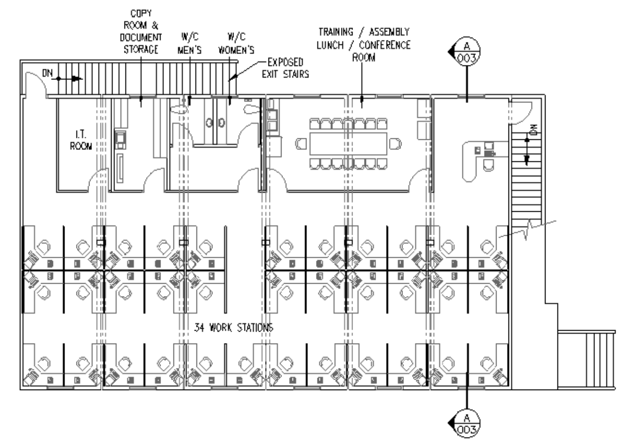


GROUND FLOOR PLAN



UPPER FLOOR PLAN

LAB EQUIPMENT LEGEND

ORE SAMPLES
1. DRYING OVEN(4 REQ'D)
2. SAMPLE CARTS(5 REQ'D)
3. TABLE
4. TABLE AND SHELVES

CONCENTRATE DRYING
1. DRYING OVEN (2 REQ'D)
2. TABLE

CONCENTRATE SAMPLES
1. WET COUNTER
2. S.S. SINK
3. DRY COUNTER
4. CONCENTRATE DUST VENT
5. PULVERIZER

COMPRESSOR ROOM
1. AIR COMPRESSOR
2. VACUUM PUMP

SAMPLE PREPARATION
1. LARGE JAW CRUSHER
2. SMALL JAW CRUSHER (2 REQ'D)
3. RIFFLE SPLITTER
4. STEEL CABINET AND VENT
5. PULVERIZER(2 REQ'D)
6. PULVERIZER TABLE
7. PULVERIZER DUST VENT
8. L-COUNTER
9. SAMPLE DUST VENT
10. WET COUNTER
11. S.S. SINK

WET LABORATORY
1. STANDARD BENCH FUME HOOD
2. SOLVENT STORAGE BASE CABINET
3. FLAMMABLE STORAGE BASE CABINET
4. PERCHLORIC ACID FUME HOOD
5. ACID STORAGE BASE CABINET(2 REQ'D)
6. SAFETY SHOWER/EYE/FACE WASH
7. BASE CABINETS
8. S.S. SINK
9. PEG BOARD
10. WALL MOUNTED STORAGE CABINETS
11. WALL MOUNTED RO UNIT
12. BASE CABINETS
13. WALL MOUNTED STORAGE CABINETS
14. BASE CABINETS
15. BASE CABINET & PASS THROUGH
16. STORAGE CABINET
17. WALL MOUNTED STORAGE CABINET
18. CENTER TABLE W/SINK & LEDGE
19. ION CHROMATOGRAPH

BALANCE
1. MICROBALANCE(2 REQ'D)
2. BALANCE TABLE(2 REQ'D)

A-A ROOM
1. AA SPECTROMETER
2. ICP
3. COMPUTER, MONITOR,KEYBOARD.
4. PRINTER
5. AIR PUMP
6. POWER SUPPLY
7. WATER COOLER
8. HOOD & EXHAUST FAN
9. TABLE

LECO
1. LECO SULFUR ANALYZER(2 REQ'D)
2. LECO PRINTER
3. PRINTER A-B SWITCHBOX
4. TABLE
5. XFR
6. WATER COOLER
7. TABLE
8. COMPUTER,MONITOR, KEYBOARD

MECHANICAL EQUIP. OUTSIDE
1. DUST COLLECTOR
2. AIR HANDLING UNIT
3. FUME HOOD EXHAUST FAN
4. AIR HANDLING UNIT

SCALE: 1:100

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
D	1	ISSUED FOR CLIENT ACCEPTANCE	17DEC08	KD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

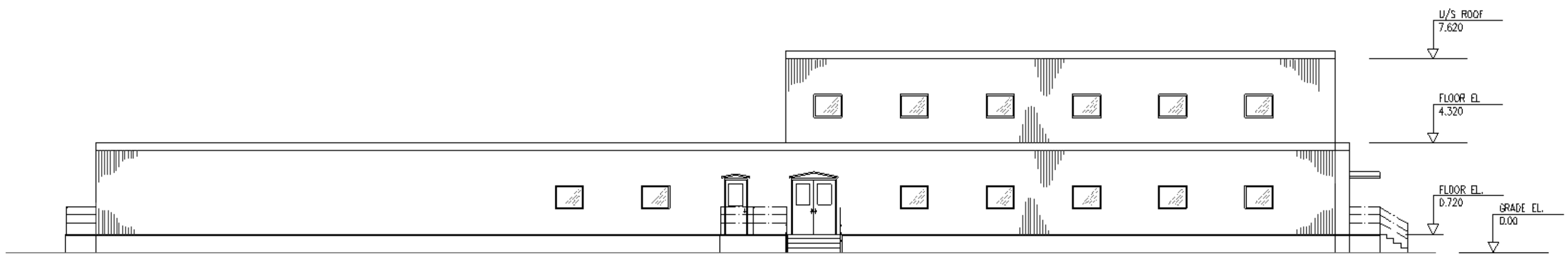
SECTION: ARCHITECTURAL
SCALE: 1:100
DESIGN BY: T. PRATT 30OCT08
DRAWN BY: T. PRATT 30OCT08
CHECK BY: J. R.
APP BY:

PACIFIC BOOKER MINERALS INC.

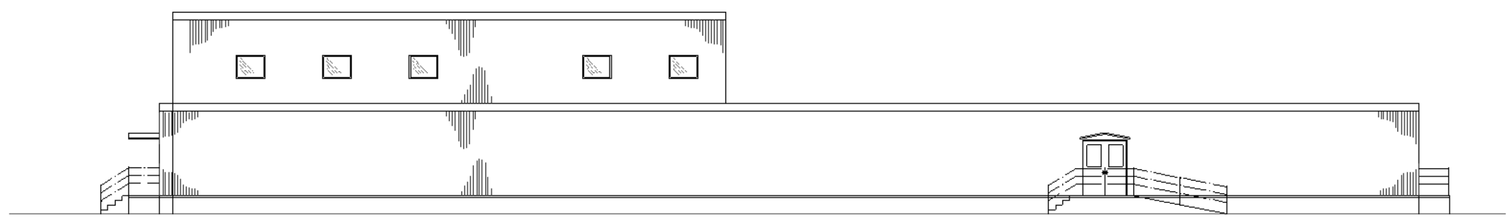
WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
ADMINISTRATION & MINE DRY BUILDING GENERAL ARRANGEMENT PLANS

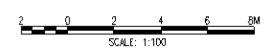
FILENAME: J111001.DWG | PROJECT NUMBER: 0652720100 | DRAWING NUMBER: J1-11-001 | REV. E



ELEVATION LOOKING EAST



ELEVATION LOOKING WEST



DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
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B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

CLIENT, PROJ.MAN., PROJ.ENG., PROCESS, ELECTR., INSTR., PIPING, MECH., STRUCT., SERVICES, ARCH., LAYOUT

SECTION: ARCHITECTURAL
SCALE: 1:100 — DATE
DESIGN BY: T. PRATT — 30OCT08
DRAWN BY: T. PRATT — 30OCT08
CHECK BY: J. R.
APP BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE **MORRISON COPPER/GOLD PROJECT**

ADMINISTRATION & MINE DRY BUILDING
GENERAL ARRANGEMENT
ELEVATIONS SHEET 1 OF 2

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
J111002.DWG	06527201.00	J1-11-002	E

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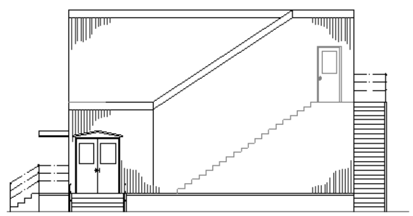
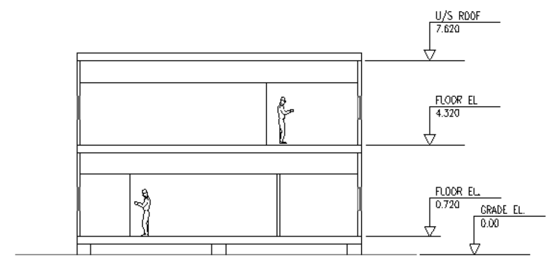
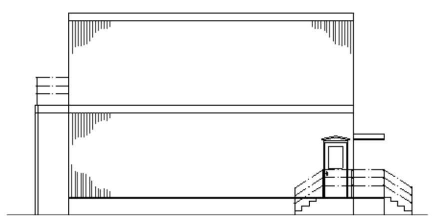


ELEVATION LOOKING NORTH



SECTION A / 001



ELEVATION LOOKING SOUTH

SCALE: 1:100

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DWG. NO.	REFERENCE DRAWINGS

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E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
D	1	ISSUED FOR CLIENT ACCEPTANCE	17DEC08	KD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: ARCHITECTURAL		
SCALE: 1:100		DATE
DESIGN. BY: T. PRATT		30OCT08
DRAWN BY: T. PRATT		30OCT08
CHECK. BY: J. R.		
APP. BY:		

pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

ADMINISTRATION & MINE DRY BUILDING
GENERAL ARRANGEMENT
ELEVATIONS SHEET 2 OF 2

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
J111003.DWG	0652720100	J1-11-003	E

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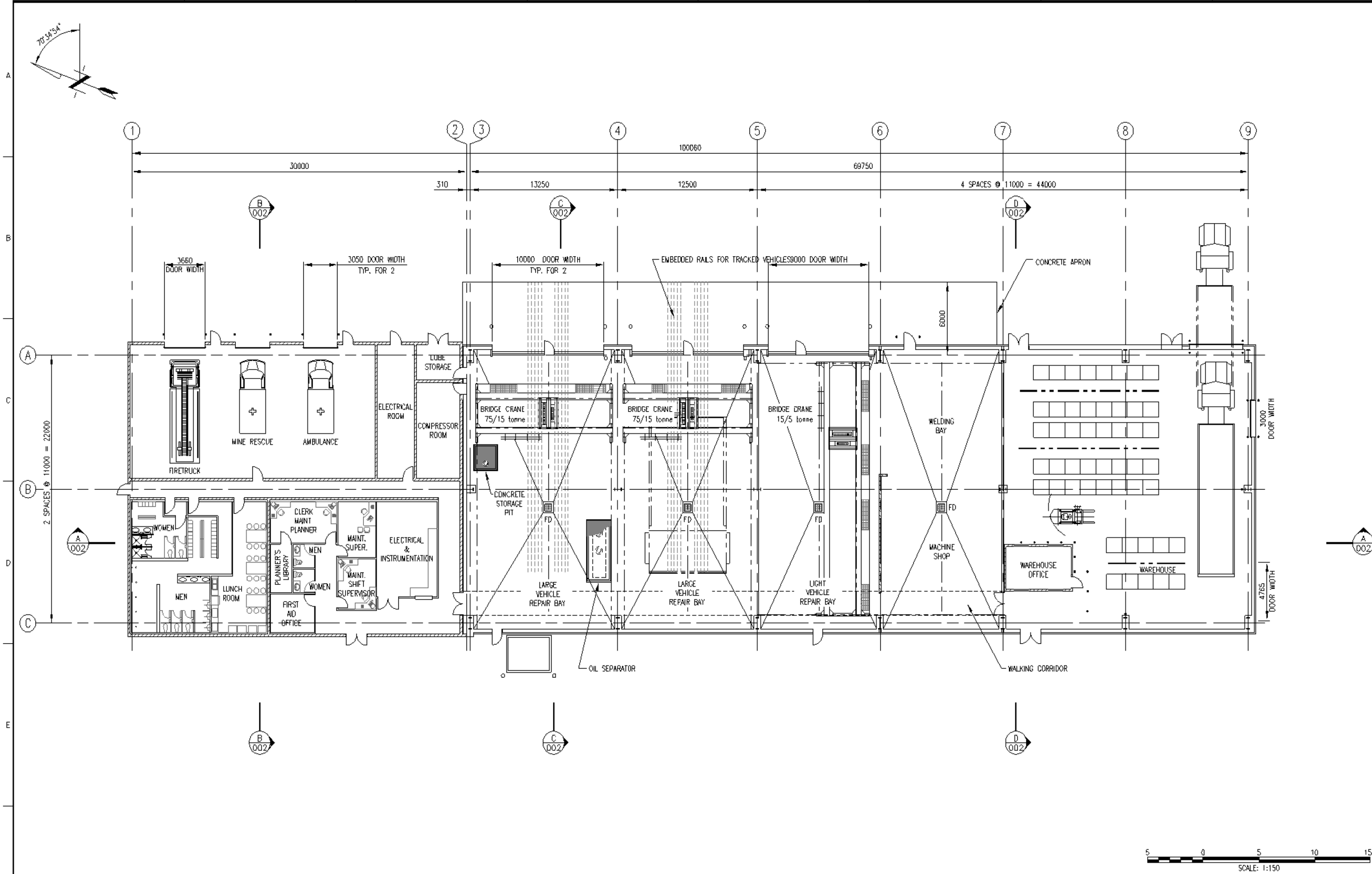

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	25MAY09	AO
D	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AO
C	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
B	1	ISSUED FOR GEOTECH REVIEW	11MAR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: ARCHITECTURAL
SCALE: 1:150
DESIGN BY: J.DIAZ 19MAR07
DRAWN BY: J.DIAZ 19MAR07
CHECK BY:
APP. BY:

DWG. NO. | REFERENCE DRAWINGS

pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
TRUCKSHOP AND WAREHOUSE GENERAL ARRANGEMENT PLAN

FILENAME: J211001.DWG | PROJECT NUMBER: 06527201.00 | DRAWING NUMBER: J2-11-001 | REV. E

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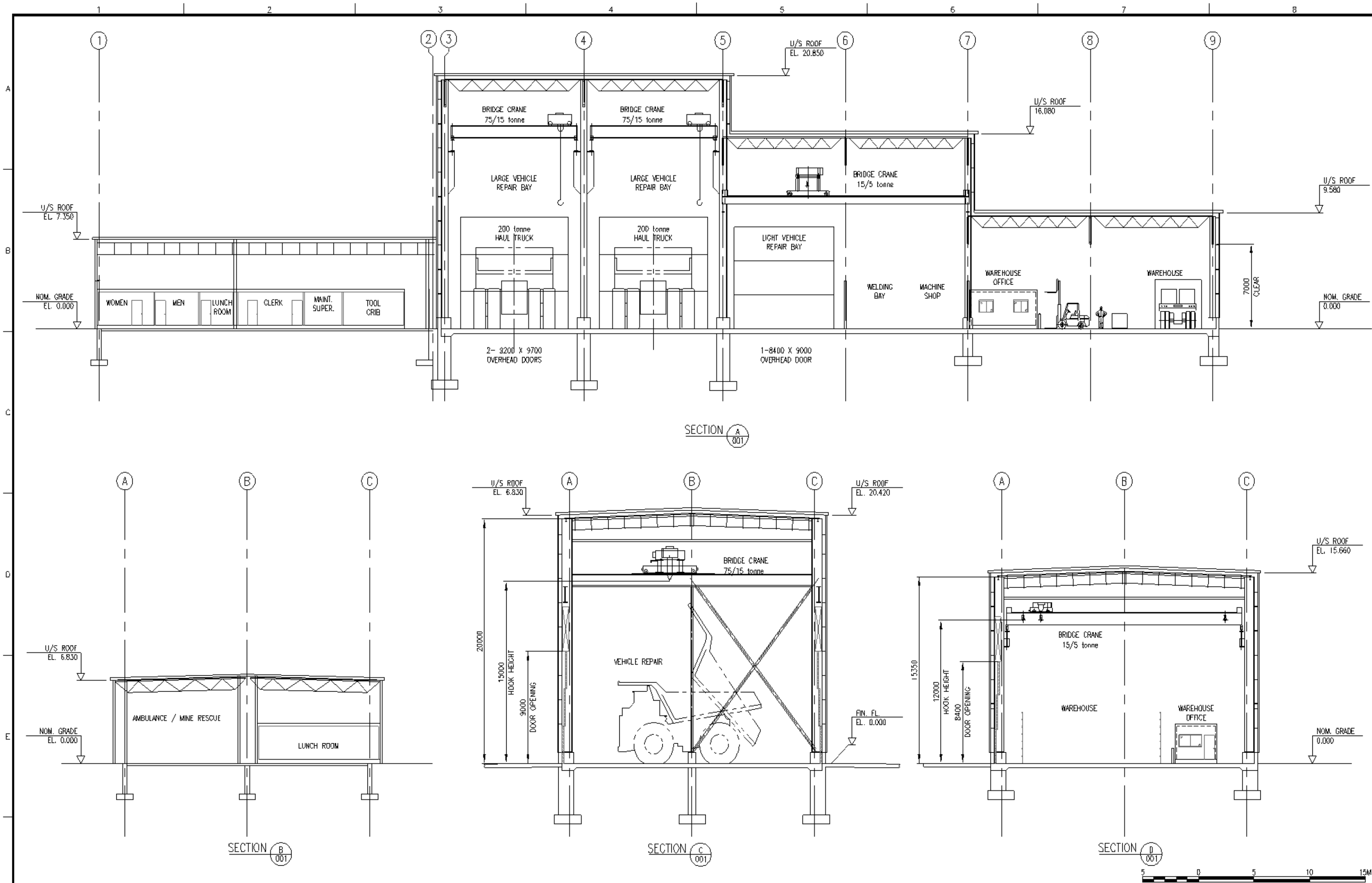

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E	1	ISSUED FOR FEASIBILITY REPORT	25MAY09	AO
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B	1	ISSUED FOR GEOTECH REVIEW	11MAR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

SECTION: ARCHITECTURAL
SCALE: 1:150 | DATE
DESIGN. BY: J.DIAZ | OCT07
DRAWN BY: J.DIAZ | OCT07
CHECK. BY:
APP. BY:

pbm
PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.

TITLE
MORRISON COPPER/GOLD PROJECT
TRUCKSHOP AND WAREHOUSE
GENERAL ARRANGEMENT
SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
J211002.DWG	06527201.00	J2-11-002	E

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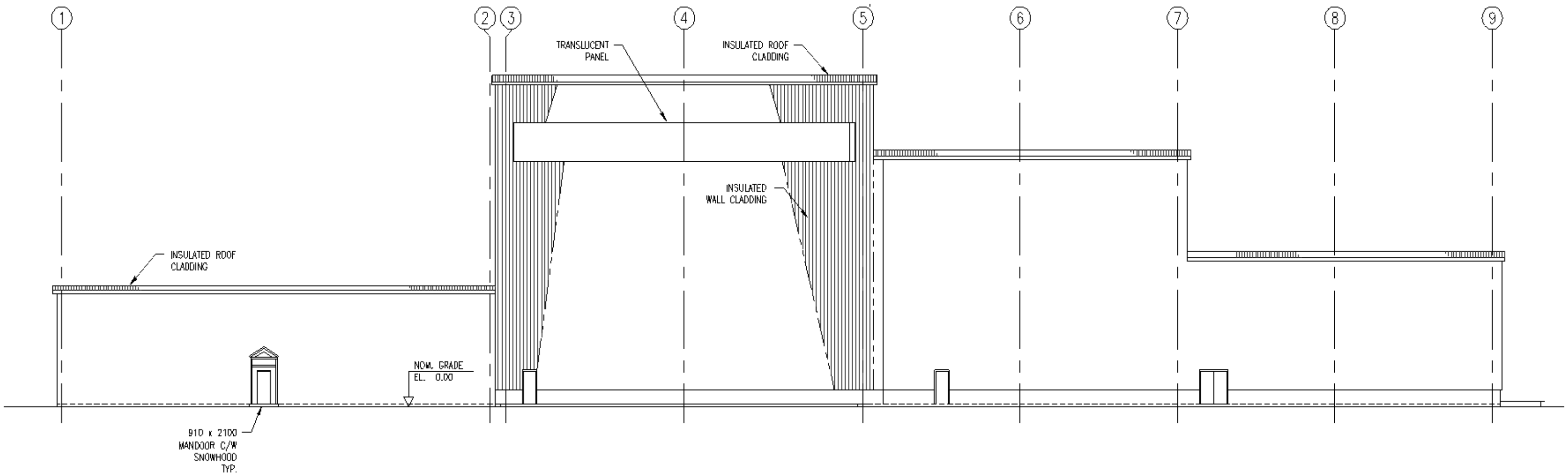
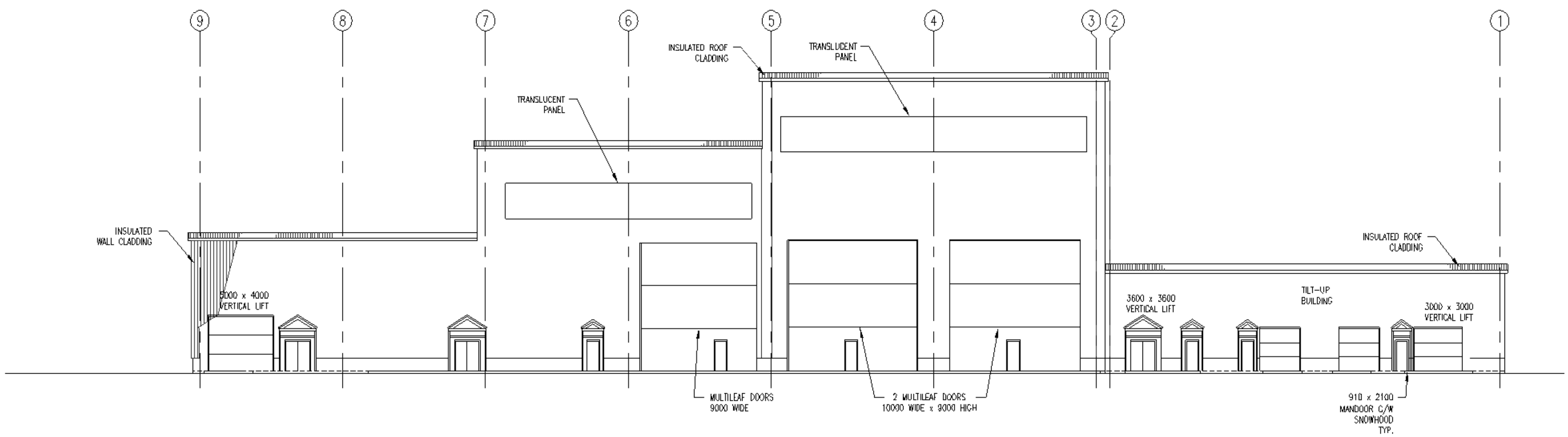


NORTH (FRONT) ELEVATION



SOUTH (BACK) ELEVATION
WAREHOUSE/TRUCKSHOP

SCALE: 1:150

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	25MAY09	AD
D	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
C	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
B	1	ISSUED FOR GEOTECH REVIEW	11MAR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: ARCHITECTURAL		
SCALE:	1:150	DATE
DESIGN BY:	J.DIAZ	21MAR07
DRAWN BY:	J.DIAZ	21MAR07
CHECK BY:		
APP BY:		

pbm
PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
TRUCKSHOP AND WAREHOUSE
GENERAL ARRANGEMENT
ELEVATIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
J211003.DWG	0652720100	J2-11-003	E

D-METRIC

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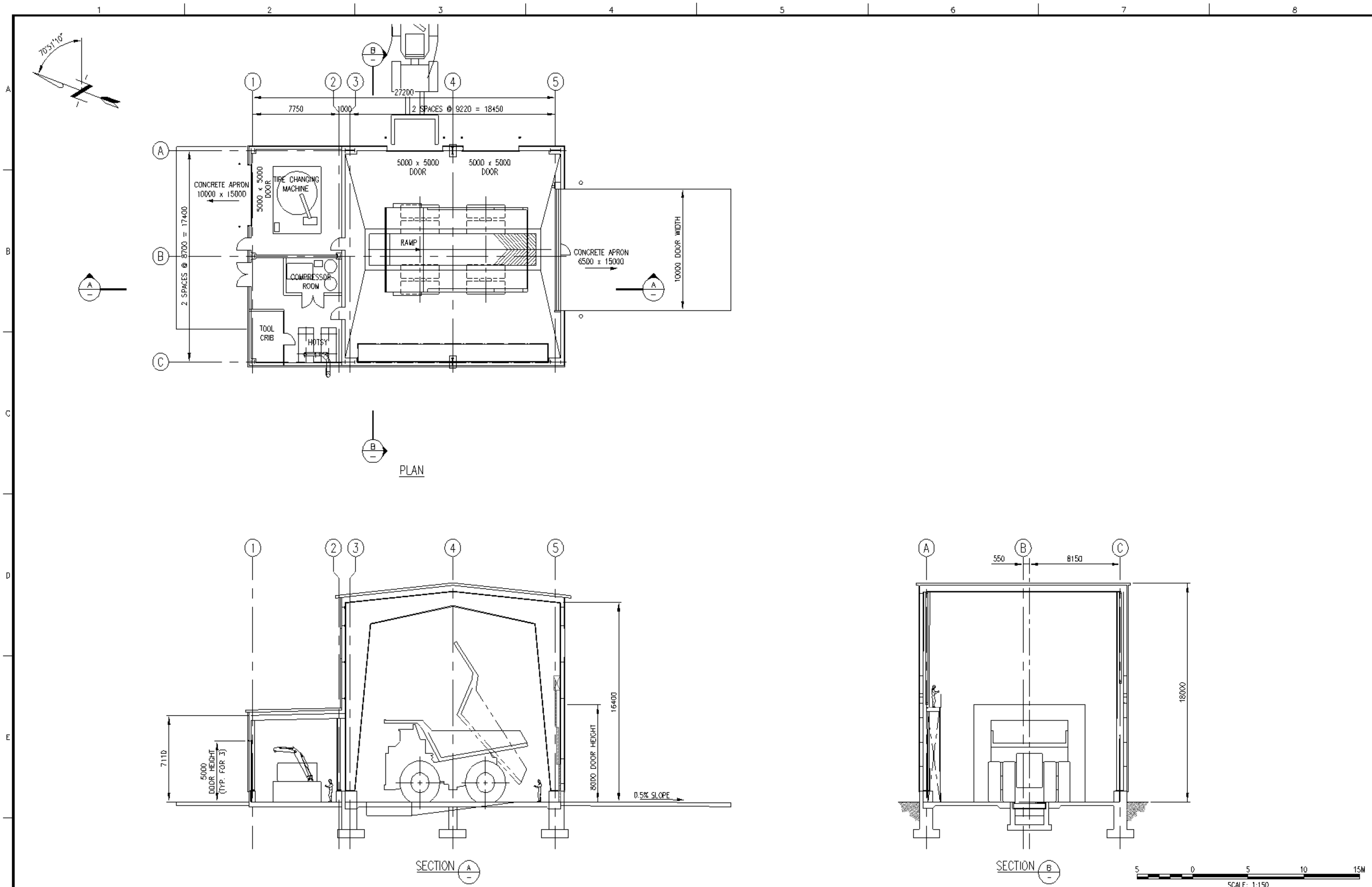

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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
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B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	ISSUED FOR CLIENT REVIEW	17MAR08	RHW

SECTION: ARCHITECTURAL		DATE
SCALE:	1:150	
DESIGN. BY:	MT	OCT07
DRAWN BY:	FH	NOV07
CHECK. BY:		
APP. BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
TRUCK WASH
PLAN AND SECTIONS

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
J611001.DWG	06527201.00	J6-11-001	D

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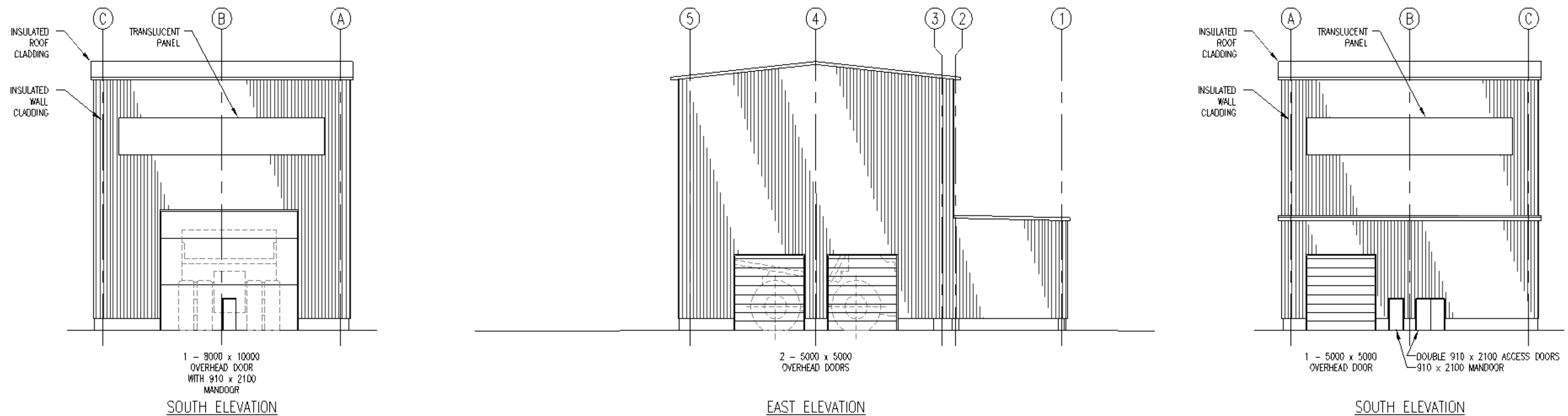

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
C	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	ISSUED FOR CLIENT REVIEW	17MAR08	RHW

DWG. NO.	REFERENCE DRAWINGS

SECTION: ARCHITECTURAL
SCALE: 1:150
DESIGN. BY: J.DIAZ — OCT07
DRAWN BY: J.DIAZ — OCT07
CHECK. BY:
APP. BY:

PACIFIC BOOKER MINERALS INC.
OCT07

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
TRUCK WASH ELEVATIONS

FILENAME	PROJECT NUMBER	DRAWING NUMBER	REV.
J611002.DWG	0652720100	J6-11-002	D

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\11-ARCH\DWG\J611002.DWG

PIPE LINE NUMBER

6"–WPR–A01234–CABT01

- MATERIAL SPECIFICATION CODE
- LINE NUMBER } UNIQUE NUMBER
- AREA NUMBER } UNIQUE NUMBER
- SERVICE CODE
- PIPE SIZE (IMPERIAL)

VALVE NUMBER

- VALVE SPECIFICATION
- VALVE SIZE (IMPERIAL)

PIPING LINE SYMBOLS

- MATERIAL FLOW (NO PIPING)
- MAIN PROCESS FLOW
- SECONDARY PROCESS FLOW
- SERVICES FLOW
- BYPASS FLOW
- EXISTING FLOW
- VENDOR SUPPLIED LINE

REFERENCE DRAWING

B1 | AD-13-001

- DRAWING NUMBER
- LOCATION ON DRAWING

PIPE SIZES

INCHES	MM	INCHES	MM	INCHES	MM
1/8"	= 6	3"	= 80	42"	= 1050
1/4"	= 8	4"	= 100	44"	= 1100
3/8"	= 10	5"	= 125	46"	= 1150
1/2"	= 15	6"	= 150	48"	= 1200
3/4"	= 20	8"	= 200	50"	= 1250
1"	= 25	10"	= 250	52"	= 1300
1-1/4"	= 32	12"	= 300	54"	= 1350
1-1/2"	= 40	14"	= 350	56"	= 1400
2"	= 50	16"	= 400	58"	= 1450
2-1/2"	= 65	18"	= 450	60"	= 1500
		20"	= 500	64"	= 1600
		22"	= 550	72"	= 1800
		24"	= 600	80"	= 2000
		26"	= 650	88"	= 2200
		28"	= 700	96"	= 2400
		30"	= 750	104"	= 2600
		32"	= 800	112"	= 2800
		34"	= 850	120"	= 3000
		36"	= 900	128"	= 3200
		38"	= 950	136"	= 3400
		40"	= 1000	144"	= 3600

PIPE SERVICE CODES

CODE	SERVICE
ABL	AIR – BLOWER
AHP	AIR – HIGH PRESSURE
AIN	AIR – INSTRUMENT
APL	AIR – PLANT
OLH	OIL – LUBE, HIGH PRESSURE
PDR	PROCESS – DRAIN
POF	PROCESS – OVERFLOW
PSC	PROCESS – SLURRY CONCENTRATE
PSL	PROCESS – SLURRY
RFL	REAGENT – FLOCCULANT
RKE	REAGENT – KEROSENE
RLM	REAGENT – LIME
RMI	REAGENT – MIBC
RPO	REAGENT – PINE OIL
RPX	REAGENT – PAX
WDR	WATER – DRAIN
WFI	WATER – FIRE
WFR	WATER – FRESH
WGS	WATER – GLAND
WPR	WATER – PROCESS
WPO	WATER – POTABLE
WRE	WATER – RECLAIM
XVN	VACUUM

PIPE SPECIFICATION CODES

CODE	MATERIAL SPECIFICATION
CABA42	CARBON STEEL – BUTT WELD
CABG61	CARBON STEEL – GROOVED
CABG62	CARBON STEEL – GROOVED
CABS22	CARBON STEEL – SCH 80 – SOCKET WELD
CABT01	CARBON STEEL, MALLABLE IRON – THREADED
CGBT02	CARBON STEEL, GALVANIZED – THREADED
CRBA41	CARBON STEEL – BUTT WELD – RUBBER LINED
CRBG63	CARBON STEEL, RUBBER LINED – GROOVED
HFBX27	HDPE – BUTT FUSED
HOBF84	HOSE, CARBON STEEL
NABS24	COPPER P.E.
PEXU81	TEFLON (PFT) TUBING
SGBA42	STAINLESS STEEL – BUTT WELD

INSTRUMENT TAG NO. SYSTEM

EACH INSTRUMENT IS IDENTIFIED BY A COMBINATION OF LETTERS AND NUMBERS. THE LETTERS ARE SELECTED FROM TABLE 1 TO CLASSIFY THE INSTRUMENT. THE LETTERS ARE FOLLOWED BY A LOOP NUMBER.

THE LOOP IDENTIFICATION NUMBERS WILL BE COMMON TO ALL INSTRUMENTS WITHIN THAT LOOP. A LETTER SUFFIX IS ADDED TO DIFFERENTIATE BETWEEN INSTRUMENTS BEARING THE SAME LETTER PREFIX WITHIN ANY GIVEN LOOP.

EXAMPLE:

11	F	IC	2034	A
AREA NUMBER	FIRST LETTER	SUCCEEDING LETTERS	SEQUENTIAL NUMBER	SUFFIX IF REQUIRED
	FUNCTIONAL IDENTIFICATION		LOOP NUMBER	
INSTRUMENT TAG NUMBER				

TABLE 1

LETTER IDENTIFICATION

	FIRST LETTER: MEASURED OR INITIATING VARIABLE	FIRST LETTER: MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING LETTERS: OUTPUT FUNCTION	SUCCEEDING LETTERS: MODIFIER
A	ANALYSIS	AUDIO	ALARM		
B	BURNER, COMBUSTION				
C	CONDUCTIVITY			CONTROL	
D	DENSITY OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW	RATIO			
G	GAUGING		GLASS		
H	HAND OPERATED				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME	RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT(PILOT)		LOW
M	MATERIAL SIZE ON MASS				MIDDLE OR INTER.
N	METAL DETECTION				
O	TORQUE		ORIFICE(RESTRICT.)		
P	PRESSURE OR VACUUM		POINT(TEST CONNECT)		
Q	QUANTITY	INTEGRATE OR TOTALIZE			
R	RADIOACTIVITY	RATIO	RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE			MULTIFUNCTION	
V	VISCOSITY OR VIBRATION			VALVE OR DAMPER	
W	WEIGHT OR FORCE		WELL		
X	SYSTEM			UNCLASSIFIED	
Y	EVENT, STATE OR PRESCENCE			RELAY OR COMPUTE	
Z	POSITION, DIMENSION			DRIVE ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

PIPING INSTRUMENT SYMBOLS

- TILT SWITCH
- MAGNETIC FLOW METER
- TURBINE OR PROPELLED FLOWMETER
- PITOT
- AVERAGING PITOT TUBE
- POSITIVE DISPLACEMENT FLOWMETER
- VORTEX FLOWMETER
- SONIC FLOWMETER
- ROTAMETER
- IMPACT
- SIGHT GLASS
- WEIR
- VENTURI
- RUPTURE DISK
- DIAPHRAGM SEAL
- INSTRUMENT WITH THERMOWELL
- VARIABLE AREA FLOW METER
- OTHER IN LINE INSTRUMENT SERVICE
- ALL TYPES OF CONTROL VALVES UNLESS OTHERWISE DESIGNATED

- XX INSTRUMENT SUPPLY (XX – SUPPLY PRESSURE IN PSI)
- CONNECTION TO PROCESS
- UNDEFINED SIGNAL
- MECHANICAL LINK
- SOFTWARE OR DATA LINK
- CAPILLARY TUBE
- HYDRAULIC SIGNAL
- PNEUMATIC SIGNAL
- PNEUMATIC BINARY SIGNAL
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED)
- ELECTRICAL BINARY SIGNAL
- ELECTRICAL SIGNAL

NOTE:
DASHED LINES BETWEEN ELECTRICAL COMPONENTS AND/OR INTERLOCK SYMBOLS ARE ONLY INTENDED TO SHOW THAT THESE COMPONENTS MAKE UP A PARTICULAR SYSTEM. THESE CONNECTING LINES DO NOT SHOW THE ACTUAL ELECTRICAL WIRING. FOR CIRCUIT DETAILS, REFER TO INSTRUMENTATION LOOP SHEETS OR ELECTRICAL DRAWING. ARROW HEAD OR DASHED LINE SHOWS DIRECTION OF ELECTRICAL TRIP.

PIPING SYMBOLS

- GATE VALVE
- KNIFE GATE VALVE
- GLOBE VALVE
- CHECK VALVE
- BUTTERFLY VALVE OR DAMPER
- PLUG VALVE
- PINCH VALVE
- BALL VALVE
- DIAPHRAGM VALVE
- NEEDLE VALVE
- RELIEF VALVE
- 3-WAY VALVE
- 4-WAY VALVE
- SURGE ANTICIPATOR VALVE
- FAIL SAFE TRIP VALVE
- SCUTTLE VALVE
- DOLE VALVE
- PULSATION DAMPER
- ROTARY FEEDER
- DART VALVE
- CON RED CONCENTRIC REDUCER
- ECC RED ECCENTRIC REDUCER
- TECH TAYLOR VALVE
- SPRAY NOZZLE

- HOSE COUPLING
- SCREWED CAP
- BUTT WELD CAP
- NOZZLE
- VICTAULIC COUPLING
- ORIFICE
- BLIND FLANGE
- FILTER
- IN LINE MIXER
- EXPANSION JOINT
- Y-STRAINER
- AUTOMATIC DRAIN / STEAM TRAP
- START UP STRAINER
- FH FIRE HYDRANT
- SPECTACLE BLIND
- FLEXIBLE HOSE
- TP 001 TIE IN POINT
- VENDOR SUPPLIED
- LUBRICATOR
- CLOSED CIRCUIT TELEVISION
- FIRE HOSE REEL
- MARIC VALVE
- FLOAT VALVE (MECHANISM)
- STRAINER

GENERAL INSTRUMENT SYMBOLS

- INSTRUMENT, SUPPLIED WITH EQUIPMENT
- INSTRUMENT, LOCALLY MOUNTED
- INSTRUMENT, FRONT PANEL MOUNTED
- INSTRUMENT, REAR PANEL MOUNTED
- INSTRUMENT, FIELD PANEL MOUNTED
- INSTRUMENT, PILOT LIGHT / INDICATING LIGHT
- INSTRUMENT, TWO VARIABLES OR DUAL FUNCTION
- INSTRUMENT, EXISTING
- INSTRUMENT, CONTROL SYSTEM FUNCTION DELTA V CONTROL SYSTEM VIDEO DISPLAY, INTERFACE NORMALLY ACCESSIBLE TO OPERATOR
- M XXXX MOTOR DRIVE NUMBER
- TYPICAL MOTOR CONTROL
- GENERALISED FOR INTERLOCK LOGIC, HARD WIRED
- P PURGE OR FLUSHING DEVICE
- Σ SUMMING
- Δ DIFFERENCE
- √ SQUARE ROOT EXTRACTOR
- f(x) NON LINEAR OR UNSPECIFIED FUNCTION
- X MULTIPLY
- ÷ DIVIDE

2 ← LOGIC DIAGRAM NUMBER

INTERLOCK NUMBER

NOTE:
DEVICES SHARING COMMON INTERLOCK NUMBERS ARE INTERRELATED.

- AS AIR SUPPLY
- GS GAS SUPPLY
- HS HYDRAULIC SUPPLY
- NS NITROGEN SUPPLY
- SS STEAM SUPPLY
- WS WATER SUPPLY
- PA PROCESS AIR SUPPLY
- IA INSTRUMENT AIR SUPPLY

VALVE ACTUATORS

- DIAPHRAM
- CYLINDER DOUBLE ACTING
- PRESSURE RELIEF
- HAND
- SELF CONTAINED PRESSURE REGULATOR
- DIGITAL
- SOLENOID
- MOTOR OPERATED
- ELECTROHYDRAULIC
- SPRING RETURN CYLINDER (FAIL OPEN OR FAIL CLOSED)

AUXILIARY SYMBOLS

- INSULATED LINE
- INSULATED LINE, STEAM
- INSULATED LINE, GLYCERIN
- INSULATED LINE, HEAT TRACE
- INSULATED LINE, THERMAL INSULATION
- PP INSULATED LINE, PERSONAL PROTECTION
- SPEC SPEC CHANGE OF PIPE SPECIFICATION
- CHANGE OF LINE NUMBER
- SPEC SPEC CHANGE OF PIPE SPECIFICATION & LINE NUMBER
- SPEC SPEC BATTERY LIMITS
- DOUBLE PIPING
- AC 101 AIR CONNECTION ONLY
- WC 101 WATER CONNECTION ONLY
- AHS 101 AIR HOSE STATION
- WHS 101 WATER HOSE STATION
- SEW 101 SHOWER & EYEWASH STATION

ABBREVIATIONS

(EXTERNAL TO INSTRUMENT IDENTIFICATION SYMBOLS)

AS	AIR SUPPLY	MH	MANHOLE
A/M	AUTO/MANUAL	N.C.	NORMALLY CLOSED
CC	CENTRAL CONTROL ROOM	N.O.	NORMALLY OPEN
DIR	DIRECT ACTING	P	PNEUMATIC
E	VOLTAGE	R	RESISTANCE
ES	ELECTRICAL SUPPLY	R/L	REMOTE/LOCAL
F.C.	FAIL CLOSED	RSP	REMOTE SET POINT
F.O.	FAIL OPEN	REV	REVERSE ACTING
FF	FAIL FLOATS	RTD	RESISTANCE TEMP. DETECTOR
FI	FAIL INTERMEDIATE	SP	SET POINT
FL	FAIL LAST POSITION	S	SOLENOID ACTUATOR
H/A	HAND AUTOMATIC	TC	THERMOCOUPLE
H/S	HIGH SELECT	T/N	TEST/NORMAL
HS	HYDRAULIC SUPPLY	WS	WATER SUPPLY
IL	INSULATION LIMIT		
IP	INSPECTION PORT		
ISO	ISOLATOR		

* = CONVERSIONS

- E = VOLTAGE
- I = CURRENT
- P = PNEUMATIC
- A = ANALOG
- B = BINARY
- F = FREQUENCY
- H = HYDRAULIC
- R = RESISTANCE

/ INPUT OUTPUT

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CLIENT · PROJ. MAN. · PROJ. ENG. · PROCESS · ELECTR. · INSTR. · PIPING · MECH. · STRUCT. · SERVICES · ARCH. · LAYOUT

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LEGENDS AND SYMBOLS PIPING & INSTRUMENTATION DIAGRAM No.1

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
AD13001.DWG	06527201.00	A0-13-001	D

D-METRIC

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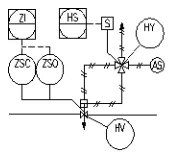
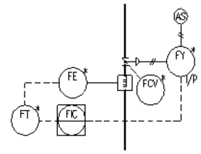
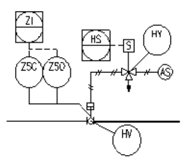


TYPE 1
HAND VALVE INSTRUMENTS



TYPE 5
FLOW CONTROL INSTRUMENTS



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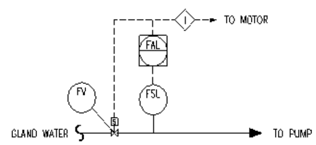
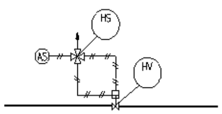


TYPE 6
GLAND WATER TYPICAL



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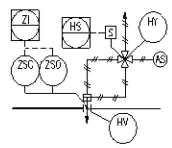
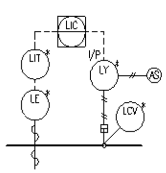
HAND VALVE INSTRUMENTS



TYPE 7
HAND VALVE INSTRUMENTS



TYPE 4
LEVEL CONTROL INSTRUMENTS

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INSTRUMENTATION DETAILS
PIPING & INSTRUMENTATION
DIAGRAM No.2

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013002.DWG	06527201.00	A0-13-002	D

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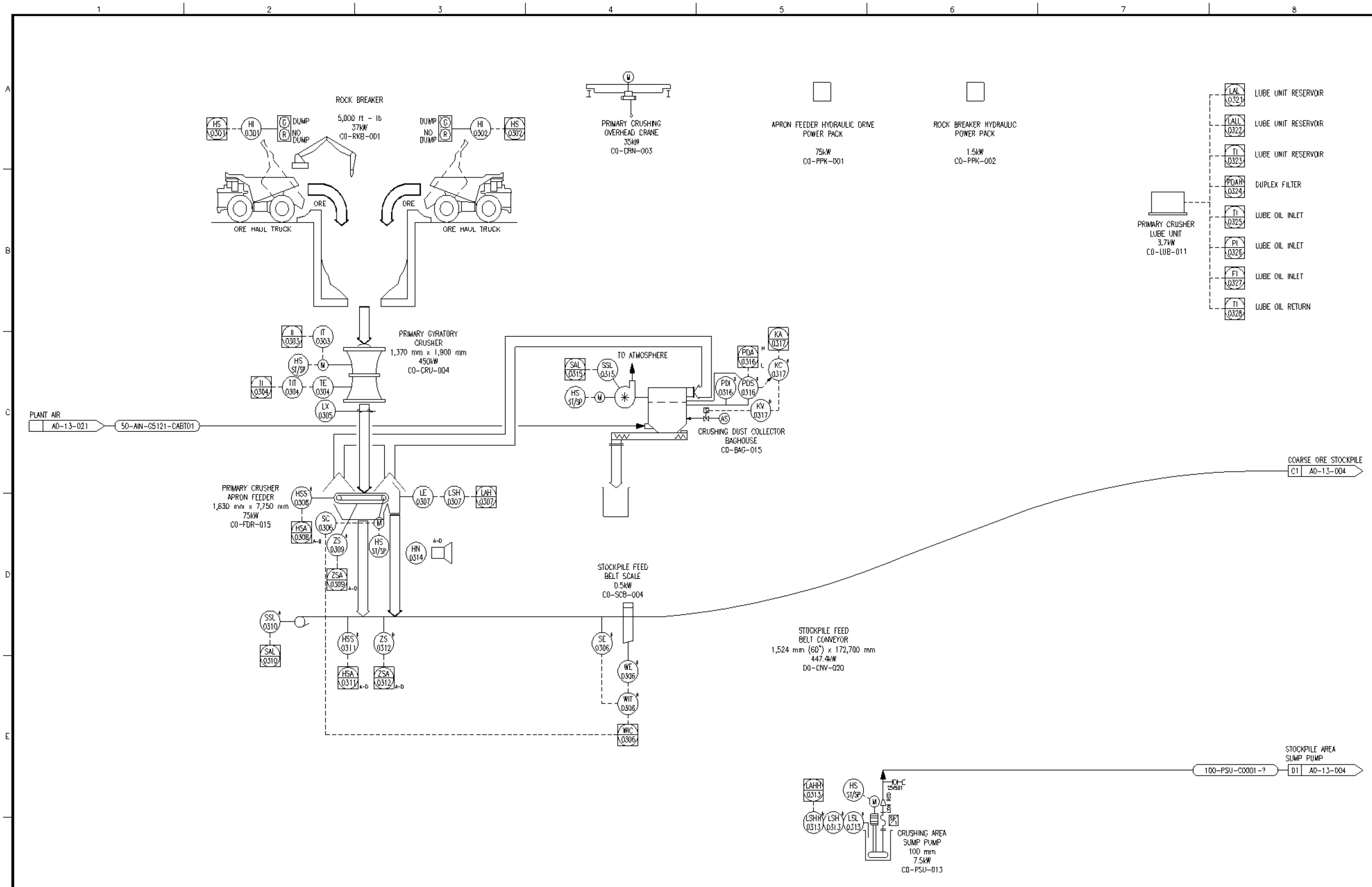

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SCALE: NONE		DATE
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TITLE MORRISON COPPER/GOLD PROJECT
PRIMARY CRUSHING
PIPING & INSTRUMENTATION
DIAGRAM No.3

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013003.DWG	06527201.00	A0-13-003	D

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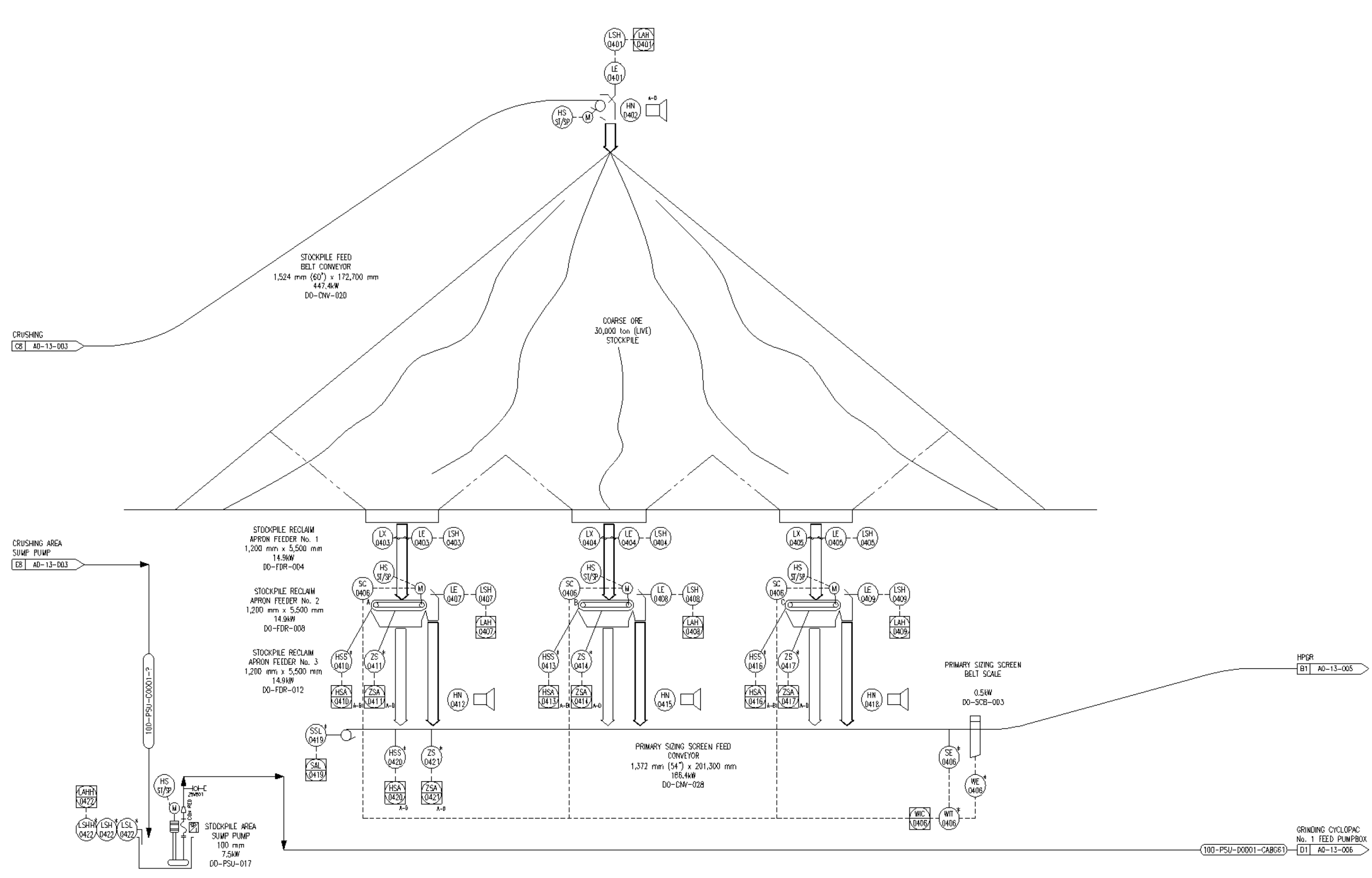

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SCALE:	NONE	
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COARSE ORE STOCKPILE & RECLAIM PIPING & INSTRUMENTATION DIAGRAM No.4

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
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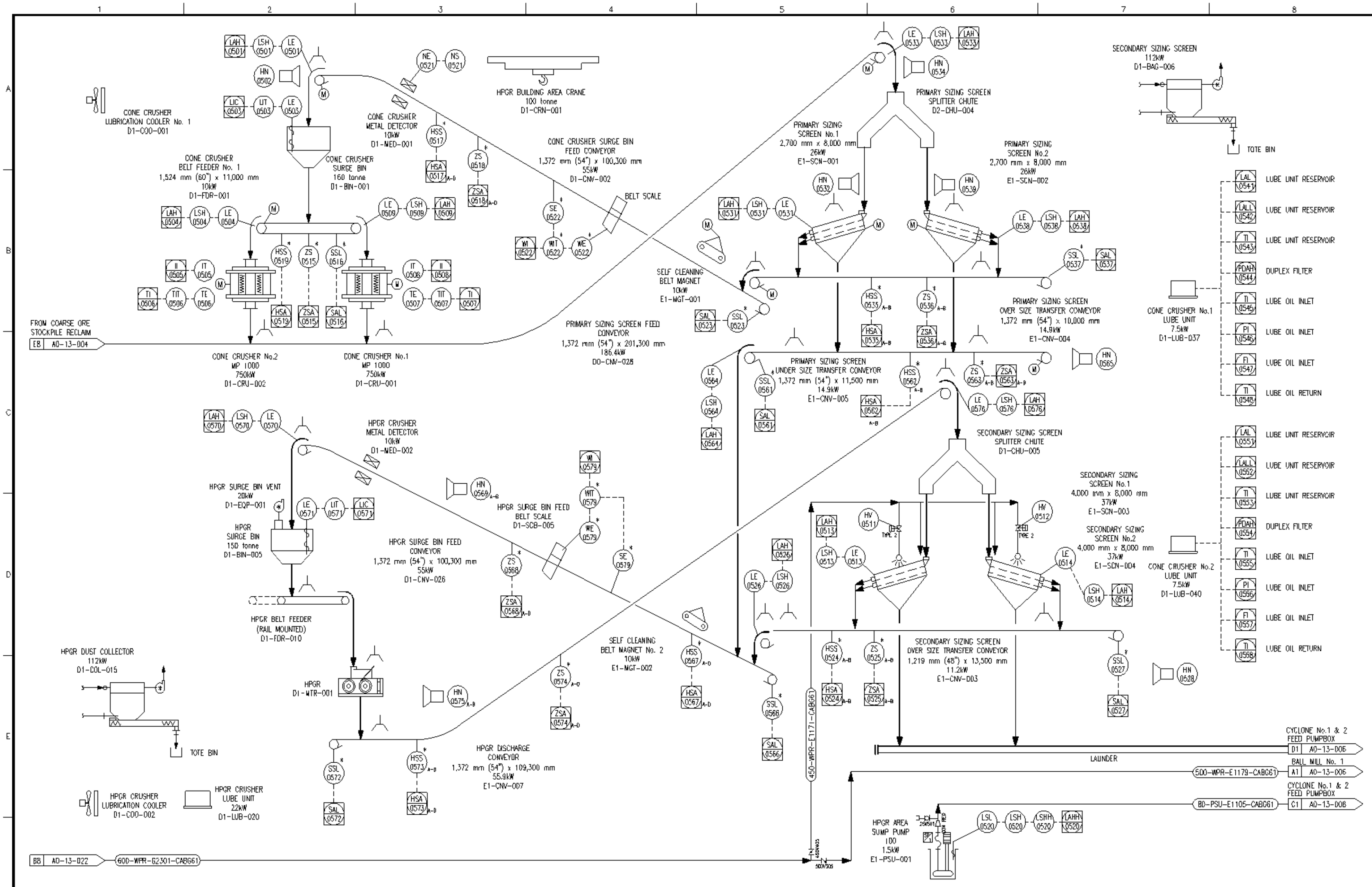

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TITLE: MORRISON COPPER/GOLD PROJECT
GRINDING – HPGR
PIPING & INSTRUMENTATION
DIAGRAM No.5

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013005.DWG	06527201.00	A0-13-005	D

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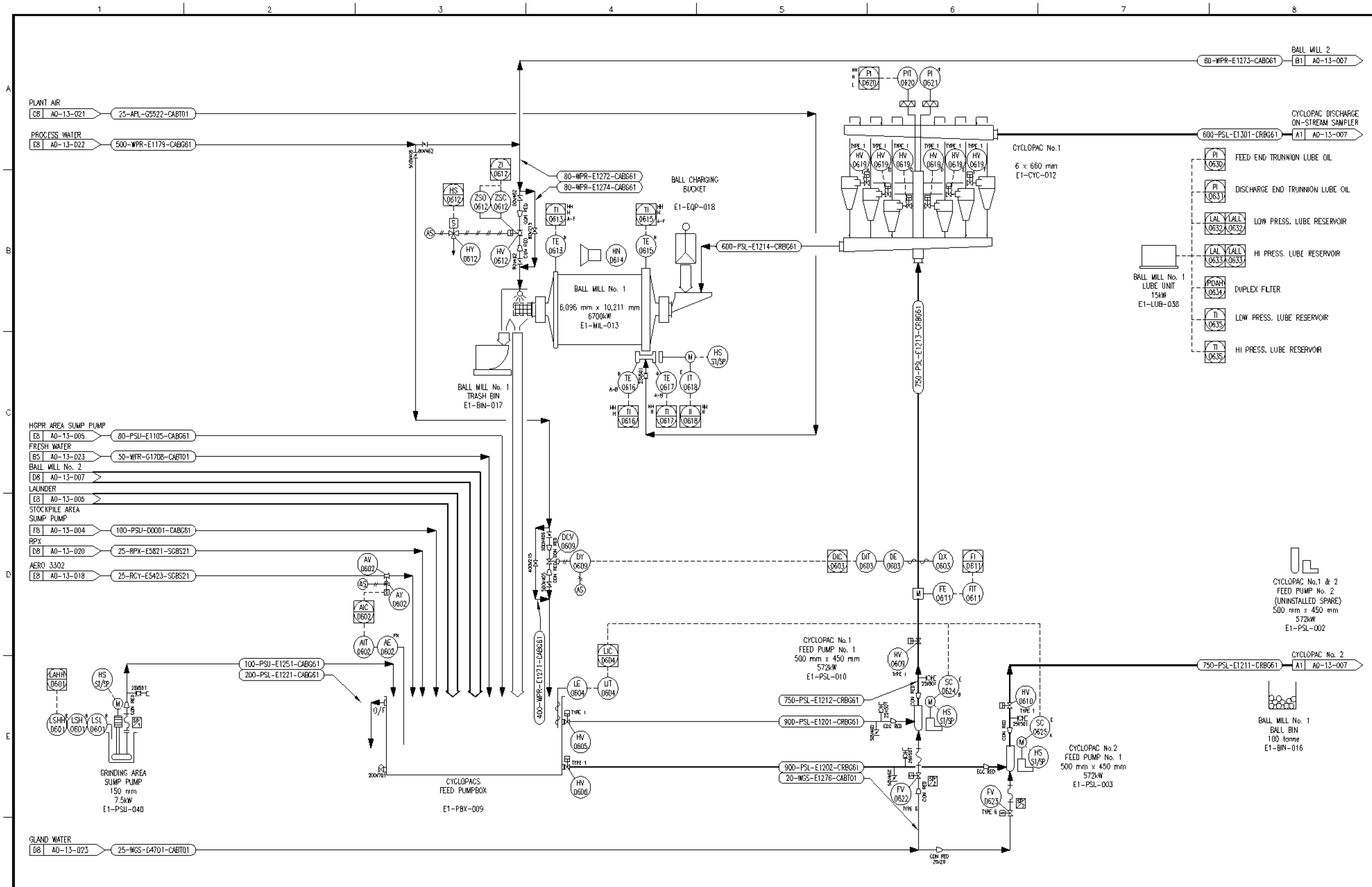

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SCALE:	NONE	DATE
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DRAWN BY:	DH/PL	FEB07
CHECK. BY:		
APP BY:		

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TITLE **MORRISON COPPER/GOLD PROJECT**

GRINDING – BALL MILL No. 1
PIPING & INSTRUMENTATION
DIAGRAM No.6

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
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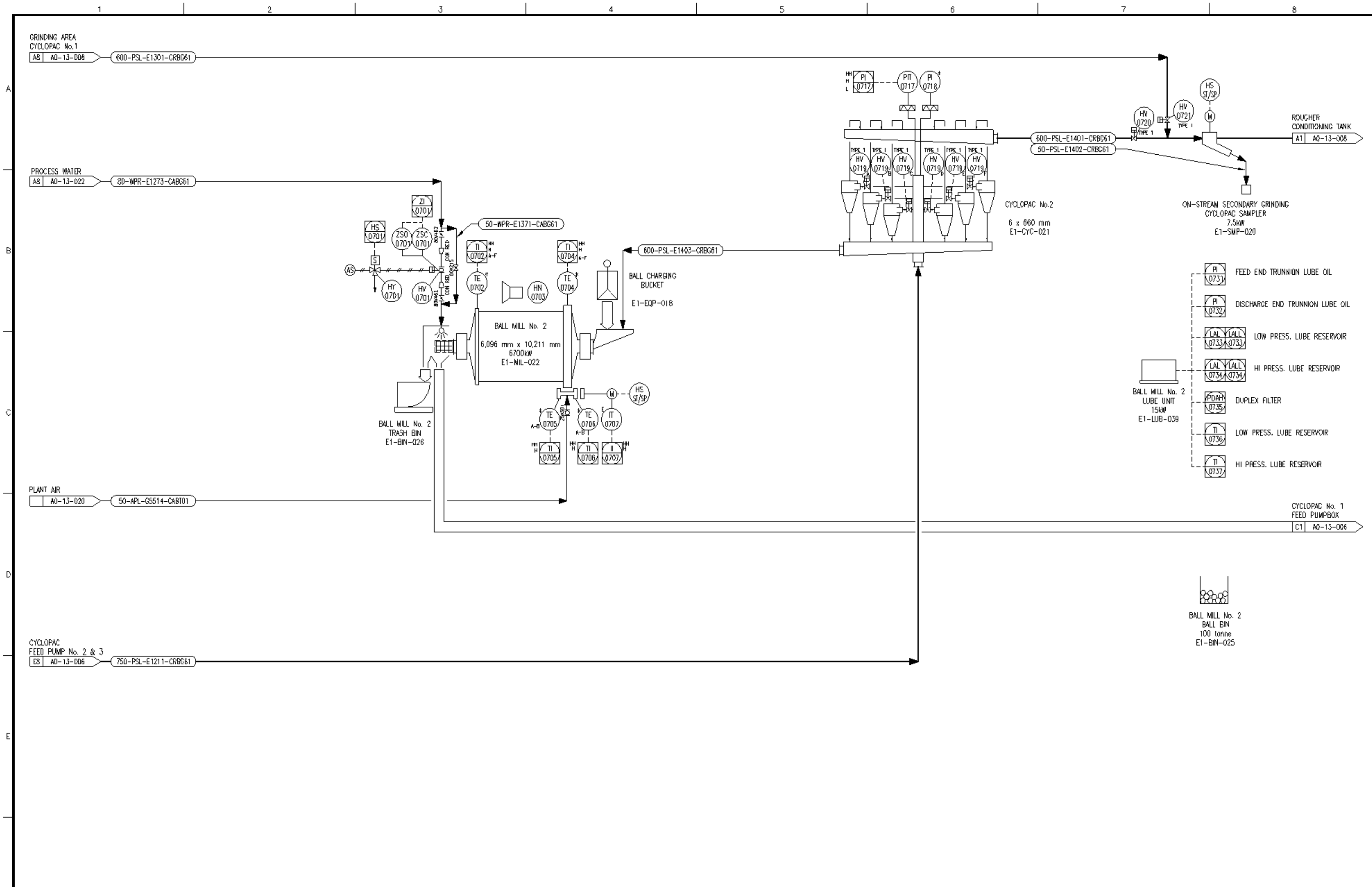

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SECTION: PIPING	
SCALE: NONE	DATE
DESIGN. BY: EA/DM	FEB07
DRAWN BY: DH/PL	FEB07
CHECK. BY:	
APP BY:	

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TITLE **MORRISON COPPER/GOLD PROJECT**

GRINDING – BALL MILL No. 2
PIPING & INSTRUMENTATION
DIAGRAM No.7

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013007.DWG	06527201.00	A0-13-007	D

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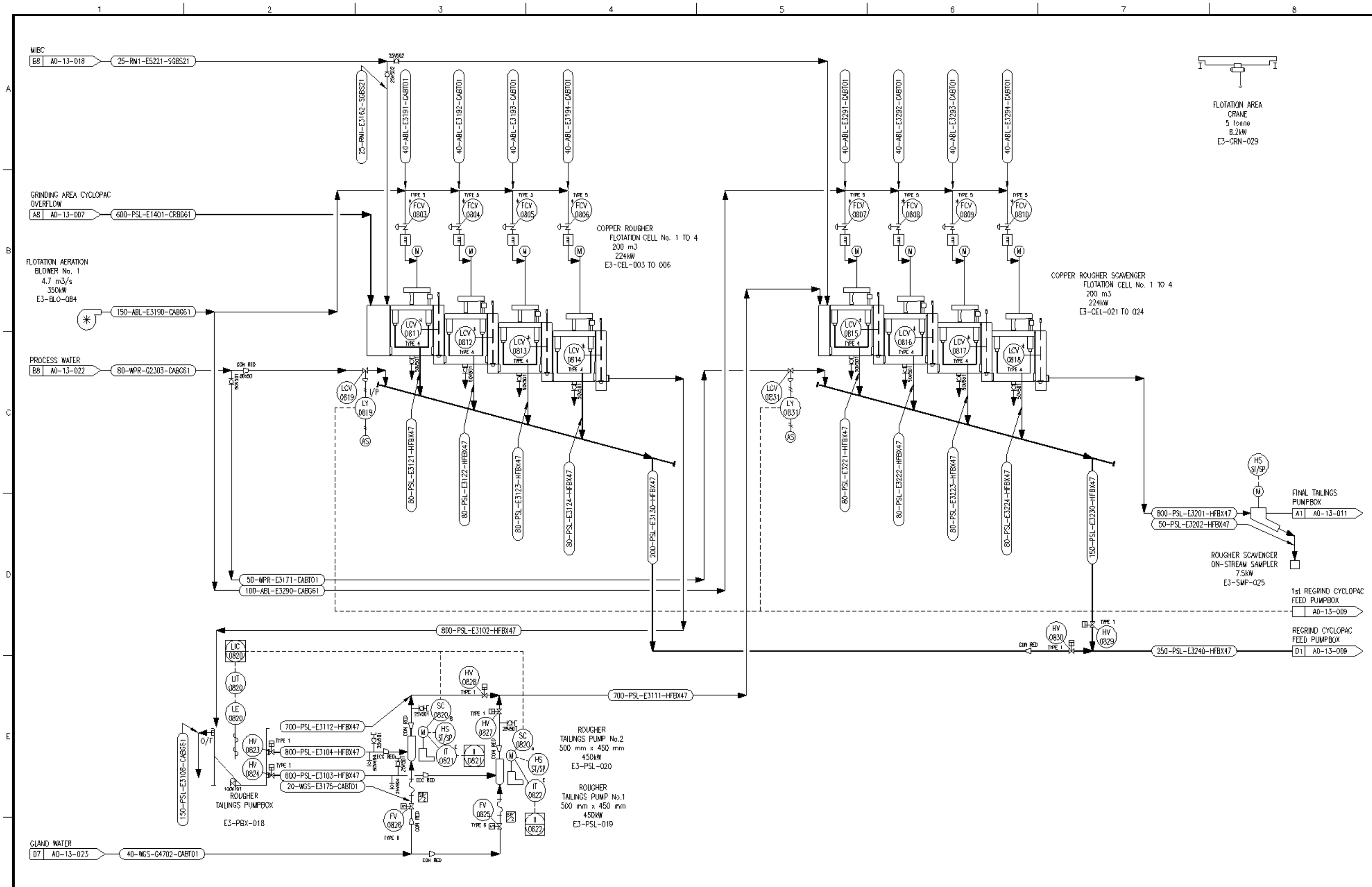

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DWG. NO. | REFERENCE DRAWINGS

SECTION: PIPING
SCALE: NONE
DESIGN. BY: EA/DM FEB07
DRAWN BY: DH/PL FEB07
CHECK. BY:
APP BY:

PACIFIC BOOKER MINERALS INC.

