WATER MANAGEMENT PLAN

HOPE BAY PROJECT, NUNAVUT

August 2016

PLAIN LANGUAGE SUMMARY

This Water Management Plan (WMP; the Plan) describes the water management practices for the Hope Bay project.

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 will implement during operations, closure and care and maintenance.

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 RECORD

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 Licence 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 Licence	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		

8	August 2016	Sections	Updated to focus on Operations once tailings deposition has started. Inclusion of changes arising from party comments through Amendment Application process: • Consideration of freshet • Consistency with other TMAC documents • Inclusion of relevant Standard Operating Procedures • Addition of Interim Water Management Strategy • Characterization of TIA inputs • Management of TIA discharge during Care & Maintenance	TMAC	TMAC

GLOSSARY AND ACRONYMS

TERM	DEFINITION
AEMP	Aquatic Effects Monitoring Program
CCME	Canadian Ministers of the Environment
DOE	Department of Environment
ECCC	Environment and Climate Change Canada
GN	Government of Nunavut
INAC	Indigenous and Northern Affairs Canada
KIA	Kitikmeot Inuit Association
MHBL	Miramar Hope Bay Ltd.
MMC	Miramar Mining Corporation
MMER	Metal Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
PCP	Pollution Control Pond
TIA	Tailings Impoundment Area
The Plan	Water Management Plan
TMAC	TMAC Resources Inc.

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1. CONTENTS

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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, closure and care and maintenance of Hope Bay facilities, 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 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 Hope Bay Project facilities, including interim and excess water 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	Licence for mining and milling undertaking to use water and deposit of waste in relation to the construction, operation, closure and reclamation.
Environmental Protection Act	1988	Government of Nunavut (GN), Department of Environment (DOE), Environmental Protection division	Legislation to authorize discharge of water
Environmental Rights Act	1988	GN, DOE, Environmental Protection division	Grants all residents the ability to launch an investigation
Metal Mining Effluent Regulation(MMER)	2002	Federal Department of Fisheries and Oceans & Environment Canada	Allows for the designation of a water body for the deposition of mine waste and outlines requirements for mine-related discharges.
Territorial Lands Act	1985	Indigenous and Northern Affairs Canada (INAC)	Crown lease and land use permit
Guideline	**Year**	**Issued by**	**Relevance**
Canadian Environmental Quality Guidelines	1999	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 procedures
Tailings Impoundment Area Operations, Maintenance and Surveillance Manual	Management of excess water from the TIA
Quality Assurance and Quality Control Plan	Sampling practices document that is reviewed and approved by the NWB
Groundwater Management Plan	Management of groundwater
Doris Water and Load Balance Model	Identification of source terms, modelling results
Doris North Infrastructure Monitoring Program	Water Management facility inspections
Standard Operating Procedure: Water Management Sampling and Discharge	Procedures to be followed for sampling water quality within containment berms and sumps, planning and execution of compliant water discharge
Standard Operating Procedure: Handling, Storage and Use of Water Sampling Preservatives	Procedures for working safely with chemicals used for preserving compliance water quality samples
Standard Operating Procedure: Water Management Spill Containments	Procedures to be followed for removing water from various spill containments

1.4. PLAN MANAGEMENT AND EXECUTION

This Plan is reviewed annually and updated as needed.

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 Director	• 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. CONTACT WATER MANAGEMENT

Water which comes into contact with the site may become contaminated and be released to the environment.

Management Response

Mine areas are constructed to minimize contact water. Facilities are designed with consideration of footprint minimization and are located, where possible, in areas of reduced runoff. Where necessary, runoff is diverted upstream of mine areas to further reduce the amount of contact water created.

Pads are constructed of non-mineralized rock and are designed to direct contact water to contact water ponds. 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.

2.2. DESIGN CAPACITY OF CONTACT WATER PONDS

Unusual precipitation events (storms) or larger than average spring melts (freshet) could produce excess contact water that could exceed pond capacities.

Management Response

Contact water pond storage capacity, freshet flows and expected storm event volumes are determined based on site specific conditions. The sizing and design of these facilities is such that they can hold water during unusual storm events and contain freshet flows for prescribed periods.

