Baffinland Iron Mines Corporation

AQUATIC EFFECTS MONITORING PLAN

BAF-PH1-830-P16-0039

PHASE 2 PROPOSAL REVISIONS
FOR REVIEW PURPOSES ONLY

Rev 2

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May 14, 2021	2	Amanda McKenzie	Christopher Murray	Incorporated QIA comments on the TARP

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ACRONYMS

AEMP ..... Aquatic Effects Management Plan
AMP ..... Adaptive Management Plan
AQNAMP ..... Air Quality & Noise Abatement Management Plan
ARD ..... Acid Rock Drainage
Baffinland ..... Baffinland Iron Mines Corporation
BMI ..... benthic macroinvertebrate
BOD ..... biochemical oxygen demand
CCME ..... Canadian Council of Ministers of the Environment
CEAA ..... Canadian Environmental Assessment Agency
CES ..... Critical Effect Sizes
COO ..... Chief Operations Officer
CREMP ..... Core Receiving Environment Monitoring Program
DFO ..... Fisheries and Oceans Canada
DQO ..... Daily Quality Objectives
ECCC ..... Environment and Climate Change Canada
EDA ..... Exploratory Data Analysis
EEM ..... Environmental Effects Monitoring
ERP ..... Early Revenue Phase
ETMF ..... Exposure Toxicity Modifying Factors
FDP ..... final discharge points
FEIS ..... Final Environment Impact Statement
HSE ..... Health, Safety and Environment
ICA ..... Inuit Certainty Agreement
IIBA ..... Inuit Impact Benefit Agreement
INAC ..... Indigenous and Norther Affairs Canada
IQ ..... Inuit Qaujimajatuqangit
ISP ..... Inuit Stewardship Plan
KP ..... Knight Piésold Ltd.
kPa ..... kilopascal
LEL ..... Lowest Effect Level
LSA ..... Local Study Area
m3 ..... cubic metres
MDL ..... method detection limit
MDMER ..... Metal and Diamond Mining Effluent Regulations
Mtpa ..... million tonnes per annum
NIRB ..... Nunavut Impact Review Board
NLCA ..... Nunavut Land Claims Agreement
NSC ..... North/South Consultants Inc
NSC ..... North/South Consultants Inc.
NWB ..... Nunavut Water Board
OITR ..... objectives, indicators, thresholds and response

PC ..... Project Certificate
PDA ..... Project Development Area
PEL ..... Probable Effect Level
PWP ..... Polishing Waste Stabilization Ponds
QIA ..... Qikiqtani Inuit Association
ROM ..... Run-of-Mine
RSA ..... Regional Study Area
SD ..... Sustainable Development
SDA ..... Statistical Data Analysis
SEL ..... Severe Effect Level
SSWQO ..... Site-specific Water Quality Objective
TARP ..... Trigger Action Response Plan
TEWG ..... Terrestrial Environment Working Group
TP ..... total phosphorus
TSS ..... total suspended solids
VEC ..... Valued Ecosystem Components
WOE ..... Weight-of-Evidence
WQO ..... Water Quality Objectives
WWTF ..... Wastewater Treatment Facility

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Aquatic Effects Monitoring Plan (AEMP) describes Baffinland Iron Mines Corporation's (Baffinland's) approach to monitoring the effects of the Mary River Project on the freshwater aquatic environment. The AEMP is designed to:

- Detect short and long-term effects of the Project's activities on the aquatic environment resulting from the Project[1]
- Evaluate the accuracy of impact predictions
- Assess the effectiveness of mitigation measures
- Identify additional mitigation measures to avert or reduce unforeseen environmental effects

The AEMP focuses on the key impacts to freshwater environment Valued Ecosystem Components (VECs), as identified in the FEIS and its addendums (Baffinland, 2013a, 2018). The freshwater VECs are:

- Water quantity
- Water and sediment quality
- Freshwater biota and fish habitat

The AEMP has been structured to serve as an overarching 'umbrella' that provides an opportunity to integrate results of individual but related aquatic monitoring programs.

The AEMP targets water and sediment quality, primary productivity (phytoplankton), benthic community structure and fish (specifically Arctic char) within the streams and lakes affected by project activities. Development of individual monitoring programs/studies under the umbrella of the AEMP has allowed for the application of a common platform in terms of study design and sampling protocols.

The following are the component studies that comprise the AEMP:

- **Environmental Effects Monitoring (EEM) Program,** as required under the Metal and Diamond Mining Effluent Regulations (MDMER) (MOJ, 2020).
- **Core Receiving Environment Monitoring Program (CREMP),** which includes monitoring of the core mine site area (water, sediment, benthic invertebrates and fish).
- **Lake Sedimentation Monitoring Program,** evaluating baseline and project-influenced lake sedimentation rates.
- **Dustfall Monitoring Program,** evaluating dustfall rates in proximity of the Project, including the Tote Road, Milne Port and the Mine Site.
- **Stream Diversion Barrier Study**, an initial study evaluating potential for fish barriers under natural conditions and due to Project-related stream diversions.

The AEMP components and the relationship of the AEMP to the Water Licence and other aquatic monitoring activities are shown on Figure 1.1.

[1] Short-term is on the scale of annual, versus long-term which is multi-year.

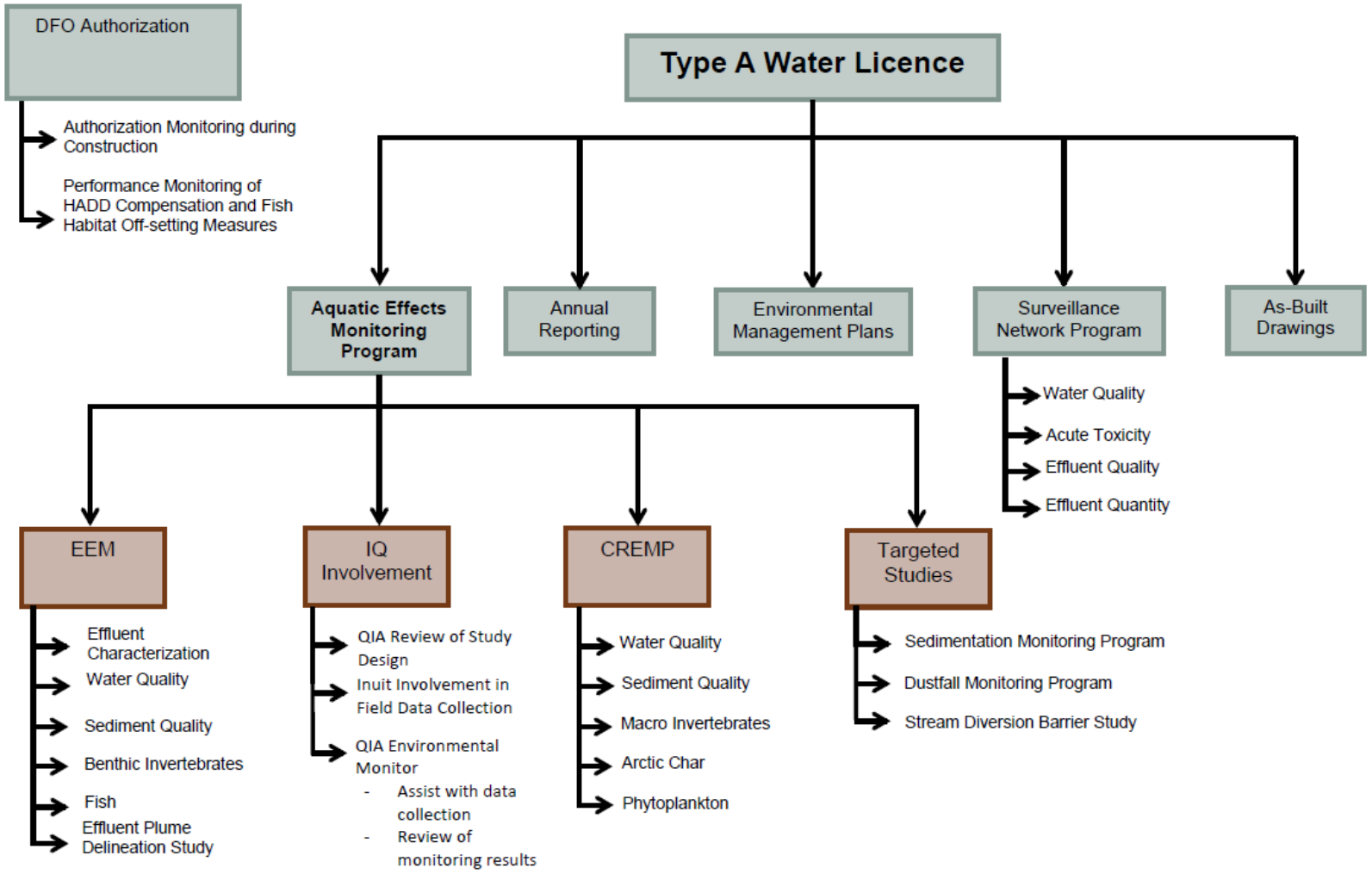

FIGURE 1.1 AEMP COMPONENTS AND RELATIONSHIP TO OTHER MONITORING PROGRAMS

The EEM Program is a legal requirement of metal and diamond mines in Canada, including the Mary River Project, under the MDMER. The EEM Program focuses on effects to the aquatic environment receiving mine effluent discharges. It has been included under the umbrella of the AEMP and follows a separate but related regulatory requirement. EEM study designs and data reports are submitted to Environment and Climate Change Canada (ECCC) every three years as per the MDMER. The results compliment annual monitoring results from the CREMP.

The CREMP forms the backbone of the AEMP. The CREMP is a detailed aquatic monitoring program intended to complement and expand the scope of an EEM Program required under the MDMER. The CREMP is intended to monitor the effects of multiple stressors on the aquatic environment, including the discharge of mine effluents and treated sewage effluent as well as ore dust deposition. The CREMP includes the monitoring of water, sediment, phytoplankton, benthic invertebrates and fish in streams and lakes near the Mine Site.

Specific effects monitoring (or targeted monitoring) is defined as monitoring conducted to address a specific question or impact and/or studies that are relatively confined in terms of spatial and/or temporal scope. Targeted environmental studies relate to specific environmental concerns that require further investigation or follow-up but are not anticipated to be components of the core monitoring program. The Lake Sedimentation Study, Dustfall Monitoring Program, and the Stream Diversion Monitoring Study are such studies.

The AEMP is a living document that will be updated periodically throughout the life of the Project to account for the close-out of shorter-term monitoring programs, changes in study designs that are driven by the findings of monitoring or changes to the Project, and new information in the field of aquatic effects monitoring including updated toxicological data.

1.2 RELATIONSHIP TO OTHER MANAGEMENT PLANS

Project activities have the potential to affect site water quality, fish habitat, vegetation and other environmental components. Therefore, this Plan must be viewed in consideration with the Environmental Management and Monitoring Plans for the Project as listed and described in Table 1.1.

TABLE 1.1 RELATIONSHIP TO OTHER MANAGEMENT PLANS

Referenced Management Plan	Document Reference Number	Information Provided by Referenced Plan
Air Quality and Noise Abatement Management Plan	BAF-PH1-830-P16-0002	Describes mitigation measures to limit adverse impacts to air quality and noise, and monitoring programs to determine the effectiveness of mitigation. Includes the dustfall monitoring program and dust mitigation protocol.
Environmental Protection Plan	BAF-PH1-830-P16-0008	Provides relevant environmental protection measures.
Surface Water and Aquatic Ecosystems Management Plan	BAF-PH1-830-P16-0026	Describes monitoring and mitigation measures to limit adverse impacts to receiving waters, aquatic ecosystems, fish and fish habitat from runoff and surface water interacting with project infrastructure.
Freshwater Supply, Sewage and Wastewater Management Plan	BAF-PH1-830-P16-0010	Describes plans for managing fresh water supplies and the disposal of effluents (sewage, oily water and mine contact water). Describes monitoring of effluent discharges, including those regulated under MDMER.

1.3 POLICIES

Baffinland has four corporate policies that apply to this management plan:

- **Sustainable Development (SD) Policy -** identifies Baffinland's commitment internally and to the public to operate in a manner that is environmentally responsible, safe, fiscally responsible and respectful of the cultural values and legal rights of Inuit.
- **Health, Safety and Environment (HSE) Policy -** describes the company's commitment to achieve a safe, healthy and environmentally responsible workplace.
- **Anti-Bribery and Anti-Corruption Policy -** describes Baffinland's commitment to ensuring its directors, officers, employees, contractors, and representatives conduct due diligence on third parties when promoting Baffinland's business.
- **Code of Business Conduct Policy -** describes Baffinland's minimum requirements for directors, officers, employees, contractors, and representatives to follow a Code of Business Conduct.

All employees and contractors must comply with the above mentioned policies, which are included in Appendix A.

1.4 REGULATORY REQUIREMENTS

This Plan is required by the following Project authorizations:

- Project Certificate No. 005 issued by the Nunavut Impact Review Board (NIRB, 2020)
- Type A Water Licence No. 2AM-MRY1325 issued by the Nunavut Water Board (NWB or the Board, 2015)
- Commercial Lease - Q13C301 (Commercial Lease) with the Qikiqtani Inuit Association (QIA, 2013)

Project Certificate (PC) Condition #21 outlines requirements for this AEMP (from NIRB, 2020):

> *The Proponent shall ensure that the scope of the Aquatic Effects Monitoring Plan (AEMP) includes, at a minimum:*
>
> *a. monitoring of non-point sources of discharge, selection of appropriate reference sites, measures to ensure the collection of adequate baseline data and the mechanisms proposed to monitor and treat runoff, and sample sediments; and*
> *b. measures for dustfall monitoring designed as follows:*
> *i. To establish a pre-trucking baseline and collect data during Project operation for comparison;*
> *ii. To facilitate comparison with existing guidelines and potentially with thresholds to be established using studies of Arctic char egg survival and/or other studies recommended by the Terrestrial Environment Working Group (TEWG); and,*
> *iii. To assess the seasonal deposition (rates, quantities) and chemical composition of dust entering aquatic systems along representative distance transects at right angles to the Tote Road and radiating outward from Milne Port and the Mine Site.*

The AEMP addresses Part (a) of PC Condition #21. Part (b) overlaps with the current dustfall monitoring program described in the Air Quality and Noise Abatement Management Plan (Baffinland, 2020). Interpretation of the dustfall monitoring data in relation to the aquatic environment forms part of the lake sedimentation targeted study described in Section 3.4.1.

