WATER MANAGEMENT PLAN

HOPE BAY, NUNAVUT

June 2015

PLAIN LANGUAGE SUMMARY

This Water Management Plan (WMP) describes the water management practices for the Doris North Project, Hope Bay. This Plan is intended to fulfil the requirements outlined in the Doris North Project Certificate and Type A Water Licence, and is an updated version of the previous plan. It is intended that this Plan be expanded in future to encompass all water management for Hope Bay on a belt-wide basis.

The WMP outlines legislation and guidance relevant to the Plan, and describes the water management facilities. It also identifies various water management issues, and the mitigation measures which TMAC is currently implementing or plans to implement during construction, operations and closure.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices are employed throughout all water management activities associated with activities at Hope Bay, thus ensuring water licence conditions are met and minimal potential downstream environmental impacts occur.

REVISION HISTORY

Revision #	Date	Section	Summary of Changes	Author	Approver
0	October 2006	New Document	Initial version of the Water Management Plan submitted with the 2006 water licence application	MHBL	MHBL
1	April 2007	Throughout	Consolidation of information on water management facilities	MMC	MHBL
2	December 2010	Throughout	Updated in accordance with Type A Water License 2AM-DOH0713	SRK	HMBL
3	July 2011		Address monitoring of Doris Lake water levels, address party review comments, RO water treatment	SRK	HBML
4	December 2011		Include Table of Concordance, incorporate underflow sumps	SRK	HBML
5	February 2012		Approved Doris North Interim Water Management Plan under 2AM-DOH1323	SRK	HBML, NWB
6	December 2012		Update to address Part F Item 1.a.,b.,c. of Water License	SRK	HBML
7	June 2015	Throughout	Update to TMAC as current licensee for the Hope Bay region. Changes to document structure for operational suitability and efficiency	TMAC (SRK)	TMAC
		Sections • 1.3; • 2.2; • 2.5; • 2.7; • 2.8; • 4.	Addition of: • Doris North Infrastructure Monitoring Program • Pollution Control Pond 2; • Talik water management • Revised: • Effluent discharge criteria • TIA Decommissioning • Water management contingencies		
		Module A	Underground talik water management, addition of proposed second Pollution Control Pond, TIA discharge to Roberts Bay		

GLOSSARY AND ACRONYMS

TERM	DEFINITION
CCME	Canadian Ministers of the Environment
DFO	Department of Fisheries and Oceans
DOE	Department of Environment
GN	Government of Nunavut
KIA	Kitikmeot Inuit Association
MHBL	Miramar Hope Bay Ltd.
MMC	Miramar Mining Corporation
MMER	Metal Mining Effluent Regulations
NWB	Nunavut Water Board
PCP	Pollution Control Pond
TIA	Tailings Impoundment Area

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1. INTRODUCTION

This Hope Bay *Water Management Plan* (the Plan) has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices are employed throughout all water management activities associated with the operation and closure of the Doris North Project, thus ensuring water licence conditions are met and minimal potential downstream environmental impacts occur.

This Plan is structured in a manner such that one document pertaining to water management is approved and implemented across all TMAC Hope Bay project sites, while still addressing site and licence-specific needs: the main document outlines TMAC's approach to water management as it pertains to all TMAC Hope Bay developments; subsequent modules provide details for each site and the associated water licence. In the event of a new water licence, or an existing licence amendment, the specific modules pertaining to that licence and site will be revised. This is intended for consistency and efficiency across operations and for compliance management.

1.1. OBJECTIVES

This plan outlines the water management needs of the Doris North mine area, and components of the project including excess water from the Tailings Impoundment Area (TIA) and underground groundwater management.

The objective of the Plan is to provide guidance and procedures required to operate, monitor and maintain water management on site in accordance with the existing licences associated with development of the Hope Bay Project.

1.2. RELEVANT LEGISLATION AND GUIDANCE

Table 1 provides a summary of federal and territorial regulations governing the Hope Bay *Water Management Plan* and associated guidelines.

Table 1: Regulations and Guidelines Pertinent to the Water Management Plan

Regulation	Year	Governing Body	Relevance
Nunavut Waters Regulations	2013	Nunavut Water Board	License for mining and milling undertaking to use water and deposit of waste in relation to the construction, operation, closure and reclamation.
Environmental Protection Act	2011	Government of Nunavut (GN), Department of Environment (DOE), Environmental Protection division	Legislation to authorize discharge of water
Environmental Rights Act	2011	GN, DOE, Environmental Protection division	Grants all residents the ability to launch an investigation
Metal Mining Effluent Regulation(MMER)	2009 –as amended to date	Federal Department of Fisheries and Oceans & Environment Canada	Allows for the elimination of a water body for the deposition of mine waste
Guideline	**Year**	**Issued by**	**Relevance**
Canadian Environmental Quality Guidelines	1999 – as amended to date	Canadian Council of Ministers of the Environment (CCME)	Provides guidance on water quality for the protection of aquatic life; both freshwater and marine

1.3. Related TMAC Documents and Programs

Table 2 provides a summary of documents related to the Hope Bay Water Management Plan.

