Monitoring and Follow-Up Plan

Doris North Project, Nunavut

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1.0 INTRODUCTION

1.1 Background

Miramar Hope Bay Ltd. (MHBL) proposes to construct and operate an underground gold mine called the Doris North Project (the Project) in the West Kitikmeot Region of Nunavut. The project is located 685 km northeast of Yellowknife and 125 km southwest of Cambridge Bay (Figure 1-1). The mine is on Inuit owned land, approximately 5 km south of the Arctic Ocean. The nearest communities are Umingmaktok, located 65 km to the west, and Bathurst Inlet, located 110 km to the southwest.

The Project will consist of an underground gold mine, associated mill site, roads, buildings, camp and other necessary infrastructure (Figure 1-2). The mine will process about 720 tonnes of ore per day producing approximately 8,700 kg (306,830 ounces) of gold. The terrestrial disturbance from the Project will be 57 ha. The Project will have a 24 month operating life employing approximately 165 persons.

Several monitoring and follow-up programs have been developed for the Doris North Project as part of corporate commitments, regulatory approval conditions (e.g., Project Certificate from the Nunavut Impact Review Board) and as a result of stakeholder consultation. This report summarizes the environmental monitoring programs that will be implemented for the Doris North Project.

1.2 Purpose of Follow-up Monitoring

A follow-up monitoring program is used to verify the accuracy of the environmental assessment and/or to determine the effectiveness of mitigation. Typically, follow-up programs are focused on issues associated with potentially significant adverse environmental effects or negotiated mitigations, such as fisheries compensation to replace productive capacity of lost fisheries habitat due to the project. Monitoring data will be analyzed to help determine if there are any undesirable environmental effects as a result of project activities.

All environmental monitoring programs are designed by qualified scientists using widely-accepted scientific standards. The monitoring and follow-up programs will be conducted by qualified and experienced professionals or technicians, with assistance, where practical, of Inuit hired from the region.

The following monitoring programs are summarized in this document:

- Air Quality and Climate Monitoring;
- Noise Monitoring;
- Hydrology Monitoring;
- Site Water Quality Monitoring;
- Tailings Geotechnical Monitoring;

- Waste Rock Characterization
- Aquatic Effects Monitoring;
- Fish Monitoring;
- Vegetation and Soil Quality Monitoring; and

Table 1-1 outlines the monitoring parameters, sampling location, and sampling frequency for each monitoring program

1.3 Purpose and Scope of the Follow-Up Monitoring Plan

The purpose of the Monitoring and Follow-Up Plan is to provide a consolidated summary of the monitoring and follow-up programs committed to by Miramar Hope Bay Ltd. at the Doris North Project (Doris North) in Nunavut. These programs are intended to collect high quality data to:

- Enable MHBL to monitor and report on performance compliance with all environmental legislation, regulations, Licenses, Permits, Leases and/or Authorizations applicable to ongoing operation of the Doris North Project
- Enable MHBL to obtain good quality data on environmental conditions at and around the mine to facilitate appropriate management of MHBL's activities and facilities at the Doris North Project;
- Allow MHBL to check the validity of the assumptions that were made during the design phase of the project and provide the data needed to adaptively manage its activities if such assumptions are shown to be incorrect; and
- Allow MHBL to check the validity of the environmental impact assessment predictions made during the environmental assessment process and modify its activities if measured impacts are worse than predicted.

These procedures are an integral component of the overall Environmental Protection Plan (EPP) for the proposed Doris North Project and will be periodically reviewed and updated as Doris North moves through construction, operations, and final closure and reclamation. This Plan is a "living document" and will be reviewed and updated periodically during the mine life to ensure that site experience with all monitoring and follow up activities are captured and shared amongst all operating staff (adaptive management).

This Management Plan is a component of the Doris North Environmental Management System and will be updated after the water license has been issued to incorporate any new commitments made by MHBL during the license process and to incorporate any conditions contained within the water license relating to the monitoring and follow-up. This Management Plan is to be reviewed annually during the first quarter of each calendar year by the mine's environmental staff and updated as needed to reflect changes in operating

procedures. The revised Monitoring and Follow-Up Plan will be made available to the appropriate mine operating staff with appropriate refresher training and sent to the Nunavut Water Board for inclusion in the public registry.

The Monitoring and Follow-Up Plan is intended to provide the mine's operating staff with a summary of the monitoring and follow up commitments that were developed through the environmental assessment and project design process. It similarly provides a summary of the same to the regulatory agencies and to the land owner who have regulatory interest over the mine facilities.

1.4 Cross Reference to Detailed Monitoring Plans

This Plan is intended to be a summary of the Monitoring and Follow-Up Plans. The reader is referred to the following supporting documents to the Revised Water License Application Support Document, April 2007, for more detailed information regarding the monitoring programs summarized in this document:

- Design of the Tailings Containment Area Doris North Project, Hope Bay, Nunavut, Canada (Supporting Document S1 to the Revised Water License Application Support Document, April 2007 – Section 11);

- Design of the Surface Infrastructure Components Doris North Project, Hope Bay, Nunavut, Canada (Supporting Document S2 to the Revised Water License Application Support Document, April 2007 - Section 7 on monitoring and instrumentation);

- Engineering Drawings For Tailings Containment Area and Surface Infrastructure Components, Doris North Project, Nunavut, Canada (Supporting Document S4 to the Revised Water License Application Support Document, April 2007 – Drawings G-04 Thermistor locations, T-09 and T-10 – Instrumentation for North and South Dams);

- Hydroclimatic Parameter Re-Evaluation (Supporting Document S5 to the Revised Water License Application Support Document, April 2007);

- Water Quality Model (Supporting Document S6 to the Revised Water License Application Support Document, April 2007 – Section 5.2);

- Geochemical Characterization of Quarry Materials (Supporting Document S7 to the Revised Water License Application Support Document, April 2007 – Section 4.3);

- Geochemical Characterization of Portal Development Rock (Supporting Document S8 to the Revised Water License Application Support Document, April 2007 – Section 5);

- Air Quality Management Plan (Supporting Document S10b to the Revised Water License Application Support Document, April 2007 – Section 3.2 for Air Quality and Section 3.3 for Meteorological monitoring);

- Noise Abatement Plan (Supporting Document S10c to the Revised Water License Application Support Document, April 2007 – Section 2 for Environmental noise monitoring and Section 3 for Health and Safety Noise Monitoring);

- Waste Rock Management Plan (Supporting Document S10d to the Revised Water License Application Support Document, April 2007 - Section 4.2 and Section 7);

- Landfill Management Plan (Supporting Document S10g to the Revised Water License Application Support Document, April 2007 – Section 5.2);

- Landfarm Management Plan (Supporting Document S10h to the Revised Water License Application Support Document, April 2007 - Section 4.7);

- Tailings Management Plan (Supporting Document S10i to the Revised Water License Application Support Document, April 2007 - Sections 4.1 and 4.2);

- Water Management Plan (Supporting Document S10j to the Revised Water License Application Support Document, April 2007 – Sections 6 and 9);

- Quality Assurance/Quality Control Plan (Supporting Document S10k to the Revised Water License Application Support Document, April 2007 – all sections);

- Aquatic Effects Monitoring Program (Supporting Document S11 to the Revised Water License Application Support Document, April 2007 -Golder 2003);

- Doris North Project No Net Loss Plan – Revision 5 (Golder 2005a and Supporting Document F4 in the Doris North Gold Mine Project FEIS); and

- Wildlife Mitigation and Monitoring Program (WMMP) (Golder 2006)).

1.5 Construction Phase Monitoring Program

Construction activities associated with the development of mine infrastructure have the potential to produce negative environmental impacts if the proper techniques are not implemented throughout all stages of development. Although activity specific method statements are available and accessible to the individuals directly conducting works in the field they are not always completely aware of, or informed as to, their proper implementation. As well, specific site conditions may warrant the alteration of techniques or materials, thereby lessening the impact on the environment. The role of the construction monitor will be to ensure that field workers understand and abide by the commitments made to governing bodies and regulatory agencies, openly communicate adaptive techniques for lessening or mitigating impacts, to document construction progress on a daily basis with photographs, and to directly communicate findings and resolutions to Miramar head office.

Construction monitoring will by its nature have to be adaptive in nature, that is daily monitoring and sampling activities will be driven by the type of construction activity being undertaken on that day and on the local conditions (weather, presence

of snow cover, etc.). There are however a number of monitoring activities that will take place during the construction period. These include but are not necessarily limited to the following types of monitoring:

- Blast vibration monitoring for quarrying activity carried out in close proximity to fish bearing waters;
- Monitoring of the performance of erosion protection measures employed by the construction contractor;
- Monitoring for sediment release from construction areas;
- Monitoring for wildlife interactions;
- Monitoring to ensure the protection of all migrating birds and their nesting sites;
- Follow-up geochemical sampling of quarried rock used in construction of site roads and pads to verify that the rock used is non-acid generating as predicted;
- Monitoring of the waste management practices employed by the contractors and their employees (food waste, hazardous wastes such as engine oil and filters, etc., non-hazardous wastes);
- Monitoring of contractor's activity to minimize ground impacts to the tundra, i.e., keeping vehicles off the tundra and on constructed roadways;
- Monitoring of dust generation and use of water by the contractor to manage dust emissions from crushing and construction activity; and
- Vegetation monitoring as discussed in Item #38 below

In addition to these types of construction monitoring, MHBL intends to continue its collection of baseline information on water quality, water quantity, climate conditions, air quality, noise monitoring, and wildlife within the Project area during the construction period (2007 and 2008).

Figure 1.1: Location of the Proposed Doris North Project

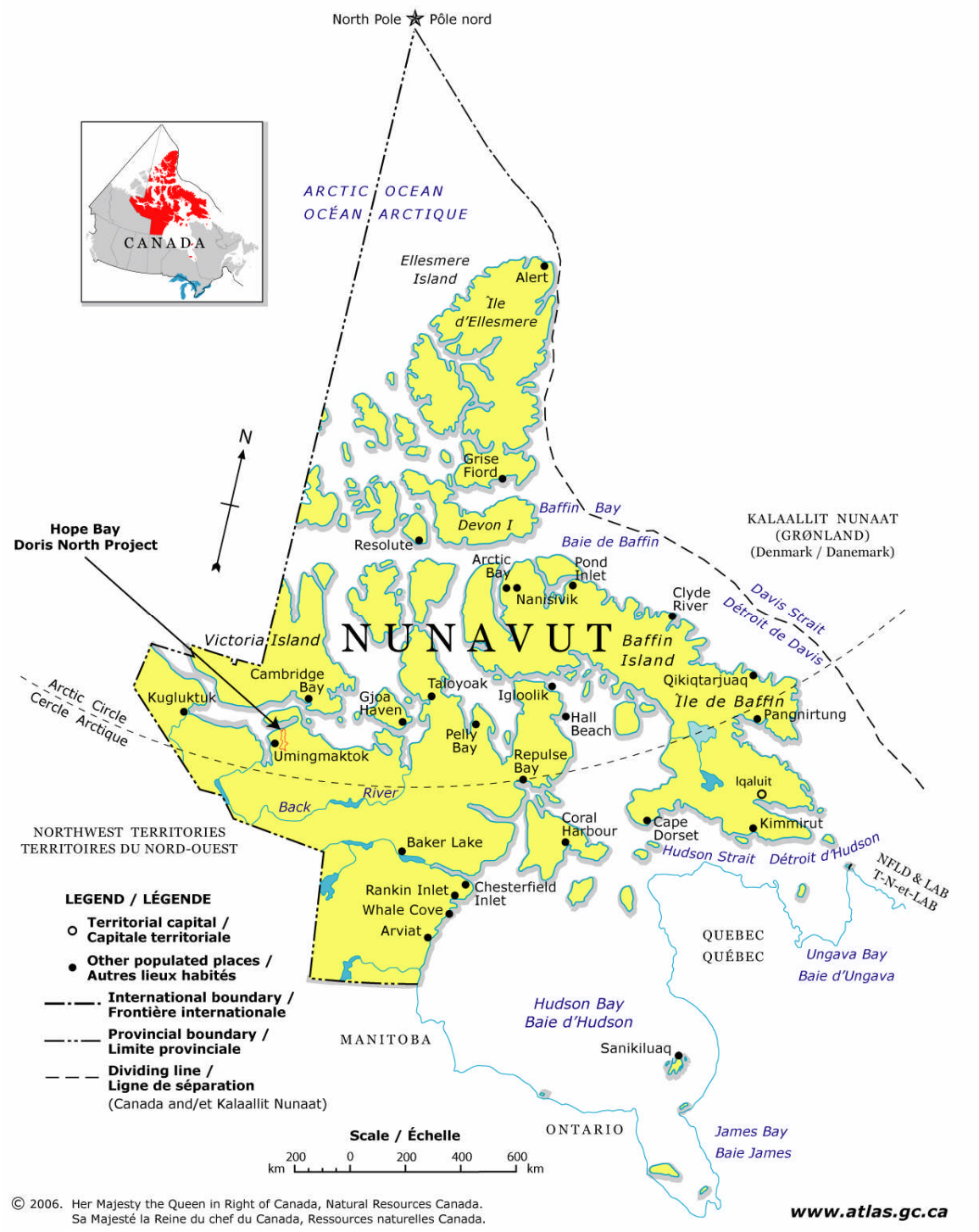


Figure 1.2: Site Infrastructure Layout of the Doris North Project

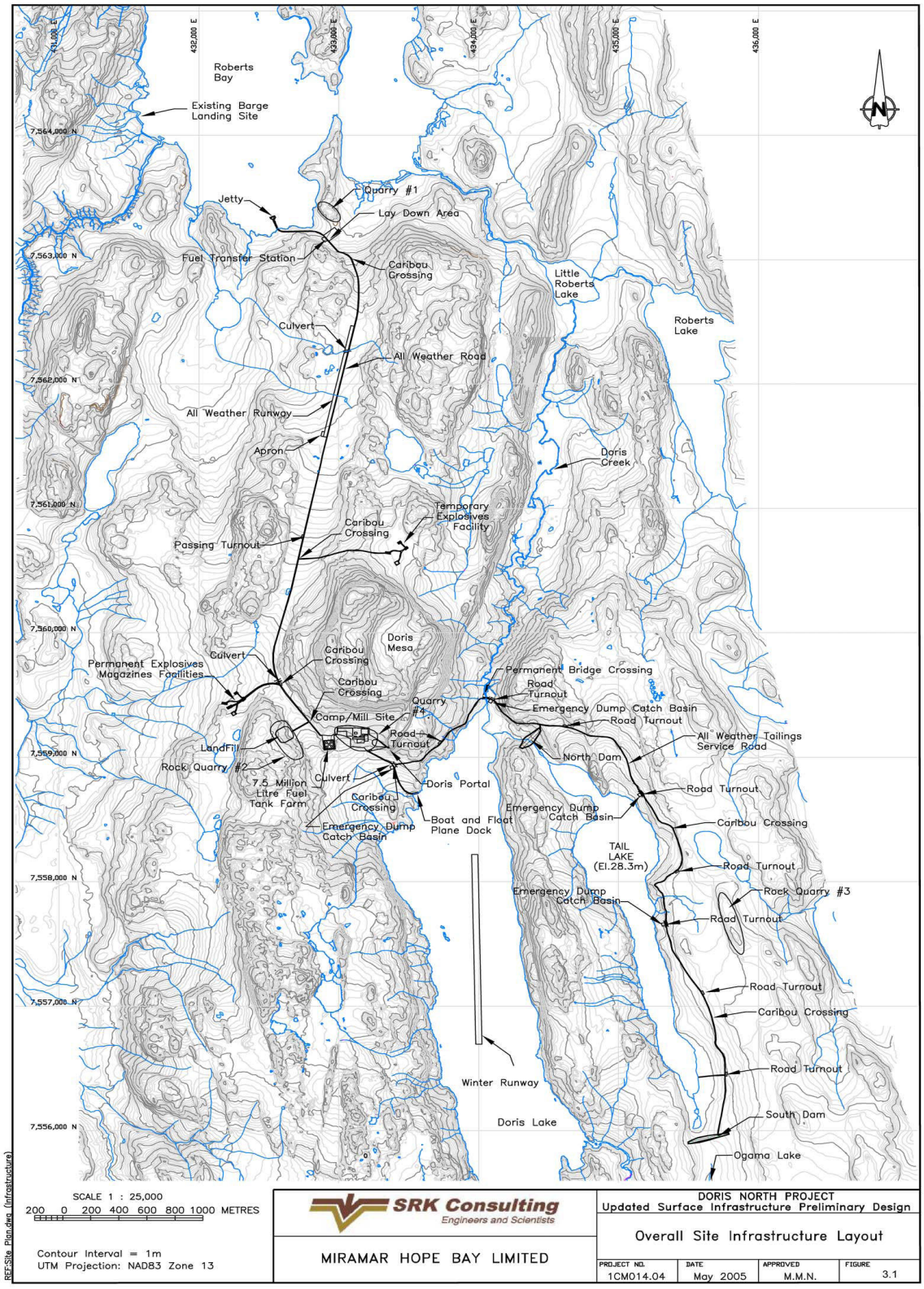


Table 1.1: Monitoring Program Summary

Category	Parameter	Location	Frequency	Mining Phase
Air Quality and Climate				
Doris North	Wind speed @ 3 m	Mill Site	Continuous	Construction, Operation, Closure, Post-closure
	Wind direction @ 3 m	Mill Site	Continuous	Construction, Operation, Closure, Post-closure
	Temperature @ 2 m	Mill Site	Continuous	Construction, Operation, Closure, Post-closure
	Relative humidity @ 2 m	Mill Site	Continuous	Construction, Operation, Closure, Post-closure
	Solar radiation @ 2.5 m	Mill Site	Continuous	Construction, Operation, Closure, Post-closure
	Precipitation (tipping bucket; summer)	Mill Site	Summer continuous	Construction, Operation, Closure, Post-closure
	Passive monitoring for SO_2, NO_2 and O_3	Mill Site	Monthly	Construction, Operation, Closure
	Particulate matter (TSP, PM_{10}, $PM_{2.5}$) PLANNED	Mill Site	Every 6^{th} day	Construction, Operation, Closure
Boston	Wind speed @ 10 m	Above the Portal	Continuous	Construction, Operation, Closure, Post-closure
	Wind direction @ 10 m	Above the Portal	Continuous	Construction, Operation, Closure, Post-closure
	Temperature @ 2 m	Above the Portal	Continuous	Construction, Operation, Closure, Post-closure
	Relative humidity @ 2 m	Above the Portal	Continuous	Construction, Operation, Closure, Post-closure
	Solar radiation @ 2.5 m	Above the Portal	Continuous	Construction, Operation, Closure, Post-closure
	Snow Depth	Above the Portal	Continuous	Construction, Operation, Closure, Post-closure
	Precipitation (tipping bucket; summer)	Above the Portal	Summer continuous	Construction, Operation, Closure
	Passive monitoring for SO_2, NO_2 and O_3	Above the Portal	Monthly	Construction, Operation, Closure

