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Oceania Tasmania

Report for Zeehan Zinc - Comstock Processing Plant

Process Water Management Plan

July 2007

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

This report describes the Process Water Management Plan for Zeehan Zinc's Processing Plant at the Comstock Mine. The Comstock Processing Plant is planned to feature an initial gravity circuit with a capacity of 30 tph with potential to be upgraded to 100tph. Planning envisages a flotation circuit being introduced to the plant.

Initial estimates put plant water requirements at 230 m3/hour. The initial gravity plant has a requirement of 120 m3/hour.

The plant site lies on the upper catchment of Comstock Creek and the immediate vicinity has been subject to open cut and underground mining activities in the past. This has resulted in acid drainage contamination of Comstock Creek and also significant alteration to local stream flow. Most significantly an existing adit discharging into Comstock Creek to the south-west of the site appears to drain a substantial catchment of the old workings, potentially including captured surface water from the creek. The area has a high rainfall but is subject to extended dry periods during summer.

The intention of the Process Water Management Plan is to

a) Ensure a consistent supply of process water to the Mill

b) Ensure that water discharge quality meets licence conditions

2. Water Demand

The current gravity circuit is limited by the jig capacity at approximately 30 tph solids throughput, although the crushing circuit can cater for the final production rate. The process involves crushing and screening with a trommel then extracting of the mineralised fraction with jigs as shown in a PFD attached as Figure 1. The water requirement of the current plant is assessed as 120 m^3/hour. Approximately 40% of the water comes into the jig plant with the raw fines with the remainder added as the fines are sent to the jigs.

Approximately 16 tph is expected to be retained in the concentrate and 7 tph retained in the coarse tailings if this material is scalped off and the remainder discharging to the tailings storage facility (TSF). Due to the relative coarseness of the fine tailings fraction it is expected that the majority of the tailings transport water will be returned as decant. Allowing 15 m^3/hr retention of fine tailings transport water means an overall loss of approximately 40 m^3/hr.

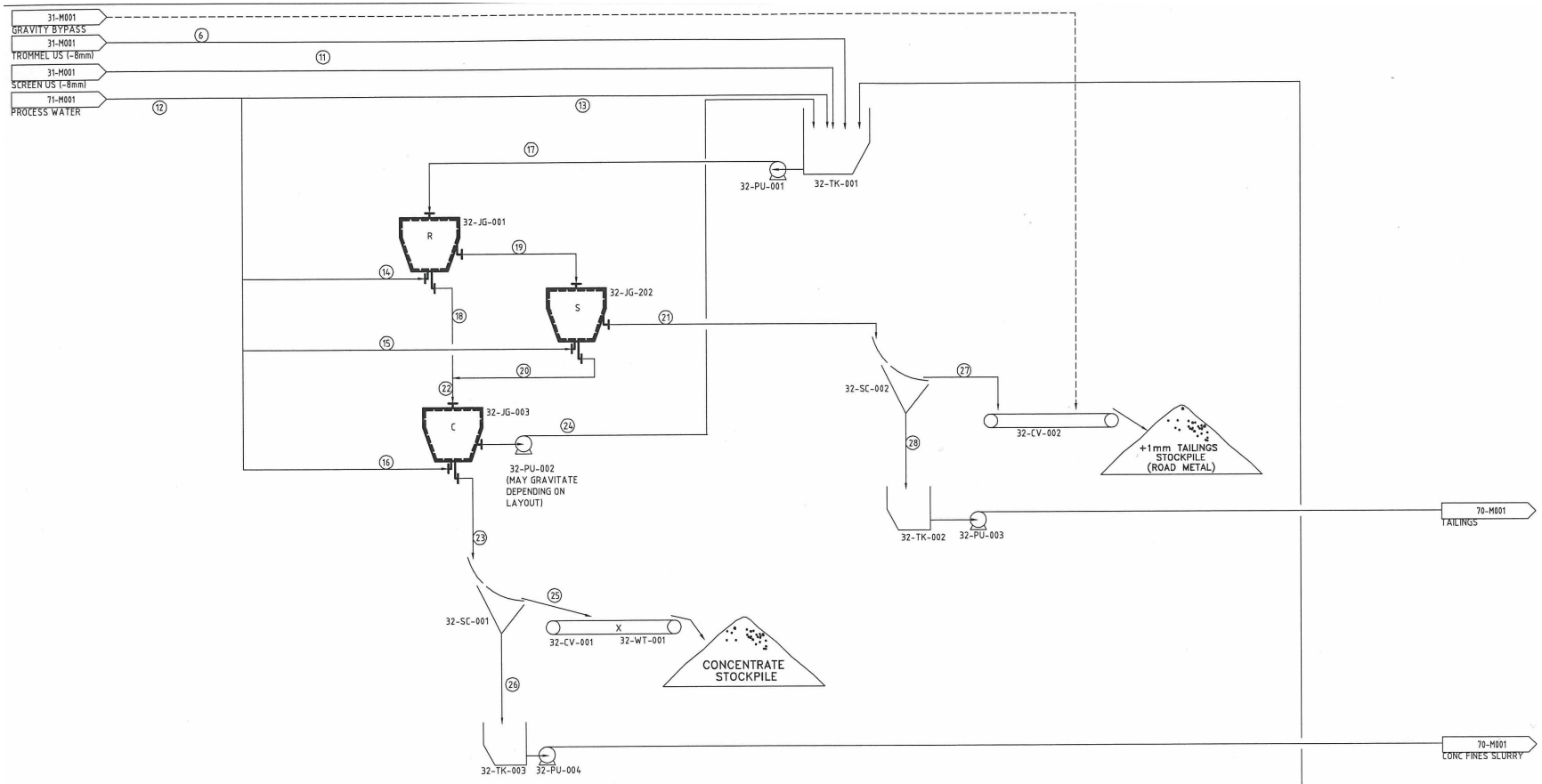
Upgrade of the gravity plant to 100 t/hr will involve various water saving processes so the water demand will not increase proportionally but losses will potentially increase to 120m^3/hr.