Table 2: Documents Related to the Water Management Plan

Document Title	Relevance
Waste Rock and Ore Management Plan	Management of surface contact water
Domestic Wastewater Treatment Management Plan	Management of treated effluent
Hope Bay Spill Contingency Plan	Spill response procedure
Tailings Management Plan	Management of excess water from the TIA
Quality Assurance and Quality Control Plan	Sampling practices document that is reviewed and approved by the NWB
Doris North Infrastructure Monitoring Program	Water Management facility inspections

1.4. PLAN MANAGEMENT AND EXECUTION

The Water Management Plan is valid until August 15, 2013 (the duration of 2AM-DOH1323). The Plan is reviewed annually.

Personnel responsible for implementing and updating the Plan are identified in Table 3.

Table 3: Roles and Responsibilities

Role	Responsibility
VP Operations	• Overall responsibility for and implementation of this management plan; • Provide the on-site resources to operate, manage, and maintain water management infrastructure, such as pipelines, diversion berms, lined ponds and holding tanks; • Provide input on modifications to design and operational procedures to improve operational performance.
Surface Manager	• Conduct regular inspections of the water management facilities and audits of the maintenance records; • Responsible for tracking water movements between the various water management facilities, including from the pollution control ponds and sumps to the tailings impoundment area (TIA); • Maintain records of the source, disposition and volume of water transported/discharged; • Report irregularities identified during visual inspections to the VP Operations.
Environment Manager	• Review and update this management plan as required; • Monitor water quality in the ponds, TIA and discharge points; • Assess whether water quality samples have met applicable regulatory standards and guidelines; • Coordinate with the surface manager responsible for water movements between the various water management facilities to ensure compliance with all licence requirements; • Audit of water management tracking records and all associated required reporting.

2. WATER MANAGEMENT ISSUES

2.1. MANAGEMENT OF CONTACT WATER

The volume of contact water requiring management will determine the size of storage facilities and treatment capacity.

Management Response

Water is diverted upstream of mine areas to reduce the amount of contact water reporting to the Sedimentation and Pollution Control Ponds (PCP).

Pads are constructed of non-mineralized rock with sedimentation and pollution control ponds for the collection of water. Once suspended solids have been allowed to settle in the sedimentation ponds, water quality is expected to meet discharge limits outlined in the Water Licence and the water can actively be discharged to the tundra. Water in the Pollution Control Ponds is directed to the TIA. Site specific details are provided in Module A.

2.2. EXTENT OF INFRASTRUCTURE REQUIRING WATER MANAGEMENT

Water that comes into contact with ore and waste rock may not meet effluent water quality discharge limits following the settling of suspended solids. Additional treatment of the contact water is expected. The areal extent of water coming into contact will determine the volume of water requiring treatment.

Management Response

The facilities have been consolidated and subdivided to reduce the quantity and variance in quality of water requiring management. The deposition of ore and waste rock on surface is restricted to designated areas. For example, at the Doris North mine industrial complex water comes into contact with ore and waste rock on pads in the east half of the complex. This water reports to Pollution Control Pond 1. Water that comes into contact with ore on Pad U reports to Pollution Control Pond 1However, the east half of the Doris North mine industrial complex reports to the sedimentation pond. Water collected in the sedimentation pond can be discharged to the tundra if effluent water quality limits meet effluent discharge limits outlined in the Water Licence thereby reducing the volume of water requiring treatment and the potentially impacted area.

2.3. DESIGN OF INFRASTRUCTURE REQUIRED TO MANAGE WATER

The distribution of facilities across the site will dictate where infrastructure must be developed to manage water.

Management Response

Locating infrastructure pads within diversion berms and grading surfaces towards the pollution control or sedimentation ponds ensures runoff and seepage will flow to the select ponds for management. Diversion berms may be constructed to temporarily route water away from infrastructure as needed, to prevent contact. If areas of underflow or shallow groundwater discharge occurs from the active layer, additional sumps may be constructed to ensure all seepage associated with contact water is captured in the water management system. Site specific details are provided in Module A.

2.4. APPROPRIATE DESIGN CAPACITY OF PONDS AND THE TIA

Pollution control ponds are to be designed to manage water from the overall drainage area during storm events such that the contained volume does not exceed the pumping capacity.

The TIA is an engineered facility designed to receive contact water as tailings slurry. Water levels are managed such that water is available for reclaim in the mill. Excess water in the reclaim pond is discharged to Roberts Bay.

Management Response

The retention pond storage capacity and the storm event are determined based on site specific conditions. It is expected that PCPs will always be operated in a manner allowing pumping to commence as soon as the containment volume is large enough for one continuous hour of pumping. All water will be transferred to the TIA. Site specific details are provided in Module A.

2.5. Appropriate Talik Water Management

During the Doris Central and Connector underground development, it is anticipated that groundwater will be intercepted from development within a talik under Doris Lake.

Inflow estimates have been modeled including management methods and the expected peak daily inflow of water to the Doris Mine is estimated to be 3,000 m^3/d when the mine is fully developed.