Table 1-1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Soil and Vegetation Sampling	Metal concentrations in lichens[1]	Project site locations and reference locations throughout the Hope Bay Region	Once during Construction, annually during Operation and once during Closure	Construction, Operation, Closure
	Metal concentrations in plants and berries[1]	Project site locations and reference locations throughout the Hope Bay Region	Once during Construction, annually during Operation and once during Closure	Construction, Operation, Closure
	Metal concentrations in soils[1]	Project site locations and reference locations throughout the Hope Bay Region	Once during Construction, annually during Operation and once during Closure	Construction, Operation, Closure
Noise				
Environmental Noise	LA_{eq}, LAF_{min}, LAF_{max}, LC_{eq} , and 1/3 band octave data.	At NM1 – Jetty and Quarry 1 area, NM2: Camp and Plant area; NM3: Quarry #2 and NM4: Tailings Area Caribou Crossing.	3 to 4 times in each project phase commencing in the summer of 2007.	Construction, Operation, Closure
Occupational Noise Monitoring	Hearing Levels Workplace Noise Levels	Pre-employment medicals and annual audiometric testing for employees working in high exposure areas or occupations UG Mine, Mill, Mtce Shop, Heavy Equipment Operators, Employees working around aircraft, other areas where noise level is 80 dBA or greater	Pre-employment and annually After commencement of operations to set operating baseline Follow up monitoring at 4 intervals per year	Operations Operations

Table 1-1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Hydrology				
	Water quantity (water level and/or discharge)	Tail Lake	Continuous	Construction, Operation, Closure, and Post-closure to end of treated tailings effluent discharge
		Doris Lake	Continuous	
		Tail Lake Outflow (upper)	Continuous during open water season including during discharge of treated tailings effluent	
		Doris Lake Outflow (upper)		
		Doris Lake Outflow (lower)		
		Roberts Lake Outflow	Continuous during open water season	Construction, Operation through verification of fisheries No Net Loss mitigation measures
		Little Roberts Lake Outflow		
	Snowcourse surveys	Doris Lake watershed	Annual in late winter	Construction, Operation, Closure and Post-closure to end of treated tailings effluent discharge
	Lake Evaporation	Doris Lake Watershed (calculated)	Continuous	Construction, Operation, Closure and Post-Closure to end of treated tailings effluent discharge

Table 1-1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Site Water Quality				
Environmental Monitoring during construction and reclamation	Total suspended sediment/Turbidity	Roberts Bay jetty Doris Lake boat launch Doris Lake water intake	Hourly to daily during in-water construction activity	Construction, Closure
Environmental Monitoring during construction and reclamation	Total suspended sediment/Turbidity	All construction sites	Daily visual inspections for all construction activity during spring freshet and during and after rain events with sampling of runoff/seepage where turbidity appears to be high	Construction, Operation
Site Compliance Monitoring	Water quality and quantity	Tail Lake end of discharge pipe to Doris Outflow Creek Doris Creek Outflow both upstream and downstream of discharge point	Weekly as per MMER during annual discharge period Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during the annual discharge period	Operation, Closure, Post Closure (for up to nine years after cessation of mining)
Site Compliance Monitoring	Water quality and quantity	Water Quality within Tail Lake – Reclaim water	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during annual the discharge period Monthly at all other times during operational phase Monthly during closure phase only during open water period	Operation, Closure, Post Closure (for up to nine years after cessation of mining)

Table 1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Site Water Quality				
Site Compliance Monitoring	Water quality and quantity Tailings Solids Backfill Solids – quality and quantity	Combined Tailings discharged to Tail Lake– water component Tailings solids discharged to Tail Lake Filtered Cyanide Leach Residue	Daily initially, reduced to weekly after 3 months of operation composited monthly composited monthly	Operation
Site Compliance Monitoring	Water quality and quantity	Temporary Waste Rock Pollution Control Pond	Monthly (during open water season)	Operation, Closure
Site Compliance Monitoring	Water quality and quantity	Plant site storm water management pond	Once before any planned discharge, daily when discharging onto the tundra	Operation, Closure
Site Compliance Monitoring	Water quality	Fuel tank farm collection sumps	Daily when discharging onto the tundra	Operation, Closure

Table 1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Site Water Quality				
Site Compliance Monitoring	Water quality	Roberts Bay Fuel tank transfer facility collection sump	Daily when discharging onto the tundra	Operation, Closure
Site Compliance Monitoring	Water quality	Landfarm collection sump	Daily when discharging onto the tundra	Operation, Closure
Site Compliance Monitoring	Water quality	Landfill collection sump	Once before any planned water is discharged to the tundra (land applied) Daily whenever the sump is being pumped to discharge onto the tundra	Operation, Closure
Seepage Monitoring of quarried rockfill along roads and pads	Water Quality – field pH	After construction is complete a survey of seep points along the site roads, airstrip and building pads will be conducted targeting ~ 100 points	An initial survey in the Spring freshet of 2008 Follow-up survey in the Spring of 2009 and 2010	Construction, Operation
Seepage Monitoring of quarried rockfill along roads and pads	Water Quality – Sulphate and Metals	Seepage points where the field pH is measured as being either below 6.0 or higher than 8.0 will be analyzed for sulphate and metals	An initial survey in the Spring freshet of 2008 Follow-up survey in the Spring of 2009 and 2010	Construction, Operation

Table 1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Site Water Quality				
Site Environmental Management	Water quality	Doris Lake at freshwater pump intake	Monthly	Operation, Closure
Site Environmental Management	Water quality	Potable Water – taken at different spots each month	Monthly	Operation, Closure
Site Environmental Management	Water quality	Sewage Treatment Plant Effluent to Mill pump box	Monthly	Operation, Closure
Effluent Treatment Process Control	Water quality and quantity	Barren bleed solution	Every two hours	Operation
Site Geotechnical				
Thermal Monitoring	Ground Temperature	Thermistor strings at jetty, fuel transfer station, airstrip, camp pad, pollution control pond, sedimentation pond, float plane dock laydown area, roads – 5 thermistor strings, and bridge abutments	Monthly	Operation
Visual Inspections	Settlement of fill materials	All surface infrastructure pads and roads and the jetty	Monthly	Operation
Tailings Geotechnical				
Thermal Monitoring	Ground Temperature	Thermistor strings at tailings dams, around Tail Lake shoreline	Monthly	Operation, Closure
Visual Inspections	Tailings containment system performance	Tailings and reclaim pipelines, dump catch basins, tailings discharge point, reclaim water pump, north and south dams and discharge system	Daily	Operation, Closure

Table 1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Geotechnical Inspections	Tailings containment system performance and dam stability	Inspection by a qualified geotechnical engineer of all structures including the dams and Tail Lake shoreline	Annually during early summer	Operation, Closure, Post-Closure
Tail Lake Bathymetry	Tail Lake bathymetry to facilitate tailings deposition management	Survey of Tail Lake bathymetry	Annually during early summer	Operation
Waste Rock Characterization				
Quarried Rock Material	ABA Characterization	Check sampling of rock quarried for use in infrastructure (jetty, roads, airstrip, building pads, dams, etc.) to verify characterization ABA characterization work completed on quarry rock sources in 2006	Approximately 100 samples spread over construction quarrying	Construction
Underground Waste Rock	ABA Characterization	ABA characterization of any non-acid generating waste rock to be permanently left on surface to verify that such rock is non-acid generating	As required – contingent measure	Construction, Operations
Aquatic Effects				
Regional Water Quality	Water Quality	Doris Outflow Creek at confluence with Little Roberts Lake	Monthly during annual discharge period	Operations, Closure, Post-Closure
Regional Water Quality	Water Quality	Little Roberts Lake Outflow	Monthly during annual discharge period	Operations, Closure, Post-Closure

Table 1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
MMER Effluent Monitoring	pH, MMER deleterious substances	Tail Lake end of Discharge pipe to Doris Outflow Creek	Weekly during annual discharge period	Operations, Closure, Post-Closure
	Acute Lethality Testing on rainbow trout and *Daphnia magna*	Tail Lake end of Discharge pipe to Doris Outflow Creek	Monthly during annual discharge period	Operations, Closure, Post-Closure
EEM Effluent Characterization	pH, MMER deleterious substances	Tail Lake end of Discharge pipe to Doris Outflow Creek	Four times per year during EEM cycle	Operations, Closure, Post-Closure
EEM Receiving Water Chemistry	pH, dissolved oxygen, temperature, MMER deleterious substances	Doris Creek Outflow both upstream and downstream of discharge point	Four times per year during EEM cycle	Operations, Closure, Post-Closure
Aquatic Effects				
EEM Fish Population Survey	Fish survival, growth, condition and reproduction	Two control streams, two control lakes, one exposure lake and two exposure streams (near-field and far-field)	Monitoring frequency is dependent on results of previous cycle (minimum of two cycles)	Operations, Closure, Post-Closure
EEM Fish Tissue Survey	Tissue mercury concentration			
EEM Benthic Invertebrate Community survey	Invertebrate density, taxa richness, diversity and similarity of community structure			
Fish				
Rearing habitat in Doris Lake.	Periphyton, benthos, and fish	Doris Lake sites and two reference sites	Annually during operation; plus Year-1 and Year-5 from decommissioning.	Operation, Closure and Post-Closure
Jetty fish habitat structures	Periphyton, benthos, and fish	Jetty structure sites and two reference sites	Summer following jetty construction, plus Year-2 of operation and Year-2 of active post-closure (year prior to jetty lowering to below water)	Construction, Operation and Post-Closure.
Rearing habitat in tributary to Roberts Lake	Use of habitat by fish (Arctic char, lake trout)	Tributary to Roberts Lake	Annually during operation; plus Year1 and Year-5 from decommissioning.	Operation, Closure and Post-Closure.

Table 1: Monitoring Program Summary (continued)

Category	Parameter	Location	Frequency	Mining Phase
Enhancement of stream channel in Roberts Creed	Success of upstream Arctic char movement into Roberts Lake	Roberts Creek above and below enhancement area	Once in a low to moderate flow year during early years of operations or closure and again in Year-9 or Year-10 (depending on flow conditions) after decommissioning	Operation/Closure and Post-Closure
	Arctic char smolt out-migration	Roberts Creek below Little Roberts Lake	Annually beginning in 2006 for 10 year period	Pre-construction, Construction, Operation, Closure, and Post-Closure
	Arctic char and lake trout abundance (catch-per-unit-effort)	Roberts Lake and selected tributaries	Annually beginning in 2006 for 10 year period	Pre-construction, Construction, Closure, and Post-Closure
Willow Habitat along Doris Lake at entrance of Tail Creek	Distribution of shoreline willow habitat	Doris Lake at entrance of Tail Creek	Once in summer of 2007 (pre-construction), once during operation and once during closure	Pre-construction, Construction, Closure
Tail Lake Fish Tissue Analyses	Metal contaminant levels in lake trout	Tail Lake	Once prior to conducting fish-out of Tail Lake	Construction
Wildlife				
VECS include: ➢ wildlife habitat; ➢ caribou; ➢ muskoxen; ➢ grizzly bears; ➢ wolverines; ➢ upland breeding birds; ➢ waterfowl; and ➢ raptors.	Habitat loss from Project footprint	Project footprint	Once during each mining phase	Construction, Operation, Closure
	Survey observations (individuals, density, species richness and sign) for all VECs	Wildlife Study Area	Annually according to species survey protocol	Construction, Operation, Closure and Post-Closure
	Sightings log and encounters	Hope Bay Region	Annual summary of observations	Construction, Operation, Closure

[1] Metal concentrations in soils, lichens, plants and berries include analyses for the following metals: Arsenic, Silver, Aluminum, Barium, Beryllium, Cadmium, Cobalt, Chromium, Copper, Molybdenum, Nickel, Lead, Antimony, Tin, Strontium, Thallium, Vanadium, Zinc, Calcium, Potassium, Magnesium, Sodium, Iron, Manganese, Phosphorus, Selenium, Titanium and Mercury.

2.0 AIR QUALITY AND CLIMATE MONITORING

2.1 Background and Rationale

An air quality and meteorological monitoring program has been operating at the Doris North Project site to measure pre-operational air quality conditions, and is the basis for the Air Quality Management Plan (AQMP). Meteorological monitoring is a continuing program that is used to support other monitoring programs including hydrology, air quality and wildlife. The following is a summary of air quality monitoring programs committed by MHBL as outlined in the Air Quality Management Plan, prepared for MHBL by Golder Associates Ltd.[1]

The proposed air quality and climate monitoring programs are summarized in Table 1-1 of this Monitoring and Follow-Up Management Plan.

2.2 Study Design

The air quality monitoring program currently includes monitoring of total suspended particulates (TSP), dustfall, sulphur dioxide (SO2), nitrogen dioxide (NO2) and ozone (O3). A Hi-Vol sampler has been configured to measure airborne particulate with a nominal aerodynamic diameter of 30 microns or less; however, it is not currently operational. Once operational, 24-hour measurements will be taken every six days as per the National Air Pollution Surveillance (NAPS) schedule. Dustfall is measured quarterly, and SO2, NO2 and O3 are measured with passive samplers and results collected monthly.

An additional Dual PartisolTM sampler will be installed in summer 2007 to measure ambient concentrations of PM10 and PM2.5. The measurement schedule will be the same as the TSP sampling. Prior to construction, monitoring for TSP and PM10 and PM2.5 will be sampled when camps are open as the sampler requires full-time power. Once operational, monitoring of these parameters would likely be year round.

The Hi-Vol and Partisol samplers will be re-sited based on protocols established by Alberta Environment (AENV Air Monitoring Directive, 1989) and through consultation with Environment Canada and Health Canada air quality officials. The Alberta Monitoring Directive has developed a site selection tool that incorporates parameters, such as wind direction frequency, receptor sensitivity and site accessibility. The primary site selection tool is the geographic coverage factor (G), which is calculated as follows:

$$G = W \times D \times R \times A \times E$$

where:

- W = Frequency of winds blowing from the emission source towards the site.
- D = Dispersion weighting computed from one of the following:
    - Short-term concentration (i.e., 1-hour)

[1] Details on the proposed air quality monitoring programs are presented in Section 3.2 and details on the meteorological monitoring program are presented in Section 3.3, Air Quality Management Plan, Supporting Document S10b to the Revised Water License Application Support Document, April 2007.

  - long-term average concentration (i.e., annual)
  - concentration occurring under the most frequent wind speed and stability class,
  - probability of detecting concentrations above a specified concentration,
  - probability that the measured concentration will be within a fixed fraction of its true value n times in N occurrences with specified percent confidence (method of Noll).

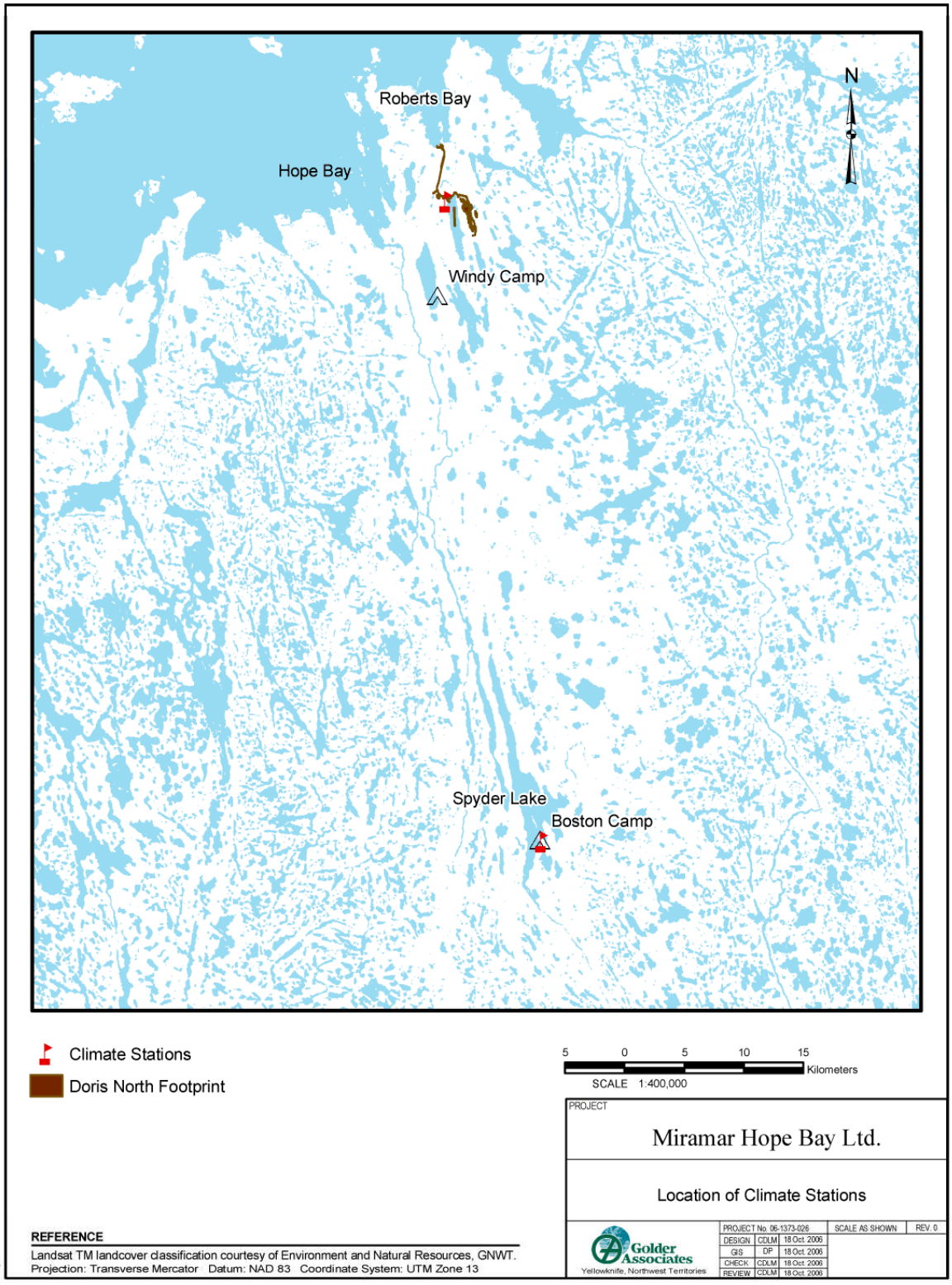
- R = Sensitivity of the receptor defined as low (1), medium (2), or high (3).
- A = Accessibility to the proposed location defined as poor (1), adequate (2), or good (3).
- E = Electric (AC) power availability for the proposed location defined as poor (1), good (2), or existing (3).

This siting method is a modified version of the one used in the Alberta Monitoring Directive, in that it incorporates the accessibility to the proposed site (A) and the availability of electric power (E). The “A” parameter was included because pre-existing access may serve to minimize the environmental impact of implementing a monitoring program. Also, additional delays in program start up are possible if road work and associated permits are required to access the site. The “E” factor is considered in the site selection weighting to consider if there is electricity currently available or if installing an electrical power source will be relatively easy or difficult. The dispersion weighting factor has the greatest influence on the G value.