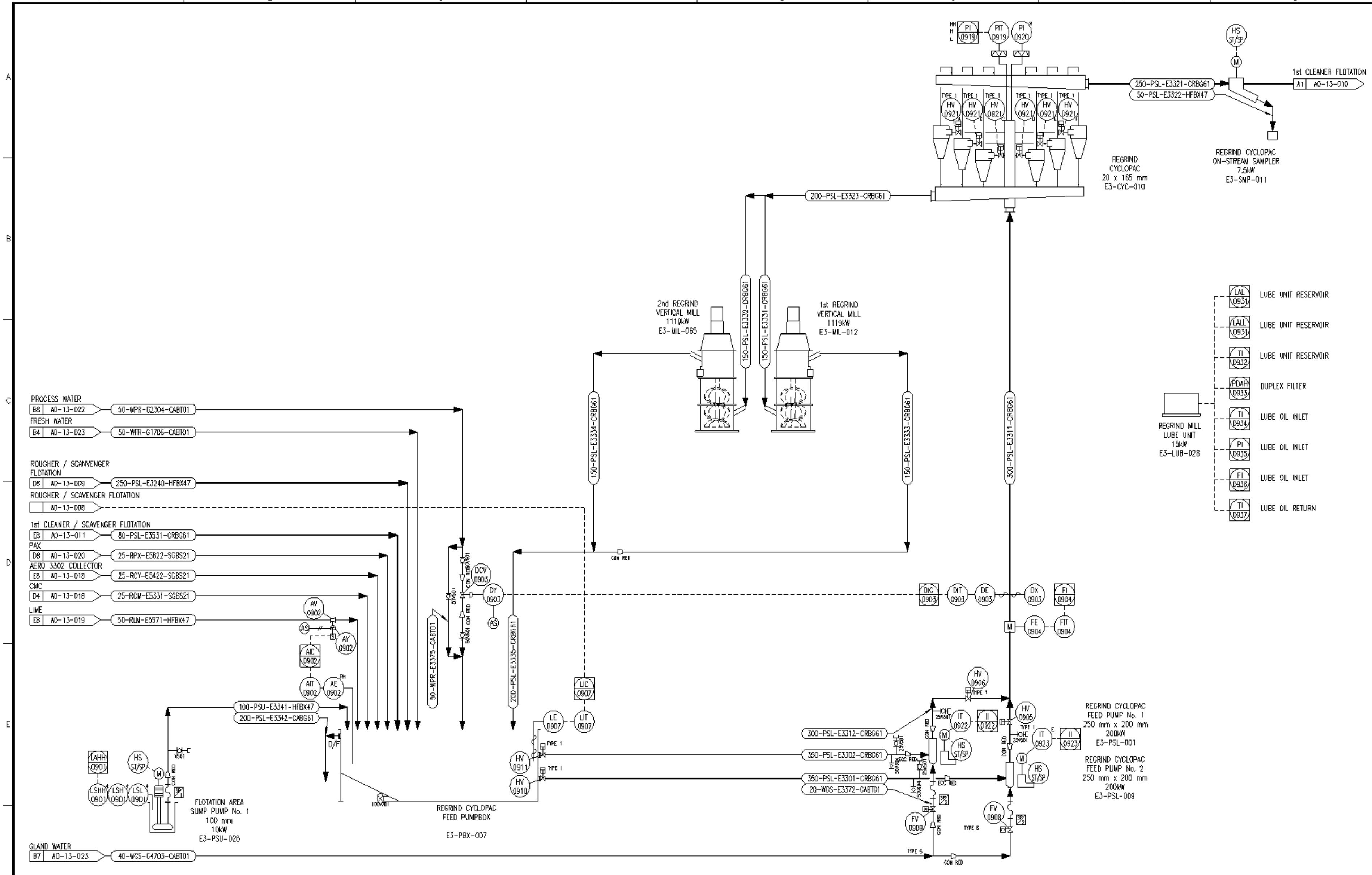
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

FLOTATION – ROUGHER / SCAVENGER PIPING & INSTRUMENTATION DIAGRAM No.8

FILENAME: A013008.DWG | PROJECT NUMBER 06527201.00 | DRAWING NUMBER A0-13-008 | REV. D

U:\W-S\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013008.DWG



DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING
SCALE: NONE — DATE
DESIGN. BY: EA/DM — FEB07
DRAWN BY: DH/PL — FEB07
CHECK. BY:
APP BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

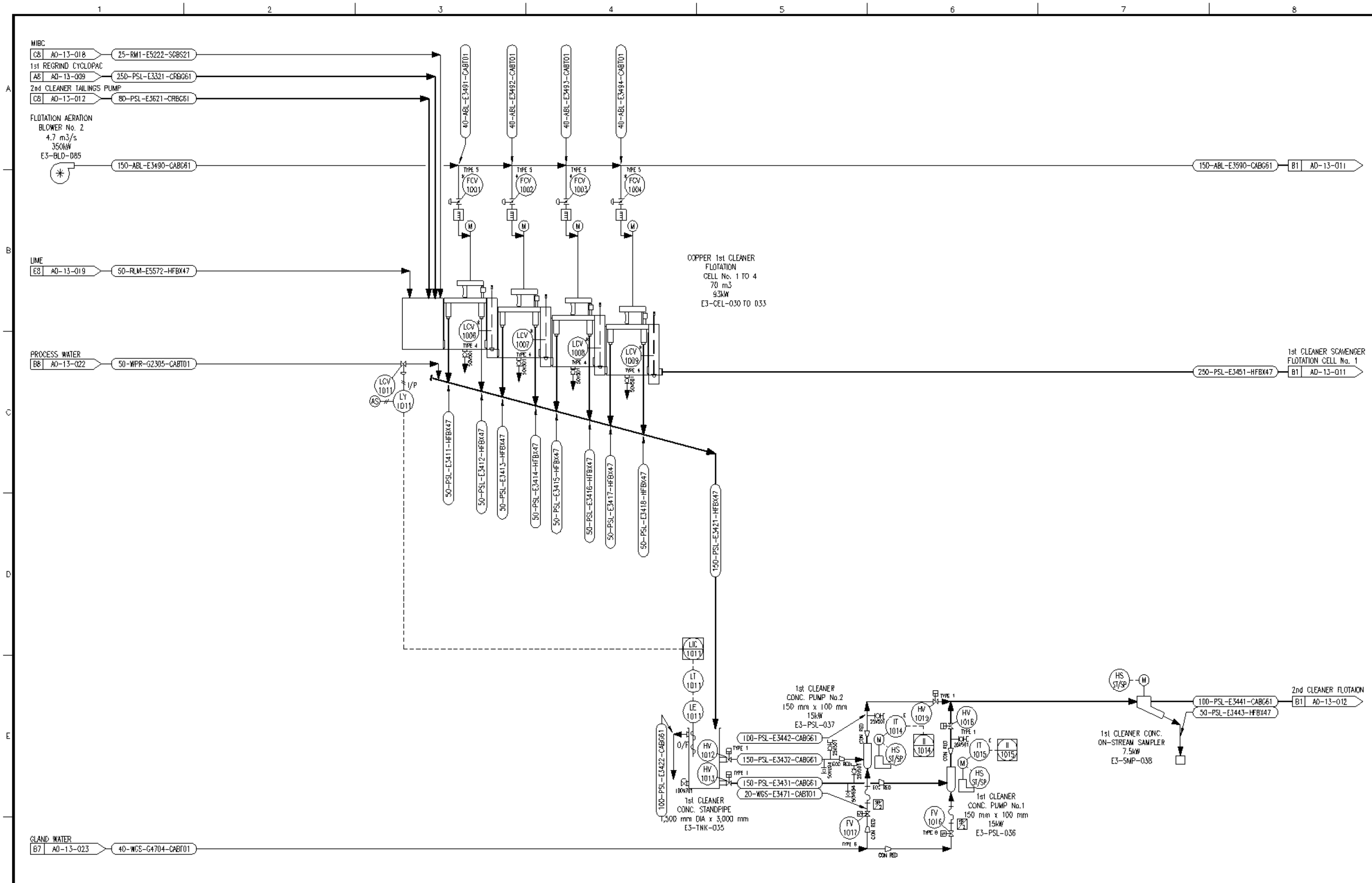
TITLE **MORRISON COPPER/GOLD PROJECT**

FLOTATION – 1st REGRIND PIPING & INSTRUMENTATION DIAGRAM No.9

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013009.DWG	06527201.00	A0-13-009	D

09/02/12

U:\K-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013009.DWG



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING		
SCALE:	NONE	DATE
DESIGN. BY:	EA/DM	FEB07
DRAWN BY:	DH/PL	FEB07
CHECK. BY:		
APP. BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

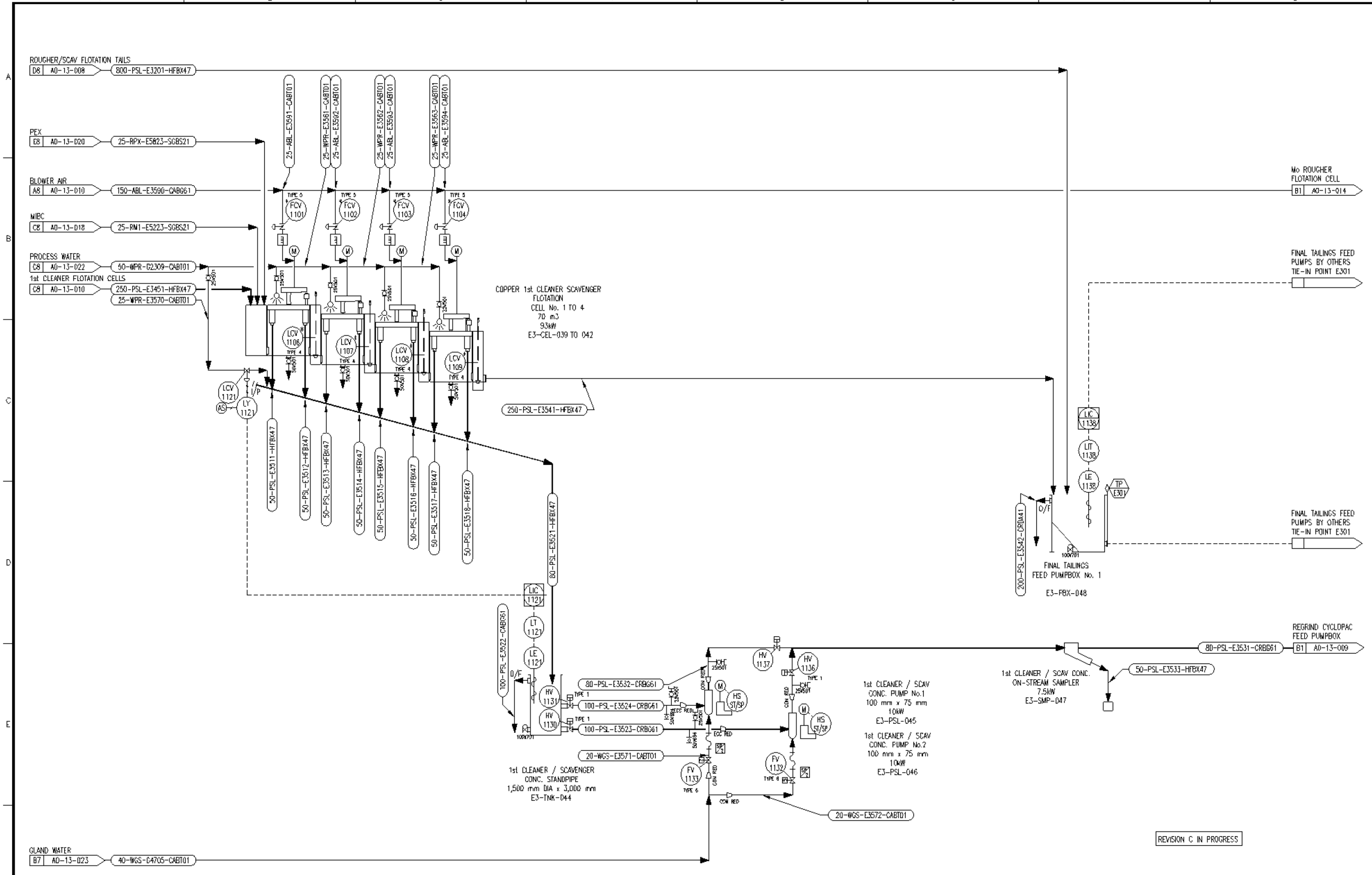
TITLE MORRISON COPPER/GOLD PROJECT

FLOTATION – 1st CLEANER PIPING & INSTRUMENTATION DIAGRAM No.10

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013010.DWG	06527201.00	A0-13-010	D

09/02/12 09:28

U:\A-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013010.DWG



REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING		
SCALE: NONE		DATE
DESIGN. BY: EA/DM		FEB07
DRAWN BY: DH/PL		FEB07
CHECK. BY:		
APP. BY:		

DWG. NO. | REFERENCE DRAWINGS

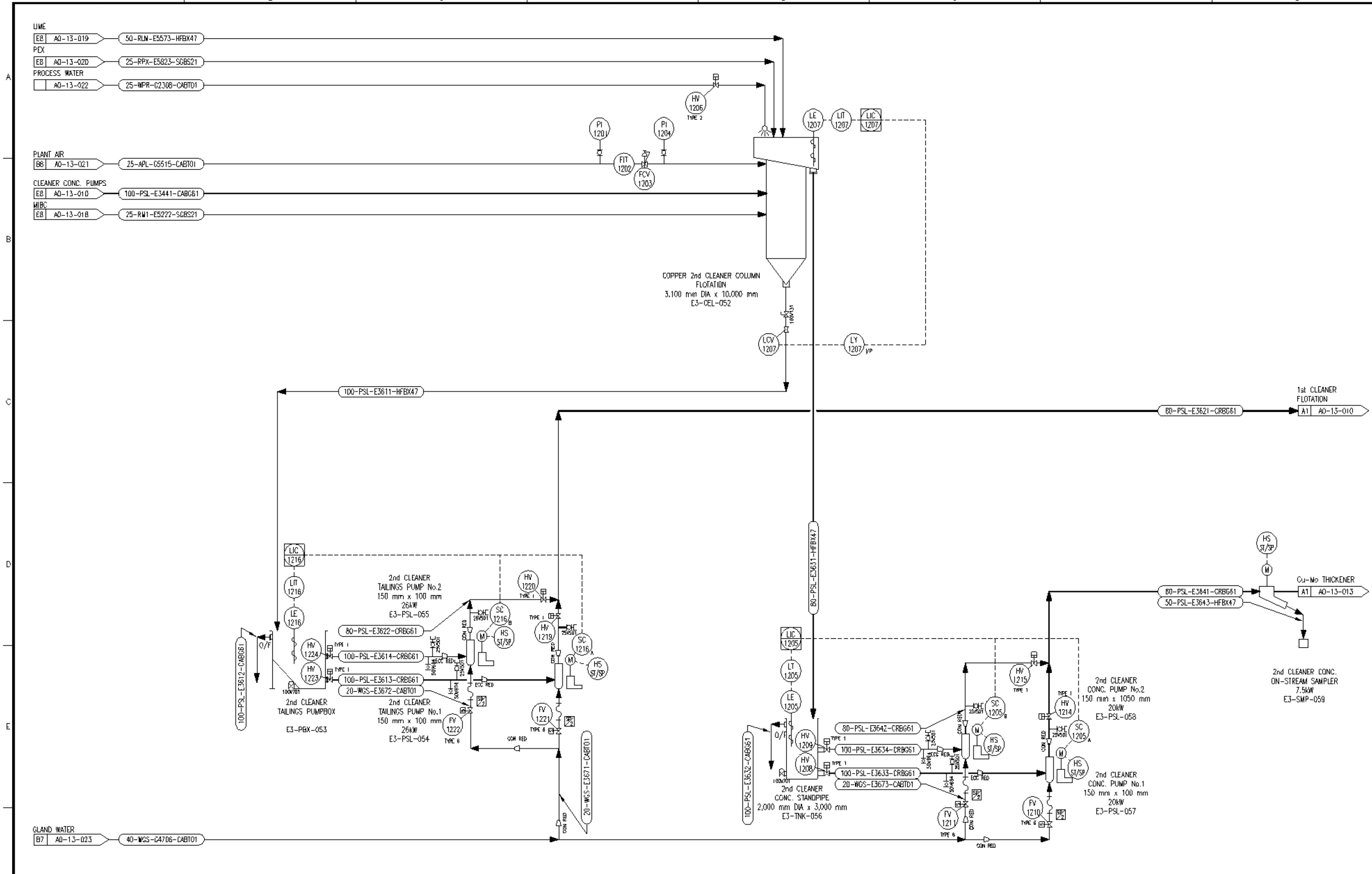
PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

FLOTATION – 1st CLEANER SCAVENGER PIPING & INSTRUMENTATION DIAGRAM No.11

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013011.DWG	06527201.00	A0-13-011	D



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING		
SCALE: NONE		DATE
DESIGN. BY: EA/DM		FEB07
DRAWN BY: DH/PL		FEB07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

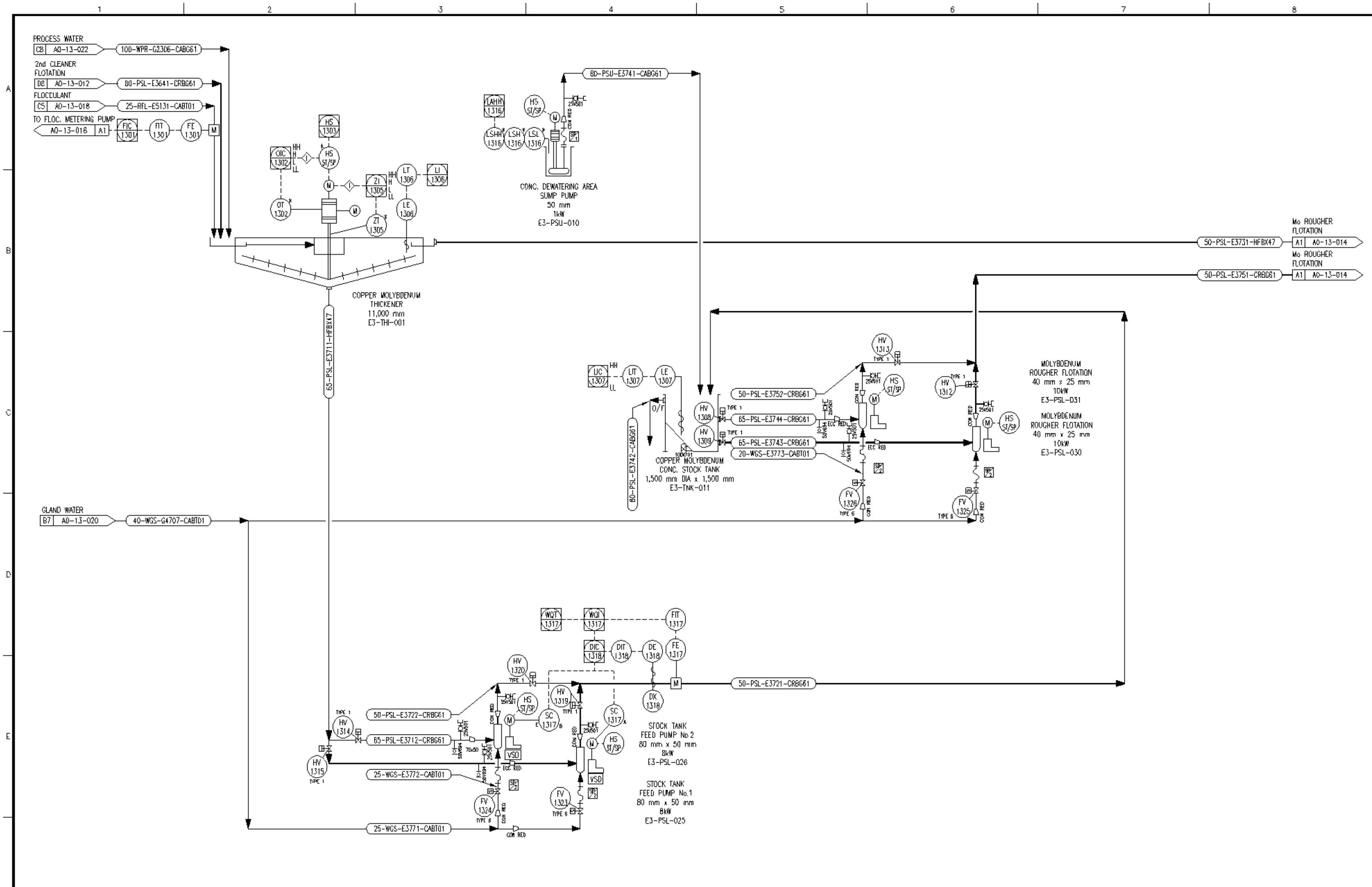
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

FLOTATION – 2nd CLEANER PIPING & INSTRUMENTATION DIAGRAM No.12

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013012.DWG	06527201.00	A0-13-012	D

09/02/12



REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING
SCALE: NONE
DESIGN. BY: EA/DM — FEB07
DRAWN BY: DH/PL — FEB07
CHECK. BY:
APP BY:

DWG. NO. — REFERENCE DRAWINGS

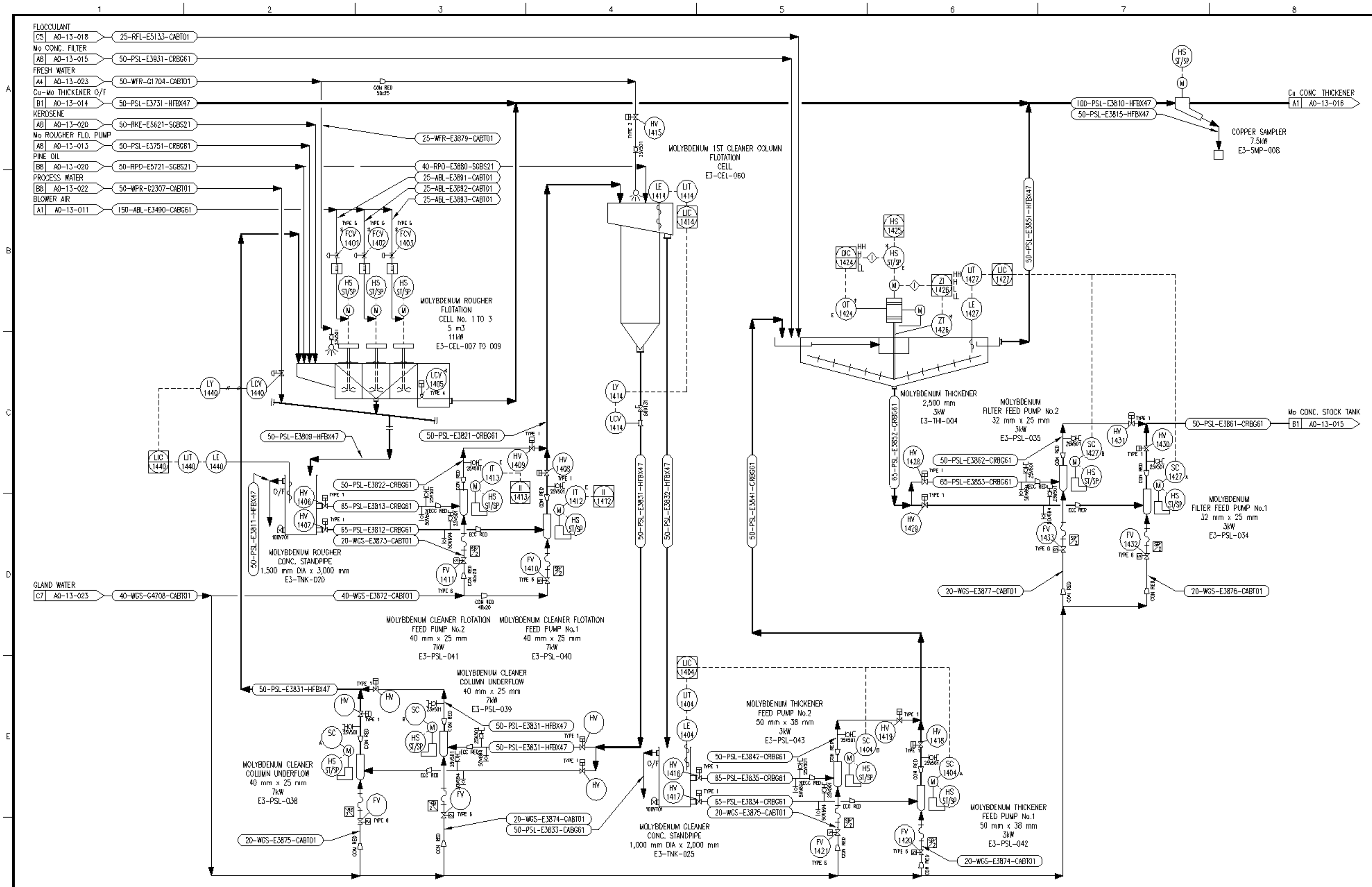
PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT

Cu/ Mo CONCENTRATE THICKENING PIPING & INSTRUMENTATION DIAGRAM No.13

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013013.DWG	06527201.00	A0-13-013	D



D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO	SECTION:	PIPING
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO	SCALE: NONE	DATE
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW	DESIGN. BY: EA/DM	FEB07
A	1	FOR CLIENT REVIEW	17DEC07	JD	DRAWN BY: DH/PL	FEB07
REV. No.	ISSUE No.	DESCRIPTION	DATE	BY	CHECK. BY: / APP BY:	

DWG. NO. | REFERENCE DRAWINGS

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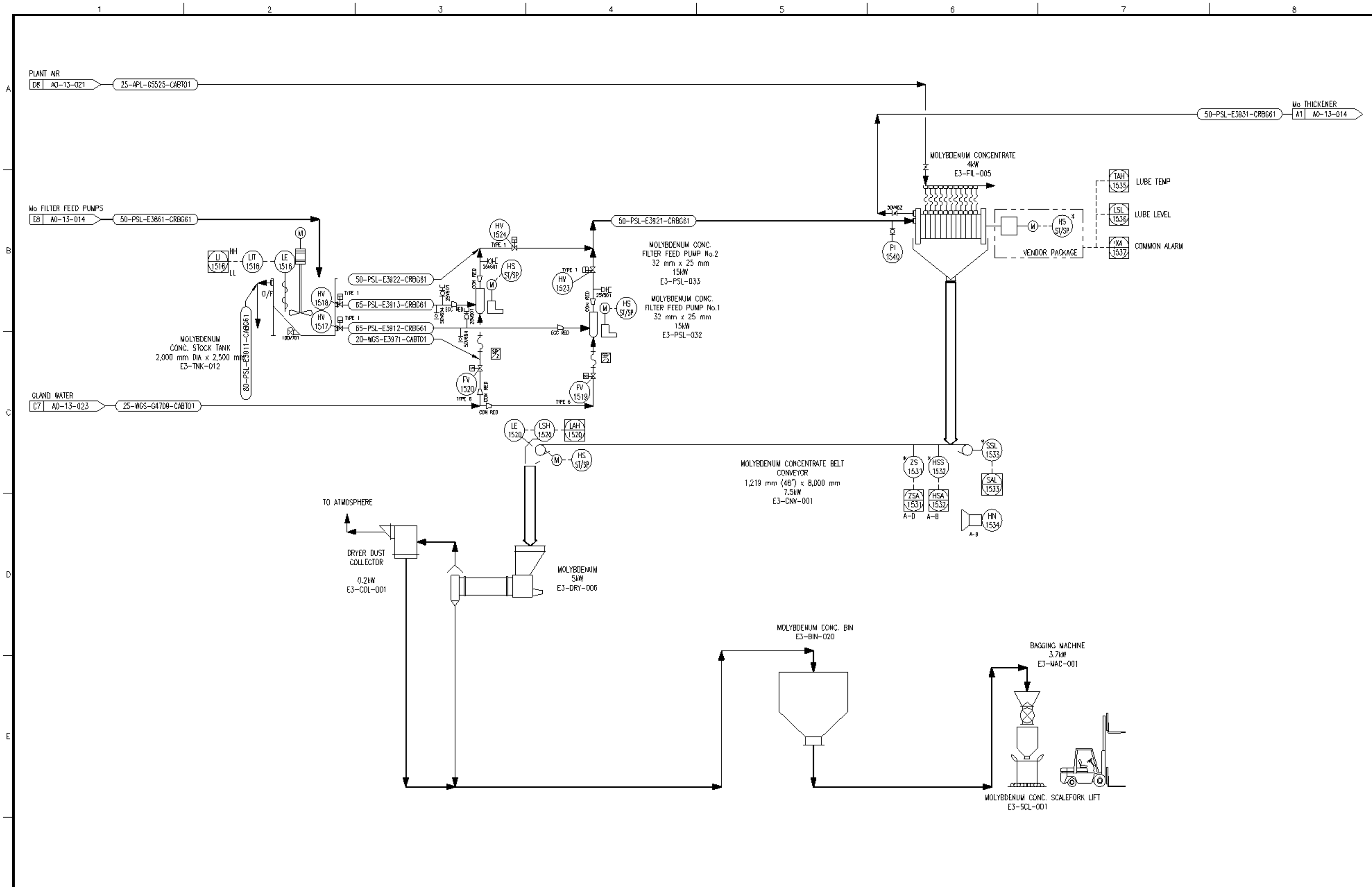
PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

Mo FLOTATION / THICKENING PIPING & INSTRUMENTATION DIAGRAM No.14

FILENAME: A013014.DWG | PROJECT NUMBER 06527201.00 | DRAWING NUMBER A0-13-014 | REV. D



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING		
SCALE:	NONE	DATE
DESIGN. BY:	EA/DM	FEB07
DRAWN BY:	DH/PL	FEB07
CHECK. BY:		
APP. BY:		

PACIFIC BOOKER MINERALS INC.

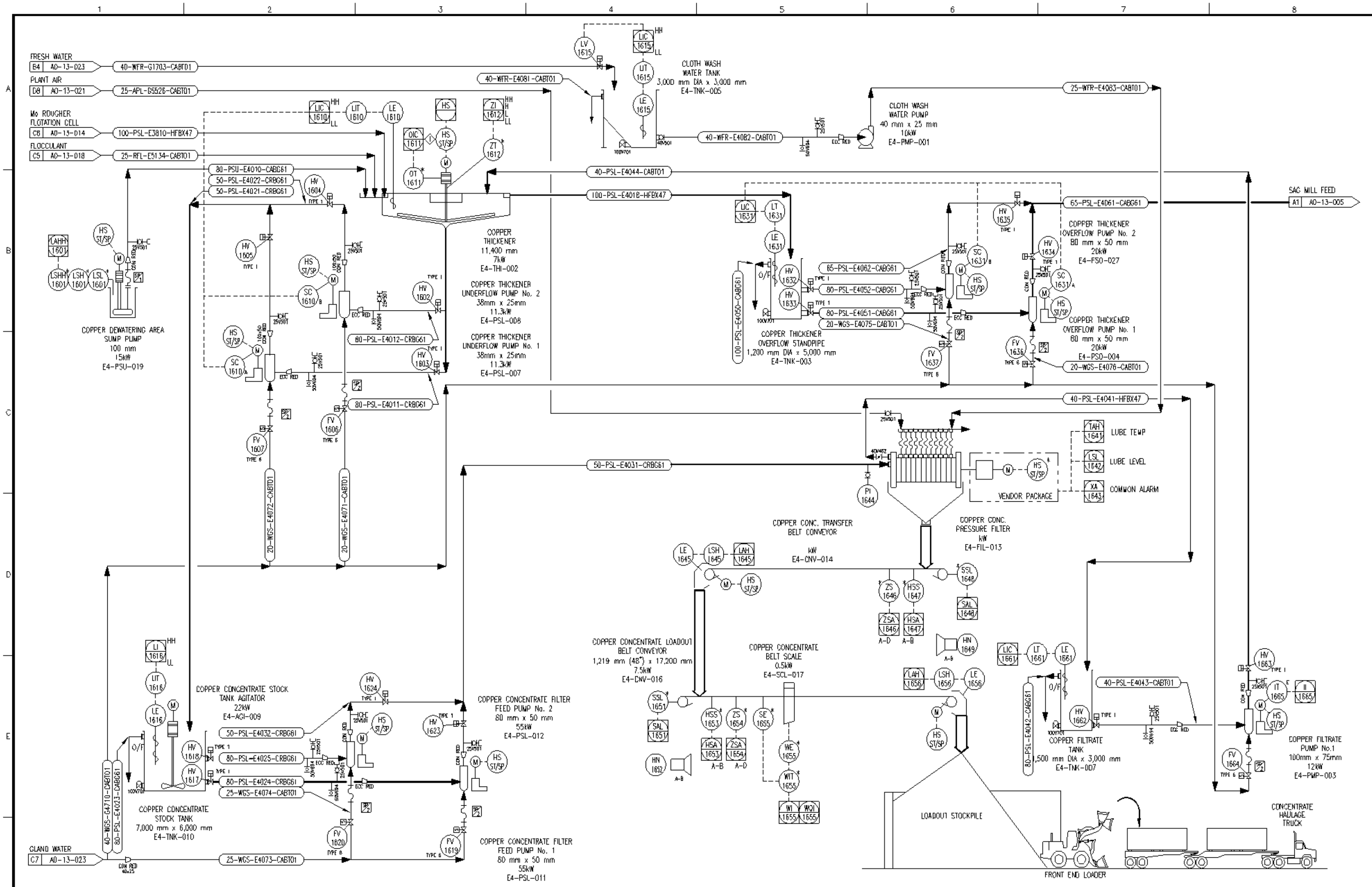
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

Mo FILTRATION
PIPING & INSTRUMENTATION
DIAGRAM No.15

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013015.DWG	06527201.00	A0-13-015	D

U:\A-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013015.DWG



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION: PIPING		
SCALE:	NONE	
DESIGN. BY:	EA/DM	FEB07
DRAWN BY:	DH/PL	FEB07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

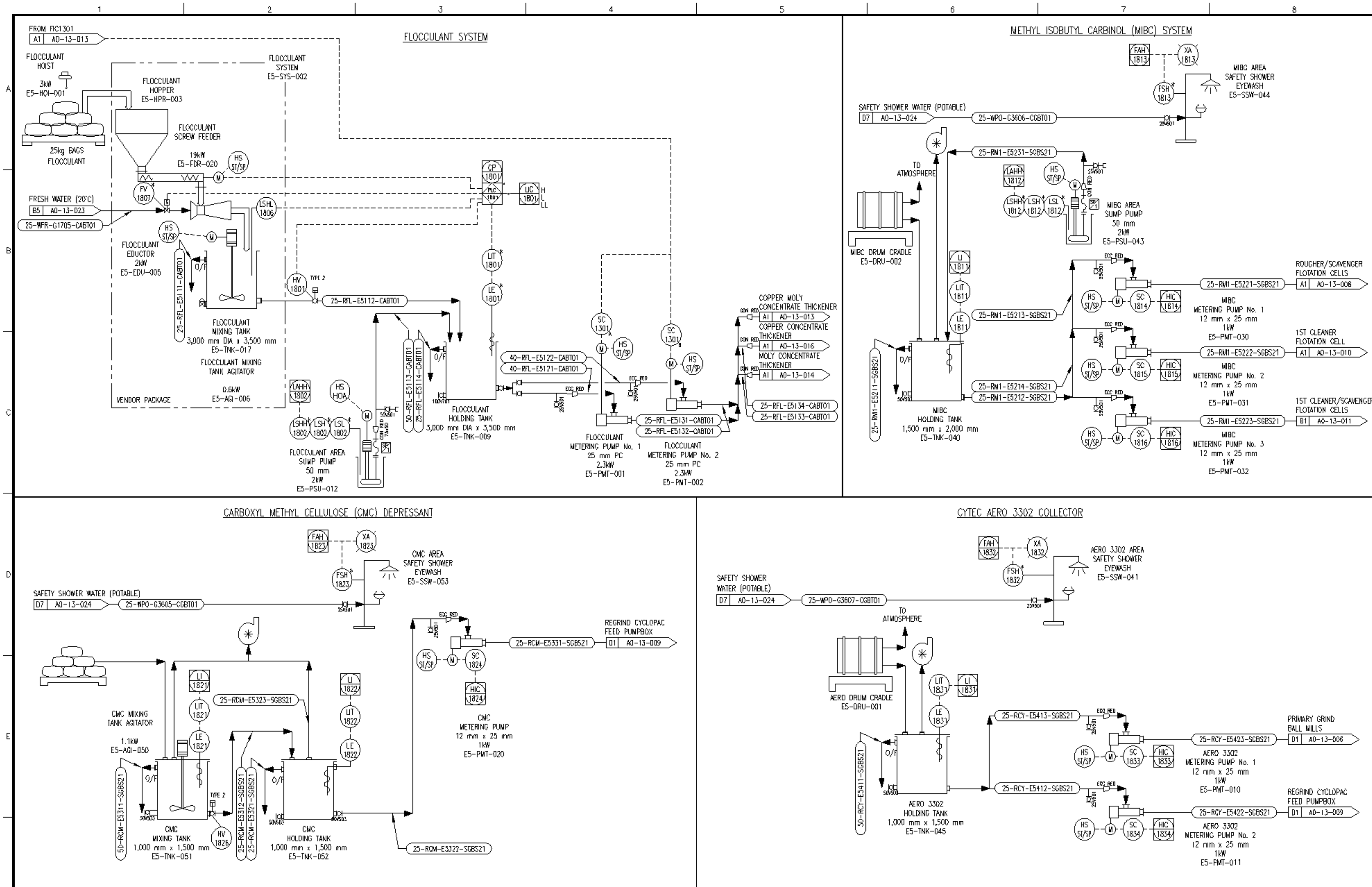
TITLE **MORRISON COPPER/GOLD PROJECT**

Cu THICKENING / FILTRATION PIPING & INSTRUMENTATION DIAGRAM No.16

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013016.DWG	06527201.00	A0-13-016	D

09/02/12

U:\H-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\FEB09\A013016.DWG



REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

PIPING
NONE
EA/DM FEB07
DH/PL FEB07

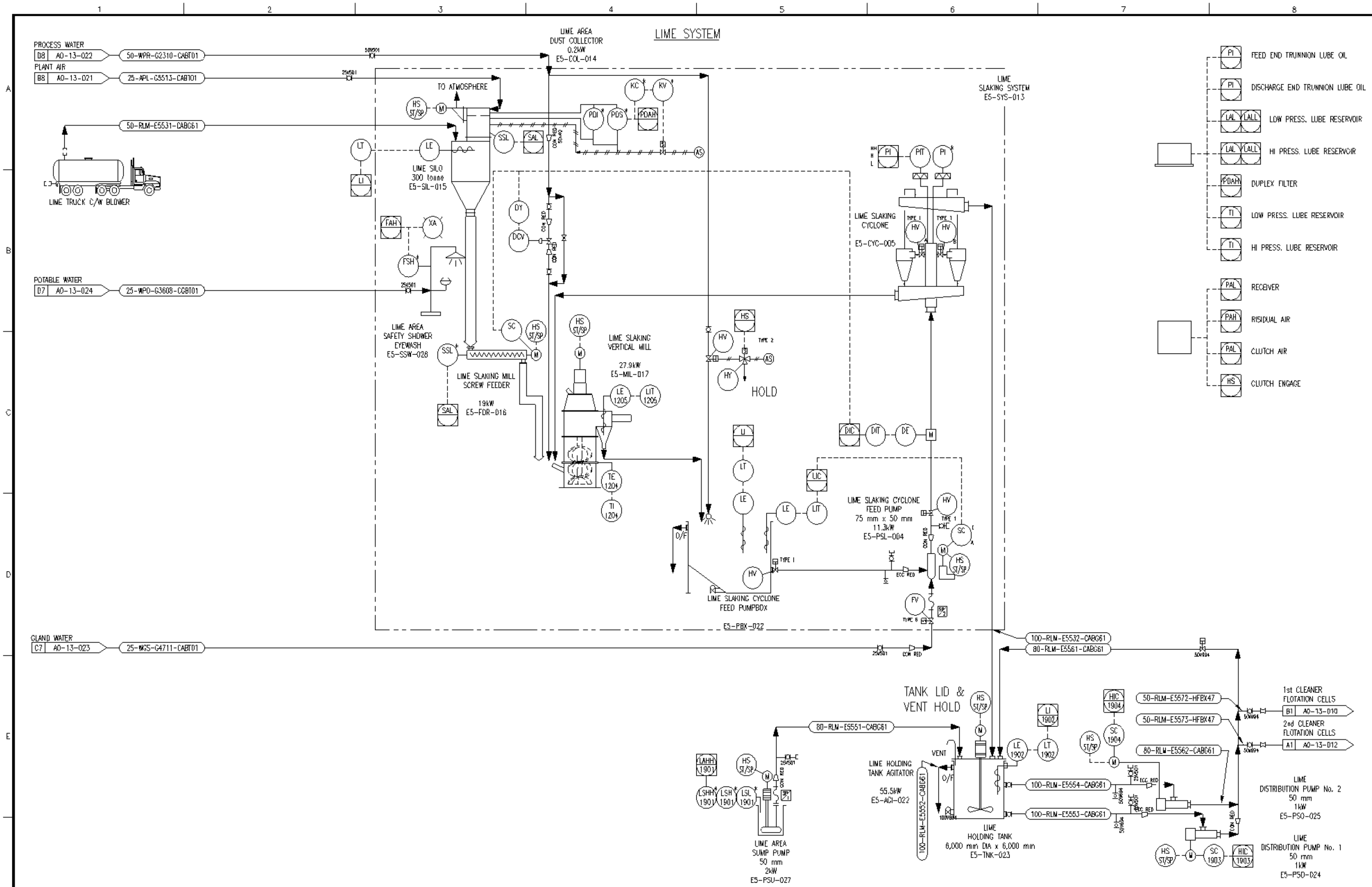
pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

MORRISON COPPER/GOLD PROJECT

REAGENTS SHEET 1 OF 3
PIPING & INSTRUMENTATION DIAGRAM No.18

A013018.DWG 06527201.00 A0-13-018 D



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION: PIPING		
SCALE:	NONE	
DESIGN. BY:	EA/DM	FEB07
DRAWN BY:	DH/PL	FEB07
CHECK. BY:		
APP. BY:		

PACIFIC BOOKER MINERALS INC.

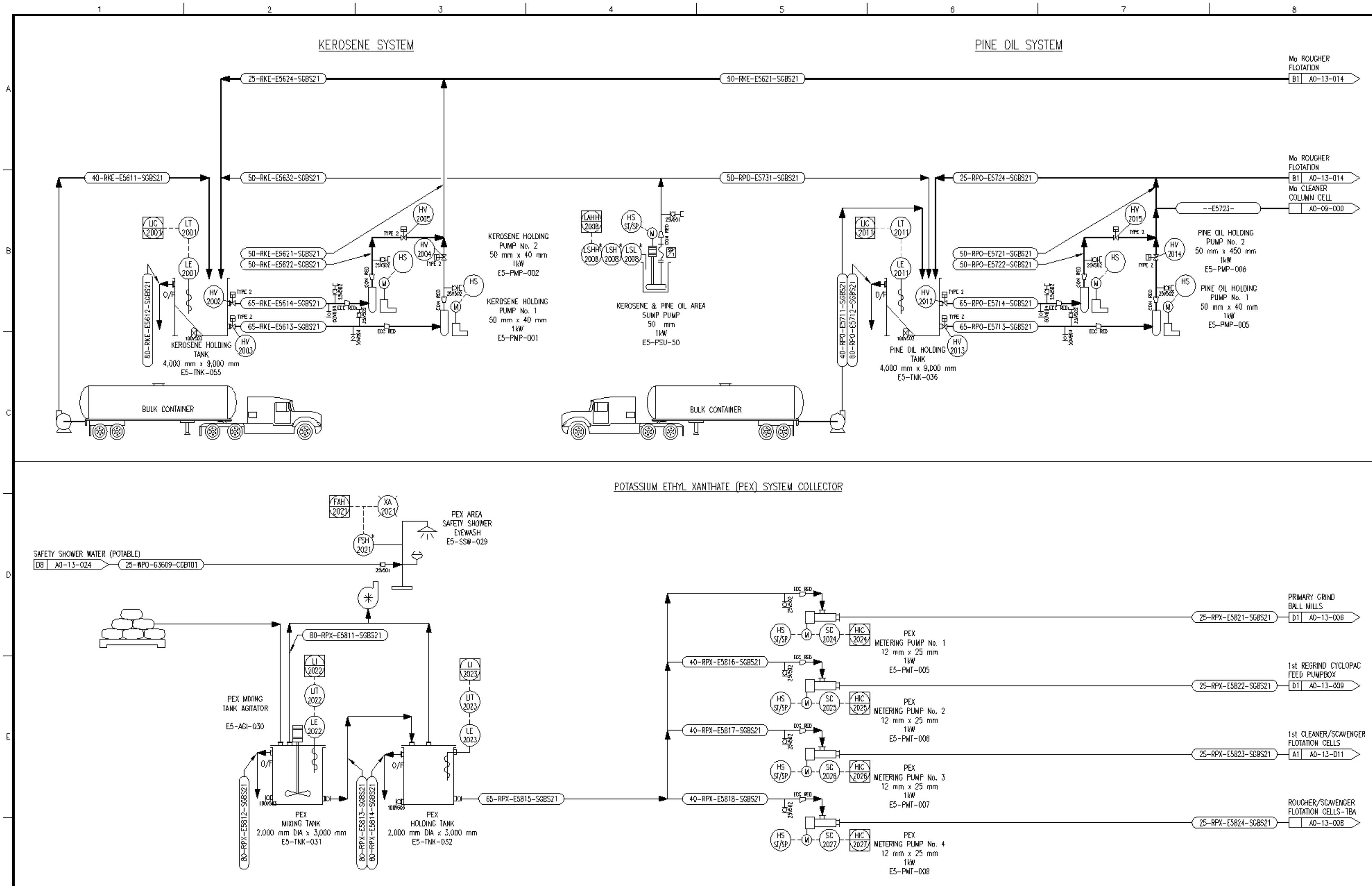
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

REAGENTS SHEET 2 OF 3
PIPING & INSTRUMENTATION
DIAGRAM No.19

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013019.DWG	06527201.00	A0-13-019	D

U:\W-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013019.DWG



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING		
SCALE: NONE		DATE
DESIGN. BY: EA/DM		FEB07
DRAWN BY: DH/PL		FEB07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

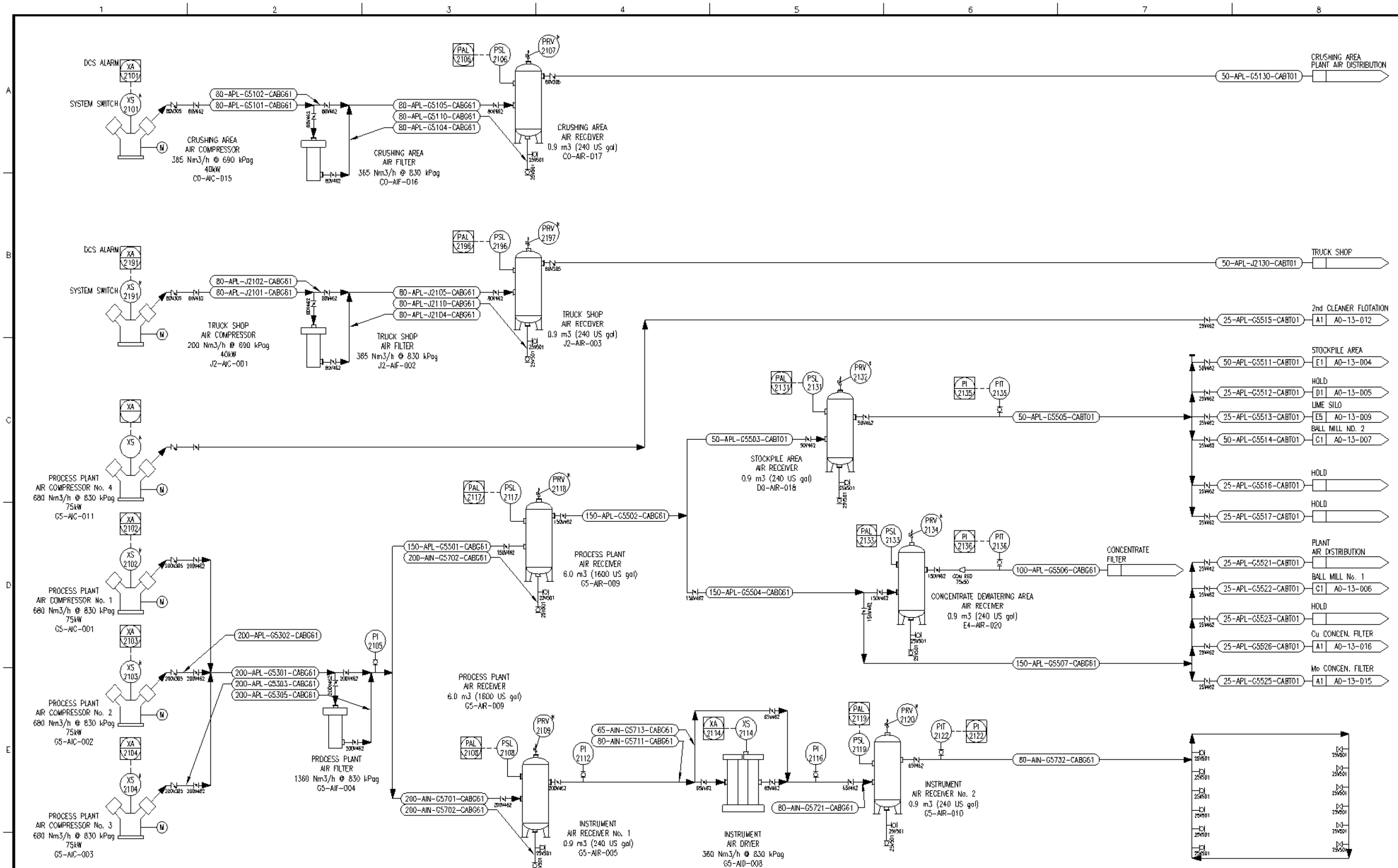
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

REAGENTS SHEET 3 OF 3
PIPING & INSTRUMENTATION
DIAGRAM No.20

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013020.DWG	06527201.00	A0-13-020	E

U:\N-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013020.DWG



NOTES
1. HIGH POINT VENTS AND LOW POINT DRAINS REQUIRED.

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

DWG. NO. | REFERENCE DRAWINGS

SECTION: PIPING
SCALE: NONE
DESIGN. BY: EA/DM — FEB07
DRAWN BY: DH/PL — FEB07
CHECK. BY:
APP BY:

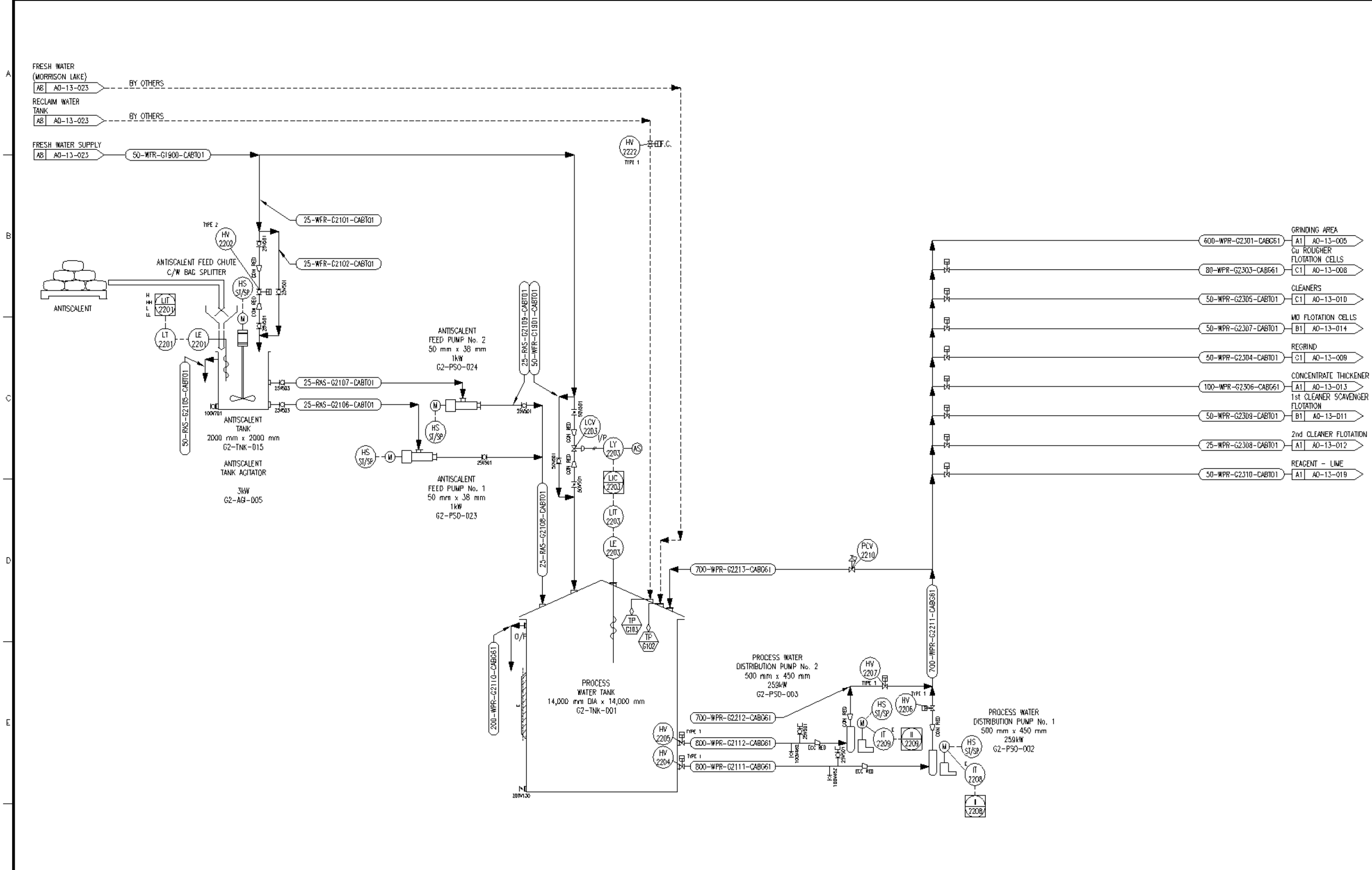
pbm — PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
AIR DISTRIBUTION
PIPING & INSTRUMENTATION
DIAGRAM No.21

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013021.DWG	06527201.00	A0-13-021	D

09/02/12



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

SECTION: PIPING		
SCALE: NONE		DATE
DESIGN. BY: EA/DM		FEB07
DRAWN BY: DH/PL		FEB07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

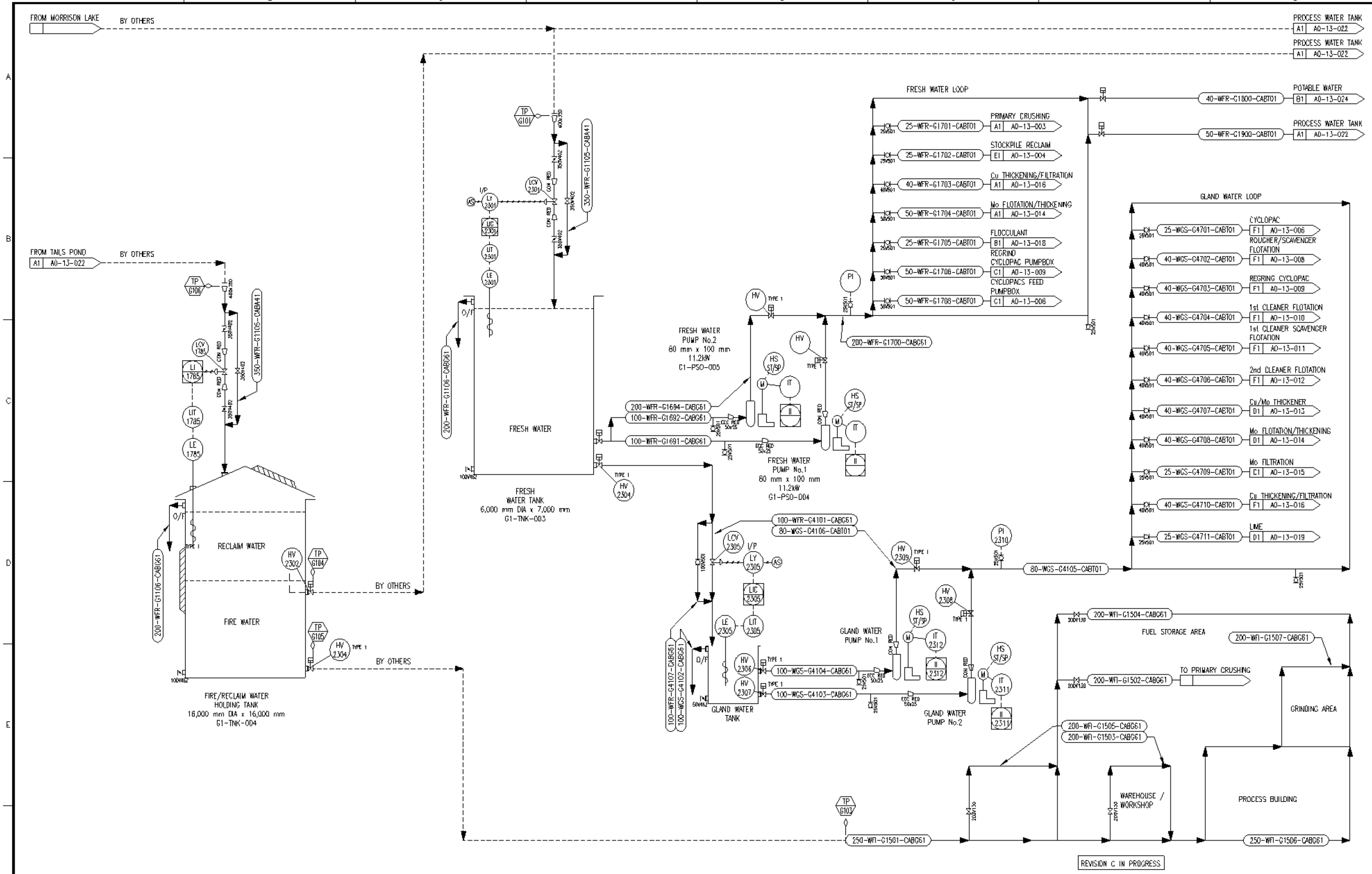
WARDROP Engineering Inc.