Management Response

To prevent excessive groundwater inflows, an investigation and grouting program will be put in place during mining. This will consist of evaluating drilled exploration holes for water in advance of development. Should water be encountered in substantial volumes a program of pressure grouting the area will be initiated. If substantial inflows are anticipated a grout curtain will be put in place prior to blasting. Any leaking drill holes that are encountered will be plugged, likely using Margo type plugs.

Where possible, groundwater will be utilized during underground drilling to reduce fresh water and salt consumption and to minimize groundwater discharge volumes. Excess groundwater will be intercepted in underground sumps and pumped to the mill building and discharged to Roberts Bay. Intercepted groundwater will be discharged to Roberts Bay year round via a diffuser.

2.6. Compliant Effluent Discharge

The location and timing of the discharge of compliant water will be dependent upon the infrastructure available at the time of discharge.

Management Response

During Care and Maintenance stages of the mine life cycle the water management strategy is to convey flows from existing pollution control ponds and non-compliant flows from the Sedimentation Pond to the TIA. As permitted in the project Water Licence, compliant water from the TIA can be discharged to Doris Creek.

During construction, sediment and erosion control measures will be implemented and monitored where needed, as part of the Construction Monitoring Program to ensure runoff meets the effluent discharge criteria specified in the licence

During operations mill effluent, surface runoff water, precipitation and contact water accumulating in the sediment control pond, pollution control pond (PCP) 1, landfill sump and Pad U (PCP 2) will be pumped to the TIA.

An interim dyke will be constructed in the TIA to allow for subaerial tailings deposition. Slurry water and accumulated water from upstream runoff will drain through the interim dyke into the TIA Reclaim Pond where process water will be reclaimed for mill operations.

Excess water will be pumped from the TIA to the Marine Outfall Mixing Box located in the mill building, and then be pumped via a pipeline along existing corridors to the Roberts Bay Discharge System. Water from the TIA will only be discharged during the open-water season (June – September inclusive).

2.7. Appropriate Discharge Criteria

Water quality criteria for the discharge of water into the marine environment is to be listed in the project Water Licence.

The Metal Mining Effluent Regulations (MMER) apply to mine effluent discharge.

Management Response

Marine water quality guidelines, specifically the Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of marine aquatic life (CCME 2015), were used to evaluate the water quality requirements for a proposed discharge to the marine environment for the Project. The (MMER) water quality limits for deleterious substances (MMER 2015) were used as the proposed authorized limits at the end of the Marine Outfall Pipeline.

2.8. Timing for Decommissioning of Dams in the Tailings Impoundment Area

The closure of the TIA will not be complete until the tailings are covered, the interim dyke is lowered to the height of the subaerial tailings and the North Dam has been breached.

Management Response

At closure, water management of the TIA will be discharged to Roberts Bay for 2 years, to lower the water level. The TIA will then be allowed recharge naturally for 5 years, after which it is expected that water quality in the TIA meets Doris Creek water quality guidelines as listed in the Water Licence. Once water quality in the TIA meets Doris Creek water quality guidelines, the North Dam in the TIA can be breached and flow restored to Tail Lake Outflow.

3. Inspection and Evaluation

3.1. Monitoring

Visual inspections of all water management structures will be completed to determine if the facilities are operating as designed and assess maintenance requirements as described in Module A. Monitoring requirements are also described in Module A. The objective of the monitoring is to:

- Ensure water in the ponds, TIA meets the appropriate discharge limits prior to discharge
- Ensure points of discharge to tundra are not negatively affected by pooling or erosion
- Ensure all water movement and volumes are tracked; and
- Assess water quality in the receiving water environment.

During construction, daily visual inspections, and inspections after significant rain events, are completed of construction activities to:

- Monitor for signs of erosion and implement mitigation measures to prevent entry of sediment to any water body; and
- Ensure runoff water quality during construction meets effluent discharge criteria as specified in the licence

3.2. Documentation and Reporting

Documentation and reporting requirements for Doris North are described in Module A. Monitoring data will be compiled into monthly and annual reports submitted to the NWB as part of the Surveillance Network Program, and a Construction Monitoring Report will be prepared in applicable years. Inspection records are maintained on site and available for review upon request.

4. CONTINGENCIES

The following Table 4 provides a list of possible non-compliance/unforeseen events and suggested adaptive management solutions.

Table 4: Water Management Contingencies

Contingency	Adaptive Management Solution
Sedimentation Pond does not meet discharge criteria	In the event that water quality in the sedimentation pond does not meet effluent discharge limits, water will be pumped to the Pollution Control Pond 1 and managed in the TIA.
Low Pollution Control Pond capacity	In the event that the water management for the pollution control ponds cannot be maintained, water can be temporarily stored in the sedimentation pond and ultimately managed in the TIA.
Malfunctioning discharge pipeline to Roberts Bay	In the event that the discharge pipeline to Roberts Bay is malfunctioning, intercepted groundwater inflows will be stored in the underground sumps and pumped to the Pollution Control Pond(s) for temporary management, or to the TIA. Excess water management in the TIA that meets water quality and discharge criteria as described in the water license will be discharged to Doris Creek during the open water season.
Excess water in the TIA	During operations, excess water in the TIA will be pumped to the Mill building and discharged to Roberts Bay.