2.3 Meteorological Monitoring Program

The current meteorological monitoring program will continue as part of the AQMP; however, the location and design of the station will be discussed with Environment Canada officials. The Doris North climate (meteorological) station was installed on the northern shore of Doris Lake in May 2003 and the Boston climate (meteorological) station was installed in July 2006 (Figure 2-1). The station is a self contained, solar/battery-powered system, and includes instrumentation to measure hourly values of temperature, wind speed, wind direction, relative humidity, solar radiation and rainfall.

Figure 2.1: Location of Climate Stations



3.0 NOISE MONITORING

3.1 Background and Rationale

The noise monitoring program is part of the overall Noise Abatement Plan), and is a requirement of the NIRB Project Certificate for the Doris North Project (Commitment #29). The overall objectives of the noise abatement plan are to protect people and wildlife from mine activity noise, including blasting, drilling, equipment, vehicles and aircraft.

The following is a summary of the noise monitoring program committed by MHBL as outlined in the Noise Abatement Plan[2], prepared for MHBL by Golder Associates Ltd., dated March 2007

The proposed noise monitoring programs are summarized in Table 1-1 of this Monitoring and Follow-Up Management Plan.

3.2 Study Design

The noise monitoring programs will be conducted 3-4 times in each project stage: pre-construction (baseline), construction, operation and closure. Baseline monitoring will commence as early as possible. Monitoring periods and dates are yet to be determined; however, the date selection will consider the potentially affected VECs. The following are factors that will be used to finalize the scheduling of baseline, construction, operations and closure monitoring:

- season;
- periods of blasting at the quarries;
- caribou migration;
- bird migration;;
- the month before bear hibernation; and
- times when major wildlife events occur.

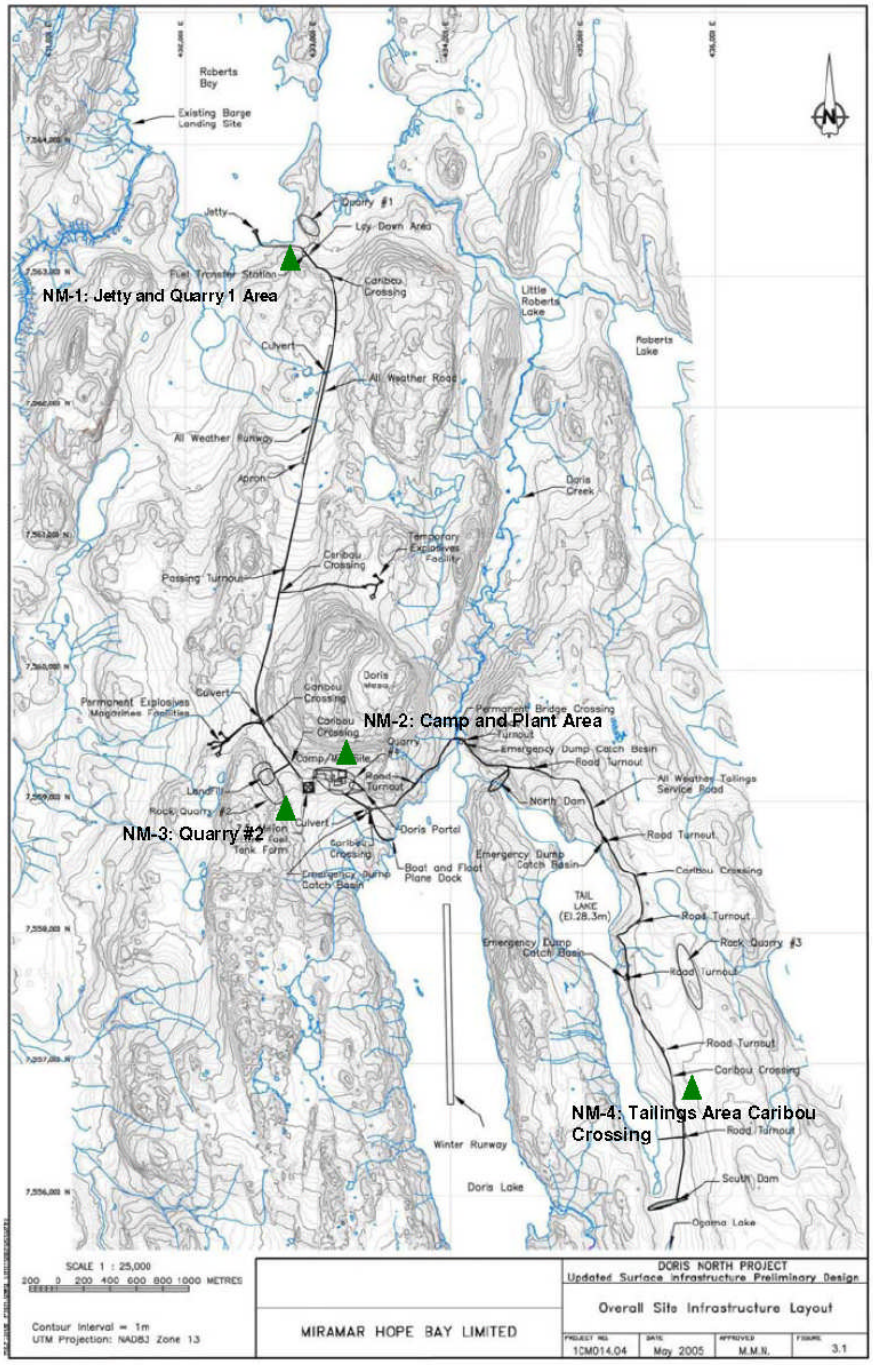
Dates for each of the initial 3-4 programs expected in the first year will be proposed and finalized prior to conduct in conjunction with HC, EC and GN-DoE.

In order to establish a preliminary baseline, a series of spot measurements at 1500 m from the Project facility and infrastructure locations was attempted in November 2006. Weather conditions prohibited successful measurements at that time, and the issues encountered are addressed in this work plan to enable monitoring at any time of the year.

Preliminary locations have been selected based on the results of noise modelling for the EIA, location of project noise sources and infrastructure and VEC factors. Locations also depended on the criteria to be met for the project. Four long-term monitoring locations are identified on Figure 3-1.

[2] Details on the proposed environmental noise monitoring program are presented in Section 2. and details on the health and safety noise monitoring program are presented in Section 3, Noise Abatement Plan, Supporting Document S10c to the Revised Water License Application Support Document, April 2007.

Figure 3.1: Proposed Environmental Noise Monitoring Locations



Type I or Type II integrating data-logging sound level meters meeting ANSI standards S12.19-1996 or ISO 1996-1 respectively will be used. For long term measurements, the meter will be equipped with a weatherproof microphone mount. An appropriate calibrator must be available and is to be used before and after each measurement period to ensure valid data collection.

The monitoring set-up should be equipped with sound recording capabilities to capture audible noises in the area. Preferably, sound level meters with a synchronized internal sound recording capability will be used. Sound recording will be used to witness long-term measurements, so identification of noise events measured at an unattended station can occur.

Weather data from one of the two on-site weather stations will be used to validate data collected.

The following overall noise levels will be measured:

- LA_{eq};
- LAFmax;
- LAFmin; and
- LCeq.

In addition, 1/3 band octave data will be collected once per project stage, if equipment is available. Octave band data will also be collected if levels exceeding project criteria are found, in order to locate the primary source requiring mitigation.

Two, 24-hour logging periods will be conducted at each location, at a 1-minute logging rate. It should be noted that if longer monitoring periods at each location be required, the logging rate would need to increase. This may result in loss of definition in measurements, making it difficult to determine the influence of short term noise events such as aircraft flyovers. Simultaneous sound recordings will also be collected during the measurement period to identify peak events and sources of sound.

The following weather parameters will be documented for the time period of each noise measurement.

- temperature;
- relative humidity;
- wind speed;
- wind direction; and
- precipitation.

Weather data from one of the on-site stations will be used.

Acceptable weather conditions for noise monitoring will be:

- wind speeds less than 20 kph;
- relative humidity less than 90%;
- no active precipitation (rain or snow); and

- temperatures such that the meter body can be maintained within manufacturer's specifications.

The following information for field will be collected:

- description of the monitoring site with sketch and pictures;
- time of set up and tear down;
- time of calibration;
- type of surface the meter is standing on;
- observed audible noise sources;
- distance from all obstacles in the area (cannot be closer than 3 m to any surface except the ground surface);
- GPS location;
- which meter is being used; and
- weather conditions at each site at the time of set up and tear down including precipitation and cloud cover.

It is imperative that detailed field notes are recorded during the monitoring period. Site visits by technicians will be conducted and are highly recommended (number of site visits depends on scheduling of the monitoring period) to identify audible noise sources and to check equipment.

A data report will be completed following each monitoring program. The field reports will generally have in tabular form weather and noise data listed hourly, graphical representations of the raw noise data, a description of the methods used, the location of monitoring sites and photos of the sites. Any noise sources that are causing criteria to be exceeded will be identified. Short-term source measurements may be conducted where necessary to allow appropriate mitigation design.

Data reports will be provided to the bird and wildlife leads for consideration in their on-going monitoring plans.

A detailed compliance report will be provided on an annual basis. The format and content of this report will be finalized in discussion with HC, EC and GN-DoE.
MHBL will have a noise monitoring component of the Doris North Occupational Health and Safety Program. The details of the program have not been finalized as operations are not expected to begin before late 2008. MHBL will have this program fully developed prior to the start of operations. However, the noise monitoring component of the Occupational Health and Safety Program will consist of the following elements:

- Pre-Employment Audiometric Testing;
- Annual Employee Audiometric Testing; and
- Workplace Noise Monitoring.

3.3 Adaptive Management

The Noise Abatement Plan also identifies criteria for environmental noise, mitigations or work procedures to be used by MHBL in controlling noise from the site, and action that will be taken if noise is not in compliance with criteria.

4.0 HYDROLOGY MONITORING

4.1 Background and Rationale

Existing hydrology data at Doris North were collected as part of the baseline study and during post-baseline (2003 to 2006) monitoring to support the EIS, water license application and project design. The hydrology monitoring program during construction, operation, closure and post-closure will be similar to the existing post-baseline program, with modifications to meet regulatory and operational requirements.

4.2 Study Design

Monitoring of snowfall, lake water levels and stream discharge will be included as part of the environmental monitoring program for the Doris North project (Figure 3-1). The purpose of this monitoring is to refine hydrological baseline estimates for water management planning, to provide data for assessment of EIS predictions, and to provide data for water management operations. Components of the hydrology monitoring program include:

- Annual snowcourse surveys: the existing snowcourse survey program will be continued through construction to post-closure of the Tail Lake facility to provide additional data to refine local hydrological parameters, and to provide a basis for operational water management. Snowcourse surveys will identify the volume of runoff into the Tail Lake facility and the Doris Lake system each spring;

- Doris and Tail lake water level monitoring: the existing lake water level monitoring program for Doris and Tail lakes will be continued through construction to post-closure of the project to provide additional data to refine local hydrological parameters, to provide a basis for operational water management, and to provide data for assessment of EIS predictions. Year-round monitoring is recommended, though it should not be necessary to implement real-time data acquisition. The Tail Lake water level station may need to be moved to a new location when the Tail Lake Outlet dam is constructed, to allow for land access during operations;

- Doris Lake outflow discharge monitoring: the existing discharge monitoring at Doris Lake outflow will be modified during the construction phase of the project to include stations above and below the water falls. This is necessary to confirm EIS predictions regarding increased flow below the falls due to discharge of treated tailings. Installation of the second station during construction is recommended to allow a reliable rating curve to be developed prior to operations. During operations, the upper station must be capable of real-time monitoring to allow treated tailings discharge rates to be properly specified;

- Tail Lake outflow discharge monitoring: the existing discharge monitoring at Tail Lake outflow will be continued until the outlet is blocked by dam construction, to provide additional data to refine local hydrological parameters. Once the dam is constructed, the local drainage area will be small enough that flows at the existing station are likely to be too small for continuous monitoring. The treated tailings discharge pipe should be equipped with continuous, real-time monitoring during operation of the tailings facility; and

- Roberts Lake and Little Roberts Lake outflows discharge monitoring: The existing discharge monitoring at Roberts Lake and Little Roberts Lake outflows will be continued through construction to provide additional data to refine local hydrological parameters, and more importantly to provide data to confirm EIS predictions with regards to the effectiveness of the fisheries “No Net Loss” plan. Monitoring at these stations could be discontinued once the effectiveness of modifications to the Roberts Lake outlet boulder garden is confirmed.

Additional data from the meteorological monitoring program will be used to characterize annual hydroclimatic conditions, and to provide input to watershed and facility water balances.

4.3 Adaptive Management

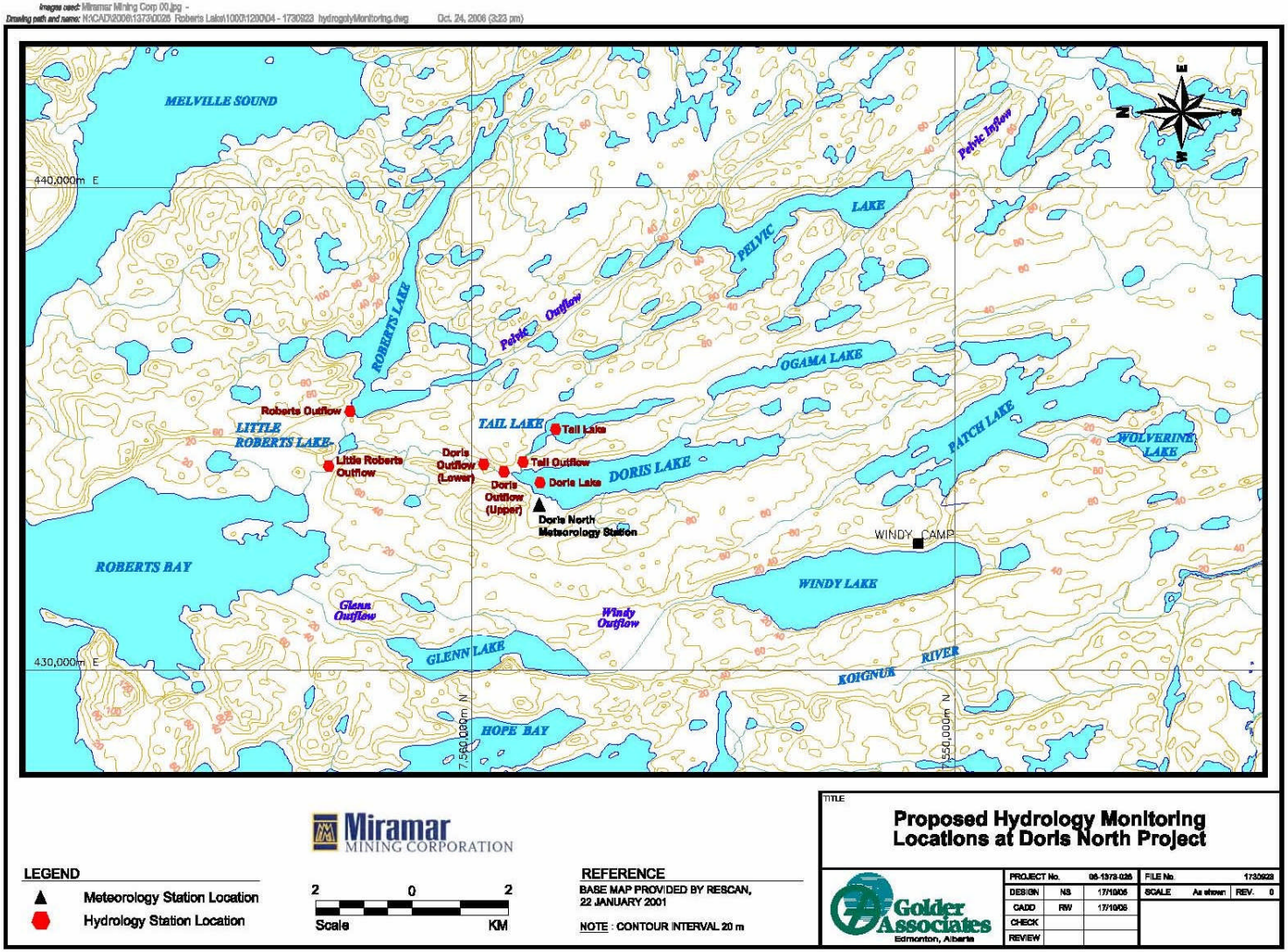
Additional data from the local hydrology monitoring program will be used to reduce uncertainty in local conditions and to provide input into operational water management planning.

The results of real-time monitoring at the Doris Lake and Tail Lake outflows will be used to define allowable discharge rates from the Tail Lake tailings facility. Additional data from the Doris Lake outflow will be used to confirm EIS predictions regarding potential geomorphological effects on the outflow. If adverse effects are indicated, mitigation will be initiated.

The results of water level monitoring at Doris and Tail lakes will be used to confirm EIS predictions regarding changes to water levels during construction and operations. If adverse effects are indicated, mitigation will be initiated.

The results of discharge monitoring at the Roberts Lake and Little Roberts Lake outflows will be used to confirm EIS prediction regarding the effectiveness of the fisheries No Net Loss plan. If the compensation measures are shown not to be effective, additional measures will be explored.