Part I of the Type A Water Licences outlines conditions related to general and aquatic effects monitoring. Schedule G of the Commercial Lease with the QIA identifies the Aquatic Effects Monitoring Program as a key monitoring plan.

Tables of concordance with the applicable regulatory approvals are provided in Appendix B.

1.5 VERSION HISTORY

The current Water Licence (Amendment No. 1; NWB, 2015) approved a 2013 AEMP Framework. The initial (Revision 0) version of the AEMP was submitted to the NWB on June 27, 2014.

On October 30, 2015, Revision 1 of the AEMP was submitted to the NWB for approval. The purpose of this submission was to satisfy the condition stated in Part I, Item 2 of the Amended Licence requiring Baffinland to submit to the NWB for approval in writing a revised version of the AEMP 60 days following the issuance of the Amended Licence.

In 2015, Minnow Environmental Inc. (Minnow) was contracted to assist Baffinland in completing the field work and reporting requirements of several of the AEMP component studies, including the CREMP. After completing the CREMP field work in 2015, Minnow proposed several modifications to the CREMP to provide greater efficiencies to the program and improve the program's ability to achieve its objectives (i.e., to evaluate short and long term effects of the Project on aquatic ecosystems). Minnow's recommendations proposed modifications to the CREMP water quality, sediment quality and benthic community monitoring programs in study lakes and streams as well as modifications to the fish population monitoring program in study lakes (Minnow, 2016).

In April 2016, Baffinland submitted Revision 2 of the AEMP to the NWB for review and approval. Revision 2 of the AEMP incorporated nearly all of the Minnow's recommendations for modifying the CREMP Study Design. Following the submission of the revised AEMP, Baffinland received feedback and comments from both Environment and Climate Change Canada (ECCC) and Indigenous and Northern Affairs Canada (INAC), including concerns regarding the rational for select recommendations proposed by Minnow.

On November 8 and 9, 2017, Baffinland chaired the 2017 Freshwater Workshop in Iqaluit, NU with regulators and stakeholders (ECCC, INAC, Government of Nunavut, NWB, QIA) to discuss the Project's freshwater monitoring programs and Minnow's proposed modifications to the CREMP. Taking into account discussions and feedback received prior to and during the 2017 Freshwater Workshop, Baffinland has incorporated several of Minnow's recommendations into the current revision of this document for final regulatory review and approval.

Revision 2 was subsequently updated to incorporate the Phase 2 Proposal and was submitted in draft to the NWB on May 1, 2019 as part of the Phase 2 Proposal application to amend the Type A Water Licence. The current update to the AEMP (Revision 2) incorporates adaptive management mechanisms consistent with Baffinland's draft Adaptive Management Plan (Section 2.3). The current document also incorporates a reorganization of the document to align with similar changes made to Baffinland's other environmental monitoring and management plans, and two rounds of comments from the QIA (QIA, 2020a,b).

2.0 PLANNING

2.1 OBJECTIVES

The goal of this Plan is to protect aquatic ecosystems by meeting the objectives and performance indicators identified in Table 2.1.

TABLE 2.1 OBJECTIVES AND PERFORMANCE INDICATORS

Objective	Performance Indicators
Detect short-term and long-term effects of the Project's activities on the aquatic environment resulting from the Project	• Water quality including AEMP benchmarks, deleterious substances, effluent characterization • Acute Lethality Testing • Critical effect sized for Arctic char and benthic invertebrates • Fish tissue study • Chlorophyll a
Evaluate the accuracy of impact predications	
Assess the effectiveness of planned mitigation measures	
Identify additional mitigation measures to avert or reduce unforeseen environmental effects	
(Insert Inuit objectives)	(Insert Inuit indicators)

Baffinland and the QIA are jointly implementing an adaptive management process into management plans developed for the Project (Section 2.3) and includes the development of Inuit objectives and performance indicators, as noted in Table 2.1.

2.2 CONSIDERATION OF INUIT QAUJIMAJATUQANGIT

2.2.1 INUIT USE OF FRESHWATER IN THE PROJECT AREA

Inuit use of the freshwater environment in the region includes harvesting of Arctic char and consumption of water and snow for drinking while on the land. Information on fishing areas from various sources suggest that nearly all fishing in the region occurs in river-lake systems that support sea run Arctic char. This includes information collected in the mid-1970s for the Inuit Land Use and Occupancy Project (Brody, 1976); community information collected in the mid-1980s for the Nunavut Atlas (Riewe, 1992), fish harvest locations during the Nunavut Wildlife Harvest Study (Priest and Usher, 2004), and information collected in the late 2000s as part of the Mary River IQ Study (KP, 2014a,b). These systems are not within the Project area.

The Project-affected waterbodies support only landlocked populations of Arctic char. The inland landlocked Arctic char lakes in the Project area are fished only occasionally when Inuit are in the area (KP, 2010 and 2014b; Riewe, 1992). Inuit have historically and continue to use Milne Inlet as an entrance to the interior of northern Baffin Island. Phillips Creek (from Katiktok to Milne Inlet) and the upper reaches of the Ravn River (south of Katiktok Lake) is an important travel corridor both for interior access for caribou hunting and for inter-community travel between Pond Inlet and Igloolik. The Tusaqtavut Studies (QIA, 2019a, b) identified fishing and freshwater resources in the region, including 12 subsistence values within 250 m of the Project footprint.

The Tusaqtavut studies also recorded community perspectives that the current Project is impacting land and resource use from the community perspective, including dust impacts to water quality along the road, access to

fishing areas, and species avoidance of areas due to impacts to fish habitat and diminished water quality (QIA, 2019a,b).

2.2.2 FUTURE CONSIDERATION OF INUIT QAUJIMAJATUQANGIT

An Inuit Stewardship Plan (ISP) will be developed by the QIA pursuant to the Inuit Certainty Agreement referenced above. The ISP will describe how Inuit monitoring activities tie into the adaptive management system and other management, mitigation, and monitoring plans, and, how Inuit monitoring will relate to the protection and promotion of Inuit rights defined under the *Nunavut Agreement* and described under legal agreements with Baffinland related to management and stewardship of Inuit owned lands and resources. The ISP will be the framework for Inuit-led monitoring of impacts and changes within communities and on the land, waters and ice as a result of the Project. The ISP will embed a "boots on the ground" approach to monitoring whereby Inuit will be hired and trained as professional monitors for monitoring under the ISP. Through the ISP, Inuit will govern the use of Inuit knowledge and observations regarding the Project.

Further updates to this plan are expected as an outcome of the development of the ISP that articulate Inuit monitoring objectives, indicators, thresholds and responses (OITRs) related to the protection of surface waters and aquatic ecosystems.

In the interim, Table 2.2 identifies the opportunities that Baffinland has explored to incorporate IQ into this Plan.

TABLE 2.2 INCORPORATION OF IQ INTO THIS MANAGEMENT PLAN

Element	Description
Environmental sensitivities and receptors	Subsistence Fishing and Fresh Water values identified in Pond Inlet's Tusaqtavut Study can be integrated into a future revision of the monitoring component of this Plan
Indicators and thresholds	Confirmation required with Inuit through QIA-Baffinland AMP Working Group; interim Inuit objectives, indicators, thresholds and responses to be identified in this Management Plan and subject to later revision through the ISP and AMP reviews on a scheduled basis
Mitigation measures	Confirmation required with Inuit through QIA-Baffinland AMP Working Group
Monitoring	Confirmation required with Inuit through QIA-Baffinland AMP Working Group
Adaptive management	Confirmation required with Inuit through QIA-Baffinland AMP Working Group
Validation of IQ Integration	To be verified by Inuit Committee
Management review	To be verified by Inuit Committee

An important aspect of integrating IQ is validating such integration with Inuit. For this reason, only potential opportunities for IQ integration have been identified. A more fulsome effort to incorporate IQ into this draft plan will be undertaken in the future, based on feedback from the Inuit Committee (to be established) and a standing Baffinland-QIA Adaptive Management Working Group, and consistent with the Adaptive Management Plan (Baffinland, 2020).

2.3 ADAPTIVE MANAGEMENT

2.3.1 DEFINING ADAPTIVE MANAGEMENT

Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes (Canadian Environmental Assessment Agency, 2016). Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project.

Baffinland has developed a draft Adaptive Management Plan (AMP) that provides the framework by which adaptive management is to be incorporated into Project operations (Baffinland, 2020). The Project-wide adaptive management process begins with a planning phase, followed by iterative phases of implementing and monitoring the actions included in the plan(s), evaluating the effectiveness of actions included in the plans based on results of monitoring and other feedback mechanisms, and adjusting management strategies and actions and responses based on monitoring. The cycle begins anew with implementation and monitoring of a revised plan, which integrates the outcomes of the previous cycle. This cycle can occur, in real-time or over an extended period according to the nature of the situation or area of focus. In this way, a properly designed and well-implemented adaptive management process progressively diminishes uncertainty, as management strategies and processes are refined throughout a project's operational lifecycle.

Monitoring and responding to effects in the short-term is addressed in a Trigger Action Response Plan (TARP) described in Section 5.0. The TARP identifies the pre-defined actions to be taken should threshold levels be exceeded. A series of escalated actions to be implemented are detailed in Section 5.0. Longer term review of and response to monitoring data is addressed in an annual review of plan effectiveness in Section 6. The latter includes an annual comparison of project effects against impact predictions made in the Final Environmental Impact Statement (FEIS; Baffinland, 2012) and the addendums (Baffinland 2013, 2018).

Implementation of the AMP will be overseen by a Baffinland-QIA Adaptive Management Working Group. Ongoing inputs from the Inuit Stewardship Plan as well as Baffinland's ongoing project monitoring will also form the basis of amendments and refinements to the objectives, indicators, thresholds, and response requirements over time.

Section 2.4 of the AMP states that with the QIA's approval of Baffinland's AMP and management plans, that implementation of pre-determined responses to effects as described in the management plan does not require additional approval by the QIA. Baffinland will communicate response actions to QIA prior to implementation unless this is not possible due to the expediency required by the circumstance. If, however, a new response not previously considered is proposed, QIA approval will be sought.

2.3.2 ADAPTIVE MANAGEMENT CHECKLIST FOR ENVIRONMENTAL MANAGEMENT

Table 2.3 presents an adaptive management checklist developed for the Aquatic Effects Monitoring Plan, identifying how adaptive management has been incorporated into the current revision of the Plan.

TABLE 2.3 INCORPORATION OF ADAPTIVE MANAGEMENT INTO THE AEMP

Adaptive Management Phases	Components	Questions to Guide Decision-Making	Status of Management Plan (i.e., complete, in progress, undergoing revisions)	Status of QIA and Baffinland Approval
Plan	Objectives	Are objectives clear and key desired outcomes defined? Do they include Inuit objectives?	In Progress Objectives are identified in Section 2.1. Inuit Objectives will need to be developed and will be integrated into Section 2.1 (first as Interim Inuit Objectives, replaced by Inuit Objectives once the Inuit Stewardship Plan is initiated).	
	Indicators	Are performance indicators adequately identified? Do they include Inuit indicators?	In Progress Performance indicators are identified in Section 2.1. Inuit Indicators will need to be developed (first as Interim Inuit Indicators, replaced by Inuit Indicators once the Inuit Stewardship Plan is initiated).	
	Identification of Thresholds	Are thresholds for specific responses identified (e.g., early warning triggers, action levels, quantitative metrics or qualitative descriptions)?	In Progress Thresholds are identified in Section 3.1. Additional thresholds tied to Inuit Objectives and Indicators will be established through QIA-Baffinland engagement on the timeline identified above.	
	IQ Integration / Influence	Are mechanisms for IQ integration/influence identified?	In Progress Integration of IQ will be clarified in the next draft of the Plan through the AMP Working Group, and later firmed up through inputs by the Inuit Committee.	
Implement and Monitor	Management Strategies and Responses	Are management strategies and response options clearly identified?	In Progress Baffinland management strategies are described in other plans. Response options are described in the Threshold Action Response Plans in Table 5.1. By nature of the AEMP monitoring effects of multiple stressors, response actions are by necessity generic. These will be augmented through the work of the AMP Working Group and later inputs by the Inuit Committee.	
	Resourcing	Are all phases of the adaptive management cycle properly resourced (in accordance with Inuit Agreements) to be fully implemented?	In Progress Resourcing in accordance with Inuit Agreements will need to be discussed through the AMP Working Group, with annual work plans and budgets developed.	