Water collected in the contact water ponds is routinely discharged to the TIA or tundra (where permitted and in compliance with discharge requirements), to retain maximum pond holding capacity and reduce the possibility of unintentional releases. Ponds are routinely monitored and water is pumped out of them as soon as the volume they contain is large enough for one continuous hour of pumping.

2.3. MANAGEMENT OF TALIK WATER

Where mining in talik regions, it is expected that groundwater will be intercepted and will need to be disposed. Groundwater disposal may negatively affect the environment if not appropriately managed, as it may contain elevated concentrations of salt or other constituents.

Management Response

Groundwater is collected in mine sumps and may be stored temporarily in the mine, and either pumped to the Marine Outfall Mixing Box located in the mill building and discharged to Roberts Bay or transferred to the TIA. Discharge to Roberts Bay or the TIA may occur year around.

Where possible, groundwater will be utilized during underground drilling to reduce fresh water and salt consumption, and to minimize groundwater discharge volumes.

2.4. ABILITY OF TIA TO MANAGE EXCESS INPUTS

Unusual quantities of natural (precipitation and runoff) and/or Project (contact water, wastewater, and groundwater) inputs may exceed TIA storage capability.

Management Response

The TIA has been designed with substantial additional capacity to store both natural and Project-related inputs in exceedance of routinely expected volumes. Water will routinely be discharged from the TIA to

Roberts Bay, and compliant groundwater preferentially be sent directly to Roberts Bay. Details of the TIA design capacity and ability to manage additional volumes are provided in in SRK (2015a, b) and TMAC 2016a.

2.5. Ability of TIA to Manage Reduced Discharge

Discharge from the TIA may be suspended due to inability to meet discharge criteria. This may occur in combination with excess inputs into the TIA.

Management Response

The TIA has been designed with substantial additional capacity to store additional volumes, including volume increases due to extended periods of discharge cessation, even when combined with increased inputs. Details of the TIA design capacity and ability to manage additional volumes are provided in SRK 2015a and b, and TMAC 2016a.

The TIA will routinely be operated at a water level that provides availability of contingency capacity.

2.6. Effluent Discharge Quality

Poor quality effluent discharged to the environment may be harmful to the environment and result in non-compliance with regulatory requirements.

Management Response

Waters intended for discharge directly from either the water control ponds and the TIA to the environment will be sampled for, and meet, applicable requirements under the *MMER, w*ater licences and/or surface leases administered pursuant to the *Territorial Lands Act*.

2.7. Decommissioning of Tailings Impoundment Area Dam

At the end of the closure period, and initiating the post-closure period, the TIA North Dam must be breached in a manner that minimizes harm to the freshwater receiving environment.

Management Response

To minimize environmental risk, the TIA North Dam will not be breached until the tailings have been covered as outlined in the approved closure plan and water quality in the TIA is confirmed suitable for discharge back into the Doris Lake system.

3. Inspection and Evaluation

3.1. Monitoring

The objective of the monitoring undertaken under this Plan is to:

- Comply with monitoring requirements outlined in applicable water licences, project certificates, and the *MMER*;
- Ensure water in the TIA, and that directed to the TIA is characterized to provide information for appropriate operation of the TIA, and so that it is available in case of an unintentional release;
- Ensure water being discharged to the environment meets the appropriate discharge limits;
- Ensure points of discharge to tundra are not negatively affected by pooling water or erosion; and
- Ensure tracking of water movement and volumes.

Monitoring is carried out in accordance with the Standard Operating Procedures listed in Table 2.

3.2. INSPECTIONS

Routine visual inspections of all water management structures will be completed by site staff to determine whether the facilities are operating as designed and to assess maintenance requirements. Facility inspections are carried out following significant rain events and throughout freshet. Annual geotechnical inspections of all engineered facilities are carried out by the engineer of record. During construction activities, daily visual inspections and inspections after significant rain events, including those associated with freshet, are completed 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 specified in the licence.

3.3. DOCUMENTATION AND REPORTING

Monitoring data will be compiled into monthly and annual reports submitted to the Nunavut Water Board (NWB), Nunavut Impact Review Board (NIRB), the Kitikmeot Inuit Association (KIA) and INAC, where required, in accordance with water licence, project certificate, land use permit and/or land lease requirements.