Once the flotation plant is operational the tailings will be finely ground and more water will be retained in the tailings. The approximate losses are estimated as follows:

Flotation tails solids content	45%
Flotation tails solids	100t/hr
Tailings transport water	120m^3/hr
Decant return @50%	60 m^3/hr
Retained water	60 m^3/hr
Other losses	50m^3/hr
Total make-up water required water recycling.	110 m^3/hr, 80 ML/month, 960 ML/annum, assuming maximum

Without recycling the total annual water consumption is estimated as 2000 ML.

Figure 1 **Preliminary Process Flow Diagram**



Stream No.	Units	6	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Label		TROMMEL US (-8mm)	SCREEN US (-8mm)	PROCESS WATER	PROCESS WATER	ROUGHER JIG WATER ADDITION	SCAVENGER JIG WATER ADDITION	CLEANER JIG WATER ADDITION	ROUGHER JIG FEED	ROUGHER JIG CONCENTRATE	ROUGHER JIG TAILS	SCAVENGER JIG CONCENTRATE	SCAVENGER JIG TAILS	CLEANER JIG FEED	CLEANER JIG CONCENTRATE	CLEANER JIG TAILS	CONCENTRATE SCREEN OS (+0.5mm)	CONCENTRATE SCREEN US (-0.5mm)	TAILING SCREEN OS (+0.5mm)	TAILING SCREEN US (-0.5mm)
Solids	tph	11.5	18.5	0.0	0.0	0.0	0.0	0.0	37.3	9.0	28.3	3.7	24.6	12.7	5.4	7.3	4.6	0.8	20.9	3.7
Water	tph	42.7	4.8	71.4	13.8	21.0	1.2	25.4	102.5	21.0	102.5	11.2	102.5	32.2	16.3	41.2	1.1	15.2	7.2	95.4
Total Flowrate	tph	54.2	23.3	71.4	13.8	21.0	11.2	25.4	139.8	30.0	130.8	14.9	127.1	44.9	21.7	48.5	5.7	16.0	28.1	99.0
% Solids	w/w	21%	79%	0%	0%	0%	0%	0%	27%	30%	22%	25%	19%	28%	25%	15%	80%	5%	74%	4%

