Tailings Management Plan

Doris North Gold Mine

Nunavut

Submitted by:

Miramar Hope Bay Limited

North Vancouver, British Columbia

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1.0 INTRODUCTION

Miramar Hope Bay Limited has developed a tailings management plan for the Doris North Project. It is a component of the site's Environmental Protection Plan.

This plan outlines the management strategy and procedures to be used to manage:

- The deposition of flotation tailings produced through the milling of ore; and
- All water to be released from the Tail Lake tailings containment system.

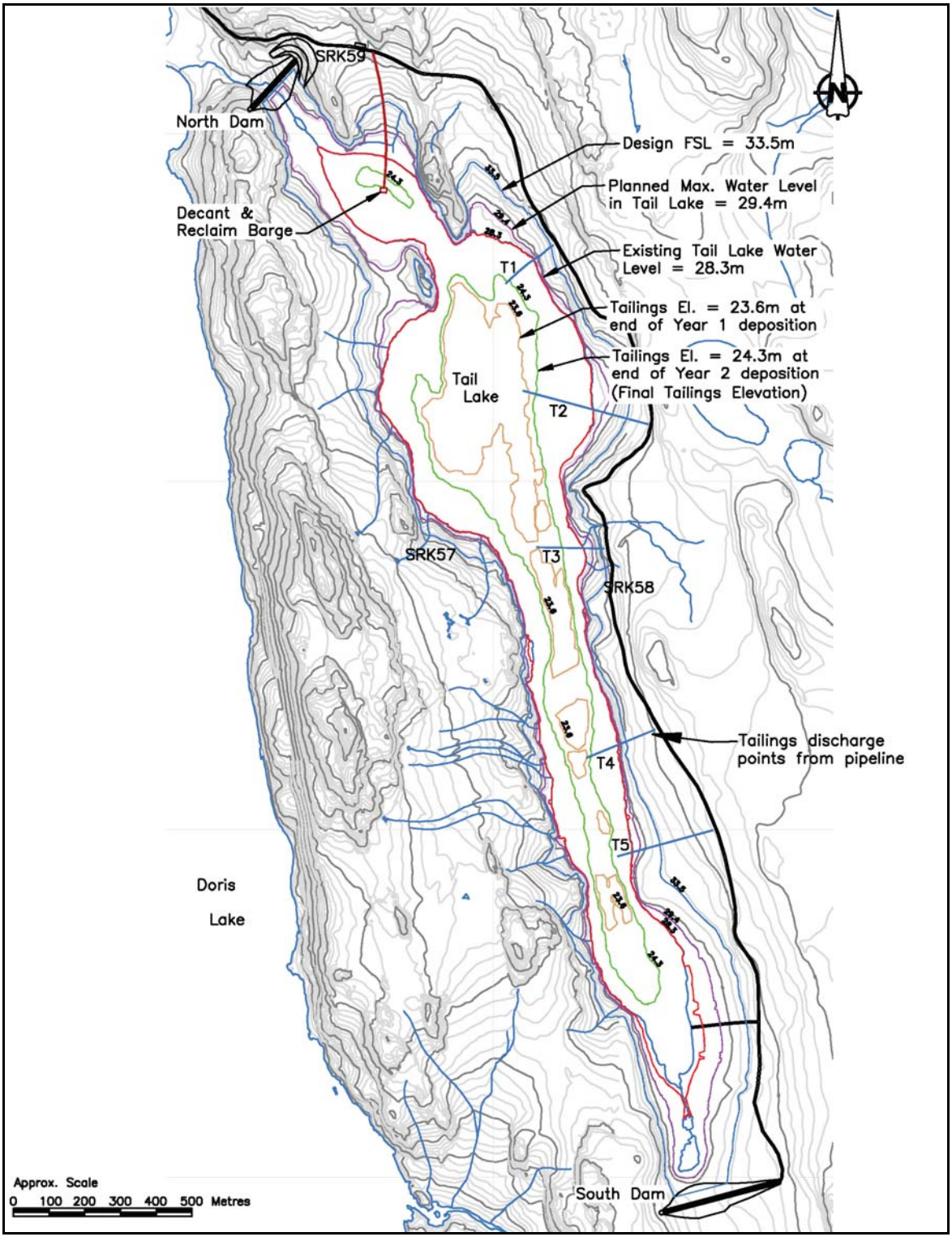
This Plan is a "living document" and will be reviewed and updated periodically during the mine life to ensure that site experience with tailings management procedures are captured and shared amongst all operating staff (adaptive management).