5. REFERENCES

Canadian Council of Ministers of the Environment (CCME), 2015. Canadian Environmental Quality Guidelines Summary Table. http://st-ts.ccme.ca/. Accessed April 2015.

Metal Mining Effluent Regulations (MMER), 2015. Authorized Limits of Deleterious Substances - Schedule 4. Last amended February 20, 2015. http://laws-lois.justice.gc.ca/eng/regulations/SOR-2002-222/. Accessed April 2015.

DORIS WATER MANAGEMENT PLAN

MODULE A: 2AM-DOH1323 (DORIS)

CONFORMITY TABLE

License	Part	Item	Topic	Plan Section
2AM-DOH1323	D	4	The Licensee shall implement sediment and erosion control measures prior to and maintained during the construction and operation where necessary to prevent entry of sediment into water	Plan Section 2.6, 2.6, Module 1
		5	The Licensee shall undertake appropriate corrective measures to mitigate impacts on surface drainage resulting from the Licensee's operations.	Section 3.1
		16	The Licensee shall monitor all activities for signs of erosion and shall implement and maintain sediment and erosion control measures prior to the undertaking to prevent entry of sediment into any water body.	Module 1
		17	The Licensee shall conduct daily visual inspections for all construction activity during spring freshet and during and after remarkable rainfall events with sampling of runoff/seepage where turbidity is evident.	Section 3.1, 3.2 Module 1
		18	All surface runoff during the construction of any facilities, where flow may directly or indirectly enter a water body, shall meet the following Effluent quality limits.	Section 3.1
		24	The Licensee shall construct and maintain all containment and runoff control structures to prevent escape of wastes to the surface or groundwater systems.	Section 2.1 to 2.4
		27	The Licensee shall direct all runoff and seepage from the Temporary Waste Rock Pad to the Pollution Control Pond for collection and transfer to the Tailings Impoundment Area.	Section 2.2
	F	2	The Licensee shall carry out regular inspections of all water management structures during periods of flow and the records be kept for review upon request of an Inspector.	Section 3.1 and 3.2

	G	2	The Licensee shall perform all land applied discharges in a manner that prevents erosion at the point of discharge and downstream.	Section 3.1
		22	All Water from the Pollution Control Pond shall be directed to the Tailings Impoundment Area, unless otherwise authorized by the Board in writing.	Section 2.1 and 2.4
		23 (a to d)	The Licensee shall operate and maintain the Sedimentation Pond and Reagent and Cyanide Storage Facility sumps in accordance with listed criteria otherwise directed to the TIA.	Module A
		26 (a to n)	The Licensee shall operate and maintain the TIA to engineering standards.	Section 2.4
		28	All Water discharged from the TIA at monitoring station TL-4 shall not exceed specified Effluent quality limits.	Module A
	J	1	The Licensee shall install and maintain flow meters or other such devices, or implement suitable methods required for the measuring of water use and Effluent discharge volumes, to be operated and maintained to the satisfaction of an Inspector.	Section 3.1
		20	The Licensee shall visually monitor and record observations, to be made available to an Inspector upon request, on a daily basis during periods of discharge onto the tundra from: a. Landfill Sump; b. Sedimentation Pond; c. Landfarm Sump; d. Plant Site Fuel Storage and Containment Area Sump; e. Roberts Bay Fuel Storage and Containment Area Sumps; f. Wastewater Treatment Plant (during the construction phase); and h. Reagent and cyanide storage facility sumps.	Section 3.1

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A1. INTRODUCTION

The Plan has been prepared in accordance with Type A Water License No. 2AM-DOH1323. The water license sets out a number of conditions related to the management of water at the Doris North site and is valid until August 15, 2023. All of the terms and condition set out in the licence have been considered throughout the development of the Plan. A conformity table was prepared which provides a summary of the terms and conditions that pertain to the water management and also provides a location within the Plan that the condition is addressed (see start of this Module).