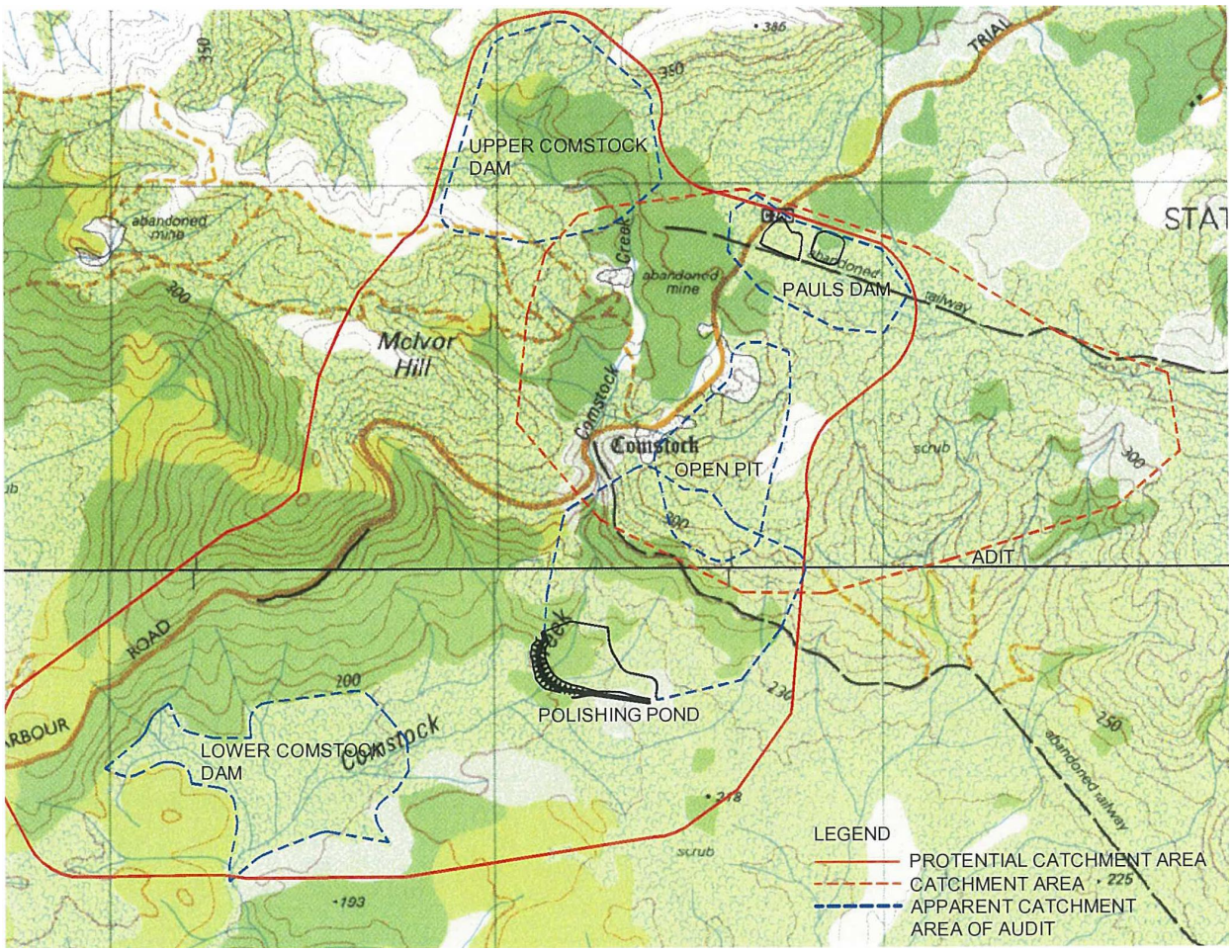
3. Water Resources and Required Infrastructure

3.1 Yield

The potential water collection catchments are shown on Figure 2. These are described as follows:

- Upper Comstock Dam – A potential water storage dam on the Upper Comstock Creek.
- Paul's Dam – A waterhole adjacent to the Trial Harbour Road
- Comstock Adit – An adit linking the underground and open cut workings
- Polishing Pond – A water storage Dam below the Swansea Waste Rock Dump
- Lower Comstock Dam – A potential water storage dam approximately 1km south-west of the mine site.

Figure 2 Potential Catchment Areas



The catchment areas and potential water yields from these catchments are presented in Table 1. The yields are based on the "Tool for Estimating Total Available Yields in Tasmania" published by the Tasmanian Department of Primary Industry and Water using a reliability factor of 80%.