Adaptive Management Phases	Components	Questions to Guide Decision-Making	Status of Management Plan (i.e., complete, in progress, undergoing revisions)	Status of QIA and Baffinland Approval
Implement and Monitor	Monitoring	Does the monitoring program provide the information needed to determine the effectiveness of management strategies and responses?	In Progress Section 3 identifies the component studies of the AEMP. The individual study designs are stand-alone documents. Monitoring associated with these studies is presented in Section 5. The role of Inuit monitors as per the Inuit Stewardship Plan, needs to be established and integrated into this Plan.	
	Timeline for Implementation	Is the possibility that rapid response may be necessary, taken into account in the implementation plan/process?	In Progress Trigger action response plans (TARPs) have been developed for the individual AEMP component studies (Table 5.1). This includes the identification of low, moderate, and high action responses. Unlike other plans, the AEMP is not a rapid response plan.	
Evaluate and Learn	Review Data and Feedback	Is the process for reviewing and evaluating management effectiveness (based on monitoring data and feedback) articulated?	In Progress Further detail including adaptive management related roles and responsibilities, reporting structures, and applicable response action forms need to be developed.	
	Additional Mitigation	Are mechanisms for determining the need for additional mitigation described?	In Progress Table 5.1 identifies actions to be undertaken according to various triggers. Need for additional mitigation is determined based on results of AEMP component studies described in Section 3 and the monitoring associated with these studies as identified in Table 5.1.	
	Input of IQ Holders	Are opportunities identified for IQ holders to review results and provide input into adaptive management responses / mitigations?	In Progress To be discussed at the AMP Working Group and later with the Inuit Committee. Mechanisms for this to occur to be defined in the next draft of the Plan.	
Adjust	Unanticipated Effects or Issues	Is it apparent how unanticipated effects or issues will be actioned and resolved?	Pending Approval Section 6 (Figure 6.1 in particular) describes the process for incorporating repeat non-compliance and unanticipated effects into future plan updates.	
	Reporting	Are reporting mechanisms for new / revised strategies and response actions established?	Pending Approval Section 6 describes the process for reporting mechanisms for new / revised strategies A review schedule of the plan is provided in Table 6.1.	

Adaptive Management Phases	Components	Questions to Guide Decision-Making	Status of Management Plan (i.e., complete, in progress, undergoing revisions)	Status of QIA and Baffinland Approval
Adjust	Scheduled Updates	Is the frequency of scheduled updates to the management plan identified?	In Progress A schedule for review of the plan is provided in Table 6.1.	

2.4 PROBLEM FORMULATION

2.4.1 PROJECT DESCRIPTION

The Project is an iron ore mine in Northern Baffin Island, Nunavut consisting of the following major components (Figure 2.1):

- Milne Port
- Mine Site
- Milne Inlet Tote Road
- North Railway
- South Railway
- Steensby Port

Each development site (excluding the railway) has been designed to be equipped with all the facilities each site requires to operate effectively including maintenance and administrative buildings, warehouses and laydown areas, ore stockpiles and associated runoff management facilities, camps, water supply, wastewater treatment plants, waste management facilities including landfills, power generation, fuel depots, telecommunication facilities, and airstrips.

Baffinland is approved to mine Deposit No. 1 at the Mine Site by open pit mining methods. The Mary River iron ore is of a very high-grade and therefore there is no need to have a process plant (or mill) on site, resulting in no tailings being generated, and therefore no tailings storage pond. The ore is only crushed and screened to produce two iron ore products:

- Lump ore - sized between 6.3 mm and 31.5 mm (about golf ball size)
- Fine ore - sized less than 6.3 mm (about pea size)

Ore is stockpiled at the Mine Site and transported either by truck or railway to Milne Port and in the future to Steensby Port. Ore handling facilities at the Mine Site consist of the open pit, separate ore stockpiles for the trucking and railway operations, and water management facilities to collect runoff from ore stockpiles. Waste rock is stockpiled in a single stockpile next to the open pit, equipped with up to two (2) ponds to collect runoff from the stockpile. The trucking and railway operations have separate ore stockpiles and runoff collection ponds but will otherwise share common water management facilities and final discharge points (Figure 2.2).

Mining of Deposit No. 1 began in September 2014 under a low-capital trucking operation, referred to as the Early Revenue Phase (ERP), that entails mining up to 4.2 million tonnes per annum (Mtpa) of iron ore and transporting ore year-round by truck to Milne Port, with marine shipping to market during the open water season. Ore handling facilities at Milne Port consist of truck unloading facilities, ore stockpiles and ship-loading facilities at an ore dock. Runoff from the stockpile area at Milne Port is collected in ponds that are intermittently discharged to the marine

waters of Milne Inlet during summer months by means of active pumping. ECCC has advised Baffinland that the effluent discharged to Milne Inlet will not be subject to the MDMER, though the *Fisheries Act* still applies, including Section 36(3) regarding the prohibition of discharges of a deleterious substance in waters frequented by fish (Anne Wilson, pers. comm.) Monitoring of effects to the marine environment is beyond the scope of this AEMP.

With the introduction of the Phase 2 Proposal, the Mary River Project will allow Baffinland to transport by rail and ship up to 12 Mtpa of ore from Milne Port, and to retain the current authorizations for the construction and operation of the Steensby Port and South Railway (Mine to Steensby) as proposed in 2012. The total mine production will eventually increase to 30 Mtpa, with 12 Mtpa being transported via the North Railway to Milne Port and 18 Mtpa transported via the South Railway to Steensby Port.

The additional or new facilities and activities required at each of the Project Sites for the implementation of Phase 2 are located at the Mine Site, the Northern Transportation Corridor, and at the Milne Port. For the Mine Site, the Project Development Area (PDA) defined in 2012 remains unchanged. However, some infrastructure within the PDA will be re-arranged to accommodate the construction of the North Railway line, support the increase in mine production and the construction of the northern section of the Steensby Railway. The Tote Road alignment will remain unchanged, some upgrades and minor realignments will be required to facilitate railway crossing.

The North Railway line will be 110 km in length, from the loading station at the Mine Site to the unloading station at Milne Port. For most of the length, the railway embankment will be constructed adjacent to the Tote Road. However, due to steep topography, a 20 km section of the railway will deviate from the Tote Road alignment. Because ore will be processed (secondary crushing and screening) at Milne Port with the Phase 2 Proposal, effluent discharged from the ore stockpiles to the marine waters of Milne Inlet will be subject to the MDMER.

The South Railway operation will be constructed as soon as economically viable. Eventually total mine production will reach 30 million tonnes per year to accommodate the 12 million tonnes per year for the North Railway operation and the approved 18 million tonnes per year South Railway operation.

Shipping of ore from Steensby Port will take place year-round. Runoff from the ore stockpile at Steensby Port will be collected and discharged to the marine waters in Steensby Inlet. Provided that crushing and screening of ore does not occur at Steensby Port, the effluent discharged to marine waters from the ore stockpile at Steensby Port would not be subject to the MDMER but would otherwise be subject to the *Fisheries Act*.

For the production increase, several proven mitigation measures have been proposed to reduce potential effects on water quality, freshwater fish, fish habitat, and other aquatic organisms. At each of the ore handling locations, crushers and screens will be installed inside buildings, and conveyors will be covered and equipped with wind ventilation hoods to reduce wind exposure and the potential for dust generation. Where practicable, ventilation ducts will be routed to dust collectors which will limit dust emissions. Baffinland's current management and monitoring plans detail the specific mitigation measures used to mitigate potential Project effects on freshwater environments during operations.

The Closure of the facilities is expected to be carried out over a three to five-year period and post-closure monitoring will follow for an additional fifteen years. If closure objectives are not met, post closure would extend beyond fifteen years.

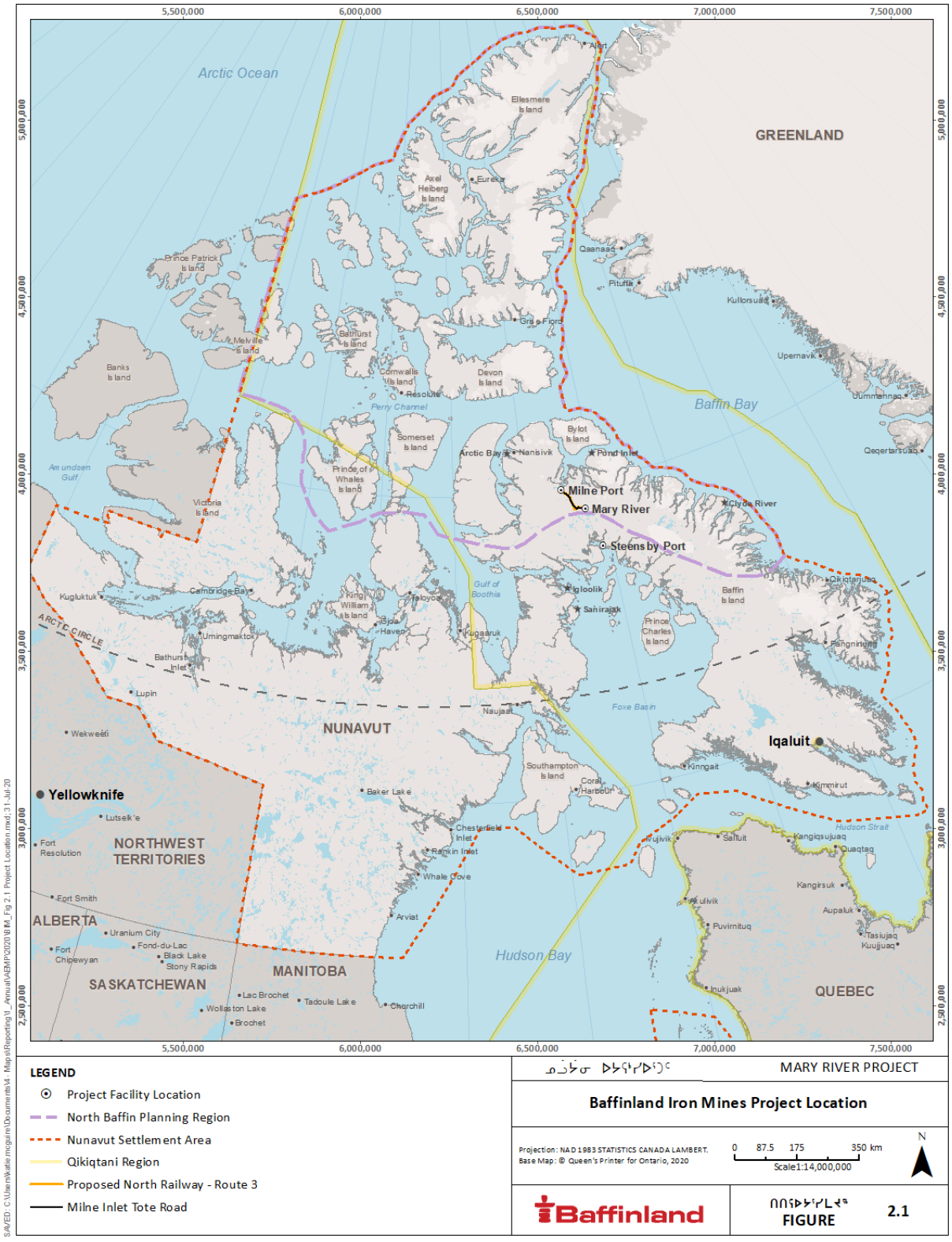

FIGURE 2.1 PROJECT SITES AND LOCATION MAP

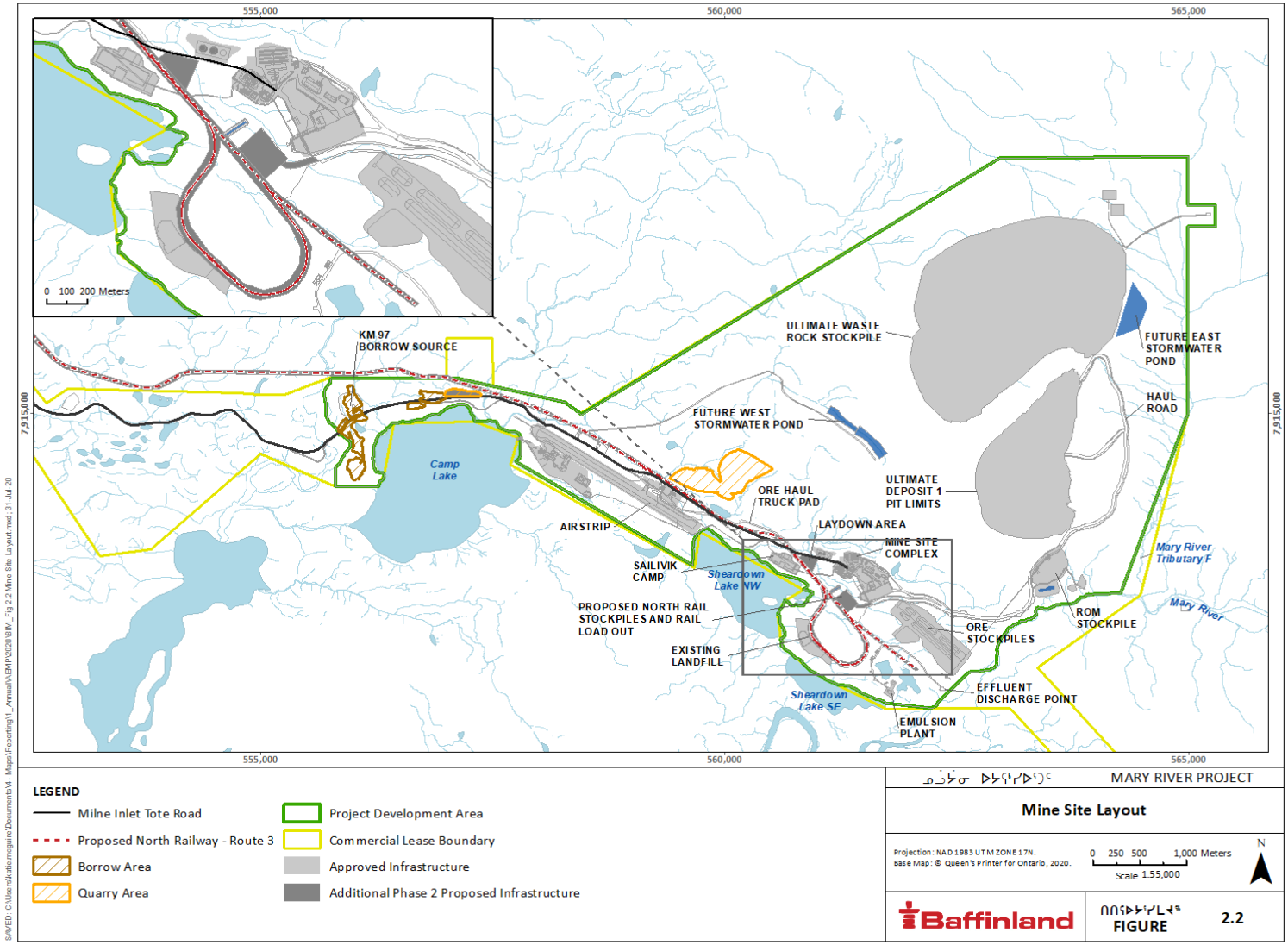

FIGURE 2.2 MINE SITE LAYOUT

2.4.1.1 WATER MANAGEMENT FACILITIES AND FINAL DISCHARGE POINTS

As shown in Figure 2.2, during the proposed Phase 2 of the Project, a new crusher facility and stormwater pond will be constructed to serve the rail load-out facility, at the location shown on the Mine Site. The pond will be designed to the same specifications as the existing pond. A site water balance process flow diagram showing stormwater management at the Mine Site is presented in an appendix of the Freshwater Water and Surface Water Management Plan. A total of four (4) ponds are planned to collect and manage surface water runoff from stockpiles and the open pit at the Mine Site.