TITLE **MORRISON COPPER/GOLD PROJECT**

PROCESS WATER DISTRIBUTION
PIPING & INSTRUMENTATION
DIAGRAM No.22

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013022.DWG	06527201.00	A0-13-022	E

08/02/12



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

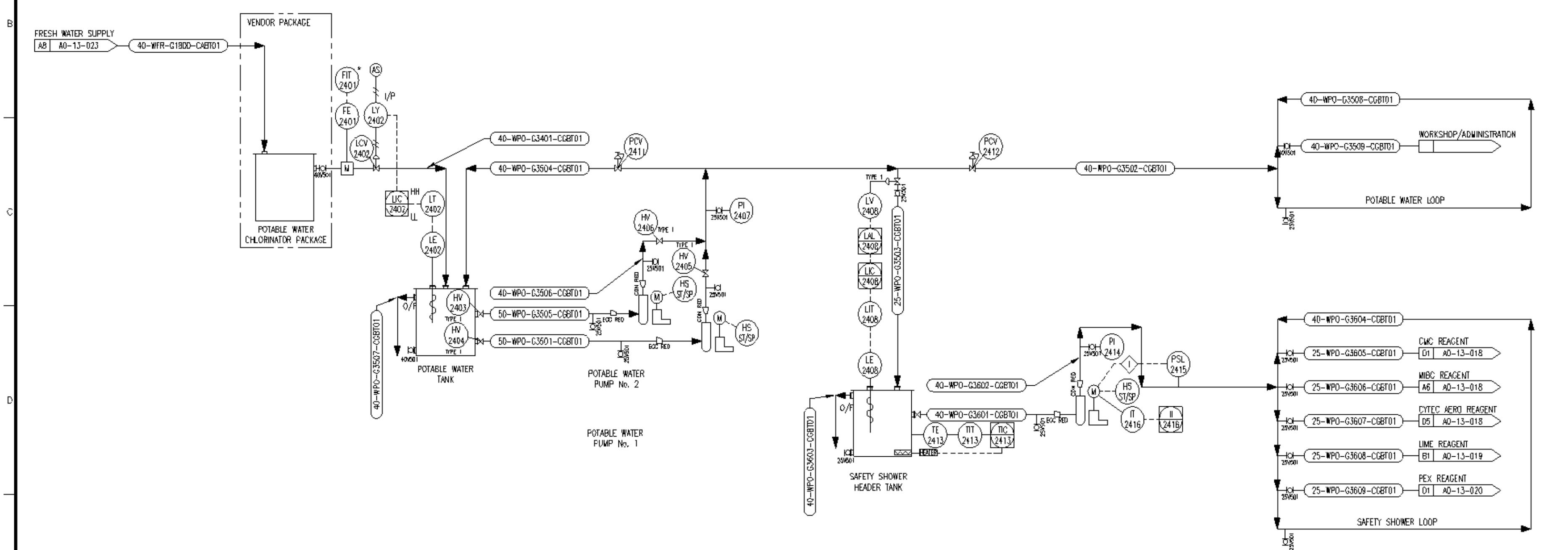
SECTION: PIPING
SCALE: NONE
DESIGN. BY: EA/DM FEB07
DRAWN BY: JY FEB07
CHECK. BY:
APP BY:

PACIFIC BOOKER MINERALS INC.
WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT
FRESH / FIRE WATER DISTRIBUTION PIPING & INSTRUMENTATION DIAGRAM No.23

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A013023.DWG	06527201.00	A0-13-023	E

U:\W-5\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\A013023.DWG



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DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
D	1	ISSUED FOR CLIENT APPROVAL	11DEC08	AO
C	1	ISSUED FOR CLIENT APPROVAL	04NOV08	AO
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	FOR CLIENT REVIEW	17DEC07	JD

		DATE
SECTION:	PIPING	
SCALE:	NONE	
DESIGN. BY:	EA/DM	FEB07
DRAWN BY:	DH/PL	FEB07
CHECK. BY:		
APP BY:		

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

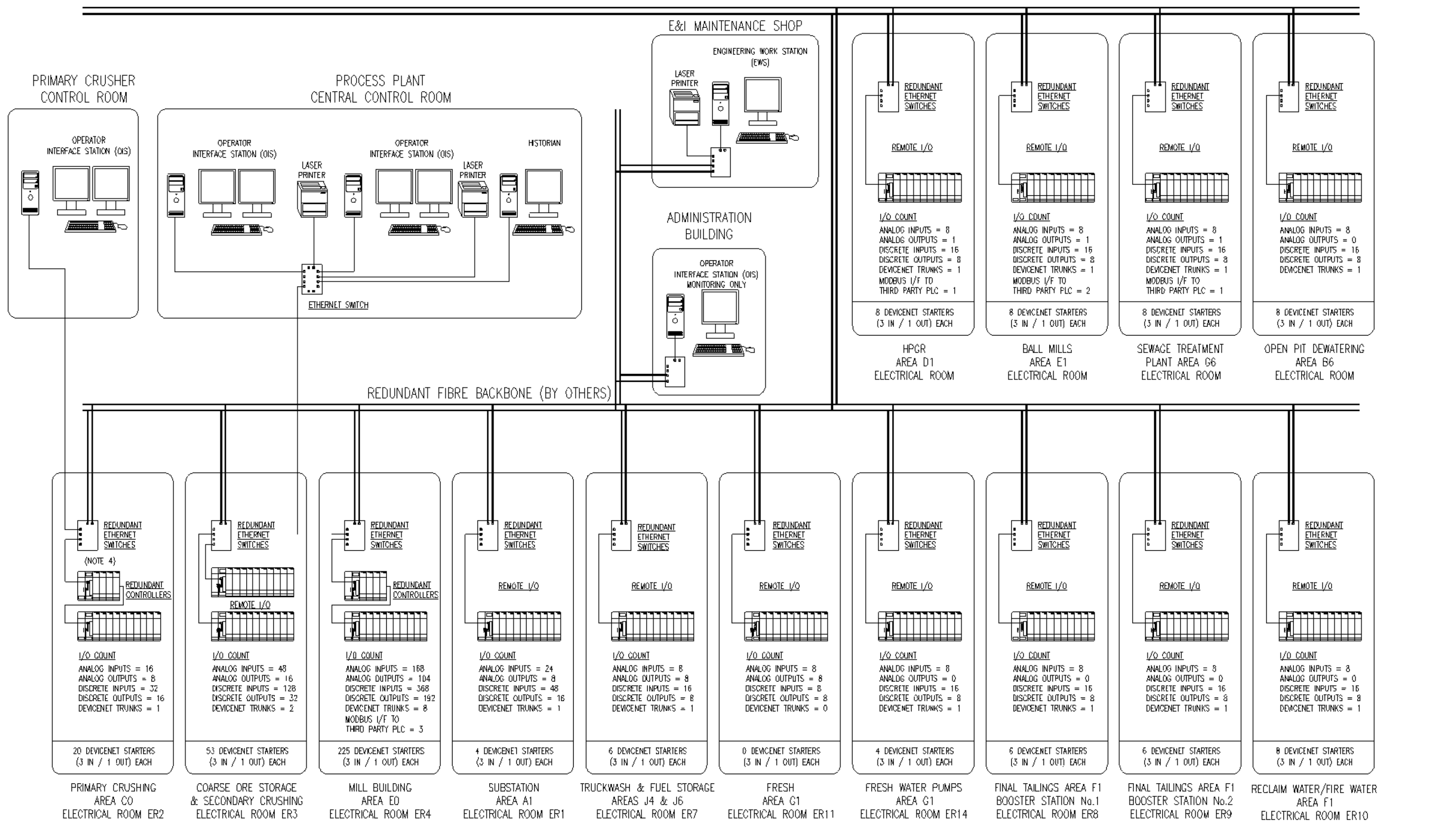
TITLE MORRISON COPPER/GOLD PROJECT

POTABLE WATER DISTRIBUTION PIPING & INSTRUMENTATION DIAGRAM No.24

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
AO13024.DWG	06527201.00	AO-13-024	E

09:30 09/02/12

U:\A-S\PACIFIC BOOKER MINERALS INC - 5272\06527201.00 - MORRISON PORPHYRY COPPER GOLD PROJECT\13-PIPING\P&ID\AO13024.DWG



PROGRESS PRINT

NOTES:

1. ANALOG INPUT MODULES SHALL HAVE 4–20 mA INPUTS WITH HART PROTOCOL.
2. DISCRETE INPUTS AND OUTPUTS SHALL BE ISOLATED 120 VAC.
3. CONTROL SYSTEM SUPPLIER'S SCOPE OF SUPPLY SHALL INCLUDE ALL SYSTEM HARDWARE, INTERCONNECTION CABLING (OTHER THAN FIBRE BACKBONE), NETWORK SWITCHES, AND I/O CABINETS WITH TERMINAL BLOCKS FOR FIELD WIRING
4. FOR CLARITY ONLY ONE NETWORK SWITCH AND ONE CONTROLLER OF REDUNDANT PAIRS SHOWN.

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
E	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AD
D	1	CLIENT COMMENTS ADDED	28JAN09	AD
C	1	ISSUED FOR CLIENT APPROVAL	13JAN09	AD
B	1	ISSUED FOR CLIENT APPROVAL	12NOV08	AD
A	1	ISSUED FOR BUDGET PRICING	07OCT08	DM

SECTION: INSTRUMENTATION		
SCALE: NONE		DATE
DESIGN BY:	DM	06OCT08
DRAWN BY:	DM	06OCT08
CHECK BY:		
APP BY:		

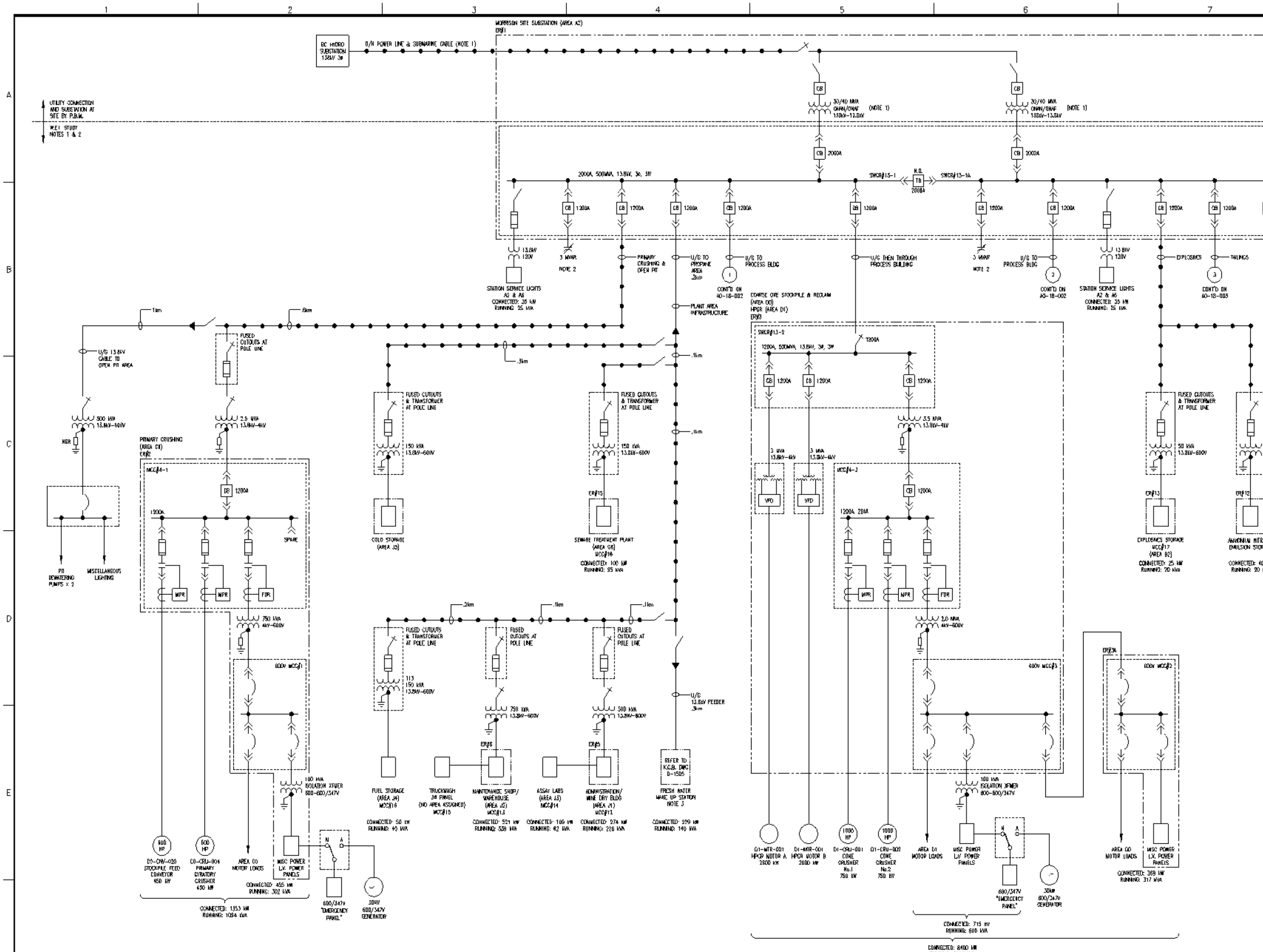
pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
PROCESS CONTROL SYSTEM BLOCK DIAGRAM

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A317001.DWG	0652720100	A3-17-001	E

U:\H-S\PACIFIC BOOKER MINERALS INC - 5272\0652720100 - MORRISON PORPHYRY COPPER GOLD PROJECT\17-INST & CTRLS\DWG\A317001.DWG



NOTES:

1. LINE CHARACTERISTICS, FAULT LEVEL, AND VOLTAGE REGULATION TO BE DETERMINED.
2. P.F. CORRECTION DETAILS NEXT PHASE DESIGN.
3. REFER TO K.C.B. DRAWING INDICATED FOR DETAILS OF EQUIPMENT AND SCOPE.

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR APPROVAL	16DEC08	GI
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	ISSUED FOR CLIENT REVIEW	06MAR08	RHW

SECTION: ELECTRICAL	
SCALE: NONE	DATE
DESIGN. BY: ACI	FEB08
DRAWN BY: SR	FEB08
CHECK. BY:	
APP. BY:	

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT

OVERALL SITE
SINGLE LINE DIAGRAM
SHEET 1 OF 3

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A018001.DWG	06527201.00	A0-18-001	D

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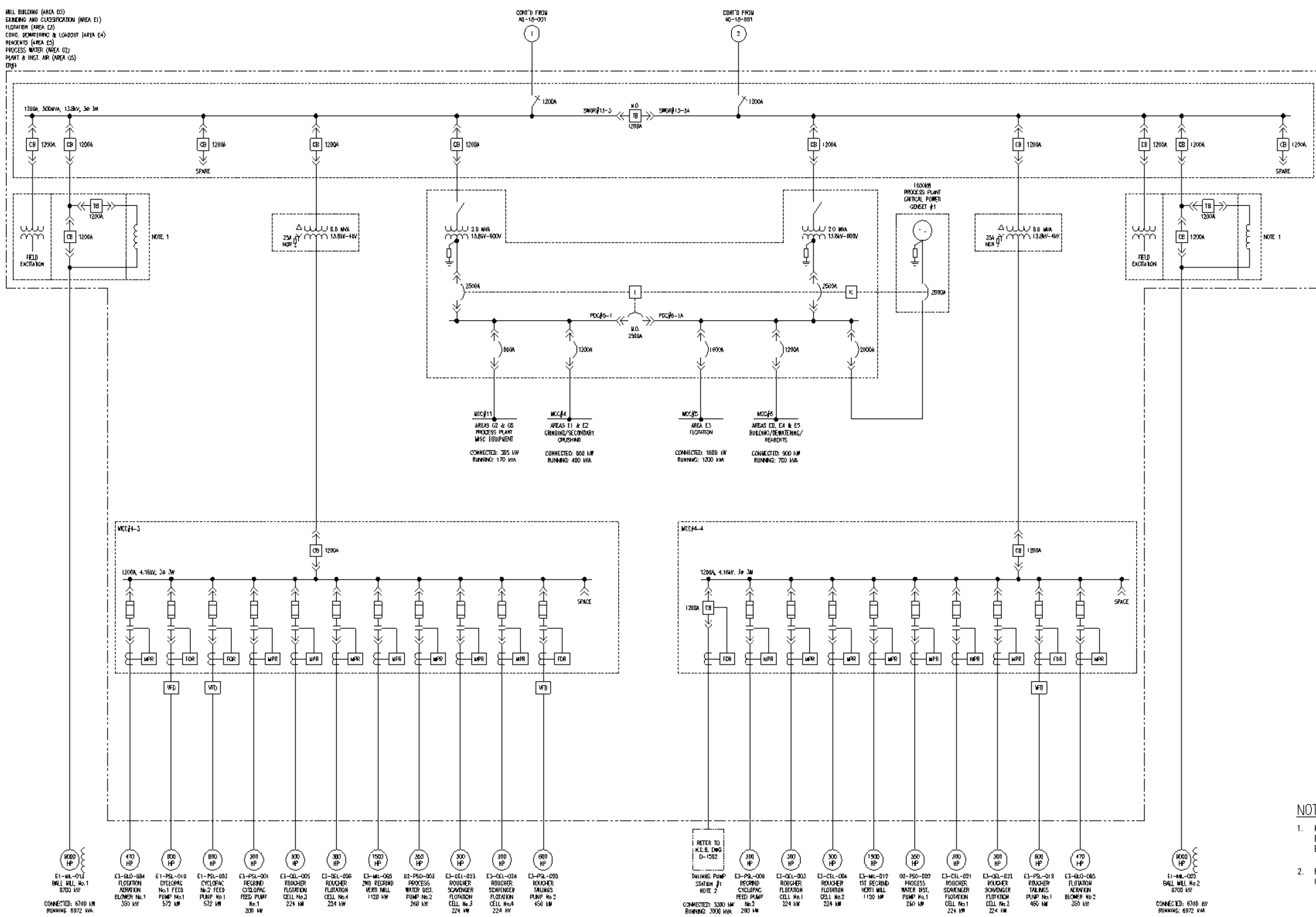

NOTES:

1. MAJOR MOTOR STARTING METHOD SUBJECT OF POWER SYSTEM STUDY WITH KNOWN UTILITY AND EQUIPMENT PARAMETERS.
2. REFER TO K.C.B. DRAWING INDICATED FOR DETAILS OF EQUIPMENT AND SCOPE.

DWG. NO.	REFERENCE DRAWINGS

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
D	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
C	1	ISSUED FOR APPROVAL	16DEC08	GI
B	1	RE-ISSUED FOR CLIENT REVIEW	04APR08	RHW
A	1	ISSUED FOR CLIENT REVIEW	06MAR08	RHW

SECTION:	ELECTRICAL	
SCALE:	NONE	DATE
DESIGN. BY:	ACI	FEB08
DRAWN BY:	SR	FEB08
CHECK. BY:		
APP. BY:		

pbm PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE MORRISON COPPER/GOLD PROJECT

OVERALL SITE
SINGLE LINE DIAGRAM
SHEET 2 OF 3

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A018002.DWG	06527201.00	A0-18-002	D

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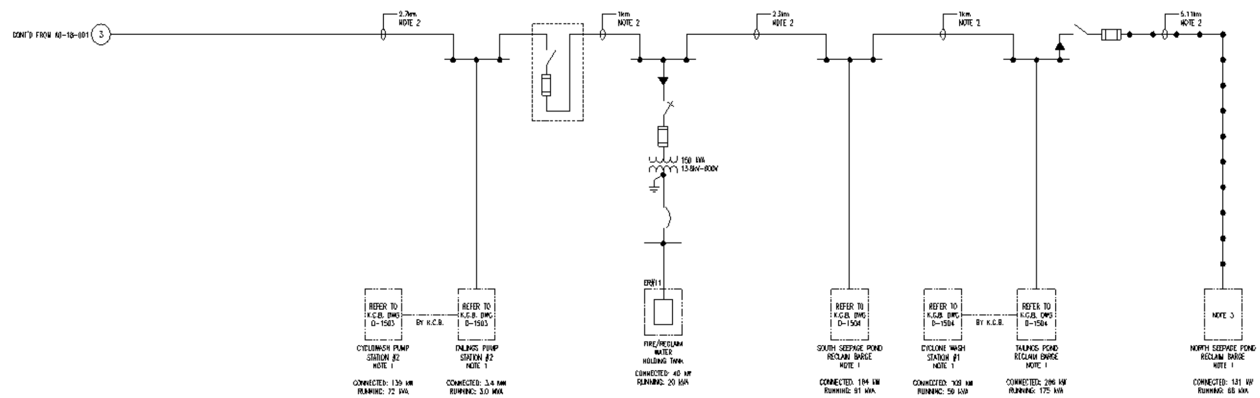

NOTES:

1. REFER TO K.C.B. DRAWINGS INDICATED FOR DETAILS OF EQUIPMENT AND SCOPE.
2. UNDERGROUND CABLE PER K.C.B. DRAWINGS. O/H LINES FOR OTHER AREAS.
3. INTERNAL DETAILS TO BE CONFIRMED.

REV. No.	ISSUE No.	DESCRIPTION	DATE	BY
B	1	ISSUED FOR FEASIBILITY REPORT	12FEB09	AO
A	1	ISSUED FOR APPROVAL	16DEC08	GI

DWG. NO.	REFERENCE DRAWINGS

SECTION: ELECTRICAL
SCALE: NONE — DATE
DESIGN. BY: GI — 08DEC08
DRAWN BY: SEO — 08DEC08
CHECK. BY:
APP. BY:

PACIFIC BOOKER MINERALS INC.

WARDROP Engineering Inc.

TITLE: MORRISON COPPER/GOLD PROJECT
OVERALL SITE
SINGLE LINE DIAGRAM
SHEET 3 OF 3

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
A018003.DWG	06527201.00	A0-18-003	B

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APPENDIX B

EQUIPMENT LIST

WARDROP
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PBM - MORRISON COPPER / GOLD PROJECT
EQUIPMENT LIST - ALL EQUIPMENT SORTED BY AREA

WARDROP PROJECT No : 06527201.00
EQUIPMENT LIST : 0652720100-LST-M0001-03

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
Area: A2 - POWER DISTRIBUTION									
A2-XEM-001	LIGHTING		20.0	☑	☐				
A2-XMM-004	HVAC		30.0	☑	☐				
A2-XMM-005	MISC POWER INCL HEAT TRACING		20.0	☑	☐				
		POWER DISTRIBUTION TOTAL kW:	70.0						
Area: A6 - YARD LIGHTING									
A6-XEM-001	MISCELLANEOUS - ELECTRICAL		100.0	☑	☐				
		YARD LIGHTING TOTAL kW:	100.0						
Area: B2 - OPEN PIT MOBILE EQUIPMENT									
B2-CRN-001	UTILITY 60 t ROUGH TERRAIN CRANE			☐	☐			GROVE RT760E	
B2-DOZ-001	WHEEL DOZER			☐	☐			CATERPILAR 834B	
B2-DRI-001	DRILL			☐	☐			SANDVIK D90KS	
B2-DRI-003	DRILL			☐	☐			SANDVIK PANTERA	
B2-EXC-001	UTILITY BACKHOE EXCAVATOR			☐	☐			CATERPILLAR	
B2-FOR-001	ROUGH TERRAIN FORKLIFT			☐	☐			SELLICK SD100	
B2-GRA-001	MOTOR GRADER			☐	☐			CATERPILLAR 16M	
B2-GRA-002	MOTOR GRADER			☐	☐			CATERPILLAR 16M	
B2-LOA-001	SKID STEER LOADER			☐	☐			CATERPILLAR 216B	
B2-LOA-003	WHEEL LOADER			☐	☐			CATERPILLAR 992G	
B2-LOA-004	WHEEL LOADER			☐	☐			CATERPILLAR 992G	
B2-SHO-001	DIESEL HYDRAULIC SHOVEL			☐	☐			KOMATSU PC4000	
B2-SHO-002	DIESEL HYDRAULIC SHOVEL			☐	☐			KOMATSU PC4000	
B2-TRA-001	TRACK-TYPE BULLDOZER			☐	☐			CATERPILLAR D10T	
B2-TRA-002	TRACK-TYPE BULLDOZER			☐	☐			CATERPILLAR D10T	
B2-TRA-003	TRACK-TYPE BULLDOZER			☐	☐			CATERPILLAR D9T	
B2-TRA-004	TRACTOR & LOWBOY			☐	☐			FREIGHTLINER	
B2-TRU-001	REAR DUMP OFF ROAD HAUL TRUCK			☐	☐			CATERPILLAR 793C	
B2-TRU-002	INTEGRATED TOOL CARRIER			☐	☐			CATERPILLAR IT14G	
B2-TRU-002	REAR DUMP OFF ROAD HAUL TRUCK			☐	☐			CATERPILLAR 793C	
B2-TRU-003	REAR DUMP OFF ROAD HAUL TRUCK			☐	☐			CATERPILLAR 793C	
B2-TRU-004	REAR DUMP OFF ROAD HAUL TRUCK			☐	☐			CATERPILLAR 793C	
B2-TRU-006	WELDING TRUCK			☐	☐				
B2-TRU-007	MECHANICS TRUCK			☐	☐				
B2-TRU-008	MECHANICS TRUCK			☐	☐				
B2-TRU-009	UTILITY HAUL TRUCK			☐	☐			CATERPILLAR 773E	
B2-TRU-010	UTILITY HAUL TRUCK			☐	☐			CATERPILLAR 773E	
B2-TRU-011	WATER TRUCK			☐	☐			CATERPILLAR D9T	
B2-TRU-012	SAND TRUCK			☐	☐				
B2-TRU-013	FUEL/LUBE TRUCK			☑	☐				
B2-TRU-014	FLATBED TRUCK			☑	☐				
B2-VEH-001	PICK-UP TRUCK			☐	☐				
B2-VEH-002	PICK-UP TRUCK			☐	☐				
B2-VEH-003	PICK-UP TRUCK			☐	☐				
B2-VEH-004	PICK-UP TRUCK			☐	☐				
B2-VEH-005	PICK-UP TRUCK			☐	☐				
B2-VEH-006	PICK-UP TRUCK			☐	☐				
B2-VEH-007	CREW-CAB/SUBURBAN			☐	☐				
B2-VEH-008	CREW-CAB/SUBURBAN			☐	☐				
B2-XEM-001	MISCELLANEOUS - ELECTRICAL		25.0	☑	☐				
		OPEN PIT MOBILE EQUIPMENT TOTAL kW:	25.0						
Area: B6 - OPEN PIT DEWATERING									
B6-PSU-001	PIT DEWATERING PUMP 1		75.0	☑	☐				
B6-PSU-002	PIT DEWATERING PUMP 2		75.0	☑	☐				
		OPEN PIT DEWATERING TOTAL kW:	150.0						
Area: B7 - OPEN PIT ELCTRICAL									
B7-XEM-001	OPEN PIT LIGHTING		5.0	☑	☐				

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PBM - MORRISON COPPER / GOLD PROJECT
EQUIPMENT LIST - ALL EQUIPMENT SORTED BY AREA

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
	OPEN PIT ELCTRICAL TOTAL kW:		5.0						
Area: C0 - PRIMARY CRUSHING									
C0-ACL-001	PRIMARY CRUSHER CONTROL ROOM AIR CONDITIONING UNIT	1200 CFM	0.2	☑	☐				
C0-ACL-002	PRIMARY CRUSHER CONTROL ROOM AIR COOLED CONDENSING UNIT	2.5 tonne	3.7	☑	☐				
C0-AHU-001	PRIMARY CRUSHER DIRECT GAS FIRED AIR HANDLING UNIT	10000 CFM	5.5	☑	☐				
C0-AIC-015	CRUSHING AREA AIR COMPRESSOR	366 Nm3/h @ 690 kPag	40.0	☑	☐				
C0-AID-018	CRUSHING AREA INSTRUMENT AIR DRYER	50 Nm3/h @ 830 kPag		☐	☐				
C0-AIF-016	CRUSHING AREA AIR FILTER	366 Nm3/h @ 830 kPag		☐	☐				
C0-AIR-017	CRUSHING AREA AIR RECEIVER	0.9 m3 (240 US gal)		☐	☐				
C0-BAG-001	PRIMARY CRUSHER DUST COLLECTOR	10000 CFM	0.2	☑	☐				
C0-BAG-015	CRUSHING DUST COLLECTOR BAGHOUSE		0.2	☑	☐				
C0-CRN-003	PRIMARY CRUSHING OVERHEAD CRANE	50/10 tonne	35.0	☑	☐				
C0-CRU-004	PRIMARY GYRATORY CRUSHER	1,370 mm x 1,900 mm	450.0	☑	☐				
C0-DUC-001	PRIMARY CRUSHER DUST DUCTING			☐	☐				
C0-FAN-001	PRIMARY CRUSHER LUBE ROOM SUPPLY FAN / FILTER	1200 CFM	2.2	☑	☐				
C0-FAN-002	PRIMARY CRUSHER CONTROL ROOM SUPPLY FAN / FILTER	200 CFM	3.7	☑	☐				
C0-FAN-003	PRIMARY CRUSHER COMPRESSOR ROOM SUPPLY FAN / FILTER	2000 CFM	2.2	☑	☐				
C0-FAN-004	PRIMARY CRUSHER ELECTRICAL ROOM SUPPLY FAN / FILTER	5000 CFM	5.5	☑	☐				
C0-FAN-005	PRIMARY CRUSHER DUST COLLECTOR EXHAUST FAN	10000 CFM	29.8	☑	☐				
C0-FDR-015	PRIMARY CRUSHER APRON FEEDER	1,830 mm x 7,750 mm	75.0	☑	☐				
C0-HTR-001	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-002	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-003	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-004	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-005	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-006	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-007	PRIMARY CRUSHER ELECTRIC UNIT HEATER		10.0	☑	☐				
C0-HTR-008	PRIMARY CRUSHER CONTROL ROOM ELECTRIC DUCT HEATER	200 CFM	6.5	☑	☐				
C0-LUB-011	PRIMARY CRUSHER LUBE UNIT		3.7	☑	☐				
C0-PPK-001	APRON FEEDER HYDRAULIC DRIVE POWER PACK		75.0	☑	☐				
C0-PPK-002	ROCK BREAKER HYDRAULIC POWER PACK		1.5	☑	☐				
C0-PSU-013	CRUSHING AREA SUMP PUMP	100 mm	7.5	☑	☐				
C0-RKB-001	ROCK BREAKER	5,000 ft - lb	37.0	☑	☐				
C0-SCB-004	STOCKPILE FEED BELT SCALE		0.5	☑	☐				
C0-VLV-001	PRIMARY CRUSHER DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	☑	☐				
C0-XEM-001	LIGHTING		25.0	☑	☐				
C0-XMM-004	HVAC		0.0	☐	☐				
C0-XMM-005	MISC POWER INCL HEAT TRACING		25.0	☑	☐				
	PRIMARY CRUSHING TOTAL kW:		905.8						
Area: D0 - COARSE ORE STOCKPILE AND RECLAIM									
D0-AHU-002	PRIMARY CRUSHER DIRECT GAS FIRED AIR HANDLING UNIT	25000 CFM	14.9	☑	☐				
D0-AIR-018	STOCKPILE AREA AIR RECEIVER	0.9 m3 (240 US gal)		☐	☐				
D0-BAG-002	STOCKPILE RECLAIM DUST COLLECTOR	22000 CFM	0.2	☑	☐				
D0-CNV-001	STOCKPILE RECLAIM DUST COLLECTOR SCREW CONVEYOR		3.7	☑	☐				
D0-CNV-020	STOCKPILE FEED BELT CONVEYOR	524 mm (60") x 172,700 m	447.4	☑	☐				
D0-CNV-028	PRIMARY SIZING SCREEN FEED CONVEYOR	372 mm (54") x 201,300 m	186.4	☑	☐				
D0-DUC-002	STOCKPILE RECLAIM DUST DUCTING			☐	☐				
D0-FAN-006	STOCKPILE RECLAIM DUST COLLECTOR EXHAUST FAN	22000 CFM	55.9	☑	☐				
D0-FAN-007	TUNNEL EXHAUST FAN	4000 CFM	3.7	☑	☐				
D0-FDR-004	STOCKPILE RECLAIM APRON FEEDER No. 1 VFD	1,200 mm x 5,500 mm	14.9	☑	☐				
D0-FDR-008	STOCKPILE RECLAIM APRON FEEDER No. 2 VFD	1,200 mm x 5,500 mm	14.9	☑	☐				
D0-FDR-012	STOCKPILE RECLAIM APRON FEEDER No. 3 VFD	1,200 mm x 5,500 mm	14.9	☐	☑				
D0-PSU-017	STOCKPILE AREA SUMP PUMP	100 mm	7.5	☑	☐				
D0-SCB-003	PRIMARY SIZING SCREEN BELT SCALE		0.5	☑	☐				
D0-VLV-002	STOCKPILE RECLAIM DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	☑	☐				
D0-WSS-LOT	STOCKPILE RECLAIM FIRE PROTECTION SPRINKLERS/HOSES/EXTINGU			☐	☐				
D0-XEM-001	LIGHTING		25.0	☑	☐				
D0-XMM-004	HVAC		0.0	☐	☐				

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PBM - MORRISON COPPER / GOLD PROJECT
EQUIPMENT LIST - ALL EQUIPMENT SORTED BY AREA

WARDROP PROJECT No : 06527201.00
EQUIPMENT LIST : 0652720100-LST-M0001-03

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
D0-XMM-005	MISC POWER INCL HEAT TRACING		25.0	✓					
	COARSE ORE STOCKPILE AND RECLAIM TOTAL kW:		800.9						
Area: D1 - HPGR									
D1-BAG-003	CRUSHER SURGE BIN BIN VENT DUST COLLECTOR	2000 CFM	0.2	✓					
D1-BAG-004	HPGR SURGE BIN BIN VENT DUST COLLECTOR	2000 CFM	0.2	✓					
D1-BAG-005	HPGR DUST COLLECTOR	30000 CFM	0.2	✓					
D1-BAG-006	SECONDARY SIZING SCREEN DUST COLLECTOR BAGHOUSE		112.0	✓					
D1-BIN-001	CONE CRUSHER SURGE BIN	160 tonne							
D1-BIN-005	HPGR SURGE BIN	150 tonne							
D1-CNV-002	CONE CRUSHER SURGE BIN FEED CONVEYOR	372 mm (54") x 100,300 m	55.0	✓					
D1-CNV-010	HPGR DUST COLLECTOR SCREW CONVEYOR		3.7	✓					
D1-CNV-026	HPGR SURGE BIN FEED CONVEYOR	372 mm (54") x 100,300 m	55.0	✓					
D1-COL-015	HPGR DUST COLLECTOR		112.0	✓					
D1-COO-001	CONE CRUSHER LUBRICATION COOLER No. 1		5.0	✓					
D1-COO-002	HPGR CRUSHER LUBRICATION COOLER		5.0	✓					
D1-COO-003	CONE CRUSHER LUBRICATION COOLER No. 2		5.0	✓					
D1-CRN-001	HPGR BUILDING AREA CRANE	100 tonne	70.8		✓				
D1-CRU-001	CONE CRUSHER No.1	MP 1000	750.0	✓					
D1-CRU-002	CONE CRUSHER No.2	MP 1000	750.0		✓				
D1-DUC-003	HPGR DUST DUCTING								
D1-EQP-001	HPGR SURGE BIN VENT		20.0	✓					
D1-FAN-008	CRUSHER BIN VENT DUST COLLECTOR EXHAUST FAN	2000 CFM	6.0	✓					
D1-FAN-009	HPGR BIN VENT DUST COLLECTOR EXHAUST FAN	2000 CFM	6.0	✓					
D1-FAN-010	HPGR DUST COLLECTOR EXHAUST FAN	30000 CFM	56.0	✓					
D1-FAN-011	HPGR ROOF EXHAUST FAN	25000 CFM	7.5	✓					
D1-FAN-012	HPGR ROOF EXHAUST FAN	25000 CFM	7.5	✓					
D1-FAN-013	HPGR ROOF EXHAUST FAN	25000 CFM	7.5	✓					
D1-FAN-014	HPGR ROOF EXHAUST FAN	25000 CFM	7.5	✓					
D1-FAN-015	HPGR ELECTRICAL ROOM EXHAUST FAN	5000 CFM	7.5	✓					
D1-FAN-016	HPGR LUBE ROOM SUPPLY FAN / FILTER	1500 CFM	3.7	✓					
D1-FAN-017	CONE LUBE ROOM #1 SUPPLY FAN SUPPLY FAN / FILTER	1500 CFM	3.7	✓					
D1-FAN-018	CONE LUBE ROOM #2 SUPPLY FAN SUPPLY FAN / FILTER	1500 CFM	3.7	✓					
D1-FDR-001	CONE CRUSHER BELT FEEDER No. 1	,524 mm (60") x 11,000 mm	10.0	✓					
D1-FDR-005	HPGR SURGE BIN FEEDER	1,220 mm x 7,700 mm	10.0	✓					
D1-FDR-006	CONE CRUSHER BELT FEEDER No. 2	,524 mm (60") x 11,000 mm	10.0	✓					
D1-FDR-010	HPGR BELT FEEDER (RAIL MOUNTED)	,524 mm (60") x 11,000 mm	10.0	✓					
D1-LUB-020	HPGR CRUSHER LUBE UNIT		22.0	✓					
D1-LUB-037	CONE CRUSHER No.1 LUBE UNIT		7.5		✓				
D1-LUB-040	CONE CRUSHER No.2 LUBE UNIT		7.5	✓					
D1-MED-001	CONE CRUSHER METAL DETECTOR		10.0	✓					
D1-MED-002	HPGR CRUSHER METAL DETECTOR		10.0	✓					
D1-MGT-002	HPGR SELF CLEANING BELT MAGNET		10.0	✓					
D1-MTR-001	HPGR	2,400 DIA x 1,700 mm	5300.0	✓					
D1-PPK-005	HPGR CRUSHER HYDRAULIC POWER PACK		9.0	✓					
D1-PSU-001	HPGR AREA SUMP PUMP	100 mm	7.5	✓					
D1-SCB-001	CONE CRUSHER BELT SCALE		0.5	✓					
D1-SCB-005	HPGR SURGE BIN FEED BELT SCALE		0.5	✓					
D1-VLV-003	HPGR DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	✓					
D1-WSS-LOT	HPGR SPRINKLERS		0.0						
D1-XEM-001	LIGHTING		30.0	✓					
		HPGR TOTAL kW:	6687.4						
Area: E0 - MILL BUILDING									
E0-GEN-001	GENERATOR SET		1600.0		✓				
E0-GEN-002	GENERATOR SET		1600.0		✓				
E0-XEM-001	LIGHTING		100.0	✓					
E0-XMM-004	HVAC		0.0						
E0-XMM-005	MISC POWER INCL HEAT TRACING		200.0	✓					
		MILL BUILDING TOTAL kW:	300.0						

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
Area: E1 - GRINDING AND CLASSIFICATION									
E1-ACL-003	GRINDING FURNACE CONTROL ROOM GAS FIRED HORIZONTAL	2000 CFM	0.4	☑	☐				
E1-ACL-004	GRINDING CONTROL ROOM AIR COOLED CONDENSING UNIT	6 tonne	5.6	☑	☐				
E1-ACL-005	GRINDING OFFICES HORIZONTAL GAS FIRED	5200 CFM	0.4	☑	☐				
E1-ACL-006	GRINDING OFFICES AIR COOLED CONDENSING	15 tonne	5.6	☑	☐				
E1-AHU-004	GRINDING GAS FIRED DIRECT UNIT	30000 CFM	14.9	☑	☐				
E1-AHU-005	GRINDING GAS FIRED DIRECT UNIT	30000 CFM	14.9	☑	☐				
E1-BIN-016	BALL MILL No. 1 BALL BIN	100 tonne		☐	☐				
E1-BIN-017	BALL MILL No. 1 TRASH BIN			☐	☐				
E1-BIN-025	BALL MILL No. 2 BALL BIN	100 tonne		☐	☐				
E1-BIN-026	BALL MILL No. 2 TRASH BIN			☐	☐				
E1-CNV-003	SECONDARY SIZING SCREEN OVER SIZE TRANSFER CONVEYOR	,219 mm (48") x 13,500 mn	11.2	☑	☐				
E1-CNV-004	PRIMARY SIZING SCREEN OVER SIZE TRANSFER CONVEYOR	,372 mm (54") x 10,000 mn	14.9	☑	☐				
E1-CNV-005	PRIMARY SIZING SCREEN UNDER SIZE TRANSFER CONVEYOR	,372 mm (54") x 11,500 mn	14.9	☑	☐				
E1-CNV-007	HPGR DISCHARGE CONVEYOR	372 mm (54") x 109,300 m	55.9	☑	☐				
E1-CRN-030	GRINDING AREA CRANE	50/10 tonne	70.8	☑	☐				
E1-CYC-012	CYCLOPAC No.1	6 x 660 mm		☐	☐				
E1-CYC-021	CYCLOPAC No.2	6 x 660 mm		☐	☐				
E1-EQP-018	BALL CHARGING BUCKET	0.5 m3		☐	☐				
E1-FAN-019	GRINDING LUBE ROOM #1 SUPPLY FAN / FILTER	1500 CFM	3.7	☑	☐				
E1-FAN-020	GRINDING LUBE ROOM #2 SUPPLY FAN / FILTER	1500 CFM	3.7	☑	☐				
E1-FAN-021	GRINDING CONTROL ROOM PRESSURIZATION UNIT	400 CFM	3.7	☑	☐				
E1-FAN-022	GRINDING EXHAUST FAN	40000 CFM	11.2	☑	☐				
E1-FAN-023	GRINDING EXHAUST FAN	40000 CFM	11.2	☑	☐				
E1-FAN-024	GRINDING EXHAUST FAN	40000 CFM	11.2	☑	☐				
E1-FAN-025	GRINDING EXHAUST FAN	40000 CFM	11.2	☑	☐				
E1-FAN-026	GRINDING LUNCHROOM EXHAUST FAN	250 CFM	0.7	☑	☐				
E1-FAN-027	GRINDING WASHROOMS EXHAUST FAN	400 CFM	3.7	☑	☐				
E1-FAN-028	GRINDING COMPRESSOR ROOM EXHAUST FAN	3000 CFM	3.7	☑	☐				
E1-FAN-029	GRINDING COMPRESSOR ROOM EXHAUST FAN	3000 CFM	3.7	☑	☐				
E1-FAN-030	GRINDING BLOWER ROOM EXHAUST FAN	4000 CFM	3.7	☑	☐				
E1-FAN-031	GRINDING BLOWER ROOM EXHAUST FAN	4000 CFM	3.7	☑	☐				
E1-HAN-001	MILL LINER HANDLER		10.0	☑	☐				
E1-HTR-017	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-018	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-019	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-020	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-021	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-022	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-023	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-024	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-025	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-026	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-027	GRINDING GAS FIRED UNIT HEATER		0.2	☑	☐				
E1-HTR-028	GRINDING CONTROL ROOM ELECTRIC DUCT HEATER	400 CFM	13.0	☑	☐				
E1-LUB-038	BALL MILL No. 1 LUBE UNIT		15.0	☑	☐				
E1-LUB-039	BALL MILL No. 2 LUBE UNIT		15.0	☑	☐				
E1-MGT-001	SELF CLEANING BELT MAGNET		10.0	☑	☐				
E1-MIL-013	BALL MILL No. 1	6,096 mm x 10,211 mm	6700.0	☑	☐				
E1-MIL-022	BALL MILL No. 2	6,096 mm x 10,211 mm	6700.0	☑	☐				
E1-PBX-009	CYCLOPACS FEED PUMPBOX			☐	☐				
E1-PSL-002	CYCLOPAC No.1 & 2 FEED PUMP No. 2 (UNINSTALLED SPARE)	500 mm x 450 mm	572.0	☐	☑				
E1-PSL-003	CYCLOPAC No.2 FEED PUMP No. 1	500 mm x 450 mm	572.0	☑	☐				
E1-PSL-010	CYCLOPAC No.1 FEED PUMP No. 1	500 mm x 450 mm	572.0	☑	☐				
E1-PSU-040	GRINDING AREA SUMP PUMP	150 mm	7.5	☑	☐				
E1-SCN-001	PRIMARY SIZING SCREEN No.1	2,700 mm x 8,000 mm	26.0	☑	☐				
E1-SCN-002	PRIMARY SIZING SCREEN No.2	2,700 mm x 8,000 mm	26.0	☑	☐				
E1-SCN-003	SECONDARY SIZING SCREEN No.1	4,000 mm x 8,000 mm	37.0	☑	☐				
E1-SCN-004	SECONDARY SIZING SCREEN No.2	4,000 mm x 8,000 mm	37.0	☑	☐				

WARDROP
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PBM - MORRISON COPPER / GOLD PROJECT
EQUIPMENT LIST - ALL EQUIPMENT SORTED BY AREA

WARDROP PROJECT No : 06527201.00
EQUIPMENT LIST : 0652720100-LST-M0001-03

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
E1-SMP-020	ON-STREAM SECONDARY GRINDING CYCLOPAC SAMPLER		7.5	☑	☐				
E1-WSS-LOT	GRINDING SPRINKLERS		0.0	☐	☐				
		GRINDING AND CLASSIFICATION TOTAL kW:	15035.5						
Area: E2 - SECONDARY CRUSHING									
E2-BAG-006	SEC SCREENING DUST COLLECTOR	55000 CFM	0.2	☑	☐				
E2-CNV-003	SEC SCREENING DUST COLLECTOR SCREW CONVEYOR		3.7	☑	☐				
E2-DUC-004	SEC SCREENING DUST DUCTING		0.0	☐	☐				
E2-FAN-032	SEC SCREENING DUST COLLECTOR EXHAUST FAN	55000 CFM	75.0	☑	☐				
E2-VLV-004	SEC SCREENING DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	☑	☐				
		SECONDARY CRUSHING TOTAL kW:	79.7						
Area: E3 - FLOTATION									
E3-AGI-003	COPPER MOLYBDENUM CONC. STOCK TANK AGITATOR		1.1	☑	☐				
E3-AGI-004	MOLYBDENUM CONC. STOCK TANK AGITATOR		4.0	☑	☐				
E3-AHU-006	FLOTATION GAS FIRED DIRECT UNIT	30000 CFM	14.9	☑	☐				
E3-AHU-007	FLOTATION GAS FIRED DIRECT UNIT	30000 CFM	14.9	☑	☐				
E3-BIN-016	1st REGRIND MILL TRASH BIN			☐	☐				
E3-BIN-020	MOLYBDENUM CONC. BIN			☐	☐				
E3-BLO-084	FLOTATION AERATION BLOWER No. 1	4.7 m3/s	350.0	☑	☐				
E3-BLO-085	FLOTATION AERATION BLOWER No. 2	4.7 m3/s	350.0	☑	☐				
E3-CEL-003	COPPER ROUGHER FLOTATION CELL No. 1	200 m3	224.0	☑	☐				
E3-CEL-004	COPPER ROUGHER FLOTATION CELL No. 2	200 m3	224.0	☑	☐				
E3-CEL-005	COPPER ROUGHER FLOTATION CELL No. 3	200 m3	224.0	☑	☐				
E3-CEL-006	COPPER ROUGHER FLOTATION CELL No. 4	200 m3	224.0	☑	☐				
E3-CEL-007	MOLYBDENUM ROUGHER FLOTATION CELL No. 1	5 m3	11.0	☑	☐				
E3-CEL-008	MOLYBDENUM ROUGHER FLOTATION CELL No. 2	5 m3	11.0	☑	☐				
E3-CEL-009	MOLYBDENUM ROUGHER FLOTATION CELL No. 3	5 m3	11.0	☑	☐				
E3-CEL-021	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 1	200 m3	224.0	☑	☐				
E3-CEL-022	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 2	200 m3	224.0	☑	☐				
E3-CEL-023	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 3	200 m3	224.0	☑	☐				
E3-CEL-024	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 4	200 m3	224.0	☑	☐				
E3-CEL-030	COPPER 1st CLEANER FLOTATION CELL No. 1	70 m3	93.0	☑	☐				
E3-CEL-031	COPPER 1st CLEANER FLOTATION CELL No. 2	70 m3	93.0	☑	☐				
E3-CEL-032	COPPER 1st CLEANER FLOTATION CELL No. 3	70 m3	93.0	☑	☐				
E3-CEL-033	COPPER 1st CLEANER FLOTATION CELL No. 4	70 m3	93.0	☑	☐				
E3-CEL-039	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 1	70 m3	93.0	☑	☐				
E3-CEL-040	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 2	70 m3	93.0	☑	☐				
E3-CEL-041	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 3	70 m3	93.0	☑	☐				
E3-CEL-042	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 4	70 m3	93.0	☑	☐				
E3-CEL-052	COPPER 2nd CLEANER COLUMN FLOTATION CELL	3,100 mm DIA x 10,000 mm	1.1	☑	☐				
E3-CEL-060	MOLYBDENUM 1ST CLEANER COLUMN FLOTATION CELL		1.1	☑	☐				
E3-CNV-001	MOLYBDENUM CONCENTRATE BELT CONVEYOR	1,219 mm (48") x 8,000 mm	7.5	☑	☐				
E3-COL-001	DRYER DUST COLLECTOR		0.2	☑	☐				
E3-CRN-029	FLOTATION AREA CRANE	5 tonne	8.2	☑	☐				
E3-CYC-010	REGRIND CYCLOPAC	20 x 165 mm		☐	☐				
E3-DRY-006	MOLYBDENUM CONCENTRATE DRYER		5.0	☑	☐				
E3-EQP-017	BALL CHARGING BUCKET	0.5 m3		☐	☐				
E3-FAN-033	FLOTATION EXHAUST FANS	40000 CFM	11.2	☑	☐				
E3-FAN-034	FLOTATION EXHAUST FANS	40000 CFM	11.2	☑	☐				
E3-FAN-035	FLOTATION EXHAUST FANS	40000 CFM	11.2	☑	☐				
E3-FAN-036	FLOTATION EXHAUST FANS	40000 CFM	11.2	☑	☐				
E3-FAN-037	FLOTATION REGRIND LUBE ROOM SUPPLY FAN / FILTER	1500 CFM	3.7	☑	☐				
E3-FIL-005	MOLYBDENUM CONCENTRATE FILTER		4.0	☑	☐				
E3-HTR-029	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER		0.2	☑	☐				
E3-HTR-030	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER		0.2	☑	☐				
E3-HTR-031	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER		0.2	☑	☐				
E3-HTR-032	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER		0.2	☑	☐				
E3-HTR-033	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER		0.2	☑	☐				
E3-HTR-034	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER		0.2	☑	☐				

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
E3-LUB-028	REGRIND MILL LUBE UNIT		15.0	☑	☐				
E3-MAC-001	BAGGING MACHINE		3.7	☑	☐				
E3-MIL-012	1st REGRIND VERTICAL MILL	4,267 mm x 5,486 mm	1119.0	☑	☐				
E3-MIL-065	2nd REGRIND VERTICAL MILL	4,267 mm x 5,486 mm	1119.0	☑	☐				
E3-PBX-007	REGRIND CYCLOPAC FEED PUMPBOX			☐	☐				
E3-PBX-018	ROUGHER TAILINGS PUMPBOX			☐	☐				
E3-PBX-048	FINAL TAILINGS FEED PUMPBOX No. 1			☐	☐				
E3-PBX-053	2nd CLEANER TAILINGS PUMPBOX			☐	☐				
E3-PSL-001	REGRIND CYCLOPAC FEED PUMP No. 1	250 mm x 200 mm	200.0	☑	☐				
E3-PSL-009	REGRIND CYCLOPAC FEED PUMP No. 2	250 mm x 200 mm	200.0	☐	☑				
E3-PSL-019	ROUGHER TAILINGS PUMP No.1	500 mm x 450 mm	450.0	☑	☐				
E3-PSL-020	ROUGHER TAILINGS PUMP No.2	500 mm x 450 mm	450.0	☐	☑				
E3-PSL-025	STOCK TANK FEED PUMP No.1	80 mm x 50 mm	8.0	☑	☐				
E3-PSL-026	STOCK TANK FEED PUMP No.2	80 mm x 50 mm	8.0	☐	☑				
E3-PSL-030	MOLYBDENUM ROUGHER FLOTATION FEED PUMP No.1	40 mm x 25 mm	10.0	☑	☐				
E3-PSL-031	MOLYBDENUM ROUGHER FLOTATION FEED PUMP No.2	40 mm x 25 mm	10.0	☐	☑				
E3-PSL-032	MOLYBDENUM CONC. FILTER FEED PUMP No.1	32 mm x 25 mm	15.0	☑	☐				
E3-PSL-033	MOLYBDENUM CONC. FILTER FEED PUMP No.2	32 mm x 25 mm	15.0	☐	☑				
E3-PSL-034	MOLYBDENUM FILTER FEED PUMP No.1	32 mm x 25 mm	3.0	☑	☐				
E3-PSL-035	MOLYBDENUM FILTER FEED PUMP No.2	32 mm x 25 mm	3.0	☐	☑				
E3-PSL-036	1st CLEANER CONC. PUMP No.1	150 mm x 100 mm	15.0	☑	☐				
E3-PSL-037	1st CLEANER CONC. PUMP No.2	150 mm x 100 mm	15.0	☐	☑				
E3-PSL-038	MOLYBDENUM CLEANER COLUMN UNDERFLOW PUMP	40 mm x 25 mm	7.0	☑	☐				
E3-PSL-039	MOLYBDENUM CLEANER COLUMN UNDERFLOW PUMP (STANDBY)	40 mm x 25 mm	7.0	☐	☑				
E3-PSL-040	MOLYBDENUM CLEANER FLOTATION FEED PUMP No.1	40 mm x 25 mm	7.0	☑	☐				
E3-PSL-041	MOLYBDENUM CLEANER FLOTATION FEED PUMP No.2	40 mm x 25 mm	7.0	☐	☑				
E3-PSL-042	MOLYBDENUM THICKENER FEED PUMP No.1	50 mm x 38 mm	3.0	☑	☐				
E3-PSL-043	MOLYBDENUM THICKENER FEED PUMP No.2	50 mm x 38 mm	3.0	☐	☑				
E3-PSL-045	1st CLEANER / SCAV CONC. PUMP No.1	100 mm x 75 mm	10.0	☑	☐				
E3-PSL-046	1st CLEANER / SCAV CONC. PUMP No.2	100 mm x 75 mm	10.0	☐	☑				
E3-PSL-054	2nd CLEANER TAILINGS PUMP No.1	150 mm x 100 mm	26.0	☑	☐				
E3-PSL-055	2nd CLEANER TAILINGS PUMP No.2	150 mm x 100 mm	26.0	☐	☑				
E3-PSL-057	2nd CLEANER CONC. PUMP No.1	150 mm x 100 mm	20.0	☑	☐				
E3-PSL-058	2nd CLEANER CONC. PUMP No.2	150 mm x 1050 mm	20.0	☐	☑				
E3-PSU-010	CONC. DEWATERING AREA SUMP PUMP	50 mm	1.0	☑	☐				
E3-PSU-026	FLOTATION AREA SUMP PUMP No. 1	100 mm	10.0	☑	☐				
E3-SCL-001	MOLYBDENUM CONC. SCALE		0.5	☑	☐				
E3-SMP-008	COPPER SAMPLER		7.5	☑	☐				
E3-SMP-011	REGRIND CYCLOPAC ON-STREAM SAMPLER		7.5	☑	☐				
E3-SMP-025	ROUGHER SCAVENGER ON-STREAM SAMPLER		7.5	☑	☐				
E3-SMP-038	1st CLEANER CONC. ON-STREAM SAMPLER		7.5	☑	☐				
E3-SMP-047	1st CLEANER / SCAV CONC. ON-STREAM SAMPLER		7.5	☑	☐				
E3-SMP-059	2nd CLEANER CONC. ON-STREAM SAMPLER		7.5	☑	☐				
E3-THI-001	COPPER MOLYBDENUM THICKENER	11,000 mm	6.0	☑	☐				
E3-THI-004	MOLYBDENUM THICKENER	2,500 mm	3.0	☑	☐				
E3-TNK-011	COPPER MOLYBDENUM CONC. STOCK TANK	1,500 mm DIA x 1,500 mm		☐	☐				
E3-TNK-012	MOLYBDENUM CONC. STOCK TANK	2,000 mm DIA x 2,500 mm		☐	☐				
E3-TNK-020	MOLYBDENUM ROUGHER CONC. STANDPIPE	1,500 mm DIA x 3,000 mm		☐	☐				
E3-TNK-025	MOLYBDENUM CLEANER CONC. STANDPIPE	1,000 mm DIA x 2,000 mm		☐	☐				
E3-TNK-035	1st CLEANER CONC. STANDPIPE	1,500 mm DIA x 3,000 mm		☐	☐				
E3-TNK-044	1st CLEANER / SCAVENGER CONC. STANDPIPE	1,500 mm DIA x 3,000 mm		☐	☐				
E3-TNK-056	2nd CLEANER CONC. STANDPIPE	2,000 mm DIA x 3,000 mm		☐	☐				
E3-WSS-LOT	FLOTATION FIRE PROTECTION SPRINKLERS/HOSES/EXTINGUISHERS			☐	☐				
		FLOTATION TOTAL kW:	6476.8						
Area: E4 - CONCENTRATE DEWATERING AND LOADOUT									
E4-AGI-009	COPPER CONCENTRATE STOCK TANK AGITATOR		22.0	☑	☐				
E4-AHU-008	LOADOUT DIRECT GAS FIRED AIR HANDLING UNIT	40000 CFM	18.7	☑	☐				
E4-AIR-020	CONCENTRATE DEWATERING AREA AIR RECEIVER	0.9 m3 (240 US gal)		☐	☐				

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EQUIPMENT LIST - ALL EQUIPMENT SORTED BY AREA

WARDROP PROJECT No : 06527201.00
EQUIPMENT LIST : 0652720100-LST-M0001-03

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
E4-BAG-007	LOADOUT DUST COLLECTOR	40000 CFM	0.2	☑	☐				
E4-CNV-004	LOADOUT DUST COLLECTOR SCREW CONVEYOR	1220 mm x 17200 mm	3.7	☑	☐				
E4-CNV-015	COPPER CONCENTRATE TRANSFER BELT CONVEYOR	,219 mm (48") x 14,600 mn	7.5	☑	☐				
E4-CNV-016	COPPER CONCENTRATE LOADOUT BELT CONVEYOR	,219 mm (48") x 17,200 mn	7.5	☑	☐				
E4-DUC-LOT	CONCENTRATE THICKENING DUST DUCTING - LOADOUT			☐	☐				
E4-FAN-038	LOADOUT DUST COLLECTOR EXHAUST FAN	40000 CFM	56.0	☑	☐				
E4-FIL-013	COPPER CONCENTRATE PRESSURE FILTER		75.0	☑	☐				
E4-HTR-035	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-036	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-037	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-038	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-039	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-040	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-041	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-HTR-042	LOADOUT GAS FIRED UNIT HEATER		0.2	☑	☐				
E4-PMP-001	CLOTH WASH WATER PUMP	40 mm x 25 mm	10.0	☑	☐				
E4-PMP-003	COPPER FILTRATE PUMP	50 mm x 38 mm	5.0	☑	☐				
E4-PSL-007	COPPER THICKENER UNDERFLOW PUMP No. 1	40 mm x 25 mm	11.0	☑	☐				
E4-PSL-008	COPPER THICKENER UNDERFLOW PUMP No. 2	40 mm x 25 mm	11.0	☐	☑				
E4-PSL-011	COPPER CONCENTRATE FILTER FEED PUMP No. 1	80 mm x 50 mm	55.0	☑	☐				
E4-PSL-012	COPPER CONCENTRATE FILTER FEED PUMP No. 2	80 mm x 50 mm	55.0	☐	☑				
E4-PSO-004	COPPER THICKENER OVERFLOW PUMP No. 1	80 mm x 50 mm	20.0	☑	☐				
E4-PSO-027	COPPER THICKENER OVERFLOW PUMP No. 2	80 mm x 50 mm	20.0	☐	☑				
E4-PSU-019	COPPER DEWATERING AREA SUMP PUMP	100 mm	15.0	☑	☐				
E4-SCL-017	COPPER CONCENTRATE BELT SCALE		0.5	☑	☐				
E4-THI-002	COPPER THICKENER	11,400 mm	7.0	☑	☐				
E4-TNK-003	COPPER THICKENER OVERFLOW STANDPIPE	1,200 mm DIA x 5,000 mm		☐	☐				
E4-TNK-006	CLOTH WASH WATER TANK	3,000 mm DIA x 3,000 mm		☐	☐				
E4-TNK-007	COPPER FILTRATE TANK	1,500 mm DIA x 3,000 mm		☐	☐				
E4-TNK-010	COPPER CONCENTRATE STOCK TANK	7,000 mm x 6,000 mm		☐	☐				
E4-VLV-006	LOADOUT DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	☑	☐				
E4-WSS-LOT	CONCENTRATE THICKENING FIRE PROTECTION SPRINKLERS/HOSES/E			☐	☐				
		CONCENTRATE DEWATERING AND LOADOUT TOTAL kW:	316.3						
Area: E5 - REAGENTS									
E5-AGI-006	FLOCCULANT MIXING TANK AGITATOR		0.6	☑	☐				
E5-AGI-022	LIME HOLDING TANK AGITATOR		55.5	☑	☐				
E5-AGI-030	PEX MIXING TANK AGITATOR		4.5	☑	☐				
E5-AGI-050	CMC MIXING TANK AGITATOR		1.1	☑	☐				
E5-BAG-008	LIME SILO BIN VENT DUST COLLECTOR	2000 CFM	0.2	☑	☐				
E5-COL-014	LIME AREA DUST COLLECTOR		0.2	☑	☐				
E5-CYC-021	LIME SLAKING CYCLONE			☐	☐				
E5-DRU-001	AERO DRUM CRADLE			☐	☐				
E5-DRU-002	MIBC DRUM CRADLE			☐	☐				
E5-EDU-005	FLOCCULANT EDUCTOR		2.0	☑	☐				
E5-FAN-039	PEX EXHAUST FAN	600 CFM	0.7	☑	☐				
E5-FAN-040	AERO 3302 EXHAUST FAN	600 CFM FRP	0.7	☑	☐				
E5-FAN-041	CMC EXHAUST FAN	600 CFM FRP	0.7	☑	☐				
E5-FAN-042	MIBC EXHAUST FAN	600 CFM FRP	0.7	☑	☐				
E5-FAN-043	KEROSENE EXHAUST FAN	600 CFM FRP	0.7	☑	☐				
E5-FAN-044	PINE OIL EXHAUST FAN	600 CFM FRP	0.7	☑	☐				
E5-FAN-045	LIME SILO DUST COLLECTOR EXHAUST FAN	2000 CFM	6.0	☑	☐				
E5-FDR-016	LIME SLAKING MILL SCREW FEEDER		18.0	☑	☐				
E5-FDR-020	FLOCCULANT SCREW FEEDER		18.0	☑	☐				
E5-HOI-001	FLOCCULANT HOIST		3.0	☑	☐				
E5-HPR-003	FLOCCULANT HOPPER			☐	☐				
E5-HTR-043	REAGENTS GAS FIRED UNIT HEATERS		0.2	☑	☐				
E5-HTR-044	REAGENTS GAS FIRED UNIT HEATERS		0.2	☑	☐				
E5-HTR-045	REAGENTS GAS FIRED UNIT HEATERS		0.2	☑	☐				

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
E5-HTR-046	REAGENTS GAS FIRED UNIT HEATERS		0.2	☑	☐				
E5-HTR-047	REAGENTS GAS FIRED UNIT HEATERS		0.2	☑	☐				
E5-HTR-048	REAGENTS GAS FIRED UNIT HEATERS		0.2	☑	☐				
E5-MIL-017	LIME SLAKING VERTICAL MILL		27.9	☑	☐				
E5-PBX-022	LIME SLAKING CYCLONE FEED PUMPBOX			☐	☐				
E5-PMP-001	KEROSENE HOLDING PUMP No. 1	50 mm x 40 mm	1.0	☑	☐				
E5-PMP-002	KEROSENE HOLDING PUMP No. 2	50 mm x 40 mm	1.0	☐	☑				
E5-PMP-005	PINE OIL HOLDING PUMP No. 1	50 mm x 40 mm	1.0	☑	☐				
E5-PMP-006	PINE OIL HOLDING PUMP No. 2	50 mm x 450 mm	1.0	☐	☑				
E5-PMT-001	FLOCCULANT METERING PUMP No. 1	25 mm PC	2.3	☑	☐				
E5-PMT-002	FLOCCULANT METERING PUMP No. 2	25 mm PC	2.3	☐	☑				
E5-PMT-005	PEX METERING PUMP No. 1	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-006	PEX METERING PUMP No. 2	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-007	PEX METERING PUMP No. 3	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-008	PEX METERING PUMP No. 4	12 mm x 25 mm	1.0	☐	☑				
E5-PMT-010	AERO 3302 METERING PUMP No. 1	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-011	AERO 3302 METERING PUMP No. 2	12 mm x 25 mm	1.0	☐	☑				
E5-PMT-020	CMC METERING PUMP	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-030	MIBC METERING PUMP No. 1	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-031	MIBC METERING PUMP No. 2	12 mm x 25 mm	1.0	☑	☐				
E5-PMT-032	MIBC METERING PUMP No. 3	12 mm x 25 mm	1.0	☑	☐				
E5-PSL-004	LIME SLAKING CYCLONE FEED PUMP	75 mm x 50 mm	11.3	☑	☐				
E5-PSO-024	LIME DISTRIBUTION PUMP No. 1	50 mm	1.0	☑	☐				
E5-PSO-025	LIME DISTRIBUTION PUMP No. 2	50 mm	1.0	☐	☑				
E5-PSU-012	FLOCCULANT AREA SUMP PUMP	50 mm	2.0	☑	☐				
E5-PSU-027	LIME AREA SUMP PUMP	50 mm	2.0	☑	☐				
E5-PSU-043	MIBC AREA SUMP PUMP	50 mm	2.0	☑	☐				
E5-PSU-050	KEROSENE & PINE OIL AREA SUMP PUMP	50 mm	1.0	☑	☐				
E5-SIL-015	LIME SILO	300 tonne		☐	☐				
E5-SSW-028	LIME AREA SAFETY SHOWER EYEWASH			☐	☐				
E5-SSW-029	PEX AREA SAFETY SHOWER EYEWASH			☐	☐				
E5-SSW-039	PINE OIL AREA SAFETY SHOWER EYEWASH			☐	☐				
E5-SSW-041	AERO 3302 AREA SAFETY SHOWER EYEWASH			☐	☐				
E5-SSW-044	MIBC AREA SAFETY SHOWER EYEWASH			☐	☐				
E5-SSW-053	CMC AREA SAFETY SHOWER EYEWASH			☐	☐				
E5-SYS-002	FLOCCULANT SYSTEM			☐	☐				
E5-SYS-013	LIME SLAKING SYSTEM			☐	☐				
E5-TNK-009	FLOCCULANT HOLDING TANK	3,000 mm DIA x 3,500 mm		☐	☐				
E5-TNK-017	FLOCCULANT MIXING TANK	3,000 mm DIA x 3,500 mm		☐	☐				
E5-TNK-023	LIME HOLDING TANK	6,000 mm DIA x 6,000 mm		☐	☐				
E5-TNK-031	PEX MIXING TANK	2,000 mm DIA x 3,000 mm		☐	☐				
E5-TNK-032	PEX HOLDING TANK	2,000 mm DIA x 3,000 mm		☐	☐				
E5-TNK-036	PINE OIL HOLDING TANK	4,000 mm x 9,000 mm		☐	☐				
E5-TNK-040	MIBC HOLDING TANK	1,500 mm x 2,000 mm		☐	☐				
E5-TNK-045	AERO 3302 HOLDING TANK	1,000 mm x 1,500 mm		☐	☐				
E5-TNK-051	CMC MIXING TANK	1,000 mm x 1,500 mm		☐	☐				
E5-TNK-052	CMC HOLDING TANK	1,000 mm x 1,500 mm		☐	☐				
E5-TNK-055	KEROSENE HOLDING TANK	4,000 mm x 9,000 mm		☐	☐				
E5-WSS-LOT	REAGENTS SPRINKLERS		0.0	☐	☐				
		REAGENTS TOTAL kW:	176.2						
Area: F0 - TAILINGS									
F0-PBX-001	TAILINGS PUMP STATION NO. 2 PUMP BOX	7,500 x 5,000 x10,000mm		☐	☐				by KCBL
F0-PBX-001	TAILINGS PUMP STATION NO. 1 PUMP BOX	7,500 x 5,000 x10,000mm		☐	☐	RUBBER LINED STEEL			
F0-PSU-001	TAILINGS PUMP STATION NO. 1 VFD - PUMP 1 (DUTY) - BY KCBL	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-002	TAILINGS PUMP STATION NO. 1 PUMP 2 (DUTY)	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-003	TAILINGS PUMP STATION NO. 1 PUMP 3 (DUTY)	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-004	TAILINGS PUMP STATION NO. 1 VFD - PUMP 4 (DUTY)	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-005	TAILINGS PUMP STATION NO. 2 VFD - PUMP 1 (DUTY) - BY KCBL	400mm x 350mm	820.0	☑	☐				by KCBL