Table 1 Comstock Mine – Water Resources

Catchment	Catchment Area Km^2	Total Annual Yield (ML) (80% reliability)	Average Annual Reliable Yield Summer Flow (m^3/hr)	Average Annual Reliable Yield Winter Flow (m^3/hr)
Upper Comstock Dam (potential)	0.3	390	23	67
Paul's Dam	0.137	180	10	30
Comstock Adit *	0.73	960	56	160
Polishing Pond	0.122	160	9	27
Lower Comstock Dam (potential)	2.6	3400	200	570

*area adjusted to account for actual measured flows

Table 1 shows that, given sufficient storage and maximising recycling, the Comstock Adit alone can supply 960 ML, the required annual make-up water demand. Adding the catchments of Paul's Dam and the Polishing Pond gives a total potential of 1300 ML or 50% more than the annual predicted make-up water requirement at full production. This means that recycling can be reduced during wetter periods provided water quality is acceptable for release. However recycling of some degree is essential unless a major storage is constructed at Lower Comstock.

Figure 3 shows the predicted spill from the Comstock Mine water management system comprising Paul's Dam, the Adit and Polishing Pond Catchments using rainfall data from the past 7 years and allowing for Mill draw of 80 ML/month. This shows that there would be no excess water several times per year and that this could persist for several weeks. Figure 3 also shows the prediction that an additional 80 ML of water would have been required to maintain water supply to the mill during the most severe dry periods.

The current storages are proposed at the site:

Polishing Pond – estimated current storage 40 ML with scope for raising to 52 ML by raising by 1m.

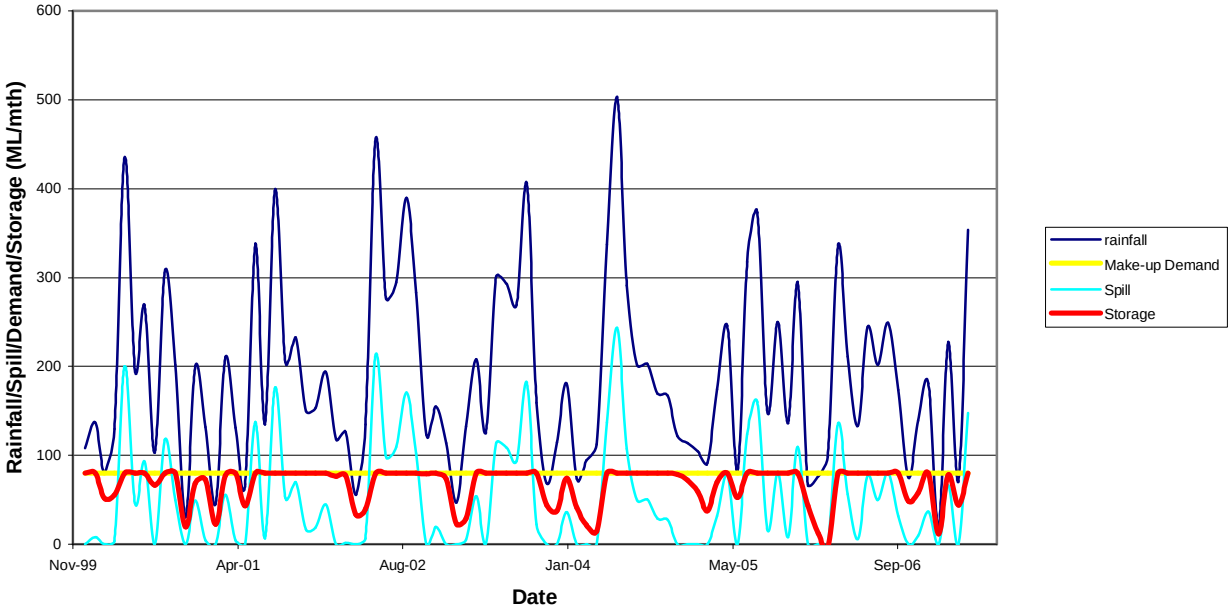
Pauls Dam – estimated current storage 10 ML.

Clearwater Storage – a proposed turkeys nest pond next to Pauls Dam. This is currently designed for 20 ML capacity but has scope for extension.