- Waste Rock Facility East Pond (inactive, referred to as monitoring station MS-09 under the Type A Water Licence) - collects runoff from the waste rock stockpile, and is situated NE of Deposit No. 1 mining operations.
- Waste Rock Facility West Pond (referred to as monitoring station MS-08 under the Type A Water Licence) - collects runoff from the waste rock stockpile, and is situated NW of Deposit No. 1 mining operations.
- Ore Stockpile Facility Pond (Crusher/Rail Loading Facility referred to as monitoring station MS-06 under the Type A Water Licence) - collects runoff from the footprint of the Ore Stockpile Facility used to crush and store ore at the Mine Site.
- Run-of-Mine (ROM) Stockpile Facility Pond (ROM Pond) (referred to as monitoring station MS-07 under the Type A Water License) - collects runoff from the footprint of the ROM Stockpile located near KM 106 of the Mine Haul Road.

Currently, Deposit No. 1 has not developed sufficiently to the point that there is a sump with active discharge. Downstream surface water quality stations as part to of the CREMP and SNP currently evaluate surface water run off.

As shown in Figure 2.3, during the life of the Project, mine effluent will be actively discharged to two (2) watercourses:

- Mary River
- Camp Lake Tributary 1

There will be three (3) final discharge points that will discharge mine effluent to the Mary River:

- Waste Rock Facility East Pond discharge
- Run-of-mine (ROM) Stockpile Facility discharge
- Ore Stockpile Facility Pond (Crusher/Rail Loading Facility) discharge

Run-off collected from the Waste Rock Facility East Pond (MS-09) will be discharged to one (1) final discharge point located within the catchment of Camp Lake Tributary 1 once constructed.

2.4.1.2 STREAM DIVERSIONS

The development of the open pit, a waste rock stockpile, and associated water management facilities (ditches, berms and settling ponds) will divert and redirect runoff away from certain watercourses during the operational phase of the Project (Baffinland, 2012). Five (5) tributary streams are anticipated to be affected by diversions in the Mine Area (Figure 2.3).

It should be noted that due to the reduced mining footprint (open pit and waste rock stockpile) during the ERP, Project-related stream diversions and impacts on flow during the ERP are anticipated to be negligible. As such the Stream Diversion Barrier Study has been suspended until the commencement of the full production (rail) phase of the Project.

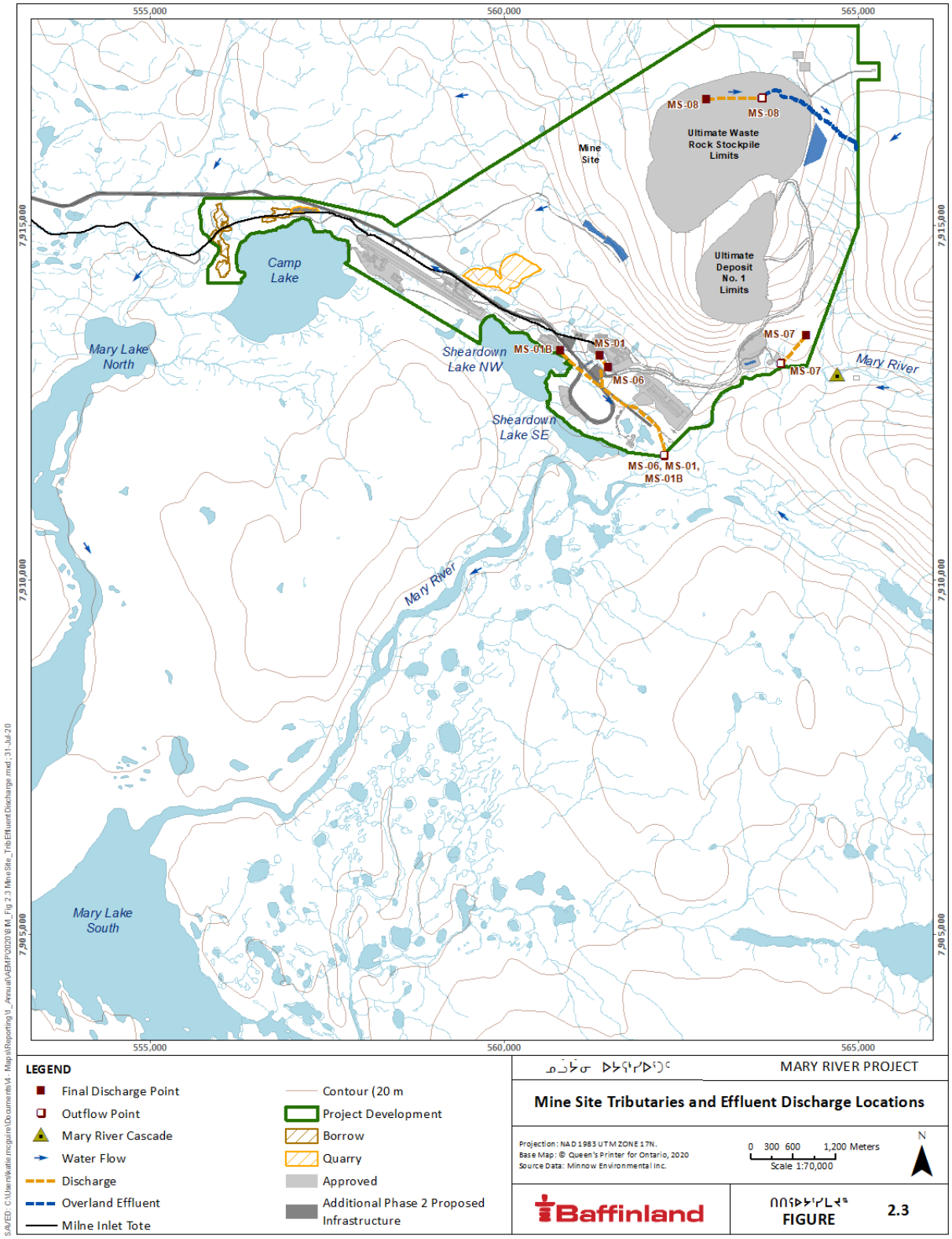

FIGURE 2.3 MINE SITE TRIBUTARIES AND EFFLUENT DISCHARGE LOCATIONS

2.4.2 WATER QUANTITY

Article 20 Inuit Water Rights of the Nunavut Land Claims Agreement (NLCA) formally recognizes the importance of water quantity and flow to the Inuit. Under the NLCA, Inuit require compensation if a project or activity will substantially affect the quantity of water flowing through Inuit-Owned Lands. Therefore, water quantity has been identified as a VEC. The water quantity VEC can be defined as the spatial and temporal variability of the volume of water within the Regional Study Area (RSA) that may be subject to alteration by Project activities.

Conditions applying to water use and management have been outlined in Part E of the Type A Water Licence. These conditions will be adhered to throughout applicable timeframe of this licence. The current limits on water use in the Type A Water Licence are 1,888 m^3/day and 689,000 m^3/year total water use from all sources during the construction phase, and 967 m^3/day or 353,000 m^3/year during the operation phase, for total domestic camp and industrial water use from all sources. A discussion of the Project's effects on the freshwater VECs follows.

Key Issues and Pathways for Water Quantities

Key issues identified for freshwater quantity are listed below:

- Water withdrawal;
- Water diversion (stream diversion or changes to flow patterns in a specific watershed); and
- Runoff or effluent discharge.

Key Indicators and Thresholds

The key indicators for water quantity are listed below:

- Water withdrawn for consumption (measured in cubic metres - m^3); and
- Streamflow increase or decrease (measured as a percent change of mean).

The thresholds are the water quantities authorized under the Type A Water Licence. Compliance with these thresholds is addressed in the Fresh Water Supply, Sewage and Wastewater Management Plan.

Diversions, Drainage Flows (Runoff) and Effluent Discharges

Diversions, drainage flows and effluent discharges are mainly impacted at the Mine Site and have potential effects on fish habitat due to reduction or increase in flows that result from the site development. This is further discussed in Section 3.4.3.

2.4.3 WATER AND SEDIMENT QUALITY VEC

Key Issues and Pathways

Key issues considered for the surface water and sediment quality VEC are summarized in Table 2.4.

TABLE 2.4 KEY ISSUES FOR WATER AND SEDIMENT QUALITY

Pathway	Key Issues	Location	Project Phases
Surface runoff	Uncontrolled runoff at construction site Erosion and sediment entrainment Site drainage control Spills and contamination Drainage from quarry sites	All	Construction Operation Closure
Discharges from secondary containment	Fuel depots/storage - contact water may be contaminated with hydrocarbon/petroleum products	Milne Port, Mine Site, Railway construction, Steensby Port, Quarry sites	Construction Operation Closure
Discharge of brine used for drilling in permafrost	Salinity of the discharge	Railway tunnels	Construction
Pooling water in landfarm	Pooling water maybe contaminated with hydrocarbon/petroleum product and may require treatment prior to discharge	Milne Port Mine Site Steensby Port	Construction Operation Closure
Pooling water in landfill	Pooling water maybe contaminated with metals, hydrocarbon/petroleum product and may require treatment prior to discharge	Milne Port Mine Site Steensby Port	Construction Operation Closure
Treated sewage effluent discharges	Effectiveness of treatment - pH, flows, Biological oxygen demand (BOD), Faecal Coliform (FC), TSS, nutrient, metals, oil and grease	Sheardown Lake Mary River outfall	Construction Operation Closure
Treated oily water treatment plant discharge	Effectiveness of treatment - pH, flows, TSS, metals, oil and grease	Mary River outfall	Construction Operation Closure
Dustfall	TSS in runoff, sediment deposition on stream and lake bottoms	Mine Site	Construction Operation Closure
Run of mine ore stockpile contact water	Metals, TSS, blasting residue (ammonia, nitrate)	Mary River	Operation
Ore stockpile contact water	Metals, TSS, blasting residue (ammonia, nitrate)	Mary River	Operation
Mine pit dewatering	Metals, TSS, blasting residue (ammonia)	Camp Lake Tributary	Operation
Waste rock stockpile facility runoff - west pond	ARD, metals, TSS, blasting residue (ammonia)	Camp Lake Tributary	Operation Closure Post-closure
Waste rock stockpile facility runoff - east pond	ARD, metals, TSS, blasting residue (ammonia)	Mary River	Operation Closure Post-closure
Mine pit water	ARD, metals	Open pit	Post-closure

2.4.4 FRESHWATER AQUATIC BIOTA AND HABITAT

Key Issues and Pathways

Arctic char (*Salvelinus alpinus*) is the primary freshwater biota of interest regarding potential effects of the Project on the aquatic environment. Potential linkages between the Project components/activities and Arctic char are presented on Figure 2.4. These linkage pathways can be categorized into three key issues as follows:

- Key Issue #1: Potential effects on the health and condition of Arctic char
- Key Issue #2: Potential effects on Arctic char habitat
- Key Issue #3: Potential effects on direct mortality of Arctic char

2.4.4.1 POTENTIAL EFFECTS ON THE HEALTH AND CONDITION OF ARCTIC CHAR

Project-related changes in water and/or sediment quality have the potential to affect the health and condition of Arctic char. The major pathways of effects are based on the residual effects identified in the water and sediment quality assessment. Linkages considered for potential effects include three general categories:

- Point source discharges including treated sewage effluent, waste rock facility runoff, ore stockpile runoff, mine pit water, run-of-mine stockpile runoff, and exploration drilling runoff
- Aqueous non-point sources including effects related to sediment and erosion, release of blasting residues, general site runoff, development of quarries and borrow pits)
- Dust emissions and introduction to surface waters

Effects considered under this key issue relate to sub-lethal effects of Project-related changes in water and/or sediment quality on fish health and condition.