2.0 CONSTRUCTION OF TAILINGS IMPOUNDMENT AREA (TAIL LAKE)

Flotation tailings and a small volume of treated barren bleed solution produced during the milling process will be deposited in Tail Lake located about 5 km from the proposed mill location (see Figure 1). Tailings deposition will be sub-aqueous, requiring the construction of two water retaining structures: the North Dam and the South Dam. The North Dam is designed to retain a maximum hydraulic head of 7.5 m and the South Dam 2.0 m.

The tailings impoundment is sized to operate as a zero discharge facility during the two years of operation, if necessary; however, the proposed water management strategy is based on the annual release of supernatant from the impoundment. In addition, under the most conservative water balance assumptions, Tail Lake would take just over five years to reach the design Full Supply Level (FSL) of 33.5 m with no discharge. A permanent spillway will be constructed at this elevation, to prevent the possibility of dam overtopping.

Figure 1: Site Plan of Tail Lake



2.1 Construction of Dams and Embankments

The two dams will be constructed as water retaining structures. They will be frozen core dams founded on non-organic permafrost and/or bedrock. The frozen core integrity will be ensured by the installation of passive thermistors in the core key trench. Secondary containment will also be provided by installation of a geosynthetic clay liner (GCL) upstream of the core. The core, transition (filter) and outer shell construction materials will be processed local quarry rock. The detailed design reports for these two dam structures can be found within the following documents:

- Design of the Tailings Containment Area, Doris North Project, prepared by SRK Consulting (Canada) Inc, dated October 2006;
- Engineering Drawings for Tailings Containment Area and Surface Infrastructure Components, Doris North Project, prepared by SRK Consulting (Canada) Inc., dated October 2006; and
- Technical Specifications for Tailings Containment Area and Surface Infrastructure Components, Doris North Project, prepared by SRK Consulting (Canada) Inc, dated October 2006.

The geometric design of the dams has been based on the results of numerous field investigations, including seven detailed geotechnical drilling programs between 2002 and 2006, and a geophysical survey completed in 2006. These investigations specifically targeted geotechnical and thermal information at potential dam locations and along the perimeter of Tail Lake. The subsurface investigations included the installation of temperature measuring devices (thermistors) in selected holes, to aid in the determination of temporal permafrost conditions. Ground temperature measurements along the dam alignments indicate that permafrost is present over the entire length of the dams, with mean annual ground temperatures ranging between -9 °C and -7 °C.

Detailed equipment to monitor the dam performance will be built-in during the construction phase, and a rigorous monitoring and reporting program will be followed through to final decommissioning of the dams.

2.2 Roads, Pipelines and Distribution Lines

Tailings will be deposited into Tail Lake, necessitating a 5.5 km, 5 m wide all-weather service road. A 127 mm diameter insulated tailings feed line and a 100 mm diameter, insulated and heat traced return water pipeline will be placed on the shoulder of the road, taking up at least 1.5 m of the roadway space. The pipelines will be placed on the outside edge of the roadway, *i.e.,* closest to the Tail Lake shoreline. This will minimize the number of pipe crossings required.

A pump house pad will be constructed next to the tailings service road close to the North Dam (Figure 1). The control instrumentation for the tailings decant and reclaim water systems will be housed in a structure erected on this pad.