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
F0-PSU-006	TAILINGS PUMP STATION NO. 2 PUMP 2 (DUTY)	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-007	TAILINGS PUMP STATION NO. 2 PUMP 3 (DUTY)	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-008	TAILINGS PUMP STATION NO. 2 VFD - PUMP 4 (DUTY)	400mm x 350mm	820.0	☑	☐				by KCBL
F0-PSU-016	FRESHWATER MAKE-UP PUMP 1 (DUTY)	150mm	100.7	☑	☐				by KCBL
F0-PSU-017	FRESHWATER MAKE-UP PUMP 2 (STANDBY)	150mm	100.7	☐	☑				by KCBL
F0-XEM-001	LIGHTING		5.0	☑	☐				
F0-XMM-001	TAILINGS PUMP STATION NO. 2 PUMP STATION AUXILIARY LOADS		104.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
F0-XMM-004	HVAC		20.0	☑	☐				
F0-XMM-005	FRESHWATER MAKE-UP PUMP STATION AUXILIARY LOADS		27.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
F0-XMM-006	MISC POWER INCL HEAT TRACING		20.0	☑	☐				
		TAILINGS TOTAL kW:	6836.7						
Area: F1 - TAILINGS DISPOSAL AND RECLAIM									
F1-CYC-001	RECLAIM DAM FINAL TAILINGS CYCLOPAC	6 X 650 mm		☐	☐				by KCBL
F1-CYC-002	RECLAIM DAM FINAL TAILINGS CYCLOPAC	6 X 650 mm		☐	☐				by KCBL
F1-PSU-009	RECLAIM BARGE PUMP 1 (DUTY)	400mm	82.0	☑	☐				by KCBL
F1-PSU-010	RECLAIM BARGE PUMP 2 (DUTY)	400mm	82.0	☑	☐				by KCBL
F1-PSU-011	RECLAIM BARGE PUMP 3 (STANDBY)	400mm	82.0	☐	☑				by KCBL
F1-PSU-018	CYCLOWASH PUMP STATION NO. 1 PUMP 1 (DUTY)	100mm x 150mm	48.5	☑	☐				by KCBL
F1-PSU-019	CYCLOWASH PUMP STATION NO. 1 PUMP 2 (STANDBY)	100mm x 150mm	48.5	☐	☑				by KCBL
F1-PSU-020	CYCLOWASH PUMP STATION NO. 2 PUMP 1 (DUTY)	100mm x 150mm	55.9	☑	☐				by KCBL
F1-PSU-021	CYCLOWASH PUMP STATION NO. 2 PUMP 2 (STANDBY)	100mm x 150mm	55.9	☐	☑				by KCBL
F1-XMM-002	RECLAIM BARGE PUMP STATION AUXILIARY LOADS		40.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
F1-XMM-006	CYCLOWASH PUMP STATION NO. 1 PUMP STATION AUXILIARY LOADS		27.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
F1-XMM-007	CYCLOWASH PUMP STATION NO. 2 PUMP STATION AUXILIARY LOADS		27.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
		TAILINGS DISPOSAL AND RECLAIM TOTAL kW:	362.4						
Area: F2 - TAILINGS POND									
F2-PSU-012	NORTH SEEPAGE POND RECLAIM BARGE PUMP 1 (DUTY)	150mm	52.0	☑	☐				by KCBL
F2-PSU-013	NORTH SEEPAGE POND RECLAIM BARGE PUMP 2 (STANDBY)	150mm	52.0	☐	☑				by KCBL
F2-PSU-014	SOUTH SEEPAGE POND RECLAIM BARGE PUMP 1 (DUTY)	150mm	78.3	☑	☐				by KCBL
F2-PSU-015	SOUTH SEEPAGE POND RECLAIM BARGE PUMP 2 (STANDBY)	150mm	78.3	☐	☑				by KCBL
F2-XMM-003	NORTH SEEPAGE POND RECLAIM BARGE PUMP STATION AUXILIARY L		27.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
F2-XMM-004	SOUTH SEEPAGE POND RECLAIM BARGE PUMP STATION AUXILIARY L		27.0	☑	☐				Includes small power and lighting,controls, HVAC, o/h crane
		TAILINGS POND TOTAL kW:	184.3						
Area: G1 - FRESH/FIRE WATER									
G1-PSO-001	WELL WATER PUMP	150 mm	125.0	☑	☐				
G1-PSO-004	FRESH WATER PUMP No.1	80 mm x 100 mm	11.2	☑	☐				
G1-PSO-005	FRESH WATER PUMP No.2	80 mm x 100 mm	11.2	☐	☑				
G1-TNK-003	FRESH WATER TANK	6,000 mm DIA x 7,000 mm		☐	☐				
G1-TNK-004	FIRE/RECLAIM WATER HOLDING TANK	6,000 mm DIA x 16,000 mm		☐	☐				
		FRESH/FIRE WATER TOTAL kW:	136.2						
Area: G2 - PROCESS WATER									
G2-AGI-005	ANTISCALENT TANK AGITATOR		3.0	☑	☐				
G2-PSO-002	PROCESS WATER DISTRIBUTION PUMP No. 1	500 mm x 450 mm	259.0	☑	☐				
G2-PSO-003	PROCESS WATER DISTRIBUTION PUMP No. 2	500 mm x 450 mm	259.0	☐	☑				
G2-PSO-023	ANTISCALENT FEED PUMP No. 1	50 mm x 38 mm	1.0	☑	☐				
G2-PSO-024	ANTISCALENT FEED PUMP No. 2	50 mm x 38 mm	1.0	☐	☑				
G2-TNK-001	PROCESS WATER TANK	4,000 mm DIA x 14,000 mm		☐	☐				
G2-TNK-015	ANTISCALENT TANK	2000 mm x 2000 mm		☐	☐				
		PROCESS WATER TOTAL kW:	263.0						
Area: G5 - PLANT AND INSTRUMENT AIR									
G5-AIC-001	PROCESS PLANT AIR COMPRESSOR No. 1	680 Nm3/h @ 830 kPag	75.0	☑	☐				
G5-AIC-002	PROCESS PLANT AIR COMPRESSOR No. 2	680 Nm3/h @ 830 kPag	75.0	☑	☐				
G5-AIC-003	PROCESS PLANT AIR COMPRESSOR No. 3	680 Nm3/h @ 830 kPag	75.0	☐	☑				
G5-AIC-011	PROCESS PLANT AIR COMPRESSOR No. 4	680 Nm3/h @ 830 kPag	75.0	☑	☐				
G5-AID-008	INSTRUMENT AIR DRYER	360 Nm3/h @ 830 kPag		☐	☐				
G5-AIF-004	PROCESS PLANT AIR FILTER	1360 Nm3/h @ 830 kPag		☐	☐				

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
G5-AIR-005	INSTRUMENT AIR RECEIVER No. 1	0.9 m3 (240 US gal)		☐	☐				
G5-AIR-009	PROCESS PLANT AIR RECEIVER	6.0 m3 (1600 US gal)		☐	☐				
G5-AIR-010	INSTRUMENT AIR RECEIVER No. 2	0.9 m3 (240 US gal)		☐	☐				
		PLANT AND INSTRUMENT AIR TOTAL kW:	225.0						
Area: G6 - SEWAGE TREATMENT									
G6-XEM-001	MISCELLANEOUS - ELECTRICAL		100.0	☑	☐				
		SEWAGE TREATMENT TOTAL kW:	100.0						
Area: J1 - ADMINISTRATION AND MINE DRY									
J1-ACL-007	ADMINISTRATION FAN COIL #1 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-008	ADMINISTRATION AIR COOLED CONDENSING UNIT #1	2.5 tonne	3.7	☑	☐				
J1-ACL-009	ADMINISTRATION FAN COIL #2 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-010	ADMINISTRATION AIR COOLED CONDENSING UNIT #2	2.5 tonne	3.7	☑	☐				
J1-ACL-011	ADMINISTRATION FAN COIL #3 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-012	ADMINISTRATION AIR COOLED CONDENSING UNIT #3	2.5 tonne	3.7	☑	☐				
J1-ACL-013	ADMINISTRATION FAN COIL #4 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-014	ADMINISTRATION AIR COOLED CONDENSING UNIT #4	2.5 tonne	3.7	☑	☐				
J1-ACL-015	ADMINISTRATION FAN COIL #5 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-016	ADMINISTRATION AIR COOLED CONDENSING UNIT #5	2.5 tonne	3.7	☑	☐				
J1-ACL-017	ADMINISTRATION FAN COIL #6 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-018	ADMINISTRATION AIR COOLED CONDENSING UNIT #6	2.5 tonne	3.7	☑	☐				
J1-ACL-019	ADMINISTRATION FAN COIL #7 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-020	ADMINISTRATION AIR COOLED CONDENSING UNIT #7	2.5 tonne	3.7	☑	☐				
J1-ACL-021	ADMINISTRATION FAN COIL #8 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-022	ADMINISTRATION AIR COOLED CONDENSING UNIT #8	2.5 tonne	3.7	☑	☐				
J1-ACL-023	ADMINISTRATION FAN COIL #9 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-024	ADMINISTRATION AIR COOLED CONDENSING UNIT #9	2.5 tonne	3.7	☑	☐				
J1-ACL-025	ADMINISTRATION FAN COIL #10 AIR CONDITIONING UNIT	1200 CFM	0.7	☑	☐				
J1-ACL-026	ADMINISTRATION AIR COOLED CONDENSING UNIT #10	2.5 tonne	3.7	☑	☐				
J1-AHU-009	ADMINISTRATION DIRECT GAS FIRED AIR HANDLING UNIT	3000 CFM	3.7	☑	☐				
J1-FAN-046	ADMINISTRATION SHOWERS EXHAUST FAN	2000 CFM	3.7	☑	☐				
J1-FAN-047	ADMINISTRATION LUNCHROOM EXHAUST FAN	240 CFM	0.2	☑	☐				
J1-FAN-048	ADMINISTRATION WASHROOMS EXHAUST FAN	240 CFM	0.2	☑	☐				
J1-FAN-049	ADMINISTRATION JANITORS EXHAUST FAN	100 CFM	0.2	☑	☐				
J1-FAN-050	ADMINISTRATION ELECTRICAL ROOM SUPPLY FAN / FILTER FAN	1200 CFM	3.7	☑	☐				
J1-HTR-049	ADMINISTRATION PROPANE HOT WATER HEATER		0.0	☐	☑				
J1-HTR-050	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-051	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-052	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-053	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-054	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-055	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-056	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-057	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-058	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-059	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-HTR-060	ADMINISTRATION ELECTRIC BASEBOARD HEATERS		0.7	☑	☐				
J1-WSS-LOT	ADMINISTRATION BUILDING SPRINKLERS		0.0	☐	☐				
J1-XEM-001	MISCELLANEOUS - ELECTRICAL		100.0	☑	☐				
		ADMINISTRATION AND MINE DRY TOTAL kW:	164.6						
Area: J2 - TRUCKSHOP AND WAREHOUSE									
J2-ACL-027	WAREHOUSE OFFICE AIR CONDITIONING UNIT	1500 CFM	0.7	☑	☐				
J2-ACL-028	WAREHOUSE OFFICE AIR COOLED CONDENSING UNIT	4 tonne	7.5	☑	☐				
J2-ACL-029	FIRST AID GAS FIRED AIR CONDITIONING UNIT	1300 CFM	0.7	☑	☐				
J2-ACL-030	FIRST AID AIR COOLED CONDENSING UNIT	3 tonne	3.7	☑	☐				
J2-AHU-010	TRUCK BAYS GAS FIRED AIR HANDLING UNIT #1	25000 CFM	14.9	☑	☐				
J2-AHU-011	TRUCK BAYS GAS FIRED AIR HANDLING UNIT #2	25000 CFM	14.9	☑	☐				
J2-AHU-012	WAREHOUSE GAS FIRED AIR HANDLING UNIT #3	6000 CFM	5.5	☑	☐				

PBM - MORRISON COPPER / GOLD PROJECT
EQUIPMENT LIST - ALL EQUIPMENT SORTED BY AREA

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
J2-AHU-013	TRUCK SHOP GAS FIRED AIR HANDLING UNIT #4	13000 CFM	7.5	☑	☐				
J2-AHU-014	TRUCK SHOP OFFICES GAS FIRED AIR HANDLING UNIT #5	3200 CFM	3.7	☑	☐				
J2-AHU-015	TRUCK WASH DIRECT GAS FIRED AIR HANDLING UNIT	25000 CFM	14.9	☑	☐				
J2-AIC-001	TRUCK SHOP AIR COMPRESSOR	200 Nm3/h @ 690 kPag	40.0	☑	☐				
J2-AIF-002	TRUCK SHOP AIR FILTER	386 Nm3/h @ 830 kPag		☐	☐				
J2-AIR-003	TRUCK SHOP AIR RECEIVER	0.9 m3 (240 US gal)		☐	☐				
J2-FAN-051	TRUCK SHOP HIGH BAYS EXHAUST FAN	12000 CFM	5.5	☑	☐				
J2-FAN-052	TRUCK SHOP HIGH BAYS EXHAUST FAN	12000 CFM	5.5	☑	☐				
J2-FAN-053	TRUCK SHOP HIGH BAYS EXHAUST FAN	12000 CFM	5.5	☑	☐				
J2-FAN-054	TRUCK SHOP HIGH BAYS EXHAUST FAN	12000 CFM	5.5	☑	☐				
J2-FAN-055	TRUCK WASH EXHAUST FAN	25000 CFM	7.5	☑	☐				
J2-FAN-056	TYRE CHANGE EXHAUST FAN	2000 CFM	2.2	☑	☐				
J2-FAN-057	TRUCK WASH COMPRESSOR ROOM EXHAUST FAN	1200 CFM	2.2	☑	☐				
J2-FAN-058	TRUCK SHOP LOW BAYS EXHAUST FAN	12000 CFM	3.7	☑	☐				
J2-FAN-059	TRUCK SHOP LOW BAYS EXHAUST FAN	12000 CFM	3.7	☑	☐				
J2-FAN-060	TRUCK SHOP LOW BAYS EXHAUST FAN	12000 CFM	3.7	☑	☐				
J2-FAN-061	WAREHOUSE EXHAUST FAN	8000 CFM	3.7	☑	☐				
J2-FAN-062	TRUCK SHOP SHOWERS EXHAUST FAN	4000 CFM	3.7	☑	☐				
J2-FAN-063	TRUCK SHOP COMPRESSOR ROOM EXHAUST FAN	1500 CFM	2.2	☑	☐				
J2-FAN-064	TRUCK SHOP BATTERY ROOM EXHAUST FAN	300 CFM	0.3	☑	☐				
J2-FAN-065	TRUCK SHOP ELECTRICAL ROOM EXHAUST FAN	1200 CFM	2.2	☑	☐				
J2-FAN-066	TRUCK SHOP LUBE STORAGE EXHAUST FAN	1500 CFM	2.2	☑	☐				
J2-FAN-067	TRUCK SHOP WELDING ARMS	1200 CFM	2.2	☑	☐				
J2-FAN-068	TRUCK SHOP WELDING ARMS	1200 CFM	2.2	☑	☐				
J2-FAN-069	TRUCK SHOP FIRST AID EXHAUST FAN	250 CFM	0.2	☑	☐				
J2-FAN-070	TRUCK SHOP CEILING FANS	48" DIA	0.1	☑	☐				
J2-FAN-071	TRUCK SHOP CEILING FANS	48" DIA	0.1	☑	☐				
J2-FAN-072	TRUCK SHOP CEILING FANS	48" DIA	0.1	☑	☐				
J2-FAN-073	TRUCK SHOP CEILING FANS	48" DIA	0.1	☑	☐				
J2-HTR-061	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-062	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-063	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-064	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-065	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-066	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-067	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-068	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-069	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-070	TRUCK SHOP GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-071	TRUCK SHOP AMBULANCE ELECTRIC UNIT HEATER		0.4	☑	☐				
J2-HTR-072	TRUCK SHOP AMBULANCE ELECTRIC UNIT HEATER		0.4	☑	☐				
J2-HTR-073	WAREHOUSE GAS FIRED UNIT HEATER		0.2	☑	☐				
J2-HTR-074	WAREHOUSE GAS FIRED UNIT HEATER		0.2	☑	☐				
J2-HTR-075	WAREHOUSE GAS FIRED UNIT HEATER		0.2	☑	☐				
J2-HTR-076	WAREHOUSE GAS FIRED UNIT HEATER		0.2	☑	☐				
J2-HTR-077	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-078	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-079	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-080	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-081	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-082	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-083	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-HTR-084	TRUCK WASH GAS FIRED RADIANT HEATER		0.1	☑	☐				
J2-WSS-LOT	TRUCK SHOP & WAREHOUSE SPRINKLERS		0.0	☐	☐				
J2-XEM-001	MISCELLANEOUS - ELECTRICAL		300.0	☑	☐				
		TRUCKSHOP AND WAREHOUSE TOTAL kW:	481.8						
Area: J3 - ASSAY LABORATORY									
J3-AHU-016	ASSAY LAB GAS FIRED AIR HANDLING UNIT #1	10000 CFM	5.5	☑	☐				

EQUIPMENT NUMBER	DESCRIPTION	EQUIPMENT SIZE	POWER (kW)	OPERATING	STAND BY	MATERIAL	CAPACITY	MODEL	REMARKS
J3-AHU-017	ASSAY LAB GAS FIRED AIR HANDLING UNIT #2	10000 CFM	5.5	☑	☐				
J3-BAG-009	ASSAY LAB DUST COLLECTOR #1	10000 CFM	0.2	☑	☐				
J3-BAG-010	ASSAY LAB DUST COLLECTOR #2	10000 CFM	0.2	☑	☐				
J3-FAN-074	ASSAY LAB DUST COLLECTOR EXHAUST FAN #1	10000 CFM	29.8	☑	☐				
J3-FAN-075	ASSAY LAB DUST COLLECTOR EXHAUST FAN #2	10000 CFM	29.8	☑	☐				
J3-FAN-076	ASSAY LAB PERCHLORIC SCRUBBER EXHAUST FAN	1200 CFM	7.5	☑	☐				
J3-FAN-077	ASSAY LAB COMPRESSOR ROOM SUPPLY FAN / FILTER FAN	1200 CFM	7.5	☑	☐				
J3-FAN-078	ASSAY LAB WASHROOMS EXHAUST FAN	240 CFM	0.2	☑	☐				
J3-FAN-079	ASSAY LAB LECO EXHAUST FAN	400 CFM	0.2	☑	☐				
J3-FAN-080	ASSAY LAB GENERAL EXHAUST EXHAUST FAN	2000 CFM	3.7	☑	☐				
J3-FAN-081	ASSAY LAB LUNCH ROOM EXHAUST FAN	250 CFM	0.2	☑	☐				
J3-FAN-082	ASSAY LAB ELECTRICAL ROOM EXHAUST FAN	1200 CFM	3.7	☑	☐				
J3-FAN-083	ASSAY LAB DRYERS EXHAUST FAN	400 CFM	0.4	☑	☐				
J3-FAN-084	ASSAY LAB AA HOODS EXHAUST FAN	400 CFM	0.2	☑	☐				
J3-HTR-085	ASSAY LAB GAS FIRED HOT WATER HEATER		9.0	☑	☐				
J3-HTR-086	ASSAY LAB ELECTRIC BASEBOARD HEATER		0.8	☑	☐				
J3-HTR-087	ASSAY LAB ELECTRIC BASEBOARD HEATER		0.8	☑	☐				
J3-HTR-088	ASSAY LAB ELECTRIC BASEBOARD HEATER		0.8	☑	☐				
J3-HTR-089	ASSAY LAB ELECTRIC BASEBOARD HEATER		0.8	☑	☐				
J3-HTR-090	ASSAY LAB ELECTRIC BASEBOARD HEATER		0.8	☑	☐				
J3-HTR-091	ASSAY LAB ELECTRIC BASEBOARD HEATER		0.8	☑	☐				
J3-SCR-005	ASSAY LAB PERCHLORIC SCRUBBER	1200 CFM	0.0	☐	☐				
J3-VLV-006	LOADOUT DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	☑	☐				
J3-VLV-007	LOADOUT DUST COLLECTOR ROTARY VALVE	8" DIA	0.7	☑	☐				
J3-WSS-LOT	ASSAY LAB SPRINKLERS		0.0	☐	☐				
		ASSAY LABORATORY TOTAL kW:	109.6						
Area: J4 - FUEL STORAGE AND DISTRIBUTION									
J4-XEM-001	MISCELLANEOUS - ELECTRICAL		100.0	☑	☐				
		FUEL STORAGE AND DISTRIBUTION TOTAL kW:	100.0						
Area: J5 - COLD STORAGE WAREHOUSE									
J5-XEM-001	MISCELLANEOUS - ELECTRICAL		20.0	☑	☐				
		COLD STORAGE WAREHOUSE TOTAL kW:	20.0						

PLANT TOTAL kW: 40,112

APPENDIX C

POWER LOAD LIST

WARDROP
Wardrop Engineering Inc.

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

WARDROP PROJECT No : 06527201.00
LOAD LIST : 0652720100-LST-E0001-06

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD	SPEED FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
Area: A2 - POWER DISTRIBUTION																						
A2-XEM-001	LIGHTING	☑	☐	☐	☐	☐	600	20.0	26.8	0.80	0.90	0.90	0.95	15.2	16.8	0.80	0.90	☑	53,113	59,752	112,866	112,866
A2-XMM-004	HVAC	☑	☐	☐	☐	☐	600	30.0	40.2	0.80	0.70	0.90	0.95	17.7	19.8	0.80	0.80	☑	61,965	61,965	123,931	123,931
A2-XMM-005	MISC POWER INCL HEAT TRACING	☑	☐	☐	☐	☐	600	20.0	26.8	0.80	0.80	0.90	0.95	13.5	15.0	0.65	0.90	☑	38,360	53,113	91,473	91,473
				POWER DISTRIBUTION TOTAL kW:				70.0				TOTAL RUNNING kW:		46.3	51.5		TOTAL kW.hr:		153,438	174,831	328,269	328,269
Area: A6 - YARD LIGHTING																						
A6-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐	☐	600	100.0	134.1	0.80	0.70	0.90	0.95	58.9	65.5	0.50	0.90	☑	129,095	232,371	361,465	361,465
				YARD LIGHTING TOTAL kW:				100.0				TOTAL RUNNING kW:		58.9	65.5		TOTAL kW.hr:		129,095	232,371	361,465	361,465
Area: B2 - OPEN PIT MOBILE EQUIPMENT																						
B2-TRU-013	FUEL/LUBE TRUCK	☑	☐	☐	☐	☐					1.00							☐				0
B2-TRU-014	FLATBED TRUCK	☑	☐	☐	☐	☐					1.00							☐				0
B2-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐	☐	600	25.0	33.5	0.80	0.90	0.90	0.95	18.9	21.1	0.70	0.80	☑	58,093	66,392	124,484	124,484
				OPEN PIT MOBILE EQUIPMENT TOTAL kW:				25.0				TOTAL RUNNING kW:		18.9	21.1		TOTAL kW.hr:		58,093	66,392	124,484	124,484
Area: B6 - OPEN PIT DEWATERING																						
B6-PSU-001	PIT DEWATERING PUMP 1	☑	☐	☐	☐	☐	600	75.0	100.6	0.80	1.00	0.90	0.90	66.7	74.1	0.60	0.60	☐	175,200	175,200	350,400	0
B6-PSU-002	PIT DEWATERING PUMP 2	☑	☐	☐	☐	☐	600	75.0	100.6	0.80	1.00	0.90	0.90	66.7	74.1	0.60	0.60	☐	175,200	175,200	350,400	0
				OPEN PIT DEWATERING TOTAL kW:				150.0				TOTAL RUNNING kW:		133.3	148.1		TOTAL kW.hr:		350,400	350,400	700,800	0
Area: B7 - OPEN PIT ELCTRICAL																						
B7-XEM-001	OPEN PIT LIGHTING	☑	☐	☐	☐	☐	600	5.0	6.7	0.80	1.00	0.90	0.90	4.4	4.9	0.80	0.80	☐	15,573	15,573	31,147	0
				OPEN PIT ELCTRICAL TOTAL kW:				5.0				TOTAL RUNNING kW:		4.4	4.9		TOTAL kW.hr:		15,573	15,573	31,147	0
Area: C0 - PRIMARY CRUSHING																						
C0-ACL-001	PRIMARY CRUSHER CONTROL ROOM AIR CONDITIONING UNI	☑	☐	☐	☐	☐	600	0.2	0.3	0.80	0.70	0.90	0.95	0.1	0.2	0.90	0.60	☑	572	381	953	953
C0-ACL-002	PRIMARY CRUSHER CONTROL ROOM AIR COOLED CONDENSI	☑	☐	☐	☐	☐	600	3.7	5.0	0.80	0.70	0.90	0.95	2.2	2.4	0.90	0.60	☑	8,667	5,778	14,446	14,446
C0-AHU-001	PRIMARY CRUSHER DIRECT GAS FIRED AIR HANDLING UNIT	☑	☐	☐	☐	☐	600	5.5	7.4	0.80	0.70	0.90	0.95	3.2	3.6	0.95	0.95	☑	13,490	13,490	26,981	26,981
C0-AIC-015	CRUSHING AREA AIR COMPRESSOR	☑	☐	☐	☐	☑	600	40.0	53.6	0.80	0.65	0.86	0.95	21.8	25.4	0.95	0.95	☑	90,722	90,722	181,444	181,444
C0-BAG-001	PRIMARY CRUSHER DUST COLLECTOR	☑	☐	☐	☐	☐	600	0.2	0.3	0.80	0.90	0.87	0.90	0.2	0.2	0.95	0.95	☐	666	666	1,332	0
C0-BAG-015	CRUSHING DUST COLLECTOR BAGHOUSE	☑	☐	☐	☐	☑	600	0.2	0.3	0.80	0.90	0.87	0.90	0.2	0.2	0.95	0.95	☐	666	666	1,332	0
C0-CRN-003	PRIMARY CRUSHING OVERHEAD CRANE	☑	☐	☐	☐	☐	600	35.0	46.9	0.20	0.20	0.90	0.95	1.5	1.6	0.95	0.95	☐	6,132	6,132	12,264	0
C0-CRU-004	PRIMARY GYRATORY CRUSHER	☑	☐	☐	☐	☑	4160	450.0	603.5	0.70	1.00	0.89	0.96	328.1	368.7	0.95	0.95	☐	1,365,328	1,365,328	2,730,656	0
C0-FAN-001	PRIMARY CRUSHER LUBE ROOM SUPPLY FAN / FILTER	☑	☐	☐	☐	☐	600	2.2	3.0	0.80	0.70	0.90	0.95	1.3	1.4	0.95	0.95	☑	5,396	5,396	10,792	10,792
C0-FAN-002	PRIMARY CRUSHER CONTROL ROOM SUPPLY FAN / FILTER	☑	☐	☐	☐	☐	600	3.7	5.0	0.80	0.70	0.90	0.95	2.2	2.4	0.95	0.95	☑	9,149	9,149	18,298	18,298
C0-FAN-003	PRIMARY CRUSHER COMPRESSOR ROOM SUPPLY FAN / FILT	☑	☐	☐	☐	☐	600	2.2	3.0	0.80	0.70	0.90	0.95	1.3	1.4	0.95	0.95	☑	5,396	5,396	10,792	10,792
C0-FAN-004	PRIMARY CRUSHER ELECTRICAL ROOM SUPPLY FAN / FILTE	☑	☐	☐	☐	☐	600	5.5	7.4	0.80	0.70	0.90	0.95	3.2	3.6	0.95	0.95	☐	13,490	13,490	26,981	0
C0-FAN-005	PRIMARY CRUSHER DUST COLLECTOR EXHAUST FAN	☑	☐	☐	☐	☐	600	29.8	40.0	0.80	0.70	0.90	0.95	17.6	19.5	0.95	0.95	☐	73,192	73,192	146,383	0
C0-FDR-015	PRIMARY CRUSHER APRON FEEDER	☑	☐	☐	☑	☐	600	75.0	100.6	0.80	0.90	0.84	0.92	58.7	69.9	0.95	0.95	☐	244,233	244,233	488,465	0
C0-HTR-001	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-002	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-003	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-004	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-005	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-006	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-007	PRIMARY CRUSHER ELECTRIC UNIT HEATER	☑	☐	☐	☐	☐	600	10.0	13.4	1.00	0.80	1.00	1.00	8.0	8.0	0.50	0.95	☑	17,520	33,288	50,808	50,808
C0-HTR-008	PRIMARY CRUSHER CONTROL ROOM ELECTRIC DUCT HEATE	☑	☐	☐	☐	☐	600	6.5	8.7	1.00	0.80	1.00	0.95	5.5	5.5	0.50	0.95	☑	11,987	22,776	34,763	34,763
C0-LUB-011	PRIMARY CRUSHER LUBE UNIT	☑	☐	☐	☐	☑	600	3.7	5.0	0.80	0.60	0.87	0.90	2.0	2.3	0.95	0.95	☐	8,193	8,193	16,386	0
C0-PPK-001	APRON FEEDER HYDRAULIC DRIVE POWER PACK	☑	☐	☐	☐	☑	600	75.0	100.6	0.80	0.60	0.89	0.98	37.4	42.0	0.95	0.95	☐	155,713	155,713	311,426	0
C0-PPK-002	ROCK BREAKER HYDRAULIC POWER PACK	☑	☐	☐	☐	☑	600	1.5	2.0	0.80	0.50	0.87	0.90	0.7	0.8	0.95	0.95	☐	2,768	2,768	5,536	0
C0-PSU-013	CRUSHING AREA SUMP PUMP	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	0.25	0.84	0.92	1.6	1.9	0.95	0.95	☐	6,755	6,755	13,510	0
C0-RKB-001	ROCK BREAKER	☑	☐	☐	☐	☑	600	37.0	49.6	0.80	0.50	0.86	0.95	15.5	18.0	0.95	0.95	☐	64,552	64,552	129,104	0
C0-SCB-004	STOCKPILE FEED BELT SCALE	☑	☐	☐	☐	☑	600	0.5	0.7	0.80	1.00	0.87	0.90	0.4	0.5	0.95	0.95	☐	1,845	1,845	3,690	0
C0-VLV-001	PRIMARY CRUSHER DUST COLLECTOR ROTARY VALVE	☑	☐	☐	☐	☐	600	0.7	1.0	0.80	1.00	0.90	0.95	0.6	0.7	0.95	0.95	☐	2,614	2,614	5,228	0
C0-XEM-001	LIGHTING	☑	☐	☐	☐	☐	600	25.0	33.6	0.90	0.90	0.90	0.95	21.3	23.7	0.80	0.90	☑	74,691	84,027	158,717	158,717
C0-XMM-005	MISC POWER INCL HEAT TRACING	☑	☐	☐	☐	☐	600	25.0	33.6	0.80	0.80	0.90	0.95	18.8	18.7	0.65	0.90	☑	47,949	66,392	114,341	114,341
				PRIMARY CRUSHING TOTAL kW:				905.8				TOTAL RUNNING kW:		599.5	670.7		TOTAL kW.hr:		2,336,806	2,482,670	4,819,476	927,184
Area: D0 - COARSE ORE STOCKPILE AND RECLAIM																						
D0-AHU-002	PRIMARY CRUSHER DIRECT GAS FIRED AIR HANDLING UNIT	☑	☐	☐	☐	☐	600	14.9	20.0	0.80	0.70	0.80	0.90	9.3	11.6	0.50	0.95	☑	20,331	38,629	58,960	58,960
D0-BAG-002	STOCKPILE RECLAIM DUST COLLECTOR	☑	☐	☐	☐	☐	600	0.2	0.3	0.80	0.90	0.90	0.95	0.2	0.2	0.95	0.95	☑	631	631	1,261	1,261
D0-CNV-001	STOCKPILE RECLAIM DUST COLLECTOR SCREW CONVEYOR	☑	☐	☐	☐	☐	600	3.7	5.0	0.75	1.00	0.90	0.95	2.9	3.3	0.95	0.95	☐	12,253	12,253	24,506	0
D0-CNV-020	STOCKPILE FEED BELT CONVEYOR	☑	☐	☐	☐	☑	4160	447.4	600.0	0.75	1.00	0.88	0.90	372.8	423.7	0.95	0.95	☐	1,551,359	1,551,359	3,102,719	0
D0-CNV-028	PRIMARY SIZING SCREEN FEED CONVEYOR	☑	☐	☐	☐	☑	600	186.4	250.0	0.75	1.00	0.88	0.90	155.3	176.5	0.95	0.95	☐	646,342	646,342	1,292,684	0
D0-FAN-006	STOCKPILE RECLAIM DUST COLLECTOR EXHAUST FAN	☑	☐	☐	☐	☐	600	55.9	75.0	0.80	1.00	0.90	0.95	47.1	52.3	0.95	0.95	☑	196,014	196,014	392,028	392,028
D0-FAN-007	TUNNEL EXHAUST FAN	☑	☐	☐	☐	☐	600	3.7	5.0	0.80	1.00	0.90	0.95	3.1	3.5	0.95	0.95	☑	13,070	13,070	26,140	26,140
D0-FDR-004	STOCKPILE RECLAIM APRON FEEDER No. 1 VFD	☑	☐	☐	☑	☐	600	14.9	20.0	0.75	0.90	0.84	0.90	11.2	13.4	0.95	0.95	☐	46,499	46,499	92,998	0
D0-FDR-008	STOCKPILE RECLAIM APRON FEEDER No. 2 VFD	☑	☐	☐	☑	☐	600	14.9	20.0	0.75	0.90	0.84	0.90	11.2	13.4	0.95	0.95	☐	46,499	46,499	92,998	0
D0-FDR-012	STOCKPILE RECLAIM APRON FEEDER No. 3 VFD	☐	☑	☐	☑	☐	600	14.9	20.0	0.75	0.25	0.84	0.90	0.0	0.0	0.95	0.95	☐	0	0	0	0

WARDROP
Wardrop Engineering Inc.

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

WARDROP PROJECT No : 06527201.00
LOAD LIST : 0652720100-LST-E0001-06

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD	SPEED FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
D0-PSU-017	STOCKPILE AREA SUMP PUMP	✓				✓	600	7.5	10.1	0.80	0.25	0.84	0.92	1.6	1.9	0.96	0.96	✓	6,784	6,784	13,568	13,568
D0-SCB-003	PRIMARY SIZING SCREEN BELT SCALE	✓				✓	600	0.5	0.7	0.80	0.90	0.87	0.90	0.4	0.5	0.96	0.96		1,661	1,661	3,321	0
D0-VLV-002	STOCKPILE RECLAIM DUST COLLECTOR ROTARY VALVE	✓					600	0.7	1.0	0.80	0.90	0.90	0.96	0.6	0.6	0.96	0.96		2,353	2,353	4,705	0
D0-XEM-001	LIGHTING	✓					600	25.0	33.5	0.80	0.90	0.90	0.96	18.9	21.1	0.96	0.96	✓	78,840	78,840	157,680	157,680
D0-XMM-006	MISC POWER INCL HEAT TRACING	✓					600	25.0	33.5	0.80	0.80	0.90	0.96	16.8	18.7	0.65	0.96		47,949	70,080	118,029	0
				COARSE ORE STOCKPILE AND RECLAIM TOTAL kW:				815.8				TOTAL RUNNING kW:		651.5	740.6		TOTAL kW.hr:		2,670,585	2,711,014	5,381,599	649,637
Area: D1 - HPGR																						
D1-BAG-003	CRUSHER SURGE BIN BIN VENT DUST COLLECTOR	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.1	0.96	0.96		491	491	981	0
D1-BAG-004	HPGR SURGE BIN BIN VENT DUST COLLECTOR	✓					600	0.2	0.3	0.80	0.90	0.90	0.96	0.2	0.2	0.96	0.96		631	631	1,261	0
D1-BAG-005	HPGR DUST COLLECTOR	✓					600	0.2	0.3	0.80	0.90	0.90	0.96	0.2	0.2	0.96	0.96		631	631	1,261	0
D1-BAG-006	SECONDARY SIZING SCREEN DUST COLLECTOR BAGHOUSE	✓				✓	600	112.0	150.2	0.80	0.90	0.90	0.96	84.9	94.3	0.96	0.96		353,203	353,203	706,406	0
D1-CNV-002	CONE CRUSHER SURGE BIN FEED CONVEYOR	✓				✓	600	55.0	73.8	0.75	1.00	0.89	0.96	42.9	48.2	0.96	0.96		178,421	178,421	356,843	0
D1-CNV-010	HPGR DUST COLLECTOR SCREW CONVEYOR	✓					600	3.7	5.0	0.80	1.00	0.88	0.96	3.1	3.6	0.96	0.96		13,070	13,070	26,140	0
D1-CNV-026	HPGR SURGE BIN FEED CONVEYOR	✓				✓	600	55.0	73.8	0.80	1.00	0.88	0.96	45.7	52.0	0.96	0.96		190,316	190,316	380,632	0
D1-COL-015	HPGR DUST COLLECTOR	✓				✓	600	112.0	150.2	0.80	0.90	0.88	0.96	83.8	95.3	0.96	0.96		348,797	348,797	697,595	0
D1-COO-001	CONE CRUSHER LUBRICATION COOLER No. 1	✓				✓	600	5.0	6.7	0.80	0.90	0.87	0.90	4.0	4.6	0.96	0.96		16,607	16,607	33,214	0
D1-COO-002	HPGR CRUSHER LUBRICATION COOLER	✓				✓	600	5.0	6.7	0.80	0.90	0.90	0.96	3.8	4.2	0.96	0.96		15,768	15,768	31,536	0
D1-COO-003	CONE CRUSHER LUBRICATION COOLER No. 2	✓				✓	600	5.0	6.7	0.80	0.90	0.87	0.90	4.0	4.6	0.96	0.96		16,607	16,607	33,214	0
D1-CRN-001	HPGR BUILDING AREA CRANE		✓			✓	600	70.8	94.9	0.80	0.00	0.88	0.95	0.0	0.0	0.95	0.95		0	0	0	0
D1-CRU-001	CONE CRUSHER No.1	✓				✓	4160	750.0	1005.8	0.80	1.00	0.91	0.96	625.0	686.8	0.96	0.96		2,600,625	2,600,625	5,201,250	0
D1-CRU-002	CONE CRUSHER No.2		✓			✓	4160	750.0	1005.8	0.80	1.00	0.91	0.96	0.0	0.0	0.96	0.96		0	0	0	0
D1-EQP-001	HPGR SURGE BIN VENT	✓				✓	600	20.0	26.8	0.80	1.00	0.85	0.93	17.2	20.2	0.95	0.95		71,587	71,587	143,174	0
D1-FAN-008	CRUSHER BIN VENT DUST COLLECTOR EXHAUST FAN	✓					600	6.0	8.0	0.80	0.90	0.90	0.96	4.5	5.0	0.96	0.96		18,795	18,795	37,591	0
D1-FAN-009	HPGR BIN VENT DUST COLLECTOR EXHAUST FAN	✓					600	6.0	8.0	0.80	0.90	0.90	0.96	4.5	5.0	0.96	0.96		18,795	18,795	37,591	0
D1-FAN-010	HPGR DUST COLLECTOR EXHAUST FAN	✓					600	56.0	75.0	0.80	0.90	0.90	0.96	42.4	47.1	0.96	0.96		176,444	176,444	352,888	0
D1-FAN-011	HPGR ROOF EXHAUST FAN	✓					600	7.5	10.0	0.80	0.90	0.90	0.96	5.7	6.3	0.96	0.96		23,526	23,526	47,052	0
D1-FAN-012	HPGR ROOF EXHAUST FAN	✓					600	7.5	10.0	0.80	0.70	0.90	0.96	4.4	4.9	0.96	0.96		18,298	18,298	36,596	0
D1-FAN-013	HPGR ROOF EXHAUST FAN	✓					600	7.5	10.0	0.80	0.70	0.90	0.96	4.4	4.9	0.96	0.96		18,298	18,298	36,596	0
D1-FAN-014	HPGR ROOF EXHAUST FAN	✓					600	7.5	10.0	0.80	0.70	0.90	0.96	4.4	4.9	0.96	0.96		18,298	18,298	36,596	0
D1-FAN-015	HPGR ELECTRICAL ROOM EXHAUST FAN	✓					600	7.5	10.0	0.80	0.70	0.90	0.96	4.4	4.9	0.96	0.96	✓	18,298	18,298	36,596	36,596
D1-FAN-016	HPGR LUBE ROOM SUPPLY FAN / FILTER	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.96	0.96	✓	9,149	9,149	18,298	18,298
D1-FAN-017	CONE LUBE ROOM #1 SUPPLY FAN SUPPLY FAN / FILTER	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.96	0.96	✓	9,075	9,075	18,151	18,151
D1-FAN-018	CONE LUBE ROOM #2 SUPPLY FAN SUPPLY FAN / FILTER	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.96	0.96	✓	8,075	9,075	18,151	18,151
D1-FDR-001	CONE CRUSHER BELT FEEDER No. 1	✓				✓	600	10.0	13.4	0.80	0.90	0.84	0.92	7.8	9.3	0.95	0.95		32,423	32,423	64,847	0
D1-FDR-005	HPGR SURGE BIN FEEDER	✓					600	10.0	13.4	0.80	0.90	0.84	0.96	7.6	9.0	0.96	0.96		31,536	31,536	63,072	0
D1-FDR-006	CONE CRUSHER BELT FEEDER No. 2	✓				✓	600	10.0	13.4	0.80	0.90	0.84	0.92	7.8	9.3	0.95	0.95		32,423	32,423	64,847	0
D1-FDR-010	HPGR BELT FEEDER (RAIL MOUNTED)	✓				✓	600	10.0	13.4	0.80	0.90	0.90	0.96	7.6	8.4	0.96	0.96		31,536	31,536	63,072	0
D1-LUB-020	HPGR CRUSHER LUBE UNIT	✓				✓	600	22.0	29.5	0.80	0.90	0.90	0.96	16.7	18.5	0.96	0.96	✓	69,379	69,379	138,758	138,758
D1-LUB-037	CONE CRUSHER No.1 LUBE UNIT		✓			✓	600	7.5	10.1	0.80	0.00	0.84	0.92	0.0	0.0	0.96	0.96	✓	0	0	0	0
D1-LUB-040	CONE CRUSHER No.2 LUBE UNIT	✓				✓	600	7.5	10.1	0.80	0.80	0.84	0.92	5.2	6.2	0.95	0.95	✓	21,616	21,616	43,231	43,231
D1-MED-001	CONE CRUSHER METAL DETECTOR	✓				✓	600	10.0	13.4	0.80	0.90	0.84	0.92	7.8	9.3	0.95	0.95	✓	32,423	32,423	64,847	64,847
D1-MED-002	HPGR CRUSHER METAL DETECTOR	✓				✓	600	10.0	13.4	0.80	0.90	0.84	0.92	7.8	9.3	0.96	0.96	✓	32,423	32,423	64,847	64,847
D1-MGT-002	HPGR SELF CLEANING BELT MAGNET	✓				✓	600	10.0	13.4	0.80	0.90	0.84	0.92	7.8	9.3	0.96	0.96	✓	32,423	32,423	64,847	64,847
D1-MTR-001	HPGR	✓			✓		4160	5300.0	7107.4	0.85	1.00	0.91	0.96	4687.8	5128.9	0.96	0.96		19,506,041	19,506,041	39,012,081	0
D1-PPK-005	HPGR CRUSHER HYDRAULIC POWER PACK	✓				✓	600	9.0	12.1	0.80	0.75	0.90	0.95	5.7	6.3	0.96	0.96		23,652	23,652	47,304	0
D1-PSU-001	HPGR AREA SUMP PUMP	✓				✓	600	7.5	10.1	0.80	0.25	0.87	0.90	1.7	1.9	0.96	0.96		6,920	6,920	13,839	0
D1-SCB-001	CONE CRUSHER BELT SCALE	✓				✓	600	0.5	0.7	0.80	0.80	0.87	0.90	0.4	0.4	0.95	0.95		1,476	1,476	2,952	0
D1-SCB-006	HPGR SURGE BIN FEED BELT SCALE	✓				✓	600	0.5	0.7	0.80	0.80	0.87	0.90	0.4	0.4	0.96	0.96		1,476	1,476	2,952	0
D1-VLV-003	HPGR DUST COLLECTOR ROTARY VALVE	✓					600	0.7	1.0	0.80	0.80	0.90	0.96	0.5	0.6	0.96	0.96		2,091	2,091	4,182	0
D1-XEM-001	LIGHTING	✓					600	30.0	40.2	0.80	0.90	0.90	0.95	22.7	25.3	0.90	0.95	✓	89,629	94,608	184,237	184,237
						HPGR TOTAL kW:		7,515.7				TOTAL RUNNING kW:		5791.2	6356.9		TOTAL kW.hr:		24,092,274	24,097,253	48,189,527	651,962
Area: E0 - MILL BUILDING																						
E0-GEN-001	GENERATOR SET		✓				600	1600.0	2145.6		1.00											0
E0-GEN-002	GENERATOR SET		✓				600	1600.0	2145.6		1.00											0
E0-XEM-001	LIGHTING	✓					600	100.0	134.1	0.90	0.80	0.90	0.95	75.8	84.2	0.80	0.90	✓	265,566	298,762	564,328	564,328
E0-XMM-005	MISC POWER INCL HEAT TRACING	✓					600	200.0	268.2	0.80	0.90	0.90	0.95	151.6	168.4	0.50	0.90	✓	331,958	597,524	929,482	929,482
					MILL BUILDING TOTAL kW:			3,500.0				TOTAL RUNNING kW:		227.4	252.6		TOTAL kW.hr:		597,524	896,286	1,493,811	1,493,811
Area: E1 - GRINDING AND CLASSIFICATION																						
E1-ACL-003	GRINDING FURNACE CONTROL ROOM GAS FIRED HORIZONT	✓					600	0.4	0.5	0.80	0.70	0.90	0.96	0.2	0.2	0.80	0.80	✓	770	770	1,541	1,541
E1-ACL-004	GRINDING CONTROL ROOM AIR COOLED CONDENSING UNIT	✓					600	5.6	7.5	0.80	0.70	0.90	0.96	3.3	3.6	0.80	0.80	✓	11,484	11,484	22,969	22,969
E1-ACL-005	GRINDING OFFICES HORIZONTAL GAS FIRED	✓					600	0.4	0.5	0.80	0.70	0.90	0.96	0.2	0.2	0.80	0.80	✓	770	770	1,541	1,541
E1-ACL-006	GRINDING OFFICES AIR COOLED CONDENSING	✓					600	5.6	7.5	0.80	0.80	0.90	0.96	3.7	4.2	0.80	0.80	✓	13,125	13,125	26,250	26,250
E1-AHU-004	GRINDING GAS FIRED DIRECT UNIT	✓					600	14.9	20.0	0.80	0.80	0.90	0.96	10.1	11.2	0.80	0.80	✓	35,220	35,220	70,440	70,440
E1-AHU-005	GRINDING GAS FIRED DIRECT UNIT	✓					600	14.9	20.0	0.80	0.80	0.90	0.96	10.1	11.2	0.80	0.80	✓	35,220	35,220	70,440	70,440
E1-CNV-003	SECONDARY SIZING SCREEN OVER SIZE TRANSFER CONVEY	✓				✓	600	11.2	15.0	0.75	1.00	0.87	0.90	9.3	10.7	0.96	0.96		38,750	38,750	77,500	0
E1-CNV-004	PRIMARY SIZING SCREEN OVER SIZE TRANSFER CONVEYOR	✓				✓	600	14.9	20.0	0.75	1.00	0.84	0.92	12.1	14.4	0.96	0.96		50,324	50,324	100,648	0

WARDROP
Wardrop Engineering Inc.

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

WARDROP PROJECT No : 06527201.00
LOAD LIST : 0652720100-LST-E0001-06

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD	SPEED FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
E1-CNV-006	PRIMARY SIZING SCREEN UNDER SIZE TRANSFER CONVEYO	✓				✓	600	14.9	20.0	0.75	1.00	0.84	0.92	12.1	14.4	0.96	0.96		50,324	50,324	100,648	0
E1-CNV-007	HPGR DISCHARGE CONVEYOR	✓				✓	600	55.9	75.0	0.75	1.00	0.88	0.96	43.6	49.4	0.96	0.96		181,341	181,341	362,682	0
E1-CRN-030	GRINDING AREA CRANE	✓				✓	600	70.8	94.9	0.80	0.10	0.88	0.96	5.9	6.8	0.15	0.15		3,901	3,901	7,801	0
E1-FAN-019	GRINDING LUBE ROOM #1 SUPPLY FAN / FILTER	✓					600	3.7	5.0	0.80	1.00	0.90	0.96	3.1	3.5	0.96	0.96	✓	13,070	13,070	26,140	26,140
E1-FAN-020	GRINDING LUBE ROOM #2 SUPPLY FAN / FILTER	✓					600	3.7	5.0	0.80	1.00	0.90	0.96	3.1	3.5	0.96	0.96	✓	13,070	13,070	26,140	26,140
E1-FAN-021	GRINDING CONTROL ROOM PRESSURIZATION UNIT	✓					600	3.7	5.0	0.80	1.00	0.90	0.95	3.1	3.5	0.95	0.95	✓	13,070	13,070	26,140	26,140
E1-FAN-022	GRINDING EXHAUST FAN	✓					600	11.2	15.0	0.80	0.70	0.90	0.96	6.6	7.3	0.60	0.96	✓	17,335	27,447	44,782	44,782
E1-FAN-023	GRINDING EXHAUST FAN	✓					600	11.2	15.0	0.80	0.70	0.90	0.95	6.6	7.3	0.60	0.95	✓	17,335	27,447	44,782	44,782
E1-FAN-024	GRINDING EXHAUST FAN	✓					600	11.2	15.0	0.80	1.00	0.90	0.96	9.4	10.5	0.96	0.96	✓	39,210	39,210	78,420	78,420
E1-FAN-025	GRINDING EXHAUST FAN	✓					600	11.2	15.0	0.80	1.00	0.90	0.96	9.4	10.5	0.96	0.96	✓	39,210	39,210	78,420	78,420
E1-FAN-026	GRINDING LUNCHROOM EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.90	0.96	0.4	0.5	0.60	0.96	✓	1,156	1,830	2,985	2,985
E1-FAN-027	GRINDING WASHROOMS EXHAUST FAN	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.60	0.96	✓	5,778	9,149	14,927	14,927
E1-FAN-028	GRINDING COMPRESSOR ROOM EXHAUST FAN	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.60	0.96	✓	5,778	9,149	14,927	14,927
E1-FAN-029	GRINDING COMPRESSOR ROOM EXHAUST FAN	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.60	0.96	✓	5,778	9,149	14,927	14,927
E1-FAN-030	GRINDING BLOWER ROOM EXHAUST FAN	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.60	0.96	✓	5,778	9,149	14,927	14,927
E1-FAN-031	GRINDING BLOWER ROOM EXHAUST FAN	✓					600	3.7	5.0	0.80	0.70	0.90	0.96	2.2	2.4	0.60	0.96	✓	5,778	9,149	14,927	14,927
E1-HAN-001	MILL LINER HANDLER	✓				✓	600	10.0	13.4	0.80	0.70	0.84	0.92	6.1	7.2	0.10	0.10		2,655	2,655	5,309	0
E1-HTR-017	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.95	0.1	0.2	0.50	0.95	✓	318	603	921	921
E1-HTR-018	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.95	0.1	0.2	0.50	0.95	✓	318	603	921	921
E1-HTR-019	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.95	0.1	0.2	0.50	0.95	✓	318	603	921	921
E1-HTR-020	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-021	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-022	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-023	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-024	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-025	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-026	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-027	GRINDING GAS FIRED UNIT HEATER	✓					600	0.2	0.3	0.80	0.70	0.90	0.96	0.1	0.2	0.50	0.96	✓	318	603	921	921
E1-HTR-028	GRINDING CONTROL ROOM ELECTRIC DUCT HEATER	✓					600	13.0	17.4	0.80	0.80	1.00	1.00	8.3	8.3	0.50	0.95	✓	18,221	34,620	52,840	52,840
E1-LUB-038	BALL MILL No. 1 LUBE UNIT	✓				✓	600	15.0	20.1	0.80	0.90	0.84	0.92	11.7	13.9	0.96	0.96		48,635	48,635	97,270	0
E1-LUB-039	BALL MILL No. 2 LUBE UNIT	✓				✓	600	15.0	20.1	0.80	0.90	0.84	0.92	11.7	13.9	0.96	0.96		48,636	48,636	97,270	0
E1-MGT-001	SELF CLEANING BELT MAGNET	✓				✓	600	10.0	13.4	0.80	1.00	0.84	0.92	8.7	10.3	0.96	0.96		36,026	36,026	72,052	0
E1-MIL-013	BALL MILL No. 1	✓			✓		13800	6700.0	8984.8	0.90	1.00	0.90	0.96	6274.7	6971.9	1.00	1.00		27,483,247	27,483,247	54,966,493	0
E1-MIL-022	BALL MILL No. 2	✓			✓		13800	6700.0	8984.8	0.90	1.00	0.90	0.96	6274.7	6971.9	1.00	1.00		27,483,247	27,483,247	54,966,493	0
E1-PSL-002	CYCLOPAC No.1 & 2 FEED PUMP No. 2 (UNINSTALLED SPARE)		✓		✓		4160	572.0	767.1	0.80	0.00	0.88	0.94	0.0	0.0	0.96	0.96		0	0	0	0
E1-PSL-003	CYCLOPAC No.2 FEED PUMP No. 1	✓			✓		4160	572.0	767.1	0.80	1.00	0.88	0.94	486.3	550.1	0.96	0.96		2,023,458	2,023,458	4,046,915	0
E1-PSL-010	CYCLOPAC No.1 FEED PUMP No. 1	✓			✓		4160	572.0	767.1	0.80	1.00	0.88	0.94	486.3	550.1	0.96	0.96		2,023,458	2,023,458	4,046,916	0
E1-PSU-040	GRINDING AREA SUMP PUMP	✓				✓	600	7.5	10.1	0.80	0.25	0.86	0.96	1.6	1.8	0.96	0.96		6,542	6,542	13,085	0
E1-SCN-001	PRIMARY SIZING SCREEN No.1	✓				✓	600	26.0	34.9	0.80	1.00	0.86	0.95	21.8	25.5	0.96	0.96		90,722	90,722	181,444	0
E1-SCN-002	PRIMARY SIZING SCREEN No.2	✓				✓	600	26.0	34.9	0.80	1.00	0.86	0.95	21.8	25.5	0.96	0.96		90,722	90,722	181,444	0
E1-SCN-003	SECONDARY SIZING SCREEN No.1	✓				✓	600	37.0	49.6	0.80	1.00	0.84	0.94	31.5	37.5	0.95	0.95		131,027	131,027	262,054	0
E1-SCN-004	SECONDARY SIZING SCREEN No.2	✓				✓	600	37.0	49.6	0.80	1.00	0.84	0.94	31.5	37.5	0.96	0.96		131,027	131,027	262,054	0
E1-SMP-020	ON-STREAM SECONDARY GRINDING CYCLOPAC SAMPLER	✓				✓	600	7.5	10.1	0.80	0.70	0.87	0.90	4.7	5.4	0.96	0.96		19,418	19,418	38,836	0
				GRINDING AND CLASSIFICATION TOTAL kW:				15,607.5				TOTAL RUNNING kW:		13846.3	15417.7		TOTAL kW.hr:		60,244,107	60,301,401	120,545,508	658,594
Area: E2 - SECONDARY CRUSHING																						
E2-BAG-006	SEC SCREENING DUST COLLECTOR	✓					600	0.2	0.3	0.80	0.90	0.90	0.96	0.2	0.2	0.96	0.96		631	631	1,261	0
E2-CNV-003	SEC SCREENING DUST COLLECTOR SCREW CONVEYOR	✓					600	3.7	5.0	0.80	0.90	0.90	0.95	2.8	3.1	0.95	0.95		11,763	11,763	23,526	0
E2-FAN-032	SEC SCREENING DUST COLLECTOR EXHAUST FAN	✓					600	75.0	100.6	0.80	0.90	0.90	0.96	56.8	63.2	0.96	0.96		236,520	236,520	473,040	0
E2-VLV-004	SEC SCREENING DUST COLLECTOR ROTARY VALVE	✓					600	0.7	1.0	0.80	0.60	0.90	0.96	0.4	0.4	0.96	0.96		1,568	1,568	3,137	0
				SECONDARY CRUSHING TOTAL kW:				79.7				TOTAL RUNNING kW:		60.2	66.9		TOTAL kW.hr:		250,482	250,482	500,964	0
Area: E3 - FLOTATION																						
E3-AGI-003	COPPER MOLYBDENUM CONC. STOCK TANK AGITATOR	✓		✓		✓	600	1.1	1.5	0.80	1.00	0.84	0.94	0.9	1.1	1.00	1.00		4,100	4,100	8,201	0
E3-AGI-004	MOLYBDENUM CONC. STOCK TANK AGITATOR	✓		✓		✓	600	4.0	5.4	0.80	1.00	0.84	0.94	3.4	4.1	0.96	0.96		14,165	14,165	28,330	0
E3-AHU-006	FLOTATION GAS FIRED DIRECT UNIT	✓					600	14.9	20.0	0.80	1.00	0.90	0.96	12.6	14.0	0.96	0.96		52,280	52,280	104,559	0
E3-AHU-007	FLOTATION GAS FIRED DIRECT UNIT	✓					600	14.9	20.0	0.80	1.00	0.90	0.95	12.6	14.0	0.96	0.96		52,280	52,280	104,559	0
E3-BLO-084	FLOTATION AERATION BLOWER No. 1	✓				✓	4160	350.0	469.4	0.80	1.00	0.88	0.94	297.9	338.5	0.95	0.95		1,239,447	1,239,447	2,478,894	0
E3-BLO-085	FLOTATION AERATION BLOWER No. 2	✓				✓	4160	350.0	469.4	0.80	1.00	0.88	0.94	297.9	338.5	0.95	0.95		1,239,447	1,239,447	2,478,894	0
E3-CEL-003	COPPER ROUGHER FLOTATION CELL No. 1	✓				✓	4160	224.0	300.4	0.80	1.00	0.89	0.96	186.7	209.7	0.96	0.96		776,720	776,720	1,553,440	0
E3-CEL-004	COPPER ROUGHER FLOTATION CELL No. 2	✓				✓	4160	224.0	300.4	0.80	1.00	0.89	0.96	186.7	208.7	0.96	0.96		776,720	776,720	1,553,440	0
E3-CEL-005	COPPER ROUGHER FLOTATION CELL No. 3	✓				✓	4160	224.0	300.4	0.80	1.00	0.89	0.96	186.7	208.7	0.96	0.96		776,720	776,720	1,553,440	0
E3-CEL-006	COPPER ROUGHER FLOTATION CELL No. 4	✓				✓	4160	224.0	300.4	0.80	1.00	0.89	0.96	186.7	208.7	0.96	0.96		776,720	776,720	1,553,440	0
E3-CEL-007	MOLYBDENUM ROUGHER FLOTATION CELL No. 1	✓		✓		✓	600	11.0	14.8	0.80	1.00	0.89	0.96	9.2	10.3	0.95	0.95		38,143	38,143	76,285	0
E3-CEL-008	MOLYBDENUM ROUGHER FLOTATION CELL No. 2	✓		✓		✓	600	11.0	14.8	0.80	1.00	0.89	0.96	9.2	10.3	0.96	0.96		38,143	38,143	76,285	0
E3-CEL-009	MOLYBDENUM ROUGHER FLOTATION CELL No. 3	✓		✓		✓	600	11.0	14.8	0.80	1.00	0.89	0.96	9.2	10.3	0.96	0.96		38,143	38,143	76,285	0
E3-CEL-021	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 1	✓				✓	4160	224.0	300.4	0.80	1.00	0.88	0.94	190.4	216.4	0.96	0.96		792,403	792,403	1,584,806	0
E3-CEL-022	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 2	✓				✓	4160	224.0	300.4	0.80	1.00	0.88	0.94	190.4	216.4	0.96	0.96		792,403	792,403	1,584,806	0
E3-CEL-023	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 3	✓				✓	4160	224.0	300.4	0.80	1.00	0.88	0.94	190.4	216.4	0.96	0.96		792,403	792,403	1,584,806	0

WARDROP
Wardrop Engineering Inc.