These storages have total capacity very close to the proposed ultimate water storage requirement and scope for enlargement. Consequently the catchment areas of the adit, Pauls Dam and Polishing pond will be sufficient to meet the Mill requirements both during the initial gravity plant operation and also for the 100t/hr flotation plant.

Additional storage at Upper Comstock or Lower Comstock catchments seem not to be required for the current planned operation. But this should be reviewed as monitoring data of actual water flows is gathered during the initial operating period.

Figure 3 Comstock Mine Water Balance



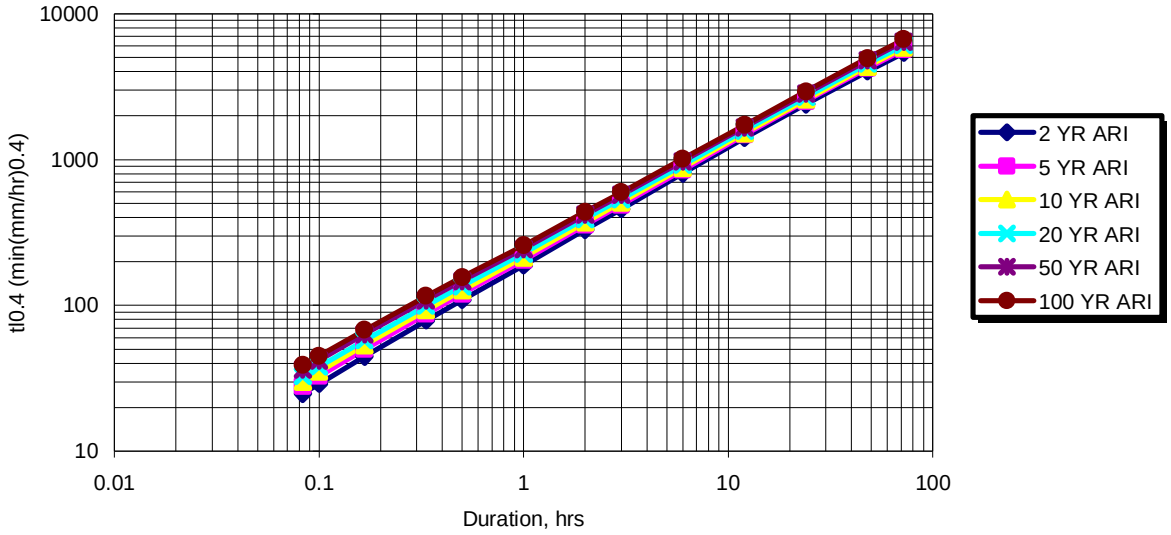
Note:

Rainfall	The estimated total rainfall over the Adit, Pauls Dam and Polishing Pond catchment areas
Make-up Demand	Demand for top–up water for the mill, (assessed as 80 ML/month)
Spill	Estimated spill from the Polishing Pond based on the difference between run-off and demand
Storage	Remaining storage in the site dams (based on total 80 ML capacity) during operations.

4. Flood Flows and Monitoring

The rainfall intensity chart for Zeehan is reproduced in Figure 4

Figure 4 Rainfall Intensity - Zeehan



The calculated AEP 1:1000 flood flow for the Polishing Pond is 1.4 cumec for the natural catchment. A total flood flow of 2 cumecs is proposed to allow for other inflows from the tailings decant and adit.

Normal spill flows from the Polishing Pond are a maximum of 500 ML/month or 200L/sec. The flow monitoring system should comprise a v-notch weir to cover up to 200L/sec (450 deep, 90^{o}) and broad crest for larger flows. Three 900 by 900 box-culvert sections are proposed with weir plates.

5. Water Infrastructure

Preliminary information on the site water infrastructure is presented on the construction drawings attached as Appendix A. Pump details and pump curve are attached in Appendix B.

The pumps and pipework are designed to allow full recycling of up to 230 m3/hr. Key components are described as follows:

5.1 Polishing Pond

The polishing pond is an earth and rockfill dam with full supply level 206, crest level 207 and storage capacity of approximately 40 ML. The polishing pond catchment includes the waste rock dump and tailings storage together with the adit discharge. The pond has a typical retention time of 5 days for the combined runoff and recycled water load.

The Polishing Pond features a floating suction outlet feeding a high lift pump system capable of 65 l/sec at 130 m head.

A 250 DN polyethylene pipe transfers water from the pumpstation to head tanks above the Mill at RL 213.