ROBERTS BAY
Roberts Outflow
LITTLE ROBERTS LAKE
Little Roberts Outflow
Doris Outflow (Lower)
Doris Outflow (Upper)
TAIL LAKE
Tail Lake
Tail Outflow
Doris Lake
DORIS LAKE
Doris North Meteorology Station
OGAMA LAKE
PATCH LAKE
WOLVERINE LAKE
WINDY CAMP


Images used: Miramar Mining Corp 00.jpg --
Drawing path and name: N:\CAD\2006\1373\0026 Roberts Lake\100\1200\04 - 1730923 hydrogolyMonitoring.dwg Oct. 24, 2006 (3:23 pm)
MELVILLE SOUND
440,000m E
430,000m E
7,560,000m N
7,550,000m N
ROBERTS LAKE
Pelvic Inflow
PELVIC LAKE
Pelvic Outflow
OGAMA LAKE
Roberts Outflow
LITTLE ROBERTS LAKE
Little Roberts Outflow
Doris Outflow (Lower)
Doris Outflow (Upper)
TAIL LAKE
Tail Lake
Tail Outflow
Doris Lake
DORIS LAKE
Doris North Meteorology Station
PATCH LAKE
WOLVERINE LAKE
WINDY CAMP
ROBERTS BAY
Glenn Outflow
Windy Outflow
WINDY LAKE
GLENN LAKE
KOIGNUK RIVER
HOPE BAY
Miramar MINING CORPORATION
LEGEND
Meteorology Station Location
Hydrology Station Location
2 0 2
Scale KM
REFERENCE
BASE MAP PROVIDED BY RESCAN, 22 JANUARY 2001
NOTE : CONTOUR INTERVAL 20 m
TITLE
Proposed Hydrology Monitoring Locations at Doris North Project
Golder Associates
Edmonton, Alberta
PROJECT No. 06-1373-026
FILE No. 1730923
DESIGN NS 17/10/06
SCALE As shown
REV. 0
CADD RW 17/10/06
CHECK
REVIEW

5.0 SITE WATER QUALITY MONITORING

5.1 Background

The proposed site water quality monitoring programs for the Doris North Project that are summarized here are drawn from a number of different documents. For additional information the reader is referred to the following documents:

1. Water sampling around the tailings containment area

    - The SRK Water Quality Model, Doris North Project, Hope Bay, Nunavut, Canada, dated March 2007 – Sections 5.2.2, 5.2.3, 5.2.4 and 5.2.5 (Supporting Document S6 to the Revised Water License Application Support Document, April 2007)

    - Tailings Management Plan, dated March 2007 – Section 4 (Supporting Document S10i to the Revised Water License Application Support Document, April 2007)

2. Water sampling at the plant site

    - Water Management Plan, dated March 2007 – Section 4 (Supporting Document S10j to the Revised Water License Application Support Document, April 2007)

3. Water sampling at the non-hazardous landfill site

    - Landfill Management Plan, dated March 2007 – Section 5.2 (Supporting Document S10g to the Revised Water License Application Support Document, April 2007)

    - Water Management Plan, dated March 2007 – Section 4 (Supporting Document S10j to the Revised Water License Application Support Document, April 2007)

4. Water sampling at the hydrocarbon contaminated soil landfarm facility

    - Landfarm Management Plan, dated March 2007 – Section 4.7 (Supporting Document S10h to the Revised Water License Application Support Document, April 2007)

    - Water Management Plan, dated April 2007 – Section 4 (Supporting Document S10j to the Revised Water License Application Support Document, April 2007)

5. Water sampling at the fuel handling facilities

- Water Management Plan, dated April 2007 – Section 4 (Supporting Document S10j to the Revised Water License Application Support Document, April 2007)

Site water quality monitoring will be conducted for several purposes:

- Site Compliance Monitoring – sampling of sites expected to be included within the Surveillance Network Program (SNP) that is expected to be included in the water license for the Doris North Project. These sites are to be sampled to allow MHBL mine site personnel to determine whether water from the mine facilities meets standards for discharge, how much water can be discharged and to verify compliance with the discharge standards set under the water license and by the MMER. The SNP stations proposed for inclusion in the water license are summarized in Table 5.1 along with the proposed frequency of sampling at each station and the parameters to be monitored.;

- Site Environmental Management Sampling – samples expected to be collected by MHBL to facilitate management of the site water management facilities and to provide data needed by mine operational staff to make operational decisions, such as if snow melt water collected within say the fuel tank containment berm meets all standards for discharge to the tundra or needs to be sent through a filter to separate hydrocarbons as one example;

- Effluent Treatment Process Control – samples taken within the mill to provide data to MHBL operating personnel that will tell them how the mill effluent treatment circuit is performing and to adjust operational controls accordingly to optimize treatment performance; and

- Environmental Effects Monitoring of water quality in the downstream aquatic receiving environment to meet obligations under the MMER to monitor for potential mine related effects and to facilitate adaptive management programs to mitigate when adverse effects are found (covered in Section 8 of this Plan).

Table 5.1: Proposed SNP Monitoring Stations, Sampling Frequency & Monitoring Parameters

SNP MONITORING STATIONS				
SNP #	**Description**	**Location Coordinates / notes**	**Frequency**	**Monitoring Parameters**
TL1	Tail Lake at the Reclaim Pump Barge - depth of 1.5 m below surface	UTM 13W 433799E 7558286N (Approx.)	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during remainder of annual discharge period	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn
			Prior to commencing discharge and then monthly thereafter during active discharge	Acute Lethality Test (Reference Method EPS 1/RM/13)
TL2	Doris Outflow Creek - upstream (at the flow monitoring station adjacent to the bridge)	UTM 13W 434071E 7559511N (Approx.) - same as the hydrological monitoring location	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during remainder of annual discharge period	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn Daily flow in m^3 during periods of discharge from Tail Lake
TL3	Doris Outflow Creek - down stream (~100 m downstream of the base of the waterfall	UTM 13W 434101E 7559781N (Approx.)	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during remainder of annual discharge period	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn
TL4	Tail Lake Discharge End-of-Pipe - taken at a valve at the discharge end of the transfer pump pipeline	To be confirmed	Weekly during periods of discharge	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn Daily flow in m^3 during periods of discharge from Tail Lake
			Monthly during active discharge	Acute Lethality Test (Reference Method EPS 1/RM/13)
TL5	Combined Tailings Discharged into Tail Lake (Water Component) - taken from a valve at the discharge end of the mill tailings pumps	To be confirmed	Daily initially, reduced to weekly after 3 months of operation	pH, TSS, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn and Volume Monthly flow in m^3 during periods of discharge
TL6	Combined Tailings Discharged into Tail Lake (Solid Component) - taken from a valve at the discharge end of the mill tailings pumps	To be confirmed	Monthly on a composite sample taken from the TL6 weekly samples	Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn and Tonnage Monthly tonnage during periods of discharge
TL7	Filtered Cyanide Leach Residue sent UG as backfill	n/a	Monthly	Tonnage
TL8	Reclaim water pumped from Tail Lake to Mill Process water tank taken from a valve at the discharge end of the reclaim water pump	n/a	Monthly	pH, TSS, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn Daily flow in m^3 during periods of pumping
ST1	Discharge from Camp/Mill pad sedimentation pond taken from the pond at a depth of ~0.25 m	To be confirmed	Once before any discharge, daily when discharging onto the tundra	pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn Daily flow in m^3 during periods of discharge
ST2	Discharge from Temporary Waste Rock Stockpile Pollution Control Pond taken from a depth of ~0.25 m	To be confirmed	Monthly during open water season	pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Alkalinity, Chloride, Al, As, Cu, Fe, Pb, Ni, and Zn
ST3	Discharge from Non-hazardous landfill pollution control sump taken from discharge of pump used to land apply this water	To be confirmed	Daily when discharging onto the tundra	pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn Daily flow in m^3 during periods of discharge
ST4	Discharge from the landfarm sump taken from discharge of oil adsorption system	To be confirmed	Daily when discharging onto the tundra	pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, Ethyl benzene and Total Ammonia
ST5	Discharge from the fuel tank farm sump taken from discharge of oil adsorption system	To be confirmed	Daily when discharging onto the tundra	pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, and Ethyl benzene. Daily flow in m^3 during periods of discharge
ST6	Discharge from the Roberts Bay fuel storage tank containment & transfer station sump taken from discharge of oil adsorption system	To be confirmed	Daily when discharging onto the tundra	pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, and Ethyl benzene. Daily flow in m^3 during periods of discharge
ST7	Freshwater pumped from Doris Lake taken from a valve on the discharge end of the fresh water pump	n/a	Monthly	pH, TSS, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn Daily flow in m^3 during periods of pumping

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

The following sections provide a summary description of these site water quality monitoring programs.

5.2 Site Compliance Water Quality Monitoring

The following section provides a summary description of the proposed water quality compliance sampling, Tail Lake discharge flow control, system, analytical requirements, data management requirements, calculation of allowable discharge flow rates, and, operational and post operational water management activities.

Under the proposed Tail Lake discharge strategy, MHBL suggests that the water license contain a two component discharge standard, as follows:

Component 1: - Compliance Standard in the Receiving Water at the SNP point below the waterfall in Doris Outflow creek.

The water license would require that whenever water is being discharged from Tail Lake, water quality at the SNP point below the waterfall in Doris Outflow creek meet the following water quality standard (Table 5.2):

Table 5.2: Proposed WQ Standard in Doris Outflow Creek at SNP Point below the waterfall

Parameter	Units	MMER Criteria	CCME Guidelines	Average Allowable Concentration at the SNP Point in the Doris Outflow Creek below the waterfall whenever water is being discharged from Tail Lake
pH			6 to 9	6 to 9
TSS	mg/L	15		15
Free CN	mg/L		0.0050	0.01
Total CN	mg/L	1		0.01
Total Ammonia-N[1,3,4]	mg/L		1.27[1]	1.27[1]
Nitrate	mg/L		2.9	2.9
Nitrite	mg/L		0.02	0.05
Total Metals				
Aluminium Al	mg/L		0.10	0.10
Arsenic As	mg/L	0.5	0.005	0.01
Cadmium Cd	mg/L		0.000038	0.000038
Chromium Cr	mg/L		0.0010	0.0010
Copper Cu	mg/L	0.3	0.0020 to 0.0040[2]	0.00
Iron Fe	mg/L		0.30	0.30
Lead Pb	mg/L	0.2	0.0020	0.002
Mercury Hg	mg/L		0.00010	0.00010
Molybdenum Mo	mg/L		0.073	0.073
Nickel Ni	mg/L	0.5	0.025	0.025
Selenium - Se	mg/L		0.0010	0.0010
Zinc Zn	mg/L	0.5	0.030	0.03

Notes:

1) At pH 7.5 and 20 ^{o}C; Total ammonia concentration discharge standard to vary with pH and temperature as per the table below

2) The Guideline is for Chromium (VI) and not for total chromium

3) Ammonia, Nitrate and Nitrite in units of nitrogen equivalency

4) Where CCME guideline is dependent on other water quality values the mean values of these parameters were used to calculate the guideline for the Doris North Project

Temp (^{0}C)	pH							
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
0	231	73.0	23.1	7.32	2.33	0.749	0.250	0.042
5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021

All reported total ammonia concentrations are reported in mg/L NH_3; measurements of total ammonia in the aquatic environment are often also expressed as mg/L total ammonia-N. The present guideline values (mg/L NH_3) can be converted to mg/L total ammonia-N by multiplying the corresponding guideline value by 0.8

Component 2: End-of-Pipe Compliance Discharge Standard

All water discharged from Tail Lake must also meet the following MMER Standard (Table 5.3):

Table 5.3: End-of-Pipe Discharge Standard for all discharges from Tail Lake

Parameters	Units	Maximum Authorized Monthly Mean	Maximum Average Allowable Concentration at the Tail Lake Discharge End-of-Pipe	Maximum Allowable Concentration in a Grab Sample at the Tail Lake Discharge End-of-Pipe
pH	s.u.	6.0 to 9.5	6.0 to 9.5	6.0 to 9.5
Arsenic	mg/L	0.5	0.75	1.0
Copper	mg/L	0.3	0.45	0.6
Cyanide	mg/L	1.0	1.5	2.0
Lead	mg/L	0.2	0.3	0.4
Nickel	mg/L	0.5	0.75	1.0
Zinc	mg/L	0.5	0.75	1.0
Total Suspended Solids	mg/L	15	22.5	30
Radium 226	Bq/L	0.37	0.74	1.11
Non-acutely lethal	%	100	100	100

Notes: All concentrations are total values

Non-acutely lethal means survival of at least 50% of rainbow trout subjected to 100% concentration effluent for a period of 96 hours.

Both components must be met to achieve compliance with the water license. In this way water quality in the receiving environment is protected at a point immediately downstream of the waterfall in the Doris Outflow creek.

Approved water sampling protocols will be adopted. Water sampling and monitoring for the management of Tail Lake water during each annual open water discharge period are described in the following sections. Proposed site surface water monitoring stations are shown in Figure 4-1.

5.2.1 Tail Lake

The intake to the discharge pipeline will be located on a floating barge system within the northern part of Tail Lake, about 1.5 m below the water surface. Two weeks prior to commencement of operations (assuming a spring start-up), water quality in Tail Lake will be monitored every second day to establish baseline conditions. The sampling point for water quality in Tail Lake will be at the reclaim water pump house set on a floating barge on Tail Lake. This barge will be left in place on the lake year round and equipped with circulation capacity to keep the water below the barge from freezing. This is the same point in the lake from where the discharge pump will draw water for discharge into the Doris Outflow creek. Samples will be obtained from the barge at depths of 1.0 m, 1.5 m and 2.0 m for this initial two week period (the discharge pump intake will be set at a depth of 1.5 m).

After two weeks the frequency will be lowered to a minimum of once per week at a single depth of 1.5 m on the assumption that, given the relative size of Tail Lake, the water quality within the lake will not change very quickly. Consequently MHBL has proposed that the frequency of sampling be decreased to a minimum of once per week at a depth of 1.5 m after this initial two week period has passed. If water quality in Tail Lake is changing at a significantly more rapid rate than predicted then MHBL will return the frequency of sampling to once every 24 hours until it can be shown that the water quality within Tail Lake is not varying quickly on a day to day basis.

Before any discharge commences, Tail Lake water (taken from the reclaim floating pump house at a depth of 1.5 m) will be submitted for toxicity testing and metals analysis. Only if the water meets MMER criteria will discharge from Tail Lake commence.

During winter months when no water is being discharged, samples of Tail Lake water will be taken from the mill reclaim water pipeline on a monthly basis whenever the reclaim water system is operational.

5.2.2 Tail Lake Discharge - End of Pipe Discharge

The frequency of sampling and analysis is specified in the MMER to be weekly, at least initially, for regulated parameters. However, there is provision to reduce the frequency of analysis for some parameters based on the results obtained. These results will be correlated with the intake water quality results for further confirmation that the intake monitoring results reasonably reflect actual discharge water quality.

5.2.3 Doris Creek Upstream of Discharge Point

The upstream water quality samples for Doris Outflow creek will be obtained upstream of the flow monitoring point, as dictated by site conditions. Sampling will initially be undertaken every second day to coincide with the intake monitoring samples. As for the intake sampling, MHBL has proposed that the frequency of sampling be decreased to a minimum of once per week after this initial two week period has passed. If water quality in Doris Outflow creek is changing at a significantly more rapid rate than predicted then MHBL will return the frequency of sampling to once every 24 hours until it can be shown that the water quality within Doris Outflow creek is not varying quickly on a day to day basis.

5.2.4 Doris Creek Downstream of Waterfall

Doris Creek downstream of the waterfall will be monitored only during periods of active discharge. The sample location will be established at the first safely accessible spot downstream of the plunge pool below the falls. From a preliminary review this spot appears to be approximately 50 m below the base of the falls. The site will be selected to ensure that complete mixing of Tail Lake discharge and Doris Outflow creek has occurred. The sampling frequency would follow the frequency for the discharge pump intake and for Doris Outflow creek upstream of the weir, i.e., sampling will initially be undertaken every second day and then the frequency of sampling be decreased to a minimum of once per week after this initial two week period has passed. If water quality in Doris Outflow creek is changing at a significantly more rapid rate than predicted then MHBL will return the frequency of sampling to once every 24 hours until it can be shown that the water quality within Doris Outflow creek is not varying quickly on a day to day basis.

Doris Outflow, 20 August 2003. View of waterfall (4.3 m in height), located 400 m downstream of Doris Lake

5.2.5 Dam Seepage

If evident, toe seepage at the North and South Dams will be sampled and monitored on a weekly basis. If flows become significant, the seepage will be collected and pumped back to Tail Lake.

MHBL will inform the geotechnical engineer of record for the North and South Dam in writing (by email or FAX) whenever seepage flow from the dam is noted. The intent is to

inform the geotechnical engineer of record for the two dams so that this engineer can assist and advise MHBL in monitoring dam stability implications where needed.

5.2.6 Mill Effluent

Mill tailings discharge water will be monitored at a location after all of the effluent streams have been combined into a single flow. Initially the water quality will be sampled daily. MHBL proposes that once a good baseline has established (after three months of operation) this frequency be reduced to once per week.

5.2.7 Total Suspended Sediment /Turbidity

A total suspended sediment (TSS) monitoring program will be conducted during the construction of the water intake structure in Doris Lake, the boat dock in Doris Lake, and the jetty in Roberts Bay. This will provide a review of the effectiveness of sediment control efforts and ensure compliance with regulatory requirements. The monitoring program will consist of periodic monitoring (e.g., hourly to daily, depending on the construction activity) of total suspended sediments, or its surrogate, turbidity, at reference and test stations in the vicinity of the construction activities (Figure 4-1). As total suspended sediment measurements require water samples to be sent offsite to a laboratory for analyses, turbidity measurements will be the primary monitoring tool. At the initiation of the construction work, both turbidity measurements and TSS samples will be collected concurrently, to allow derivation of a turbidity-TSS relationship for the construction site. The monitoring results will be compared to regulatory guidelines for protection of aquatic life (CCME), and if guidelines are being exceeded, appropriate mitigation measures will be implemented to reduce the input of suspended sediment into the water.

A program of additional turbidity and total suspended sediment (TSS) monitoring will be conducted around all construction activity during non-winter months, specifically during spring freshet and during and immediately after any significant rain events that could result in release of sediment through erosion.

This program will consist of visual inspections of all construction sites looking at runoff flows and seeps. Where runoff appears turbid, turbidity measurements will be taken in the field and water samples taken for analysis of total suspended solids. This will provide a review of the effectiveness of sediment control efforts and ensure compliance with regulatory requirements. The results will be used to determine when and where additional sediment control measures are required or where and when construction activity should be temporarily suspended.

5.3 Site Environmental Management Sampling

Water quality samples will be periodically collected by MHBL to facilitate management of the site water management facilities and to provide data needed by mine operational staff to make operational decisions. The expected sampling locations are summarized as follows:

5.3.1 Camp/Mill Sedimentation Pond

During the spring melt, the water collected in the Camp/Mill sedimentation pond will be sampled by the on-site environmental personnel and analyzed for pH, TSS, Total Ammonia, Nitrate, Nitrite, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn.

Water will be pumped from the sedimentation pond onto the tundra and be land applied, as long as it meets the proposed discharge standards as set out in Table 5.4. The water will be discharged to the area immediately to the south of the pond where it will have a ~500 m cross country flow path before reaching Doris Lake. Pumping from the sedimentation pond will only start once water in the pond has been verified as meeting the proposed discharge standards.

Table 5.4: Proposed Discharge Standards for the Camp and Mill Pad Sedimentation Pond

	Proposed Discharge Standard	
Parameter Being Monitored	**Maximum Allowable Concentration in a Grab Sample**	**Maximum Authorized Monthly Mean[1]**
pH	9.0	6.0 to 9.0
TSS - mg/L	30	15
Total Ammonia-N (mg/L)	4	2
Total CN - mg/L	2	1
Total Oil and Grease - mg/L	10 and no visible sheen on pond	5 and no visible sheen on pond
Total Metals - all mg/L		
Aluminum - Al	2	1
Arsenic - As	0.10	0.05
Copper - Cu	0.30	0.02
Iron - Fe	0.60	0.30
Lead - Pb	0.20	0.01
Nickel - Ni	0.50	0.05
Zinc - Zn	0.50	0.01

1) Based on a review of discharge limits used at other mine sites in the NWT for small volume discharges into freshwater

Once pumping starts the discharge from the pond will be sampled daily for each day of pump operation with the sample analyzed for pH, TSS, Total Ammonia, Nitrate, Nitrite, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn.