A Construction Monitoring Report will be prepared in applicable years and submitted to regulators where required.

Annual Geotechnical Inspection Reports are submitted to the NWB annually where required.

Inspection records are maintained on site and available for review upon request.

4. CONTINGENCIES

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
Pollution control pond water does not meet discharge limits	In the event that pond water quality does not meet effluent discharge limits, water will be sent to the TIA.
Low Pollution Control Pond capacity	In the event that the water volumes for the pollution control ponds cannot be accommodated due insufficient capacity, water can be temporarily stored in other ponds and ultimately sent to the TIA.
Malfunctioning discharge pipeline to Roberts Bay	In the event that the Marine Outfall Discharge Pipeline malfunctions, intercepted groundwater will be temporarily stored in underground sumps or pumped to the TIA. Discharge from the TIA will temporarily cease.
Excess water in the TIA	During operations, excess water in the TIA will be pumped to the Marine Outfall Mixing Box located in the mill building and discharged to Roberts Bay during the open water season.

5. REFERENCES

Environmental Protection Act, RSNWT (Nu) 1988, c E-7

Environmental Rights Act, R.S.N.W.T. 1988,c.83

Metal Mining Effluent Regulations, SOR/2002-222

Nunavut Waters Regulations, SOR/2013-69

Territorial Lands Act, R.S.C., 1985, c. T-7

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines Summary Table. http://st-ts.ccme.ca/. Accessed April 2015.

HBML. 2012. Hope Bay Mining Ltd.'s Quality Assurance and Quality Control Plan for Water Licence 2AMDOH0713,2BB-BOS1217, 2BE-HOP1222. November 2012.

SRK Consulting (Canada) Inc. 2015a. Doris North Project Tailings Management System Design. Report submitted to TMAC Hope Bay Limited, May 2015.

SRK Consulting (Canada) Inc. 2015b. Doris North Project – Water and Load Balance. Report Submitted to TMAC Resources Inc. Project Number 1CT022.002. June 2015.

TMAC Resources (TMAC) Inc. 2016a. Doris Tailings Impoundment Area Operations, Maintenance, and Surveillance manual, Hope Bay, Nunavut. August 2016.

TMAC Resources (TMAC) Inc. 2016b. Waste Rock and Ore Management Plan, Hope Bay, Nunavut. August 2016.

TMAC Resources (TMAC) Inc. 2016c. Domestic Wastewater Treatment Plan, Hope Bay, Nunavut. April 2016.

TMAC Resources (TMAC) Inc. 2016d. Doris Aquatic Effects Monitoring Plan, Hope Bay, Nunavut. August 2016.

TMAC Resources (TMAC) Inc. 2016e. Spill Contingency Plan, Hope Bay, Nunavut. April 2016.

TMAC Resources (TMAC) Inc. 2016f. Groundwater Management Plan, Hope Bay, Nunavut. August 2016.

DORIS WATER MANAGEMENT PLAN

MODULE A: 2AM-DOH1323 (DORIS)

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A1. INTRODUCTION

This Plan has been prepared in accordance with Type A Water Licence No. 2AM-DOH1323. The water licence sets out a number of conditions related to the management of water at the Doris site and is valid until August 15, 2023. All of the terms and conditions set out in the licence have been considered throughout the development of the Plan.