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

WARDROP PROJECT No : 06527201.00
LOAD LIST : 0652720100-LST-E0001-06

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD	SPEED FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
E3-CEL-024	COPPER ROUGHER SCAVENGER FLOTATION CELL No. 4	☑	☐	☐	☐	☑	4160	224.0	300.4	0.80	1.00	0.88	0.94	190.4	216.4	0.95	0.95	☐	792,403	792,403	1,584,806	0
E3-CEL-030	COPPER 1st CLEANER FLOTATION CELL No. 1	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-031	COPPER 1st CLEANER FLOTATION CELL No. 2	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-032	COPPER 1st CLEANER FLOTATION CELL No. 3	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-033	COPPER 1st CLEANER FLOTATION CELL No. 4	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-039	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 1	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-040	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 2	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-041	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 3	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-042	COPPER 1st CLEANER SCAVENGER FLOTATION CELL No. 4	☑	☐	☑	☐	☑	600	93.0	124.7	0.80	1.00	0.89	0.96	77.3	86.9	0.95	0.95	☐	321,807	321,807	643,614	0
E3-CEL-052	COPPER 2nd CLEANER COLUMN FLOTATION CELL	☑	☐	☐	☐	☐	600	1.1	1.5	0.80	1.00	0.90	0.95	0.9	1.0	0.95	0.95	☐	3,854	3,854	7,709	0
E3-CEL-060	MOLYBDENUM 1ST CLEANER COLUMN FLOTATION CELL	☑	☐	☐	☐	☐	600	1.1	1.5	0.80	1.00	0.90	0.95	0.9	1.0	0.95	0.95	☐	3,854	3,854	7,709	0
E3-CNV-001	MOLYBDENUM CONCENTRATE BELT CONVEYOR	☑	☐	☐	☐	☑	600	7.5	10.1	0.75	1.00	0.87	0.90	6.2	7.2	0.95	0.95	☐	25,949	25,949	51,897	0
E3-COL-001	DRYER DUST COLLECTOR	☑	☐	☐	☐	☑	600	0.2	0.3	0.80	1.00	0.90	0.95	0.2	0.2	0.95	0.95	☐	701	701	1,402	0
E3-CRN-029	FLOTATION AREA CRANE	☑	☐	☐	☐	☑	600	8.2	11.0	0.80	0.10	0.84	0.92	0.7	0.8	0.10	0.10	☑	311	311	622	622
E3-DRY-006	MOLYBDENUM CONCENTRATE DRYER	☑	☐	☐	☐	☑	600	5.0	6.7	0.80	1.00	0.87	0.90	4.4	5.1	0.95	0.95	☐	18,452	18,452	36,905	0
E3-FAN-033	FLOTATION EXHAUST FANS	☑	☐	☐	☐	☐	600	11.2	15.0	0.80	0.70	0.90	0.95	6.6	7.3	0.95	0.95	☑	27,447	27,447	54,894	54,894
E3-FAN-034	FLOTATION EXHAUST FANS	☑	☐	☐	☐	☐	600	11.2	15.0	0.80	0.70	0.90	0.95	6.6	7.3	0.95	0.95	☑	27,447	27,447	54,894	54,894
E3-FAN-035	FLOTATION EXHAUST FANS	☑	☐	☐	☐	☐	600	11.2	15.0	0.80	0.70	0.90	0.95	6.6	7.3	0.95	0.95	☑	27,447	27,447	54,894	54,894
E3-FAN-036	FLOTATION EXHAUST FANS	☑	☐	☐	☐	☐	600	11.2	15.0	0.80	0.70	0.90	0.95	6.6	7.3	0.95	0.95	☑	27,447	27,447	54,894	54,894
E3-FAN-037	FLOTATION REGRIND LUBE ROOM SUPPLY FAN / FILTER	☑	☐	☐	☐	☐	600	3.7	5.0	0.80	0.70	0.90	0.95	2.2	2.4	0.95	0.95	☑	9,149	9,149	18,298	18,298
E3-FIL-005	MOLYBDENUM CONCENTRATE FILTER	☑	☐	☑	☐	☑	600	4.0	5.4	0.80	0.70	0.87	0.90	2.5	2.8	0.95	0.95	☑	10,333	10,333	20,667	20,667
E3-HTR-029	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER	☑	☐	☐	☐	☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	☑	288	456	744	744
E3-HTR-030	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER	☑	☐	☐	☐	☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	☑	288	456	744	744
E3-HTR-031	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER	☑	☐	☐	☐	☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	☑	288	456	744	744
E3-HTR-032	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER	☑	☐	☐	☐	☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	☑	288	456	744	744
E3-HTR-033	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER	☑	☐	☐	☐	☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	☑	288	456	744	744
E3-HTR-034	MOLYBDENUM CONCENTRATE GAS FIRED UNIT HEATER	☑	☐	☐	☐	☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	☑	288	456	744	744
E3-LUB-028	REGRIND MILL LUBE UNIT	☑	☐	☐	☐	☑	600	15.0	20.1	0.80	0.80	0.84	0.92	10.4	12.4	0.95	0.95	☐	43,231	43,231	86,462	0
E3-MAC-001	BAGGING MACHINE	☑	☐	☐	☐	☑	600	3.7	5.0	0.80	0.80	0.87	0.90	2.6	3.0	0.95	0.95	☐	10,924	10,924	21,848	0
E3-MIL-012	1st REGRIND VERTICAL MILL	☑	☐	☐	☐	☑	4160	1119.0	1500.6	0.90	1.00	0.91	0.96	1048.0	1146.6	0.95	0.95	☐	4,360,607	4,360,607	8,721,214	0
E3-MIL-065	2nd REGRIND VERTICAL MILL	☑	☐	☐	☐	☑	4160	1119.0	1500.6	0.90	1.00	0.91	0.96	1048.0	1146.6	0.95	0.95	☐	4,360,607	4,360,607	8,721,214	0
E3-PSL-001	REGRIND CYCLOPAC FEED PUMP No. 1	☑	☐	☐	☐	☑	4160	200.0	268.2	0.80	1.00	0.88	0.94	170.0	192.3	0.95	0.95	☐	707,503	707,503	1,415,006	0
E3-PSL-009	REGRIND CYCLOPAC FEED PUMP No. 2	☐	☑	☐	☐	☑	4160	200.0	268.2	0.80	0.00	0.88	0.94	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-019	ROUGHER TAILINGS PUMP No.1	☑	☐	☐	☑	☐	4160	450.0	603.5	0.80	1.00	0.88	0.94	392.6	432.8	0.95	0.95	☐	1,591,881	1,591,881	3,183,762	0
E3-PSL-020	ROUGHER TAILINGS PUMP No.2	☐	☑	☐	☑	☐	4160	450.0	603.5	0.80	0.00	0.88	0.94	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-025	STOCK TANK FEED PUMP No.1	☑	☐	☑	☐	☑	600	8.0	10.7	0.80	1.00	0.84	0.92	6.9	8.3	0.95	0.95	☐	28,621	28,621	57,642	0
E3-PSL-026	STOCK TANK FEED PUMP No.2	☐	☑	☐	☐	☑	600	8.0	10.7	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-030	MOLYBDENUM ROUGHER FLOTATION FEED PUMP No.1	☑	☐	☑	☐	☑	600	10.0	13.4	0.80	1.00	0.84	0.92	8.7	10.3	0.95	0.95	☐	36,026	36,026	72,052	0
E3-PSL-031	MOLYBDENUM ROUGHER FLOTATION FEED PUMP No.2	☐	☑	☐	☐	☑	600	10.0	13.4	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-032	MOLYBDENUM CONC. FILTER FEED PUMP No.1	☑	☐	☑	☐	☑	600	15.0	20.1	0.80	1.00	0.84	0.92	13.0	15.5	0.95	0.95	☐	54,039	54,039	108,078	0
E3-PSL-033	MOLYBDENUM CONC. FILTER FEED PUMP No.2	☐	☑	☐	☐	☑	600	15.0	20.1	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-034	MOLYBDENUM FILTER FEED PUMP No.1	☑	☐	☑	☐	☑	600	3.0	4.0	0.80	1.00	0.84	0.92	2.6	3.1	0.95	0.95	☐	10,808	10,808	21,616	0
E3-PSL-035	MOLYBDENUM FILTER FEED PUMP No.2	☐	☑	☐	☐	☑	600	3.0	4.0	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-036	1st CLEANER CONC. PUMP No.1	☑	☐	☑	☐	☑	600	15.0	20.1	0.80	1.00	0.84	0.94	12.7	15.3	0.95	0.95	☐	53,006	53,006	106,013	0
E3-PSL-037	1st CLEANER CONC. PUMP No.2	☐	☑	☐	☐	☑	600	15.0	20.1	0.80	0.00	0.84	0.94	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-038	MOLYBDENUM CLEANER COLUMN UNDERFLOW PUMP	☑	☐	☐	☐	☑	600	7.0	9.4	0.80	1.00	0.84	0.92	6.1	7.2	0.95	0.95	☐	25,218	25,218	50,436	0
E3-PSL-039	MOLYBDENUM CLEANER COLUMN UNDERFLOW PUMP (STAN	☐	☑	☐	☐	☑	600	7.0	9.4	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-040	MOLYBDENUM CLEANER FLOTATION FEED PUMP No.1	☑	☐	☐	☐	☑	600	7.0	9.4	0.80	1.00	0.84	0.92	6.1	7.2	0.95	0.95	☐	25,218	25,218	50,436	0
E3-PSL-041	MOLYBDENUM CLEANER FLOTATION FEED PUMP No.2	☐	☑	☐	☐	☑	600	7.0	9.4	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-042	MOLYBDENUM THICKENER FEED PUMP No.1	☑	☐	☑	☐	☑	600	3.0	4.0	0.80	1.00	0.84	0.92	2.6	3.1	0.95	0.95	☐	10,808	10,808	21,616	0
E3-PSL-043	MOLYBDENUM THICKENER FEED PUMP No.2	☐	☑	☐	☐	☑	600	3.0	4.0	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-045	1st CLEANER / SCAV CONC. PUMP No.1	☑	☐	☑	☐	☑	600	10.0	13.4	0.80	1.00	0.84	0.94	8.5	10.2	0.95	0.95	☐	35,338	35,338	70,675	0
E3-PSL-046	1st CLEANER / SCAV CONC. PUMP No.2	☐	☑	☐	☐	☑	600	10.0	13.4	0.80	0.00	0.84	0.94	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-054	2nd CLEANER TAILINGS PUMP No.1	☑	☐	☑	☐	☑	600	26.0	34.9	0.80	1.00	0.84	0.94	22.1	26.4	0.95	0.95	☐	91,878	91,878	183,755	0
E3-PSL-055	2nd CLEANER TAILINGS PUMP No.2	☐	☑	☐	☐	☑	600	26.0	34.9	0.80	0.00	0.84	0.94	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSL-057	2nd CLEANER CONC. PUMP No.1	☑	☐	☐	☐	☑	600	20.0	26.8	0.80	1.00	0.84	0.94	17.0	20.3	0.95	0.95	☐	70,675	70,675	141,350	0
E3-PSL-058	2nd CLEANER CONC. PUMP No.2	☐	☑	☐	☐	☑	600	20.0	26.8	0.80	0.00	0.84	0.94	0.0	0.0	0.95	0.95	☐	0	0	0	0
E3-PSU-010	CONC. DEWATERING AREA SUMP PUMP	☑	☐	☐	☐	☑	600	1.0	1.3	0.80	0.10	0.84	0.94	0.1	0.1	0.95	0.95	☐	354	354	708	0
E3-PSU-026	FLOTATION AREA SUMP PUMP No. 1	☑	☐	☐	☐	☑	600	10.0	13.4	0.80	0.10	0.84	0.92	0.9	1.0	0.95	0.95	☐	3,603	3,603	7,205	0
E3-SCL-001	MOLYBDENUM CONC. SCALE	☑	☐	☐	☐	☑	600	0.5	0.7	0.80	1.00	0.87	0.90	0.4	0.5	0.95	0.95	☐	1,845	1,845	3,690	0
E3-SMP-008	COPPER SAMPLER	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	1.00	0.84	0.92	6.5	7.7	0.95	0.95	☐	27,019	27,019	54,039	0
E3-SMP-011	REGRIND CYCLOPAC ON-STREAM SAMPLER	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	1.00	0.84	0.92	6.5	7.7	0.95	0.95	☐	27,019	27,019	54,039	0
E3-SMP-025	ROUGHER SCAVENGER ON-STREAM SAMPLER	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	1.00	0.84	0.92	6.5	7.7	0.95	0.95	☐	27,019	27,019	54,039	0
E3-SMP-038	1st CLEANER CONC. ON-STREAM SAMPLER	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	1.00	0.84	0.92	6.5	7.7	0.95	0.95	☐	27,019	27,019	54,039	0
E3-SMP-047	1st CLEANER / SCAV CONC. ON-STREAM SAMPLER	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	1.00	0.84	0.92	6.5	7.7	0.95	0.95	☐	27,019	27,019	54,039	0
E3-SMP-059	2nd CLEANER CONC. ON-STREAM SAMPLER	☑	☐	☐	☐	☑	600	7.5	10.1	0.80	1.00	0.84	0.92	6.5	7.7	0.95	0.95	☐	27,019	27,019	54,039	0
E3-THI-001	COPPER MOLYBDENUM THICKENER	☑	☐	☑	☐	☑	600	6.0	8.0	0.80	1.00	0.87	0.90	5.3	6.1	0.95	0.95	☐	22,143	22,143	44,286	0
E3-THI-004	MOLYBDENUM THICKENER	☑	☐	☑	☐	☑	600	3.0	4.0	0.80	1.00	0.87	0.90	2.7	3.1	0.95	0.95	☐	11,071	11,071	22,143	0

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD	SPEED FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
							FLOTATION TOTAL kW:	7,250.8					TOTAL RUNNING kW:	5641.0	6309.3			TOTAL kW.hr:	23,468,934	23,469,942	46,938,876	263,627
Area: E4 - CONCENTRATE DEWATERING AND LOADOUT																						
E4-AGI-009	COPPER CONCENTRATE STOCK TANK AGITATOR	✓				✓	600	22.0	29.5	0.80	1.00	0.84	0.94	18.7	22.4	0.95	0.95		77,743	77,743	155,485	0
E4-AHU-008	LOADOUT DIRECT GAS FIRED AIR HANDLING UNIT	✓					600	18.7	25.1	0.80	0.70	0.80	0.90	11.6	14.5	0.95	0.95		48,416	48,416	96,831	0
E4-BAG-007	LOADOUT DUST COLLECTOR	✓					600	0.2	0.3	0.80	1.00	0.80	0.90	0.2	0.2	0.95	0.95		740	740	1,479	0
E4-CNV-004	LOADOUT DUST COLLECTOR SCREW CONVEYOR	✓					600	3.7	5.0	0.75	0.80	0.90	0.95	2.4	2.6	0.95	0.95		9,802	9,802	19,605	0
E4-CNV-015	COPPER CONCENTRATE TRANSFER BELT CONVEYOR	✓				✓	600	7.5	10.1	0.75	1.00	0.87	0.90	6.2	7.2	0.95	0.95		25,949	25,949	51,897	0
E4-CNV-016	COPPER CONCENTRATE LOADOUT BELT CONVEYOR	✓				✓	600	7.5	10.1	0.75	1.00	0.87	0.90	6.2	7.2	0.95	0.95		25,949	25,949	51,897	0
E4-FAN-038	LOADOUT DUST COLLECTOR EXHAUST FAN	✓					600	56.0	75.0	0.80	1.00	0.80	0.90	49.7	62.2	0.95	0.95		206,977	206,977	413,955	0
E4-FIL-013	COPPER CONCENTRATE PRESSURE FILTER	✓		✓		✓	600	75.0	100.6	0.80	1.00	0.90	0.95	63.2	70.2	0.95	0.95		262,800	262,800	525,600	0
E4-HTR-035	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-036	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-037	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-038	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-039	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-040	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-041	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-HTR-042	LOADOUT GAS FIRED UNIT HEATER	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.60	0.95	✓	288	456	744	744
E4-PMP-001	CLOTH WASH WATER PUMP	✓				✓	600	10.0	13.4	0.80	1.00	0.87	0.90	8.9	10.2	0.95	0.95		36,905	36,905	73,809	0
E4-PMP-003	COPPER FILTRATE PUMP	✓		✓		✓	600	5.0	6.7	0.80	1.00	0.84	0.92	4.3	5.2	0.95	0.95		18,013	18,013	36,026	0
E4-PSL-007	COPPER THICKENER UNDERFLOW PUMP No. 1	✓		✓		✓	600	11.0	14.8	0.80	1.00	0.84	0.92	9.5	11.4	0.95	0.95		39,629	39,629	79,257	0
E4-PSL-008	COPPER THICKENER UNDERFLOW PUMP No. 2		✓			✓	600	11.0	14.8	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95		0	0	0	0
E4-PSL-011	COPPER CONCENTRATE FILTER FEED PUMP No. 1	✓		✓		✓	600	55.0	73.8	0.80	1.00	0.89	0.96	45.8	51.5	0.95	0.95		190,713	190,713	381,425	0
E4-PSL-012	COPPER CONCENTRATE FILTER FEED PUMP No. 2		✓			✓	600	55.0	73.8	0.80	0.00	0.89	0.96	0.0	0.0	0.95	0.95		0	0	0	0
E4-PSO-004	COPPER THICKENER OVERFLOW PUMP No. 1	✓				✓	600	20.0	26.8	0.80	1.00	0.84	0.92	17.3	20.7	0.95	0.95		72,052	72,052	144,104	0
E4-PSO-027	COPPER THICKENER OVERFLOW PUMP No. 2		✓			✓	600	20.0	26.8	0.80	0.00	0.84	0.92	0.0	0.0	0.95	0.95		0	0	0	0
E4-PSU-019	COPPER DEWATERING AREA SUMP PUMP	✓				✓	600	15.0	20.1	0.80	0.10	0.84	0.92	1.3	1.5	0.95	0.95		5,404	5,404	10,808	0
E4-SCL-017	COPPER CONCENTRATE BELT SCALE	✓				✓	600	0.5	0.7	0.80	1.00	0.87	0.90	0.4	0.5	0.95	0.95		1,845	1,845	3,690	0
E4-THI-002	COPPER THICKENER	✓		✓		✓	600	7.0	9.4	0.80	1.00	0.87	0.90	6.2	7.1	0.95	0.95		25,833	25,833	51,667	0
E4-VLV-005	LOADOUT DUST COLLECTOR ROTARY VALVE	✓					600	0.7	1.0	0.80	1.00	0.90	0.95	0.6	0.7	0.95	0.95		2,614	2,614	5,228	0
							CONCENTRATE DEWATERING AND LOADOUT TOTAL kW:	402.3					TOTAL RUNNING kW:	253.6	296.1			TOTAL kW.hr:	1,053,687	1,055,032	2,108,719	5,955
Area: E5 - REAGENTS																						
E5-AGI-006	FLOCCULANT MIXING TANK AGITATOR	✓				✓	600	0.6	0.8	0.80	1.00	0.87	0.90	0.5	0.6	0.95	0.95		2,214	2,214	4,429	0
E5-AGI-022	LIME HOLDING TANK AGITATOR	✓		✓		✓	600	55.5	74.4	0.80	1.00	0.86	0.95	46.5	54.4	0.95	0.95		193,657	193,657	387,313	0
E5-AGI-030	PEX MIXING TANK AGITATOR	✓				✓	600	4.5	6.0	0.80	1.00	0.87	0.90	4.0	4.6	0.95	0.95		16,607	16,607	33,214	0
E5-AGI-050	CMC MIXING TANK AGITATOR	✓				✓	600	1.1	1.5	0.80	1.00	0.87	0.90	1.0	1.1	0.95	0.95		4,060	4,060	8,119	0
E5-BAG-008	LIME SILO BIN VENT DUST COLLECTOR	✓					600	0.2	0.3	0.80	1.00	0.80	0.90	0.2	0.2	0.95	0.95		740	740	1,479	0
E5-COL-014	LIME AREA DUST COLLECTOR	✓				✓	600	0.2	0.3	0.80	1.00	0.90	0.95	0.2	0.2	0.95	0.95		701	701	1,402	0
E5-EDU-006	FLOCCULANT EDUCTOR	✓				✓	600	2.0	2.7	0.80	1.00	0.87	0.90	1.8	2.0	0.95	0.95		7,381	7,381	14,762	0
E5-FAN-039	PEX EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.95	0.95	✓	1,931	1,931	3,863	3,863
E5-FAN-040	AERO 3302 EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.95	0.95	✓	1,931	1,931	3,863	3,863
E5-FAN-041	CMC EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.95	0.95	✓	1,931	1,931	3,863	3,863
E5-FAN-042	MIBC EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.95	0.95	✓	1,931	1,931	3,863	3,863
E5-FAN-043	KEROSENE EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.95	0.95	✓	1,931	1,931	3,863	3,863
E5-FAN-044	PINE OIL EXHAUST FAN	✓					600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.95	0.95	✓	1,931	1,931	3,863	3,863
E5-FAN-045	LIME SILO DUST COLLECTOR EXHAUST FAN	✓					600	6.0	8.0	0.80	1.00	0.80	0.90	5.3	6.6	0.95	0.95	✓	22,044	22,044	44,088	44,088
E5-FDR-016	LIME SLAKING MILL SCREW FEEDER	✓				✓	600	19.0	25.5	0.80	1.00	0.85	0.93	16.3	19.2	0.95	0.95		68,008	68,008	136,015	0
E5-FDR-020	FLOCCULANT SCREW FEEDER	✓				✓	600	19.0	25.5	0.80	1.00	0.85	0.93	16.3	19.2	0.95	0.95		68,008	68,008	136,015	0
E5-HOI-001	FLOCCULANT HOIST	✓				✓	600	3.0	4.0	0.80	1.00	0.90	0.95	2.5	2.8	0.10	0.10		1,107	1,107	2,213	0
E5-HTR-043	REAGENTS GAS FIRED UNIT HEATERS	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.50	0.95	✓	240	456	696	696
E5-HTR-044	REAGENTS GAS FIRED UNIT HEATERS	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.50	0.95	✓	240	456	696	696
E5-HTR-045	REAGENTS GAS FIRED UNIT HEATERS	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.50	0.95	✓	240	456	696	696
E5-HTR-046	REAGENTS GAS FIRED UNIT HEATERS	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.50	0.95	✓	240	456	696	696
E5-HTR-047	REAGENTS GAS FIRED UNIT HEATERS	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.50	0.95	✓	240	456	696	696
E5-HTR-048	REAGENTS GAS FIRED UNIT HEATERS	✓					600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.50	0.95	✓	240	456	696	696
E5-MIL-017	LIME SLAKING VERTICAL MILL	✓				✓	600	27.9	37.4	0.80	1.00	0.84	0.94	23.7	28.3	0.95	0.95		98,802	98,802	197,603	0
E5-PMP-001	KEROSENE HOLDING PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMP-002	KEROSENE HOLDING PUMP No. 2		✓			✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PMP-005	PINE OIL HOLDING PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMP-006	PINE OIL HOLDING PUMP No. 2		✓			✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PMT-001	FLOCCULANT METERING PUMP No. 1	✓				✓	600	2.3	3.1	0.80	1.00	0.87	0.90	2.0	2.3	0.50	0.50		4,467	4,467	8,935	0
E5-PMT-002	FLOCCULANT METERING PUMP No. 2		✓			✓	600	2.3	3.1	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PMT-005	PEX METERING PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMT-006	PEX METERING PUMP No. 2	✓				✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PMT-007	PEX METERING PUMP No. 3	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMT-008	PEX METERING PUMP No. 4		✓			✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PMT-010	AERO 3302 METERING PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD	SPEED FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
E5-PMT-011	AERO 3302 METERING PUMP No. 2		✓			✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PMT-020	CMC METERING PUMP	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMT-030	MIBC METERING PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMT-031	MIBC METERING PUMP No. 2	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PMT-032	MIBC METERING PUMP No. 3	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PSL-004	LIME SLAKING CYCLONE FEED PUMP	✓				✓	600	11.3	15.2	0.80	1.00	0.84	0.92	9.8	11.7	0.50	0.50		21,426	21,426	42,852	0
E5-PSO-024	LIME DISTRIBUTION PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.50	0.50		1,942	1,942	3,885	0
E5-PSO-025	LIME DISTRIBUTION PUMP No. 2		✓			✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.50	0.50		0	0	0	0
E5-PSU-012	FLOCCULANT AREA SUMP PUMP	✓				✓	600	2.0	2.7	0.80	0.25	0.87	0.90	0.4	0.5	0.50	0.50		971	971	1,942	0
E5-PSU-027	LIME AREA SUMP PUMP	✓				✓	600	2.0	2.7	0.80	0.25	0.87	0.90	0.4	0.5	0.50	0.50		971	971	1,942	0
E5-PSU-043	MIBC AREA SUMP PUMP	✓				✓	600	2.0	2.7	0.80	0.25	0.87	0.90	0.4	0.5	0.50	0.50		971	971	1,942	0
E5-PSU-050	KEROSENE & PINE OIL AREA SUMP PUMP	✓				✓	600	1.0	1.3	0.80	0.25	0.87	0.90	0.2	0.3	0.50	0.50		486	486	971	0
							REAGENTS TOTAL kW:	183.5					TOTAL RUNNING kW:	144.1	169.5			TOTAL kW.hr:	545,072	546,389	1,091,441	71,443
Area: F0 - TAILINGS																						
F0-PSU-001	TAILINGS PUMP STATION NO. 1 VFD - PUMP 1 (DUTY) - BY KCB	✓			✓		4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-002	TAILINGS PUMP STATION NO. 1 PUMP 2 (DUTY)	✓				✓	4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-003	TAILINGS PUMP STATION NO. 1 PUMP 3 (DUTY)	✓				✓	4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-004	TAILINGS PUMP STATION NO. 1 VFD - PUMP 4 (DUTY)	✓			✓		4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-005	TAILINGS PUMP STATION NO. 2 VFD - PUMP 1 (DUTY) - BY KCB	✓			✓		4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-006	TAILINGS PUMP STATION NO. 2 PUMP 2 (DUTY)	✓				✓	4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-007	TAILINGS PUMP STATION NO. 2 PUMP 3 (DUTY)	✓				✓	4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-008	TAILINGS PUMP STATION NO. 2 VFD - PUMP 4 (DUTY)	✓			✓		4160	820.0	1099.6	0.80	1.00	0.90	0.98	669.4	743.8	0.92	0.92		2,697,365	2,697,365	5,394,730	0
F0-PSU-016	FRESHWATER MAKE-UP PUMP 1 (DUTY)	✓				✓	600	100.7	135.0	0.80	1.00	0.95	0.97	83.1	87.4	0.34	0.34		123,680	123,680	247,361	0
F0-PSU-017	FRESHWATER MAKE-UP PUMP 2 (STANDBY)		✓			✓	600	100.7	135.0	0.80	1.00	0.95	0.97	0.0	0.0	0.00	0.00		0	0	0	0
F0-XEM-001	LIGHTING	✓					600	5.0	6.7	0.80	0.90	0.90	0.95	3.8	4.2	0.80	0.90	✓	13,278	14,938	28,216	28,216
F0-XMM-001	TAILINGS PUMP STATION NO. 2 PUMP STATION AUXILIARY LO	✓					600	104.0	139.5	0.75	1.00	0.90	0.98	79.6	88.4	1.00	1.00	✓	348,612	348,612	697,224	697,224
F0-XMM-004	HVAC	✓					600	20.0	26.8	0.80	0.90	0.90	0.95	15.2	16.8	0.80	0.90	✓	53,113	59,752	112,866	112,866
F0-XMM-005	FRESHWATER MAKE-UP PUMP STATION AUXILIARY LOADS	✓					600	27.0	36.2	0.75	1.00	0.90	0.98	20.7	23.0	1.00	1.00	✓	90,505	90,505	181,010	181,010
F0-XMM-005	MISC POWER INCL HEAT TRACING	✓					600	20.0	26.8	0.80	0.80	0.65	0.95	13.5	20.7	0.40	0.90		23,606	53,113	76,719	0
							TAILINGS TOTAL kW:	6,937.4					TOTAL RUNNING kW:	5570.8	6190.7			TOTAL kW.hr:	22,231,714	22,269,521	44,501,235	1,019,317
Area: F1 - TAILINGS DISPOSAL AND RECLAIM																						
F1-PSU-009	RECLAIM BARGE PUMP 1 (DUTY)	✓				✓	600	82.0	110.0	0.80	1.00	0.95	0.98	66.9	70.5	0.76	0.82		222,626	240,417	463,243	0
F1-PSU-010	RECLAIM BARGE PUMP 2 (DUTY)	✓				✓	600	82.0	110.0	0.80	1.00	0.95	0.98	66.9	70.5	0.76	0.82		222,626	240,417	463,243	0
F1-PSU-011	RECLAIM BARGE PUMP 3 (STANDBY)		✓			✓	600	82.0	110.0	0.80	1.00	0.95	0.98	0.0	0.0	0.00	0.00		0	0	0	0
F1-PSU-018	CYCLOWASH PUMP STATION NO. 1 PUMP 1 (DUTY)	✓				✓	600	48.5	65.0	0.80	1.00	0.95	0.97	40.0	42.1	0.92	0.25		161,184	43,800	204,984	0
F1-PSU-019	CYCLOWASH PUMP STATION NO. 1 PUMP 2 (STANDBY)		✓			✓	600	48.5	65.0	0.80	1.00	0.95	0.97	0.0	0.0	0.00	0.00		0	0	0	0
F1-PSU-020	CYCLOWASH PUMP STATION NO. 2 PUMP 1 (DUTY)	✓				✓	600	55.9	75.0	0.80	1.00	0.95	0.97	46.1	48.5	0.92	0.31		185,777	62,599	248,376	0
F1-PSU-021	CYCLOWASH PUMP STATION NO. 2 PUMP 2 (STANDBY)		✓			✓	600	55.9	75.0	0.80	1.00	0.95	0.97	0.0	0.0	0.00	0.00		0	0	0	0
F1-XMM-002	RECLAIM BARGE PUMP STATION AUXILIARY LOADS	✓					600	40.0	53.6	0.75	1.00	0.90	0.98	30.6	34.0	1.00	1.00	✓	134,082	134,082	268,163	268,163
F1-XMM-006	CYCLOWASH PUMP STATION NO. 1 PUMP STATION AUXILIAR	✓					600	27.0	36.2	0.75	1.00	0.90	0.98	20.7	23.0	1.00	1.00	✓	90,505	90,505	181,010	181,010
F1-XMM-007	CYCLOWASH PUMP STATION NO. 2 PUMP STATION AUXILIAR	✓					600	27.0	36.2	0.75	1.00	0.90	0.98	20.7	23.0	1.00		✓	90,505			
							TAILINGS DISPOSAL AND RECLAIM TOTAL kW:	548.8					TOTAL RUNNING kW:	291.9	311.5			TOTAL kW.hr:	1,107,704	811,820	1,829,019	449,173
Area: F2 - TAILINGS POND																						
F2-PSU-012	NORTH SEEPAGE POND RECLAIM BARGE PUMP 1 (DUTY)	✓				✓	600	52.0	69.7	0.80	1.00	0.95	0.97	42.9	45.1	0.75	0.25		140,882	46,961	187,843	0
F2-PSU-013	NORTH SEEPAGE POND RECLAIM BARGE PUMP 2 (STANDBY)		✓			✓	600	52.0	69.7	0.80	1.00	0.95	0.97	0.0	0.0	0.00	0.00		0	0	0	0
F2-PSU-014	SOUTH SEEPAGE POND RECLAIM BARGE PUMP 1 (DUTY)	✓				✓	600	78.3	105.0	0.80	1.00	0.95	0.97	64.6	68.0	0.75	0.25		212,137	70,712	282,849	0
F2-PSU-015	SOUTH SEEPAGE POND RECLAIM BARGE PUMP 2 (STANDBY)		✓			✓	600	78.3	105.0	0.80	1.00	0.95	0.97	0.0	0.0	0.00	0.00		0	0	0	0
F2-XMM-003	NORTH SEEPAGE POND RECLAIM BARGE PUMP STATION AU	✓					600	27.0	36.2	0.75	1.00	0.90	0.98	20.7	23.0	1.00	1.00	✓	90,505	90,505	181,010	181,010
F2-XMM-004	SOUTH SEEPAGE POND RECLAIM BARGE PUMP STATION AU	✓					600	27.0	36.2	0.75	1.00	0.90	0.98	20.7	23.0	1.00	1.00	✓	90,505	90,505	181,010	181,010
							TAILINGS POND TOTAL kW:	314.6					TOTAL RUNNING kW:	148.8	159.0			TOTAL kW.hr:	534,029	298,683	832,712	362,020
Area: G1 - FRESH/FIRE WATER																						
G1-PSO-001	WELL WATER PUMP	✓				✓	600	125.0	167.6	0.80	0.80	0.90	0.95	63.2	70.2	0.70	0.70	✓	193,642	193,642	387,284	387,284
G1-PSO-004	FRESH WATER PUMP No.1	✓				✓	600	11.2	15.0	0.80	1.00	0.90	0.95	9.4	10.5	0.95	0.90		39,245	37,179	76,424	0
G1-PSO-005	FRESH WATER PUMP No.2		✓			✓	600	11.2	15.0	0.80	1.00	0.90	0.95	0.0	0.0	0.95	0.90		0	0	0	0
							FRESH/FIRE WATER TOTAL kW:	147.4					TOTAL RUNNING kW:	72.6	80.7			TOTAL kW.hr:	232,887	230,821	463,708	387,284
Area: G2 - PROCESS WATER																						
G2-AGI-005	ANTISCALENT TANK AGITATOR	✓				✓	600	3.0	4.0	0.80	1.00	0.90	0.95	2.5	2.8	0.95	0.95		10,512	10,512	21,024	0
G2-PSO-002	PROCESS WATER DISTRIBUTION PUMP No. 1	✓				✓	4160	259.0	347.3	0.80	1.00	0.88	0.94	220.2	249.1	0.95	0.95		916,216	916,216	1,832,432	0
G2-PSO-003	PROCESS WATER DISTRIBUTION PUMP No. 2		✓			✓	4160	259.0	347.3	0.80	0.00	0.88	0.94	0.0	0.0	0.95	0.95		0	0	0	0
G2-PSO-023	ANTISCALENT FEED PUMP No. 1	✓				✓	600	1.0	1.3	0.80	1.00	0.87	0.90	0.9	1.0	0.95	0.95		3,690	3,690	7,381	0
G2-PSO-024	ANTISCALENT FEED PUMP No. 2		✓			✓	600	1.0	1.3	0.80	0.00	0.87	0.90	0.0	0.0	0.95	0.95		0	0	0	0
							PROCESS WATER TOTAL kW:	523.0					TOTAL RUNNING kW:	223.6	252.9			TOTAL kW.hr:	930,418	930,418	1,860,837	0
Area: G5 - PLANT AND INSTRUMENT AIR																						
G5-AIC-001	PROCESS PLANT AIR COMPRESSOR No. 1	✓				✓	600	75.0	100.6	0.70	0.80	0.89	0.96	43.7	49.3	0.80	0.60		152,981	114,736	267,717	0

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD/FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
G5-AIC-002	PROCESS PLANT AIR COMPRESSOR No. 2	☑	☐	☐	☐ ☑	600	75.0	100.6	0.70	0.80	0.89	0.96	43.7	49.3	0.80	0.60	☐	152,981	114,736	267,717	0
G5-AIC-003	PROCESS PLANT AIR COMPRESSOR No. 3	☐	☑	☐	☐ ☑	600	75.0	100.6	0.70	0.00	0.89	0.96	0.0	0.0	0.80	0.60	☐	0	0	0	0
G5-AIC-011	PROCESS PLANT AIR COMPRESSOR No. 4	☑	☐	☐	☐ ☑	600	75.0	100.6	0.70	1.00	0.89	0.96	54.6	61.7	0.80	0.60	☐	191,227	143,420	334,647	0
	PLANT AND INSTRUMENT AIR TOTAL kW:						300.0					TOTAL RUNNING kW:	141.9	160.3		TOTAL kW.hr:		497,189	372,892	870,081	0
Area: G6 - SEWAGE TREATMENT																					
G6-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐ ☐	600	100.0	134.1	0.80	1.00	0.90	0.95	84.2	93.6	0.92	0.92	☑	339,335	339,335	678,669	678,669
	SEWAGE TREATMENT TOTAL kW:						100.0					TOTAL RUNNING kW:	84.2	93.6		TOTAL kW.hr:		339,335	339,335	678,669	678,669
Area: J1 - ADMINISTRATION AND MINE DRY																					
J1-ACL-007	ADMINISTRATION FAN COIL #1 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-008	ADMINISTRATION AIR COOLED CONDENSING UNIT #1	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-009	ADMINISTRATION FAN COIL #2 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-010	ADMINISTRATION AIR COOLED CONDENSING UNIT #2	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-011	ADMINISTRATION FAN COIL #3 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-012	ADMINISTRATION AIR COOLED CONDENSING UNIT #3	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-013	ADMINISTRATION FAN COIL #4 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-014	ADMINISTRATION AIR COOLED CONDENSING UNIT #4	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-015	ADMINISTRATION FAN COIL #5 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-016	ADMINISTRATION AIR COOLED CONDENSING UNIT #5	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-017	ADMINISTRATION FAN COIL #6 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-018	ADMINISTRATION AIR COOLED CONDENSING UNIT #6	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-019	ADMINISTRATION FAN COIL #7 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-020	ADMINISTRATION AIR COOLED CONDENSING UNIT #7	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-021	ADMINISTRATION FAN COIL #8 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-022	ADMINISTRATION AIR COOLED CONDENSING UNIT #8	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-023	ADMINISTRATION FAN COIL #9 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-024	ADMINISTRATION AIR COOLED CONDENSING UNIT #9	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-ACL-025	ADMINISTRATION FAN COIL #10 AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.80	0.60	☑	1,626	1,220	2,846	2,846
J1-ACL-026	ADMINISTRATION AIR COOLED CONDENSING UNIT #10	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-AHU-009	ADMINISTRATION DIRECT GAS FIRED AIR HANDLING UNIT	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.60	☑	8,132	6,099	14,232	14,232
J1-FAN-046	ADMINISTRATION SHOWERS EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.90	0.95	2.2	2.4	0.80	0.60	☑	7,704	5,778	13,483	13,483
J1-FAN-047	ADMINISTRATION LUNCHROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.80	0.60	☑	310	232	542	542
J1-FAN-048	ADMINISTRATION WASHROOMS EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.80	0.60	☑	310	232	542	542
J1-FAN-049	ADMINISTRATION JANITORS EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.90	0.95	0.1	0.1	0.80	0.60	☑	310	232	542	542
J1-FAN-050	ADMINISTRATION ELECTRICAL ROOM SUPPLY FAN / FILTER F	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.90	0.95	2.2	2.4	0.80	0.60	☑	7,704	5,778	13,483	13,483
J1-HTR-049	ADMINISTRATION PROPANE HOT WATER HEATER	☐	☑	☐	☐ ☐	208	0.0	0.0	1.00	0.80	1.00	1.00	0.0	0.0	0.70	0.70	☑	0	0	0	0
J1-HTR-050	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-051	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-052	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-053	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-054	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-055	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-056	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-057	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-058	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-059	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-HTR-060	ADMINISTRATION ELECTRIC BASEBOARD HEATERS	☑	☐	☐	☐ ☐	208	0.7	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	523	2,091	2,614	2,614
J1-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐ ☐	600	100.0	134.1	0.80	1.00	0.90	0.95	84.2	93.6	0.95	0.95	☑	350,400	350,400	700,800	700,800
	ADMINISTRATION AND MINE DRY TOTAL kW:						164.6					TOTAL RUNNING kW:	125.6	143.0		TOTAL kW.hr:		478,210	464,948	943,158	943,158
Area: J2 - TRUCKSHOP AND WAREHOUSE																					
J2-ACL-027	WAREHOUSE OFFICE AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.90	0.50	☑	1,830	1,017	2,846	2,846
J2-ACL-028	WAREHOUSE OFFICE AIR COOLED CONDENSING UNIT	☑	☐	☐	☐ ☐	600	7.5	10.0	0.80	0.70	0.80	0.90	4.6	5.8	0.90	0.50	☑	18,298	10,165	28,463	28,463
J2-ACL-029	FIRST AID GAS FIRED AIR CONDITIONING UNIT	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	0.70	0.80	0.90	0.5	0.6	0.90	0.50	☑	1,830	1,017	2,846	2,846
J2-ACL-030	FIRST AID AIR COOLED CONDENSING UNIT	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.90	0.50	☑	9,149	5,083	14,232	14,232
J2-AHU-010	TRUCK BAYS GAS FIRED AIR HANDLING UNIT #1	☑	☐	☐	☐ ☐	600	14.9	20.0	0.80	0.70	0.80	0.90	9.3	11.6	0.50	0.90	☑	20,331	36,596	56,927	56,927
J2-AHU-011	TRUCK BAYS GAS FIRED AIR HANDLING UNIT #2	☑	☐	☐	☐ ☐	600	14.9	20.0	0.80	0.70	0.80	0.90	9.3	11.6	0.50	0.90	☑	20,331	36,596	56,927	56,927
J2-AHU-012	WAREHOUSE GAS FIRED AIR HANDLING UNIT #3	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.50	0.90	☑	7,495	13,490	20,985	20,985
J2-AHU-013	TRUCK SHOP GAS FIRED AIR HANDLING UNIT #4	☑	☐	☐	☐ ☐	600	7.5	10.0	0.80	0.70	0.80	0.90	4.6	5.8	0.50	0.90	☑	10,165	18,298	28,463	28,463
J2-AHU-014	TRUCK SHOP OFFICES GAS FIRED AIR HANDLING UNIT #5	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.50	0.90	☑	5,083	9,149	14,232	14,232
J2-AHU-015	TRUCK WASH DIRECT GAS FIRED AIR HANDLING UNIT	☑	☐	☐	☐ ☐	600	14.9	20.0	0.80	0.70	0.80	0.90	9.3	11.8	0.50	0.90	☑	20,331	36,596	56,927	56,927
J2-AIC-001	TRUCK SHOP AIR COMPRESSOR	☑	☐	☐	☐ ☑	600	40.0	53.6	0.80	0.70	0.86	0.95	23.5	27.4	0.60	0.60	☑	61,706	61,706	123,411	123,411
J2-FAN-051	TRUCK SHOP HIGH BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.90	0.80	☑	13,490	11,991	25,482	25,482
J2-FAN-052	TRUCK SHOP HIGH BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.90	0.80	☑	13,490	11,991	25,482	25,482
J2-FAN-053	TRUCK SHOP HIGH BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.90	0.80	☑	13,490	11,991	25,482	25,482
J2-FAN-054	TRUCK SHOP HIGH BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.90	0.80	☑	13,490	11,991	25,482	25,482
J2-FAN-055	TRUCK WASH EXHAUST FAN	☑	☐	☐	☐ ☐	600	7.5	10.0	0.80	0.70	0.80	0.90	4.6	5.8	0.90	0.80	☑	18,298	16,265	34,563	34,563
J2-FAN-056	TYRE CHANGE EXHAUST FAN	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.90	0.80	☑	5,396	4,797	10,193	10,193

WARDROP
Wardrop Engineering Inc.

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

WARDROP PROJECT No : 06527201.00
LOAD LIST : 0652720100-LST-E0001-06

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD/FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
J2-FAN-057	TRUCK WASH COMPRESSOR ROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.90	0.80	☑	5,396	4,797	10,193	10,193
J2-FAN-058	TRUCK SHOP LOW BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.90	0.80	☑	9,149	8,132	17,281	17,281
J2-FAN-059	TRUCK SHOP LOW BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.90	0.80	☑	9,149	8,132	17,281	17,281
J2-FAN-060	TRUCK SHOP LOW BAYS EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.90	0.80	☑	9,149	8,132	17,281	17,281
J2-FAN-061	WAREHOUSE EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.90	0.80	☑	9,149	8,132	17,281	17,281
J2-FAN-062	TRUCK SHOP SHOWERS EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.90	0.80	☑	9,149	8,132	17,281	17,281
J2-FAN-063	TRUCK SHOP COMPRESSOR ROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.90	0.80	☑	5,396	4,797	10,193	10,193
J2-FAN-064	TRUCK SHOP BATTERY ROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.3	0.4	0.80	0.70	0.80	0.90	0.2	0.2	0.90	0.80	☑	736	654	1,390	1,390
J2-FAN-065	TRUCK SHOP ELECTRICAL ROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.90	0.80	☑	5,396	4,797	10,193	10,193
J2-FAN-066	TRUCK SHOP LUBE STORAGE EXHAUST FAN	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.90	0.80	☑	5,396	4,797	10,193	10,193
J2-FAN-067	TRUCK SHOP WELDING ARMS	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.80	0.80	☑	4,797	4,797	9,593	9,593
J2-FAN-068	TRUCK SHOP WELDING ARMS	☑	☐	☐	☐ ☐	600	2.2	3.0	0.80	0.70	0.80	0.90	1.4	1.7	0.80	0.80	☑	4,797	4,797	9,593	9,593
J2-FAN-069	TRUCK SHOP FIRST AID EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	392	392	786	786
J2-FAN-070	TRUCK SHOP CEILING FANS	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	218	218	436	436
J2-FAN-071	TRUCK SHOP CEILING FANS	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	218	218	436	436
J2-FAN-072	TRUCK SHOP CEILING FANS	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	218	218	436	436
J2-FAN-073	TRUCK SHOP CEILING FANS	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	218	218	436	436
J2-HTR-061	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-062	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-063	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-064	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-065	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-066	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-067	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-068	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-069	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-070	TRUCK SHOP GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-071	TRUCK SHOP AMBULANCE ELECTRIC UNIT HEATER	☑	☐	☐	☐ ☐	208	0.4	0.5	1.00	0.80	0.80	1.00	0.3	0.4	0.30	0.80	☑	392	1,046	1,438	1,438
J2-HTR-072	TRUCK SHOP AMBULANCE ELECTRIC UNIT HEATER	☑	☐	☐	☐ ☐	208	0.4	0.5	1.00	0.80	0.80	1.00	0.3	0.4	0.30	0.80	☑	392	1,046	1,438	1,438
J2-HTR-073	WAREHOUSE GAS FIRED UNIT HEATER	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	137	365	502	502
J2-HTR-074	WAREHOUSE GAS FIRED UNIT HEATER	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	137	365	502	502
J2-HTR-075	WAREHOUSE GAS FIRED UNIT HEATER	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	137	365	502	502
J2-HTR-076	WAREHOUSE GAS FIRED UNIT HEATER	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	137	365	502	502
J2-HTR-077	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-078	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-079	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-080	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-081	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-082	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-083	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	0.70	0.80	1.00	0.1	0.1	0.30	0.80	☑	74	196	270	270
J2-HTR-084	TRUCK WASH GAS FIRED RADIANT HEATER	☑	☐	☐	☐ ☐	600	0.1	0.1	0.80	1.00	0.80	1.00	0.1	0.1	0.30	0.80	☑	105	280	385	385
J2-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐ ☐	600	300.0	402.3	0.50	1.00	0.90	0.95	157.9	175.4	0.90	0.90	☑	622,421	622,421	1,244,842	1,244,842
					TRUCKSHOP AND WAREHOUSE TOTAL kW:		481.8				TOTAL RUNNING kW:		269.6	313.2		TOTAL kW.hr:		958,235	999,687	1,957,922	1,957,922
Area: J3 - ASSAY LABORATORY																					
J3-AHU-016	ASSAY LAB GAS FIRED AIR HANDLING UNIT #1	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.50	0.90	☑	7,495	13,490	20,985	20,985
J3-AHU-017	ASSAY LAB GAS FIRED AIR HANDLING UNIT #2	☑	☐	☐	☐ ☐	600	5.5	7.4	0.80	0.70	0.80	0.90	3.4	4.3	0.50	0.90	☑	7,495	13,490	20,985	20,985
J3-BAG-009	ASSAY LAB DUST COLLECTOR #1	☑	☐	☐	☐ ☐	600	0.2	0.3	0.80	0.70	0.80	0.90	0.1	0.2	0.90	0.90	☑	491	491	981	981
J3-BAG-010	ASSAY LAB DUST COLLECTOR #2	☑	☐	☐	☐ ☐	600	0.2	0.3	0.80	0.70	0.80	0.90	0.1	0.2	0.90	0.90	☑	491	491	981	981
J3-FAN-074	ASSAY LAB DUST COLLECTOR EXHAUST FAN #1	☑	☐	☐	☐ ☐	600	29.8	40.0	0.80	0.70	0.80	0.90	18.6	23.2	0.80	0.80	☑	65,059	65,059	130,118	130,118
J3-FAN-075	ASSAY LAB DUST COLLECTOR EXHAUST FAN #2	☑	☐	☐	☐ ☐	600	29.8	40.0	0.80	0.70	0.80	0.90	18.6	23.2	0.80	0.80	☑	65,059	65,059	130,118	130,118
J3-FAN-076	ASSAY LAB PERCHLORIC SCRUBBER EXHAUST FAN	☑	☐	☐	☐ ☐	600	7.5	10.0	0.80	0.70	0.80	0.90	4.6	5.8	0.80	0.80	☑	16,265	16,265	32,530	32,530
J3-FAN-077	ASSAY LAB COMPRESSOR ROOM SUPPLY FAN / FILTER FAN	☑	☐	☐	☐ ☐	600	7.5	10.0	0.80	0.70	0.90	0.95	4.4	4.9	0.80	0.80	☑	15,409	15,409	30,817	30,817
J3-FAN-078	ASSAY LAB WASHROOMS EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	406	406	811	811
J3-FAN-079	ASSAY LAB LECO EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	406	406	811	811
J3-FAN-080	ASSAY LAB GENERAL EXHAUST EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.80	☑	8,132	8,132	16,265	16,265
J3-FAN-081	ASSAY LAB LUNCH ROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	406	406	811	811
J3-FAN-082	ASSAY LAB ELECTRICAL ROOM EXHAUST FAN	☑	☐	☐	☐ ☐	600	3.7	5.0	0.80	0.70	0.80	0.90	2.3	2.9	0.80	0.80	☑	8,132	8,132	16,265	16,265
J3-FAN-083	ASSAY LAB DRYERS EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.4	0.5	0.80	0.70	0.80	0.90	0.2	0.3	0.80	0.80	☑	813	813	1,626	1,626
J3-FAN-084	ASSAY LAB AA HOODS EXHAUST FAN	☑	☐	☐	☐ ☐	600	0.2	0.2	0.80	0.70	0.80	0.90	0.1	0.1	0.80	0.80	☑	406	406	811	811
J3-HTR-085	ASSAY LAB GAS FIRED HOT WATER HEATER	☑	☐	☐	☐ ☐	208	9.0	12.1	0.80	0.70	1.00	1.00	5.0	5.0	0.20	0.80	☑	4,415	17,660	22,075	22,075
J3-HTR-086	ASSAY LAB ELECTRIC BASEBOARD HEATER	☑	☐	☐	☐ ☐	208	0.8	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	526	2,102	2,628	2,628
J3-HTR-087	ASSAY LAB ELECTRIC BASEBOARD HEATER	☑	☐	☐	☐ ☐	208	0.8	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	526	2,102	2,628	2,628
J3-HTR-088	ASSAY LAB ELECTRIC BASEBOARD HEATER	☑	☐	☐	☐ ☐	208	0.8	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	526	2,102	2,628	2,628
J3-HTR-089	ASSAY LAB ELECTRIC BASEBOARD HEATER	☑	☐	☐	☐ ☐	208	0.8	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	526	2,102	2,628	2,628
J3-HTR-090	ASSAY LAB ELECTRIC BASEBOARD HEATER	☑	☐	☐	☐ ☐	208	0.8	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	526	2,102	2,628	2,628
J3-HTR-091	ASSAY LAB ELECTRIC BASEBOARD HEATER	☑	☐	☐	☐ ☐	208	0.8	1.0	1.00	0.80	1.00	1.00	0.6	0.6	0.20	0.80	☑	526	2,102	2,628	2,628
J3-VLV-006	LOADOUT DUST COLLECTOR ROTARY VALVE	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	1.00	0.90	0.95	0.6	0.7	0.90	0.90	☑	2,476	2,476	4,953	4,953
J3-VLV-007	LOADOUT DUST COLLECTOR ROTARY VALVE	☑	☐	☐	☐ ☐	600	0.7	1.0	0.80	1.00	0.90	0.95	0.6	0.7	0.90	0.90	☑	2,476	2,476	4,953	4,953

WARDROP
Wardrop Engineering Inc.

PBM - MORRISON COPPER / GOLD PROJECT
LOAD LIST

WARDROP PROJECT No : 06527201.00
LOAD LIST : 0652720100-LST-E0001-06

EQUIPMENT NUMBER	DESCRIPTION	OPER.	STND BY	CRITICAL LOAD	SPEED VFD/FIXED	VOLTAGE	POWER (kW)	POWER (HP)	EST. LOAD FACTOR	EST. USED FACTOR	EST. PWR FACTOR	EST EFF.	RUNNING kW	RUNNING kVA	EST UTIL. SUMMER	EST UTIL. WINTER	INFRA.	kW.hr SUMMER	kW.hr WINTER	kW.hr ANNUAL	INFRA. LOAD
						ASSAY LABORATORY TOTAL kW:	109.6					TOTAL RUNNING kW:	68.5	82.7			TOTAL kW.hr:	208,984	243,681	452,665	452,665
Area: J4 - FUEL STORAGE AND DISTRIBUTION																					
J4-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐ ☐	600	100.0	134.1	0.50	1.00	0.90	0.95	52.6	58.5	0.90	0.90	☑	207,474	207,474	414,947	414,947
						FUEL STORAGE AND DISTRIBUTION TOTAL kW:	100.0					TOTAL RUNNING kW:	52.6	58.5			TOTAL kW.hr:	207,474	207,474	414,947	414,947
Area: J5 - COLD STORAGE WAREHOUSE																					
J5-XEM-001	MISCELLANEOUS - ELECTRICAL	☑	☐	☐	☐ ☐	600	20.0	26.8	0.80	1.00	0.90	0.95	16.8	18.7	0.90	0.90	☑	66,392	66,392	132,783	132,783
						COLD STORAGE WAREHOUSE TOTAL kW:	20.0					TOTAL RUNNING kW:	16.8	18.7			TOTAL kW.hr:	66,392	66,392	132,783	132,783
						PLANT TOTAL kW:	46,358.2					PLANT TOTAL RUNNING kW:	34543.9	38436.2			PLANT TOTAL kW.hr:	143,758,643	143,885,688	287,553,825	12,334,372

SYNCHRONOUS MOTOR TABLE

EQUIPMENT NUMBER	DESCRIPTION	RUNNING kW	LEAD. PWR FACTOR	CORRECTED kVAR
E1-MIL-013	BALL MILL No. 1	6275	0.90	3039
E1-MIL-022	BALL MILL No. 2	6275	0.90	3039

UNCORRECTED PF	0.90
UNCORRECTED kVAR	16,854
AVAIL. CORRECTION	12,156
NEW kVAR	4,698
EST kVA	34,862
EST PF	0.99

	OVERALL AVAILABILITY	TOTAL kW.hr	ADJUSTED ANNUAL kW.hr
PROCESS TOTAL	0.92	275,219,453	253,201,897
INFRASTRUCTURE	1.00	12,334,372	12,334,372
	SUBTOTAL:	287,553,825	265,536,269
Estimate Distribution Losses (%) =	1.50	4,313,307	3,983,044
Estimate energy not including any contingency		291,867,133	269,519,313

NOTES:
- No contingencies included for power (kW) or energy (kWh) per owner's preference
- No allowance for future growth included

SITE KVA AND POWER FACTOR:
Projected kVA and power factor based on:
- values included in current equipment database
- operation of major synchronous motors at leading power factor
- amount of correction = .9 lag to .9 lead for synchronous motors

APPENDIX D

List of Site Conditions and Design Criteria's

LIST OF SITE CONDITIONS AND DESIGN CRITERIA'S

List Design Criteria		
Document No.	**Rev. No.**	**Document Titles**
0652720100-TS-G0001-00	00	Project Conditions & Standards
0652720100-DBM-P0001-00	L	Process Design Criteria
0652720100-DBM-R0005-01	01	Mechanical Design Criteria
0652720100-DBM-R0011-01	00	Piping Design Criteria
0652720100-DBM-R0002-01	01	Dust Control Design Criteria
0652720100-DBM-R0003-01	01	Fire Protection Design Criteria
0652720100-DBM-R0004-01	01	HVAC Design Criteria
0652720100-DBM-R0001-03	03	Civil Design Criteria
0652720100-DBM-R0006-02	02	Instrumentation Design Criteria
0652720100-DBM-R0007-03	03	Electrical Design Criteria

Section Type: **Project Conditions & Standards**

Document Type: **Technical Specification**

Document Number: **0652720100-TS-G0001-00**

This sheet records the issue and revisions of the document.

Revision No.	Date Revised	Chapter/section/page revised, plus any remarks	Signatures				
			Prepared By	Discipline Engineer	Process Engineer	Project Manager	Client
A	March 21, 2007	Issued for Squad Check	DS	HG	**HG**	**DS**	**ET**
00	March 29, 2007	Issued for Procurement	DS	HG	**HG**	**DS**	**ET**

1.0 INTRODUCTION

1.1 GENERAL

Project	**Morrison Porphyry Copper Gold Project**
Owner/Operator	**Pacific Booker Minerals Inc.**

1.1.1 Process Description

Process operations consist of crushing, grinding, and flotation to produce copper/gold concentrate and molybdenum concentrate from the ore, open pit mined on site. The production rate for mining and process will be 30,000 tonne per day. The concentrate will be shipped to the Port of Stewart where it will be loaded onto ocean vessels and delivered to international smelting operations.

1.2 LOCATION

1.2.1 The Morrison property is a greenfield site located in Western Central British Columbia. The property is located approximately 65 kilometers northeast of Smithers on the southeastern end of Morrison Lake, latitude 55° 11' 26" and longitude 126° 19' 11".

1.2.2 The site climatic conditions are extreme with a record high temperature of 35.8 and a record low temperature of -43.9. The humidex and wind chill temperatures have reached 37.1 and -50.1 respectively. Daily winter precipitation has been recorded as high as 60cm of snow, a daily rain fall of 60mm has also been recorded. The average relative humidity in the area is 85.9%

1.2.3 The Project site elevation ranges from approximately 736 m above sea level at Morrison Lake to 1372 m above sea level at the top of the surrounding hills.

1.3 ACCESS TO SITE

Road Access:	To access site from Smithers turn off highway 16, four km south of Smithers, travel 100 km along Babine Lake Road and Nilkitwa Forest Service Road (FSR), and 40 km along Morrison FSR to site. To access site from Topley turn off Highway 16 at Topley, travel 40 km along Granisle Road to Topley Landing, barge across Babine Lake, and drive 50 km along Hagan Road to site. Smithers and Topley are both serviced by Highway 16 (Yellowhead Highway) a major road route through Northern Canada.
Air Access:	The Smithers Airport is situated in the northeast sector of Smithers and has a 5,000 ft. by 150 ft. asphalt runway suitable for light to medium aircraft with a 24-hour Flight Service Station.
Rail Access:	The Canadian National Railroad has direct service to Smithers from most Canadian and US origins.

2.0 GENERAL CLIMATIC CONDITIONS

2.1 ANNUAL PRECIPITATION

Average Annual Precipitation	Rain	354 mm
	Snow	204 cm

2.2 TEMPERATURES

Annual Daily Average Temperature	3.9°C
Winter Design Temperature*	-32°C
Summer Design Temperature*	31°C

All Equipment shall be capable of operating continuously over a temperature range of -40°C to 40°C

2.3 WIND

Basic Wind Velocities

Annual high average	7 km/h
Maximum hourly reached	66 km/h
Maximum gust reached	120 km/h

National Building Code (NBC) data for hourly wind pressure*

Hourly wind pressure for a 1/10 year return period	0.31 kPa
Hourly wind pressure for a 1/50 year return period	0.40 kPa

2.4 SEISMIC

The project site is located in a moderately active earthquake zone.

NBC Seismic Data*

Sa(0.2) = 0.120
Sa(0.5) = 0.078
Sa(1.0) = 0.052
Sa(2.0) = 0.033
PGA = 0.059

2.5 SNOW LOAD

NBC Snow Data*

Snow Load kPa, 1/50 year return period	Ss =3.2 kPa
	Sr =0.2 kPa

*All NBC Data is based on Smithers BC statistics

3.0 SPECIFICATIONS

3.1.1 Where the term 'or equivalent' is specified, 'equivalents' shall be subject to approval by the Consultant.

3.1.2 Where the term 'specified' is used in context in documentation, such shall mean 'in accordance with the specifications, drawings and other requirements forming part of the Purchase Order/Contract'.

4.0 DESIGN AND CONSTRUCTION

4.1 GENERAL

4.1.1 The operating life for this plant and all static equipment shall be a minimum of 20 years.

4.1.2 Equipment design shall be based on long term operation.

4.1.3 All equipment shall be capable of operating in accordance with the operating schedule given below, at 100% full running loads, with minimal unscheduled downtime.

Operating weeks per year	52
Operating days per week	7
Operating hours per day	24

4.1.4 All design shall facilitate ease of access for handling, transportation, installation, adjustment, control, maintenance and repair.

4.1.5 The equipment shall be manufactured in accordance with standard, robust, heavy-duty design provided this is not in conflict with the specification. The equipment shall be capable of continuous operation, outdoor where applicable, with downtime only for normal maintenance, and without excessive noise, vibration, wear, overheating, stress, and deflection. The operating availability shall not be less than 98%. The minimum working life of the equipment shall not be less than 20 years.

4.1.6 The equipment shall be designed and constructed in accordance with current and modern technology, and the latest engineering practice. Only equipment with proven service in a similar application shall be offered. The equipment shall be manufactured of new and unused material of the highest quality and fit for purpose. Workmanship throughout shall be in accordance with the best and modern practices carried out by suitably qualified personnel.

4.1.7 The substitution of components and materials shall be subject to prior written approval of Wardrop.

4.1.8 Equipment shall be capable of operating at the site under at least the following conditions (unless specified otherwise):

- location as specified on the drawings
- dusty and wet environment
- extremes of the specified ambient temperatures
- high pressure hose washdown.

4.2 STANDARDS

4.2.1 All Equipment shall be CSA approved

4.2.2 As a minimum, all mechanical and plant equipment shall be designed and constructed in conformance with the latest version of standards and codes published by the following Institutes and societies:

- ASME American Society of Mechanical Engineers
- ANSI American National Standards Institute
- SAE Society of Automotive Engineers
- SSPC Structural Steel Painting Council
- OSHA Occupational Safety and Health Act
- MSHA Miners Safety and Health Administration
- AGMA American Gear Manufacturers Association
- ASTM American Society for Testing Of Materials.

4.2.3 As a minimum, all electrical equipment accompanying mechanical and plant equipment shall be constructed in conformance with the latest version of standards and codes published by the following Institutes and societies:

- NEMA National Electrical Manufacturers Association
- EEMAC Electrical and Electronic Manufacturers of Canada.

4.2.4 As a minimum, all instrumentation accompanying mechanical and plant equipment shall be constructed in conformance with the latest version of standards and codes published by the following Institutes and societies:

- ANSI American National Standards Institute
- API American Petroleum Institute
- ISA Instrument Society of America
- ISO International Standards Organization.

4.2.5 All structural steel and concrete design and construction shall conform to the latest editions of the following codes and standards, including revisions and errata:

- CISC — Code of Standard Practice for Structural Steel
- NBC — National Building Code of Canada
- CWB — Canadian Welding Bureau
- CSA-S16.1 — Limit States Design of Steel Structures
- CAN/CSA-G40.20 — General Requirements for Rolled or Welded Structural Quality Steel
- CAN/CSA-G40.21 — Structural Quality Steels
- ASTM A307 — Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
- ASTM A325 — Specification for High Strengths Bolts for Structural Steel Joints
- CSA-A23.1/A23.2 — Concrete Materials and Methods of Concrete Construction /Methods of Test for Concrete
- CSA-A23.3 — Design of Concrete Structures
- CSA-G40.20 /G40.21 — General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel.

4.3 UNITS

4.3.1 Metric units shall be used for all design work and shall be shown on all drawings and calculations. Units shall be International System (SI).

4.4 HAZARDOUS MATERIALS

4.4.1 The following materials shall not be used:

- asbestos and compounds thereof
- poly-chlorinated bi-phenyl's (PCB's) and compounds thereof.

4.4.2 The following materials shall not be used without specific approval:

- polyurethane and compounds thereof
- chloro-fluoro-hydrocarbons (CFC's) and compounds thereof
- radioactive materials.

4.5 NOISE

4.5.1 Noise levels of emissions from any equipment shall not exceed 85 dBa at one (1) meter.

4.6 ELECTRICAL AND INSTRUMENTATION

4.6.1 Electrical power supply:

- 13.8 kV three phase, 60 Hz, resistance grounding
- 4160 V three phase, 60 Hz, resistance grounding
- 600 V, three phase, 60 Hz, resistance grounding
- 120 V, single phase, 60 Hz, grounded.

4.6.2 Control voltage (motor starters, external control devices, etc.):

- 120 V, 60 Hz, single phase, single pole grounded.

4.6.3 Instrument power supply:

- 120 V, 60 Hz, or 24 V DC via regulated power supply.

4.6.4 Instrument signal voltage:

- 4–20mA DC fully isolated.

4.6.5 Control Systems supply voltage:

- 120 V, 60 Hz via regulated power supply.

4.6.6 Control Systems inputs:

- 120 V, 60 Hz and 24 V DC.

4.6.7 Control Systems outputs:

- Voltage free contacts suitable for 120 V, 60 Hz and 24 V DC.

4.7 AIR SUPPLY

4.7.1 Plant air will be supplied as follows:

Pressure, kPa	750
Approach Temperature, °C	8–10
Liquid Phase Oil Carry-over, mg/m³	2–3

4.7.2 Instrument air will be supplied as follows:

Pressure, kPa	500
Approach Temperature, °C	3
Liquid Phase Oil Carry-over, mg/m³	0.1

5.0 SURFACE PROTECTION FOR PROPRIETARY EQUIPMENT

5.1.1 Unless otherwise specified in the Standard Specification, the Manufacturer's standard surface protection system for all proprietary plant and equipment shall be provided. This system shall be suitable for the conditions on site.

6.0 PACKAGING FOR TRANSPORTATION AND STORAGE

6.1.1 The equipment will be stored in open warehousing on site and any items that would be subject to damage by the elements must be adequately protected.