3.0 TAILINGS DEPOSITION

Flotation tailings and treated barren bleed solution (tailings) produced during the milling process will be deposited in Tail Lake about 5 km from the proposed mill location. Tail Lake is 81 ha in size within a catchment area of 4.4 km^2. The normal water level in Tail Lake is 28.3 m above sea level. Detailed bathymetry for Tail Lake confirms that it is a shallow lake, with a maximum depth of 6 m. Tail Lake has a discontinuous outflow into Doris Lake immediately upstream of the Doris outflow creek. Ogama Lake (158 ha in size) is situated immediately south of Tail Lake and its normal water level is at 24.3 m above sea level. The height of land between the lakes is at 33 m above sea level. The normal volume of Tail Lake is approximately 2,2 million m^3.

The tailings will be pumped as a slurry with a solids content of 36% solids by weight and will be discharged sub-aqueously into Tail Lake. The discharge location will not be fixed, but will be moved around such that the tailings impoundment can be sequentially filled from its deepest location. This deposition methodology will enable the final closure water level to be returned to its pre-deposition value of 28.3 m. Tailings will be pumped from the mill to Tail Lake via a 127 mm insulated pipeline. The pipeline route will be southwest from the mill site towards the northwest shore of Doris Lake. From there the pipeline will continue along the Doris Lake shore towards a crossing at the Doris outflow before continuing south-west towards the Tail Lake shoreline. The maximum piping distance from the mill to the southern tip of Tail Lake will be 5.5 km.

Return water will be pumped from Tail Lake to the plant through a heat traced and insulated 100 mm diameter HDPE line. Both tailings and return water pipelines will follow the alignment of the tailings service road.

Operationally the pipe settling and freezing risk will be managed by constructing emergency dump catch basins strategically along the pipeline to allow drainage of the pipeline in the event of a pump stopping. This would ensure controlled containment of the tailings. The emergency dump catch basins located outside the Tail Lake watershed will be sized to hold the contents of both the tailings and reclaim water pipelines. Within the Tail Lake watershed, the reclaim water line will drain by gravity onto the tundra and into Tail Lake; consequently, the emergenecy dump catch basins within the Tail Lake watershed have been sized to hold only the contents of the tailings pipeline.

The emergency dump catch basins have been sized to allow two sequential fillings plus an additional 0.5 m of freeboard. Containment in each basin will be provided by HDPE lining.

4.0 TAIL LAKE WATER MANAGEMENT

A water management strategy for the Tail Lake tailings containment system was developed by SRK Consulting (Canada) inc. (SRK) for MHBL and is a component of the *Water Quality Model, Doris North Project, Nunavut, Canada* report, prepared by SRK dated October 2006 (see Water License Application document – Supporting Document S6). The following management plan is drawn from this source.

4.1 Objectives

The primary objective of the Tail Lake water management strategy is to meet CCME guidelines (Canadian Water Quality Guidelines) for parameters of concern to protect freshwater aquatic life in Doris Creek, downstream of the waterfall.

4.2 Doris Creek Flow Monitoring

A pressure transducer will be installed at a suitable location within Doris Creek to facilitate real time monitoring of flow. The pressure transducer will be connected to a programmable logic controller (PLC) that would record flows in Doris Creek and be used to control the discharge flow rate. If initial monitoring suggests that greater accuracy is required, a flow monitoring weir may be constructed in Doris Creek at a location approximately 50 to 100 m upstream of the waterfall, as dictated by site conditions.

During periods of active discharge, the flow level in Doris Creek will be monitored visually on a daily basis and checked against the real time monitoring results. For this purpose, a staff gauge will be installed at the location where the pressure transducer is located. The area will also be inspected on a daily basis for ice and any debris, and cleared as required to ensure accurate monitoring of flows.