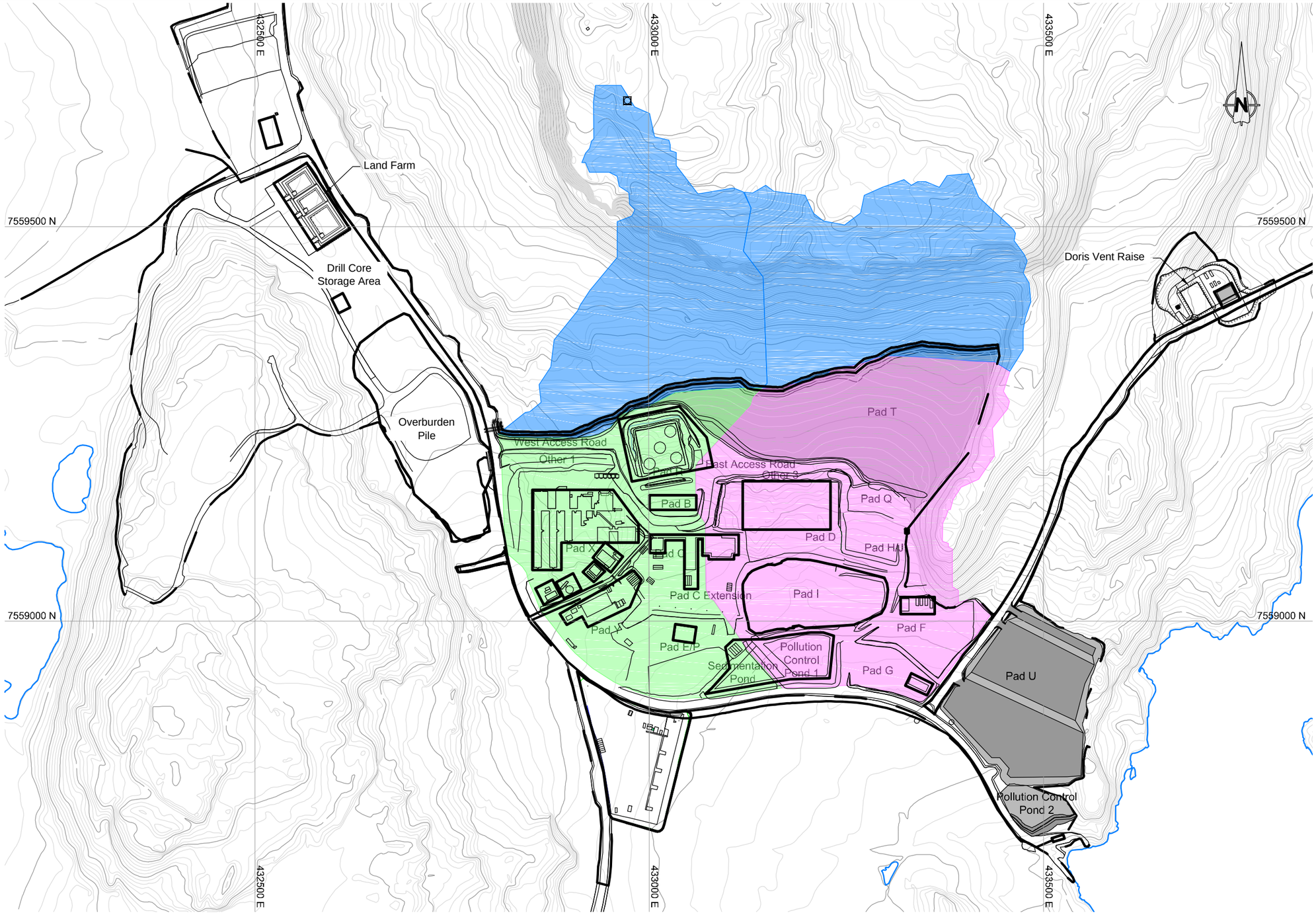
A2. DORIS WATER MANAGEMENT FACILITIES

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 control ponds within the Doris Mine area.

Table A1: Facilities within the Mine Area

Facility	Reporting to
Pad X (Main Camp)	Sedimentation Pond
Pad B (Laydown Area)	Sedimentation Pond
Pad C (Administrative Buildings)	Sedimentation Pond
Pad R (Fuel Storage Area)	Sedimentation Pond
Pad Y (Warehouse/Laydown Area)	Sedimentation Pond
Pad E/P (Laydown Area)	Sedimentation Pond
Pad D (Mill Terrace)	Pollution Control Pond 1
Pad T (Waste Rock Storage Area)	Pollution Control Pond 1
Pad Q (Ore Storage Area)	Pollution Control Pond 1
Pad H/J (Ore Storage Area)	Pollution Control Pond 1
Pad I (Existing Waste Rock Storage Area)	Pollution Control Pond 1
Pad F (Laydown Area)	Pollution Control Pond 1
Pad G (Laydown Area)	Pollution Control Pond 1
Pad U (Ore Storage Area)	Pollution Control Pond 2
Sumps	Contact water ponds
Doris North Diversion	Non-contact area away from site
Contact Water Ponds	Tailings Impoundment Area
Tailings Impoundment Area	Roberts Bay

The following sections provide a description of water management infrastructure.