2.4.4.2 POTENTIAL EFFECTS ON FISH HABITAT

Project activities with the potential to affect Arctic char habitat include the following:

- Placement of Project infrastructure in water bodies (e.g., water intakes, sewage outfalls, stream crossings, lake encroachments, laydown areas)
- Various Project-related effects pathways that may alter other aquatic biota that are food sources for Arctic char or form a component of the food web and thus may affect the productive capacity of their habitat (i.e., lower trophic level biota)
- Project-related effects on sedimentation rates that may result in alteration of habitat quality (e.g., due to dust deposition)
- Project-related changes to hydrology and subsequent effects on aquatic habitat (e.g., water withdrawal, stream diversion)
- Project-related effects on fish passage, with subsequent effects on the availability of habitat, including:
    - Stream crossing construction and operation
    - Changes in hydrology that may alter hydraulic conditions necessary for fish passage (e.g., stream velocities, water depth)

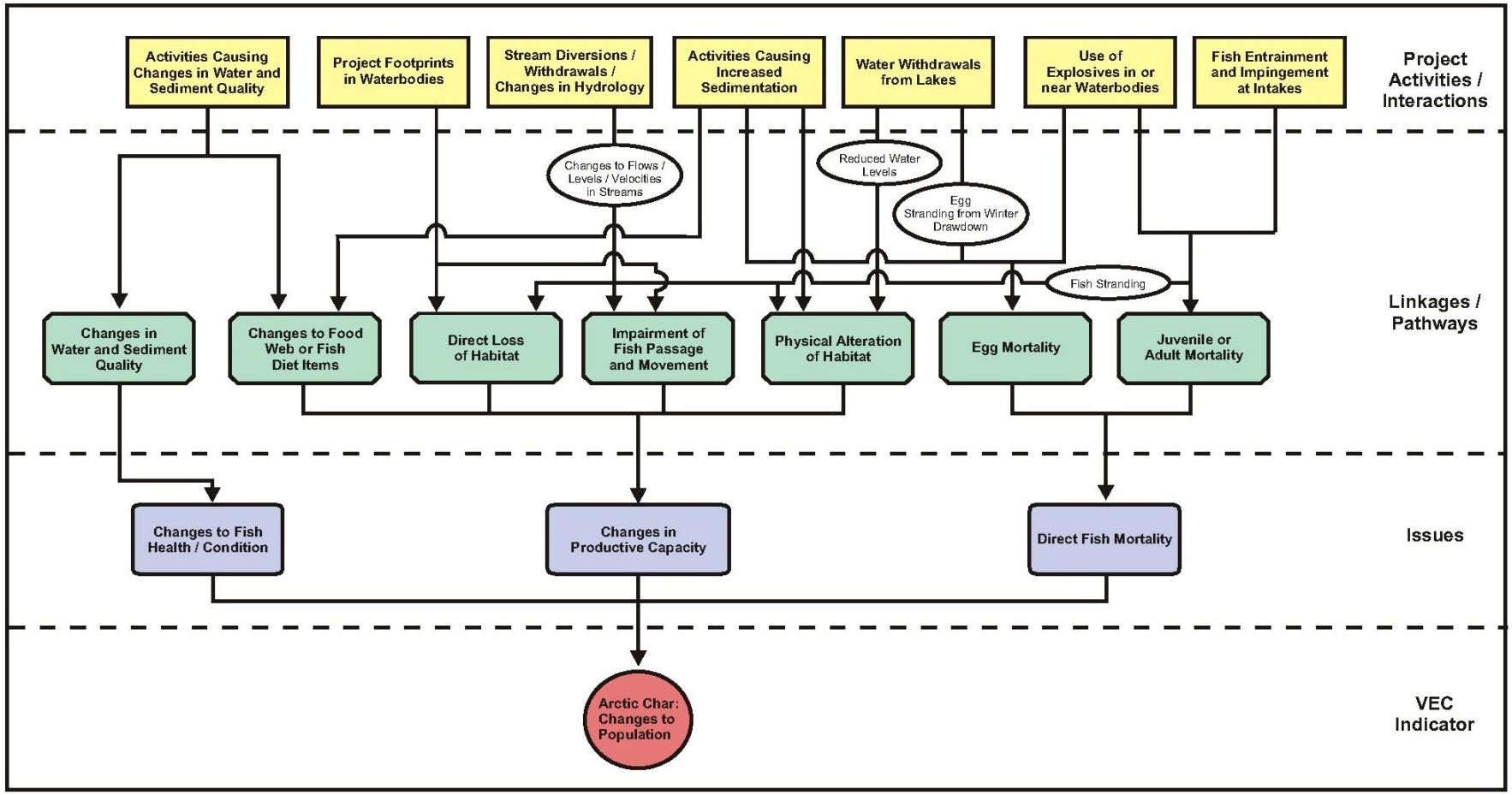

FIGURE 2.4 PROJECT ACTIVITIES/PATHWAYS OF POTENTIAL EFFECTS TO ARCTIC CHAR

Most of these key issues relate to construction activities in or near water bodies.

The following changes are associated with Mine Site development during the life of the Project and also have the potential to affect fish and fish habitat:

- Water withdrawn from Camp Lake for domestic and industrial consumption will be discharged (after treatment) to the Mary River
- Water withdrawal from Camp Lake will affect lake water levels and outflow discharge
- Drainage patterns where the Mine Site infrastructures/facilities are located will be altered. Most site runoff will be redirected to Mary River. As a result, less runoff will discharge to Sheardown Lake and Camp Lake. Tributaries of Sheardown Lake will be impacted. Lower flows may create barriers to fish passage.
- Mine pit dewatering, when it eventually occurs, will be directed to the waste rock sedimentation pond or to other permitted containment structures, as required

2.4.4.3 POTENTIAL EFFECTS ON DIRECT FISH MORTALITY

Project-related activities with the potential to cause direct mortality of Arctic char that are considered include the following:

- Effects of sedimentation on mortality of eggs
- Potential egg stranding related to winter drawdown at water source lakes
- Blasting in or near Arctic char habitat
- Placement of Project infrastructure in Arctic char habitat (i.e., potential spawning areas)
- Potential for entrainment and/or impingement of Arctic char eggs and juveniles at water intakes
- Potential fish stranding related to water diversions and/or alterations in discharge or water levels

Potential effects of sedimentation on survival (hatching success) of Arctic char eggs will be addressed through monitoring sediment deposition rates in Sheardown Lake as a target study (Section 3.4.1). Potential for winter drawdown to cause egg stranding will be addressed through monitoring of water levels as the primary indicator, supported by information on Arctic char population monitoring (e.g., year class strengths, recruitment). Potential effects of blasting in or near Arctic char habitat is addressed through the blasting management and monitoring program. The potential for placement of Project infrastructure to cause direct mortality of Arctic char (i.e., placement of infrastructure on fish eggs) is addressed through mitigation and management, specifically through avoidance of potential spawning areas and/or by adherence to timing windows to avoid the egg incubation period. Potential for entrainment and impingement of fish at water intakes will be mitigated through adherence to DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* (DFO, 1995). The last potential pathway of effect will be addressed through a follow-up target study to confirm fish passage at Mine area streams affected by water diversions (Section 3.4.3).

2.4.4.4 POTENTIAL EFFECTS OF BLASTING ON FISH

Blasting will be conducted to support the construction and operation phases of the Project. The concern for potential effects on fish due to blasting overpressure mainly arises for the railway construction. Effects of blasting on free-swimming Arctic char and their eggs will be mitigated through the implementation of a detailed blasting management plan developed in accordance with DFO's blasting guidelines (Wright and Hopky, 1998). During review of the Phase 2 Proposal, Baffinland agreed with a request from DFO to apply a more stringent overpressure threshold of 50 kPa, instead of the published 100 kPa threshold identified by Wright and Hopky (1998).

2.4.4.5 STREAM AND RIVER CROSSING CONSTRUCTION AND LAKE ENCROACHMENTS

Construction activities at watercourse crossings along the railway, railway access road, Project service roads and the Tote Road have the potential to cause the following effects:

- Stranding of Arctic char due to the need for isolation of the watercourses. This effect will be mitigated through the use of appropriate timing windows for construction when possible and through fish salvage operations when required.
- Potential impediments to fish passage at stream crossings due to changes in water levels, flows and/or velocities. This potential pathway of effect would be addressed through follow-up monitoring at selected stream crossings (i.e., a subset) to evaluate fish passage. This Stream Diversion Barrier Study monitoring is described in Knight Piésold (2014c).

2.4.5 POTENTIAL ISSUES AND CONCERNS BY PROJECT COMPONENT

Potential effects on aquatic ecosystems are presented below for each of the Project components within the two geographical areas for the construction and operation phases of the Project. Since abandonment and reclamation activities are similar in nature to construction activities, the concerns identified for the construction phase are also relevant for the closure phase.

2.4.5.1 MINE SITE (WATER MANAGEMENT AREA 48)

The Mine Site includes the infrastructure required to support mining activities (camp, maintenance shops, fuel depots, Wastewater Treatment Facility (WWTF), laydown areas, waste handling and storage facilities, landfill site and landfarm, explosives storage, manufacture and use). The freshwater supply for the Mine Site will be drawn from Camp Lake. Several quarries and borrows will be developed within the Mine Site area to provide aggregate material for the site development and ongoing operations and maintenance.

Potential aquatic effects at the Mine Site are listed in Table 2.5. The locations of all controlled discharges from the Mine Site are presented in Section 3.2.

2.4.5.2 MILNE PORT (WATER MANAGEMENT AREA 48)

Milne Port will serve as the main staging areas for material and equipment required for the construction activities at the Mine Site, as well as a shipping point for the Project. The site includes fuel depots, camps and WWTF, laydown areas, maintenance facilities, and temporary waste transit areas. Two sites have been identified for the fresh water supply for Milne Port: Phillip's Creek during summer and KM 32 Lake during the winter). A number of quarries and borrows will be developed near Milne Port to provide aggregate for the site development and ongoing operations and maintenance.

TABLE 2.5 POTENTIAL RESIDUAL EFFECTS TO THE MINE SITE AQUATIC ENVIRONMENT

VEC	Concern	Pathway	Indicator
Water Quantity	Withdrawal of water from Camp Lake		Volume withdrawn
	Flow diversion from Sheardown Lake		Visual - water level
Water and Sediment Quality	Earthworks	Surface runoff discharging to Camp Lake, Sheardown Lake, lake tributaries and Mary River	TSS, dust, spills
	Construction activities		TSS, dust, spills
	Site drainage		TSS, dust, spills
	Quarry site drainage		TSS, dust, spills, residual ammonia
	Fuel tank farms	Discharges from secondary containment areas to receiving environment - surface drainage	Hydrocarbons
	Waste storage area		Metals
	Bermed storage area		Metals, hydrocarbon
	Landfarm		Metals, hydrocarbon
	Landfill		Metals, hydrocarbon
	Treated Sewage Effluent (exploration camp)	Outfall to Sheardown Lake	BOD, TSS, nutrient
	Treated Sewage Effluent (main camp)	Outfall to Mary River	BOD, TSS, nutrient
	Treated Effluent from Oily Water Treatment Plant	Outfall to Mary River	TSS, hydrocarbon
	Waste rock stockpile drainage	Discharge to Camp Lake tributary	TSS, metals, nutrients
	Waste rock stockpile drainage	Discharge to Mary River	TSS, metals, nutrients
	ROM stockpile drainage	Discharge to Mary River	TSS, metals, nutrients
	Ore stockpile drainage	Discharge to Mary River	TSS, metals, nutrients
	Mine pit dewatering	Discharge to Camp Lake tributary	TSS, metals, nutrients/blasting residues
	Mine pit water post closure	End of life mine life pit water quality	Metals
	Dust	TSS in runoff	TSS

VEC	Concern	Pathway	Indicator
Freshwater Biota and Fish Habitat	Footprint of facilities in water bodies - water crossings	Loss of habitat - crossing of Mary River , Camp Lake tributaries	Percentage of habitat lost, amount of habitat compensation
	Integrity of water crossing	Alteration of habitat	Erosion, blockage
	Fish passage	Alteration of habitat	Blockage, barrier
	Water diversions - changes in streams	Alteration or loss of habitat	Low flow and barrier to fish passage
	Changes in water and sediment quality (point and non-point sources)	Effects on Arctic char health and condition; effects on lower trophic level biota (Arctic char habitat)	Arctic char health and condition; population metrics; benthic invertebrate community metrics
	Dust Deposition	Alteration of habitat	Increased sediment deposition in streams and lakes Benthic invertebrate community metrics
		Deposition on Arctic char eggs - reduced egg survival	Sedimentation rates in Arctic char spawning habitat
Groundwater quality	Landfill	Seepage in groundwater	Metals

At Milne Port, runoff from the ore management areas (ore stockpiles, crushing facilities) is directed to six (6) surface water management ponds and settling ditches:

- Milne Port Ore Stockpile Facility Pond - East (monitoring station MP-05)
- Milne Port Ore Stockpile Facility Pond - West (monitoring station MP-06)
- Stormwater Pond No. 3 (MP-07)
- Stormwater Pond No. 4 (MP-08)
- Stormwater Pond No. 5 (MP-09)
- Lump Ore Stockpile Perimeter Ditching East (MP-10a)
- Lump ore Stockpile perimeter ditching West (MP-10b)

General site drainage at Milne Port, excluding ore management and containment areas, is directed to a series of swales located along the shoreline of Milne Inlet (ocean). Effluent from water treatment plants (sewage, oily water) and surface water management ponds are discharged to Milne Inlet without coming in contact with any freshwater body. As a result, site drainage and effluent discharge at Milne Port have negligible effects on the freshwater receiving environment. The concerns for freshwater aquatic effects during the construction, operation and closure of the Milne Port site are listed below:

Water Quantity

- Withdrawal of water from Philips Creek (summer) and KM 32 Lake (winter)
- Water and Sediment Quality
- Quarry management (runoff quality, Acid Rock Drainage (ARD) potential, residual ammonia from blasting activities)
- Construction of water intakes - TSS/turbidity
- Spills caused by accidents and malfunctions

Freshwater Biota and Fish Habitat

- Low magnitude effects to fish and fish habitat related to water quality changes

The discharge criteria for the effluent and runoff water quality are presented in the Type A Water Licence. The locations of all controlled discharges from the Milne Port site are presented in Section 2.4.1.