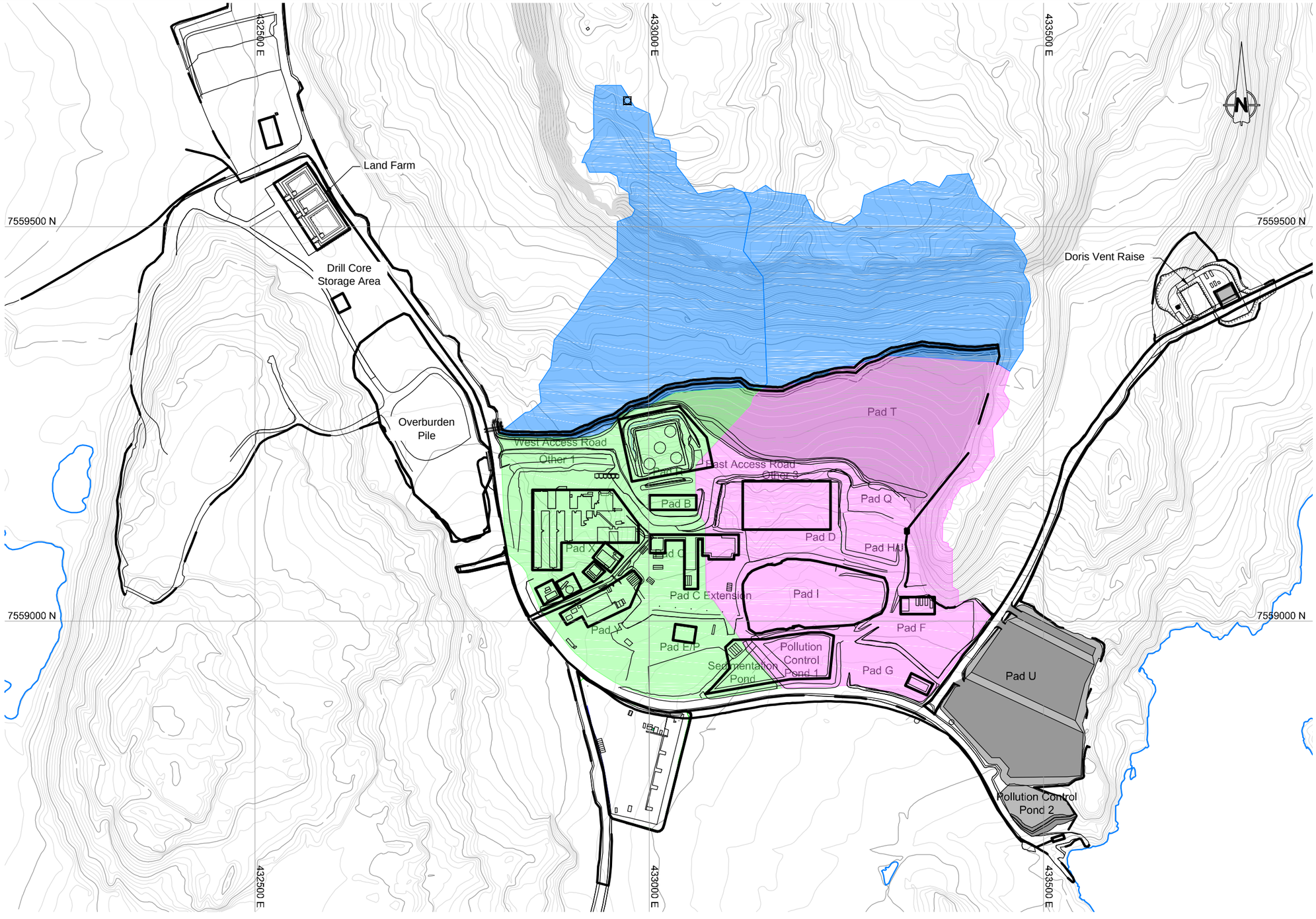
A2. DORIS WATER MANAGEMENT FACILITIES

The mine facilities relevant to this water management plan are a combination of constructed facilities and facilities that are planned for construction as part of Amendment 3. Table A1 provides a summary of mine infrastructure relevant to this water management plan. Figure 1 illustrates the mine area and total catchment areas reporting to the sedimentation and control ponds within the Doris North Mine Area.

Table A1: Facilities within the Mine Area

Facility	Reporting to
Pad X (Main Camp)	Existing Sedimentation Pond
Pad B (Laydown Area)	Existing Sedimentation Pond
Pad C (Administrative Buildings)	Existing Sedimentation Pond
Pad R (Fuel Storage Area)	Existing Sedimentation Pond
Pad Y (Warehouse/Laydown Area)	Existing Sedimentation Pond
Pad E/P (Laydown Area)	Existing Sedimentation Pond
Pad D (Mill Terrace)	Existing Pollution Control Pond 1
Pad T (Waste Rock Storage Area)	Existing Pollution Control Pond 1
Pad Q (Ore Storage Area)	Existing Pollution Control Pond 1
Pad H/J (Ore Storage Area)	Existing Pollution Control Pond 1
Pad I (Existing Waste Rock Storage Area)	Existing Pollution Control Pond 1
Pad F (Laydown Area)	Existing Pollution Control Pond 1
Pad G (Laydown Area)	Existing Pollution Control Pond 1
Pad U (Ore Storage Area)	Proposed Pollution Control Pond 2

The following sections provide a description of water management infrastructure.



LEGEND

- Diverted Area (145,444 m^2)
- Non-Contact Area (83,733 m^2)
- Contact Area (128,369 m^2)

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TMAC RESOURCES

TMAC Resouces Inc.

Water Management Plan

Doris North Mine Area

DATE:	APPROVED:	FIGURE:
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A2.1 DORIS NORTH DIVERSION

In order to divert water upstream of the mine area and reduce the amount of contact water, the Doris North diversion berm diverts approximately 145,444 m^2 away from the site. The Doris North diversion berm was constructed in 2011 and reduces the total amount of water reporting to the Sedimentation and Pollution Control Ponds to 212,142 m^2.