LEGEND

- Diverted Area (145,444 m ^{2})
- Contact Area - Sedimentation (83,733 m^2)
- Contact Area - Pollution (128,369 m^2)

0 20 40 60 80 100
Scale in Metres

srk consulting

SRK JOB NO.: 1CT022.002

FILE NAME: 1CT022.002_Water Management Plan.dwg

TMAC RESOURCES

TMAC Resouces Inc.

Water Management Plan

Doris North Mine Area

DATE:	APPROVED:	FIGURE:
May 2015	SP	1

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A2.1 DORIS NORTH DIVERSION

To divert water upstream of the mine area and reduce the amount of contact water, the Doris North diversion berm was constructed in 2011 and diverts water from the south slope of Doris Mountain away from the site.

Pad U does not require any diversion as it is on the downstream side of the existing access road to Doris Lake and the TIA. The surface of Pad U will be graded to ensure runoff and seepage flow to Pollution Control Pond 2.

A2.2 CONTACT WATER PONDS

SEDIMENTATION (SAMPLING LOCATION - ST-1)

As illustrated in Figure 1, surface runoff from pads located on the west side of the mine area reports to the existing sedimentation/holding pond. This pond also serves as a lined temporary holding pond for water from Pollution Control Pond (PCP) 1, the sumps, and other site water which is to be pumped to the TIA. Water from this pond is pumped directly to the TIA on an as-needed basis. The existing sedimentation pond has capacity of 3,325 m^3.

POLLUTION CONTROL POND 1 (SAMPLING LOCATION - ST-2)

Pads located on the east side of the mine area are graded to ensure all runoff and seepage will be diverted and collected in PCP 1. PCP 1 is designed to be a retention pond for the 24 hr 1 in 25 year storm, has a storage capacity of 2,992 m^3 and is adequately sized to accommodate typical freshet flows. 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.

POLLUTION CONTROL POND 2 (SAMPLING LOCATION - ST-13)

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**Error! Reference source not found.**). The 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.

A2.2 SUMPS

SUMP 1

Sump 1 is constructed downstream of the Sedimentation PCP 1, downstream of the south east corner of the facility. This is an underflow interception sump that captures shallow groundwater discharge from the active layer. This sump ensures any seepage that might be bypassing the pond is captured and returned to the water management system via an automated float operated pump.