The spillway features a V-notch weir and water monitoring station

5.2 Adit

A major adit discharging to Comstock Creek to the south of the mill intercepts underground and surface workings. Flow is understood to consistently average approximately 45 L/sec. This flow is intercepted, treated with caustic soda and diverted to the Polishing Pond via a series of aeration weirs.

The diversion pipe is 250 DN PE 100 PN 10 polyethylene.

5.3 Settling Pond (Paul's Dam) and Clear Water Storage

Paul's Dam is an excavated pit able to collect surface runoff from the vicinity of the old tramway. The capacity is approximately 10 ML. A turkey's nest Clear Water Storage is located immediately to the east. Stormwater is settled in Paul's Dam then pumped to the Clear Water Dam. This has a storage capacity of approximately 20 ML. Water is pumped from the Clear Water Storage via a 250 PE100, PN 10 pipeline.

Transfer Pump capacity is

Pauls Dam	65 l/sec at 7.5 m head.
Clearwater Pond	65 l/sec at 18 m head.

5.4 Mill Head Tanks and Mill Feed Pipe

Both Clear Water and Polishing Pond Pumps feed to a tank farm above the mill. The tank farm comprises 6 No 40 m3 tanks giving a total 240 m3 capacity. A 250 PE100 PN10 pipe feeds to the Mill. This has a capacity of 230m3/hr. The tank capacity provides approximately 1 hour storage. The pump controls will be based on level switches at the tanks and at the source storages with the logic for

operation giving priority to the Clear Water Storage. Thus in wet weather the maximum water supply will be taken from the Clear Water Dam. When the level in the Clear Water Dam drops, make up water will be drawn from the Polishing Pond. In dry weather the Polishing Pond will become the major source with maximum water recycling.

6. Adit Water Treatment

Water quality monitoring of the Comstock Adit and the Comstock Creek has shown that the creek is somewhat contaminated upstream of the site and increasingly so downstream of the adit. Representative water quality data averaged from data taken 2003 –2005 is presented in Table 2.

Table 2 Representative Water Quality from Comstock Creek and Adit

Site	TSS Mg/L	Cond.	pH	Al υg/L	As υg/L	Cd υg/L	Co υg/L	Cu υg/L	Fe υg/L	Mn υg/L	Ni υg/L	Pb υg/L	Zn υg/L
W1 (u/s)	4.5	105	4.65	250	178	6	9	7	5500	1100	21	115	3300
W3 (adit)	100	925	3.5	4000	174	40	59	11	49000	9390	115	243	30000

The required water quality for the gravity circuit is not critical but pH control will be important when the flotation plant comes on line. With the gravity plant operational the normal water returned to the mill will comprise a mixture of adit water and tailings decant. The latter is expected to be neutralised by contact with tailings, which should initially include a net neutralising capacity prior to oxidation. Consequently the mixed return water should be of improved quality compared to the raw adit water. Similarly, spill from the Polishing Pond during winter will be a combination of adit water plus decant from the tailings and natural stormwater runoff and should be of improved quality particularly after contact in the Polishing Pond.

The water quality requirement for discharge from the Polishing Pond is that pH needs to be a maximum of 1 pH unit below that of the Comstock Creek upstream. This essentially means maintaining the status quo. This criteria could be met during normal operations but might need some control, particularly during mill shutdown. Accordingly a simple caustic dosing system is proposed to allow manual dosing of the adit water prior to discharge to the Polishing Pond. This system will comprise a dosing pump delivering the caustic to the adit outlet via a small diameter pipeline. The caustic will be supplied in 1000 L polyethylene bulk containers of 50% solution. An immersion heater will be used to maintain the solution above its 6^{o} freezing temperature. The container will be bunded with a portable plastic bund. The extent of dosing will be manually adjusted by reference to the continuous pH monitoring station at the Polishing Pond outlet.

The dosed water will be piped to the old creek bed below the Comstock Creek Diversion and passed over rockfill weirs to aerate the flow. This is expected to precipitate iron and possibly other metals as hydroxides. The extent and performance of the precipitates is currently unknown and will depend on the extent of dosing necessary. This will need to be reviewed and the need for further treatment assessed once the system is operational.

Appendix A

Water Infrastructure Drawings

Appendix B

Pump Data

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