Pad T is located within the diversion berm and will not need any additional water management as its surface will be graded to ensure runoff and seepage will flow to the existing Pollution Control Pond 1. Pad U does not require any diversion as it is on the downstream side of the existing access road to Doris Lake and Tail Lake. The surface of Pad U will be graded to ensure runoff and seepage flow to the proposed Pollution Control Pond 2.

A2.2 SEDIMENTATION POND

As illustrated in Figure 1, pads located on the west side of the mine area report to the existing sedimentation pond. These pads are constructed of non-mineralized rock where water collected in the pond can be discharged to the tundra if effluent water quality limits meet effluent discharge limits outlined in the Water Licence. The existing sedimentation pond has capacity of 3,325 m^3.

Table A2: Sedimentation Pond Effluent Discharge Limits to Tundra

Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration in any Grab Sample (mg/L)
pH	Between 6.0-9.0	9.0
Total Suspended Solids	15.0	30.0
Total Ammonia	2.0	4.0
Total CN	1.0	2.0
Total Oil and Grease	5 and no visible sheen	10 and no visible sheen on pond
Total Aluminum	1.0	2.0
Total Arsenic	0.05	0.10
Total Copper	0.02	0.30
Total Iron	0.30	0.60
Total Lead	0.01	0.02
Total Nickel	0.05	0.10
Total Zinc	0.01	0.02

Source: Water Licence 2AM-DOH1323 Part G, 23

A3. POLLUTION CONTROL PONDS

A3.1 EXISTING POLLUTION CONTROL POND 1

Pads located on the east side of the mine area that have the potential of being contaminated will be graded to ensure all runoff and seepage will be diverted and collected in the existing Pollution Control Pond. This includes the proposed Pad T which will be composed of a waste rock storage area. The Pollution Control Pond is designed to be a retention pond for the 24 hr 1 in 25 year storm and has a storage capacity of 2,992 m^3. The total volume of runoff captured in this pond will be transferred to the TIA. It is expected that the pond will always be operated in a manner allowing pumping and/or trucking to commence as soon as the containment volume is large enough for one continuous hour of pumping. Associated with Pollution Control Pond 1, on the south east corner of the facility, is an underflow interception sump that captures shallow groundwater discharge from the active layer. This sump is monitored for water quality to ensure any seepage that might be bypassing the pond is captured and returned to the water management system.