SUMP 2

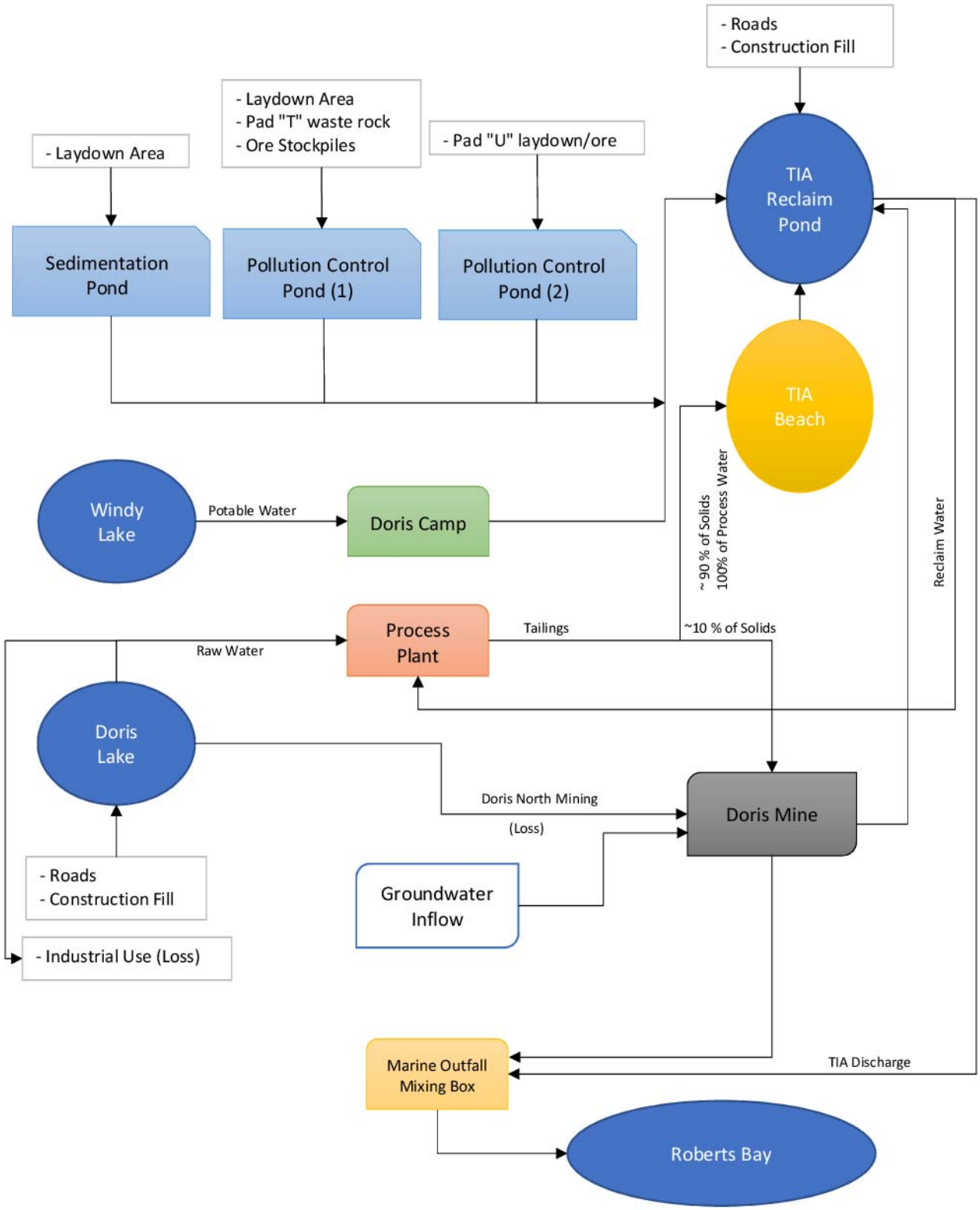
Sump 2 is constructed downstream of Pad F/G along the east edge of the TIA Access Road. This is an underflow interception sump that captures shallow groundwater discharge from the active layer. This sump ensures any seepage that might emanate from Pad F/G is captured and returned to the water management system via an automated float operated pump.

A2.4 TAILINGS IMPOUNDMENT AREA

The TIA is an existing facility bounded by the North Dam, which is water retaining, and the South Dam, which is solids retaining. Sub-aerial tailings deposition occurs at the south end of the facility with reclaim water being pumped from the Reclaim Pond in the north end of the facility. The TIA is operated to maintain sufficient water to supply the mill, while not exceeding the full supply level of 33.5 m and allowing for contingency water holding capacity.

Following the commencement of tailings deposition in the TIA, excess TIA water is discharged to Roberts Bay during the open water season.

In the event of effluent non-compliance, discharge pipeline malfunction or excessive groundwater inflows, the TIA has the capacity to contain water without discharging.



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		Water Management - Operations		
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A3. TIA WATER MANAGEMENT

A3.1 CURRENT WATER MANAGEMENT

The current water management strategy is to convey all mine surface contact water to the TIA. Compliant TIA water, in excess of operational needs, is discharged to Roberts Bay, typically during the open water season, via the Marine Outfall Mixing Box located at the mill building. Based on inflow volumes, the TIA effluent may comingle with groundwater discharge from the mine and both groundwater and excess TIA water will be co-disposed in Roberts Bay in compliance with *MMER* limits. Monitoring of the discharge to Roberts Bay will occur as prescribed under the *MMER*, including effluent characterization, acute lethality testing, sublethal toxicity testing.