2.4.5.3 TOTE ROAD AND NORTHERN RAILWAY (WATER MANAGEMENT AREA 48)

The Tote Road and the Northern Railway will connect Milne Port to the Mine Site. Site routine maintenance of the Tote Road and Northern Railway Infrastructure will be required to be conducted over the life of the Project to support the transport of ore to Milne Port. This maintenance may include repairing of water crossings, regrading of the road, and ongoing maintenance of surface water management structures (i.e., roadside swales, ditches). Several borrow sources and quarries will be developed along the length of the Tote Road and Northern Railway to support routine maintenance activities.

As part of Phase 2, a temporary ore stockpiling area at KM 57 of the Northern Railway will operate for 1 to 2 years during rail construction. This transfer area will facilitate the movement of ore from haul trucks to railcars. The haul trucks will deliver ore to the ore staging area from the Mine Site via the Tote Road. The ore will be loaded on railcars using front-end loaders. Once loaded the train will proceed north to Milne Port. Runoff from the stockpiles will be collected and directed to a stormwater pond. Runoff from the ore stockpiles at this facility will be directed to the KM 57 Ore Stockpile Facility pond. Discharge from the stormwater pond will be monitored to confirm it meets the requirements outlined in the current Type A Water Licence and effluent collected in this pond will be sampled to confirm it meets the mine effluent discharge criteria specified in the Licence before applying the water to the Tote Road as part of dust suppression efforts.

The concerns for potential aquatic effects during construction, operation and closure of the Tote Road are related to:

Water and Sediment Quality

- Dustfall from road traffic and related effects on water quality
- Dustfall generated by ore stockpiling and handling
- Drainage management from borrow sources

Freshwater Biota and Fish Habitat

- Construction and ongoing maintenance of stream crossings
- Changes in water quality that may affect biota
- Bank erosion, stability, blockage, integrity of the water crossings, fish passage

2.4.5.4 SOUTHERN RAILWAY (WATER MANAGEMENT AREAS 48 AND 21)

The longer term plans for the Project involve the transportation of iron ore from the Mine Site to the Steensby Port by railway. The concerns for potential aquatic effects occur mainly during the construction period of the railway embankment. Four construction camps (with waste incinerators) will be established at the onset of the construction period. Sewage effluent from these camps will be transported by truck to either the Mine Site or the Steensby Port sewage treatment facilities for treatment. There will be no local discharges of treated effluent at these construction camps (trucked to Steensby or Mine site sewage treatment plants). Domestic water supply and water required for construction activities will be drawn from a number of local lakes. A number of quarries will be developed along the

railway alignment in order to provide the necessary rock and aggregate required for the rail embankment, stream crossing and bridge construction.

The concerns for potential aquatic effects during construction, operation and closure of the railway are related to the loss or alteration of fish habitat:

Water Quantity (Potable Water and Construction Activities)

- Water withdrawals affecting downstream flows

Water and Sediment Quality

- Surface runoff water quality (Total Suspended Solids (TSS), spills, dust from traffic)
- Quarry management (runoff water quality, TSS, ARD, blasting and ammonia)

Freshwater Biota and Fish Habitat

- Stream/river crossings - flow velocity, TSS, erosion, fish stranding, fish passage and integrity of the water crossing
- Lake and river encroachment - loss of habitat, TSS (construction)
- Changes in water quality (e.g., dust, sewage effluent) - effects on Arctic char health and condition/habitat
- Blasting near water (blasting overpressure)

2.4.5.5 STEENSBY PORT (MANAGEMENT AREA 21)

The longer term plans for the Project involve the sizing and stockpiling of iron ore at Steensby Port prior to being loaded into the ore carriers for shipment. Steensby Port will contain large infrastructure required for ongoing support of the Port, the railway operation as well as the mine. The infrastructure at Steensby will include an airstrip, maintenance facilities (vehicles and railway), fuel depots, camps, a WWTF, warehouses, laydown areas, waste handling and storage facilities, landfill site, landfarm, explosives storage facilities, a freight dock, an ore stockpile and the ore loading dock. The freshwater supply for the Steensby Port will be drawn from two local lakes. Two quarries will be developed to provide aggregate for the development of the site.

At the Steensby site, surface drainage will be directed toward Steensby Inlet. Treated sewage effluent and treated oily water will discharge to Steensby Inlet. As a result, site drainage and effluent discharge will have minimal effects on the freshwater receiving environment.

The concerns for potential freshwater aquatic effects during the construction, operation and closure of the Steensby port are related to:

Water Quantity

- Withdrawal of water from 3 KM Lake (dust suppression and other minor uses) and ST347 Lake (permanent camp)

Water and Sediment Quality

- Quarry management (runoff quality, ARD potential, residual ammonia from blasting activities)
- Construction of water intakes - TSS/turbidity
- Spills caused by accidents and malfunctions

Freshwater Biota and Fish Habitat

- Stream/river crossings - flow velocity, TSS, erosion, fish stranding, fish passage and integrity of the water crossing
- Lake and river encroachment - loss of habitat, TSS (construction)
- Construction of water intakes - avoidance of spawning areas

The discharge criteria for the effluent and runoff water quality are presented in the Type A Water Licence.

3.0 COMPONENT STUDIES

3.1 THRESHOLDS

Thresholds are defined in the Adaptive Management Plan as specified performance indicators that define the conditions and triggering actions - these may be staged such that specific actions are associated with different levels of concern, including early warning thresholds to initiate precautionary responses, thereby avoiding adverse effects associated with higher thresholds. For the AEMP the term benchmark is used throughout this document.

3.1.1 PROCESS FOR DEVELOPING WATER AND SEDIMENT QUALITY BENCHMARKS

The Mine Site occurs within an area of metals enrichment and therefore generic water quality and sediment guidelines established for all areas within Canada may naturally be exceeded near the Mine Site. Thus, the selection of appropriate benchmarks must consider established water and sediment quality guidelines, such as those developed by the Canadian Council of Ministers of the Environment (CCME), as well as site-specific natural enrichment, and other factors such as Exposure Toxicity Modifying Factors (ETMF), including pH, water hardness, dissolved organic carbon, etc. (CCME, 2007).

The assessment of surface water and sediment quality data over the life of the Project will be on-going, and the identified benchmarks may change throughout this process, as more data becomes available. For example, an AEMP benchmark established early on in the life of the mine may require updating in 10 years to a Site-specific Water Quality Objective (SSWQO), based on new published literature which has become available, or site specific toxicity tests conducted to further understand ETMF or resident species toxicity. The iterative, cyclical nature of modification of benchmarks under an AEMP is well established (MacDonald et al., 2009).

3.1.1.1 WATER QUALITY BENCHMARKS

The substances for benchmark development in surface waters are as follows:

- Metals/Metalloids: Al, As, Cd, Cr, Co, Cu, Fe, Pb, Ni, Ag, Tl, V, Zn
- General Parameters and Nutrients: Chloride, Sulphate, Ammonia, Nitrite, Nitrate

In addition, numerous parameters will be evaluated in the Exploratory Data Analysis (Step 1 of Assessment Framework), including pH, DO, hardness, TSS, Alkalinity, Mg, P, K, Total Organic Carbon and Dissolved Organic Carbon, to monitor potential change. If changes in these substances are noted, benchmarks can be developed at a later stage.

Proposed water quality benchmarks for area lakes and rivers are presented in Tables 3.1 and 3.2, respectively. In most cases, the recommended AEMP benchmarks are consistent between lakes and rivers, with the vast majority of selected benchmarks being regulatory water quality guidelines.

TABLE 3.1 WATER QUALITY BENCHMARKS FOR MINE SITE LAKES

Parameter	Units	Water Quality Guideline	Camp Lake	Mary Lake	Sheardown Lake	Selected Benchmark	Benchmark Method
Metals [3]							
Aluminium	mg/L	0.1	0.026	0.137	0.179 (Shallow) 0.173 (Deep)	CL = 0.1 ML = 0.13; SDL shall/deep = 0.179/0.173	A (CL), B (ML/SDL)
Arsenic	mg/L	0.005	NC	0.00018	0.0001	0.005	A
Cadmium	mg/L	0.0001 (CL) 0.00006 (ML) 0.00009 (SDL)	NC	0.000023	0.000017	0.0001 (CL) 0.00006 (ML) 0.00009 (SDL)	A
Chromium	mg/L	NGA	NC	0.001	0.000641	0.0003 (CL) (ML) = 0.0005[8] (SDL) = 0.000642[9]	B (ML/SDL), C (CL)
Chromium $^{+3}$	mg/L	0.0089	NC	0.005	NC	0.0089	A
Chromium $^{+6}$	mg/L	0.001	NC	0.001	NC	0.003 – 0.015 (CL)[5] 0.003 (ML/SDL)[5]	C
Cobalt	mg/L	0.004	NC	NC	0.0002	0.004	A
Copper	mg/L	0.002	0.0113	0.00239	0.00243	(CL) = 0.004[7] (ML) = 0.0024 (SDL) = 0.0024	B
Iron	mg/L	0.3	0.0421	0.173	0.211	0.3	A
Lead	mg/L	0.001	0.000334	0.00013	0.00026	0.001	A
Nickel	mg/L	0.025	0.000941	0.00080	0.000973	0.025	A
Silver	mg/L	0.0001	NC	NC	0.0000104	0.0001	A
Thallium	mg/L	0.0008	NC	NC	0.0001	0.0008	A
Vanadium	mg/L	0.006	NC	0.00146	0.001	0.006	A
Zinc	mg/L	0.030	0.0037	0.003	0.00391	0.030	A
Water Quality Parameters							
Chloride (Cl^-)	mg/L	120	4	13	5	120	A
Ammonia (NH_3+NH_4)	mg N/L	0.855[4]	0.84	0.32	0.44	0.855	A
Nitrite (NO_2^-)	mg N/L	0.060	0.1[6]	0.1[6]	0.1[6]	0.060	A
Nitrate (NO_3)	mg N/L	13	NC	0.11	NC	3	A
Sulphate	mg/L	218	3	7	5	218	A

NOTES:

1. NGA = No Guideline Available; NC = Not Calculated; TBD = To be Determined; Guideline Still under Development; CL = Camp Lake; ML = Mary Lake; SDL = Sheardown Lake.
2. Method A = Water Quality Guideline from CCME/B.C. MOE; Method B = 97.5%ile of Baseline; Method C = 3* mdl.
3. Total metals unless otherwise noted.
4. Assumes temperature at 10 degrees c, and pH of 8.
5. The 2013 detection limit for cr6+ increased in 2013 from 0.001 to 0.005, hence this affects the 3* mdl calculation for the benchmark in camp lake. Efforts will be made to reduce this MDL in 2014, and comparisons to the lower of the 2 benchmarks would then be applied in camp lake. If detection limits improve, method a (selection of the guideline) may be implemented.
6. These values are elevated detection limits, and hence, the guideline has been selected as the AEMP benchmark.
7. The maximum value of 0.0113 mg/L copper was removed to calculate the 97.5th percentile, as this value appears to be an outlier.
8. An elevated detection limit of 0.001 mg/l was removed from the dataset and calculations, and the AEMP selected was the 97.5th percentile, which is 0.0005 mg/L.
9. Several detected values ranging from 0.00079 - 0.00316 mg/L CR have been reported in the dataset for SDL, and hence, these values were considered to represent baseline, and were included in the 97.5th percentile calculation.

TABLE 3.2 WATER QUALITY BENCHMARKS FOR MINE SITE STREAMS

Parameter	Units	Water Quality Guideline	Camp Lake Tributary	Mary River[3]	Selected Benchmark	Benchmark Method
Metals[4]						
Aluminum	mg/L	0.1	0.179	0.97	CLT = 0.179 MR = 0.966	B
Arsenic	mg/L	0.005	0.00012	0.00013	0.005	A
Cadmium	mg/L	0.00008 (CLT) 0.00006 (MR)	NC	0.00002	CLT = 0.00008 MR = 0.00006	A
Chromium	mg/L	NGA	0.000856	0.0023	CLT = 0.000856 MR = 0.0023	B
Chromium $^{+3}$	mg/L	0.0089	NC	0.005	0.0089	A
Chromium $^{+6}$	mg/L	0.001	NC	NC	0.003[5]	C
Cobalt	mg/L	0.004	NC	0.0004	0.004	A
Copper	mg/L	0.002	0.00222	0.0024	CLT = 0.0022 MR = 0.0024	B
Iron	mg/L	0.3	0.326	0.874	CLT = 0.326 MR = 0.874	B
Lead	mg/L	0.001	0.000333	0.00076	0.001	A
Nickel	mg/L	0.025	0.00168	0.0018	0.025	A
Silver	mg/L	0.0001	NC	0.0001	0.0001	A
Thallium	mg/L	0.0008	0.0002	0.0002	0.0008	A
Vanadium	mg/L	0.006	NC	0.002	0.006	A
Zinc	mg/L	0.030	0.0035	0.01	0.030	A
Water Quality Parameters						
Chloride (Cl^-)	mg/L	120	23	21.55	120	A
Ammonia (NH_3+NH_4)	mg N/L	0.855[6]	0.60	0.60	0.855	A
Nitrite (NO_2^-)	mg N/L	0.060	0.095[7]	0.06	0.060	A
Nitrate (NO_3)	mg N/L	13	0.118	0.14	13	A
Sulphate	mg/L	218	6	8	218	A

NOTES:

1. NGA = No Guideline Available; NC = Not Calculated; TBD = To Be Determined; Guideline Still Under Development; MR = MARY RIVER; CLT = Camp Lake Tributary.
2. Method A = Water Quality Guideline from CCME/B.C. MOE; Method B = 97.5% percentile of Baseline; Method C = 3* MDL.
3. One sample (outlier) containing chemical concentrations orders of magnitude above other values was not included in the calculations for Mary River.
4. Total metals unless otherwise noted.
5. Efforts will be made to reduce this mdl in 2014, and comparisons to the higher of the method a or c would then be applied as the AEMP benchmark.
6. Assumes temperature at 10 degrees C, and pH of 8.0.
7. 97.5th percentile is being driven by elevated detection limit, therefore, the guideline was selected.