END OF SPECIFICATION

Client: Pacific Booker Minerals Inc.
Project Name: Morrison Copper/Gold Project
Project Number: 06527201.00
Date: 10-Dec-08
Revision Date: 10-Dec-08
Revision: L

Daily tonne milled: 30,000 tonne/day
Mill availability: 92%
Annual operating days: 365 days
Annual throughput: 10,950,000 tonne

CODES Source

1 Client
2 Industry / Experience
3 Calculation
4 Mass Balance
5 PRA Met Lab
6 SGS Met Lab
7 Beacon Hill Consultants
8 Suppliers
9 Others

WARDROP

PROCESS DESIGN CRITERIA

Document: 0652720100-DBM-P0001-00

All values are in metric units

DESCRIPTION	UNIT	VALUE	SOURCES
GENERAL			
Type Of Deposit		Porphyry Copper Gold Ore	
Ore Characteristics			
Specific Gravity	g/cm³	2.7	6
Bulk Density	t/m^3	1.6	2
Moisture Content	%	3.0	1
Abrasion Index (Average)	g	0.320	6
Operating Schedule			
Shift/Day		2	1
Crusher Plant Hours/Shift	h	8	1
Crusher Plant Hours/Day	h	16	1
Grinding and Flotation Hours/Shift	h	12	1
Grinding and Flotation Hours/Day	h	24	1
Days/Year	days	365	1
Plant Availability/Utilization			
Overall Plant Feed	t/y	10,950,000	2,1
Overall Plant Feed	t/d	30,000	1
Primary Crushing Plant Availability	%	75.0	2
Secondary and Tertiary (HPGR) Crushing Availability	%	92.0	2
Grinding and Flotation Plant Availability	%	92.0	2
Primary Crushing Rate	t/h	2,500.0	3
Secondary and Tertiary (HPGR) Crushing Rate	t/h	1,358.7	3
Grinding Rate	t/h	1,358.7	3
Flotation Rate	t/h	1,358.7	3
Head Grades	% Cu	0.40	6
	% Mo	0.006	6
	g/t Au	0.19	6
	g/t Ag	1.60	6
Recovery:	Cu %	84.00	5,6
	Mo %	78.00	5,6
	Au %	56.00	5,6
	Ag %	56.00	5,6
Cu Concentrate Grade	% Cu	26.50	5,6
	% Mo	0.37	5,6
	g/t Au	9.00	5,6
	g/t Ag	75.00	5,6
Mo Concentrate Grade	% Cu	0.83	5,6
	% Mo	53.60	5,6
Cu Concentrate Mass Recovery	%	1.27	3
Mo Concentrate Mass Recovery	%	0.009	3
Cu Concentrate Production	t/y	138,838	3
Mo Concentrate Production	t/y	956	4
CRUSHING			
Primary Crushing Production Parameters			
Feed Particle Size	mm	1,500	2
Crusher Type	type	Gyratory	2
Number of Crushers		1	3
Primary Crushing Availability	%	75	
Crushing Rate	t/h	2,500.0	4
Product Size, P_{80}	mm	150	2
Liner Wear Rate	kg/kW·h	0.022	3

Crushed Ore Stockpile Parameters			
Crushed Ore Stockpile (Live Capacity)	t	30,000	2
Crushed Ore Bulk Density	t/m^3	1.6	2
Angle of Repose	degrees	37	2
Angle of Reclaim	degrees	60	2
No of Feeders		3	3
Average Tonnage Rate (Each), Operating	t/h	453	4
Type of Discharge Feeders	type	Apron	2
SECONDARY CRUSHING & SCREENING			
Crusher Type		Cone	
Number of Crushers		2 (1 in operation)	
Operating Shifts/Day		2	
Operating Hours/Shift		12	
Secondary Crushing Availability	%	92	
Processing Rate	mtph	1,019.0	
Product Size, P80	mm	45.0	
No of Discharge Feeders		2 (1 in operation)	
Type of Discharge Feeders		Belt Feeder	
Crushed Ore Bulk Density	t/m^3	1.6	
Screen Type	double deck	Vibratory/Dry	
Number of Screens		2	
Processing Rate		2,377.7	
Screen Appertures	mm	75 and 45	
TERTIARY CRUSHING			
Crusher Type		HPGR	
Number of Units		1	
Tertiary Crushing Plant Availability	%	92	
Processing Rate (Fresh Feed)	t/h	1,358.7	
Type of Feeders		Belt Feeder	
Number of Feeders		1	
Specific Energy Consumption	kWh/t	2.0	
Average Specific Throughput	ts/hm^3	220	
Feed Size, 80% Passing	mm	45.0	
Product Size, 80% Passing	mm	3.8	
Screen Type	double deck	Vibratory/Wet	
Number of Screens		2	
Screen Availability	%	92	
Processing Rate	t/h	1,834.2	
Screen Appertures	mm	15 and 6	
GRINDING			
Mill Type		Ball mill	2
Number of Mills		2	3
Processing Rate	t/h	1,358.7	4
Bond Ball Mill Work Index	kWh/t	16.1	6
Feed Solids	%w/w	72.0	2
Abrasion Index, Ai		0.320	6
Liner Wear Rate	kg/kW·h	0.008	3
Feed Size, F_{80}	mm	3.6	6
Product Size, P_{80}	µm	150	1, 5
Mill Speed	% CS	72	2
Ball Mill Charge	%	35	
Recirculation Load	%	300	2
Classification	type	Cyclones	
FLOTATION CIRCUIT			
Copper and Gold Flotation			
Conditioning			
Solids Flow Rate	t/h	1,358.8	4
Pulp Flow Rate	m^3/h	3,022.9	4
Solids/Pulp Density	%	35.0	4
Conditioning Residence Time	min	2.0	3
Pulp pH		9.8	6
Rougher/Scavenger Flotation			
Solids Flow Rate	t/h	1,358.8	4
Pulp Flow Rate	m^3/h	3,022.9	4
Solids/Pulp Density	%	35.0	4
Plant Retention Time	min	30.0	4
Batch Retention Time	min	12.0	2
Flotation Time Scale-up		2.5	6
Pulp pH		9.5	6
Rougher Concentrate Weight Recovery	%	8.0	3

Concentrate Regrind Circuit			
Throughput	t/h	147.6	
Mill Type	type	Tower Mill	
Number of Mills		2	
Primary Ball Mill Bond Work Index	kWh/t	17.0	
Pulp Density	% solids	65.0	
Feed Size, P_{80}	μm	150.0	
Product Size, P_{80}	μm	25.0	
Mill Ball Charge	%	35.0	
Recirculation Load	%	300	
Classification		Cyclones	
Cyclone Feed Density	%	42.4	2
1st Cleaner Flotation			
Solids/Pulp Density	%	24.9	4
Solids Flow Rate	t/h	159.2	4
Pulp Flow Rate	m^3/h	481.3	4
Plant Retention Time	min	33.6	4
Residence Time Scale-up		2.8	2
Batch Retention Time	min	12.0	6
Flotation pH		11.0	6
1st Cleaner Scavenger Flotation			
Solids/Pulp Density	%	23.9	4
Solids Flow Rate	t/h	130.3	4
Pulp Flow Rate	m^3/h	452.1	4
Plant Retention Time	min	33.6	4
Residence Time Scale-up		2.8	2
Batch Retention Time	min	12.0	6
Flotation pH		11.0	6
2nd Cleaner Flotation			
Solids/Pulp Density	%	27.3	4
Solids Flow Rate	t/h	29.0	4
Pulp Flow Rate	m^3/h	86.4	4
Plant Retention Time	min	16.8	4
Residence Time Scale-up		2.8	2
Batch Retention Time	min	6.0	6
Flotation pH		11.5	6
Moly Flotation			
Thickening			
Thickener	type	High Rate	
Copper-Moly Concentrate Thickener Feed Solids Flowrate	t/h	17.6	4
Thickener U/F Density	% solids	50.0	
Thickener Diameter	m	11.4	3
Thickener Unit Area-required	$t/m^2/h$	0.20	
Slurry Storage Tank Capacity	h	12	
Moly Rougher Flotation			
Solids/Pulp Density	%	38.1	4
Solids Flow Rate	t/h	24.0	4
Pulp Flow Rate	m^3/h	45.5	4
Moly Cleaner Flotation			
Solids/Pulp Density	%	24.9	4
Solids Flow Rate	t/h	6.8	4
Pulp Flow Rate	m^3/h	22.2	4

CONCENTRATE DEWATERING			
Copper Concentrate			
Thickening			
Thickener	type	High Rate	
Copper Concentrate Thickener Feed Solids Flowrate	t/h	17.2	4
Thickener U/F Density	% solids	60.0	4
Thickener Diameter	m	11.4	3
Thickener Unit Area-required	t/m^2/h	0.20	
Slurry Storage Tank Capacity	h	12	
Filtration			
Filter	type	Pressure	
Solids Feed Rate	t/h	25.8	4
Slurry Feed Flowrate	m^3/h	26.0	4
Filter Rate	t/(h·m^2)	0.3	
Filter Unit Area Required	kg/m^2/h	TBA	
Filter Operating Time	%	85	
Filter Area	m^2	101.3	3
Filter Cake Moisture	%	8	4
Filtered Copper Concentrate Storage Capacity	t	2,067	3
Filtered Copper Concentrate Storage Capacity	m^3	984	3
Moly Concentrate			
Thickening			
Thickener	type	High Rate	
Moly Concentrate Thickener Feed Solids Flowrate	t/h	0.33	4
Thickener U/F Density	% solids	60.0	4
Thickener Diameter	m	2.5	3
Thickener Unit Area-required	t/m^2/h	0.20	
Slurry Storage Tank Capacity	h	12	
Filtration			
Filter	type		
Solids Feed Rate	t/h	0.41	4
Slurry Feed Flowrate	m^3/h	2.77	4
Filter Rate	t/(h·m^2)	0.3	
Filter Unit Area Required	kg/m^2/h	TBC	
Filter Operating Time	%	85	
Filter Area	m^2	1.6	3
Filter Cake Moisture	%	20	4
Filtered Copper Concentrate Storage Capacity	t	39	3
Filtered Copper Concentrate Storage Capacity	m^3	19	3
Dryer			
Dryer	type		
Solids Feed Rate	t/h	0.41	4
Concentrate Feed Moisture	%	20	4
Concentrate Product Moisture	%	5	4
Pyrite Flotation (OPTIONAL)			
Solids/Pulp Density	%	55.0	
Solids Flow Rate	t/h	872.0	
Pulp Flow Rate	m^3/h	1,048.9	
Concentrate Production Rate	t/h	282.5	
REAGENTS			
Lime (Hydrated)	g/t	500	6
Potasium Ethyl Xanthate (PEX)	g/t	55	6
Cytec Aero 3302	g/t	15	6
Carboxyl Methyl Cellulos (CMC)	g/t	5	6
MIBC	g/t	55	6
Kerosene	g/t	6	6
Fuel Oil	g/t	6	6
Flocculant	g/t	10	

Client: Pacific Booker Minerals Inc.
Project Name: Morrison Copper/Gold Project
Project Number: 06527201.00
Date: 10-Dec-08
Revision Date: 10-Dec-08
Revision: L

Daily tonne milled 30,000 tonne/day
Mill availability 92%
Annual operating days 365 days
Annual throughput 10,950,000 tonne

PROCESS DESIGN CRITERIA - MATERIAL BALANCE

Document: 0652720100-DBM-P0001-00

All values are in metric units
Blue font - Water
Red font - Reagent
Green font - Reagent

	Flow ID	Solids, t/h	Solids SG	Solids, m^3/h	Water, t/h	% Solids	Water, m^3/h	Pulp, t/h	Pulp SG	Pulp, m^3/h	Com/s
ROM Ore	100	1,250.00	2.72	459.56	38.66	97.00	38.66	1,288.66	2.59	498.22	
Feed to Gyratory Crusher - Design with 85% Availability	101	2,500.00	2.72	919.12	77.32	97.00	77.32	2,577.32	2.59	996.44	
Grinding Feed - Design with 92% Availability	210	1,358.70	2.72	499.52	42.02	97.00	42.02	1,400.72	2.59	541.54	
Feed to Cone Crusher	211	1,019.02	2.72	374.64	31.52	97.00	31.52	1,050.54	2.59	406.16	75.00%
Primary Sizing Screen Feed	212	2,377.72	2.72	874.16	73.54	97.00	73.54	2,451.26	2.59	947.70	
Primary Sizing Screen Product	213	1,358.70	2.72	499.52	42.02	97.00	42.02	1,400.72	2.59	541.54	
HPGR Feed	214	1,834.24	2.72	674.35	94.86	95.08	94.86	1,929.10	2.51	769.21	
Secondary Screen Feed	215	1,834.24	2.72	674.35	94.86	90.00	94.86	1,929.10	2.51	769.21	
Secondary Screen Oversize Product	216	475.54	2.72	174.83	52.84	90.00	52.84	528.38	2.32	227.67	35.00%
Process Water to Secondary Screen Feed	217	0.00	1.00	0.00	955.50	0.00	955.50	955.50	1.00	955.50	
Secondary Screed Undersize Product	218	1,358.70	2.72	499.52	997.52	57.66	997.52	2,356.21	1.57	1,497.04	
Process Water to Ball Mill Discharge	219	0.00	1.00	0.00	60.00	0.00	60.00	60.00	1.00	60.00	
Ball Mill Lube Unit #1 Process Water to Ball Mill Pump Box	220	0.00	1.00	0.00	15.00	0.00	15.00	15.00	1.00	15.00	
Ball Mill Lube Unit #2 Process Water to Ball Mill Pump Box	221	0.00	1.00	0.00	15.00	0.00	15.00	15.00	1.00	15.00	
Total Ball Mill Discharge Pumpbox	222	1,358.72	2.72	499.53	1,087.55	55.54	1,087.55	2,446.27	1.54	1,587.08	
GSW Cyclopac #1 Feed Pump	223	0.00	1.00	0.00	5.00	0.00	5.00	5.00	1.00	5.00	
Process Water to Cyclopac Feed Pump Box	224	0.00	1.00	0.00	1,425.75	0.00	1,425.75	1,425.75	1.00	1,425.75	
Feed to Cyclone Feed Pump Box	225	5,434.81	2.72	1,998.09	4,350.19	55.54	4,350.19	9,785.00	1.54	6,348.28	
Ball Mill #1 Discharge	226	2,038.04	2.72	749.28	913.45	69.05	913.45	2,951.49	1.78	1662.73	
Additional Process Water Grinding	227	0.00	1.00	0.00	1,485.75	0.00	1,485.75	1,485.75	1.00	1,485.75	
Cyclone #1 Feed	228	2,717.39	2.72	999.04	2,175.09	55.54	2,175.09	4,892.48	1.54	3,174.13	400.00%
Cyclone #1 U/F	229	2,038.04	2.72	749.28	913.45	69.05	913.45	2,951.49	1.78	1,662.73	
Cyclone #1 O/F	230	679.35	2.72	249.76	1,261.65	35.00	1,261.65	1,940.99	1.28	1,511.41	
Ball Mill #2 Discharge	231	2,038.04	2.72	749.28	913.45	69.05	913.45	2,951.49	1.78	1,662.73	
GSW Cyclopac #2 Feed Pump	232	0.00	1.00	0.00	5.00	0.00	5.00	5.00	1.00	5.00	
Cyclone #2 Feed	233	2,717.39	2.72	999.04	2,175.09	55.54	2,175.09	4,892.48	1.54	3,174.13	400.00%

Client: Pacific Booker Minerals Inc.
Project Name: Morrison Copper/Gold Project
Project Number: 06527201.00
Date: 10-Dec-08
Revision Date: 10-Dec-08
Revision: L

Daily tonne milled 30,000 tonne/day
Mill availability 92%
Annual operating days 365 days
Annual throughput 10,950,000 tonne

PROCESS DESIGN CRITERIA - MATERIAL BALANCE

Document: 0652720100-DBM-P0001-00

All values are in metric units
Blue font - Water
Red font - Reagent
Green font - Reagent

	Flow ID	Solids, t/h	Solids SG	Solids, m^3/h	Water, t/h	% Solids	Water, m^3/h	Pulp, t/h	Pulp SG	Pulp, m^3/h	Com/s
Cyclone #2 U/F	234	2,038.04	2.72	749.28	913.45	69.05	913.45	2,951.49	1.78	1,662.73	
Cyclone #2 O/F	235	679.35	2.72	249.76	1,261.65	35.00	1,261.65	1,940.99	1.28	1,511.41	
Feed to Rougher Flotation	236	1,358.70	2.72	499.52	2,523.29	35.00	2,523.29	3,881.99	1.28	3,022.81	
Feed to Ball Mill Discharge Pumpbox	237	1,358.70	2.72	499.52	997.52	57.66	997.52	2,356.21	1.57	1,497.04	
Feed to Rougher Flotation	129	1,358.80	2.72	499.56	2,523.35	35.00	2,523.35	3,882.15	1.28	3,022.91	
Launder Water to Rougher Concentrate Flotation	130	0.00	1.00	0.00	34.78	0.00	34.78	34.78	1.00	34.78	
Rougher Concentrate to Regrinding Mills	131	108.70	2.90	37.48	253.62	30.00	253.62	362.32	1.24	291.10	8.00%
Rougher Tailings	132	1,250.10	2.60	480.81	2,269.72	35.52	2,269.72	3,519.83	1.28	2,750.53	
GSW Rougher Tailings Pump	133	0.00	1.00	0.00	5.00	0.00	5.00	5.00	1.00	5.00	
Feed to Rougher Scavenger Flotation	134	1,250.12	2.60	480.81	2,274.72	35.47	2,274.72	3,524.84	1.28	2,755.54	
Rougher Scavenger Concentrate	135	27.17	2.90	9.37	63.41	30.00	63.41	90.58	1.24	72.78	2.00%
Rougher Scavenger Tailings to Final Tailings Pumpbox	136	1,222.94	2.60	470.36	2,211.32	35.61	2,211.32	3,434.26	1.28	2,681.68	
Fresh Water Regrind Mill Lube Units	137	0.00	1.00	0.00	10.00	0.00	10.00	10.00	1.00	10.00	
Lime Slurry	138	0.34	1.30	0.26	1.36	20.00	1.36	1.70	1.05	1.62	
GSW Regrind Cyclopac Feed Pump	139	0.00	1.00	0.00	1.60	0.00	1.60	1.60	1.00	1.60	
Regrind Cyclone Feed	140	443.73	2.90	153.01	602.14	42.43	602.14	1,045.87	1.38	755.15	300.00%
Regrind Cyclone U/F	141	296.17	2.90	102.13	159.48	65.00	159.48	455.65	1.74	261.61	
Fresh Water Cone Crusher Lub Unit	142	0.00	1.00	0.00	5.00	0.00	5.00	5.00	1.00	5.00	
Regrind Cyclone O/F	143	147.56	2.90	50.88	442.67	25.00	442.67	590.22	1.20	493.55	
Launder Water to 1st Cleaner Flotation	144	0.00	1.00	0.00	4.00	0.00	4.00	4.00	1.00	4.00	
MIBC Feed to Rougher Flotation	145	0.04	0.81	0.05	0.00	100.00	0.00	0.04	0.81	0.05	
Feed to 1st Cleaner Flotation	146	159.24	2.90	54.91	481.35	24.86	481.35	640.58	1.19	536.25	
1st Cleaner Flotation Concentrate	147	28.94	3.00	9.65	67.53	30.00	67.53	96.47	1.25	77.18	2.13%
GSW 1st Cleaner Concentrate Pump	148	0.00	1.00	0.00	1.60	0.00	1.60	1.60	1.00	1.60	
1st Cleaner Concentrate to 2nd Cleaner Flotation	149	28.94	3.20	9.04	73.13	28.35	73.13	102.07	1.24	82.18	
1st Cleaner Tailings	150	130.29	3.40	38.32	413.81	23.95	413.81	544.11	1.20	452.13	

Client: Pacific Booker Minerals Inc.
Project Name: Morrison Copper/Gold Project
Project Number: 06527201.00
Date: 10-Dec-08
Revision Date: 10-Dec-08
Revision: L

Daily tonne milled 30,000 tonne/day
Mill availability 92%
Annual operating days 365 days
Annual throughput 10,950,000 tonne

PROCESS DESIGN CRITERIA - MATERIAL BALANCE

Document: 0652720100-DBM-P0001-00

All values are in metric units
Blue font - Water
Red font - Reagent
Green font - Reagent

	Flow ID	Solids, t/h	Solids SG	Solids, m^3/h	Water, t/h	% Solids	Water, m^3/h	Pulp, t/h	Pulp SG	Pulp, m^3/h	Com/s
Launder Water to 1st Cleaner Scavenger Flotation	151	0.00	1.00	0.00	4.00	0.00	4.00	4.00	1.00	4.00	
1st Cleaner Scavenger Flotation Tailings	152	118.61	2.60	45.62	386.55	23.48	386.55	505.16	1.17	432.17	
1st Cleaner Scavenger Flotation Concentrate	153	11.69	3.20	3.65	27.27	30.00	27.27	38.95	1.26	30.92	0.86%
GSW 1st Cleaner Tailings Pump	154	0.00	1.00	0.00	16.00	0.00	16.00	16.00	1.00	16.00	
GSW 1st Cleaner Scav Concentrate Pump	155	0.00	1.00	0.00	1.60	0.00	1.60	1.60	1.00	1.60	
1st Cleaner Scavenger Tailings to Final Tailings Pumpbox	156	118.61	2.60	45.62	402.55	22.76	402.55	521.16	1.16	448.17	
Launder Water to Rougher Scavenger Flotation	157	0.00	1.00	0.00	25.00	0.00	25.00	25.00	1.00	25.00	
Launder Water to Copper 2nd Cleaner Flotation	158	0.00	1.00	0.00	4.00	0.00	4.00	4.00	1.00	4.00	
Feed to 2nd Cleaner Flotation	159	29.01	3.20	9.07	77.33	27.28	77.33	106.34	1.23	86.40	
2nd Cleaner Concentrate	160	17.55	3.50	5.02	40.96	30.00	40.96	58.52	1.27	45.98	1.29%
GSW 2nd Cleaner Concentrate Pump	161	0.00	1.00	0.00	1.60	0.00	1.60	1.60	1.00	1.60	
2nd Cleaner Concentrate Feed to Cu-Mo Thickener	162	17.55	3.50	5.02	42.56	29.20	42.56	60.12	1.26	47.58	
2nd Cleaner Tailings	163	11.46	3.20	3.58	36.37	23.96	36.37	47.83	1.20	39.95	
GSW 2nd Cleaner Tailings Pump	164	0.00	1.00	0.00	1.60	0.00	1.60	1.60	1.00	1.60	
2nd Cleaner Tailings Feed to 1st Cleaner Flotation	165	11.46	3.20	3.58	37.97	23.18	37.97	49.43	1.19	41.55	
Process Water to Regrind Pump Box	166	0.00	1.00	0.00	20.00	0.00	20.00	20.00	1.00	20.00	
Process Water to Ball Mill Discharge	300	0.00	1.00	0.00	80.00	0.00	80.00	80.00	1.00	80.00	
Ball Mill Process Water	167	0.00	1.00	0.00	40.00	0.00	40.00	40.00	1.00	40.00	
Total Process Water Rougher Flotation	168	0.00	1.00	0.00	59.78	0.00	59.78	59.78	1.00	59.78	
1st Cleaner Process Water	169	0.00	1.00	0.00	8.00	0.00	8.00	8.00	1.00	8.00	
Total Cooling Water	170	0.00	1.00	0.00	45.00	0.00	45.00	45.00	1.00	45.00	
Final Copper Concentrate to Thickener	171	17.55	3.70	4.74	42.56	29.20	42.56	60.12	1.27	47.31	
Potable Water	172	0.00	1.00	0.00	3.15	0.00	3.15	3.15	1.00	3.15	
Final Mo Concentrate	173	0.33	1.00	0.33	0.76	30.00	0.76	1.09	1.00	1.09	0.02%
Final Tailings	174	1,341.55	2.60	515.98	2,613.87	33.92	2,613.87	3,955.42	1.26	3,129.85	
GSW Filter Feed Pump	175	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	

Client:	**Pacific Booker Minerals Inc.**
Project Name:	**Morrison Copper/Gold Project**
Project Number:	**06527201.00**
Date:	**10-Dec-08**
Revision Date:	**10-Dec-08**
Revision:	**L**

Daily tonne milled	30,000 tonne/day
Mill availability	92%
Annual operating days	365 days
Annual throughput	10,950,000 tonne

PROCESS DESIGN CRITERIA - MATERIAL BALANCE

Document: **0652720100-DBM-P0001-00**

WARDROP

All values are in metric units
Blue font - Water
Red font - Reagent
Green font - Reagent

	Flow ID	Solids, t/h	Solids SG	Solids, m^3/h	Water, t/h	% Solids	Water, m^3/h	Pulp, t/h	Pulp SG	Pulp, m^3/h	Com/s
Feed to Copper Thickener	**176**	17.23	3.70	4.66	48.20	26.33	48.20	65.43	1.24	52.86	
Copper Thickener U/F	**177**	17.23	3.70	4.66	11.49	60.00	11.49	28.71	1.78	16.14	1.27%
Copper Thickener O/F + Filtrates	**178**	0.00	3.70	0.00	47.90	0.00	47.90	47.90	1.00	47.90	
Copper Concentrate	**179**	17.23	3.70	4.66	1.50	92.00	1.50	18.73	3.04	6.15	
Tailings Thickener O/F	**180**	0.00	2.60	0.00	2,319.38	0.00	2,319.38	2,319.38	1.00	2,319.38	
Settled Tailings	**181**	1,341.55	2.60	515.98	294.49	82.00	294.49	1,636.04	2.02	810.47	
Concentrate Filter Feed	**182**	17.23	3.70	4.66	12.69	57.59	12.69	29.91	1.72	17.34	
GSW Final Tailings Pump	**183**	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	
GSW Process Water Distribution Pump	**184**	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	
Total Gland Seal Water	**185**	0.00	1.00	0.00	43.20	0.00	43.20	43.20	1.00	43.20	
Total Reagents Water	**186**	0.84	1.30	0.65	2.83	0.01	2.83	3.67	1.06	3.48	
Filter Filtrate Waters	**187**	0.00	3.70	0.00	11.19	0.00	11.19	11.19	1.00	11.19	
GSW Tailings Reclaim Booster Pump #1	**188**	0.00	1.30	0.00	0.00	0.00	0.00	0.00	1.00	0.00	
Cu-Mo Thickener Feed	**189**	17.55	3.70	4.74	42.56	29.20	42.56	60.12	1.27	47.31	
Cu-Mo Thickener O/F	**190**	0.00	1.00	0.00	25.01	0.00	25.01	25.01	1.00	25.01	
Cu-Mo Thickener U/F	**191**	17.55	3.70	4.74	17.55	50.00	17.55	35.11	1.57	22.30	
GSW Thickener U/F Pump	**192**	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
Feed to Mo Rougher Flotation	**193**	24.02	3.70	6.49	39.05	38.09	39.05	63.07	1.38	45.54	
Process Water to Mo Rougher Flotation	**194**	0.00	1.00	0.00	2.00	0.00	2.00	2.00	1.00	2.00	
Mo Rougher Concentrate	**195**	6.79	4.00	1.70	15.85	30.00	15.85	22.65	1.29	17.55	0.50%
Mo Rougher Tailings	**196**	17.23	3.70	4.66	23.19	42.62	23.19	40.42	1.45	27.85	
Process Water to Mo Cleaner Flotation	**197**	0.00	1.00	0.00	2.00	0.00	2.00	2.00	1.00	2.00	
Feed to Mo Cleaner Flotation	**198**	6.79	4.00	1.70	20.45	24.94	20.45	27.25	1.23	22.15	
Mo Cleaner Concentrate	**199**	0.33	4.60	0.07	0.76	30.00	0.76	1.09	1.31	0.83	0.02%
Mo Cleaner Tailings	**200**	6.47	4.00	1.62	20.29	24.17	20.29	26.76	1.22	21.91	
Feed to Mo Thickener	**201**	0.33	4.60	0.07	2.70	10.79	2.70	3.02	1.09	2.77	

Client:	**Pacific Booker Minerals Inc.**
Project Name:	**Morrison Copper/Gold Project**
Project Number:	**06527201.00**
Date:	**10-Dec-08**
Revision Date:	**10-Dec-08**
Revision:	**L**

Daily tonne milled	30,000 tonne/day
Mill availability	92%
Annual operating days	365 days
Annual throughput	10,950,000 tonne

PROCESS DESIGN CRITERIA - MATERIAL BALANCE

Document: **0652720100-DBM-P0001-00**

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Blue font - Water
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Green font - Reagent

	Flow ID	Solids, t/h	Solids SG	Solids, m^3/h	Water, t/h	% Solids	Water, m^3/h	Pulp, t/h	Pulp SG	Pulp, m^3/h	Com/s
Mo Thickener U/F	202	0.33	4.60	0.07	0.22	60.00	0.22	0.54	1.89	0.29	
Mo Thickener O/F	203	0.00	4.60	0.00	2.48	0.00	2.48	2.48	1.00	2.48	
GSW Mo Thickener U/F Pump	204	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
Feed to Mo Filter	205	0.33	4.60	0.07	1.42	18.70	1.42	1.74	1.17	1.49	
Mo Concentrate	206	0.33	4.60	0.07	0.08	80.00	0.08	0.41	2.67	0.15	
Mo Filter Flitrate Waters	207	0.00	4.60	0.00	1.34	0.00	1.34	1.34	1.00	1.34	
Total Process Water to Moly Flotation	208	0.00	1.00	0.00	4.00	0.00	4.00	4.00	1.00	4.00	
Total Process Water to Cyclones Feed Pumpbox	209	0.00	1.00	0.00	1,380.74	0.00	1,380.74	1,380.74	1.00	1,380.74	
PEX Feed to Grinding Circuit	238	0.02	1.26	0.02	0.00	100.00	0.00	0.02	1.26	0.02	
Aero 3302 Feed to Grinding Circuit	239	0.01	1.03	0.01	0.03	20.00	0.03	0.04	1.01	0.03	
	240	0.00	0.81	0.00	0.00	100.00	0.00	0.00	0.81	0.00	
MIBC Feed to Rougher Scavenger Flotation	241	0.01	0.81	0.02	0.00	100.00	0.00	0.01	0.81	0.02	
PEX Feed to Rougher Flotation	242	0.09	1.26	0.07	0.00	100.00	0.00	0.09	1.26	0.07	
PEX Feed to Regrind Circuit	243	0.01	1.26	0.01	0.00	100.00	0.00	0.01	1.26	0.01	
Aero3302 Feed to Rougher Flotation	244	0.01	1.03	0.01	0.06	20.00	0.06	0.07	1.01	0.07	
Aero3302 Feed to Regrind Circuit	245	0.01	1.03	0.01	0.03	20.00	0.03	0.04	1.01	0.03	
PEX Feed to 1st Cleaner Scavenger Flotation	246	0.01	1.26	0.01	0.00	100.00	0.00	0.01	1.26	0.01	
Lime Feed to 1st Cleaner Flotation	247	0.18	1.30	0.14	0.71	20.00	0.71	0.89	1.05	0.84	
Lime Feed to 2nd Cleaner Flotation	248	0.05	1.30	0.04	0.20	20.00	0.20	0.25	1.05	0.24	
MIBC Feed to 2nd Cleaner Flotation	249	0.02	0.81	0.02	0.00	100.00	0.00	0.02	0.81	0.02	
Flocculant Feed to Copper Thickener	250	0.05	1.30	0.04	0.45	10.00	0.45	0.50	1.02	0.49	
GSW Moly Flotation Feed Pump	251	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
GSW Moly Filter Feed	252	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
GSW Moly Thickener Feed	253	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
GSW Copper Thickener U/F Pump	254	0.00	1.00	0.00	0.60	0.00	0.60	0.60	1.00	0.60	

Client:	**Pacific Booker Minerals Inc.**
Project Name:	**Morrison Copper/Gold Project**
Project Number:	**06527201.00**
Date:	**10-Dec-08**
Revision Date:	**10-Dec-08**
Revision:	**L**

Daily tonne milled	30,000 tonne/day
Mill availability	92%
Annual operating days	365 days
Annual throughput	10,950,000 tonne

PROCESS DESIGN CRITERIA - MATERIAL BALANCE

Document: **0652720100-DBM-P0001-00**

WARDROP

All values are in metric units
Blue font - Water
Red font - Reagent
Green font - Reagent

	Flow ID	Solids, t/h	Solids SG	Solids, m^3/h	Water, t/h	% Solids	Water, m^3/h	Pulp, t/h	Pulp SG	Pulp, m^3/h	Com/s
GSW Tailings Reclaim Booster Pump #2	255	0.00	1.30	0.00	0.00	0.00	0.00	0.00	1.00	0.00	
GSW Mo Cleaner Column U/F Pump	256	0.00	1.30	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
GSW Mo Cleaner Flotation Feed Pump	257	0.00	1.30	0.00	0.60	0.00	0.60	0.60	1.00	0.60	
Feed to Final Tailings Cyclopac	258	1,341.55	2.60	515.98	2,613.87	33.92	2,613.87	3,955.42	1.26	3,129.85	
Final Tailings Cyclone U/F	259	872.01	2.60	335.39	713.46	55.00	713.46	1,585.47	1.51	1048.85	65.00%
Final Tailings Cyclone O/F	260	469.54	2.60	180.59	1,900.40	19.81	1,900.40	2,369.95	1.14	2,081.00	
PEX Feed to Pyrite Flotation Cell	261	0.01	1.00	0.01	0.00	100.00	0.00	0.01	1.00	0.01	
Feed to Pyrite Flotation Cell	262	872.02	2.60	335.39	713.46	55.00	713.46	1,585.48	1.51	1,048.85	
Pyrite Flotation Cell Concentrate	263	282.53	4.80	58.86	345.32	45.00	345.32	627.85	1.55	404.18	36.00%
Pyrite Flotation Cell Tailings Sand	264	589.48	2.60	226.72	368.14	61.56	368.14	957.63	1.61	594.87	
Water to Grinding	265	0.00	4.80	0.00	2,441.24	0.00	2,441.24	2,441.24	1.00	2,441.24	
Water to 1st Copper Cleaning	266	0.00	2.60	0.00	12.00	0.00	12.00	12.00	1.00	12.00	

Client:	**Pacific Booker Minerals Inc.**
Project Name:	**Morrison Copper/Gold Project**
Project Number:	**06527201.00**
Date:	**10-Dec-08**
Revision Date:	**10-Dec-08**
Revision:	**L**

Daily tonne milled	30,000 tonne/day
Mill availability	92%
Annual operating days	365 days
Annual throughput	10,950,000 tonne

PROCESS DESIGN CRITERIA - WATER BALANCE

Document: 0652720100-DBM-P0001-00

All values are in metric units

Flow ID	Description	Water Flowrate (m3/hr)		Process Water Tank		Fresh Water Tank
		In	Out	In	Out	Out
	Grinding					
210	Grinding Feed - Design with 92% Ava	42.02				
217	Process Water to Secondary Screen I	955.50			955.50	
219	Process Water to Ball Mill Discharge	60.00			60.00	
220	Ball Mill Lube Unit #1 Process Water	15.00				15.00
221	Ball Mill Lube Unit #2 Process Water	15.00				15.00
223	GSW Cyclopac #1 Feed Pump	5.00				5.00
224	Process Water to Cyclopac Feed Pun	1425.75			1425.75	
232	GSW Cyclopac #2 Feed Pump	5.00				5.00
238	PEX Feed to Grinding Circuit	0.00				0.00
239	Aero 3302 Feed to Grinding Circuit	0.03				0.03
236	Feed to Rougher Flotation		2523.29			
	Totals	2523.29	2523.29			
	Copper Rougher Flotation / Concentrate Regrind					
236	Feed to Rougher Flotation	2523.29				
131	Rougher Concentrate to Regrinding Mills		253.62			
135	Rougher Scavenger Concentrate		63.41			
133	GSW Rougher Tailings Pump	5.00				5.00
244	Aero3302 Feed to Rougher Flotation	0.06				0.06
242	PEX Feed to Rougher Flotation	0.00				0.00
136	Rougher Scavenger Tailings to Final Tailings Pumpb		2211.32			
	Totals	2528.35	2528.35			
130	Launder Water to Rougher Concentra	34.78			34.78	
131	Rougher Concentrate to Regrinding M	253.62				
135	Rougher Scavenger Concentrate	63.41				
137	Fresh Water Regrind Mill Lube Units	10.00				10.00
138	Lime Slurry	1.36				1.36
139	GSW Regrind Cyclopac Feed Pump	1.60				1.60
243	PEX Feed to Regrind Circuit	0.00				0.00
241	MIBC Feed to Rougher Scavenger Fl	0.00				0.00
245	Aero3302 Feed to Regrind Circuit	0.03				0.03
143	Regrind Cyclone O/F		442.67			
151	Launder Water to 1st Cleaner Scaver	4.00			4.00	
153	1st Cleaner Scavenger Flotation Con	27.27				
155	GSW 1st Cleaner Scav Concentrate	1.60				1.60
157	Launder Water to Rougher Scavenge	25.00			25.00	
166	Process Water to Regrind Pump Box	20.00			20.00	
	Totals	442.67	442.67			
	Copper 1st and 2nd Cleaner Flotations					
143	Regrind Cyclone O/F	442.67				
144	Launder Water to 1st Cleaner Flotatio	4.00			4.00	
145	MIBC Feed to Rougher Flotation	0.00				0.00
246	PEX Feed to 1st Cleaner Scavenger F	0.00				0.00
247	Lime Feed to 1st Cleaner Flotation	0.71				0.71
248	Lime Feed to 2nd Cleaner Flotation	0.20				0.20

249	MIBC Feed to 2nd Cleaner Flotation	0.00				0.00
148	GSW 1st Cleaner Concentrate Pump	1.60				1.60
153	1st Cleaner Scavenger Flotation Concentrate		27.27			
154	GSW 1st Cleaner Tailings Pump	16.00				16.00
156	1st Cleaner Scavenger Tailings to Final Tailings Pum		402.55			
158	Launder Water to Copper 2nd Cleane	4.00			4.00	
161	GSW 2nd Cleaner Concentrate Pump	1.60				1.60
162	2nd Cleaner Concentrate Feed to Cu-Mo Thickener		42.56			
164	GSW 2nd Cleaner Tailings Pump	1.60				1.60
	Totals	472.37	472.37			
	Moly Flotation					
162	2nd Cleaner Concentrate Feed to Cu-	42.56				
192	GSW Thickener U/F Pump	0.60				0.60
251	GSW Moly Flotation Feed Pump	0.60				0.60
256	GSW Mo Cleaner Column U/F Pump	0.60				0.60
257	GSW Mo Cleaner Flotation Feed Pum	0.60				0.60
194	Process Water to Mo Rougher Flotati	2.00			2.00	
197	Process Water to Mo Cleaner Flotatio	2.00			2.00	
196	Mo Rougher Tailings		23.19			
199	Mo Cleaner Concentrate		0.76			
190	Cu-Mo Thickener O/F		25.01			
	Totals	48.96	48.96			
	Copper Concentrate Dewatering					
176	Feed to Copper Thickener	48.20				
175	GSW Filter Feed Pump	0.60				0.60
254	GSW Copper Thickener U/F Pump	0.60				0.60
179	Copper Concentrate		1.50			
178	Copper Thickener O/F + Filtrates		47.90	47.90		
	Totals	49.40	49.40			
	Moly Concentrate Dewatering					
199	Mo Cleaner Concentrate	0.76				
204	GSW Mo Thickener U/F Pump	0.60				0.60
252	GSW Moly Filter Feed	0.60				0.60
253	GSW Moly Thickener Feed	0.60				0.60
206	Mo Concentrate		0.08			
203	Mo Thickener O/F		2.48			
	Totals	2.56	2.56			
	Final Tailings					
174	Final Tailings	2613.87				
181	Settled Tailings		294.49			
180	Tailings Thickener O/F		2319.38	2319.38		
	Totals	2613.87	2613.87			
				Water Tank		**Tank**
				In	**Out**	**Out**
	Tank Totals			2367.28	2537.02	86.78

Excess process water to GSW Tank	-169.74
GSW Tank Makeup Required	169.74

Process Water & Reagent Makeup Required	256.52		50	gpd/person
Potable Water Distribution	3.15		400	persons
Fresh Water Supply	259.67	9.9	% Fresh Water	
Total Water In (Average Rate) (Fresh Water and Ore)	301.70			
Total Water Out with Concentrate (Average Rate)	1.58	300.1		
Total Water Out Retained in Tailings (Average Rate)	179.45	120.7		
Reclaim Water Returned	2367.28			
Fresh Water	259.67			
Total Water Required to Operate Plant	2626.95	m3/hr	11,585	USgpm

DESIGN CRITERIA REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	November 2, 2007	Issued For Client Information	DS	DS		DS	
01	October 16, 2008	Issued for Client Approval	JR	JR	AS	JCR	

TABLE OF CONTENTS

1.0 SCOPE OF WORK AND BATTERY LIMITS

- Design of the mechanical works for the main process plant and surrounding ancillary buildings for the Morrison Porphyry processing areas are broken into five distinct areas of the immediate process plant main site are:
  - Primary Crushing, Conveying and Crushed Ore Storage
  - Secondary & Tertiary Crushing
  - Process Plant
  - Water Supply and Distribution System
  - Ancillary Facilities
- All mechanical work on the Pacific Booker – Morrison Copper/Gold project will fall under the scope of this document.

2.0 CODES AND STANDARDS

- The design and manufacture of mechanical systems and components shall conform to the latest versions of the following codes and standards:
  - Local Codes and Standards (TSA or equivalent)
  - American National Standards Institute (ANSI)
  - Confromite Europeenne (CE)
- The current editions of the following codes, standards, and specifications published by the following societies and institutions will be considered as a part of these criteria, unless otherwise noted. Whenever a difference exists between these criteria and any referenced publication, these criteria will govern.

AFBMA	Anti-friction Bearing Manufacturer's Association
AGMA	American Gear Manufacturer's Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
ASNT	American Society of Non-destructive Testing

ASTM	American Society of Testing and Materials
AWS	American Welding Society
MPTA	Mechanical Power Transmission Association
CEMA	Conveyor Equipment Manufacturers Association
CSA	Canadian Standards Association
EEMAC	Electrical and Electronic Manufacturers Association of Canada
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineer's Society - Lighting Handbook
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
JIC	Joint Industrial Conference
MGI	Metal Grating Institute
MSHA	Mining Safety and Health Administration
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fluid Power Association
OSHA	Occupation Safety and Health Act
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code

- All equipment shall be rated for a minimum elevation of 750 m feet above sea level and an ambient temperature range of -40°C to 30°C and shall have CE Marking.

- Manufacturer's recommended design, installation practices and procedures shall be adhered to whenever such practices and procedures are available.

- Metric units of measurement will be used throughout.

- Design of all materials handling equipment will comply with these criteria. Items not covered herein will conform to the appropriate referenced publications. Details will comply with all the relevant drawings.

3.0 MECHANICAL DESIGNS AND CONSTRUCTION

3.1 General

- Layout of Facilities

- Adequate clearances for proper operation, maintenance and clean-up will be provided in the layout of equipment.
- Space will be provided for the largest normal unit recommended by any of the recognized equipment manufacturers.

3.2 Materials Specifications: Shafting, Bearings and Idlers

- Pulleys and Shafts
  - This section covers only Non-Engineered Class pulleys as defined by CEMA/ANSI B105.1. If any of the pulleys contained on the project fall within the scope of an Engineered Class pulley, these will be supplied. Pulleys will be designed to CEMA Standards unless operating tensions dictate otherwise where they will be designed as engineered pulleys.
  - Each pulley will be of welded steel drum type construction having two solid type end discs, each of which will be complete with solid end hubs with a compression fit type locking device, to provide a clamp fit on the shaft. Additional stiffeners or discs may be incorporated in the pulley, if required by the Manufacturer's standard pulley design or manufacturing methods.
  - End discs will be continuously welded to the rim with full penetration welds.
  - All pulleys will be of the diameter and face width suitable for the design.
  - Pulley face widths will be equal to belt width + 51 mm (2") for belt widths up to and including 1067 mm (42") and belt width + 76 mm (3") for belt widths greater than this size.
  - Pulleys on conveyors for which a fabric belt type is specified will have a crowned face. Crowned pulleys will be crowned to maximum of 3 mm (1/8") per foot of total face width. Crown is defined as the amount per foot of total face width by which the diameter at the centre of the face exceeds the diameter at the edge. Pulleys on conveyors that have steel cord belts will be of the flat face design.
  - Drive pulleys will be lagged with 12 mm thick ceramic or diamond patterned synthetic or natural rubber, having a Shore "A" Scale Durometer Harness value of 55 to 65, A scale. It will be hot vulcanized to the pulley. Drive pulleys will only contact the non-dirty side of the belt.
  - Lagging will be provided for all pulleys that contact the dirty side of the belt. Lagging will be 10 mm thick plain synthetic or natural rubber, having a Shore

Durometer Hardness value of 45 to 50, "A" Scale. It will be hot vulcanized to the pulley.

- All pulley shafts will be of one-piece design, furnished with keyseats and keys to match the pulley hubs and drive components. Shafts will be made from the steel grade as defined by the American Iron and Steel Institute. The grade specified may be upgraded. Depending on the grade specified, acceptable upgrades from a minimum C1018 are C1045 or C4140.

- Wherever a shaft is reduced in diameter, a fillet radius of at least half of the difference in diameters will be used to a minimum of 12 mm. Shaft ends will be chamfered 3 mm x 3 mm. The diameter of the necked portion of the shaft will not be less than 80% of the non-necked portion.

- Shafts 100 mm diameter or less will not be necked at bearings, but may be necked for shaft mounted reducers.

- All keys and keyseats will have semi-circular ends. Square keys will be used.

- All pulleys will be locked to the shaft using a keyless compression type locking device.

- The slope of the shaft at the pulley end disc resulting from deflection of the pulley shaft, for normal running conditions, will not exceed 0.0023 mm per millimetre.

- One shaft on each conveyor (usually the tail shaft) will be extended at one end for a distance of 165 mm from the centre-line of the pillow block bearing. This end of the shaft will be machined and have several tapped holes for mounting the speed switch pulse plate.

- For shaft mounted speed reducers, it will be assumed that the resultant of all overhung loads will act at an angle of 90° to the resultant of the belt tension and pulley weight.

- Bearings and Pillow Blocks

    - Pillow block bearings will be of the self-aligning, double row, spherical roller, adapter mount type, in split housings.

    - Bearings will be rated for a B10 life of [100,000 hours).

    - All pillow blocks will be of the Manufacturer's standard design and will be identified by specific reference to a catalogue number. All bearing pillow blocks will be of the four mounting bolt type, with slotted mounting holes. Adjusting screws will be installed on both sides of pillow blocks.

- All pillow blocks will be suitable for installation on supports prepared in accordance with AFBMA standard mounting dimensions for SAF 225 series pillow blocks up to and including 200 mm diameter bore and for SAF 230 series above this size.
- Pillow blocks will be fitted with taconite type seals, which will effectively exclude micron size dust particles. All pillow blocks will be provided with standard lubrication fittings.
- Each shaft will be provided with one "fixed" type and one "floating" type pillow block. The fixed type will be on the drive end if it is a drive shaft.
- Wherever the shaft does not extend through the pillow block, a housing end closure will be provided.

- Idlers
  - Idlers will be selected to provide optimum standardization.
  - All idler design and selection will be in accordance with the minimum requirements recommended by CEMA.
  - All idlers will be of the Manufacturer's standard design and construction. They will be complete with roll supporting frames and brackets.
  - Idlers will have taper roller bearings or ball bearings, rated for a minimum BU life of [90,000) hours, sealed for life, with triple labyrinth seals, suitable for operation in a dusty, and abrasive environment.
  - The idlers will be located to limit the amount of belt sag during normal running conditions to the percentage of spacing shown in the following schedule.

Coarse Ore Conveyors:	Carry side	1 ½%
Fine Ore Conveyors:	Carry side	2%
All Conveyors:	Carry side under skirts	1%
	Return side	2%

  - The maximum spacing for all the idlers and the maximum belt wrap angles for the return idlers will be determined by design requirements.
  - Idler frames will be suitable for hold-down bolts spaced at belt width plus 225 mm (9").

- Carrying idlers for conveyors will have three equal length rolls with 35° trough angles. Belt feeders will have 20° trough picking type idlers.

- Normal carrying idlers will be equipped with steel rolls. Non-tilted idler stands will be used.

- Impact carrying idlers will be equipped with rolls composed of closely spaced rubber discs. The rolls will be mounted in a fixed frame.

- Transition carrying idlers will be of the same general design as the normal carry idlers, but the inclined rolls will be adjustable in 5° increments from a minimum of 5° to within 5° of the specified full troughing angle.

- Picking type carrying idlers will have the same overall design features as normal impact and carrying idlers, except that they will have a long horizontal center roll and short end rolls inclined at 20°.

- Return idlers will be of the vee-type design, inclined at 10°, equipped with rubber discs, with disc grouping at each end of the roll to prevent the belt edge from becoming caught between discs.

- Carry training idlers for conveyors will be of the same general design as the normal carrying idlers, but will be designed to pivot horizontally and will be equipped with vertical belt edge rollers.

- Weigh scales will be equipped with idlers that will be modified according to manufacturers' recommendations for use on weigh scales, if required.

3.3 Materials Specifications: Drive Components

- General

  - Drive components will be selected to provide optimum standardization.

  - Heating and/or cooling requirements and the quantity and type of oil to be used, for winter and summer operation, will be stated for each component.

  - The drive components will be suitable for outdoor operation, not covered and operating continuously, in environmental conditions specified.

  - All drive components will be suitable for up to 6 starts per hour.

- Drive units 100 kW and above will be provided with fluid couplings. Drives below this will be connected with flexible couplings or V-belts unless design requirements dictate otherwise.
- The overall drive ratio will be within 4% of that specified, including any fluid coupling slippage.

- Fluid Couplings
  - Fluid couplings will be of the hydraulic delay-fill type. Any subsidiary couplings or V-belt sheaves necessary to complete the connection between the motor and the speed reducer will be included.
  - The complete fluid coupling or combination unit will be finish bored and keyseated to suit the related component shafts and will incorporate features that will permit its assembly and removal, without disturbance of the motor or speed reducer.
  - The fluid coupling will be capable of limiting the starting torque to a maximum value of 140% of the motor normal running full load torque. (unless alternative stated)
  - Couplings will be provided with standard non-contracting thermal switches and fused plugs.

- V-Belt Drives
  - V-belt drives will utilize standard "narrow" V-belt (3V, 5V and 8V) cross sections and standard lengths, in matched sets.
  - All sheaves will be statically balanced.
  - Sheaves will have compression type bushings, finish bored and keyseated to suit the related component shafts.
  - V-belt drives will be selected on the basis of a service factor of at least 1.5, applied to the motor nameplate power rating.

- Speed Reducers - General
  - All speed reducers will be designed in accordance with the standards of the American Gear Manufacturers Association (AGMA).
  - Speed reducers will incorporate adequate seals, in combination with other design features, to effectively exclude micron size dust particles and other contaminants.

- Speed reducers will be complete with any necessary oil level indicators, drains, and breathers. Reducers will be designed to operate without external oil coolers.

- Air breathers will be complete with removable filters for cleaning or replacement. The filter will be capable of retaining microscopic dust particles. Magnetic drain plugs will be provided to remove any metal particles in the oil.

- Lubrication will be automatic and adequate for the conditions and service specified.

- Built-in backstops will be integral with the reducer, completely enclosed and sealed. They will be of the all mechanical, automatic, over-running, one way clutch type, utilizing hardened rollers or sprags. The backstop torque rating will be equal to the normal operating or peak overload torque rating of the reducer, whichever governs the selection.

- The thermal power rating of speed reducers will equal or exceed the motor nameplate rating at the specified site elevation.

- Speed Reducers - Shaft Mounted

  - Helical type gearing will be used in all shaft mounted speed reducers.

  - The service factor for selection of reducers will be in accordance with AGMA Class II, with a minimum value of 1.4, applied to the motor nameplate power rating.

  - The conveyor drive shaft will be necked to accommodate the reducer maximum bore, if required.

  - The motor mounts for mounting the motor on top of the reducer will be adjustable for V-belt tensioning.

- Speed Reducers - Foot Mounted

  - Helical type gearing will be used in all foot mounted speed reducers, in combination with bevel or spiral-bevel gears if in right angle shaft configuration.

  - All foot mounted speed reducers will be arranged for standard horizontal floor mounting and will have horizontally split housings.

  - Foot mounted speed reducers will be selected on the basis of a service factor of at least 1.5 applied to the motor nameplate power rating.

  - The gearing in foot mounted reducers will be AGMA Class 12.

    - All bearings will have a B10 life rating of a minimum of (60,000 hours), in accordance with AFBMA.

- Flexible Couplings

    - High and low speed couplings will be of the flexible grid member or gear type.
    - Flexible couplings will be selected on the basis of a service factor of at least 1.5, applied to the motor nameplate power rating.
    - The coupling hubs will be finish bored and keyseated to suit the related component shafts. Square keys will be used.

- Chain Drives

    - Roller chain drives will be used only in cases where other types of power transmission are difficult or impossible.
    - Chain drives will be of the standard ASA roller chain type.
    - Chain drives will be enclosed in a dust free, oil tight chain casing.
    - Chain drives will be selected on the basis of a service factor of at least 1.3 applied to the motor nameplate power rating.

- Drive Bases

    - Drive bases will be of rigid construction longitudinally, transversely and torsionally and will be designed to withstand all static and dynamic loads during operation, transportation and installation.
    - Fabricated bases will be stress relieved after welding and prior to machining. All holes will be drilled. Punched or burned holes are not acceptable.
    - Mounting surfaces on the drive bases will be machined for the speed reducer and motor to ensure accurate alignment.
    - Adjustment bolts and shims will be provided on the drive bases to facilitate alignment of components.
    - All drive components will be installed and aligned on the drive base.
    - Lifting lugs will be provided on the drive bases for lifting the complete drive assembly including motor in a balanced condition.

3.4 Materials Specifications: Conveyor Components

- Conveyor Belt
  - Belt construction will be selected and rated for operation with hot vulcanized splices.
  - Conveyors equipped with steel cord belting will be equipped with mechanical or electronic rip detection systems as required.
  - Maximum standardization of belt type will be maintained for the various belt widths.
  - All belting will be constructed free of longitudinal and transverse twisting, wavy cords or other irregularities.
  - Belt will have sufficient flexibility for proper bending around pulleys and proper troughing on idlers at the angles specified.
  - Belt widths will be within a tolerance of 1%.
  - Belting with repaired carcass faults will not be acceptable.
  - Belting will be equipped with standard covers of suitable thickness.
  - Fabric belts will have molded rubber or cut edges.
- Take-Ups
  - Take-up travel will provide allowance for the belt splicing operation, permanent stretch, and stretch due to take-up tensioning, temporary stretch due to variation of conveyor loadings, and temporary stretch resulting from starting loads.
  - If a take-up trolley is required for mounting the take-up pulley, it will be equipped with self cleaning vee-groove wheels and hold-down rollers to prevent the trolley from derailing.
  - Where screw take-ups are required, they will be of the bottom guide type with a protected screw. They will also be suitable for mounting the standard pillow blocks described herein.
  - Hydraulically assisted screw take-ups will be provided for high tension belt feeders, if necessary.

  - All wire ropes and wire rope hardware used for take-ups will have a minimum breaking strength of 5 times the imposed maximum load. Wire rope sheaves will have a minimum tread diameter of 24 times the wire rope diameter.
  - Conveyors 30 m or less in length will be provided with screw take-ups. For conveyors over 30 m in length, or when constant belt operating tension is required, gravity take-ups will be provided.

- Tramp Iron Magnets
  - Tramp iron magnets will be of the suspended, electromagnetic type and positioned over the head pulley of conveyors where required.
  - The position of each magnet relative to the head pulley will be based on manufacturers' recommendations.
  - Where required, self-cleaning magnets will discharge tramp metal in the direction of conveyor belt travel.
  - Magnet support structures will be designed to allow easy removal of the magnet for maintenance and, in the case of manually cleaned magnets, de-energizing.

- Belt Weigh Scales
  - Belt weigh scales will be of the single idler, pivoted weigh bridge type with static test weight.
  - Belt weigh scales will be located where belt tensions are low and tension variations are minimal.
  - Belt weigh scales will not be located on or near concave or convex curves.

- Belt Scrapers and Plows
  - One primary scraper and one secondary scraper will be provided for the head pulley of each conveyor.
  - The primary scraper will be a single blade type that removes most of the loose material clinging to the belt.
  - The secondary scraper will be of the multiple-blade type with tungsten carbide scrapers.

- Both the primary and secondary scrapers will be supplied with all the required mounting and tensioning hardware.
- Scrapers will be located such that material cleaned off the belt will fall into the discharge chute. All areas of the discharge chute which contact scrapings will be lined with UHMW polymer.
- Vee-Plows will be installed on the clean side of the belt before tail pulleys.
- The design of the plow will be such that the steel frame will not come into contact with the belt after the rubber blade has completely worn out.
- Safety chains or other means will be installed to prevent the plow from travelling with the belt in the event of a mounting failure.
- Head pulleys on all conveyors will be arranged to allow easy access to belt scrapers from floor or walkway level.

- Chutework and Skirting
    - The transfer or lower portion of chutes for coarse ore conveyors will be fabricated from 10 mm thick mild steel plate, with 100 x 10 mm flat bar stiffeners. Split line flanges will be fabricated from 100 x 10 mm flat bar. Hoods or upper portions of chutes not subject to material contact will be fabricated from 6 mm thick mild steel plate, with 75 x 6 mm flat bar stiffeners.
    - Chutes for conveyors other than those handling coarse ore will be fabricated from 6 mm thick mild steel plate, with 75 x 6 mm flat bar stiffeners. Split line flanges will be fabricated from 75 x 6 mm flat bar.
    - Chute surfaces subject to material impact or abrasion will be lined with abrasion resistant metal liners.
    - Chute dimensions will be based on the maximum surge capacity of the related conveyor and on the type of material being transferred, with a minimum amount of throat constriction, sufficiently braced for impact loading. Supporting steelwork will be designed to withstand plugged chute conditions.
    - Chute fabrication will be of welded, dust tight construction in suitable sections for easy handling during erection and maintenance. If supported from the floor above, chutes will be split below the floor and provided with rubber seals for ease of removal.

- The section of chute immediately above the head pulley, from the horizontal centerline of the shaft and above, will be readily removable, without disturbing the remainder of the chute, to facilitate access to the head pulley.

- The drop height of material through chutes will be minimized to prevent damage due to high impact loads and to prevent excessive generation of dust.

- The rear wall of chutes on which fines tend to accumulate will be lined with UHMW polymer. The top edge of the liner will be located behind the rear face of the pulley and extended up to the return belt.

- Trajectories will be plotted for all conveyor discharge chutes. Both upper and lower limits of the trajectory will be shown.

- Transferred material will not strike the front plate of the chute. For crushed ore, the main discharge stream will strike material contained in a rock box. For concentrates, the transfer will be made in as direct a trajectory as possible, not interrupted by a rock box, feed plate or other device.

- Material discharging to stockpiles will not contact the chute.

- The valley angle within chutes will not be less than 65°.

- The withdrawal angle used for material being discharged from storage will be 65°.

- Chute widths will be standardized as much as possible for uniform liner sizes. Inside width of head chutes will be equal to pulley face width plus 75 mm.

- Chutes for crushed ore will be provided with a V-shaped loading plate, set between the skirts. The apex of the V will be located just ahead of the calculated trajectory of the conveyor discharge.

- If possible, discharge from scrapers will fall vertically down the main chute.

- Chute design will permit convenient installation, inspection and adjustment access to scrapers.

- Skirts will be fabricated from minimum 6 mm thick mild steel and provided with minimum 12 mm thick, adjustable rubber with a Shore Durometer Hardness value of 40, A scale. The distance between skirts will be set at 2/3 belt width. Skirts will be provided with a 3 mm thick top cover plate and dust take-off flange.

- Conveyors with multiple load points will have continuous skirting between the load points.

- Rubber dust curtains will be provided at chute entrances, at the rear of skirts and at belt exit points from the skirts. Dust seals will be provided where pulley shafts protrude through chute walls.

- Provision will be made for the installation of plugged chute detectors in the chutes.

- Chutes will be provided with at least one latched inspection door that does not require tools for opening or removal. Minimum opening size will be 450 x 450 mm

- Skirt lengths will be 2400 mm minimum.

3.5 Materials Specifications: Safety Components

- Deck Plates

  - Steel deck plate will be provided over load points and prior to discharge chute locations, mounted on top of the stringer, to prevent material from falling onto the return side belt. Minimum thickness of deck plate will be 3 mm.

  - Feeders and short conveyors will be provided with full-length deck plates.

- Guards

  - All hazardous revolving or reciprocating parts not guarded by the frame of the equipment or by remote location will be provided with guards.

  - Protection screens will be provided to prevent access to the areas directly under gravity take-up weights.

  - Where remote take-up weights are connected to the conveyor take-up trolley by cables, all sheaves will be guarded. Guarding of these areas will be by individual local guards or by area guarding.

  - Guards will prevent physical access to the nip points of pulleys. Where guarding is local to a pulley, it will extend not less than one metre from a nip point.

  - Guards that must be removed to perform regular maintenance will not normally exceed 20 kg and will never exceed 30 kg in mass.

  - Guards will be designed to provide quick and easy access to the equipment.

- Switches

- Pull cord switches will be mounted on all sides of a conveyor where personnel access is possible.
- Speed switches will be provided on all conveyors, either on the tail pulley or adjacent to a non-driven pulley.
- Belt misalignment switches will be provided near the head end and tail pulleys of conveyors.

- Galleries and Pre-Assembled Conveyor Stringers And Idlers
  - The Vendor must include within the scope of supply pre-fabricated tubular or other cross-section (e.g. Cam-Span or similar) galleries.
  - The galleries shall be designed and detailed for connection to structural steel work as required.
  - The galleries shall be supplied complete with conveyor stringers, troughing and return idlers.
  - The gallery cross section shall be such as to accommodate necessary cable trays, a walkway (2'-6") wide plus the belt conveyor. The relationship between the walkways and conveyors in each gallery shall be as shown on the layout drawings.
  - Lighting and associated wiring and terminal boxes, etc. shall be supplied as listed in the section below.
  - Support bents are to be supplied in locations shown on the drawings. Support on other structures shall be as shown on the drawings and in consultation with the engineer.
  - Included within the scope of supply is the head and tail frames for the conveyors, all stringer support legs and bracing. Walkways for the conveyor from the tail or head frame to the connection with the conveyor galleries. The chutes shall be supplied by others. The head and tail frame support legs shall be supplied which shall generally be supported on the platform steel provided by others.
  - Vertical take-up frames, complete with bearing supports, shall be compatible with Purchaser's take-up guides. Details and size of the guides will be provided at a later date.
  - Conveyors shall be provided with a (2 mm, 3 mm) thick deck plate on the top of the stringers at all loading points and head end, where spillage is a safety concern. The

deck plate shall extend approximately 6 meters (20 ft) beyond the end of the skirt at loading points.

- All conveyors shall be housed in galleries supplied by the Vendor. Galleries and supporting steelwork shall be designed according to Simons Civil Specification 21.0-C-08, "Design & Supply of Conveyor Galleries & Support Bents".

- Assembly of all conveyor components shall be supplied as complete and operable units, including all necessary auxiliaries, and shall be shop assembled to the conveyors and belt feeders, where applicable.

- All bearings shall be fully shop lubricated as per the manufacturer's instructions.

3.6 Materials Specifications: Surface Preparations and Finish

- The painting system and colour for the conveyor hardware shall be of the manufacturer's standards with due regard for the duty and service as expressed in this specification.

- All exposed shafting and machined surfaces, including keyways, shall be protected from damage or corrosion during shipping by a coating of Rustveto or wrapping such as oil impregnated Denso tape. The manufacturers' standard surface preparation and paint shall be applied. (Unless a corrosive atmosphere exists).

- The painting system and colours for the fabricated steelwork shall be provided during the procurement.

4.0 SAFETY FACTORS

- All mechanical equipment will be design with appropriate safety factors typical of the design loads, usage, and equipment type.

5.0 EQUIPMENT AVAILABILITY

- Equipment will be designed to maximize availability and at minimum of 98% unless specified otherwise. Equipment maintenance schedules will allow for routine maintenance of all systems.

6.0 EQUIPMENT DESIGN CRITERIA

- Individual specifications will be written for all major equipment and will be the basis for the quoting and procurement of major equipment.

End of Section

REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	November 4, 2008	Issued For Client Approval	EA	TS	AS	JCR	
01	December 10, 2008	Issued for Client Acceptance	EA	TS	AS	JCR	

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SCOPE

This design criteria outlines the basis for the overall design of piping systems, general requirements of components and drawings.

All measurements (lengths, flows, pressures, temperatures) will be expressed in units of the metric system.

The base design codes shall be CSA Standard B51-2003.

1.0 CODES AND STANDARDS

1.1 Requirements

- The components of piping systems will comply, as a minimum and as appropriate, with the following standards. In the event of a conflict between codes and the technical specifications, the requirements of the more stringent shall govern:

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASME B31.1	Code for pressure Piping “Power Piping”
ASTM B31.3	Code for "Chemical Plant and Petroleum Refinery Piping”
ASTM	American Society for Testing and Materials
AWWA	American Water Works Associations
AWS	American Welding Society
CSA	Canadian Standards Association
HIS	Hydraulic Institute Standards
NBC	National Building Code of Canada
NFC	National Fire Code
NFPA	National Fire Protection Association
PFI	Pipe Fabricators Institute
PPI	Plastic Pipe Institute
ULC/FM	Underwriters Laboratories Canada/Factory Mutual

1.2 Other Requirements

- Pressure piping systems, which are subject to design registration, shall be submitted for approval by the appropriate authorities.
- All drawings associated with fire protection shall be submitted to the local Fire Marshal and to the insurance underwriter for approval (not required for the DFS).

2.0 GENERAL DESIGN DEFINITIONS

2.1 Design Pressure

- Design pressure shall be the most severe condition of internal or external pressure under normal operating conditions.
- Normal operating condition is the most severe condition of pressure and temperature expected to exist when continuous operating conditions are in progress.
- Normal operating conditions do not include pipe pressure testing and abnormal system operation.
- Design pressure for unrelieved piping on pumped systems shall be the pump shut-off discharge pressure.
- Design pressure for vacuum piping shall be full vacuum pressure.
- Minimum design pressure shall be 1034 kPa.
- Where two piping systems of different design pressures are connected, the piping system with the higher pressure will extend to the first block valve on the lower system.

2.2 Design Temperature

- Design temperature will be the maximum temperature under normal operating conditions as defined above.
- Design temperature will be consistent though out the complete system.

3.0 PIPING MATERIALS AND METHODS

3.1 General

- Pipes, pipe components and valves will be classified primarily in accordance with material of pipe and components and each class group will be given a secondary classifications based on service performed and/or pressure/temperature ratings.
- The specification for the materials includes the following:
  - Piping Specification General

- Piping Materials Class Index
- Pipe Support Specification Index
- Line List
- Valve List
- Tie-in list
- Pipe Materials Specifications
- Valve Specifications
- Rubber Lining
- Thermal Insulation
- Painting Labels & Colours

4.0 PIPING DESIGN

4.1 Line Sizing Criteria

Table 1 – Line Sizes

Description		Velocity m/s
Slurries General	pump discharge gravity flow	1.2 - 2.1* 0.5 - 1
Process Solutions Lines	pump discharge gravity flow	2.0 -2.5 2.0 -3.0
Air		15.0 - 30.0
Steam		30.0 - 45.0
Water	pump discharge gravity flow	2.0 - 3.0 2.0 -3.0
Flocculant	pump discharge	0.25 - 0.5
Fuel Oil	pump discharge	1.0
Reagent	pump discharge	0.7

**Velocities dependent upon density. Specific gravity, particle size and pipe diameter calculated using Durand formula.*

4.2 Line Sizing

- All piping sizes will be expressed in nominal pipe size using Metric Units.
- Piping shall be sized for flowsheet design rated flow conditions. Provision for future increase capacity shall be made only when specifically requested by client.
- Nominal Pipe size diameters 125mm, 175mm, 225mm, 325mm, 550mm, shall not be used, except where required to connect to equipment. Conversion to standard piping shall be as near the equipment as possible.

- Minimum pipe size run shall be 25mm except for connections to equipment, instrument services, lube oil piping and auxiliary services such as pump and x-ray tube cooling.
- In pipe utilidors the minimum pipe size shall be 50mm
- Generally pipe sizing will be based on:
  - Historic data for similar projects.
  - Economics
  - Available pressure drop and power consumption
  - Velocity limitations
- Pump suction lines will be at least one size larger than pump suction flange size.
- Gravity piping shall be sized in general to provide maximum design flow at 50 – 60% full pipe.
- Control valve bypasses on slurry piping shall be line size and on solution, air, and steam piping shall be control valve size.

4.3 Pipe slopes

Table 2 – Pipe Slopes

Description	Nominal Size Fraction (mm)	Percent Solids (%)	Minimum Slope (angle)
Slurries	-	-	1 – 2
Solutions	-	-	0.5 – 1
Air and Vents	-	-	0.5 - 1
Steam and Condensate	-	-	0.5 – 1
Water	-	-	0.5 - 1

4.4 Launders

Launders are defined as an open channel for carrying suspended solids in water under gravity flow conditions. Although launder sizes are calculated, specified and verified by the Process and Mechanical Engineering groups, Launder design generally conform to the following guidelines:

- The quantity that will flow in an open channel is dependant on several factors, which are the cross-sectional area of the flow stream, the slope of the launders, the roughness condition of the sides and bottom of the launder and the shape of the launder as well as the flow characteristics of the pulp itself. The preferred shape of the launder is the semi-circular bottom-type, where possible. This particular shape reduces the hydraulic radius, thus allowing for a lesser slope and still maintaining a required velocity. Flat bottom launders may be used where connections to distributors are rectangular in shape. Flat bottom launders may also be used where gravity flow pipelines are collected by a common launder.

- For each Launder, minimum geometric parameters to ensure adequate flow, including slopes and sizes, shall be determined by appropriate calculation methods – the Colebrook White Formula, Manning formula or an approved equivalent.
- Slurry launders will have a minimum total depth of four times the flow depth.

4.5 Slurry Piping

- All piping shall be routed as direct as possible to its destination minimizing the use of bends, abrasions and plugging.
- All piping shall be routed above ground whenever possible.
- Pipe bends shall have a minimum radius of three pipe diameters (3D) for pipe size 76mm and above. Five pipe diameters (5D) for pipe sizes 50mm and below unless layout constraints determine otherwise. Where necessary, material conducting hose will be used in place of bends.
- Piping will be jointed to allow the pipe to be rotated to distribute wear due to abrasion.
- Drain and flushing connections shall be provided on all pump suctions. Flushing connections shall be the quick disconnect type. Flushing and drain connections shall have ball type block valves. On larger slurry lines drain valves shall be knife gate type. All piping will be self draining with one high point.
- Block valves shall be knifegate type fitted with replaceable natural gum rubber sleeves which allow full port flow and eliminate seat cavities preventing packing of the sleeve with solids. On smaller line sizes full port fully enclosed body style replaceable natural gum rubber sleeve pinch valves shall be provided.
- Pump suction lines shall be minimum length and the use of bends or valves will be kept to a minimum. Suction piping shall be sloped down from the pumpbox to the pump suction inlet and have fabrication reducers with 10° included angle wherever possible.
- High abrasion slurries shall be C.S. extra heavy wall pipe butt welded and flanged, or Standard wall rubber lined pipe.
- Low abrasion slurries shall be standard wall pipe butt welded and flanged.
- Slurry lines outside of buildings or heated areas shall be either C.S. extra heavy wall pipe, C.S. Standard wall rubber lined, standard wall pipe, or HDPE flanged pipe and fittings. Wall thickness to suit pressure rating of system.
- Piping at pumps shall be arranged to avoid interference with access to pumps, the surrounding maintenance areas, and pull spaces during maintenance. Removable spool pieces to be provided where required (eg. pump suction and discharges) to permit maintenance with a minimum of piping disassembly.

- Suitable supports and anchors shall be provided for piping at pumps such that excessive weight and stresses will not be transmitted to the pump casings. Temporary start-up strainers will be provided on non-slurry pump suctions.
- The number and location of sampling connections shall be provided as per P&ID. All sampling points shall have an isolating or sampling value.