Nitrate, Nitrite and Sulphate are proposed as parameters to be monitored but with no set discharge limit. This is due to the nature of these specific parameters. Nitrate and nitrite will provide nutrients that will be adsorbed through land application. Water quality is protected by monitoring for Total Ammonia.

The discharge point and downstream on the tundra is to be visually monitored on a daily basis whenever water is being discharged from the pond to ensure that such discharge is not causing erosion or pooling.

5.3.2 Temporary Waste Rock Pile Pollution Control Pond

The Temporary Waste Rock Pile Pollution Control Pond is designed to contain all surface runoff and melt water from the temporary waste rock pile, the ore stockpile and the mill site. The pond is designed for full containment of the 1:100 year storm event of 24-hour duration, plus an additional freeboard of 0.3 m. Containment is provided, at least to the full supply level of 35.7 m by an HDPE liner sandwiched between two geotextiles. A protective cover layer is placed over the liner. No emergency spillway is provided, since it is intended that pumping out of this facility be initiated whenever there is at least one hour of pumping capacity in the pond. The pond pumps are designed to completely empty the pond within six hours.

The water that accumulates within the Temporary Waste Rock Pile Pollution Control Pond is to be pumped to the tailings pump box within the mill so that it can be transferred to the tailings containment area. No water is to be discharged onto the surrounding tundra without the authorization of the Nunavut Water Board. The water that accumulates within the Temporary Waste Rock Pile Pollution Control Pond is to be sampled monthly during periods of open water and sent for analysis (pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Alkalinity, Chloride, Al, As, Cu, Fe, Pb, Ni, and Zn). The results are to be reported to the Nunavut Water Board under the Surveillance Network Program (SNP) contained within the water license.

5.3.3 Fuel Tank Storage and Transfer Containment Area Collection Sumps

Water quality samples will be taken prior to any planned discharge during open water season from the plant site fuel tank farm collection sump and from the Roberts Bay fuel storage tank and transfer station containment area collection sump. The samples will be analyzed for pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, Ethyl benzene. The data from this sampling will be used by MHBL to determine whether accumulated snowmelt or precipitation runoff collected within the sump meets standards for direct discharge onto the tundra.

The precipitation runoff and snowmelt collected in the sumps at the fuel tank farm facility will be treated by passing this water through an F1 “Flow and Plug” Oil Adsorption System (Model F11-C-180-TM-Cx2 as supplied by Terry Ruddy Sales of Edmonton Alberta). This is a portable unit set up on standard pallets so that they can be moved to the Roberts Bay fuel tank and transfer station containment area, the plant site fuel tank farm containment area and the landfarm facility as and when needed. The unit will be moved into location soon after the spring snowmelt so that the collection sumps at these facilities can be drained of

standing water. The unit will then be moved back into position whenever these sumps fill (such as in the late summer or fall when precipitation falling as rain normally increases).

The discharge from the Oil Adsorption system will be sampled and analyzed on a once per day basis whenever the system is in operation. The sample will be taken from the discharge of the oil adsorption system prior to this water being land applied onto the tundra. The samples will be analyzed for: pH, Total Suspended Solids and Total Oil and Grease. At each discharge location the discharge point and downstream on the tundra is to be visually monitored on a daily basis whenever water is being discharged to ensure that such discharge is not causing erosion or pooling.

MHBL recommends that the standard that must be achieved for discharge be set as set out in Table 5.5:

Table 5.5: Proposed Discharge Standard for Water Discharged from the Sumps in the Lined Fuel Storage Containment Areas

	Proposed Discharge Standard	
Parameter Being Monitored	**Maximum Allowable Concentration in a Grab Sample**	**Maximum Authorized Monthly Mean[1]**
pH	9.0	6.0 to 9.0
TSS - mg/L	30	15
Total Oil and Grease - mg/L	10	5

1) Based on a review of discharge limits used at other mine sites in the NWT for small volume discharges into freshwater

MHBL looked at discharge limits established in other water licenses for relatively new mine sites in the North to determine what discharge standards were being used to protect the freshwater aquatic environment for small volume discharges from surface runoff ponds and fuel containment facilities. Only limited information could be found. The results of the MHBL review are presented in Table 6.2 of the Water Management Plan[3] . At Doris North the treated water released from the Roberts Bay fuel tank and transfer station containment area sump, the plant site fuel tank farm containment sump and landfarm sump will be land applied onto the tundra. The tundra will play a significant role in attenuating contaminants contained in this release. The large dilution available in Doris Lake and Roberts Bay will further attenuate these contaminants. The proposed discharge limits for the release of treated water from these facilities were drawn from the data in Table 6.2 in the Water Management Plan. These levels have been selected by the regulatory agencies managing water in the N.W.T. as being protective of water quality in the receiving environment in similar settings.

[3] Water Management Plan, Supporting Document S10j to the Revised Water License Application Support Document, April 2007.

5.3.4 Landfarm Collection Sump

MHBL will implement a monitoring program around the landfarm facility. The objective is to measure both soil and water to verify that remediated soil removed from the landfarm and treated water from the landfarm meets the appropriate remediation criteria. The monitoring program proposed by MHBL is broken down as follows:

1. Contaminated soil within the landfarm will be sampled at the beginning of each summer treatment season to verify the nature and extent of contamination within the soils to be remediated. The soil samples will be collected by MHBL and tested for Extractable Hydrocarbons F1 and F2, Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Total Petroleum Hydrocarbons (TPH), polychlorinated biphenyl (PCB) and total metals using a 36 element ICP-MS scan. MHBL proposes that each separate pile within the landfarm be divided into quadrants, and sampled with a target density of one composite of ten samples per 25 m^3 to adequately characterize the soil's hydrocarbon levels. The soil sampling records will be kept by the Environmental Coordinator and reported to the KIA and the NWB as required (at a minimum as part of the annual reporting).

2. A similar sampling program will be conducted by MHBL prior to any soil being removed from the landfarm for use in reclamation to demonstrate that the soil has been remediated to the GN remediation standards (Industrial) as set out in Table 2.1 above. The soil samples will be collected by MHBL and tested for Extractable Hydrocarbons F1 and F2, Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Total Petroleum Hydrocarbons (TPH), polychlorinated biphenyl (PCB) and total metals using a 36 element ICP-MS scan. MHBL proposes that each pile of remediated soil be divided into quadrants, and sampled with a target density of one composite of ten samples per 25 m^3 to adequately characterize the soil's hydrocarbon levels. The soil sampling records will be kept by the Environmental Coordinator and reported to the KIA and the NWB as required (at a minimum as part of the annual reporting). Similarly records will be kept and reported as above as to each location where remediated soil is placed along with an estimate of the volume placed in each location.

3. Samples of the precipitation runoff and snowmelt water collected within the landfarm facility liner will be conducted early each summer following the spring melt to determine water quality prior to the start up of the oil adsorption treatment system. The samples will be analyzed for pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, Ethyl benzene and Total Ammonia.

4. The discharge from the Oil Adsorption system will be sampled and analyzed on a once per day basis whenever the system is in operation. The sample will be taken from the discharge of the oil adsorption system prior to this water being land applied onto the tundra. The samples will be analyzed for: pH, Total Suspended Solids, Total Oil and Grease and Total Ammonia.

MHBL recommends that the standard that must be achieved for discharge be as set out in Table 5.6.

Table 5.6: Proposed Discharge Standard for Water Discharged from the Sump in the Lined Landfarm Facility

	Proposed Discharge Standard	
Parameter Being Monitored	**Maximum Allowable Concentration in a Grab Sample**	**Maximum Authorized Monthly Mean[1]**
pH	9.0	6.0 to 9.0
TSS - mg/L	30	15
Total Oil and Grease - mg/L	10	5
Total Ammonia-N (mg/L)	4	2

1) Based on a review of discharge limits used at other mine sites in the NWT for small volume discharges into freshwater

The discharge point and downstream on the tundra is to be visually monitored on a daily basis whenever water is being discharged to ensure that such discharge is not causing erosion or pooling.

5.3.5 Landfill Collection Sump

Uncontaminated precipitation runoff will be directed away from the landfill area by small rockfill berms located along the upslope edge of the quarry excavation. Similar rockfill berms constructed along the down slope edge of the quarry excavation will retain precipitation runoff and snowmelt within the landfill footprint. The floor of the quarry is to be sloped gently to drain into an excavated sump located at the south-east corner of the landfill area.

During the Spring melt, the water collected in this sump will be sampled by the on-site environmental personnel and analyzed for pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn.

Water will be pumped from the sump onto the tundra and be land applied, as long as it meets the proposed discharge standards as set out in Table 5.7 (the same discharge standard as proposed for the mill and camp pad sedimentation pond). Pumping from the landfill pollution control sump will only start once water in the sump has been verified as meeting the proposed discharge standards. The water will be discharged to the area immediately to the east of Quarry 2 where it will have a long cross country flow path before reaching Doris Lake. The discharge point and downstream on the tundra is to be visually monitored on a daily basis whenever water is being discharged to ensure that such discharge is not causing erosion or pooling.

Once pumping starts the discharge from the sump will be sampled daily for each day of pump operation with the sample analyzed for pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn. The water will be discharged to an area immediately to the east of Quarry 2 where it will have a long cross country flow path before reaching Doris Lake.

If water quality does not meet the proposed discharge standards then the water contained in the landfill pollution control sump will be pumped into a truck mounted tank and transferred to the tailings containment facility at Tail Lake. This transfer of water will continue until sampling verifies that the landfill pollution control sump water complies with the proposed discharge standards.

Table 5.7: Proposed Discharge Criteria for Landfill Pollution Control Sump

	Proposed Discharge Standard	
Parameter Being Monitored	**Maximum Allowable Concentration in a Grab Sample**	**Maximum Authorized Monthly Mean[1]**
pH	9.0	6.0 to 9.0
TSS - mg/L	30	15
Total Ammonia-N (mg/L)	4	2
Total CN - mg/L	2	1
Total Oil and Grease - mg/L	10 and no visible sheen on pond	5 and no visible sheen on pond
Total Metals - all mg/L		
Aluminum - Al	2	1
Arsenic - As	0.10	0.05
Copper - Cu	0.30	0.02
Iron - Fe	0.60	0.30
Lead - Pb	0.20	0.01
Nickel - Ni	0.50	0.05
Zinc - Zn	0.50	0.01

1) Based on a review of discharge limits used at other mine sites in the NWT for small volume discharges into freshwater

5.3.6 Sewage Treatment Plant Effluent

MHBL proposes that the water license contain the following discharge standard (Table 5.8) for the treated grey water discharged onto the tundra from the sewage treatment plant during the construction phase:

Table 5.8: Proposed Treated Sewage Discharge Standard During the Construction Phase

	Proposed Discharge Standard	
Parameter Being Monitored	**Maximum Allowable Concentration in a Grab Sample**	**Maximum Authorized Monthly Mean**
pH	9.0	6.0 to 9.0
TSS - mg/L	100	100
BOD - mg/L	80	80
Faecal Coliform - CFU/100ml	10,000	10,000
Total Oil and Grease - mg/L	10 and no visible sheen on pond	10 and no visible sheen

Estimated volume of discharge is 69 m^3/day.

This is the same discharge standard previously set by the Nunavut Water Board for the Boston Exploration camp in Water License NWB1BOS0106.

After the mill commences operation there will no longer be any separate discharge from this sewage treatment plant as all treated greywater will then be co-disposed in Tail Lake with the mill tailings.

Samples of the treated sewage effluent will be taken on a monthly basis. The data from this sampling will be used by MHBL to monitor the performance of the sewage treatment plant and to adjust operating conditions and procedures as needed to optimize treatment performance. The data will also be used to monitor the quality of this waste water stream in comparison to the predictions made in the Tail Lake Water Quality Model[4].

5.3.7 Potable Water Quality

Samples of freshwater drawn from Doris Lake will be collected on a monthly basis from the Doris Lake pump house. Samples of treated potable water will be collected on a monthly basis from various fresh water taps throughout the accommodation camp, dry facilities and offices. These samples will be analyzed for potable water quality parameters including harmful bacteria to monitor potable water quality used by all personnel at the Doris North Project site.

5.4 Effluent Treatment Process Control Sampling

Samples of treated barren bleed solution within the mill will be take on a regular basis (every two hours) to provide data to MHBL operating personnel that will tell them how the

[4] Section 3.3.6, Water Quality Model, Supporting Document S6 to the Revised Water License Application Support Document, April 2007.

mill effluent treatment circuit is performing and to adjust operational controls accordingly to optimize treatment performance. These are internal samples and are not included in the water license SNP.

5.5 Water Quality Analyses

5.5.1 Onsite Laboratory

Condition 9 of the Doris North Project Certificate issued by the Nunavut Impact Review Board requires:

> *MHBL will fund and install an on-site laboratory for continuous and real-time monitoring of water quality contained within Tail Lake and Doris Creek after discharge. This will be done prior to the commencement of operations. The laboratory shall be certified, with standards to include the calibration of water quality monitoring instruments. MHBL shall file proof of application to become accredited, upon request of the NWB or NIRB's Monitoring Officer.*

MHBL will take the following actions to comply with this condition:

- A low level detection environmental laboratory will be established on site. For convenience the laboratory will be sited near the camp complex, but sufficiently removed from the mill site to prevent contamination. The laboratory will be established prior to commencement of any discharges from Tail Lake.
- Suitably qualified personnel familiar with the operation and maintenance of a low level environmental laboratory will be retained to operate the laboratory. Documented standard operating procedures (SOPs) will be used.
- The laboratory will be equipped with a low level inductively coupled plasma (ICP) mass spectrophotometer (MS) to enable low level detection analyses of metals[5].
- MHBL will seek laboratory accreditation with the Canadian Association for Environmental Analytical Laboratories (CAEAL). The requirements include a well-documented quality assurance/quality control (QA/QC) program, as well as demonstrated proficiency in analysis of performance evaluation (PE) samples. The assessment and accreditation will be updated every two years.
- A documented internal quality control program will be implemented[6] which will include items such as calibration schedules, use of quality control samples, established control specifications with corrective actions if specifications are not met, data validation, equipment maintenance, and staff training and evaluation programs.

[5] Technical information for the ICP-MS is provided in Appendix J, Water Quality Model, Supporting Document S6 to the Revised Water License Application Support Document, April 2007.
[6] See the Quality Assurance/Quality Control Plan, Supporting Document S10k to the Revised Water License Application Support Document, April 2007.

- Quality control samples will include:
- Blanks – analysis of de-ionized water to ensure that there is no contamination due to laboratory procedure;
- Duplicates – a replicate analysis of a homogeneous sample to show method precision;
- Spikes – a replicate sample spiked with a known amount of stock standard solution to show both method precision and accuracy and to check for any interferences; and
- Reference materials – a National Institute of Standards and Technology (NIST) or other suitable certified reference material to show method accuracy.

All of the above laboratory QC samples will be run regularly. Results will be compared to Data Quality Objectives (DQOs) and be used to flag sample results where DQOs are not met. Control samples will be run at a minimum frequency of 10% of the samples for analysis. Quality records will be kept and will be available for inspection.

If the on-site environmental laboratory is unable to provide the key analytical data required to calculate how much water can be safely discharged from Tail Lake (e.g. due to equipment failure, staff shortage, material shortage or other cause), MHBL will terminate the discharge of water from Tail Lake until this key data can be obtained either through an accredited outside commercial lab or by repairing the cause preventing the data being obtained through the on-site laboratory. MHBL will maintain critical spare components on site to reduce this risk but it cannot be totally eliminated.

5.5.2 Water Quality Parameters

The parameters that will be monitored regularly, and intermittently, at the site are summarised in Table 5.9. Not all of the parameters will necessarily be measured on-site. Non-critical parameters such as dissolved and total organic carbon would be measured off-site on a less frequent basis.

Table 5.9: Parameters to be Measured for Effluent Characterization and WQ Monitoring

Category	Parameter	On-Site Analysis
Deleterious substances and pH[1,2]	Arsenic	Yes
	Copper	Yes
	Lead	Yes
	Nickel	Yes
	Zinc	Yes
	Radium 226	-
	Total cyanide	Yes
	Total suspended solids	Yes
	pH	Yes
Required Effluent Characterization and Water Quality Monitoring Parameters[2,3]	Aluminum	Yes
	Cadmium	Yes
	Iron	Yes
	Mercury[4]	-
	Molybdenum	Yes
	Ammonia	-
	Nitrate	-
	Alkalinity	-
	Total hardness	-
Required Additional Water Quality Monitoring Parameters	Dissolved oxygen[5]	Yes
	Temperature[5]	Yes
Site-Specific Parameters[6]	Chromium	Yes
	Manganese	Yes
	Selenium	Yes
	Total phosphorus	Yes
	Nitrite[7]	-
	Conductivity	Yes
	Calcium	Yes
	Chloride	-
	Magnesium	Yes
	Potassium	Yes
	Sodium	Yes
	Sulphate	Yes
	Dissolved organic carbon[5]	-
	Total organic carbon [5]	-

Notes:
1. List of parameters regulated (deleterious substances and pH) as per Schedule 3 of the MMER; concentration limits specified in the regulation (Schedule 4).
2. All concentrations are total values; dissolved concentrations may also be reported; effluent loading (Section 20 of MMER) will also be calculated and reported.
3. List of parameters required for effluent characterization and water quality monitoring as per Schedule 5 of the MMER
4. Analysis of mercury may be discontinued if the concentration of total mercury in effluent is less than 0.10 µg/L in 12 consecutive samples of effluent.
5. In situ measured parameters only for water quality monitoring (in receiving waters).
6. These other parameters are potential contaminants or supporting parameters; analysis is optional and may be added based on site specific historical monitoring data or geochemistry data.