In most cases, the benchmarks are consistent between lakes and streams, with the vast majority of selected benchmarks being generic WQOs (i.e., CWQG-PAL or surrogate). Where natural concentrations varied, and exceeded available WQOs, or < 5% of values was detected, recommended benchmarks varied.

3.1.1.2 SEDIMENT QUALITY BENCHMARKS

The parameters for sediment quality benchmark development are as follows:

- Arsenic
- Cadmium
- Chromium
- Copper
- Iron
- Manganese
- Nickel
- Phosphorus

In addition, lead, mercury and zinc were also included for benchmark development, as CCME sediment quality guidelines exist for these parameters.

The higher of the CCME/surrogate guideline or natural baseline was selected as the Final AEMP benchmark and is presented in Table 3.3.

3.1.2 NUTRIENT/EUTROPHICATION INDICATORS AND BENCHMARKS

The indicator for phytoplankton abundance is chlorophyll-*a* (North/South Consultants Inc. [NSC], 2014a). Chlorophyll-*a* is the most widely used indicator of phytoplankton abundance and is relatively easy to sample. It is also associated with lower analytical variability and is more cost-effective than biomass and community composition metrics.

The phytoplankton monitoring program considers related/supporting variables including nutrients (phosphorus and nitrogen), measures of water clarity (i.e., TSS, turbidity, Secchi disk depth), and temperature in the data analysis and reporting phase.

The benchmark for chlorophyll-*a* for the Mary River Project (3.7 µg/L) is based on maintaining the trophic status (i.e., oligotrophic) of Mine Area lakes. Specifically, the benchmark represents the average of the upper and lower ranges of trophic boundaries for lakes based on chlorophyll a, as designated and/or adopted in the scientific literature (Table 3.4).

3.1.3 BENTHIC MACROINVERTEBRATE INDICATORS AND BENCHMARKS

Unlike water or sediment, where protection of aquatic life guidelines may be used to develop triggers or thresholds for effects assessment, there are no universal benchmarks for biological variables such as abundance or diversity. Rather, the magnitude of change or difference relative to expected conditions is typically used to establish CESs for biological variables. Environment Canada (2012) identifies CESs for a BMI metric as multiples of within-reference-area standard deviations (i.e., ±2SD). As for fish, confirmed effects are based on the results of two consecutive surveys. The metrics identified for both Mine Area lakes and streams through this process were:

- Chironomidae proportion
- Shannon's Equitability
- Simpson's Diversity Index
- Total Taxa Richness
- Bray-Curtis Index of Dissimilarity (Bray-Curtis Index)

TABLE 3.3 SEDIMENT QUALITY BENCHMARKS (INTRINSIK, 2015)

Jurisdiction, Type of Guideline and Statistical Metric		Hg	As	Cd	Cr	Cu	Fe	Mn	Ni	P*	Pb	Zn
CCME (2014)	ISQG	0.17	5.9	0.6	37.3	35.7	NGA	NGA	NGA	NGA	35	123
	PEL	0.486	17	3.5	90	197	NGA	NGA	NGA	NGA	91.3	315
Ontario (OMOE, 2008)	LEL	0.2	6	0.6	26	16	20,000	460	16	600	31	120
	SEL	2	33	10	110	110	40,000	1100	75	2,000	250	820
97.5th Percentiles of Lake Areas and Lake Specific Benchmarks by Area												
Mary Lake (2007 - 2014) and Camp lake (2007 - 2014) (N=31)		<0.1	5.3	<0.5	98	50	52,400	4,370	72	1580	25	135
AEMP Benchmark - Mary Lake and Camp Lake		0.17A	5.9A	1.5C	98B	50B	52,400B	4,370B	72B	1,580B	35A	135B
Sheardown Lake SE (2007 - 2014) (N=11)		<0.1	2	1	79	56	34,400	657	66	1278	18	63
AEMP Benchmark - Sheardown Lake SE		0.17A	5.9A	1.5C	79B	56B	34,400B	657B	66B	1278B	35A	123A
Sheardown Lake NW (2007-2014, excluding 2008) (N=25)		<0.1	6.4	<0.5	96	62	53,000	4,300	84	1,100	24	107
AEMP Benchmark - Sheardown Lake NW		0.17A	6.2B	1.5C	97B	58B	52,200B	4,530B	77B	1958B	35A	123A

NOTES:

1. Units are mg/kg unless otherwise noted.
2. As recommended by Minnow, arsenic, copper and iron sediment quality benchmarks may be modified in the future to account for the elevated levels of these metals observed in sediments of Reference Lake 3 during the 2015 CREMP field program.
3. *=N for phosphorus is lower than other elements / parameters.
4. A = guideline is based on sediment quality guideline (CCME or Ontario).
5. B = guideline is based on 97.5% percentile of baseline data.
6. C = guideline is based on 3 times MDL.
7. Where mercury and cadmium were not detected in any samples in a given area; the detection limit is used to represent the 97.5% percentiles.

TABLE 3.4 DERIVATION OF THE BENCHMARK FOR CHLOROPHYLL-*A*

Reference	Chlorophyll *a* (µg/L)	
	Maximum Oligotrophic	Minimum Mesotrophic
OECD (1982) and AENV (2014)	2.5	2.5
Wetzel (2001)	4.5	3
Nürnberg (1996)	3.5	3.5
Carlson (1977)	2.6	2.6
Swedish EPA (2000)	5	5
USEPA (2009)	2	2
University of Florida (2002)	3	3
Galvez-Cloutier R. and M. Sanchez. (2007)	3	3
Ryding and Rast (1989)	8	8
Mean	3.79	3.62

3.1.4 ARCTIC CHAR INDICATORS AND BENCHMARKS

Environment Canada (2012) recommends monitoring of sexually mature individuals of a minimum of two fish species for EEM programs and use of invasive sampling (i.e., lethal) if acceptable. Alternative study designs include non-lethal sampling methods for fish populations/communities, as well as studies of juvenile fish if appropriate and/or required. The Mine Area streams and lakes support only two (2) fish species: land-locked Arctic char and ninespine stickleback (*Pungitius pungitius*).

Non-lethal sampling methods will be used to the extent possible to minimize impacts of monitoring on the Arctic char populations. As a result, metrics that can be reliably obtained from live fish will be included in CREMP. Metrics will include indicators of fish growth, condition, and reproduction.

As it is not possible to identify a level of change in Arctic char population metrics that would be indicative of long-term effects or “unacceptable ecological changes” for the mine area fish populations, the CREMP will initially apply the recommended EEM benchmarks (Table 3.5). However, it is recommended that the applicability/appropriateness of these benchmarks be reviewed on a regular basis and, if appropriate, modified as the CREMP progresses. The management response framework should also be regularly reviewed and adjusted over time to ensure the program is effective, sensitive, and ecologically meaningful.

3.1.5 INUIT OBSERVATIONAL GUIDELINES

Inuit may identify thresholds that are applicable to the protection of surface water quality and aquatic ecosystems. In no instance will Inuit thresholds lead to non-compliance with regulatory objectives or requirements; Inuit requirements may be more sensitive - but not less sensitive - to environmental change than regulatory requirements.

TABLE 3.5 FISH METRICS AND STATISTICAL ANALYSIS METHODS RECOMMENDED UNDER EEM

Effect Indicators	Non-Lethal Survey	(Threshold) Fish Effect Endpoint	CES[2]	Statistical Test
Growth	*Length of YOY (age 0) at end of growth period	Length and weight of YOY (age 0) and age 1+ at end of growth period	± 25%	ANOVA
	*Weight of YOY (age 0) at end of growth period			ANOVA
	*Size of 1+ fish			ANOVA
	*Size-at-age (body weight at age)			ANCOVA
	Length-at-age			ANCOVA
	Body Weight			ANOVA
	Length			ANOVA
Reproduction	*Relative abundance of YOY (% composition of YOY)	Relative abundance of YOY (% composition of YOY) OR relative age-class strength	± 25%	Kolmorgorov-Smirnov test performed on length-frequency distributions with and without YOY included; OR proportions of YOY can be tested using a Chi-squared test.
	OR relative age-class strength			
Condition	*Condition Factor	Condition Factor	± 10%	ANCOVA
Survival	*Length-frequency distribution	Length or age frequency distribution	± 25%	2-sample Kolmorgorov-Smirnov test
	*Age-frequency distribution (if possible)			2-sample Kolmorgorov-Smirnov test
	YOY Survival			

NOTES:

1. Metrics indicated with an asterisk are endpoints used for determining effects under EEM, as designated by statistically significant differences between exposure and reference areas. Other endpoints may be used to support analyses.
2. CES's are expressed as a percentage of the reference means.

3.1.6 EFFECTS PREDICTIONS

Adaptive management includes short-term and longer-term review and response cycles[2] (Section 2.3). The thresholds described above (discharge limits, receiving water quality guidelines, and future Inuit observational guidelines) are applied to guide short-term adaptive management through implementation of the TARPs (Section 5).

[2] Short-term is on the scale of annual, versus long-term which is multi-year.

The effects predictions from the FEIS and addendums are thresholds that are appropriate for longer-term review and response cycles, such as the annual review of regulatory compliance and unexpected effects. The effects predictions from the FEIS and addendums can be used for comparison to the Project's performance as described in Section 6.1 Annual Review of Compliance and Unanticipated Effects. The Company may also identify the need for further adaptive management when unanticipated effects or effects that exceed FEIS predictions occur.

3.2 EEM UNDER MDMER

As a metal mine, the discharge of mine effluents from this mine is regulated by the MDMER. These regulations, administered under the federal *Fisheries Act*, apply to mining and milling operations that discharge effluent(s) at a rate greater than 50 m^3/day. Mining began in September 2014, at which time temperatures can be below 0°C, precipitation may fall as snow, and runoff ceases in local rivers and streams. Therefore, the 50 m^3/day mine effluent discharge rate was achieved during freshet (spring melt) on July 10, 2015. The MDMER monitoring program provides a mechanism for verifying environmental effects and responding to unexpected effects of contact water discharges on the aquatic environment. There are subtleties in the regulations that are not captured in this overview, and for this reason, in implementing monitoring under the MDMER, Site Environment staff are directed to more detailed guidance developed for Baffinland by Minnow Environmental Inc. (2018), as well as the MDMER legislation itself.

Effluent monitoring components of the MDMER are identified along with testing frequencies in Table 3.6. Four effluent final discharge points (FDPs) are currently monitored: MS-06, MS-06B, MS-07 and MS-08 (each location is described further in Table 3.7).

TABLE 3.6 COMPONENTS OF EFFLUENT MONITORING UNDER THE MDMER

Component	Frequency
Deleterious substances monitoring	Weekly during discharge.
Effluent characterization	Once per calendar quarter, at least one month after the previous quarterly sample; on effluent samples that were tested to be acutely lethal.
Acute lethality testing (Rainbow Trout and Daphnia magna)	Monthly; additional testing if effluent found to be acutely lethal. Daphnia magna is a "monitor-only" parameter with no compliance-related repercussions for failed tests.
Sublethal toxicity testing (fish, invertebrate species, plant species, algal species in freshwater and marine water	Quarterly during discharges (generally twice annually at Mary River) concurrent with effluent characterization samples. Testing is completed only at the FDP that contributes the highest loadings of deleterious substances taking receiving environment dilution factors into account, which at the Project is FDP MS-08 at the waste rock facility. Sublethal toxicity testing data are used to potentially inform biological effects monitoring and are not used for evaluating regulatory compliance.
Effluent volume monitoring	Total monthly volume of effluent deposited from each FDP for each month during which there was a deposit (discharge).

Adaptive management is built into the effluent characterization components of the MDMER monitoring program. If a monthly effluent sample is determined to be acutely lethal by an acute lethality test, the following additional actions are required:

- Effluent characterization testing on each failing sample
- Acute lethality testing of grab samples from the same final discharge point twice monthly (but not less than seven days apart)

The regular frequency of acute lethality sampling can be resumed if the effluent is determined not to be acutely lethal in three consecutive tests.

Additionally, the frequency of acute lethality testing at a given FDP may be reduced to once each calendar quarter if the effluent from that FDP is determined not to be acutely lethal for 12 consecutive months.

If any of the following is reported to have occurred, Baffinland shall notify an ECCC inspector without delay and report the results in writing to the inspector within 30 days:

- MDMER Discharge Limits in Schedule 4 are being or have been exceeded
- Effluent pH is less and 6.0 or greater than 9.5
- An effluent is acutely lethal

If any of the above have occurred over the year, the causes of that non-compliance must be described in the annual report to ECCC along with remedial measures that are planned or that have been implemented.

The MDMER outline requirements for routine effluent monitoring, acute lethality testing, and EEM. The objective of EEM is to determine whether mining activity is causing an effect on fish, benthic invertebrate communities and/or the use of fisheries resources (based on mercury accumulation in fish tissues).