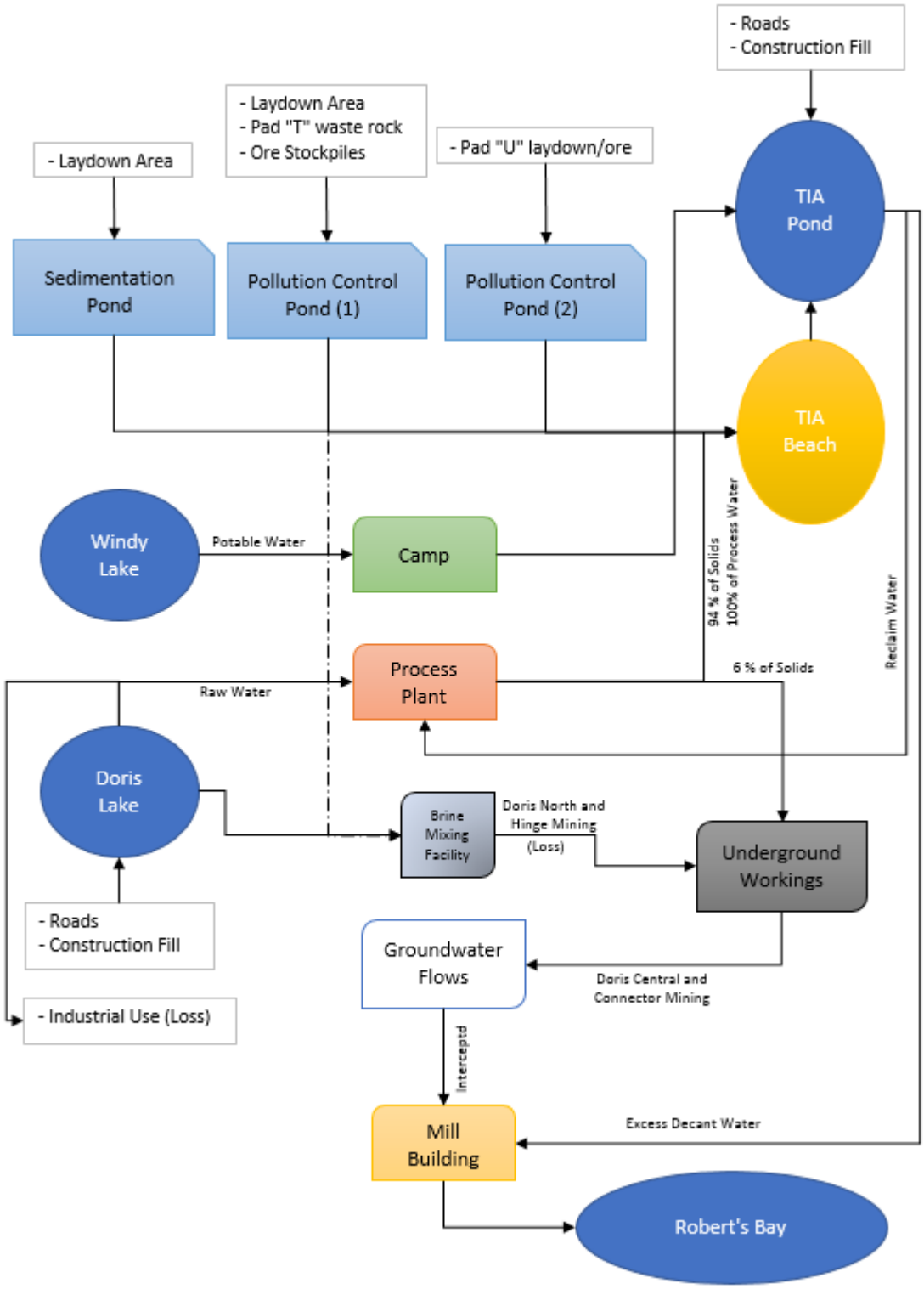
A3.2 PROPOSED POLLUTION CONTROL POND 2

Pad U will be located on the east side of the access road flowing towards Doris Lake. The primary intent of use for Pad U is general laydown and temporary ore storage, if needed. The pad will be graded in a manner to ensure runoff and seepage is collected by a downstream pollution control pond (Figure 1). The proposed pollution control pond will be designed to manage water and contain flow from the overall drainage area for a 100-year, 24 hour storm event. It is expected that this pond will always be operated in a manner allowing pumping to commence as soon as the containment volume is large enough for one continuous hour of pumping. All water will be transferred to the TIA.

A4. UNDERGROUND WATER MANAGEMENT

A4.1 TALIK WATER MANAGEMENT

During the Doris Central and Connector underground development, it is anticipated that groundwater will be intercepted from development within a talik under Doris Lake. Figure 2 provides an illustration of the water management during operations. Groundwater will be intercepted in underground sumps and pumped to the mill building and discharged to Roberts Bay. Intercepted groundwater will be discharged to Roberts Bay year round via a diffuser.



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		Water Management - Operations		
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A5. TIA WATER MANAGEMENT

A5.1 CURRENT WATER MANAGEMENT

The current water management strategy is to convey flows from the existing pollution control pond (Pollution Control Pond 1) and non-compliant flows from the Sedimentation Pond to the TIA. As permitted in the project Water Licence, compliant water from the TIA can be discharged to Doris Creek. Table A3 provides a summary of the effluent water quality limits as described in the Water Licence.

Discharged flows from the TIA shall not exceed 10% of the background flows in Doris Creek and during period of discharge, water quality in Doris Creek should be lower than the limits summarized in Table A4.

Table A3: TIA Effluent Discharge Limits to Doris Creek

Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration in any Grab Sample (mg/L)
pH	Between 6.0-9.5	Between 6.0-9.5
Total Suspended Solids	15.00	30.00
Total Arsenic	0.50	1.00
Total Copper	0.30	0.60
Total Cyanide	1.00	2.00
Total Lead	0.20	0.40
Total Nickel	0.50	1.00
Total Zinc	0.50	1.00
Radium 226	0.37 Bq/L	1.11 Bq/L
Biological Oxygen Demand	80	160
Fecal Coliform	10,000 CFU/100 ml	10,000 CFU/100 ml
Total Ammonia	6	-

Source: Water Licence 2AM-DOH1323 Part G, 28

Table A4: Doris Creek Water Quality Limits during periods of discharges

Parameter	Maximum Concentration of and Grab Sample (mg/L)
pH	Between 6.0-9.0
Total Suspended Solids	15.0
Total Oil and Grease	5
Chloride	150
Free Cyanide	0.005
Total Cyanide	0.010
Total Ammonia	1.54 at pH 7.5 and temperature of 20 degrees C
Nitrate	2.9
Nitrite	0.060
Total Aluminum	0.100
Total Arsenic	0.0050
Total Cadmium	0.000017
Chromium	0.0010
Total Copper	0.002

Parameter	Maximum Concentration of and Grab Sample (mg/L)
Total Iron	0.300
Total Mercury	0.000026
Total Molybdenum	0.073
Total Nickel	0.025
Total Lead	0.001
Total Selenium	0.001
Total Silver	0.0001
Total Thallium	0.0008
Total Zinc	0.030

Source: Water Licence 2AM-DOH1323 Part G, 30

A5.1 WATER MANAGEMENT DURING OPERATIONS

During operations, mill effluent, surface runoff water, precipitation and contact water accumulating in the sediment control pond, pollution control pond (PCP) 1, landfill sump and Pad U (PCP 2) will be pumped to the TIA.

An interim dyke will be constructed in the TIA to allow for subaerial tailings deposition. Slurry water and accumulated water from upstream runoff will drain through the interim dyke into the TIA Reclaim Pond where process water will be reclaimed for mill operations.

Excess water will be pumped from the TIA to the Marine Outfall Mixing Box located in the mill building, and then be pumped via a pipeline along existing corridors to the Roberts Bay Discharge System. Water from the TIA will only be discharged during the open-water season (June – September inclusive).