7. Nitrite will not be considered as a controlling parameter for the calculation of the ADVR and TDR unless actual concentrations significantly exceed the predicted values

5.5.3 Third Party Verification

Condition 10 of the Doris North Project Certificate issued by the Nunavut Impact Review Board requires:

> *Upon commencement of operations, MHBL shall ensure that the monitoring of Tail Lake and Doris Creek water quality, above and below the waterfall, be verified and reported to NIRB three times during discharge by an independent, third party laboratory. The sampling must be carried out independently or supervised in which case MHBL must provide the sampling and delivery of samples to the independent, third party laboratory, with copies of the results directly to the NWB and NIRB's Monitoring Officer.*

MHBL will comply with this condition upon the commencement of operations (when tailings are first placed into the TCA) as follows:

1. In the first open water season following or during the commencement of operations, MHBL will arrange to have a qualified independent third party come to site on three separate occasions to collect samples from the Water License defined SNP sites in Tail Lake and in the Doris Outflow creek, both above and below the waterfall. These samples will be collected when water is being discharged from Tail Lake into Doris Outflow creek. MHBL staff will take duplicate samples at the same time and from the same locations. The samples collected by the independent third party will be split by the independent third party with one set of samples going to an accredited independent laboratory selected by the independent third party who are carrying out the sampling and the second set being analysed by MHBL at the on-site environmental laboratory. The parallel set of samples collected by MHBL at the same time will also be split with one set being analysed at the on-site environmental laboratory and the other set going to the external accredited laboratory used on a regular basis by MHBL for analysis of its compliance samples. All samples will be analysed for the full set of analytical parameters as set for these specific SNP stations in the Water License. This will provide a good set of data to check the analytical accuracy of both the on-site environmental laboratory and the external laboratory used by MHBL to analyse all of its environmental compliance samples. Preparation of chain of custody forms and actual shipping of the samples to the independent third part laboratory will be supervised by the independent third part conducting the sampling, who will also make arrangements to have the resultant analysis sent directly to the NWB and to the NIRB Monitoring Officer and to MHBL. MHBL will provide its analytical results on the spilt and parallel samples to the NWB and NIRB Monitoring Officer through the monthly Water License SNP report.
2. In subsequent years the same sampling and analytical process will be applied however in place of having the independent third party come to site on three occasions, MHBL will arrange to have the independent third party come to site for the first sampling to monitor and verify the sampling and handling techniques being used by MHBL. The

actual sampling will be conducted by MHBL personnel and audited by the independent third party. The samples will be handled as in the first year. The independent third party will provide a report on his audit visit to the NWB, the NIRB Monitoring Officer and to MHBL. For the next two sampling rounds in that year, MHBL will conduct the sampling using the same sampling and handling procedures and arrange to have the samples sent to the independent third party lab. Copies of the chain of custody documents for these samples will be sent to the NWB, the NIRB Monitoring Officer and to the independent third party laboratory. The results will be communicated as set out for the first year.

5.6 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.

5.6.1 Data Management

Condition 11 of the Doris North Project Certificate issued by the Nunavut Impact Review Board requires:

> *Monitoring information collected under this approval shall contain the following information:*
>
> *a. The name of the person(s) who performed the sampling or took measurements;*
>
> *b. Date, time, and place of sampling or measurement;*
>
> *c. Date of analysis;*
>
> *d. Name of the person who performed the analysis;*
>
> *e. Analytical methods or techniques used; and*
>
> *f. Results of any analysis*

MHBL will comply with this condition. Monitoring information to be collected for each sample taken and analysed will include:

- The name of the person(s) who performed the sampling or took measurements;
- Date, time, and place of sampling or measurement;

- Date of analysis;
- Name of the person who performed the analysis;
- Analytical methods or techniques used; and
- Results of any analysis.

This information will be incorporated into the monthly Water License SNP reports.

Condition 12 of the Doris North Project Certificate issued by the Nunavut Impact Review Board requires:

> *The results and records of any monitoring, data, or analyses shall be kept for a minimum of the life of the project including closure and post closure monitoring. This time period shall be extended if requested by NIRB, DFO, EC or the NWB.*

MHBL will comply with this condition.

MHBL will set up and maintain a Laboratory Information Management System (LIMS) to record and manage all the water quality monitoring results. MHBL will consult with NIRB's Monitoring Officer for guidance on presentation of monitoring results and records.

5.6.2 Quality Assurance/Quality Control During Sampling

MHBL will apply the following QA/QC procedures during sampling[7]:

- Use of field blanks: Field blanks are samples of pure water that are subjected to exactly the same procedures as routine samples, following which they are analyzed for the same parameters as the field samples. Any measurement of the parameter of interest, above method detection limits, will indicate any analytical error, impurities in the laboratory distilled water supply, contaminated sample preservatives, or contamination of the sample during the handling process. Combined with the results of other quality control procedures, analysis of field blanks can help identification of sources of contamination. A set of field blanks will be made up once each month and taken into the field when the active SNP stations are sampled. New sample bottles will be used and prepared using distilled water from the normal laboratory water supply. This set will represent all of the parameters routinely analyzed. They will be preserved in the field and submitted to the laboratory identified as field blanks.

- Duplicate sampling – Replicate sampling (or sometimes referred to as duplicate sampling) is the collection of more than one sample for a given analysis at a given location. The replicate samples are collected, handled, and analyzed using the standard procedures applied to routine samples. Replicate sampling, combined with

[7]These procedures are is also included in the Quality Assurance and Quality Control Plan, Supporting Document S10k to the Revised Water License Application Support Document, April 2007.

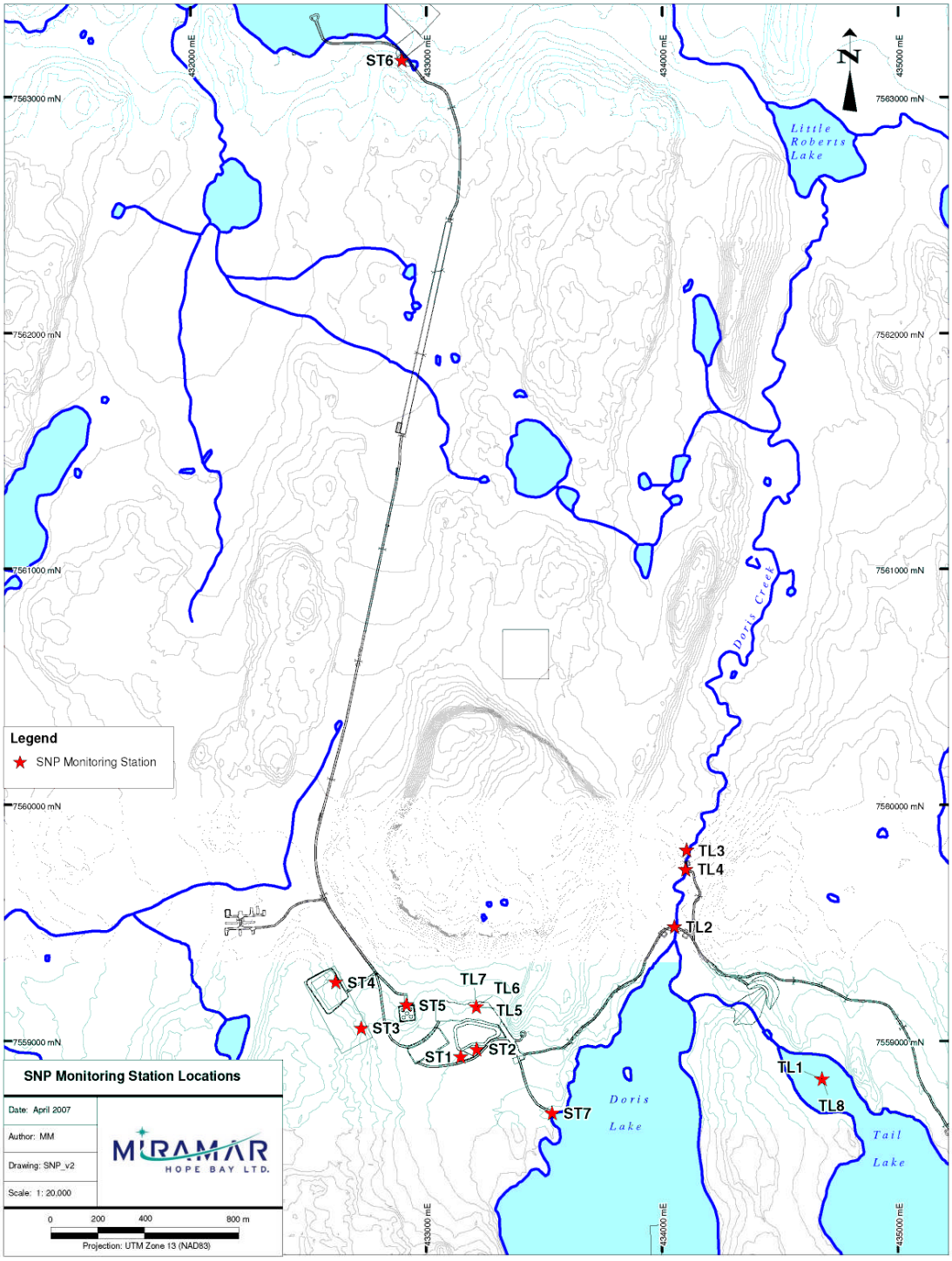
the results of other quality control procedures, can help indicate sources of error and are particularly useful in identifying problems with accuracy and sampling methods. Once per operating season, for each active Water License Surveillance Network Program stations (sampling stations prescribed in the Water License), a set of duplicate samples will be taken, representing as many of the routine analyses as possible. Where possible, this should be carried out in conjunction with audit sampling conducted by the designated inspector. Replicate sampling should alternate between the prescribed Water License Surveillance Network Program stations.

These results will be included in the reports provided to the NWB and KIA.

Samples will be delivered to the analytical laboratory as soon as possible after collection. All samples will be stored and transported at a temperature <10 degrees Celsius. Coolers and ice packs are provided for field transportation and samples will be refrigerated as soon as possible following arrival at the laboratory.

A chain of custody form will be completed for each sampling site respectively. The original will be sent to the external laboratory while a copy will be filed accordingly on-site. A follow-up call will be made to the external environmental laboratory ensuring that samples are received.

Figure 5.1: Proposed Site Water Quality Monitoring Locations



6.0 TAILINGS & SITE GEOTECHNICAL MONITORING

6.1 Background

A geotechnical monitoring program has been included in the final tailings dam design report[8] and in the surface infrastructure design report[9]. The following is a summary of the proposed geotechnical monitoring and follow-up for the surface roads, building pads and jetty and for the tailings containment area.

The proposed monitoring program includes monitoring of the thermal regime, deformation, and seepage. The level of monitoring will be intensive during the early stages of operations since it is during this period that the dam performance against the design assumptions will be confirmed.

6.2 Methods

The surface infrastructure components of the Doris North Project will require two types of monitoring:

- Visual monitoring – physical inspection of all fill surfaces taking special care to identify any areas that may have undergone settlement.
- Thermal monitoring – to evaluate the depth of the active zone, such that advance warning of potential settlement can be determined.

A total of eight thermistors have been installed in locations where surface infrastructure is to be constructed[10]. Where possible, these installations must be retained through construction. In addition, new thermistors are to be installed at the following locations as part of the fill construction:

- Jetty; two strings
- Fuel transfer station; one string
- Airstrip; three strings
- Camp pad; two strings
- Pollution control pond; one string
- Sedimentation pond; one string
- Float plane dock laydown area; one string

[8] Section 11, Design of the Tailings Containment Area, Supporting Document S1 to the Revised Water License Application Support Document, April 2007.
[9] Section 7, Design of the Infrastructure Components, Supporting Document S2 to the Revised Water License Application Support Document, April 2007.
[10] See Drawing G-04, Engineering Drawings for Tailings Containment Area and Surface Infrastructure Components, Supporting Document S4 to the Revised Water License Application Support Document, April 2007.

- Roads; five strings
- Bridge abutments; two strings

Each of these strings should have at least three beads measuring between depths of 0.3 m and 3 m below natural ground surface. The thermistor strings need not have data loggers, but monitoring frequency of manual readings on all stings must be completed at least once a month. If warming trends are observed, this frequency should be increased as appropriate. This data will be reviewed by a qualified geotechnical engineer, at least once a year to assist in making appropriate maintenance recommendations.

Given the importance of the frozen core for the performance of the dam, the ground temperature inside the dam will be monitored. The ground temperature measurements will determine the extent of the frozen region in the dam and should provide information on the rate of thawing or freezing fronts. Temperature sensors are located in sensitive areas, such as the upstream zone of the dam, the outer shell that will be subject to the fluctuations of the active zone, as well as the abutments. Temperature sensors will be installed both horizontally and vertically, and as much as possible, will be installed as the dams are being constructed.

Monthly readings will be manually taken from these sensors to depict the thermal regime in the dams; however, data loggers will be installed to collect continuous data at key locations. This frequency will be maintained until the dam reaches pseudo-steady state conditions. The frequency will then be reduced thereafter but the frequency will have to coincide with the peaks of the annual climatic cycles (i.e., low and high temperatures).

Settlement will be monitored by installing monuments along the crest and sloped faces of the dam. The monuments will be installed during the construction of the dam and will be surveyed on a regular basis to monitor the movement of the dam, both horizontally and vertically. The deformation will be monitored using settlement plates (or similar devices) and, possibly, inclinometers. The frequency of measurements will be higher during the initial stage of the operations, and will be based on the rate at which the talik is developing along the upstream side of the dams. The frequency of the measurements may be decreased as the rate of deformation decreases.

Climatic data will be collected during the operation of the mine. The climatic data will include ambient air temperature, precipitation (rain and snow), wind speed and wind direction as a minimum (see Section 2.3 - climate monitoring). Surveys of snow cover would also be performed to complement the assessment of the thermal regime at the dams.

The dams will be inspected on a regular basis (weekly) to detect damage, deformation or any other anomalies. It is important that the inspections be frequent during the period the lake level is rising and the talik developing. The water level of Tail Lake will also be monitored as part of those regular inspections. Observations of potential seepage will be incorporated in the dam inspection requirements.

6.3 Reporting

The data collected from the monitoring program will be compiled and assessed as part of the Annual Monitoring Program for the tailings containment area. The compiled data will be made available to the regulatory agencies as well as other parties that may have interest in such data. The frequency of reporting will be on an annual basis.

6.4 Annual Geotechnical Site Inspection

6.4.1 Background

In addition to the regular site inspections of the tailings containment area, a suitably qualified professional engineer registered in the Nunavut Territory will make an annual inspection of the tailings dams each summer. The subsequent inspection report will summarize the observations and the review of the available monitoring data (described above). The report will be filed in a timely manner so that, if required, mitigation measures to these structures can be implemented prior to the next freshet.

6.4.2 Maintenance

The dams may require maintenance as the talik develops on the upstream face of the dams. The talik will induce settlements along the upstream face of the dams. The central frozen core is expected to remain frozen and is unlikely to be subject to significant settlement. The final design includes provisions to reduce or minimize these potential settlements along the upstream faces. Regardless of the outcome of the final design, the maintenance program should include placement of additional fill on the upstream face of the dams as settlement develops. The frequency of the maintenance should decrease over time as the thermal regime gradually reaches equilibrium. Regular inspection of the dams will identify any other maintenance issues.

7.0 WASTE ROCK CHARACTERIZATION MONITORING

7.1 Quarry Rock Material

The proposed construction rock quarries have been characterized as having low acid generating and metal leaching potential. In the winter of 2006, a geotechnical drilling program was conducted at all four quarry sites to better define and characterize subsurface rock conditions. The data obtained from this program have been used in the design and operational planning for the four proposed quarry sites[11].

The quarry outcrops are 15 to 20 m in height and will not be mined below grade to prevent creating permanent ponds at closure. Given the nature of the bedrock geology in the area, it is unlikely that the rock types seen at surface will significantly change as the quarries are developed, given the relatively shallow depth of the proposed quarries (maximum of 20 m in depth). This was validated during the 2006 geotechnical drilling program.

A total of 157 samples was taken from this drill program and subjected to conventional acid base accounting analysis. The data verified that the construction rock from these four quarry sites will be non-acid generating rock.

However there is always a small chance that some unexpected change in rock type will be encountered as the quarries are developed. To ensure that any such change is detected, the quarry faces will be inspected by MHBL's field geologists as they are exposed; if sulphide mineralization is encountered, quarrying will stop until additional testing is completed and the implications assessed. The objective is to ensure that no potentially acid generating rock is used in site construction.

In addition, a program of check ABA (acid base accounting) testing will be conducted on the quarried rock used in site construction to verify that all rock used is non acid generating. A target of collecting 100 samples spread equally over the approximately one million tonnes of rock to be quarried has been established for this follow-up program.

During construction samples of quarried rockfill will be collected from the various road and pad construction sites and sent to an accredited external lab for acid base accounting analysis. The following information will be collected for each sample collected:

- Location of Sample Point;
- GPS Coordinates of sample point;
- Name of Quarry from which the rockfill came from;
- Date rockfill was placed;
- The Name of the person who performed the sampling;

[11] See Additional information on the program in Geochemical Characterization of Quarry Materials, Supporting Document S7 to the Revised Water License Application Support Document, April 2007.

- Date and time of sampling;
- Date of analysis;
- Name of person who performed the analysis;
- Analytical method or techniques used; and
- Results of analysis.

The data will be cross-referenced to a site infrastructure map. The objective is to collect ~100 samples from across the site (spread to capture a representative cross-section of all rockfill used in site construction) to verify that the rock used in construction is non-acid generating.

In the unlikely event that potentially acid generating rock is identified at any of these sample locations, a more intensive sampling program will be conducted around the spot where the rock was discovered. Construction records will be checked to find any other locations where rock from that same quarry on the same date could have been placed. These will also be sampled. Any potentially acid generating rock located by this means will be tagged for removal and replacement during the next winter season. The material removed will be moved to the temporary waste rock stockpile to ultimately be placed underground.

A seep survey will be conducted in the first spring freshet following the major earthworks construction (Spring of 2008) along the roadways and beside the pads to measure pH levels in the precipitation runoff and snowmelt that comes in contact with this rock. The pH of each seep will be measured using a field pH meter with the following data recorded:

- Location of sample point;
- GPS Coordinates of sample point;
- The Name of the person who performed the sampling;
- Date and time of sampling;
- Date of analysis;
- Name of person who performed the analysis;
- Analytical method or techniques used; and
- Results of analysis.

The data will be cross-referenced to a site infrastructure map. The objective is to collect ~100 samples from across the site (spread to capture a representative cross-section of all rockfill used in site construction) to verify that the rock used in construction is non-acid generating. In any location where the field pH is measured to be below 5.0 or above 8.0, a

water sample will be collected and submitted for analysis for pH, Total Sulphate, Total Ammonia, Nitrate, Alkalinity, Dissolved Al, As, Cd, Cu, Pb, Ni, and Zn.
Any potentially acid generating rock located by this means will be tagged for removal and replacement during the next winter season. The material removed will be moved to the temporary waste rock stockpile to ultimately be placed underground.

This seep survey will be repeated in the spring freshet of 2009 and 2010.

7.2 Underground Waste Rock

MHBL does not plan to use any of the underground waste rock for construction of the site roads, building pads, laydown areas, tailings dams or other site infrastructure, to ensure that only non-acid generating rock is used in such construction. Under the mining plan, it is expected that all development waste rock will be used internally as backfill within the mine workings.

In the event that during the mine life, MHBL wishes to use some of the underground waste rock for use on surface for some unspecified purpose, such as cover material in the non-hazardous landfill area, then the following procedures will be used to demonstrate that such rock is suitable for such use:

- Only waste rock that has been demonstrated through confirmatory test work to be non-acid generating and non-metal leaching will be allowed for use on surface;

- Acid Base Accounting test work will be used to demonstrate that underground waste rock is suitable for use on surface. Typically one ABA test for every 5,000 tonnes of rock to be used will be required to meet this requirement assuming that the 5,000 tonnes are all from one rock lithology and location; and

- The NPR value derived from the ABA test must exceed3.0 to meet the threshold of being classified as non-acid generating for this purpose.