4.3 Determination of the Discharge Rate

The discharge rate will be determined in two steps. In the first step, the Allowable Discharge Volume Ratio (ADVR) is calculated as follows:

$$ADVR(Cu) = (CCME_{Cu} - [Cu]_{DC}) / ([Cu]_{TL} - CCME_{Cu})$$

Where $[Cu]_{DC}$ = copper concentration in Doris Creek (mg/L),

$[Cu]_{TL}$ = copper concentration in Tail Lake (mg/L), and

$CCME_{Cu}$ = CCME Freshwater Aquatic Guideline or site specific objective for copper (mg/L).

The ADVR for other key parameters would then be calculated on the same basis. The lowest ADVR ($ADVR_{MIN}$) is then selected as the controlling ADVR.

In the second step, the target discharge rate (TDR) is calculated as follows:

$$TDR = Q_{DC} * 0.8 * ADVR_{MIN}$$

Where TDR = target discharge rate (m^3/s), and

$ADVR_{MIN}$ = lowest allowable discharge ratio.

The factor 0.8 is a factor of safety that will ensure that the discharge contaminant loading remains at or below 80 percent of the CCME guideline in Doris Creek. This conservatism is applied to allow for potential upset conditions in flows or analytical results.

4.4 Discharge Control

The discharge system will comprise the installation of a discharge control system that will accurately control and measure the discharge flow rate over a flow range spanning 50 L/s to 275 L/s. A programmable logic controller (PLC) will be used to both control the discharge rate as well as log instantaneous flow rates and cumulative discharge volumes. The flow would be controlled with an actuated flow control valve, with excess flow recycled back to Tail Lake. The PLC will actuate the flow control valve to discharge Tail Lake water at a fixed ratio, equal to the TDR, relative to the flow in Doris Creek.

The pump intakes in Tail Lake (for the operational period) will be mounted on a floating barge system well away from the tailings discharge point to minimise suspended solids in the intake. Silt curtains will be installed around the pump intake to minimise intake of suspended solids.

The discharge to Doris Creek will be located sufficiently downstream from the flow monitoring location to ensure that the discharge will not interfere with flow measurements in Doris Creek, but sufficiently upstream of the waterfall to ensure complete mixing with Doris Creek water. The outlet will be placed such that the discharge flow will not lead to erosion or degradation of the creek bed.

4.5 Operational Strategy

Starting in Year 1, the discharge strategy will be implemented as follows:

- Prior to commencement of milling, the laboratory will be set-up and analytical procedures developed, documented and verified. Sampling protocols will also be documented and verified.
- Two weeks prior to commencement of operations (assuming a spring start-up), water quality in Tail Lake and Doris Creek will be monitored every second day to establish baseline conditions.
- Real-time monitoring of the flows in Doris Creek will commence as soon as practical during the open water season. The pressure transducer would be connected to a programmable logic controller (PLC) that would record flows in Doris Creek and be used to control the discharge flow rate.
- Commencing with the start of tailings deposition, Tail Lake will be monitored for an additional two weeks every second day. As the dynamics of the system, i.e. rate of change in water quality, becomes better understood, the frequency of monitoring could be reduced.
- Before any discharge would commence, Tail Lake water would be submitted for toxicity testing and metals analysis. Only if the water meets MMER criteria will discharge from Tail Lake commence. The flow ratio would be calculated for each sampling event and adjusted as necessary. The discharge flow would be

controlled by the automated flow control system which would use the real time flow monitoring in Doris Creek to control the discharge flow rate. Flow rates would automatically be logged by the flow control system.

In subsequent years, it is anticipated that at the start of the open water season the analytical turnaround time will likely prevent discharge for the first few days. The downstream together with the upstream and Tail Lake water quality monitoring results will be used to verify the performance of the discharge system at regular intervals and to make flow control adjustments as appropriate.

As part of the control strategy, the actual water quality in Tail Lake will regularly be compared with the predicted water quality to assess the accuracy of the model. If necessary, the model may be recalibrated to the actual water quality observed in Tail Lake. The model would then be rerun to assess potential implications on the discharge strategy and to determine future operational requirements.