During the operations, closure and care and maintenance phases additional characterization of TIA inputs as summarized in Table A2 will occur.

Table A2: Additional characterization of TIA-related water

Source Term	Applies to	Station ID	Monitoring Parameters[1]	Frequency	Phase
TIA	TIA	TL-1	G, N1, N2, MT, HC and TDS, Cl, T-Ag, T-Ca, T-Cd, T-Cr,T-Hg, T-K, T-Mo, T-Mg, T-Na, T-Se, T-Tl	Annually	Operation, Closure, Care and Maintenance
			Dissolved Oxygen and Redox Potential		
			BOD and FC		
Doris Creek Outflow upstream of bridge	Doris Creek Outflow	TL-2	G, N1, N2, MT and TDS, Cl, Free CN, Total CN, T-Ag, T-Ca, T-Cd, T-Cr, T-Hg, T-K, T-Mo, T-Mg, T- Na, T-Se, T-Tl, Total Oil and Grease	Annually for 2 years prior to breaching of Dam; should the North Dam not perform as expected, as indicted by annual geotechnical inspection	Operation, Closure, Care and Maintenance
Process Water Effluent	Effluent from Process Plant (tailings slurry water)	TL-5	G, N1, MT, and Free CN, Total CN, WAD CN, Sulphate, T-Cd, T-Cr, T- Hg, T-Mo, T-Se, and Total Metals by ICP-MS	Quarterly	Operations
			Cyanate and Thiocyanate		

Cyanide Destruction Circuit	Detox tailings reactor tank (650-TK-565)	TL-9	Continuous automated monitoring. Should the automatic monitor used to carry out this measurement be out of service manual samples from the detox filter feed pumps (650-PU-567/568) will be used to verify process operations.		Operations
Groundwater Inflows[2]	Mine Water Discharge Point	TL-12	Chloride, total dissolved solids (TDS), and nitrate	Weekly	Operations, during continuous pumping
			Total ammonia-N, nitrate-N, nitrite-N, pH, EC, ICPMS metals, alkalinity, acidity, sulphate, TSS, major ions and total and WAD CN	Monthly	
Exposed Tailings Beaches	Tailings beach surface area from subaerial deposition	TL-13	Total metals, sulphur and total inorganic carbon	Weekly sub-sample collection for the preparation of a monthly composite sample	Operations
Pollution Control Ponds	Pollution Control Ponds	ST-1 ST-2 ST-13	G, N1, MT and Total Sulphate, Total CN, Total Oil and Grease, Alkalinity, Chloride, and Total Metals by ICP-MS	Annually	Operations, Closure, Care and Maintenance

Other Site Water	Wastewater and water from site sumps directed to the TIA	ST-3 ST-4 ST-5 ST-6a ST-6b ST-8 ST-11	As outlined in Water Licence	Annually, once prior to discharge	Operations, Closure, Care and Maintenance
Mine Site Collection Ponds	Water from site directed to the TIA	ST-1 ST-2 ST-3 ST-4 ST-5 ST-6a ST-6b ST-8 ST-11 ST-13	As prescribed in Water Licence	Annually, once prior to discharge	Operations, Closure, Care and Maintenance

[1] As per Schedule J Table 1

[2] Monitored under *Groundwater Management Plan* (TMAC 2016)

A3.2 WATER MANAGEMENT DURING OPERATIONS

During operations, mill effluent, treated wastewater, surface runoff water, precipitation and contact water from the control ponds will be pumped to the TIA.

An Interim Dike will be constructed in the TIA to facilitate subaerial tailings deposition. Slurry water and accumulated water from upstream runoff will drain through the Interim Dike 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 normally be discharged during the open-water season (June – September inclusive).

Effluent discharged will be monitored as applicable and required under the *MMER*. *MMER* effluent discharge limits are presented in Table A3.