8.0 AQUATIC EFFECTS MONITORING

8.1 Background and Rationale

As of 6 December 2002, all metal mining projects are required to follow the Metal Mining Effluent Regulations (MMER), which incorporates an Environmental Effects Monitoring (EEM) program. The objective of the metal mining EEM is to evaluate the effects of mine effluent on fish, fish habitat, and the use of fisheries resources. Biological monitoring studies must include a fish survey (fish population and fish tissue analysis) and a benthic invertebrate community survey, and effluent and water quality monitoring studies, which include effluent characterization, water quality monitoring, and sublethal toxicity testing. Aquatic EEM consists of a series of monitoring and interpretation cycles, with the requirements of each cycle dependent upon the findings of the previous cycle.

8.2 Study Design

The MMER and, hence, the EEM requirements will apply to the Doris North Project once effluent is discharged at a rate exceeding 50 m3/day. Environmental effects monitoring requirements have been divided into two parts:

- Part 1: Effluent and Water Quality Monitoring Studies; and,
- Part 2: Biological Monitoring Studies.

The effluent and water quality monitoring studies (Part 1) will commence within six months of the Project becoming subject to the MMER (i.e., which will occur once effluent is discharged at a rate exceeding 50 m3/day). MHBL will submit annual reports, summarizing effluent and water quality, and sublethal toxicity results, by 31 March each year. Effluent samples will be collected a minimum of four times per year to determine pH and concentrations of deleterious substances. Water quality samples downstream of the waterfall on Doris Creek will also be collected a minimum of four times per year to measure pH, deleterious substances, dissolved oxygen and temperature. Sublethal toxicity testing will be conducted twice per year for the first three years of discharge, and once per year thereafter, to determine the effects of mine effluent on survival, growth and reproduction of a fish, an invertebrate, an algae and a plant species.

MHBL will submit the design for the initial biological monitoring study (Part 2) within 12 months of becoming subject to the MMER. The first interpretive report will be submitted within 36 months of the becoming subject to the MMER, and the submission date for subsequent monitoring cycles will be determined by the results of the previous cycle. The biological monitoring study includes a benthic invertebrate community survey (ICS), a fish population survey and a fish tissue study. For each monitoring component, an effect is defined as a statistically significant difference, between reference and exposure areas, in one or more of the measured endpoints.

To facilitate the development of the EEM project for the Doris North Project, MHBL contracted Golder Associates to evaluate available baseline data and to design a monitoring program in accordance with EEM requirements. This preliminary study design, titled “Effluent And Aquatic Monitoring Study Design For Doris North Project, Nunavut,

Canada" (Golder 2003; EIS Supporting Document F3), provides details of the proposed monitoring program. The study design document will be updated in consultation with Environment Canada, once the Doris North Project becomes subject to MMER.

The proposed ICS is a Multiple Control/Impact design consisting of five replicate stations in each of two stream reference areas, two reference lakes, two stream exposure areas and one exposure lake (Figure 5-1). The ICS will compare benthic invertebrate density, taxa richness, diversity and similarity of community structure between exposure and reference areas.

The fish population survey will include analysis of survival, growth, condition and reproduction for two sentinel fish species in the exposure and reference area. As in the ICS, the Multiple control/Impact design for the proposed fish survey will include two stream reference areas, two reference lakes, two stream exposure areas and one exposure lake (Figure 5-1). The stream survey will target ninespine stickleback, a small-bodied fish species with limited migration, and lake trout will be targeted in the lakes.

A fish tissue study, to determine mercury concentration in muscle tissues, is required if the effluent mercury concentration is greater than 0.10 µg/L. The proposed fish tissue study will consist of lake trout fillets from the exposure and reference areas that will be collected and compared to baseline fish tissue data.

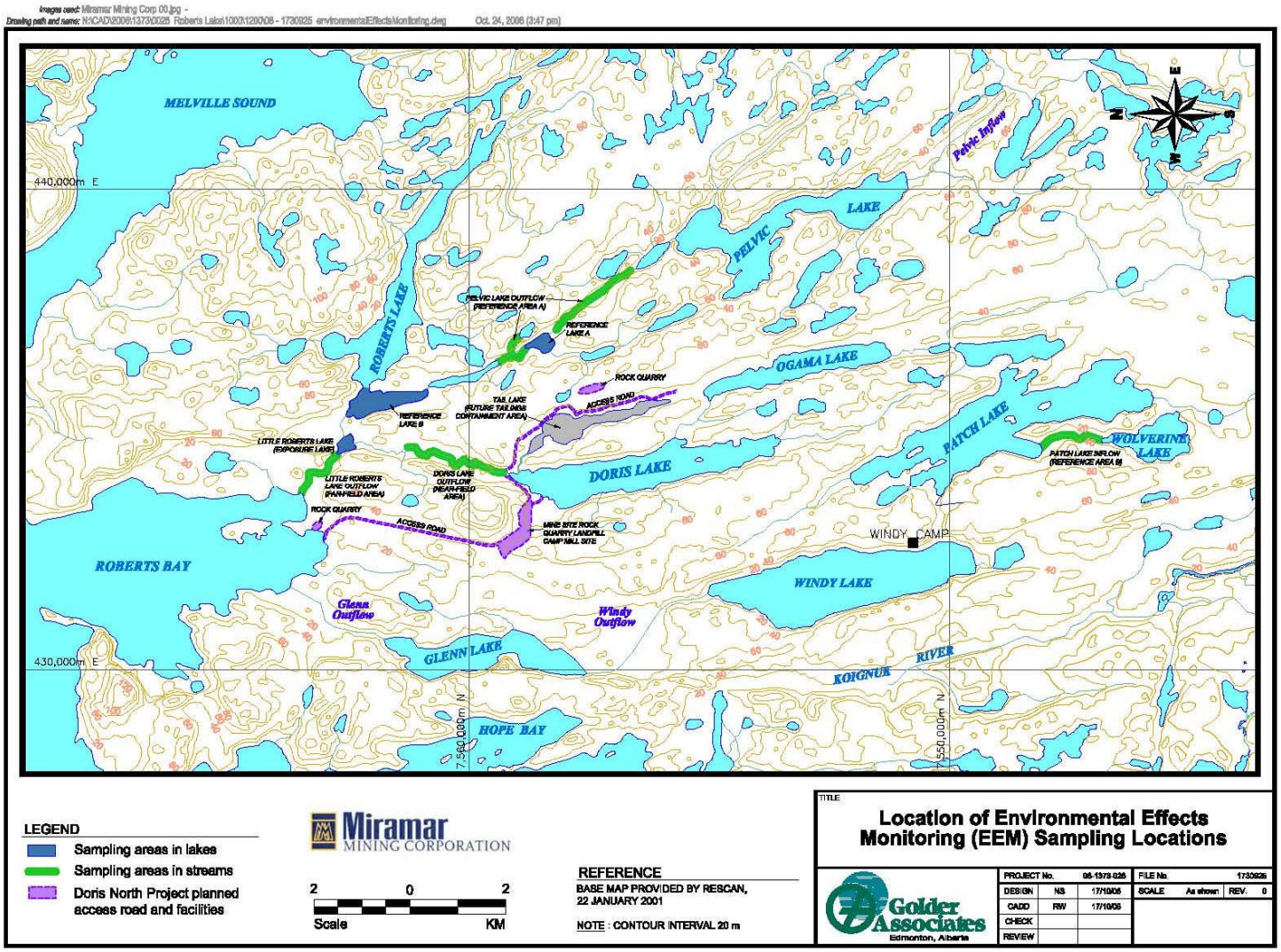
8.2.1 Adaptive Management

All mines regulated by the MMER are required to conduct a minimum of two consecutive biological monitoring cycles. MHBL will submit the second interpretive report within 36 months after the previous report submission if effects are found in two or fewer of the biological monitoring components. If effects are found in all three components, the second interpretive report will be submitted within 24 months.

If effects are not found in two consecutive biological monitoring cycles, MHBL may reduce the monitoring frequency, and will submit a subsequent interpretive report within 72 months of the previous report submission. However, if mine discharge operations or the receiving environment changes, MHBL will conduct a biological monitoring study within 24 months of the change.

If the same effects are found in two consecutive cycles, MHBL will design a monitoring study to determine the geographic extent and the magnitude of the effect, and submit an interpretive report within 24 months of the previous report submission. After the extent and magnitude have been determined, MHBL will design an Investigation of Cause study and submit the interpretive report within 24 months of the previous report submission. The Investigation of Cause study determines the follow-up actions required by MHBL, and the mine will return to conducting biological monitoring studies.

Figure 8.1: Location of Environmental Effects Monitoring (EEM) Sampling Stations



9.0 FISH MONITORING

9.1 Fisheries Compensation Plan

MHBL submitted a Doris North Project "No Net Loss" Plan Revision 5 (Golder Associates Ltd. 2005; EIS Supporting Document F4), which outlines the proposed fisheries mitigation and compensation developed in discussion with the Department of Fisheries and Oceans (DFO) and KIA. The plan is currently being updated to include detailed design drawings for the proposed compensation program as part of permitting requirements under the Fisheries Act.

The fisheries compensation program for the Doris North Project has been designed to ensure that "No Net Loss" in fish habitat productive capacity is achieved as it relates to the DFO policy for the management of fish habitat. The compensation program consists of four main components; these are as follows:

- Creation of rearing habitat in Doris Lake;
- Creation of additional reef habitat in the vicinity of the Jetty in Roberts Bay;
- Creation of rearing habitat in a tributary to Roberts Lake; and,
- Enhancement of the stream channel to facilitate fish migration in Roberts Outflow.

Follow-up monitoring to assess the effectiveness of the compensation program will include the following components:

9.1.1 Creation of Rearing Habitat in Doris Lake

As part of the project's compensation for the Harmful Alteration, Disruption or Destruction (HADD) to fish habitat, six shallow near-shore rearing areas in Doris Lake will be created. The key measures of enhancement success for these proposed rearing areas are to demonstrate that these areas have established primary and secondary productivity similar to that in non-enhanced rearing areas of Doris Lake (i.e., reference areas). Following one complete open-water season post-construction, monitoring will be undertaken to assess the quantity and extent of periphyton growth and benthic macroinvertebrate use in these newly created rearing habitats (i.e., treatment areas). "Reference" areas will be sampled for comparison with "treatment" areas. There will be two types of reference areas sampled.

One type of reference area will consist of habitats that are similar to the existing habitat before treatment and the second type of control areas will consist of similar habitats to the treatment areas. Most proposed treatment areas will be placed in shallow areas with sandy substrate. After enhancement, the treatment areas will consist of primarily boulder/rock substrate in shallow waters.

This portion of the monitoring program will be similar to that of a control/impact (CI) design, in which an impacted area (i.e., treatment = "newly constructed rearing habitats") is compared to one or more reference (control) areas (i.e., reference = "existing shallow water

rearing areas"). The use of at least three reference sites is similar to the requirements of a "before/after control/impact" design summarized by Minns et al. (1995).
This monitoring will continue annually during the operation of the mine (two years) and will be monitored again in Year-1 and Year-5 from decommissioning. Although the main benchmark of success is establishing suitable primary and secondary productivity, fish sampling would also be conducted to assess use of these areas by juvenile fish, in particular lake trout. Fish sampling methods would include snorkelling, underwater videography and backpack or electrofishing.

9.1.2 Jetty Fish Habitat Compensation Structures

Fisheries compensation for loss of fish habitat associated with the footprint of the jetty will include the provision of additional reef habitat through the construction of under-water rock spurs perpendicular to the jetty and rock spurs out from the shoreline at several locations along Roberts Bay. The key measures of enhancement success will be the establishment of primary and secondary productivity on the enhancement structures (i.e., which provide food source for fish), as well as the documentation of the use of the structures as rearing and feeding habitat for fish. The follow-up study design will be a Control/Impact design similar to that described above for monitoring enhancement structures in Doris Lake. Fish sampling methods will include snorkelling, minnow traps and other trapping methods, as well as underwater video and hydroacoustic gear to monitor fish presence along the enhanced and reference sites.

This monitoring will be conducted beginning the summer following the year of jetty construction and in Year-2 of operation and in Year-2 of active post-closure (i.e., year prior to jetty lowering to below water).

9.1.3 Creation of Rearing Habitat in a Tributary to Roberts Lake

As part of the project's compensation, rearing habitat will be created in a tributary to Roberts Lake. The key measure of enhancement success is to provide access to the newly created rearing habitat. To determine whether unrestricted access for Arctic char juveniles has been provided, backpack electrofishing surveys in the enhanced stream will be conducted annually during the operational period of the mine (two years). This monitoring will also be conducted again in Year-1 and Year-5 from decommissioning.

9.1.4 Enhancement in Roberts Outflow

The main premise behind the proposed enhancement of the boulder garden in Roberts Outflow is to increase accessibility to Roberts Lake for fish migrating upstream from the ocean, and to reduce the mortality of Arctic char that become stranded in the boulder zone. This boulder area restricts fish passage in low to moderate flow years. Available data show that in five out of eight years, there were extended periods of time when fish migration was hindered or blocked. Increasing access through the boulder garden would result in increased Arctic char access to rearing, feeding, and spawning habitat, as well as critical overwintering habitat. One of the key measures of success, therefore, will be the provision of nearly unrestricted passage of Arctic char into Roberts Lake.

Fish fences were used annually to monitor fish migration through the Roberts Outflow boulder garden from 2002 to 2005. This provided a baseline of Arctic char movements and related mortality during a range of flow conditions. After completion of the channel modification (i.e., during the first summer of construction), monitoring of the upstream migration of Arctic char will be undertaken during a moderate or low flow year during the early years of the development to assess fish passage success and mortality during passage through the enhanced section. This will be accomplished by installing fish fences and traps at both the upstream and downstream ends of the boulder garden to count and mark fish at the lower end of the section, and to determine the success of passage by recapturing the fish at the upper end of the section (i.e., at the entrance to the lake). This program will be repeated in Year-9 or Year-10 (depending on flow conditions) to ensure that the enhanced channel is still effective, and to assess the size of the Arctic char run at that time (i.e., reduced mortality and increased access to Roberts Lake should be reflected in increased run size).

It would be difficult to judge success of the enhancement program strictly on numbers of fish returning to Roberts Lake each year, because Arctic char often overwinter in freshwater lakes that are not part of their natal watershed, and the runs can fluctuate widely from year to year. A more direct measure of Arctic char production in the Roberts Lake system could be obtained by monitoring the out-migration of smolts (i.e., first time migrants to the ocean). In the Canadian Arctic, Arctic char juveniles spend the first four to seven years rearing in the lake system where they were born (based on data from Nauyak Lake; Johnson 1980). The size of the smolt run downstream, which normally occurs in early July, would be an appropriate measure of Arctic char production in Roberts Lake resulting from the improved access and survival of fish passing through the enhanced channel into Roberts Lake.

Based on the advice of DFO, MHBL installed a fish fence in mid June to mid July of 2006 on Roberts Creek below Little Roberts Lake to assess the feasibility of conducting annual counts over a longer-term. Based on the success of the program (i.e., it was possible to keep the smolt fence and trap operational), it appears that monitoring smolt out-migration will provide data useful in assessing the effectiveness of the enhancement facilities in the boulder garden section of Roberts Outflow.

Based on the results of the 2006 smolt out-migration monitoring, the program will be repeated annually for a total of a 10 years to document variations in out-migration run size and composition both prior to, as well as for a long enough period after channel enhancement, to determine any changes in smolt production that could be attributable to the enhancement program. MHBL proposes that the measure of success of the enhancement program would be to increase smolt production in Roberts Lake by an average of 25% over the pre-enhancement average, as the increased number of smolts would rapidly increase in biomass during their periods in the marine environment. Mathieson and Berg (1968) found Arctic char in northern Norway increased in weight by an average of 60.05% per summer season in the marine environment over a five year period. Although growth rates may be lower in the Canadian Arctic, Arctic char put on considerable weight during their forays in the productive marine environment.

A fish sampling program would also be conducted in Roberts Lake during years when the fish fence is operational (i.e., little additional cost, since the sampling crews would be on site to monitor the fish fence); however, given the size of the lake, it would be very difficult

to demonstrate that an increase in productivity for Arctic char has occurred. Catch-per-unit-effort (CPUE) will be compared to baseline data. Fish sampling methods would include gill nets for adult fish and modified Arctic fyke nets, beach seines and backpack electrofishers for juvenile fish. Tributaries to Roberts Lake would also be sampled using backpack electrofishers to capture young-of-the-year fish or small juvenile fish seeking forage areas and shelter from predators. During these programs, additional life history information (e.g., length and weight distribution, size at age for juveniles and smolts, etc.) will be collected for Arctic char in the system. It should be noted that mortalities will be kept to a minimum, as the objective of the enhancement program is to increase the standing stock and production of Arctic char in the system.

9.2 Doris Lake Willow Monitoring Program

In addition to the follow-up programs associated with the fisheries compensation program, MHBL has agreed to conduct follow-up monitoring in response to a concern raised by the Department of Fisheries and Oceans relating to potential changes to shoreline habitats along Doris Lake due to dewatering of Tail Lake outflow, and the potential effects on ninespine stickleback rearing habitat. To confirm that the ninespine stickleback habitat along the shoreline where Tail Outflow enters Doris Lake is not adversely affected by the project, MHBL will undertake a detailed survey of the willow habitat along this section of shoreline during the summer of 2007 (i.e., prior to construction). The survey methods will include the establishment of a permanent transect along a portion of the outflow with permanent 1 m by 1 m plots placed along this transect. In addition, permanent photographic survey stations will also be established along this transect as a means of visually documenting any changes in plant community cover and composition. This will provide a basis for comparison with monitoring to be conducted during operation and closure phases of the project. The frequency of monitoring will be conducted once prior to construction, once during operations and once during closure. If unforeseen effects on the shoreline habitat of Doris Lake in this area are identified, additional mitigation or compensation measures will be identified and discussed with DFO, prior to implementation.

9.3 Tail Lake Fish Tissue Analyses

Prior to the mine operation, the lake trout in Tail Lake will be removed following the DFO “General Fish-Out Protocol for Lakes to be Lost Due to Mining Developments”, and in a manner that accords with the Inuit Qaujimajatuqangit key tent of respect for fish. It is proposed that the fish would be removed through a netting program using local Inuit fish harvesters. Prior to removal of fish from the lake and possible distribution of the fish for use as human or animal food, lake trout will be collected from Tail Lake. Tissue samples a sample of the fish (i.e., 15 fish) will be analysed for metal contaminants as precautionary testing to confirm the fish are suitable by humans or animal consumption.

10.0 VEGETATION AND SOIL QUALITY MONITORING

10.1 Background and Rationale

Monitoring of vegetation quality (i.e., collection of vegetation samples for chemical analysis) will be included as part of the environmental monitoring program for the Doris North Project. The purpose of the sample collection is to determine whether dust from the site is depositing onto nearby plants, and whether the plants are taking up metals (i.e., components of dust) as a result. Information on plants concentrations can then be used to judge the quality of food for wildlife in the area.