4.6 Gravity Flow Pipelines

- Pipelines carrying slurries will be designed to flow from 3% to 75% full, however they are generally sized 1/3 or 2/3 full.
- Slopes shall be identified on P&ID's with the minimum slope.
- Gravity flow pipeline slopes and sizes shall be determined by appropriate calculation methods – the Colebrook White Formula, Manning formula or an approved equivalent.

4.7 Solution Piping

- Pressurized solution lines shall be sized as noted in Table 1 with the exception for special conditions, such as high viscosity fluids, low pressure drop requirements, long lines where lower velocity would be used to optimize system and operating cost.
- All piping will be self draining. Drain and vent connections shall be provided at high and low points of the piping system to facilitate maintenance and hydro testing.
- Generally solution piping shall be standard wall carbon steel pipe and butt welded fittings. Pipe fittings 50mm and below shall be 3000 # socket welded or threaded. If solution is corrosive, use stainless steel or Hastelloy specifications.
- Block valves shall be ball type unless permitted otherwise by piping equipment specification.
- Pockets and dead ends shall be avoided.

4.8 Water Piping

- Where feasible, water systems primary headers shall be "looped" so that all branch lines are fed from two directions.
- Suitable allowance shall be made for future demands on the system such as spray bars. Design to have a 10% additional capacity to accommodate future loads.
- Generally water piping shall be standard wall carbon steel pipe with butt weld fittings. Pipe fittings 50mm and below shall be 3000# threaded. If water is corrosive, use stainless steel.
- Block valves shall be butterfly type for 50mm and above and ball type for 50mm and below.

- Combinations safety shower/eyewash stations are required adjacent to all locations where the release of harmful fluids, airborne dust, or non-toxic particles occurs.

4.9 Air Piping

- Compressed air piping shall be sized so that the pressure drop along the line shall not exceed 10% of the initial line pressure, with full capacity being delivered at the end of the line. Air piping shall be looped.
- All take-offs shall be from the top of the header for horizontal piping to avoid oil pockets.
- All instrument air branch piping shall be run to within 6 metres of the instrument and terminate with a valve. Where clusters of instruments occur a single centrally located valved connection shall be provided.
- All plant air piping shall be standard wall carbon steel pipe with butt weld fittings. Pipe fittings 50mm and below shall be 3000 # socket welded.
- All instrument air piping shall be standard wall carbon steel pipe with butt weld fittings. Fittings 50mm and below shall be 150# malleable iron threaded. Run out pipe and fittings from branch block valve shall be stainless steel tube and fittings.

4.10 Utility Piping

- Utility stations shall supply plant air and water at convenient locations on all floors such that all parts of the floor can be reached with a 15 metre flexible hose.
- All air and water utility stations shall be 25mm, equipped with 25mm ball valve and quick disconnect type hose connections.
- Utility headers shall be located on the top deck of pipeways whenever possible. The minimum size of process and utility headers on pipeways shall be 50mm.
- Propane shall be supplied from a vendor package which shall include all necessary storage tanks, pressurization pumps, vapourizers and first stage regulators.
- Propane distribution piping shall be threaded carbon steel Sch. 80 for sizes 50mm and below Sch. 40 for sizes 80mm and above. (ASTM A333M Gr. 6 for low temp applications)
- Where propane piping is buried underground, it shall be "Yellow Jacket" coated.
- Where propane serves a building it shall rise up outside the building and be provided with a shut off valve and a second stage regulator, before entering the building. The riser shall be protected from physical damage.

4.11 Steam Piping

- Steam piping shall be sized so that the pressure drop along the line shall not exceed 10% of the original line pressure, with full capacity being delivered at the end of the line.
- All take-offs shall be from the top of the header for horizontal piping to avoid condensate pockets.
- Steam piping shall slope in the direction of the flow.
- Drip legs and steam traps shall be provided at all low points and dead ends. Block valves shall be installed either side of steam traps.
- Discharge from steam traps shall tie into a lower pressure steam or condensate system.
- All steam piping shall be standard wall carbon steel pipe and butt welded fittings. Pipe fittings 50mm and below shall be 3000# socket welded.
- To minimize condensation and prevent erosion induced by relative movement all steam and condensate lines shall be fitted with pipe shoes and shall be fully insulated as indicated by HC on the P&ID's.

4.12 Personnel Protection

- Eye wash/emergency showers shall be provided in areas where operating personnel are subject to hazardous sprays or spills.
- Pipes carrying hazardous chemicals shall have dual containment and safety shields at all flanges mechanical joints and valves to protect personnel.
- Acid, lime, or other pipe lines carrying hazardous liquids shall be located close to grade level whenever possible. These lines shall be identified clearly with signs to avoid unnecessary risks.

4.13 Insulation and Heat Tracing

- Personnel protection shall be provided on uninsulated lines operating above 60°C where they constitute a hazard to the operating personnel during normal operating routine.
- Piping subject to freezing weather shall have insulation and heat tracing or the capability of being drained down.
- Insulation shall be used on heated lines to minimize heat losses.
- Cold water lines in concealed spaces shall be insulated with anti-sweat type insulation.

5.0 GENERAL PIPING LAYOUT

5.1 Installation

- Piping within buildings shall generally be installed in 6 metre (random) lengths, unless on a pipe rack or trestle where 12 metre lengths (double random, maximum) may be utilized. In highly congested areas or areas where maintaining piping will be difficult, 3 metre lengths may be used.
- Flange bolts holes shall straddle centre lines unless otherwise indicated on the drawings.
- Headroom clearance for piping in the aisles is 5 metres. Clearance of 2.1 metres is provided over operating platforms. Minimum clearance of 5 metres for Pipe Rack to road is required.
- All slurry and utility valves shall be accessible from floors and operating platforms (maximum height 1.5 metres). Spindle extensions and chain wheel operators are only to be installed where it is not practical due to space constraints.
- Piping shall be routed in piping corridors grouped together as practically allowable. The arrangement of the piping should allow operations and maintenance to be carried out with minimum of effort.
- Piping systems shall be designed to allow for expansion and contraction. Expansion effects due to exposure to direct to direct sunlight shall also be considered.
- Piping shall be arranged to maximize inherent flexibility. Expansion joints shall only be used when it is absolutely necessary.
- Piping shall not be routed through electrical rooms.
- All walls and floor penetrations shall be sleeved.
- All control valves shall have adequate clearance for disassembly without disturbing other equipment or piping.
- Valves shall be oriented so that stems and hand wheels do not project into platform or passageway areas. However, valves should be situated so that they are readily accessible.
- Vents and drain connections shall be provided at all high and low points on tanks. Drains shall never be less than 18mm in diameter. Vents consisting of plugged bosses shall be provided at the highpoints of all piping for hydrostatic testing. The plugs should be sealed after the hydrostatic test.
- Valved connections shall be provided on piping and equipment to be drained.
- After installation, all piping shall be cleaned by flushing with water until free of dirt, grit, welding slag, and foreign materials.

5.2 Pipe Identification

- Pipes shall be marked by a system of identification set out in the following standards:
  - ANSI Z53.1-1979, "Safety Colour Code for Marking Physical Hazards",
  - ANSI A13.1-1981 (R1985), Scheme for the Identification of Piping Systems.
- Pipes shall be labelled as to contents and direction of flow as follows:
  - Hazard shall be identified using the following colour codes:

Table 3 – Classification of Hazards of Materials and Designation of colours

Classification	Background Colour	Colour of Letters for Legend
Materials of Inherently Hazardous		
Flammable of Explosive	Yellow	Black
Chemically Active or Toxic	Yellow	Black
Extreme Temperatures or Pressures	Yellow	Black
Radioactive	Yellow	Black
Materials of Inherently Low Hazardous		
Liquid or Liquid Mixture	Green	White
Gas or Gaseous Mixture	Blue	White
Fire Quenching Hazard		
Water, Foam, Carbon Dioxide, Halon etc.	Red	White

Table 3 – Size of Legend Letters and Banding

Outside Diameter of Pipe or Covering	Length of Colour Background	Size of Letters	Width of Banding Tape
mm	mm	mm	mm
10 to32	200	13	25
38 to 51	200	19	25
64 to 150	300	32	50
200 to 250	600	64	100
over 250	800	80	100

5.3 Labelling and Colour may be either:

Paint and stencil: Pipe is painted as per hazard colour code then text and flow direction arrows are stencilled in.

Adhesive labels: Hazard colour Code adhesive label with flow direction arrows, banding tape applied either side of label.

5.4 Location of text and arrows:

- maximum of 12 m centres on straight pipe;
- at all valves;
- at all changes in direction;
- at fittings for hose or other terminal connection;
- at 1.5 m above floor on vertical pipes;

- at 1.5 m from wall where pipe passes through the wall;
- at 1.5 m from equipment to which pipe is connected.;

When the contents of a container or pipe is a controlled product, there shall also be a WHMIS product identification label.

6.0 STRESS ANALYSIS

- Piping stress analysis shall be performed on lines of thermal expansion or lines where weight or fluid dynamics may cause excessive stresses.
- Piping stress analysis shall apply with applicable CSA codes.
- Piping stress analysis shall be done using computer program, manual calculation or calculation tables from the “Piping Guide” published by Syentek Inc.
- For pipe supporting guidelines, flexibility and pipe stress, refer to Piping Materials and Methods 40 05 02.
- The stress analysis of lines shall be carried out using Ceasar II.

7.0 VALVES

- Piping will be responsible for all manual general severe service gate, globe, check, butterfly, ball & diaphragm valves.
- On/Off activated valves (XV’s), control valves and PSV’s.
    - This package falls outside the piping scope. The Instrument and Process Engineering group shall be responsible for carrying out the control valve sizing. The Instrument Engineering group shall furnish piping with information required for piping hook-up.

End of Section

REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	November 2, 2007	Issued For Client Information	KL	KL/JM		DS	
01	October 31, 2008	Issued for Client Approval	BD	KL	AS	JCR	

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SCOPE

1.0 DUST CONTROL

- This specification defines the design criteria, which shall be applied to dust control systems during detailed design of the Project

2.0 CODES AND STANDARDS

2.1 Requirements

- All systems and equipment shall be designed, manufactured and tested in accordance with the latest applicable sections of the following regulations, codes, standards or specifications. Equipment specifications shall include references to specific sections of the following codes and standards where appropriate.
- The publications listed below shall be the reference documents for the dust control design criteria. Each publication shall be the latest revision.

ACGIH	American Conference of Governmental Industrial Hygienists – Industrial Ventilation Handbook.
AISI	American Iron and Steel Institute
AISC	American Institute of Steel Construction, Inc.
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers, Inc.
ASNT	American Society for Non-destructive Testing, Inc.
ASTM	American Society for Testing and Materials
AWS	American Welding Society, Inc.
ISO	International Organization for Standardization
MSHA	Mining Safety and Health Administration
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
RMA	Rubber Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association, Inc. (Industrial Duct Construction Standards only)

- In the event of conflict between the codes, the requirements of the more stringent shall govern.

3.0 GENERAL DESIGN DEFINITIONS

3.1 General

- Design pressure shall be the most severe condition of internal or external pressure under normal operating conditions.
- The basic requirements of dust control systems shall be to:
  - Minimize emissions to atmosphere.
  - Minimize loss of product from the process.
  - Maintain stack emissions below established criteria.
  - Maintain air quality standards
- The dust control systems shall be designed based on the premise that the material handling equipment, such as screens, conveyors, chutes, and skirting, are designed and maintained to prevent spillage and loss of material, and that the skirting lengths and heights are suitable for the intended dust control systems.
- Aspirated systems shall be dedicated to individual process circuits, in order to provide flexibility with operations.
- Scrubber discharges to atmosphere shall not exceed 7% opacity.

3.2 Aspirated System

- Exhaust hoods shall be provided whenever the material handling process generates dust.
- All exhaust hoods shall be flanged and bolted.
- The velocity of air entering exhaust hoods shall be such that it does not remove excess material from the process flow.
- Hoods shall be provided at the rear of transfer chutes, wherever the fall of material exceeds 3 metres, or if the receiving conveyor is inclined.
- All dust conveying ducting shall be round.
- All ducting shall be flanged in lengths that will enable ease of installation and future removal.

- Duct diameters shall be sized to ensure complete conveyance of all collected dust, from the point of collection, to the dust collection equipment.
- In no case shall the duct velocity, in dust conveying ducting, be less than 20 m/s.
- The duct velocity in “clean” air ducting shall not be less than 15.3 m/s.
- Duct cleanouts shall be provided such that the internals of all sections of dust conveying ducting can be inspected and cleaned out.
- Air flow measuring ports shall be provided in all branch ducts and all main ducts, to enable trouble shooting and for each section of the system to be tested and balanced.
- Air flow test ports shall not be located within six duct diameters upstream of any turbulence and not less than two duct diameters downstream of any turbulence.
- Dampers shall be provided in all branch ducts for air flow balancing. The dampers shall only be blast-gate type, with means to lock the gates in the final balanced position.
- Branch entries into a main duct shall preferably enter at an angle of 30 degrees, but in no case shall the angle exceed 45 degrees.
- Branch entries shall enter a main such that the duct velocities are maintained throughout the fitting.
- The included angle for duct contractions and expansions shall not exceed 15 degrees.
- No two branch entries shall enter the main duct opposite each other in the same plane.
- 90 degree bends shall be constructed of seven segments of straight ducting, (5 equal segments and 2 half segments) and shall have a centreline radius of two and a half times the duct diameter.
- Bends of less than 90 degrees shall be constructed of a pro-rated number of segments of straight duct, and have a centreline radius of two and a half times the duct diameter.
- Exhaust stacks from dry dust collection equipment, shall not have any impediment to straight through flow. The only allowable arrangement of weather protection is the stack head configuration, where the head length is at least four times the stack diameter and the head diameter is 25 mm larger than the stack diameter.
- Exhaust stack discharge velocities shall be at least 15.3 m/s.
- Exhaust stacks from dust collection equipment shall be equipped with sample ports for emission testing. The sample ports shall be 100 mm half couplings, welded to the stack at a distance of at least 4 duct diameters downstream of any turbulence and at least 2 duct diameters upstream of the point of discharge.

- Emission sample ports shall be accessible from a platform with hand railing and access ladder.
- Fan inlet ducts shall be configured to prevent uneven loading of the fan wheel.
- Fan discharge ducts shall remain straight for at least one fan inlet diameter before any bend, and that bend shall only be turned in the direction of fan rotation.
- Where ducts or fittings are rubber lined, the design duct velocities relate to the internal diameter of the rubber lining.
- Where fittings-only are rubber lined, the internal diameter of the rubber lining shall be the same diameter as the adjacent non-lined duct.
- Rubber lining shall be shop applied using the hot-cure process. Prepare internal surfaces to SSPC-10.
- All exposed edges of rubber linings shall be protected from the air stream.
- All exterior surfaces of ducts shall be prepared to SSPC-3 prior to application of paint.
- Paint shall be applied to all exterior duct surfaces.
- Ducts shall be supported at the following intervals: 3 m spacing for 200 mm diameter and smaller: 4.5 m for 210 mm diameter through 480 mm and 6 m spacing for ducts larger than 480 mm diameter.
- Duct supports shall be designed for the weight of the ducting and fittings, plus the following allowance for material:

Mains Dust Load	% Full:33 Vertical & 33 Horizontal
Sub mains Dust Load	% Full:50 Vertical & 50 Horizontal
Branches Dust Load	% Full:100 Vertical & 100 Horizontal

Vertical ducts shall be supported at the base of the riser.

3.3 Specific Application of Dust Control Systems

- Dust control shall be provided in the following areas of the project:
- Primary Crusher – Dry Dust collector and exhaust fan
  - Truck Dump Pocket – Water Sprays in summer only
  - Crusher discharge onto Apron Feeder – Dry Dust collector and exhaust fan
  - Apron Feeder discharge onto Stockpile Feed Conveyor – Dry Dust collector and exhaust fan
- Coarse Ore Stockpile

- Water Sprays – Summer Only
- Coarse Ore Stockpile Reclaim - Dry Dust collector and exhaust fan
  - Head end of apron feeders (3 Qty)
  - Chute onto receiving belt from apron feeders (3 Qty)
- Screening Grinding – Dry Dust collector and exhaust fan
  - Head end of coarse ore reclaim conveyor
  - Primary sizing screen No 1
  - Primary sizing screen #2
  - Oversize discharge chute onto primary sizing screen o/s conveyor from screen #1
  - Oversize discharge chute onto primary sizing screen o/s conveyor from screen # 2
  - Undersize discharge chute onto primary sizing screen o/s conveyor from screen #1
  - Undersize discharge chute onto primary sizing screen o/s conveyor from screen # 2
  - Receiving belt at discharge of primary sizing screen o/s conveyor onto cone crusher surge bin feed conveyor
  - Tail end of Cone crusher surge bin feed conveyor
  - Receiving belt at discharge of primary sizing screen u/s transfer conveyor
  - Tail end of HPGR surge bin feed conveyor
  - Head chute of HPGR discharge conveyor
- Cone Crusher Surge Bin
  - Aspirated Bin Vent
- HPGR Surge Bin
  - Aspirated Bin Vent
- HPGR Building – Dry Dust collector and exhaust fan
  - Head chute of cone crusher belt feeder No 1
  - Head chute of cone crusher belt feeder No 2
  - Receiving belt at discharge from cone crusher No 1
  - Receiving belt at discharge from cone crusher No 2
  - Discharge of HPGR belt feeder
  - HPGR
  - Discharge of HPGR onto HPGR discharge conveyor
  - Tail end of HPGR discharge conveyor

- Molybdenum Concentrator Dryer – Dry Dust collector and Exhaust Fan
  - Body of dryer
  - Molybdenum concentrate bin
  - Bagging machine
- Loadout - Dry Dust collector and Exhaust Fan
  - Stockpile area
- Lime Silo – Aspirated Bin Vent and Exhaust Fan

End of Section

REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	November 2, 2007	Issued For Client Information	KL	KL/JM		DS	
01	October 31, 2008	Issued for Client Approval	BD	KL	AS	JCR	

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SCOPE

1.0 HVAC

- The Fire protection Design Criteria establishes the engineering standards and practices to be followed in the execution of the following:
  - Fire protection design/build packages
  - Detailed design
  - Standard detail drawings

2.0 CODES AND STANDARDS

- All systems and equipment shall be designed, manufactured and tested in accordance with the latest applicable sections of the following regulations, codes, standards or specifications. Equipment specifications shall include references to specific sections of the following codes and standards where appropriate.

NBC	National Building Code
CEC	Canadian Electrical Code
NFC	National Fire Code
NFPA	National Fire Protection Association
FM	Factory Mutual – Relating to equipment / material approvals only
UL/ULC	Underwriters Laboratories/ Canada

- In the event of conflict between the codes, the requirements of the more stringent shall govern.

3.0 GENERAL REQUIREMENTS

3.1 General

- Operation of any fire protection device, including tamper switches, pressure switches, flow switches and alarm valves shall be supervised and monitored by a central fire alarm panel, (CFP) which will be monitored 24 hours a day.
- In addition to requirements of this design criteria, NFPA 13 shall be the design standard for all sprinkler systems. The most stringent requirements shall prevail.
- In addition to requirements of this design criteria, NPFA 14 shall be the design standard for all standpipe systems. The most stringent requirements shall prevail.

- All automatic sprinkler system control valves, standpipe water supply control valves, and fire water tank isolating valves shall be provided with padlock and chains.
- All hydraulic equipment and lube oil systems with fluid reservoirs over 378 litres, or a combined total in excess of 378 litres within 6 metres, shall be protected with automatic sprinklers with 71 degrees Celsius heads. Sprinklers shall extend 3 meters beyond the hazard or to the closest solid wall, whichever is closest.
- Mechanical equipment, such as hydraulic units, lube units and conveyors, which are protected by sprinkler systems, shall be equipped with interlocks to automatically shut down the equipment in the event of sprinkler flow.
- UL/ULC approved fire stop systems, with UL/ULC listed and/or FM approved materials, and UL/ULC listed fire/smoke dampers shall be provided wherever fire rated walls or floors are penetrated by piping, cables and ductwork. Combustible insulation or sealants, such as polyurethane foam, will not be accepted.
- All construction material for electrical rooms, including insulation, shall be constructed of 100% non-combustible materials.
- Hand held all-purpose ABC fire extinguishers shall be provided in all buildings for local emergency fire fighting. Fire extinguishers shall be located at spacing as specified by NFPA 10, with additional units being located at each exit door from the area.
- Clean agent hand held fire extinguishers shall be provided in all electrical rooms and control rooms, with spacing in accordance with NFPA 10, plus additional units being located at each exit door from the area.
- Water velocities shall not exceed 6 metres per second in any section of above ground fire protection piping.
- The entire fire protection system shall be designed in accordance with the seismic requirements of NFPA 13 and FM data sheet FM-2-8.
- All fire protection equipment and materials shall be UL/ULC listed and / or FM approved for the intended purpose.
- Hydraulic sprinkler calculations shall include for internal and external hose allowance of 113.5 cubic metres per hour, taken at the base of the riser.
- Where conveyor belts are enclosed in galleries, sprinklers are required - the design shall include for 10 heads flowing on horizontal belts with a minimum pressure of 69kPag, and 15 heads flowing on belts, inclined at more than 10°, with a minimum discharge pressure of 103 kPag at the most hydraulically remote head.
- Provide 305 mm x 305 mm x 50 mm high heat collector plates, constructed of galvanized sheet metal, wherever the vertical distance between the sprinkler heads and a solid horizontal surface exceeds NFPA requirements. Ensure that the plates are supported such that the sprinkler discharge pattern is not disrupted.

- All buildings and structures in excess of 14 meters in height, or have any dimension in excess of 30 metres, will be provided with wet class 2 standpipe systems with fixed hoses. Hoses shall be located such that all areas at all levels of the buildings, enclosed conveyor transfer towers and enclosed structures are within reach of a fire hose stream.
- Mineral oil insulated transformers shall be physically separated from each other, and from adjacent buildings and property lines, in accordance with NFPA 851, otherwise physical barriers shall be provided, in accordance with NFPA 851. Spill containment shall be provided in accordance with NFPA 851.
- Exterior non-enclosed belt conveyors and non-enclosed transfer towers, within 12 metres of grade, will be protected with fire hoses which will be manually connected to yard hydrants.
- Exterior non-enclosed belt conveyors and non-enclosed transfer towers, beyond 12 metres of grade will be protected with dry standpipes from grade elevation. The standpipe will be manually connected to a yard hydrant with in 15 m. Spacing between standpipes shall not exceed 72 metres.
- Cable trays shall be protected by hand held fire hoses. Where cable tray configurations are so congested, or in tunnels, where fire fighting with hand held fire hoses becomes impractical, the cables shall be sprinklered.
- The fire protection systems shall be designed and installed by professionals who are experienced in the proper design, installation and testing of fire protection and fire alarm systems.
- All like-equipment shall be by the same manufacturer.
- The sprinkler system piping will be hydraulically sized, designed, installed and tested by the “Fire Protection” contractor .
- Buildings in excess of 465m² shall be constructed of non-combustible construction - or be protected by an automatic sprinkler system.
- Flow switches in individual sprinkler systems shall include a shut off valve with padlocks and chains.
- All sprinkler systems shall include an inspectors test connection, located at the most hydraulically remote part of the system.
- Where clean agent suppression systems are specified, the system shall conform to NFPA 2001, and in addition, the agent shall have an ozone depletion potential (ODP) of zero and a global warming potential (GWP) of no greater than one.

3.2 Water Supplies

- The fire water storage tank will be sized to provide a minimum live dedicated storage capacity of 120 minutes of maximum fire water flow.

- Where the water pressure exceeds 690kPag at a class 2 hose connection the pressure shall be regulated using UL/ULC listed pressure reducing angle valves to limit the pressure to a maximum of 690kPag.
- Fire water piping and valves shall be rated for the maximum system pressure anticipated.
- The fire water supplies will be designed, supplied, installed, and tested in accordance with NFPA 24.

3.3 Plant Site Fire Water Supply Loop

- A buried firewater loop will serve yard hydrants, and will also feed buildings and structures with fire water for automatic sprinkler systems and standpipe systems.
- The buried fire water supply piping shall be installed a minimum of 0.5m below the frost line.
- A single, buried, fire water supply pipe will leave the fire water tank, and split into a distribution system which will be looped, and sectionalized, in such a way as to supply water to the majority of the plant-site from two directions, and have a maximum of six branches out of service at any one time between isolating valves.
- Yard hydrants which serve high risk areas such as fuel tanks, shall be equipped with a minimum of two monitors each capable of being adjusted and locked in both the vertical and horizontal directions.
- Yard hydrants will be spaced at a maximum distance of 90 metres apart, and, where possible, at a minimum perpendicular distance of 12 metres from the protected facility. The branch connections to the hydrants shall be at least 150 mm diameter.
- Yard hydrants shall be dry barrel type.
- Supply piping serving building systems shall include a post indicator valve, located at the branch connection to the mains.
- Fire hydrants, monitors, and post indicator valves shall be protected from vehicular damage with bollards.
- All buried piping will be HDPE. All risers and above grade piping will be steel. The pipe sizes shall be hydraulically verified but in no case shall they be less than 150 mm diameter.

4.0 SPECIFIC FIRE PROTECTION METHODS

4.1 General

- Yard hydrants will be the prime system for first response to a fire situation – yard hydrants will be located throughout the plant site to provide manual fire fighting capabilities to all buildings and structures.
- Hand held fire extinguishers will be provided in all areas, at all levels of structures, transfer towers and along all conveyor walkways.

4.2 Fuel Storage

- Physical separation and containment dykes will be provided as passive fire protection.
- Two Yard hydrants, with monitors will protect the fuel storage tanks from diagonally opposite locations.
- Provide a 63kg mobile (wheeled) foam fire extinguisher for manual fire fighting.

4.3 Primary Crushing

- Automatic Wet Sprinklers will be provided to protect the crusher lube unit, the apron feeder lube unit and the lube oil coolers – design density, 8.2 mm/min over 232m^2 – 71 degree Celsius heads.
- Automatic Wet Sprinklers will be provided to protect the floor area which contains the crusher apron feeder and the tail end of the stockpile feed conveyor, within the crusher building – design density, 8.2 mm/min over entire area – 71 degree Celsius heads.
- A yard hydrant located in the vicinity of the primary crusher truck dump, will protect the control room and the haulage trucks.

4.4 Stockpile Feed Conveyor

- The section of the conveyor that is within 12metres of grade will be protected from hand lines which will be manually connected to yard hydrants along the length of the conveyor.
- The section of conveyor that is above 12metres from grade will be provided with dry standpipes, terminating at grade with 100 mm hose connections and at the conveyor level with 2 x 40mm hose valves.

4.5 Stockpile Reclaim

- Automatic Wet Sprinklers will be provided to protect each level of the reclaim area (reclaim apron feeders and belt conveyor with tunnel) – design density, 8.2 mm/min over entire area – 71 degree Celsius heads.

4.6 Conveyor Galleries

- The sections of conveyors that are within buildings or within a conveyor gallery, shall be provided with a wet sprinkler system along its entire length at a design criteria of 15 heads flowing with103kPag at the most hydraulically remote head.
- Enclosed take up towers shall be provided with fire hose cabinets such that all levels are reachable by a fire hose stream. It is permissible to take the hose up one level and down one level from the cabinet location.

4.7 Mill Building

- Automatic Wet Sprinklers will be provided to protect each of the Mill Lube units, the regrind mill lube units and the lube oil coolers – design density, 8.2 mm/min over lube unit plus 3 metres all around it – 71 degree Celsius heads.
- Automatic Wet Sprinklers will be provided above the kerosene holding tank and the pine oil holding tank.
- Automatic Wet Sprinklers will be provided above the compressor and lube room area.
- Automatic Wet Sprinklers will be provided in the blower room area.
- The control room and the sub-floor will be protected by an automatic clean agent suppression system.
- Automatic Wet Sprinklers will be provided in the elevated lunch room and offices.
- Provide smoke detectors in the electrical room.
- Provide a wet, Class II standpipe hose system throughout the building such that all equipment and all areas are within reach of a hose stream.

4.8 HPGR Building

- Automatic Dry Sprinklers will be provided to protect each of the HPGR Lube units, the Cone crusher lube units, and the lube oil coolers – design density, 8.2 mm/min over lube unit plus 3 metres all around it – 71 degree Celsius heads.
- Automatic Dry Sprinklers will be provided to protect each of the conveyor belts – design density 69kPag at the most hydraulically remote head with 10 heads flowing.
- Provide a dry, Class II standpipe hose system throughout the building such that all equipment and all areas are within reach of a hose stream.

- Provide smoke detection in the electrical room.

4.9 Administration Offices

- Smoke detection will be provided throughout the building.
- The IT server room and the sub-floor will be protected by an automatic clean agent suppression system. The clean agent storage cylinder shall be located within the server room.
- Yard hydrants will protect the area from outside.

4.10 Laboratory

- Automatic Wet Sprinklers will be provided throughout the building – design density, 8.2 mm/min over 186 m2.
- Class 2 wet standpipe hose systems will be provided so that all interior areas of the building are within reach of a hose stream.
- Yard hydrants will protect the area from outside.

4.11 Truck Shop and Warehouse

- Automatic Dry Sprinklers will be provided to protect all floor areas of the truck shops – design density, 8.2 mm/min over 361m2.
- Automatic Dry Sprinklers will be provided to protect the warehouse and office areas – design density, 8.2 mm/min over 241m2.
- Provide a wet, Class II standpipe hose system throughout the building such that all equipment and all areas are within reach of a hose stream.
- Yard hydrants will protect the area from outside.

5.0 INSTALLATION AND TESTING

- Design, install, inspect and test to acceptance, in accordance with all applicable standards including NFPA 13, The Canadian Electrical Code and the National Building Code of Canada. The equipment installations shall also be in accordance with the manufacturers' recommendations.
- Provide "Contractors Material Test Certificate" in accordance with NFPA 13, for insertion into the Contractor supplied O & M Manual.
- Assemble the systems so that no excessive stress is imposed on connections. Carry out all Work required to place the fire protection equipment in proper operating condition.

- Carefully and accurately set the fire protection equipment in place, plumb and to the required elevations. Supply and set anchors and supports as required.
- Install flow switches, pressure switches and tamper switches into the system at accessible locations.
- Charge air for dry sprinkler systems shall be from a reliable source of compressed air complete with all necessary automatic controls.
- Provide quick-opening devices for dry sprinkler systems if, after testing, it is determined that water is not delivered to the system test connections within the time frame allowed by NFPA.
- All exposed fire piping shall be prepared, primed, and finish painted. The paint colour shall be fire red, equal to Devoe 7100.

End of Section

REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
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SCOPE

1.0 HVAC

- The scope of Heating, Ventilation and Air Conditioning for the project site will include:
  - Primary crusher
  - Stockpile Reclaim
  - Conveyor galleries
  - Truck Shop and warehouse
  - Mill Building
  - Administration building
  - Assay Laboratory
  - Pump House
  - Truck Wash
  - HPGR Building

1.1 HVAC DESIGN CONDITIONS

- The following outdoor conditions will apply to the design of HVAC systems:

Summer design outdoor dry bulb temperature	31°C
Summer design outdoor coincidental wet bulb temperature	18°C
Condensing temperature (air temperature)	35°C
Winter design outdoor temperature	Minus 32°C

- Building heating and cooling systems shall be designed with sufficient capability to maintain the indoor conditions and the minimum ventilation rates as shown in Table

Table 1

Service	Minimum Room Temp. °C (Winter)	Maximum Room Temp. °C (Summer)	Min. Winter Air Changes Per Hour / Flow rate (Outdoor)	Min. Summer Air Changes Per House / Flow rate (Outdoor)	Air Conditioning
HPGR Building	Not heated	36	1 a/c	4 a/c	No
Mill Building	5	36	1 a/c	4 a/c	No
Lube unit rooms	5	36	**	**	No
Conveyor Galleries	5	36	0.25 ℓ/s/m^2	**	No

Service	Minimum Room Temp. °C (Winter)	Maximum Room Temp. °C (Summer)	Min. Winter Air Changes Per Hour / Flow rate (Outdoor)	Min. Summer Air Changes Per House / Flow rate (Outdoor)	Air Conditioning
Conference / Board rooms	20	26	10 ℓ/s/pers	**	Yes
Communication Rooms	20	26	0.25 ℓ/s/m^2	**	Yes
Storage Rooms	15	28	0.25 ℓ/s/m^2	0.25 ℓ/s/m^2	No
Open or Private Offices	20	26	10 ℓ/s/pers	10 ℓ/s/pers	yes
Washrooms	18	30	15 a/c	15 a/c	no
Lunch Rooms	20	26	10 ℓ/s/pers	10 ℓ/s/pers	Yes
Utility Rooms	15	30	0.25 ℓ/s/m^2	0.25 ℓ/s/m^2	no
Janitor Rooms	15	30	15 a/c	15 a/c	No
Laboratory	20	36	**	**	No
Corridors	18	26	0.25 ℓ/s/m^2	0.25 ℓ/s/m^2	yes
Ambulance/Fire Truck Storage	15	36	3.9 ℓ/s/m^2	3.9 ℓ/s/m^2	No
Sample Prep	15	36	2.5 ℓ/s/m^2	2.5 ℓ/s/m^2	No
Ore sample room	15	36	10 ℓ/s/pers	10 ℓ/s/pers	No
AA Room	20	26	10 ℓ/s/pers	10 ℓ/s/pers	Yes
Assay	15	36	10 ℓ/s/pers	10 ℓ/s/pers	No
Wet Lab	15	36	**	**	No
Balance Room	20	26	10 ℓ/s/pers	10 ℓ/s/pers	Yes
LECO room	20	26	10 ℓ/s/pers	10 ℓ/s/pers	Yes
Concentrate Sample room	15	36	**	**	No
Concentrate Drying room	15	36	**	**	No
Locker Rooms	18	36	2.5 ℓ/s/m^2	2.5 ℓ/s/m^2	No
Electrical Rooms	15	36	0.25 ℓ/s/m^2	**	No
Battery Room	18	24	6 a/c	6 a/c	Yes
Control Rooms	20	24	10 ℓ/s/pers	10 ℓ/s/pers	Yes
Substation	15	36	0.25 ℓ/s/m^2	**	No
Emergency Power Plant	10	36	0.25 ℓ/s/m^2	**	No
Lube Storage	10	36	0.25 ℓ/s/m^2	0.25 ℓ/s/m^2	No
Vehicle Bays	15	36	7.5 ℓ/s/m^2	7.5 ℓ/s/m^2	No
Warehouse	15	36	0.25 ℓ/s/m^2	0.25 ℓ/s/m^2	No
Vehicle Repair Shop	15	36	7.5 ℓ/s/m^2	7.5 ℓ/s/m^2	No
Compressor Rooms	15	36	4 a/c	**	No
Welding Bay	15	36	7.5 ℓ/s/m^2	7.5 ℓ/s/m^2	No
Pump House	10	36	0.25 ℓ/s/m^2	**	No
Water Treatment Plant	10	36	0.25 ℓ/s/m^2	**	No
Sanitary Sewage Treatment Plant	10	36	0.25 ℓ/s/m^2	**	No
Potable Water Treatment Plant	10	36	0.25 ℓ/s/m^2	**	No
Truck Wash	10	32	**	**	No

** Denotes air flow rate is dependent upon heat gains or exhaust flow rates within space

- Ventilation shall be greater than the above minimum where necessary to restrict contaminants or control space temperatures, in accordance with Occupational Health and Hygiene requirements.
- Occupied area such as offices will be provided with filtered outdoor air at a supply rate of no less than required by ASHRAE Standard 62-2001.
- Contaminants will be exhausted from as close to the source as possible.
- "Dirty" spaces (such as lockers, washrooms, change rooms and laboratories) will be maintained at a negative air pressure relative to adjacent "cleaner" spaces.
- Washrooms, showers and "dirty" locker room areas will be exhausted at a rate of no less than 15 air changes per hour.
- Ducting which conveys moist air, such as shower exhausts, will be constructed to slope back to the moisture source and be constructed of aluminium.
- Heat gain and heat loss calculations will be performed in accordance with ASHRAE methods and coefficients, including a 5% safety factor.
- Heat gain calculations will include all known internal gains from people, appliances, lighting, transformers, electrical equipment, hot equipment and piping.
- Cooling systems will be sized for the maximum simultaneous heat gains, including solar gains, infiltration and all internal loads.
- Heat loss calculations will not include for any internal or external heat gains.
- HVAC systems will be "zoned" with respect to solar heat gains. The zone widths will not exceed 5 metres from the north, south, east and west outside walls. The interior zone will not be integral with any other zone.
- Air conditioning supply air ducting will be insulated where routed through non-air conditioned spaces, or outdoors.
- All ducts handling outdoor air will be externally insulated to prevent condensation.
- All outdoor air intake openings will be provided with snow hoods with a maximum capture velocity of 2.54m/s. Bird screens will be removable, and also be provided with a minimum opening of 20mm x 20mm, to minimize the potential problems associated with haw frost.
- Sound levels within occupied spaces will not exceed values recommended by ASHRAE - sound absorbing internal duct liner will be used to reduce duct conveyed sound, and if that proves insufficient, sound attenuators will be provided.
- Electrical rooms and control rooms will be pressurized with filtered air to minimize ingress of dust.
- Air handling fans will be shutdown in the event of a fire alarm, in accordance with NFPA requirements.
- Fire dampers will be provided wherever a fire separation is penetrated.

- Areas where the flow rate and/or temperature of the return air to air handling units is insufficient to bring the outdoor air up to room temperature, the supply air will be heated by other means (electricity or propane).
- Air temperatures in mechanically ventilated (non-air conditioned) spaces will not exceed the coincidental outdoor air temperature by more than 5 degree Celsius.
- The density of the air at the site elevation will be taken into consideration when calculating heat transfer volume flows.
- Air conditioning will be limited to areas where internal heat gains are high, or where it will be impractical to offset the loads with outdoor air only – these areas could include electrical rooms, control rooms and offices.
- Air conditioning systems will utilize air-cooled condensing units.
- Control systems for the HVAC systems will be electronic and electric.
- HVAC equipment will be heavy duty, suitable for an industrial environment. Residential and light commercial equipment will not be specified.
- Air filters will be sized for a maximum face velocity of 2.54m/s.
- Supply, exhaust and return air ducting systems will be designed to minimize duct sizes without generating air noise and without creating excessive pressure losses.
- The heating medium for the majority of the plant will be propane. Electricity will be used for smaller spaces, electrical rooms and remote areas of the site.
- Propane will be stored in a central storage area with two vaporizers and first a stage pressure reducing station. The distribution piping will be maintained at 69kPag. The second stage regulators are each of the heated buildings will be set to 34kPag.
- Air to air heat recovery will be implemented where the exhaust air stream is not contaminated.
- Energy efficient systems will be utilized wherever possible, including free cooling controls, heat pumps, capture of stratified air, air to air heat exchangers and air compressor heat recovery ducting.
- Provision for testing and balancing will be incorporated into all sections of all ducting systems.

2.0 SYSTEMS

2.1 Space Heating

- The HPGR building will be unheated.
- All other enclosed process type buildings, including conveyor galleries, will be heated to a minimum of 5 degrees Celsius whenever the outdoor air temperature is at, or above the specified winter design condition.

- Process and ancillary plant site buildings will be heated using propane gas as the heating medium.
- Heaters will be located around the perimeter of the buildings to counteract heat losses from the building walls and doors.
- Offices shall be provided with thermostatic control with each office having the same exposure and occupancy. Each conference, training, assembly type room and specialty rooms shall be treated as separate zones.
- The outdoor air volume, for making up air that will be exhausted from the building, will be heated before being supplied into the building during cold weather. The air will be heated by air handling units, or direct fired make up air units.
- Air from laboratories shall not be recirculated and the air pressure shall be negative with respect to corridors and non-laboratory areas.
- Water heating for large end-users such as such as showers, kitchens will be performed with propane fired hot water heaters.
- Water heating for small end-users such as individual washrooms or lunch rooms will be performed with electric hot water heaters.
- Filtration systems to control the influx of dust particulate through outdoor air shall be no less than 30% efficiency per ASHRAE 52-70 rated Dust Spot Efficiencies:

End of Section

REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	March 11, 2008	Issued For Client Information	KL	KL/JM		DS	
01	November 3, 2008	Issued for Client Approval	BT	KL	AS	JCR	
02	December 10, 2008	Issued for Client Acceptance	BT	KL	AS	JCR	
03	January 7, 2009	Issued for Feasibility Report	BT	KL	AS	JCR	

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1.0 GENERAL INFORMATION

1.1 Location

- Pacific Booker Mine Inc. (PBM) Morrison property is located in Central British Columbia approximately 65 km northeast of Smithers and 35 km north of Granisle. The Morrison deposit elevation ranges from approximately 795 m to 890 m above see level at the top of the southeast ridge of the deposit.

1.2 Climatic Conditions

- The following design data for the town of Smithers and are taken from Appendix C, Table C-2, National Building Code of Canada (NBCC) 2005 Volume 2. Project site specific climatic data subjects to confirmation by the Meteorological Service of Canada.
- Precipitation

15 Min. Rain	13 mm
One Day Rain	64 mm
Annual Rain	325 mm
Annual Total Precipitation	500 mm

- Design Temperature

Minimum (Jan. 1%)	-31°C
Maximum (July 2.5% dry)	25°C
Degree Days Below 18°C	5200

- Snow Loads

Ground Snow Load – Ss (1/50)	3.2 kPa
Rain Load – Sr (1/50)	0.2 kPa

- Wind

Hourly Wind Pressure (1/10)	0.31 kPa
Hourly Wind Pressure (1/50)	0.40 kPa

- Seismic

5% Damped Horizontal Spectral Acceleration Sa (0.2 s periods)	0.12
(0.5% s periods)	0.078
(1.0% s periods)	0.055
(2.0 s periods)	0.035
Peak Ground Acceleration GA	0.059

1.3 Foundation and Soil Data

- Foundations governed by static loads, dynamic loads and transitory loads produced by wind or earthquake shall be designed in accordance with the Plantsite Foundation Report, dated December 7, 2008 by Geotechnical Consultant, Klohn Crippen Berger.
  - Bearing resistances (ULS – Ultimate Limit State):
    - Sandstone – 700 kPa
    - Undisturbed Till – 400 kPa
    - Structural Fill – 200 kPa
- Minimum depth of footing below finished grade (frost depth) – 2 m.

2.0 STRUCTURAL STEEL AND CONCRETE

2.1 Scope and Battery Limits

- As indicated on the general drawings required for the proposed process plant and associated infrastructure.

2.2 Codes and Standards

- All work will be carried out in accordance with the latest edition of the following standards, specifications and codes:
  - National Building Code of Canada (NBCC)
  - Supplement to the National Building Code of Canada (SNBCC)
  - Canadian Standards Association (CSA) Standards
  - Occupational Safety and Health Administration Standards (OSHA)

- American Society for Testing Materials (ASTM)
- Mine Safety and Health Administration (MSHA)
- National Fire Protection Association (NFPA)
- Society for Fire Protection Engineering (SFPE)
- Canadian Institute of Steel Construction (CISC)
- National Lumber Grades Authority (NLGA)
- American Petroleum Institute (API)
- American Water Works Association (AWWA)

CAN/CSA-A23.1	Concrete Materials and Methods of Concrete Construction
CAN/CSA-A23.2	Methods of Test for Concrete
CAN/CSA-A23.3	Design of Concrete Structures
CAN/CSA-G30.5	Welded Steel Wire Fabric for Concrete Reinforcement
CAN/CSA-G30.18	Billet Steel Bars for Concrete Reinforcement
CAN/CSA-086.1	Engineered Design in Wood (Limit States Design)
CAN/CSA-S304.1	Masonry Design for Buildings (Limit States Design)
CAN/CSA-S16.1	Limit States Design of Steel Structures
CAN/CSA-S136	Cold Formed Steel Structural Members
CAN/CSA-G40.20	General Requirements for Rolled or Welded Structural Quality Steel
CAN/CSA-G40.21	Structural Quality Steels
CAN/CSA-W59-M	Welded Steel Construction
API 650	Welded Steel Tanks for Oil Storage
AWWA D100	Welded Steel Tanks for Water Storage
ASTM A36	Structural Steel
ASTM A53	Specification for Steel Pipe, Welded & Seamless
ASTM A307	Specification for Carbon Steel Bolts and Studs
ASTM A325 M	Specification for High-Strength Bolts for Structural Steel Joints
CGSB/CISC/CPMA	Standards for Primer and Paint
SSPC	Specifications for Cleaning Steel Surface

- Reference Handbooks
  - Concrete Design Handbook by CPCA
  - Handbook of Steel Construction by CISC
  - Wood Design Manual by Canadian Wood Council
  - Engineered Masonry – Limit State Design
  - Soils Reports and correspondences by Klohn Crippen Berger.

2.3 Design

- Preliminary design will be carried out for reinforced concrete structures, foundations, structural steel supports, steel structures, access ways and platforms for:
  - Primary crushing
  - HPGR building
  - Mill building
  - Stockpile tunnel
  - Conveyors
  - Explosives store
  - Maintenance Shop Warehouse
  - Fuel storage
  - Administration building
  - Assay office
  - Electrical buildings
  - Truckwash
- Design Limits
  - Do not exceed the following deflection (D) to span (L) or height (H) ratios under live loads:
    - Vertical D/L

Crane runway beams	1/800
Floor members	1/360
Roof members supporting plaster	1/360
Roof framing with sheet metal cladding	1/180

- Lateral H/L

Walls with sheet metal cladding	1/180
Walls with un-insulated cladding	1/90
Interior walls with permanent partitions subjected to 0.5 kN/m2 normal to the walls:	
With brittle finishes	1/240
With flexible finishes	1/120
Crane runway beams* (subject to crane lateral force)	1/600

Building column* (subject to crane lateral force <u>or</u> wind force)	1/300
Building frames (subject to wind forces)	1/300

* Follow manufacturers standards or the following additional crane runway tolerance criteria, whichever produces the most adverse effect:

Maximum permissible tolerance between rail centers	+/- 5mm
Height tolerance between rails (S = crane span)	S/1000
Permissible height tolerance between two crane rail supports (L = distance between supports)	L/1500

- Member Depths

  Recommended depth (d) to span (L) ratios for steel beams and trusses:

	d/L
Trusses	1/14
Equipment Support Beams*	1/16
General Platform Beams	1/20
Walkway Beams	1/24

** A deeper section may be required to avoid the beam resonating at the natural frequency of equipment.*

2.4 Materials Specifications

- Structural Steel
  - Conform to latest edition of NBCC and CAN/CSA-S16.1.

Rolled structural steel shapes, plates and bars	CAN/CSA-G40.20/G40.21-350W General Requirements for Rolled or Welded Structural Quality Steel Grade 350W
Hollow sections	CAN/CSA-G40.21-M Class C Grade 350W
Structural Pipes	ASTM A53-96 Grade 240 MPa
Sag rods & Pins	ASTM 207
Bolted connections	ASTM A325
Welded connections	AWS D1.1 CSA-W59 Series E480XX low hydrogen type
Anchor bolts	CAN/CSA-G40.12 Grade 300W
Floor grating	32 mm x 4.8 mm Welded Standard “Flowforge” type Serrated grating : 38 mm x 4.8 mm

Trench grating	32 mm x 4.8 mm Welded Standard "Flowforge" type Serrated grating: 38 mm x 4.8 mm
Checkered plates	8 mm minimum checker plate with raised pattern 6 mm minimum for lightly loaded area
Stair treads	Grating tread with checker plate nosing 32 mm x 4.8 mm Welded Standard "Flowforge" type Treads with serrated grating: 38 mm x 4.8 mm Stair tread width – 308 mm
Railing and handrails	DN 40 STD pipe typical
Kickplates	150 mm high

- Concrete
  - Conform to NBCC and CAN/CSA-A23.3-M latest edition.
  - Cement shall conform to CAN/CSA-A5 Portland Cement Type 10 Normal UNO. Use corrosive resistant cement where applicable.
  - The specified compressive strength of concrete shall be as follows:

	28 Day Strength	**Max. Aggregate**	**W/C ratio**
Structural Concrete	30 MPa	20 mm	0.45 0.40 (corrosive)
Mass foundation	30 MPa	40 mm	0.45 0.40 (corrosive)
Blinding Concrete	15 MPa	20 mm	0.45 0.40 (corrosive)

- Reinforcing Steel

Deformed type billet steel bar	CAN/CSA-G30.18-M Billet Steel Bars for Concrete Reinforcement fy = 400 MPa
Welded Wire Fabric	CAN/CSA-G30.5-M

- Grout
  - Normal grout shall be non-shrink, non-metallic and non-corrosive cementitious grout.
  - Epoxy base non-shrink grout shall be used under sensitive equipment only.
- Masonry
  - Modular metric size as per CAN/CSA-A165 Series.
  - Minimum compressive strength of hollow core concrete block unit shall be 15 MPa. Mortar shall be Type M or S.

- Compressive strength of masonry grout shall not be less than that of the concrete block used.

3.0 CIVIL

3.1 Scope and Battery Limits

- This will include the areas indicated on the general layouts associated with the process plant area and facilities.
  - Overall Process site and surface facilities
  - Site grading
  - Site services
  - Raw water supply
  - Reclaim water
  - Sewage treatment
  - Potable water treatment
  - Bulk fuel storage
  - Roads
  - Site piping
  - Camp
- An estimate of the cut-to-fill quantities required to construct the plant and associated infrastructure. Site preparation quantities shall be prepared using computer software models (Autodesk Land Desktop Civil Design).

3.2 Codes and Standards

- All work will be carried out in accordance with the latest edition of local and national Codes.
  - National Building Code of Canada
  - Supplement No. 1 - Climatic Information for Building Design in Canada
  - National Fire Code of Canada
  - Explosives Act
  - Guidelines for Canadian Drinking Water Quality, latest edition.
  - Health and Safety Act

- Canadian Environmental Protection Act
- Water Rights Act
- Hazardous Products Act
- Hazardous Materials Information Review Act
- Transportation of Dangerous Goods Act
- Environmental Operating Guidelines, Access Roads and Trails
- Environmental Code of Practice for Mines
- AWWA M11 Steel Pipe Design and Installation
- AWWA A100 Standard for Water Wells
- AWWA D100 Standard for Welded Steel Tanks for Water Storage
- Distribution system requirements for the Fire Protection ManualM31
- Design of Surface Mine Haulage Roads-Bureau of Mines Information Circular 8758
- Geometric Design Standards for Canadian Roads and Streets
- Drainage Manual
- Standard For The Installation Of Centrifugal Fire Water Pumps - NFPA 20
- Installation of Private Fire Service Mains and their Appurtenances – NFPA 24
- Flammable and combustible liquids code - NFPA30
- National Fire Code of Canada
- Environmental Code of Practice for Above Ground Storage Tank Systems Containing Petroleum Products

3.3 Design

- Earthwork
  - The earthworks will be optimised for balance cut-to-fill volumes of material. Refer to soils report (KCBL).
- Yard Grading
  - Yard grading shall have minimum 2% slope, preferred max. slope of 6%; slope will be site specific.
- Foundation Design
  - Refer to soils report by (KCBL)

- Roads
  - Site Access / Ancillary Roads:
    - Min. radius 33 m
    - Max. grade 8%
    - Min. width, shoulder to shoulder 12 m
  - Haul Road:
    - Min. radius 33 m
    - Max. grade 10%
    - Min. width, shoulder to shoulder 30 m
  - Culverts shall be designed for loading from 620 tonne off-highway truck such as 793D CAT.
  - Explosives Road:
    - Min. radius 33 m
    - Max. grade 8%
    - Min. width, shoulder to shoulder 6 m
- Storm Drainage
  - Runoff, resulting from rainfall, shall be conveyed to drainage ditches by sloping the tributary surface area. Surface slopes shall be minimum 2 percent.
  - Drainage ditch slopes shall be minimum 0.5 percent.
- Sanitary System
  - Sanitary flows from the Mill Building, Warehouse, Administration building shall be calculated on the basis of the greater of a) or b) below, for the applicable building occupancy:

    a) 200 litres per capita per day

    b) Number of equivalent fixture units.
  - Sanitary sewers shall be at least 100mm in diameter. The minimum slope shall be 2 percent.
- Yard Fire Protection
  - Yard pipe for the fire protection system shall be of high density polyethylene pipe minimum 150 mm in diameter. Minimum cover below grade shall be

depth of frost penetration.

- Fire hydrants around structures shall be placed at a spacing of not more than 90m. A separate DBM has been prepared for the fire protection system.

3.4 Materials Specifications

- The terraces and embankments will be formed using existing materials on site.
- Refer to soils reports by (KCBL)

4.0 ARCHITECTURAL WORK

4.1 Scope and Battery Limits

- The work will include architectural work of the following pre-engineered and "stick-built" structures:
  - Primary crushing
  - HPGR building
  - Mill building
  - Maintenance shop warehouse
  - Administration building – Pre-engineered
  - Assay Office – Pre-engineered
  - Truckwash – Pre-engineered
  - Electrical Buildings.

4.2 Codes and Standards

- All work will be carried out in accordance with the latest edition of the following codes, standards and specifications:
  - National Building Code of Canada
  - Industrial Health and Safety Regulations
  - Health Safety and Reclamation Code for mines in British Columbia
- Reference Standards
  - Canadian Institute of Steel Construction

- American National Standard Institute
- American Society for Testing and Materials
- Canadian General Standards Board
- Canadian Standards Association
- Metal Building Manufacturer's Association
- National Fire Protection Association
- National Lumber Grades Authority
- Underwriters Laboratories of Canada

4.3 Design

- Preliminary design will be carried for interior and exterior architectural components of structures to derive pricing quotations to the level consistent with the feasibility report in conformance to the relevant codes and standards list in this memorandum.

4.4 Materials Specifications

- Roof Systems
  - Factory manufactured insulated metal sandwich panels (R=30) consists of an exterior sheet, a layer of insulation, and an interior liner sheet connected by a system of subgirts.
- Wall systems
  - Factory manufactured insulated Metal sandwich panels (R=30) consists of an exterior sheet, a layer of insulation, and a interior liner sheet connected by a system of subgirts.
- Flashing
  - Flashing material shall generally be of same quality and finish of galvanized sheet metals as specified for cladding and liner panels. Colour shall match adjoining roof cladding unless otherwise specified.
  - Unless otherwise approved, flashing shall be a minimum thickness of 0.610 mm (24 Ga).
- Interior Walls
  - Concrete Block Walls

- Internal concrete block walls will be single wythe of varying thickness depending on structural loads and fire ratings required. Where internal concrete block walls are separating, heated and unheated areas, insulation (as specified above) will be filled in voids.
- All concrete blockwork shall be standard 400 mm by 200 mm by varying thickness.

- Metal Clad Walls
  - Where internal single skin metal panel walls are required, siding shall be as described for uninsulated metal walls. The factory-applied baked on paint finish, shall be applied to both exposed surfaces.
- Steel Stud Walls
  - Galvanized 25 ga. Nominal electro-galvanized steel stud framing faced with painted or vinyl covered gypsum wallboard.
  - Regular gypsum wallboard shall be gypsum core, ivory paper faced, grey paper backed, 0.12 mm thick to ASTM C36. Fire rated gypsum wallboards shall be ULC rated.
- Wall Finishes
  - Concrete blockwalls in finished areas shall receive a three coat paint finish – one coat block sealer and two coats matt or gloss as required.

- Floors
  - Exposed concrete floors shall be treated with non-dusting hardener. Nonslip paint finishes may be applied to exposed concrete floors where deemed necessary for cleaning or appearance purposes.
  - Quarry tile or similar ceramic tile floors shall be used in locker, shower and washroom areas, with non-slip finish where required.
  - Vinyl composition floor tiles shall be used in control rooms, lunchrooms, and other areas requiring a high degree of finish. Carpets shall be used in office areas for noise reduction.
  - Bases shall be quarry or ceramic tile where the same is used for flooring.
  - 100 mm vinyl cove base shall be used where areas are finished with vinyl tiles or painted concrete floors.

   - In areas where demountable office partition systems are used, bases shall be 100 mm PVC as required by partitioning manufacturer.
- Ceiling
   - Suspended ceilings shall be 600 mm by 1200 mm acoustical ceiling system by Armstrong Ltd or equal.
   - Suspension grid shall be exposed “Tee” system of galvanized steel with baked enamel paint finish on visible portions.
   - Ceiling in shower rooms shall be suspended moisture resistant gypsum board with taped joint and shall receive three coat paint finish.
- Doors
   - Truck doors shall be sectional vertical lift doors, insulated to minimum R12 and to the sizes required by each application. All truck doors are to be electrically operated.
   - Equipment doors shall be metal, vertical rolling doors.
   - Exterior mandoors shall be commercial type swing doors, insulated hollow metal, 1.5 mm sheet steel, 45 mm thick, flush type, weather-stripped, galvanized and shop prime painted. Door frames shall be 1.52 mm sheet metal and shall be thermally broken. Double doors with dimensions other than catalogue standards shall be constructed of minimum 1.5 mm thick galvanized sheet steel, stiffened and insulated.
   - Interior doors shall be hollow metal, 1.2 mm sheet steel, 45 mm thick, flush type, galvanized and shop prime painted.
   - Office area doors shall be solid core wood.
   - Door frames, with appropriate anchors, shall be minimum 1.5 mm thick, hot rolled steel sheet, depth as shown in accordance with the Manufacturer’s Standard. Frames shall be galvanized and shop primed painted.
- Labelled Fire Doors and Frames
   - Unless noted otherwise, labelled fire doors shall be flush metal doors of the same appearance to match others. Construction of doors shall be as required by U/L for the class of door required, and door shall have the proper label affixed thereon. Double doors shall have over-lapping, two-piece astragal. Labelled doors shall be hung in U/L Labelled frames. Unless otherwise

required, frames shall be formed of 1.52 Ga. Steel and shall have anchors for securing to wall and floor.

- Plumbing fixtures
  - Vitreous china or stainless steel fixtures with exposed plumbing brass and metal work to be heavy triple chromium plated. Plumbing fixtures and trim shall be brand new free from flaws or blemishes. Surfaces shall be clean, smooth and bright and have dimensional stability. Similar plumbing fixtures shall be of one manufacturer.

    Manufacturer – America Standard.
- Windows
  - Windows shall be commercial duty, fibre glass units with triple glazing, top hung vents completed with insect screens.
- Wall Louvers
  - Wall louvers shall be AMCA (Air Movement & Control Association International Inc.) certified formed metal louvers fabricated in 16Ga. galvanized steel with all welded construction:
    - 100 mm minimum deep with blades at 45 deg angle and completed with factory installed galvanized bird screen with 12 mm screen.
    - Minimum 45 % free area.
    - Manufacturer's standard baked enamel finish with color to match the building claddings.

END OF SECTION

DESIGN CRITERIA REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	Dec 1, 2007	Issued For Client Information	DM	DM		DS	
01	Nov. 3, 2008	Issued for Client Approval	DM	DM	AS	JCR	
02	Dec. 10, 2008	Issued for Client Acceptance	DM	DM	AS	JCR	

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1.0 SCOPE AND BATTERY LIMITS

- Electronic instrumentation and control systems shall be provided in four distinct areas of the Morrison Plant:
  - Primary Crushing, Conveying and Crushed Ore Storage
  - Secondary Crushing & Screening
  - Process Plant
  - Tailings Handling
- A local operator control station shall be provided for the Primary Crushing, Conveying and Crushed Ore Storage operation.
- The remaining process areas shall be controlled via operator consoles located in the process plant central control room.

2.0 CODES AND STANDARDS

- The design and manufacture of electrical, instrumentation and controls equipment shall conform to the latest versions of the following codes and standards:
  - Canadian Electric Code (C22.1)
  - Canadian Standards Association (CSA)
  - Local Codes and Standards
  - American National Standards Institute (ANSI)
  - Instrument Society of America (ISA)
- All equipment shall be rated for a minimum elevation of 700 - 1100 meters above sea level and an ambient temperature range of -40C to 40C and shall have CSA Approval Marking.
- Manufacturer's recommended design, installation practices and procedures shall be adhered to whenever such practices and procedures are available.

3.0 INSTRUMENTATION DESIGNS AND CONSTRUCTION

3.1 General

- Electrical Supply – Electrical supply to field instruments, relays, solenoids where required shall be 120V-60Hz. Electrical supply to Control System's panel and back of panel Instruments shall be 120V-60Hz.
- Pneumatic transmitters shall have an output signal of 3-15 psig. Electronic transmitters shall have an output signal of 4-20 mA DC. Where possible, electronic transmitters shall be smart, programmable, microprocessor based 2-wire and powered by the signal receiver. If the electronic transmitter is externally powered (4-wire), its output signal must be isolated or floating with respect to ground so that the 4-20 mA DC signal could be transmitted to receiver without ground loop problem. If ground loop is a problem, then a signal isolator must be used.
- The materials of components that come into contact with process fluids (instrument wetted parts) shall be resistant to stress resulting from pressure, temperature, corrosion and erosion, and shall be made of 316 stainless steel minimum unless the process and piping specifications require a different or higher grade material.
- Control valves shall have integrally mounted smart electro-pneumatic positioners.
- Instrument Air – Instrument air supply shall be dust-free, oil-free and dry. The minimum instrument air dew point at line pressure shall be at least –40 °C or –10 °C below the minimum locally recorded ambient temperatures at the plant site, whichever is lower. No condensation shall occur in the distribution system or in the instruments. The minimum instrument air supply pressure on the header shall be 700 kPag.
- The capacity of the instrument air system shall be rated for all the connected loads plus 20%. An air receiver shall be provided for protection against loss of air. A low-pressure alarm shall be provided to indicate that the air pressure has fallen below 500 kPag. The air receiver shall be sized such that 15 minutes after the low air pressure alarm the instrument air header pressure shall not be below 250 kPag.
- Field Wiring – In general, multi-conductor cables shall be used between the Electrical Rooms and field junction boxes. Single pair cables shall be used between field junction boxes and individual instruments or electrical devices.

3.2 Control System

- The control system shall be capable of integrated process control, PID (Proportional. Integral and Derivative) loops and sequence logic control. The Control System shall have DeviceNet I/O cards for interface to motor starters for motor control, monitoring and implementing interlocks.

- The Control System shall have, as a minimum, redundancies on: controllers, operator consoles, power supplies, and communications data highways.

- An Uninterruptible Power Supply (UPS) shall be installed to power the Control System and field instruments. The UPS should have a minimum capacity of 30 minutes. The UPS system will be sized so that the connected load is only 60% of the nameplate full load rating of the UPS. The inverter units will be redundant so that in the event that a failure of one of the units the additional load will be handled by the balance of the Inverter units.

- A diesel generator, normally installed to supply emergency power to the plant, shall be connected to the UPS. This shall allow the Control System to remain online to monitor the process even during power outages.

- The Control System shall operate with a global database to allow easy engineering and operational data access, modification and troubleshooting. The Control System has capacity to interface to a Mill information System to provide a maximum data of 1 second data for all I/O attached to the system.

- The Control System shall have built-in diagnostics to allow system troubleshooting down to device I/O level.

- Configurations of control strategies on the Control System shall be via graphical means such as function blocks. This type of configuration is self documenting and provides ease of control system documentation and troubleshooting.

- The interlock system shall be designed to be “fail-safe”. On device failure, loss of power or loss of instrument air, the outputs to control process streams shall fail to a pre-defined safe state, e.g. output contact fails open, solenoid valve fails de-energized, and control valve fails closed, motor fails stopped.

- The Control System shall include a continuous Historian to collect process data. The Control System shall allow easy access to the data historian via the Control System consoles.

3.3 Grounding

- Plant electronic instrument system shall have its own dedicated grounding system. In the event that several instrument systems exist, these grounding systems shall be connected in common.
- Manufacturers recommended grounding procedures and installations shall take precedence over all grounding designs and installations.
- All signal cable shields shall only be grounded at the control system end of the circuit. The field end shall be trimmed flush with the cable jacket and taped to prevent accidental ground contact.

3.4 Mounting And Location Of Field Instruments

- All field instruments shall be mounted at grade or platform to provide easy access for operation and maintenance.
- All field mounted remote transmitters with indicators shall be mounted so that the transmitter is 1.37 meters above grade or platform and shall be located as close to the primary connection/element as possible consistent with instrument accessibility.
- Dial thermometers and pressure gauges that are line mounted shall be plainly visible and accessible from grade or platform.

3.5 Field Mounted Instruments And Equipment

- All field instruments shall meet the electrical classification of the area. Field mounted instrument electrical devices shall be supplied in weatherproof enclosures (NEMA 4), watertight and dust-tight as a minimum.
- Instruments shall be installed with flanges or unions and isolation valves to permit removal without process shutdown. Isolation valves shall be provided so that inline valves and instruments can be removed for maintenance without draining tanks and equipment.
- Separate process connections are required for each instrument including pressure gauges. Process connections for instruments on vessels shall be dedicated to the instrument and not shared with process piping.
- Test points should be provided to allow in place testing and/or calibration of instruments and equipment.

- Junction boxes shall be in accordance with the requirements of the associated electrical area classification. In an unclassified area the enclosures shall be NEMA 4X corrosion resistant, non-metallic, watertight and dust tight construction. Hinges and latches shall be 316 stainless steel. Cable entries shall be through cable glands in the bottom of the box where feasible. Watertight seals shall be used. Terminal rails shall be mounted vertically complete with sufficient grounding terminals. All connections within the junction box shall be made via terminal blocks. Splicing of wires is not permitted.
- All cables, wires, terminals and any other device shall be tagged uniquely in each box. A junction box layout and wiring diagram shall be provided and placed in a pocket in the rear side of the front door. Junction boxes shall be tagged uniquely with a lamacoid nameplate attached to the front panel. Lamacoids shall be white with black lettering.