Water quality criteria for the discharge of water into the marine environment is to be listed in the project Water Licence.

Marine water quality guidelines, specifically the Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of marine aquatic life (CCME 2015), were used to evaluate the water quality requirements for a proposed discharge to the marine environment for the Project. The Metal Mining Effluent Regulations (MMER) water quality limits for deleterious substances (MMER 2015), were used as the proposed authorized limits at the end of the Marine Outfall Pipeline.

Table A5: Effluent Limit and Roberts Bay Water Quality Limits during periods of discharges

Parameter	Units	MMER	CCME
pH		6 to 9.5	7.0 to 8.7
Total Suspended Solids	mg/L	15	
Total Cyanide	mg/L	1	
Salinity	%		10% change
Nitrate Nitrogen (N)	mg/L as N		16
Arsenic (As)	mg/L	0.5	0.0125
Cadmium (Cd)	mg/L		0.00012
Chromium	mg/L		0.0575
Copper	mg/L	0.3	
Lead	mg/L	0.2	
Mercury	mg/L		0.000016
Nickel	mg/L	0.5	
Zinc	mg/L	0.5	
Radium	Bg/L	0.37	

A5.3 WATER MANAGEMENT AT CLOSURE

At closure, water management of the TIA will be discharged to Roberts Bay for 2 years, to lower the water level. The TIA will then be allowed recharge naturally for 5 years, after which it is expected that water quality in the TIA meets Doris Creek water quality guidelines as listed in the Water Licence. Once water quality in the TIA meets Doris Creek water quality guidelines, the North Dam in the TIA can be breached and flow restored to Tail Lake Outflow.

A5.4 CARE AND MAINTENANCE OPTIONS

Should the site go on Care and Maintenance following the commissioning of the TIA water will continue to be discharged to Roberts Bay unless water quality in the TIA meets the Doris Creek water quality guidelines as listed in the Water Licence (Table A3).

A6. MONITORING AND REPORTING

A6.1 RECORD KEEPING

Records of operation and maintenance are required to evaluate the effectiveness of the operation of all water management structures. Daily records include the following information:

- Volume, quality and discharge location of any effluent moved between facilities or discharged to environment; and
- Details of any construction or maintenance undertaken at site.

Record sheets and daily operations or inspection logs are maintained with the Site Surface Operations and Environmental Departments.

A6.2 MONITORING

Continuous monitoring of Doris Lake and TIA water levels and outflows will continue under the hydrologic baseline characterization.

Sediment and Pollution Control ponds will have permanent staff gauges to allow for visual monitoring of water accumulations in each pond. Daily staff gauge readings converted to volumes will be recorded in for each pond.

All volumes of water discharged from the ponds or TIA will be monitored with flow meter or tracked by truck load as appropriate during the transfers.

- Sedimentation Pond to tundra
- Sedimentation Pond to existing Pollution Control Pond
- Sumps to Pollution Control Pond(s)
- Existing Pollution Control Pond to TIA
- Proposed Pollution Control Pond 2 to TIA
- Groundwater to Mill Building
- TIA Water to Doris Creek
- TIA excess water to Mill Building
- Mill Building to Roberts Bay

Water quality in the ponds, TIA and discharge points will be monitored in accordance with the Water Licence. Confirmation of compliance will be required prior to discharging any water from facilities, as applicable. The Environmental Department is responsible for water quality monitoring and compliance reporting.

A6.3 WATER MANAGEMENT FACILITY INSPECTIONS

Visual inspections of water management structures located through the Doris North mine area will be completed by Operations or Environmental staff. These inspections will look for the following type of issues:

- Drainage channels have not been inadvertently blocked or rerouted in a manner that could alter the intended routing of seepage or runoff to the Sediment or Pollution Control Ponds.
- Diversion structures and culverts are functioning as intended
- Integrity of all piping and other water conveyance structures
- Signs of erosion or water pooling occurring during high flow periods
- Volumes of water in the Sediment and Pollution Control Ponds
- Integrity of erosion protection at point of discharge to the tundra; and
- Any irregularities identified during the visual inspection will be recorded and relayed to the VP Operations and/or the Engineer of record for the facility in order to ensure immediate corrective action can be implemented.

A6.4 DOCUMENTATION AND REPORTING

All monitoring data compiled will be documented and incorporated into the existing monthly and annual monitoring reports submitted to the Board. These reports will include but not limited to:

- An assessment of data to identify areas of non-compliance with regulated discharge parameters;
- A summary of all water movement involving the Sedimentation, Pollution Control Ponds, TIA discharges, compliant discharges to tundra, and excess water pumped to Roberts Bay; and
- A annual calibration of the water balance and water quality prediction model.

Water management facility inspection and operations records will be retained on site and available for review upon request.

In accordance with the approval to proceed with the Doris North Project, a construction monitoring report will be prepared documenting the construction of all proposed infrastructure on site.

The report will include but is not limited to the following:

- A summary of all inspections conducted during construction; and
- Updated “As-built” drawings of the constructed infrastructure.