10.2 Study Design

The data collection program will focus on the collection of plant tissue (both vascular plants and lichen) samples and soil samples for the analysis of trace metals. Lichen is known to be an indicator plant for air emissions because lichen obtains nutrients from the air. Vascular plants are also recommended for monitoring because they also uptake metals from deposition and from soil. Soil quality can also change due to deposition. Therefore, these three types of samples will be collected prior to operation (completed in 2006), annually during operation, and once during closure.

In the summer of 2006 MHBL collected soil and vegetation samples in areas immediately adjacent to the mine lease area and reference locations not expected to be impacted from the mine site (Figure 8-1) to provide a localized baseline.

10.3 Adaptive Management

Miramar recognizes that construction and operations at the Doris North Gold Mine Project will result in the generation of dust that would be additional to natural dust levels in the north. Sources of dust would include very fine particles such as vehicle exhaust to large particles generated from roads and from vehicle traffic on roads, airstrips, blasting and rock quarries. Natural dust also occurs on the landscape from sources such as exposed bedrock, shorelines, eskers and soil.

In Nunavut, an ambient air quality guideline established under the Environmental Protection Act sets a standard respecting the maximum desirable levels of dust in ambient air in the NWT/Nunavut. Measured as total suspended particulate (TSP), the standards for dust over 24 hours are 120 micrograms per cubic metre (ug/m^3) and averaged over a year are 60 ug/m^3. There are also National Ambient Air Quality Objectives for TSP (24 hour average – 120 ug/m^3: Annual average - 70 ug/m^3); for PM_{10} (24 hour average – 25 ug/m^3) and for $PM_{2.5}$ (24 hour average – 15 ug/m^3).

Predictions regarding the effects of dust on vegetation and wildlife uptake of vegetation are speculative. There are two general questions pertaining to dust effects on vegetation, as follows:

1. What is the relationship between dust fall and uptake of metals into plant tissues (i.e., the dietary route of exposure for wildlife, and in particular, caribou)?

2. What are the effects of dust as a direct impediment to growth, reproduction and survival among the various species, and will this lead to a change in vegetation cover and species composition?

MHBL could find no published guidelines or objectives for dustfall or for metal levels in vegetation specific to Nunavut. Alberta has a published dustfall objective summarized as follows:

53 mg/100 cm^2/30 days in residential and recreational areas; and
158 mg/100 cm^2/30 days in commercial and industrial areas.

No published guidance on acceptable metal levels in vegetation were found applicable to Canada.

MHBL has committed to establish an air quality monitoring station at the Doris North Project once stable electrical power is available that will conduct ambient air quality monitoring for TSP, PM_{10}, $PM_{2.5}$ and dustfall. The station will be set up in close proximity to the proposed plant site pad.

In the summer of 2007, Miramar proposes to establish three sets of Permanent Sample Plots (PSPs) for vegetation on the Doris North Project site (Roberts Bay, along the Roberts Bay access road) and down wind (down wind along the prevailing wind direction) from the plant site (where the air quality monitoring station will be established). Each set of PSP's will consist of six sample plots, each a 5 m by 5 m square plot, in which vegetation species will be identified and the percent cover within the PSP boundary estimated for each species. The six PSP plots at each sample set location will be established at 0 m, 50 m, 100 m, 200 m, 800 m and 1600 m distance from the nominal dust generation source to sample along a theoretical dust fall gradient. Samples of the vegetation will be collected from each PSP plot and analyzed for total metals (36 element ICP). Samples of the vegetation will be collected in the summer of 2007, 2008, 2009 and 2010 at a consistent point in time (same month) so that the results are relatively comparable from one year to another and so that trends in metal levels can be tracked.
MHBL proposes that the trigger points for further action would be as follows:

1. Dustfall measurements at the air quality monitoring station that consistently average greater than 158 mg/cm^2/30 Total dustfall; or

2. A statistically significant increase in the average measured metal concentration from the 2007 baseline concentrations at the PSP plots.

If either of these trigger conditions is reached then MHBL would initiate a wider investigation of dust fall impacts on vegetation around the Doris North Project.

In the absence of specific dustfall or vegetative metal guidelines in Nunavut, MHBL is open to discussion with the landowner (the KIA) and the GN-DoE on the applicability of these proposed trigger points.

There are currently ongoing discussions in the Lac De Gras and MacKay Lake area in the Northwest Territories regarding a regional dust fall and vegetation study. Miramar will

endeavour to stay abreast of the status and results of this study and incorporate any applicable results and recommendations into the Doris North dust fall monitoring program.

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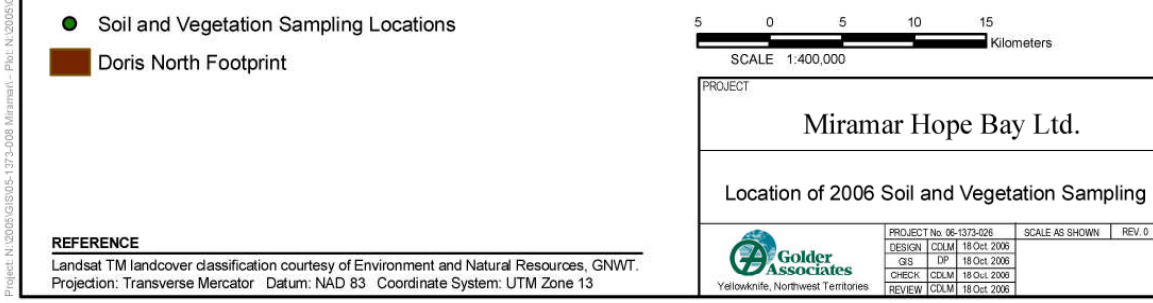
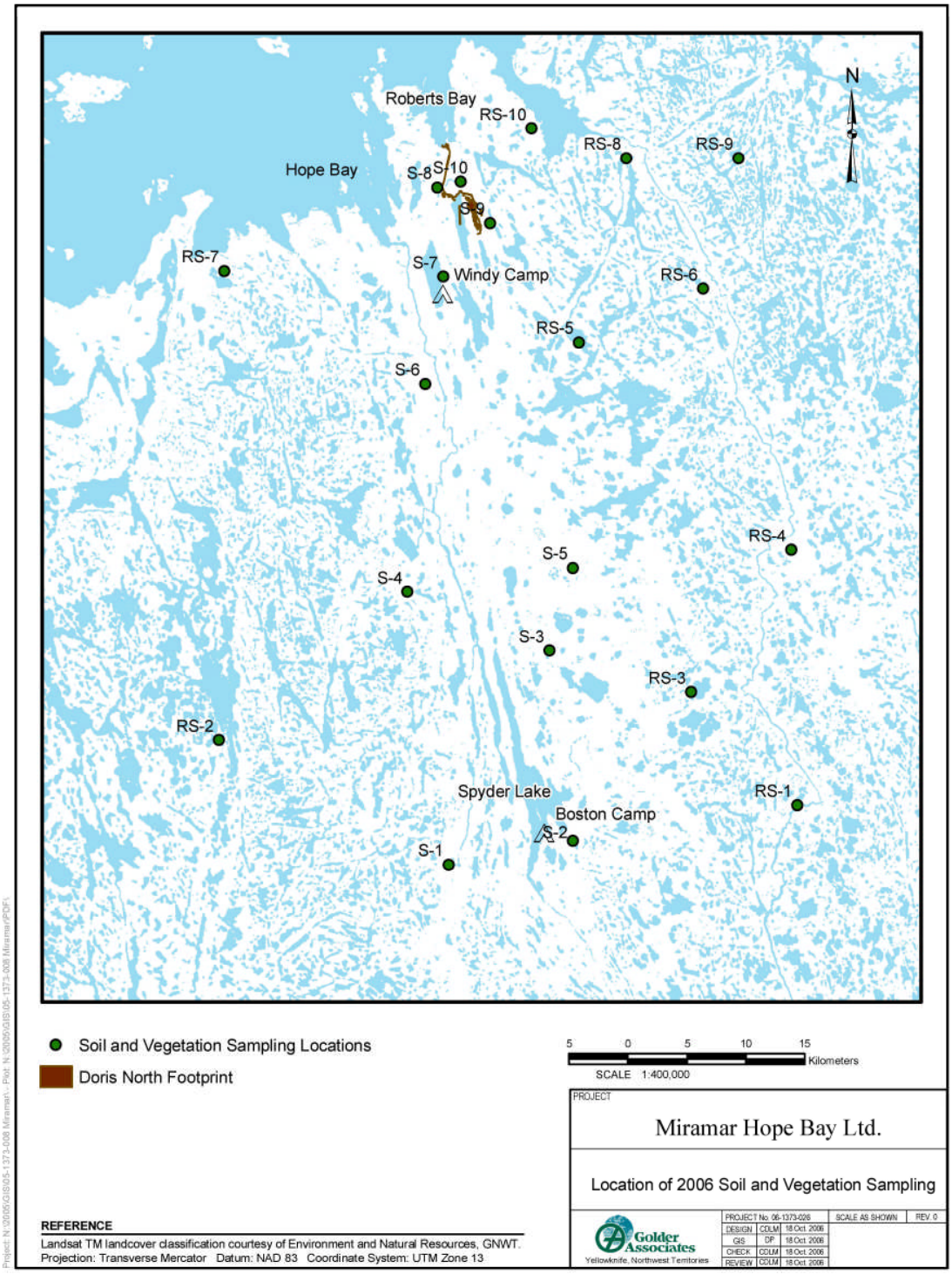

Soil and Vegetation Sampling Locations
Doris North Footprint
5 0 5 10 15
Kilometers
SCALE 1:400,000
PROJECT
Miramar Hope Bay Ltd.
Location of 2006 Soil and Vegetation Sampling
REFERENCE
Landsat TM landcover classification courtesy of Environment and Natural Resources, GNWT.
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 13
Golder Associates
Yellowknife, Northwest Territories
PROJECT No. 06-1373-026
SCALE AS SHOWN
REV. 0
DESIGN CDLM 18 Oct. 2006
GIS DP 18 Oct. 2006
CHECK CDLM 18 Oct. 2006
REVIEW CDLM 18 Oct. 2006


N
Roberts Bay
RS-10
RS-8
RS-9
Hope Bay
S-8
S-10
S-9
RS-7
S-7
Windy Camp
RS-6
RS-5
S-6
RS-4
S-5
S-4
S-3
RS-3
RS-2
Spyder Lake
Boston Camp
S-2
RS-1
S-1
Soil and Vegetation Sampling Locations
Doris North Footprint
5 0 5 10 15
Kilometers
SCALE 1:400,000
PROJECT
Miramar Hope Bay Ltd.
Location of 2006 Soil and Vegetation Sampling
REFERENCE
Landsat TM landcover classification courtesy of Environment and Natural Resources, GNWT.
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 13
Golder Associates
Yellowknife, Northwest Territories
PROJECT No. 06-1373-026
SCALE AS SHOWN
REV. 0
DESIGN CDLM 18 Oct. 2006
GIS DP 18 Oct. 2006
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REVIEW CDLM 18 Oct. 2006

11.0 WILDLIFE

11.1 Background and Rationale

MHBL submitted a revised Wildlife Mitigation and Monitoring Report[12] for the Doris North Project to the Nunavut Impact Review Board in December of 2006 in response to Project Certificate Conditions 22 and 25. The Wildlife Mitigation and Monitoring Program (WMMP) is designed to determine the direct and indirect effects of the Doris North Project on wildlife and wildlife habitat (Golder 2006). Direct effects include habitat loss from project infrastructure and direct mortality from encounters with on-site staff. Indirect effects include a reduction in habitat effectiveness through habitat avoidance near the project site as a result of human presence and sensory disturbance. Alternatively, some species (e.g. wolverine and grizzly bear) may be attracted to the project site due to human presence and camp smells. The area of avoidance or attraction is referred to as a Zone of Influence (ZOI).

11.2 Study Design

All wildlife species occurring in the Hope Bay Region can not be studied, therefore the following wildlife Valued Ecosystem Components were selected for monitoring:

- Wildlife habitat;
- Caribou;
- Muskoxen;
- Grizzly bears;
- Wolverines;
- Upland breeding birds (songbirds, shorebirds and ptarmigan);
- Waterfowl (including sea ducks); and
- Raptors (*e.g.* falcons, eagles, hawks, ravens and owls).

The general study area for determining project-related effects to wildlife is shown in Figure 10-1. The study area was selected based on previous data collection surveys, potential zone of influence (e.g. caribou) and location of other ore deposits.

Each survey is setup to obtain reference or control data (i.e. outside the perceived influence of the Project) and treatment data (i.e. influenced by the Project). Monitoring program surveys are species-specific and will be conducted according to accepted protocols.

11.2.1 Wildlife Habitat and Ungulates

Wildlife habitat will be measured through the use of acquired imagery (Ikonos) to determine if predicted losses to vegetation communities in the EIS match what is actually observed on the landscape. Surveys for caribou and muskoxen include aerial surveys over the entire wildlife study area. Additional caribou surveys include snow tracking to determine interactions with roads and other project infrastructure and behavioural observations to determine activity budgets.

[12] Final Report on Wildlife Mitigation and Monitoring Program for the Doris North Gold Mine Project, dated December 2006, prepared by Golder Associates Ltd. For Miramar Hope Bay Ltd.

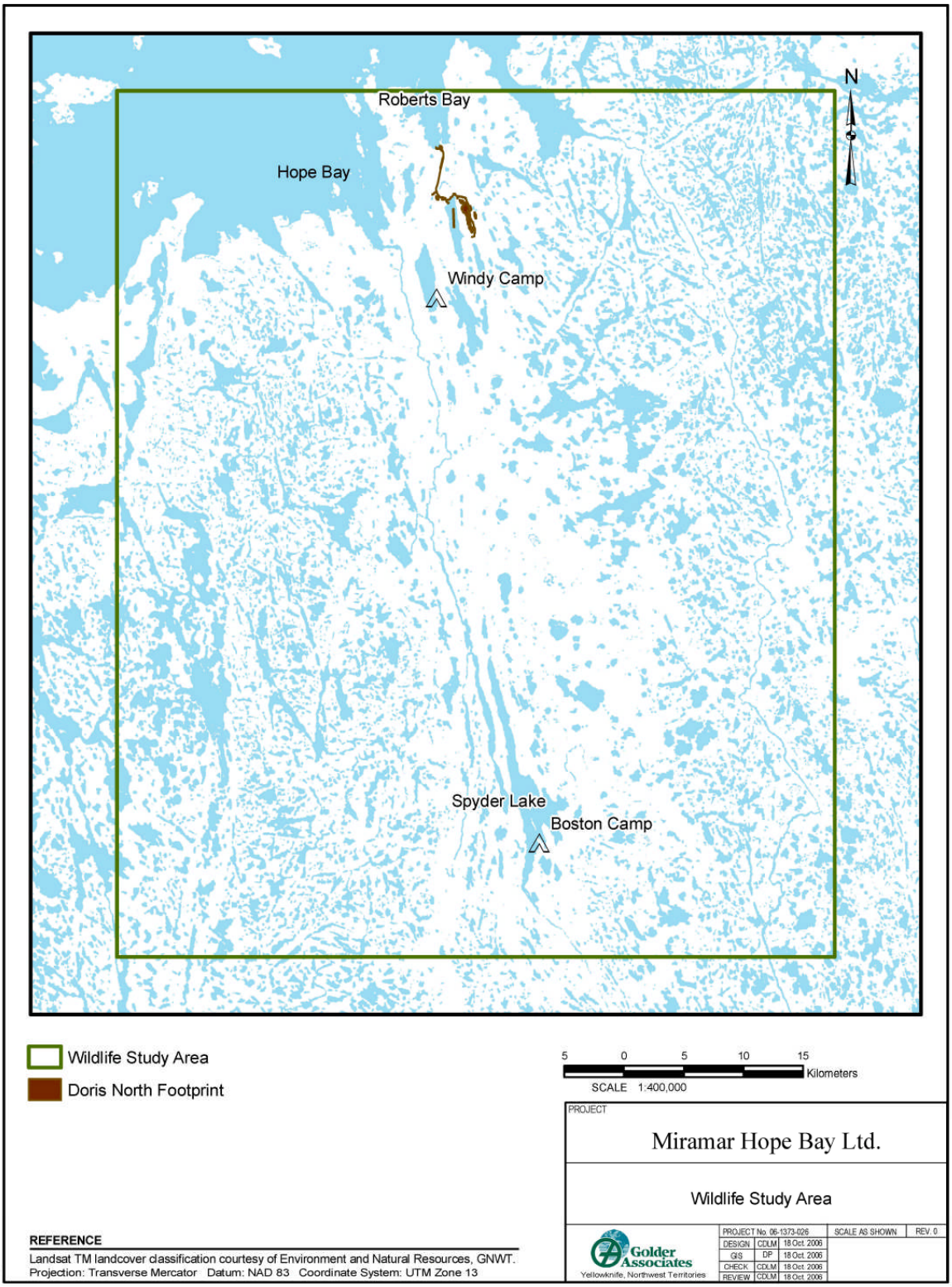
11.2.2 Carnivores

Surveys for grizzly bears include seasonal forage plots to determine grizzly bear habitat use during spring and late summer. MHBL is currently in discussions with the GN-DoE and the Kitikmeot Inuit Association (KIA) about the use of hair-snagging and DNA analysis as a protocol for grizzly bear monitoring. Wolverine surveys currently consist of snow-track counts throughout the study area (Figure 10-1) and MHBL is currently in discussions with the GN-DoE and KIA about the use of hair-snagging and DNA analysis as a protocol for wolverine monitoring as well.

11.2.3 Birds

Surveys for upland breeding birds include breeding bird point counts and PRISM plots throughout the study area. Aerial surveys for waterfowl will be conducted in blocks that represent treatment (i.e. Doris North Project) and control areas throughout the wildlife study area (Figure 10-1). Surveys for raptors consist of aerial surveys in June to determine species occupancy of historic nest sites followed by a second survey in August to determine reproductive success (i.e. presence of eggs and/or chicks).

Figure 11.1: Wildlife Study Area



11.3 Wildlife Incidents and Mortality

A wildlife sightings log will be maintained on-site through the use of sightings cards and a wildlife awareness poster that are posted in both the Windy Lake camp and Boston camp. Wildlife incidents and mortality will be monitored through various wildlife surveys of infrastructure including the tailings impoundment area, road and landfill.

11.4 Adaptive Management

Adaptive management triggers are species-specific and are outlined in the WMMP (Golder 2006). In general, the adaptive management measures are triggered if measured results contradict predictions to wildlife VECs as determined in the EIS.

This report, “Monitoring and Follow-Up Plan, Doris North Project, Nunavut, July 2007”, has been prepared by Miramar Hope Bay Ltd.

Prepared By

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General Manager, Environment

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