3.6 INSTRUMENT ELECTRICAL WIRING

- Armored multi-pair instrument cables shall be individually twisted shielded pairs of stranded #16 AWG copper conductors with drain wire, cable overall shield with drain wire, FRPVC inner jacket, aluminum interlock armour, FRPVC outer jacket, Wire pairs shall be coloured black and white. Black is positive, white is negative. The number of pairs shall be as per drawings.
- Armored control and instrument power cables shall be Teck cable with stranded copper conductors, aluminum interlock armour, and PVC outer jacket. The number of conductors and conductor size shall be as per drawings.
- Power cables shall be supplied with bare copper grounding conductor.
- All wiring shall be clearly identified at every termination with a permanent marking system. Wire markers shall be the heat-shrunk type unless otherwise specified. The preferred method of identification is the loop number as specified on the loop diagrams.
- Fiber optic cables shall be multi-strand armoured, multimode for short runs up to 2 km, single mode for longer distances. The number of fiber strands shall be as per drawings.

3.7 Instrument Air Tubing

- Instrument air tubing to an instrument shall be 1/4" OD 316 SS seamless unless specified larger on drawings. Instrument air tubing fittings shall be 316 SS compression type.

4.0 INSTRUMENTATION BY AREA

- The control system in the Primary Crushing and Secondary Crushing areas shall provide monitoring and controls for:
  - Primary gyratory crusher
  - Primary crushing apron feeder
  - Stockpile feed belt conveyor
  - Crushing dust collector
  - Stockpile reclaim feeders
  - Primary sizing & screening conveyors
  - Primary sizing screens
  - Cone crushers
  - Secondary sizing & screening conveyors
  - Secondary sizing screens
  - High pressure grinding rolls crusher
- Grinding and Classification
  - Cyclopacs feed pumpbox
  - Cyclopac feed pumps
  - Cyclopacs
  - Ball mills
- Flotation Circuits
  - Rougher flotation cells
  - Rougher tailings pumpbox
  - Rougher tailings pumps
  - Rougher scavenger flotation cells

- Regrind cyclones feed pumpbox
- Regrind cyclopac feed pumps
- Regrind cyclopac
- Regrind vertical miills
- 1st cleaner flotation cells
- 1st cleaner concentrate pumps
- 1st cleaner scavenger flotation cells
- 1st cleaner/scavenger concentrate standpipe
- 1st cleaner/scavenger concentrate pumps
- 2nd cleaner flotation cell
- 2nd cleaner flotation tailings pumpbox
- 2nd cleaner tailings pumps
- 2nd cleaner concentrate standpipe
- 2nd cleaner concentrate pumps

- Cu / Mo Thickening and Filtration
  - Cu / mo thickener
  - Stock tank feed pumps
  - Cu / mo concentrate stock tank
  - Mo rougher flotation feed pumps
  - Mo rougher flotation cells
  - Mo rougher concentrate standpipe
  - Mo cleaner flotation feed pumps
  - Mo column cleaner flotation cell
  - Mo cleaner concentrate standpipe
  - Mo thickener feed pumps
  - Mo thickener
  - Mo filter feed pumps
  - Mo concentrate stock tank

- Mo concentrate filter feed pumps
- Mo concentrate filter
- Mo concentrate dryer
- Cu thickener
- Cu thickener underflow pumps
- Cu concentrate stock tank
- Cu concentrate filter feed pumps
- Cu concentrate pressure filter
- Cu concentrate belt conveyors
- Cu filtrate tank
- Cu filtrate pump
- Cu thickener overflow standpipe
- Cu thickener overflow pumps

- Tailings Disposal
    - Final tailings pumpboxes
    - Final tailings feed pumps
    - Final tailings cyclopac
    - Py concentrate cell
    - Py concentrate pumpbox
    - Py concentrate pumps
    - Reclaim barge pumps
- Reagents
    - Reagent area safety showers
    - Flocculant mix system
    - Flocculant holding tank
    - Flocculant metering pumps
    - Mibc holding tank
    - Mibc metering pumps

    - Cmc depressant mixing tank
    - Cmc depressant holding tank
    - Cmc depressant metering pump
    - Aero 3302 holding tank
    - Aero 3302 metering pumps
    - Lime slaking system
    - Lime holding tank
    - Lime system distribution pumps
    - Kerosene holding tank
    - Kerosene holding pumps
    - Pine oil holding tank
    - Pine oil holding pumps
    - Pex mixing tank
    - Pex holding tank
    - Pex metering pumps
- Process, Potable & Gland Water / Instrument & Plant Air
    - Crushing area air compressor
    - Process plant air compressors
    - Flotation aeration blowers
    - Crushing area instrument air dryer
    - Process plant instrument air dryer
    - Crushing area instrument air receiver
    - Crushing area plant air receiver
    - Process plant instrument air receiver
    - Process plant plant air receivers
    - Fresh / fire water tank
    - Gland water pumps
    - Gland water tank

- Potable water pumps
- Potable water tank
- Potable water chlorinator package
- Process water tank
- Process water pumps
- Safety shower header tank
- Safety shower water feed pump

END OF SECTION

REVISION INDEX

Revision No.	Date Revised	Engineering Specification	Signatures				
			Prepared By	Discipline Engineer	Project Engineering	Project Manager	PBM
00	March 12, 2008	Issued For Client Information	KL	KL/JM		DS	
01	October 31, 2008	Issued for Client Approval	TK	GI	AS	JCR	
02	December 22, 2008	Issued for Client Acceptance	TK	GI	AS	JCR	
03	January 7, 2009	Issued for Client Acceptance	TK	GI	AS	JCR	

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SCOPE

1.0 WORK AND BATTERY LIMITS

- Design the electrical works from the secondary side of the two Owner supplied 138 - 13.8 kV power transformers to the main process plant, surrounding ancillary buildings and remote areas. (Incoming substation and high voltage transmission line are not in scope). Numerous ancillary buildings are pre-packaged and supplied as turn-key therefore no detailed electrical allowances or design work is required for these. No camp exists for this facility.
- The distinct areas of the project are:
  - Main plant areas:
    - Primary Crushing
    - Conveyors and Crushed Ore Stockpile
    - HPGR building
    - Main Process Plant (tailings pumping by KCBL)
  - Ancillary Buildings and Facilities:
    - Sewage treatment
    - Administration Building/Assay Office
    - Maintenance Shop/Warehouse
    - Truck wash
    - Fuel Storage
  - Remote Ancillary Buildings and Facilities including:
    - Water Storage (Wardrop)
    - Explosives Storage
    - Tailings booster pump stations as required (KCBL)
    - Tailings Pond Area as required (KCBL)
    - Lake water pump station as required (KCBL)
    - Open pit (initial lighting and dewatering pumps)
- Critical loads (defined as those who require power upon normal electrical supply failure) are and are so indicated on the project electrical load list. The process plant loads in this category are primarily items such as agitators which must be able to operate when normal electrical power fails to avoid settling. The restart of such

equipment on emergency systems will be controlled by operations and maintenance personnel with electrical power derived from emergency diesel generation sources provided.

2.0 CODES AND STANDARDS

- The design and manufacture of electrical equipment will conform to the latest versions of the following International codes and standards:
  - CSA Standard M421-00, Use of Electricity in Mines
  - Canadian Electrical Code (CEC C22.1)
  - American National Standards Institute (ANSI)
  - Institute of Electrical and Electronics Engineers (IEEE)
  - Canadian Standards Association
  - National Electrical Manufacturer's Association (NEMA)
  - Health, Safety and Reclamation Code for Mines in British Columbia

3.0 POWER SYSTEM

3.1 General

- Main power will be provided from a 138 kV step down substation facility and distributed at 13.8 kV on the plant site. The power system at this interface point will have the capacity and characteristics to support the plant electrical load and equipment.

3.2 System Voltage

- Voltage is AC at 60 Hz
- Voltage levels will be as follows:

Equipment	Distribution System Voltage
Grinding mill motors	13.8 kV, 3-phase, high resistance grounded
All other drives over 200 HP	4.16 kV, 3-phase, high resistance grounded
All drives from 0.5 HP to 200 HP	600 V, 3-phase, high resistance grounded
Motors with VFD up to 800 HP , 600 V	600 V, 3-phase, high resistance grounded (these items to be decided on case by case basis)
Small drives below 0.5 HP	120/208 V, 3- or 1-phase, solidly grounded

Electrical heaters over 2 kW	600 V, 3-phase-
Electrical heaters 2.0 kW or less	120/208 V, 3- or 1-phase, solidly grounded
Lighting 120 or 347 V	1-phase solidly grounded
Small power & controls 120 V	1-phase solidly grounded
Heat tracing short lengths 208 V	1-phase solidly grounded
Heat tracing long lengths 600 V	3- or 1-phase solidly grounded

4.0 POWER DISTRIBUTION

4.1 General

- Electrical distribution configuration for the project is s shown on the project single line diagrams. Components will consist of :
  - Medium voltage switchgear, power cables and motor control for major motors. Motor control and feeder breakers will be provided in common equipment line-ups.
  - Medium voltage electronic soft-starts or adjustable speed drives will be provided in stand-alone equipment enclosures.
  - Step down power transformers from 13.8 kV to 4.16 kV or 600 V, sized to provide capacity for planned loads.
  - Low voltage power distribution will generally be provided by power distribution centers.
  - Power for motors will be supplied from factory assembled motor control centers. Remote disconnect switches will not be installed at motor locations. A local "Start/Stop" pushbutton and H-O-A selector will be used. Lockout is to be done at the motor control center by qualified electricians in accordance with Owner developed lockout procedure.
  - Power for lighting and receptacles will be supplied from lighting and power panel boards.
  - Overhead power lines will be 13.8kV or 4.16 kV.
  - Underground cables at 13.8 kV and/or 4.16 kV will be utilized where practical to minimize future access issues and where so indicated in plant areas designed by others.
- Transformers shall be design loaded to not more than load to 70 % of full capacity. Dedicated purpose transformers which are part of specific equipment systems (e.g. conveyor or pump variable frequency drive systems) shall be sized according to the duty anticipated.

4.2 Voltage Drop, Power Factor and Large Motor Starting

- Overall voltage drop from source distribution transformer secondary to the end of last feeder shall not be more than 3 %. Overall voltage drop from the supply to point of utilization shall not exceed 5 %..
- The single line diagram includes 6 MVAR of 13.8 kV power factor correction to assist in site power factor correction. The leading reactive power available from the two ball mills will add to this capacity and provide an adjustable variable method to correct power factor.
- The two significant ball mill motors will be provided with a switched reactor starting method.
- Large motor starting and site reactive power control are a function of the electrical parameters of the source of supply and driven equipment. The power system study to further refine the methods outlined above requires detailed utility electrical parameters along with equipment details as input to a next phase power system study..

5.0 EQUIPMENT DESIGN CRITERIA

5.1 Enclosures

- Equipment and device enclosures will have the following ratings:

Location	Rating
Control Room, Electrical Room	NEMA 1A
All Other Areas (Non-Classified)	NEMA 12 or 4 as needed

5.2 Cables

- All power and control cables will be copper and generally be installed in underground non-metallic ducts or above ground in ladder type cable trays. Cables will have interlocking aluminium armour with a PVC FT4 rated jacket, suitable to -40 °C and as follows:

13.8 kV System	15 kV rated
600 V System	1,000 V rated, #12 AWG minimum
Controls	600 V rated, #14 AWG minimum. A minimum of 10% spare conductors will be left in each control cable where possible.
Colour Coding	All power wiring will be colour coded to suit local standards.

5.3 Electric Motors

- For standard applications motors will be TEFC, 1.15 SF, high efficiency. Inverter duty motors shall be IEEE 841 rated. No areas are anticipated to be classified as hazardous due to the presence of an explosive dust or gas concentration under normal or process upset conditions.

5.4 Low Voltage Power Distribution Centres

- Low voltage power distribution centres shall be fully rated at the site elevation. Enclosure type shall be equivalent to NEMA 1A for installation in indoor electrical rooms.
- Each low voltage switchboard shall be complete with an incoming main breaker section and suitable digital protective relaying including ground fault detection and alarms.
- Individual distribution feeder cells will be circuit breaker type with digital protective relaying.
- Design loading for low voltage distribution centres shall not exceed 75% of calculated running loads including spares.

5.5 Medium Voltage Distribution

- Medium voltage distribution equipment and motor control centres shall be metal-clad and fully rated at the elevation of utilization. Enclosure type shall be equivalent to NEMA 1A for indoor electrical room applications.
- Each medium voltage switchboard shall be complete with an incoming main breaker or load break rated disconnect switch section and have suitable digital protective relaying.
- Individual distribution feeder cells will be vacuum contactor type with current limiting fusing, digital protective relaying and zero sequence type ground fault detection.
- Individual motor cells will be vacuum contactor type with current limiting fusing, digital protective relaying and zero sequence type ground fault detection.

5.6 Low Voltage Motor Control Centres

- Motor Control Centres shall be 600 V, 3 phase, 3 wire complete with copper bus, top mounted ground bar and bus bracing as noted on other design documents. Enclosures shall be NEMA 1A for installation in an indoor, modular electrical rooms or major building electrical rooms.

- MCC's shall have incoming sections with digital meter display of instantaneous three phase voltage, current and power parameters. All transformer fed MCC's require a main breaker sized to the transformer secondary current complete with digital protection relay.
- Individual MCC starters shall be complete with door mounted H-O-A selector switches, start-stop push buttons and LED type pilot lights.
- MCC starters shall be connected to local plant control system I/O racks for control purposes where control is not strictly manual.

5.7 Lighting

- Lighting will be high intensity discharge and fluorescent. High intensity discharge lighting will be provided in exterior locations, for roadway lighting and where specified indoors. Fluorescent lighting will be provided in the control rooms, motor control centre rooms, offices and other plant buildings. Note that, where possible at the design stage, steps will be taken to reduce energy use in all areas by:
  - Use of two level switches for larger lighting area – activated by personnel entering area when needed for operations or maintenance
  - Use of detection type switches to turn off lights in office areas after periods of room being empty
  - Photocell controlled exterior lighting
- Control room lighting will be electronically dimmable and fixtures shall be complete with louvers to minimize glare from operating monitors. Lighting for offices and control rooms will be via 120 V, high efficiency fluorescent type fixtures.
- Battery powered emergency lights and exit signs will be included for offices, labs, electrical rooms, the control room and major egress routes indoors.
- Where required by the nature of the process, lighting fixtures shall be of the corrosion resistant type. Outdoor floodlight circuits will be automatically controlled by photocells with a "Manual-Off-Auto" bypass selector switch. Main indoor lighting circuits will be supplied from 600/347v lighting panels. In general, plant lighting will be switched from the supply panels, in all other areas local switching will be provided. Offices, control room, leave 10 % of fixtures unswitched

- **In areas with rotating or moving equipment, lighting sources shall be frequency selected to illustrate relative motion and avoid stroboscopic effects.**

5.8 Lighting Illumination Levels

- Illumination levels shall meet the following requirements:

AREAS	LEVEL
Electrical Room	300 lux
Control Room	500 lux
Offices	600 lux
Loading	30 lux
Yard	10 lux

5.9 Grounding

- The ground grid will be connected wherever possible to building steel, tanks, and equipment and the ground wire will be installed exposed wherever possible. The ground grid will also be connected to the main substation ground. Where corrosion presents a problem, ground wire shall have PVC insulation. All underground connections on the main ground grid will be exothermic type. Exposed connections and taps will be made with pressure type connectors.

- Ground rods will be installed at corners of buildings and around buildings at intervals not to exceed 25 m, and connected to the ground grid with soft drawn bare copper ground wire. Motor control centres, medium and low voltage switchgear, unit substations, transformers, etc., will be provided with two connections to the ground grid. All medium voltage motors, control panels, tanks, vessels, and other equipment will have at least one direct connection to the ground grid. All 120 V receptacles will be grounded by means of a separate green coloured insulated wire. Ground fault circuit interrupter type receptacles will be located in as required throughout the plant site. A #2/0 AWG bare ground cable will be installed in all cable trays. The ground cable will be connected to all sections and fittings at intervals of not less than 15 m. Final resistance of the grounding system will be in accordance with the local codes and standards.

5.10 Fire Alarm

- An allowance for a basic fire alarm system will form part of the design package.

End of Section

APPENDIX E

HPGR Trade Off Study

December 06, 2007

High-Pressure Grinding Tests

on

Copper/Gold/Molybdenum Ore

from the

Morrison Project
British Columbia, Canada

for Pacific Booker Minerals Inc.

at the

Polysius Research Centre

Project No. 2337 2844 / 2220-7959
WE no. 11815

By: Rene Klymowsky/Holger Plath

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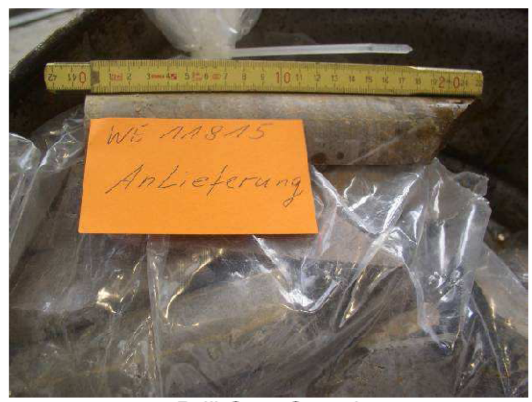
1. Introduction

Pacific Booker Minerals Inc., consulted by Wardrop Engineering, initiated a test program at Polysius AG in Germany to investigate the application of High Pressure Grinding Rolls (HPGR's) at their copper/gold/molybdenum porphyry project in the Morrison Lake area, Northern BC.

Ore samples were received in two shipments, 4 drums each, containing a gross weight of 1720 kg. The samples consisted entirely of drill core, which was crushed to < 1¼" for testing. The tests were carried out in a semi-industrial HPGR at three different pressure levels. Closed-circuit tests were simulated using a 6 mm screen. Standard Bond and POLYSIUS laboratory mill (LABMILL) grinding tests were done on the material before and after pressing to determine the extent of weakening of the material. Furthermore, abrasion tests were carried out at different moisture contents to determine the wear life of the rolls.

Earlier testwork carried out on drill core at SGS Lakefield indicated Bond Work Indices ranging from 11- 23.5 kWh/t, with an average value of 16.4 kWh/t.

Shipment - 2 of 8 drums - 1620 kg net



Drill Core Samples

2. Summary

The feed and product size distributions from open circuit runs in the HPHR on the ore are shown in Figure 1. Increasing pressure had very little effect on the product particle size distributions. Also, moisture content variation had little effect on product PSD's. The main effect of these variables was on the throughput and specific energy consumption. These effects are examined in more detail in the report.

Results from closed-circuit tests with a 6 mm screen are shown in Figure 2. The actual cut size was about 5 mm. The screening was conducted dry, and was quite efficient, resulting in > 90% recovery of the amount of < 5 mm in the HPGR product. The P80 size was about 2.8 mm. It is expected that wet screening would yield very similar results.

The material was of low to medium abrasiveness, with an ATWAL wear index (ATWI) of 9-15 g/t. Wear life for the rolls was estimated at 7000 hours. Bond WI was 17.8 kWh/t before, and 16.1 kWh/t after HPGR, a reduction of 10% in ore hardness.

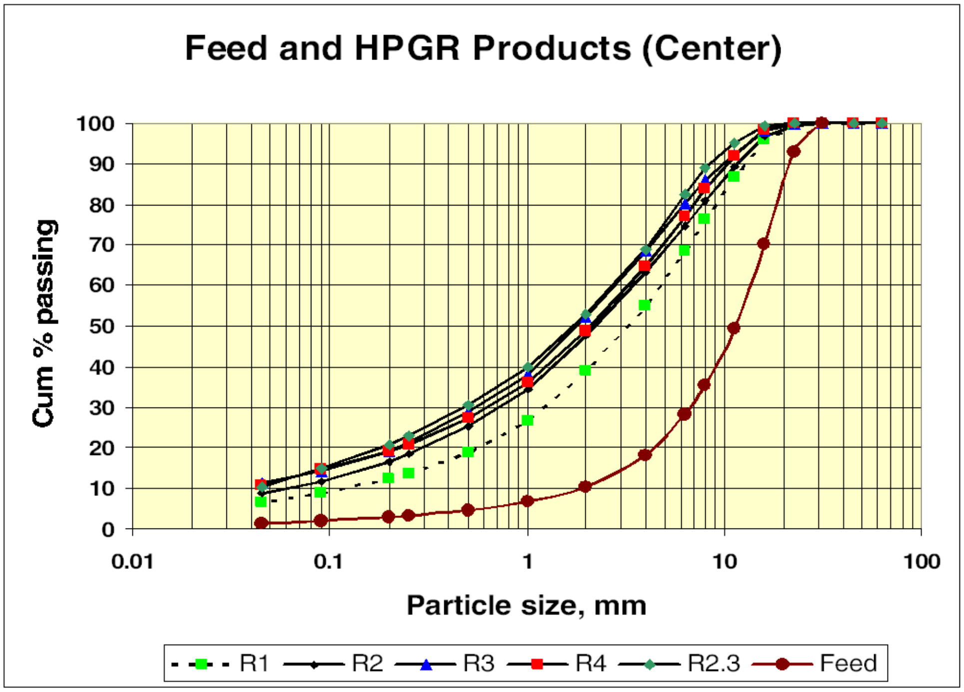


Figure 1. Results of a single pass through the HPGR.

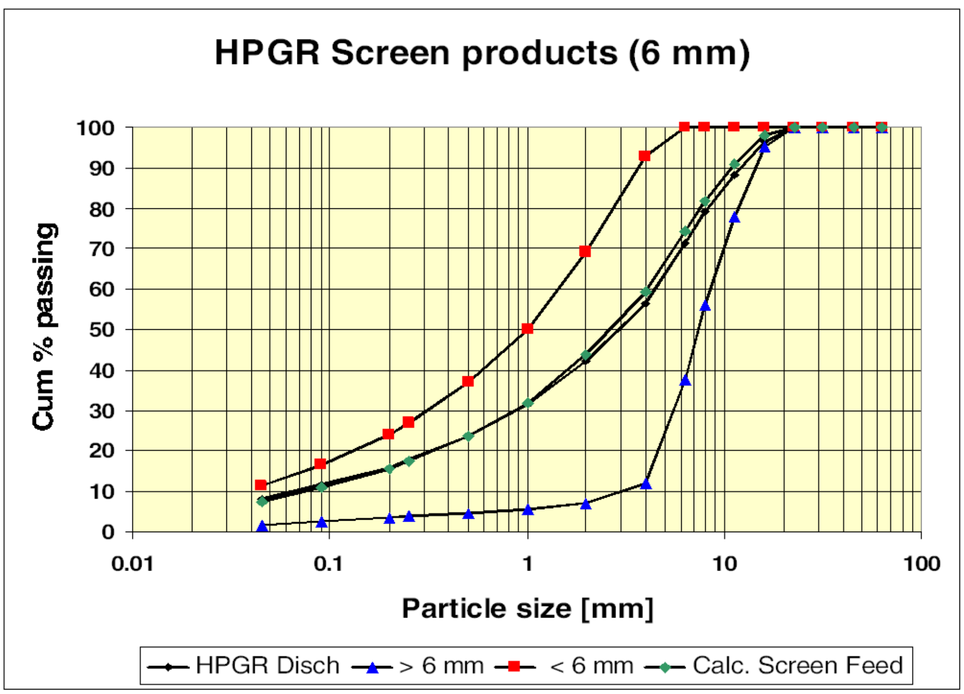


Figure 2. Results of closed-circuit testing in the HPGR.

3. Definition of terms used in testing of High-pressure Grinding Rolls

The key parameters derived from the results of testing in a HPGR are:

- the specific throughput rate
- the specific press force which should be applied to obtain a certain comminution effect
- the specific energy consumption
- the power required for a given throughput and size of rolls.

3.1 Specific Throughput Rate $\dot{m}$

The **specific throughput rate** $\dot{m}$ is defined as the throughput of a given size of machine divided by the projected area and circumferential speed of the rolls:

$$\dot{m} = M / (D * L * u) \quad [ts/hm^3]$$

M	[tph]	:	throughput rate
D	[m]	:	diameter of rolls
L	[m]	:	width of rolls
u	[m/s]	:	circumferential speed of rolls

<u>Note</u>: The **specific throughput rate** $\dot{m}$ has units of ts/hm^3, corresponding to the throughput of a HPGR with rolls 1 m in diameter x 1 m wide operating at a roll speed of 1 m/s.

The **specific throughput rate** mainly depends on the <u>properties of the material</u> *(e.g., hardness, the physical density of the material, the particle-size distribution of the feed, and the moisture content)*; the <u>grinding pressure</u>, and the <u>type of roll surface</u> employed.

However, the **specific throughput rate** depends only to a limited extent on the diameter and speed of the rolls and is therefore useful for scaling-up from a test unit to a full size industrial unit. HPGRs (and vertical roller mills) are unique among comminution devices in having a specific capacity term which can be assigned to the material and operating conditions.

3.2 Specific Press Force

The **specific press or grinding force** is defined as the total hydraulic force exerted on the rolls divided by the projected area of the rolls in units of N/mm^2 :

$$F_{(sp)} = F / (1000 * L * D) \quad [N/mm^2]$$

$F_{(sp)}$	$[N/mm^2]$	:	specific grinding force
F	[kN]	:	grinding force
L	[m]	:	width of rolls
D	[m]	:	diameter of rolls

This form is useful for comparing pressures on different sizes of HPGR units.

Note: The maximum grinding pressure in the gap between the rolls will be between 40 and 60 times the applied **specific grinding force**, depending on the nip angle. For mineral applications it is sufficient to define the **specific grinding force**.

3.3 Specific Energy Consumption

The **specific energy consumption $W_{(sp)}$** is the energy input which is absorbed per ton of material. It is proportional to the applied <u>specific grinding force</u>.

$$W_{(sp)} \sim c\,(F_{(sp)},\dot{m}) * (F_{(sp)} / \dot{m}) \quad [kWh/t]$$

$W_{(sp)}$	[kWh/t]	:	specific energy input
$F_{(sp)}$	[N/mm²]	:	specific grinding force
$\dot{m}$	[(t*s)/(m³*h)]	:	specific throughput rate
$c\,(F_{(sp)},\dot{m})$		:	factor (function of $F_{(sp)}$ and $\dot{m}$)

The proportionality is usually linear.

3.4 Power requirements.

The net power required for a given size of rolls is the product of the specific energy input $W_{(sp)}$ and the throughput rate M :

$$P = W_{(sp)} * M \quad [kW]$$

P	[kW]	:	power draw
$W_{(sp)}$	[kWh/t]	:	specific energy input
M	[tph]	:	throughput rate

The minimum motor power required is determined by multiplying the net power by a factor of 1.15 to account for any unevenness in the power draw of each roll. Final motor power is determined by the maximum power that can be transmitted by the gear boxes fitted to a given size of machine.

3.5 Specific Power

The net power required for a given size of rolls may also be derived from the specific power function.

The **specific power P_{SP}** is defined as the power used by a given size of machine divided by the projected area and circumferential speed of the rolls:

$$P_{SP} = P / (D * L * u) \quad [ts/hm^3]$$

P	[kW]	:	power draw
D	[m]	:	diameter of rolls
L	[m]	:	width of rolls
u	[m/s]	:	circumferential speed of rolls

The specific power varies linearly with the specific press force applied, and may be used to determine whether sufficient power has been provided for a unit with a given pressing capacity.

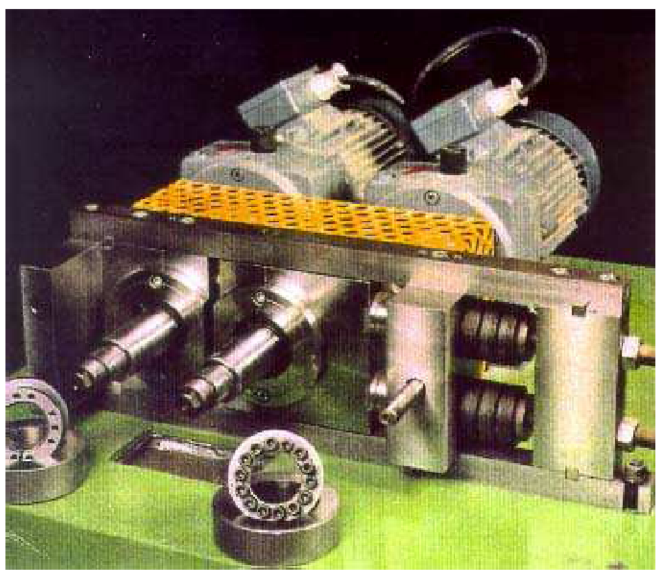
4. Description of Test Facilities

4.1 ATWAL Abrasion Testing High Pressure Grinding Roll

The ATWAL unit is used to determine the wear rates of different ores in High Pressure Grinding Rolls. About 100 kg of material are needed for one test run.

The ATWAL is equipped with smooth solid tyres made of Nihard IV. To ensure nipping of the material between the rolls, the feed is crushed to < 3.15 mm. The rolls are weighed before and after each test, and a specific wear rate is determined from the weight loss divided by the amount of material treated. This specific wear rate is then used to calculate the wear life to be expected on a industrial size HPGR unit.

The ATWAL is choke fed in order to achieve the maximum possible throughput. The grinding force, energy and specific throughput are measured, and the grinding force adjusted, if required.



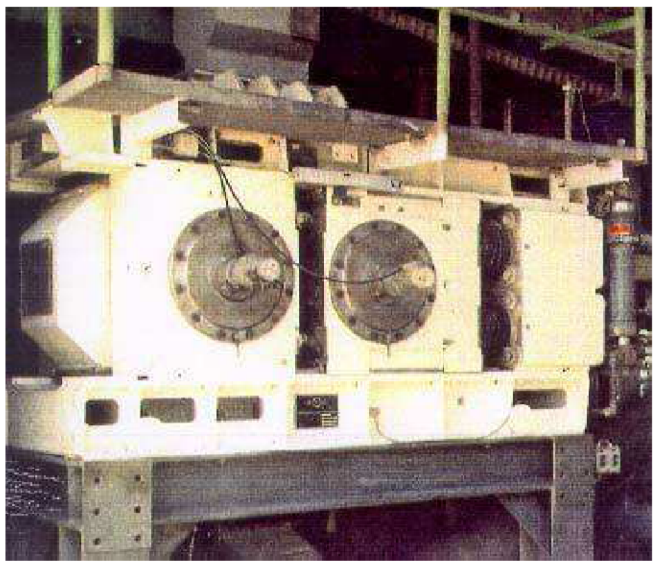
<u>Data of test unit:</u>

Diameter of rolls	: 0.10 m
Width of rolls	: 0.03 m
Speed of rolls	: 0.46 m/s
Top feed size	: 3.15 mm

4.2 REGRO Semi-industrial High Pressure Grinding Roll

<u>Data of test unit:</u>

Diameter of rolls	: 0.71 m	Speed of rolls	: 0.29 - 1.10 m/s
Width of rolls	: 0.21 m	Top feed size	: 16 - 35 mm



The REGRO is equipped with an autogenous wear protection surface in the form of studded liners.

Process data obtained from test work allows the sizing of industrial scale machines.

Data logging: feed rate,
zero gap ,cake thickness
preset nitrogen pressure, zero hydraulic pressure
operating hydraulic pressure
power draw of motors
circumferential speed of rolls

These data allow the calculation of process data such as:

- specific throughput rate
- grinding force and specific energy input
  required for achieving a certain product fineness

5. Test Programme & Results

5.1 Test Programme

The following test programme was approved by Wardrop Engineering. The client, Pacific Booker Minerals, witnessed the tests.

TEST PROGRAMME:

200 KLY
19/09/2007

Project: 2337 2992
WE: 11815

		Analysis
Provided material	< 25 mm 1500 kg	**PSD**, MC, BD, PD
REGRO feed	< 25 mm	PSD, MC, BD
ATWAL feed	< 3.15 mm	Fineness at 90, 250 and 1000 µm

	Test	Feed size	Quantity	Moisture	Pressure	Analysis Centre	Edge	Discharge
ATWAL	A1	< 3.15 mm	100 kg	1%	4 N/mm²			
	A2	< 3.15 mm	100 kg	3%	4 N/mm²			
REGRO	R1	< 25 mm	150 kg	natural	30/25	**PSD**, CD	**PSD**	
	R2	< 25 mm	150 kg	natural	40/30	**PSD**, CD	**PSD**	
	R3	< 25 mm	150 kg	natural	50/40	**PSD**, CD	**PSD**	
	R4	< 25 mm	150 kg	6%	40/30	**PSD**, CD	**PSD**	
Feed preparation: cont'd with product of R2								
Locked-cycle	R2.2	< 25 mm	150 kg	natural	40/30	**PSD**, CD	**PSD**	
with 6 mm screen	R2.3	< 25 mm	150 kg	natural	40/30			
	R2.4	< 25 mm	150 kg	natural	40/30	**PSD**, CD	**PSD**	
Screen products								**PSD**
Bond	B1 (before)	< 3.15 mm	10 kg	dry				**PSD**
	B2 (after)	< 3.15 mm	10 kg	dry				**PSD**
LaborMühle	LM1	Crush < 6 m	10 kg	dry				
	LM2	R2.3 < 6 mm	10 kg	dry				

Abbreviations and comments

PSD: Particle size analysis
45, 90, 200, 250 and 500 µm
1, 2, 4, 8, 11.2, 16, 22.4, 31.5 mm, etc.

MC: Moisture content
BD: Bulk density
CD: Cake density
PD: Material density

5.2 ATWAL Wear Test Results

Two ATWAL Wear Tests were carried out on the test material, one on dry material with 1% moisture, and one on wet material with 3% moisture. The results of these tests are given below.

Test	Material	Feed size	Moisture	Specific throughput	Spec. grinding force	Specific wear rate
		[mm]	[%]	[ts/(h m³)]	[N/mm²]	[g/t]
A 1	copper ore	0 x 3.15	1.0	118.4	4.0	9.84
A 2	copper ore	0 x 3.15	3.0	155.8	4.0	15.7

Table 2: ATWAL high pressure grinding wear tests

The tests indicated a low to medium wear rates of 9-15 g/t for the material on the ATWAL testing unit. The wear rates given refer to Nihard IV at the specific conditions on the ATWAL abrasion test unit. They do <u>not</u> reflect the wear rate on full size industrial rolls.

Corresponding wear rates on the ATWAL for other ores are given below:

Other ores	:	very abrasive	> 40 g/t
		medium abrasive	10 to 40 g/t
		low abrasive	< 10 g/t

Scale-up to full size industrial rolls takes into account the final roll diameter and speed of the rolls selected, type and length of the studs employed, as well as the feed characteristics of the material to be treated, i.e. size and moisture. The scale-up is based on a data collected on various ores treated in industrial High Pressure Grinding Rolls.

Preliminary estimates for an industrial size unit would indicate a wear life for the rolls of approx. 7000 h.

5.3 Semi-industrial High-pressure Grinding Tests on the REGRO

Preliminary REGRO tests were run at three different press forces on dry material. Then locked-cycle tests were run with medium pressure in closed-circuit with a 6mm dry screen. The influence of press force and recycle of the oversize on:

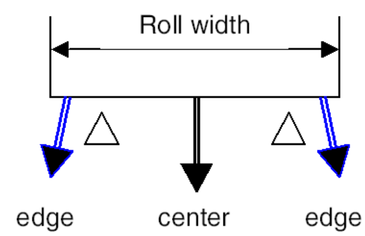
- the specific throughput
- the specific energy input
- the product fineness.

is given in the Table below.

Test no:	Moisture	Specific Press Force	Specific Throughput	Specific Power	Specific Energy	Product fineness (center) Cumulative % passing		
	[%]	[N/mm²]	[ts/hm³]	[kWs/m³]	[kWh/t]	8 mm	2 mm	0.025 mm
Open- circuit								
R1	1.00	2.59	229.6	320	1.40	76.18	38.80	13.70
R 2/2.1	1.00	3.49	218.0	386	1.77	80.95	47.60	18.40
R3	1.00	4.22	210.6	445	2.11	86.17	52.40	21.60
R4	4.10	3.45	221.8	438	1.97	83.68	48.80	20.70
R2.2	1.00	3.59	220.6	383	1.74	-	-	-
Closed-circuit with 6mm screen								
R2.3	1.00	3.69	225.8	384	1.70	88.87	52.80	23.00

Table 3: Summary of REGRO semi-industrial scale test results.

The feed and product particle size distributions were analysed by dry screening. The discharge of the REGRO was split into a centre and an edge portion. Both portions were analysed separately. Part of the products from the rolls were in the form of compacted flakes, which required de-agglomeration for sizing. The material was de-agglomerated in a rotating drum prior to screen analysis.



The size analysis of the feed and HPGR products are shown in Figures 3-4. The average P80 size achieved in the total discharge was 10 mm; the avg. P80 size in the centre product was 7 mm. The size distributions varied narrowly around these points, indicating that the effect of pressure and recycle on the size reduction was minimal.

The material formed weak flakes, and screening was quite efficient even on a dry basis, Figures 5-6. The circulating load obtained from the dry screening was < 60%, and was expected to be slightly lower from the wet screening.

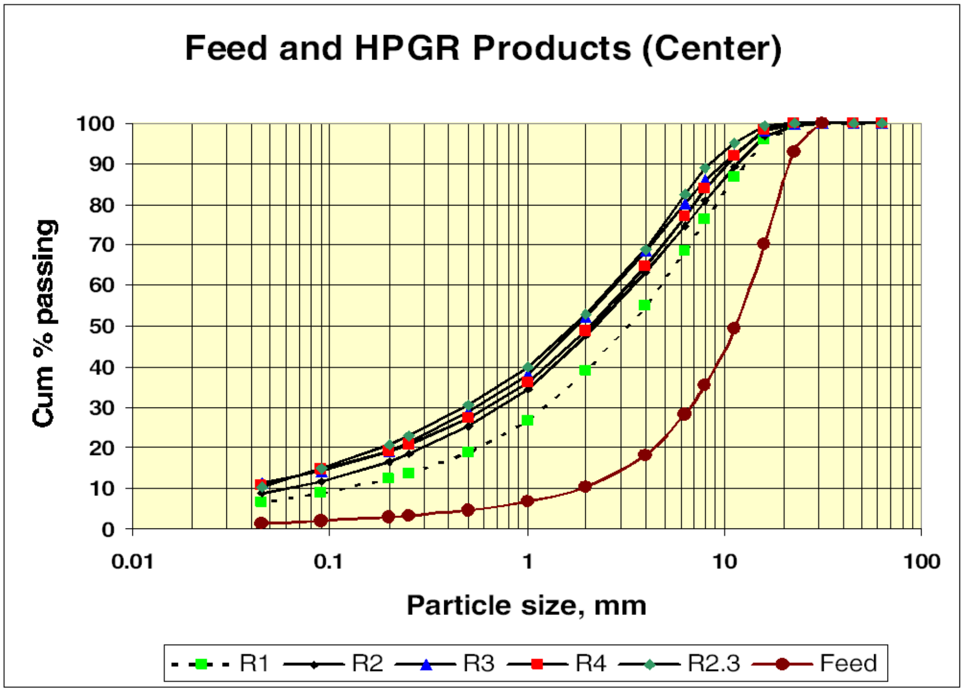


Figure 3. Size distributions feed and center products.

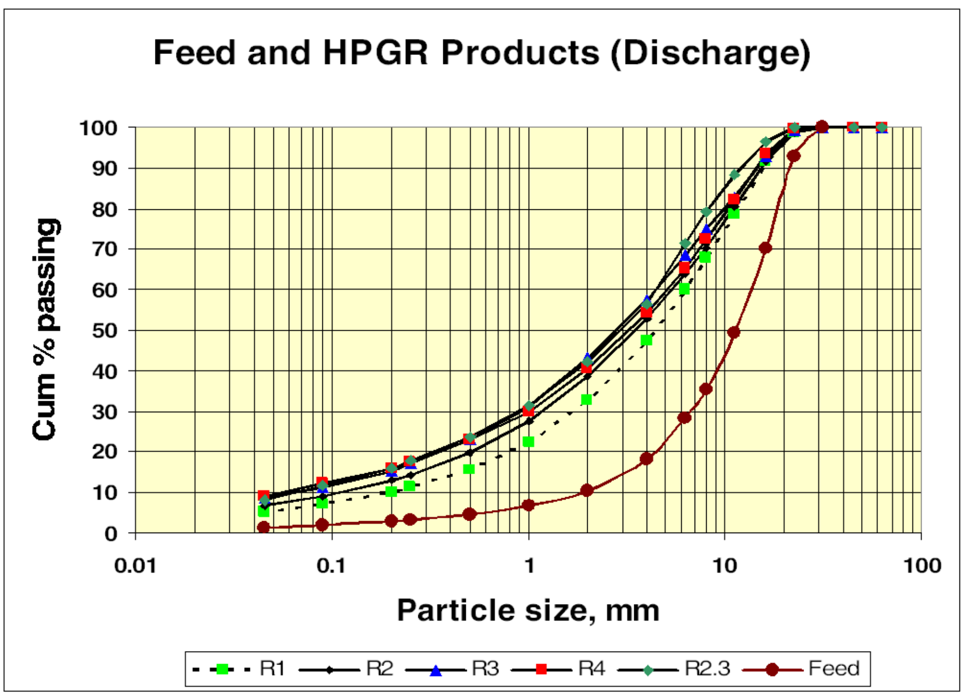


Figure 4. Size distributions feed and total discharge.

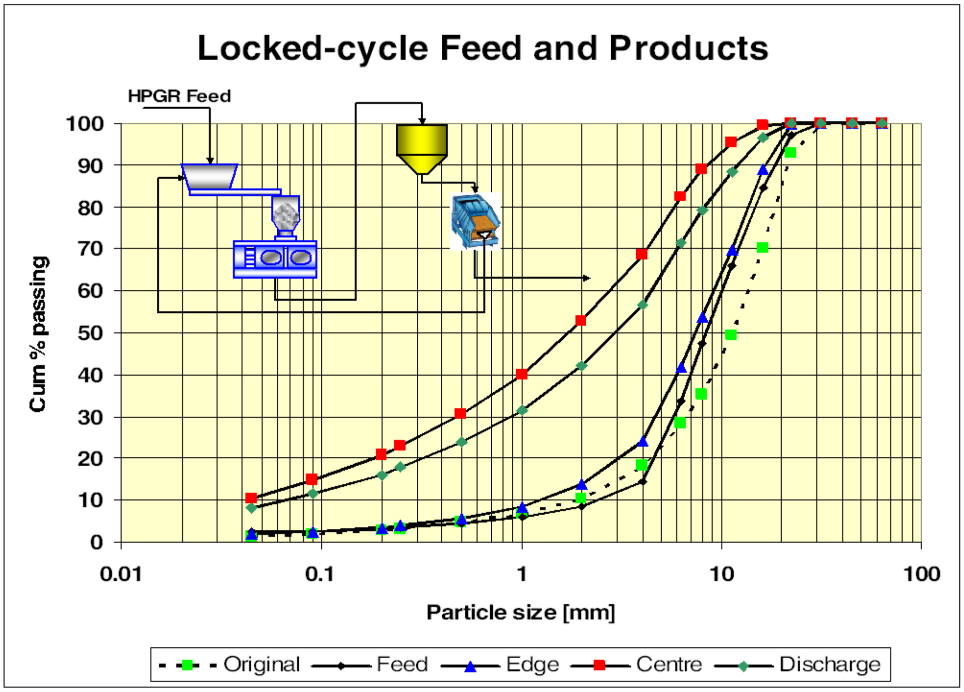


Figure 5. Locked-cycle test results, Test R2.3.

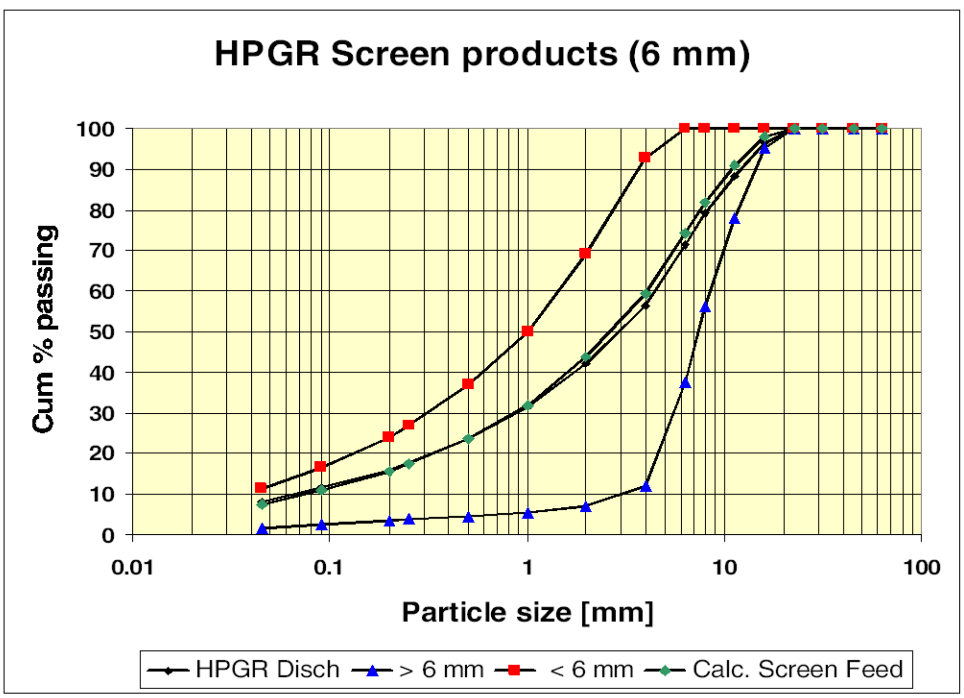
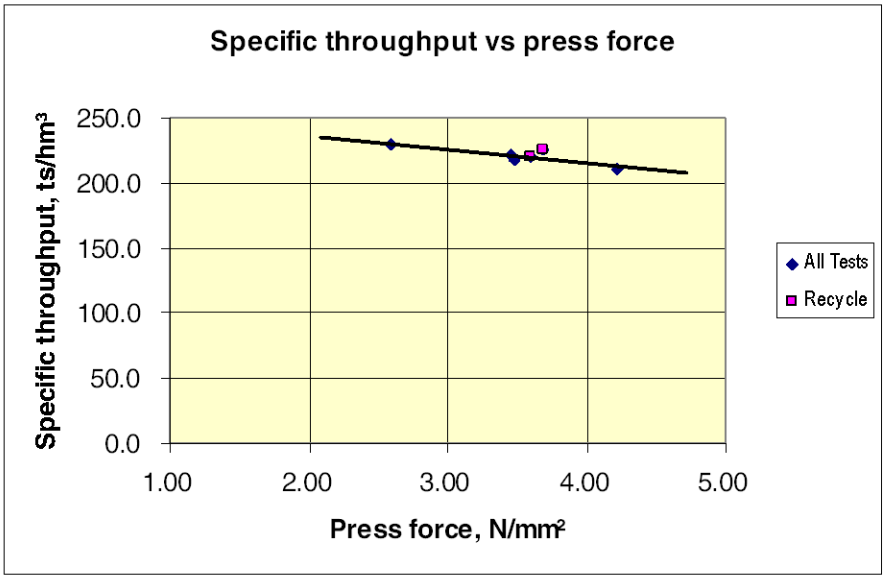


Figure 6. Size distributions dry screen products, Test R2.3.

5.4 Influence of operating conditions.

The influence of the specific press force and moisture on the specific throughput and power draw is shown in Figures 7 and 8. Both press force and moisture had little effect on the throughput. Average specific throughput was 220 ts/hm³ at 3.5 N/mm². However they had a significant effect on the power draw. Fig. 8. Moisture increased the power draw by 20%.



Figures 7. Variation of specific throughput with pressure.

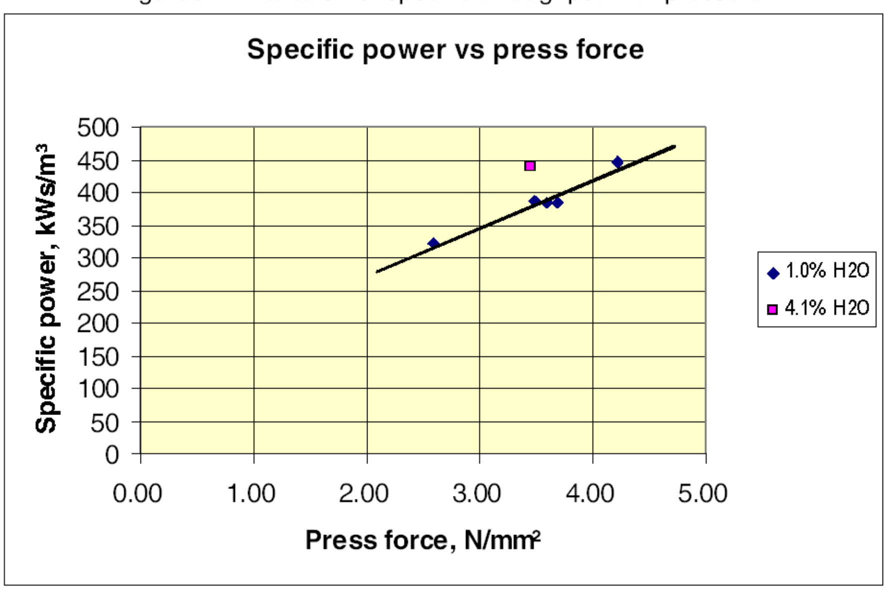


Figure 8. Variation of specific power with pressure.

For dry material, the specific power draw at 3.5 N/mm² was average for copper ores, 380 kWs/m³. Moisture increased this value to about 450 kWs/m³. The specific energy mirrored the specific power trend, resulting in 1.7 kWh/t for dry material and 2.0 kWh/t for wet material at a press force of 3.5 N/mm².

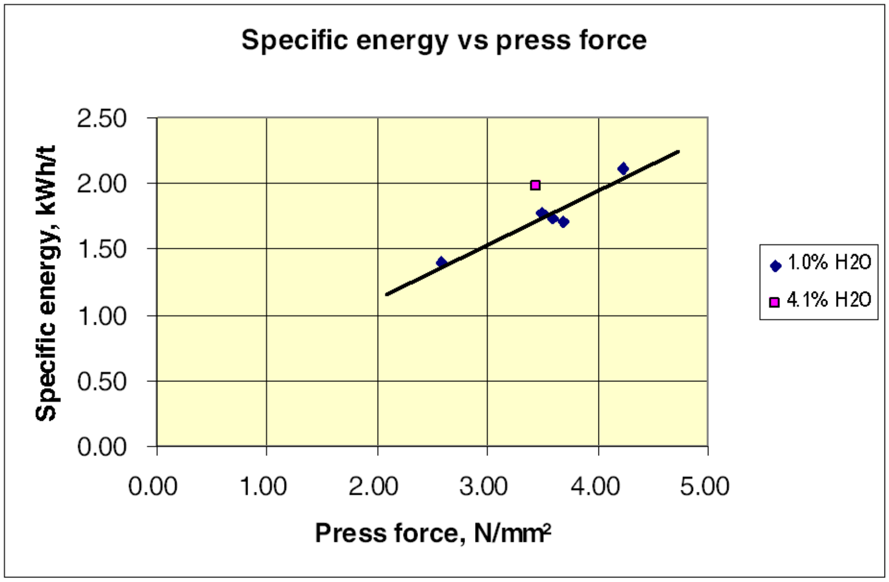


Figure 9. Variation of specific energy with pressure.

Figures 10 and 11 show the effect of grinding pressures on the product fineness. At pressures > 3.5 mm, there was little increase in product fineness, Figure 10. The optimum press force necessary was found to be 3.5 N/mm², see Figure 11.

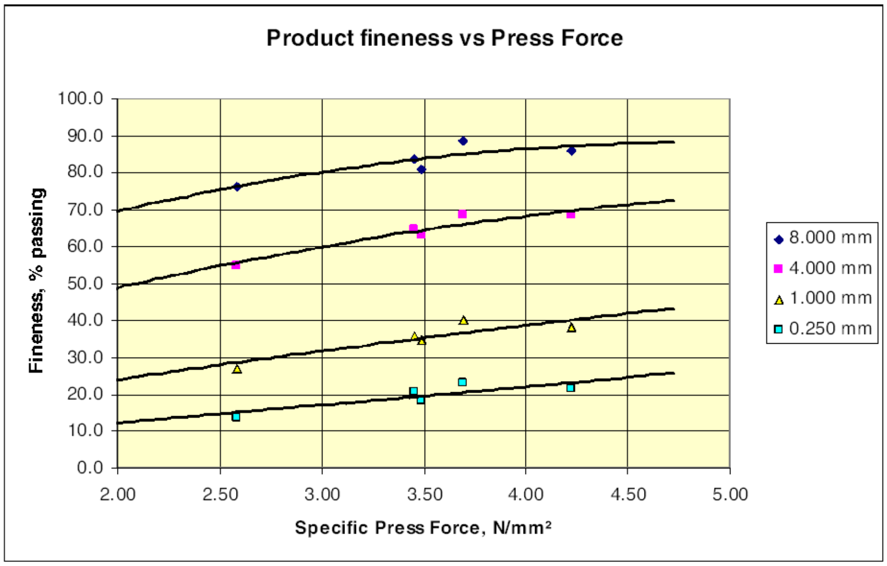


Figure 10. Variation of Product fineness with pressure.

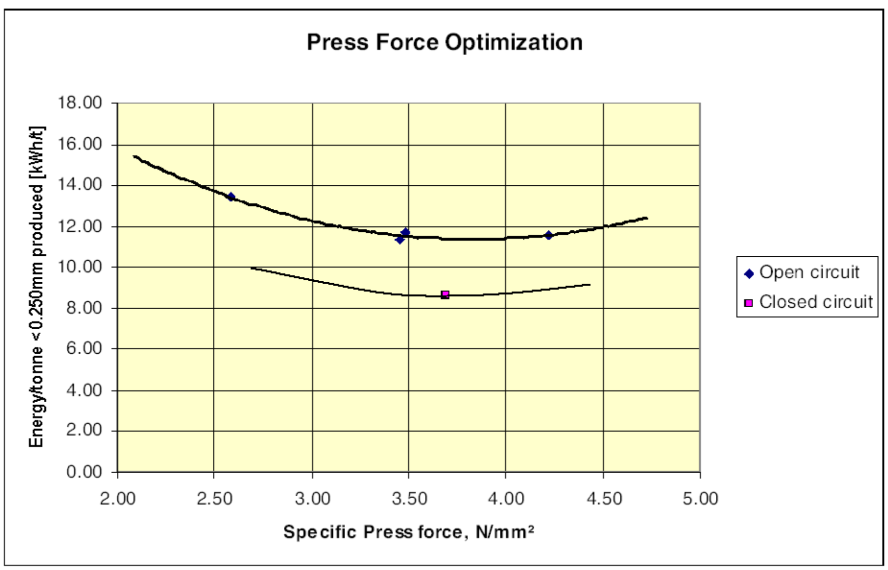


Figure 11. Variation of Product fineness with pressure.

6. Grinding Tests

6.1 Standard Bond Tests

Two standard Bond grinding tests were performed on the material: one on the original feed; the second on product of Test R 2.3 (from closed-circuit with dry screening). The results are given in the Table below. Size analyses of the Bond test feed and products are shown in Figures 12 & 13. The value obtained on the original feed was 17.8 kWh/mt. Treatment in HPGR resulted in a 10% reduction in the WI to 16.1 kWh/t.

Table 4. Summary of Standard Bond Test Results.

	Pi	Gbp	F80	P80	Wi (st)	Wi (mt)
Original ore	90	0.92	2541	64.7	16.2	17.8
R2.3 Product	90	1.06	2108	64.5	14.6	16.1

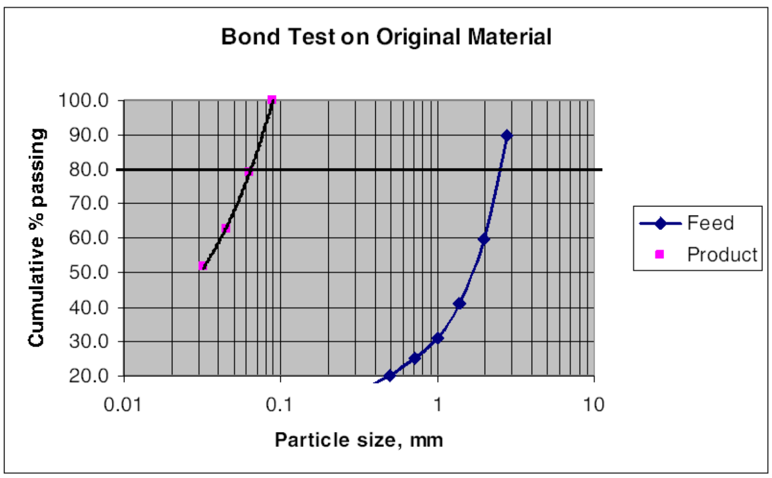


Figure 12.

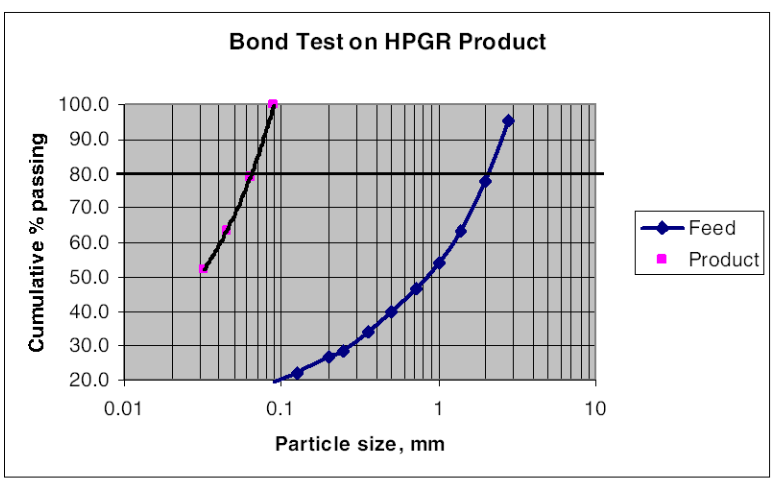
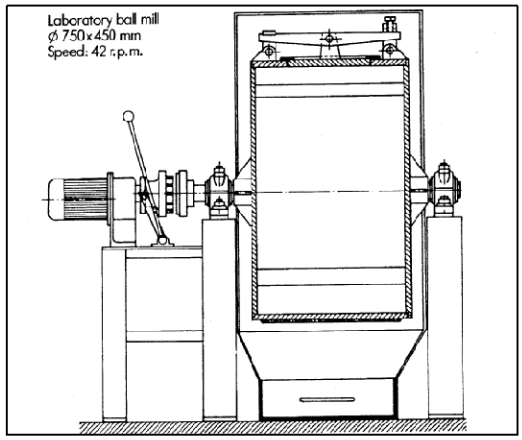


Figure 13.

6.2 POLYSIUS LABMILL Grinding Tests

The LABMILL grinding test was designed specifically for testing HPGR products without pre-crushing of the product for the test. The test is conducted dry in a 750 mm diam. x 450 mm wide ball mill on 7.5 litres of material. The feed, up to 30 mm in size, is ground stepwise using different ball gradings. The ball grading for each step is selected according to the material fineness. The energy consumption and material fineness is determined after each step.



The results are evaluated by plotting the specific energy consumption, in kWh/t, against the product fineness at a given size. Usually two sizes are selected, 90 µm and 200 µm. Linear regression lines are drawn through the points, and estimates are made of the energy required to achieve 80% passing a given size.

A comparison is then made between the energy required for the original feed and for the HPGR product, and the energy savings are calculated from the results. To even up the comparison, the feed was crushed to the top size of the product.

Industrial energy requirements may be calculated from the test results by applying scale-up factors. The LABMILL test is able to provide a realistic comparison of the ball mill energy required for materials with different size distributions. A summary of the LABMILL test results is given in the Table below.

Table 5. Summary LABMILL test results.

	LABMILL Grindability Test Results				
GRIND	**HPGR Feed**		**HPGR Prod.**		**Savings, %**
80% < 200µm	7.07	**kWh/t**	6.06	**kWh/t**	14.2
80% < 90µm	10.62	**kWh/t**	9.27	**kWh/t**	12.7
100% < 90µm	13.76	**kWh/t**	12.28	**kWh/t**	10.8

These indicated a potential energy saving at a P80 of 200 µm of 14% and at a P80 of 90 µm of 12%. Size analyses of the feed size distributions used in the tests are shown in Figure 14.

The energy-size relationships obtained in the tests are shown in Figure 15.

The results indicated higher energy savings than the Bond Tests. The difference in the results is attributable to the larger amount of fines generated in the product by the HPGR, which is not accounted for in the Bond calculations.

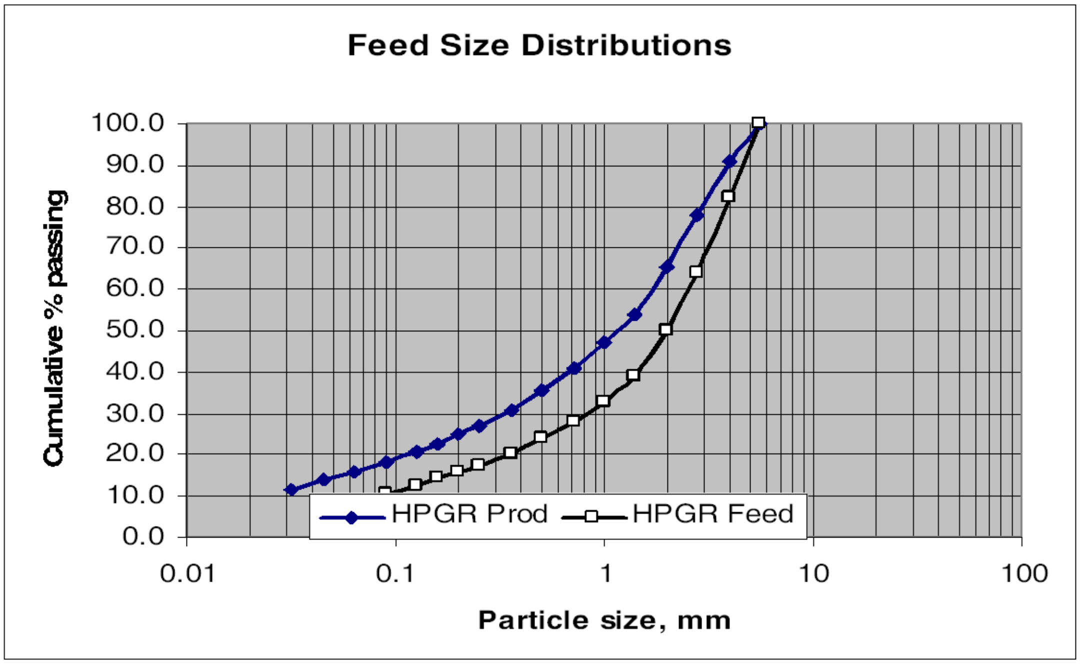


Figure 14. Feed to the LABMILL tests.

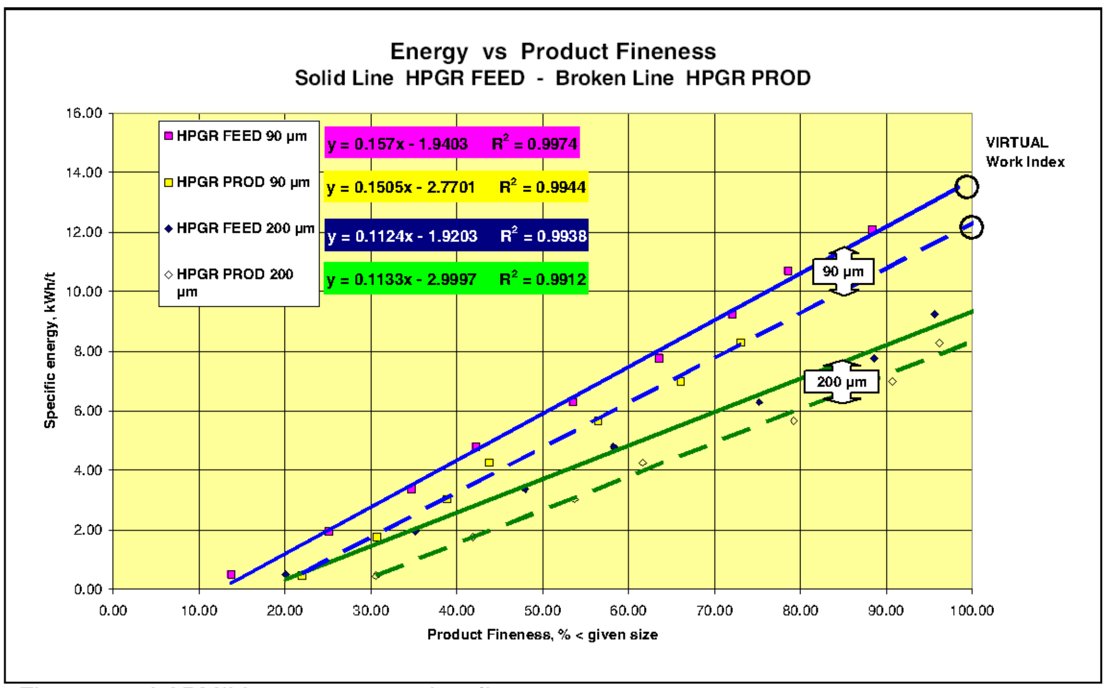


Figure 15. LABMILL energy vs product fineness.

7. Conclusions

1. The material was found to be of low to medium abrasiveness, ATWI index 9-15 g/t. The wear life of the rolls was estimated at 7000 h.

2. The size reduction achieved was better than average for copper ores, > 80% < 8.0 mm, >50% < 2 mm, >20% < 0.2 mm. Increasing pressure had a minimal effect. The max specific press force necessary was 3.5 N/mm².

3. The specific throughput for design purposes was 220 ts/hm³. Recycling of oversize in a closed-circuit operation had no significant effect.

4. The net specific energy consumption was 1.7 kWh/t at a specific press force of 3.5 N/mm² for dry material, and 2.0 kWh/t for wet material with 4-5% moisture content.

5. The material did not form competent flakes on pressing, and could be screened with relatively high efficiency.

6. The Bond Work index of the sample tested was 17.8 kWh/t before and 16.1 kWh/t after HPGR. Pressing in the HPGR resulted in a 10% weakening of the material, through the formation of micro-cracks.

7. LABMILL tests indicated potential energy savings in the order of 14% at a P80 size of 200 µm and 12% at 90 µm from the greater amount of fines created by the HPGR.