Table A3: Effluent limits during periods of discharge to Roberts Bay

Parameter	Units	*MMER*
pH		6 to 9.5
Total Suspended Solids	mg/L	15
Total Cyanide	mg/L	1
Arsenic	mg/L	0.5
Copper	mg/L	0.3
Lead	mg/L	0.2
Nickel	mg/L	0.5
Zinc	mg/L	0.5
Radium	Bg/L	0.37

A3.3 WATER MANAGEMENT AT CLOSURE AND POST-CLOSURE

At closure, the complete inventory of TIA water will be discharged to Roberts Bay. This is expected to take up to 2.5 years. The TIA will then be allowed to recharge naturally for about 5 years, returning to its pre-development water level of 28.3 m, after which it is expected that water quality in the TIA will be suitable to discharge to the Doris system. Once water quality in the TIA meets Doris Creek water quality guidelines (Table A4), the North Dam can be breached and flow restored to Tail Lake Outflow. Following breaching of the dam, water quality will be monitored in accordance with the provisions of the water licence.

Table A4: 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

A3.4 CARE AND MAINTENANCE OPTIONS

Should the project be placed into Care and Maintenance following tailings deposition in the TIA, compliant water will continue to be discharged to Roberts Bay seasonally to maintain water levels at or below the full supply level. Monitoring will continue as described above and as required under the *MMER*.

A4. INTERIM WATER MANAGEMENT STRATEGY

Mine water inflow is expected as mining progresses into the Doris Lake talik. For a period of time early in the mine life, anticipated to be between May 2017 and January 2018, TMAC will encounter saline groundwater similar in concentration to seawater, after which the salinity concentration is expected to decline due to an increased fresh water component of the mine inflow originating from Doris Lake.

To discharge to Roberts Bay, the *MMER* requires that effluent not be acutely lethal to rainbow trout when tested in accordance with the applicable Reference Method. Currently, an alternate species acclimated to salt water is not permitted for use. Efforts are underway to amend the *MMER* to address this.

To ensure it is in compliance with the *MMER*, TMAC has developed an interim effluent and mine water management strategy to be employed while the *MMER* is being amended. Saline groundwater with a NaCl concentration >10,000 mg/L during the period May 2017 through January 2018 (approximately 415,000 m^3) will be temporarily pumped to the TIA for holding. The resulting concentration of NaCl in

the TIA will be such that compliance with *MMER* may be possible and seasonal compliant discharge from the TIA to Roberts Bay may occur.

Once permitted by Environment and Climate Change Canada (ECCC) to carry out toxicity testing on saline tolerant species, TMAC would revert to the water management plans outlined in preceding sections.

A5. MONITORING AND REPORTING

A5.1 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.

Results of sampling as presented in Table A2 are reported to the NWB in conjunction with Annual Reporting.

A5.2 MONITORING

Continuous monitoring of Doris Lake water levels will occur under the Aquatic Effects Monitoring Program (AEMP). TIA water levels are monitored and reported in the Annual Geotechnical Inspection Report.

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 movements will be monitored with flow meters, tracked by truck load, or otherwise quantified as appropriate during the transfers. These include, but are not limited to, movements from:

- Discharges to tundra;
- Transfers between Sumps and Pollution Control Ponds to Sedimentation Pond;
- Transfers to the TIA;
- Groundwater to the Marine Outfall Mixing Box;
- TIA excess water to Marine Outfall Mixing Box, and
- Marine Outfall Mixing Box to Roberts Bay.

Water quality in the ponds, TIA and discharge points will be monitored in accordance with Table A2 herein, the Water Licence and *MMER* where applicable. 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.

A5.3 WATER MANAGEMENT FACILITY INSPECTIONS

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

- Drainage channels have 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.

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 corrective action can be implemented.

A5.4 DOCUMENTATION AND REPORTING

All monitoring data compiled will be documented and reported as prescribed under the water licence, *MMER*, or otherwise. Any data not explicitly requiring monthly reporting under the Water Licence will be reported in the existing Annual Reports to the NWB. These reports will include but are not limited to:

- An assessment of data to identify areas of non-compliance with regulated discharge parameters;
- A summary of all water inputs to the TIA, TIA discharges, discharges to tundra, and excess water pumped to Roberts Bay; and
- Calibration of the water and load balance model as required.

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

An Annual Geotechnical Inspection Report will be submitted to the NWB annually.

A Construction Monitoring Report will be prepared in applicable years and submitted to regulators where required. 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.