As shown in Figure 3.1, during the life of the Project, mine effluent will be discharged to two (2) watercourses:

- Mary River (early in the Mine life); and
- Camp Lake Tributary 1 (later in the Mine life).

There are three (3) final discharge points that will discharge mine effluent to the Mary River:

- Waste Rock Facility discharge (East Pond; MS-08);
- Run-of-mine (ROM) Stockpile Facility discharge (MS-07); and
- Ore stockpile discharges (trucking and rail phases) at the rail load-out area (MS-06).

There will be one (1) final discharge point to Camp Lake Tributary 1, from the West Pond (MS-09) collecting runoff from the west side of the waste rock stockpile. As shown in Figure 3.1, during ERP operations, mine effluent is only discharged to the Mary River at three (3) final discharge points:

- Waste Rock Facility Pond (MS-08) - discharged to the Mary River via Mary River Tributary F;
- Run-of-mine (ROM) Stockpile Facility discharge (MS-07); and
- Ore Stockpile (Crusher) Pond (MS-06) - discharged to the Mary River using the same pipeline and outfall used to discharge the Project's treated sewage effluent at the Mine Site (referred to as MS-01 under the Type A Water Licence).

As recommended by ECCC (ECCC Comment 2, Appendix C), Table 3.7 outlines the Mary River Project current and anticipated discharge descriptions.

Additional final discharge points will be identified for the Milne Port facility, once crushing operations are initiated. Prior to the initiation of crushing activities, Baffinland will prepare and submit for approval the study design and location of final discharge points to ECCC. As discharge from the Milne Port facility will report to the marine environment, the required EEM study will be included in the Marine Environment Effects Monitoring Program and is outside the scope of the AEMP.

TABLE 3.7 MARY RIVER PROJECT CURRENT AND ANTICIPATED DISCHARGE POINTS

Discharge Source	Effluent Final Discharge Point Identifier	Coordinates (NAD 83)		Receiving Waterbody	Existing AEMP Receiving Environment Downstream Monitoring Locations				
		Latitude	Longitude		Water Quality	Sediment Quality	Phytoplankton	Benthic Invertebrates	Fish
Waste Rock Facility (East Pond[1])	MS-08	71˚20'24.7"	79˚13'18.4"	Unnamed Tributary to Mary River (Mary River Tributary-F)	Mary River Tributary-F (FO-01) Mary River (MS-08-DS, EO-10)	Mary Lake	Mary River Tributary-F (FO-01) Mary River (EO-10)	Mary River (E0-01) Mary River Tributary-F (EEM only)	Mary River (EEM only) and Mary Lake
Ore Stockpile (Crusher) Pond	MS-06	71˚18'06.4"	79˚15'29.7"	Mary River	Mary River (EO-20 and EO-21)	Mary Lake	Mary River (EO-20 and EO-21)	Mary River (EO-20)	Mary River (EEM only) and Mary Lake
Run-of-Mine Stockpile Facility	MS-07	TBD	TBD	Mary River	Mary River (EO-03 and EO-21)	Mary Lake	Mary River (EO-03 and EO-21)	Mary River (EO-01)	Mary River (EEM only) and Mary Lake
West Pond	MS-09	Not Applicable	Not Applicable	Camp Lake Tributary 1	CLT1 Stations	Camp Lake	CLT1 Stations	CLT1 US	Camp Lake

NOTES:

1. An interim sedimentation pond has been constructed to contain runoff from the waste rock stockpile generated during Early Revenue Phase operations.
2. Facility not yet constructed, final location of discharge point to be determined.
3. Infrastructure is not associated with the Early Revenue Phase of the Project and therefore has not been constructed to date.

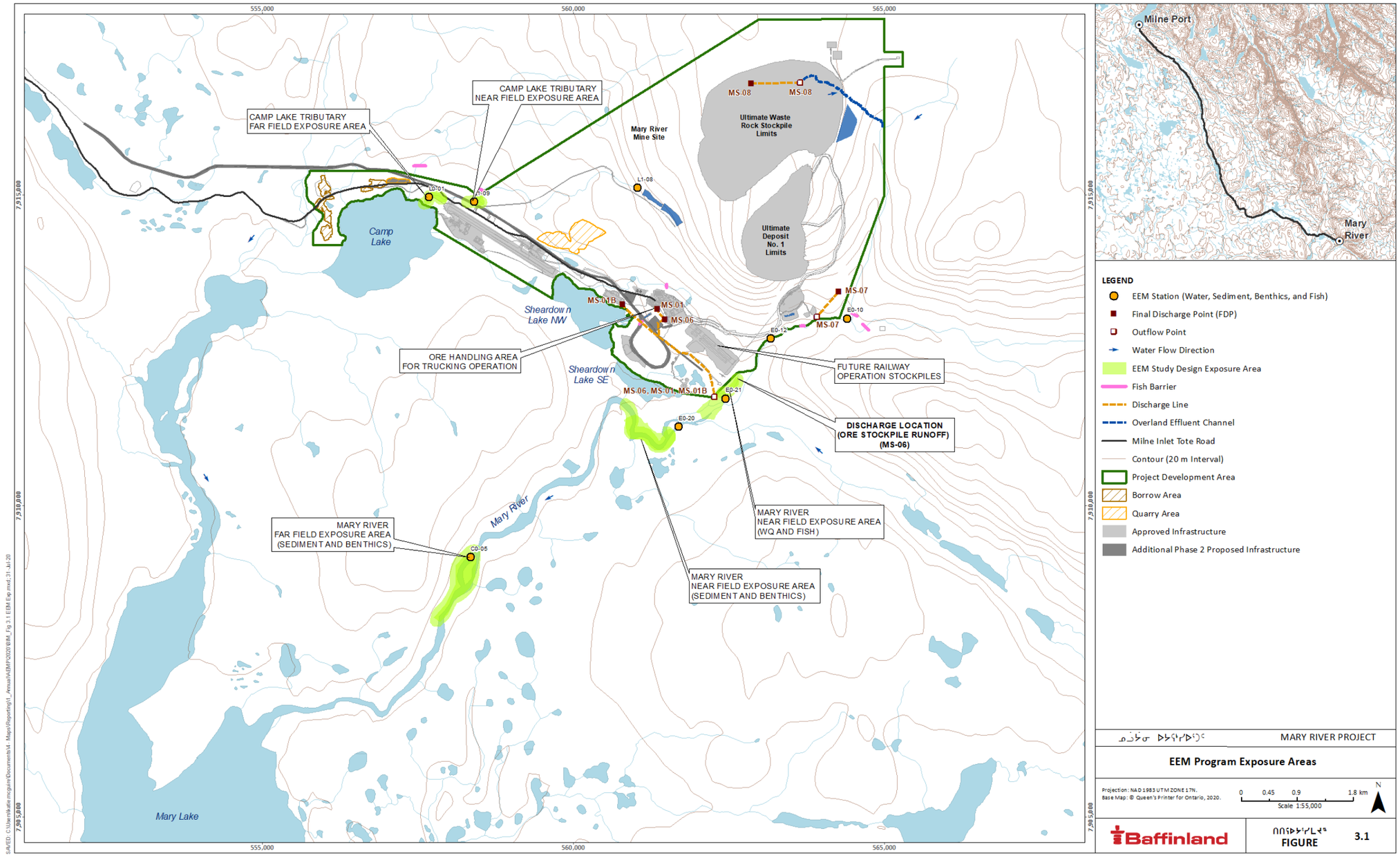

FIGURE 3.1 EEM PROGRAM EXPOSURE AREAS

3.3 CREMP STUDY DESIGN

3.3.1 CREMP OVERVIEW

The CREMP has been established to monitor effects of the Project on the downstream aquatic environment. The CREMP focuses on follow-up monitoring to validate predictions to aquatic valued ecosystem components (VECs) and key indicators, as follows:

- Water quantity
- Water and sediment quality
- Freshwater biota (benthic invertebrate indicators, phytoplankton, and Arctic char)

The EEM program (Section 3.2) identifies the exposure areas in the freshwater environment that will receive mine effluent discharges. The CREMP encompasses a larger geographic extent than the EEM program and is intended to monitor potential effects to the aquatic environment via other pathways such as dust deposition or changes in water flow due to diversions.

Based on the conclusions in the FEIS, mine site aquatic effects will be primarily confined to the Mary River, Camp Lake, Sheardown Lake and their associated tributaries (Figure 2.1). Mary Lake is the ultimate receiving water for these drainage areas, but it is of sufficient size that detectable effects are not predicted. The CREMP includes monitoring in Mary Lake to confirm this prediction.

The CREMP is intended to monitor effects as follows:

- Camp and Sheardown Lake Tributaries - will be affected by dust deposition and water diversions; Camp Lake Tributary 1 will receive waste rock stockpile runoff from the West Pond
- Sheardown Lake - will experience changes in water quality due to airborne dust dispersion and runoff, sewage effluent discharges from the exploration camp during construction, changes in hydrology, and potential changes in productivity to tributaries of Sheardown Lake
- Camp Lake - will receive runoff from tributaries affected by dust deposition and mine effluent (West Pond), will be affected by water diversions and withdrawals, as well as changes in water quality due to airborne dust dispersion
- Mary River - will be subject to airborne dust dispersion and will receive mine effluent at multiple locations as well as treated sewage effluent
- Mary Lake - is the ultimate receiving waters of Camp Lake, Sheardown Lake and the Mary River

In 2015, Reference Lake 3 was established as the reference lake for the CREMP. Reference Lake 3 will be used to assist in identifying mine influenced changes to the water, sediment and freshwater biota of mine area lakes. As recommended by ECCC (ECCC Comment 3, Appendix C), Tables 3.8, 3.9 and 3.10 indicate a number of reference areas including lakes, tributaries, and upstream locations, that have been identified. The reference areas used for each receiving environment including the type of sampling and how the reference area data will be used in comparisons to exposure site data have been outlined.

After completing the CREMP in 2015, Minnow proposed, as indicated earlier, several modifications to the CREMP in an effort to provide greater efficiencies to the program and improve the program's ability to achieve its objectives.

A brief description of the CREMP by component is provided below.

3.3.2 WATER QUALITY

The key pathways of potential effects of the Project on water quality include:

- Water quality changes related to discharge of ore or stockpile runoff to freshwater systems (immediate receiving environments: Mary River and CLT-1)
- Water quality changes (primarily nutrients and total suspended solids [TSS]) related to discharge of treated sewage effluent (immediate receiving environments: Mary River and Sheardown Lake NW)
- Water quality changes due to deposition of dust in lakes and streams (Mine Area in zone of dust deposition)
- Water quality changes due to non-point sources, such as site runoff and use of Ammonium Nitrate Fuel Oil (ANFO) explosives (Mine Area)

The key question related to the pathways of effect is:

- *What is the estimated mine-related change in contaminant concentrations in the exposed area?*

The primary issue of concern with respect to water quality is related to the combined effects on metal and TSS concentrations from mine effluent discharges and ore dust deposition on water quality in adjacent lakes and streams. As such, the CREMP and the baseline data review (Knight Piésold, 2014a) focused on waterbodies that will receive mine effluent discharges and are closest to the sources of ore dust. Camp Lake and CLT-1, as well as the Mary River and Mary Lake, will receive mine effluent discharges. These waterbodies, along with Sheardown Lake, may also be affected by ore dust deposition and sources of fugitive dust (i.e., road dust, crushers).

The discharge of treated sewage effluent also has the potential to cause eutrophication, with total phosphorus (TP) being the limiting nutrient. TP concentrations are highly variable, however, making it a poor indicator. While TP will continue to be monitored as part of the CREMP, chlorophyll-*a* will be monitored as a more reliable indicator of potential eutrophication, as part of the freshwater biota CREMP.

After completing the CREMP in 2015, Minnow proposed several modifications to the CREMP. Within the list of Minnow's recommendations, Minnow noted that no consistent spatial differences in water quality/chemistry were evident in any of the study lakes in 2015, nor during any of the baseline studies, suggesting that study lakes are generally well mixed with relatively uniform water chemistry throughout the year. (Minnow, 2016). Because of this, Minnow recommended three modifications to the CREMP lake water quality sampling program:

1. Reduce the number of water quality monitoring stations to three (3) in each of Camp, Sheardown NW and SE lakes and four (4) in Mary Lake (Minnow Recommendation 7; Minnow, 2016) including those outlined in Table 3.11.
2. Collect a single water quality sample at mid-depth instead of collecting two samples, surface and bottom, at each lake water quality monitoring station (Minnow Recommendation 9; Minnow, 2016).
3. Conduct water quality *in situ* profiling at the main (i.e. deepest) basin of the study lakes to evaluate the occurrence of anoxic conditions and guide the subsequent sampling approach (Minnow Recommendation 8; Minnow 2016).[3]

[3] Anoxic conditions have not been observed at any of the study lakes since baseline studies began in 2005.

TABLE 3.8 REFERENCE AREAS FOR THE MARY LAKE SYSTEM

Study System	Water Body	Representative Water Quality Station [d]			Reference Area used for each Study Component [a, b, c]				
		Station Identifier	Easting	Northing	Water Quality	Sediment Quality	Phytoplankton	Benthic Invertebrates	Fish
Reference Areas	Lotic Reference	CLT-REF3	567004	7909174	Y	-	Y	-	-
		CLT-REF4	568533	7907874	Y	-	Y	Y	-
		MRY-REF3	585407	7900061	Y	-	Y	-	-
		MRY-REF2	570650	7905045	Y	-	Y	-	-
	Reference Lake 3	REF-03-W1	575642	7852666	Y	Y	Y	Y	Y
		REF-03-W2	574836	7852744	Y		Y		
		REF-03-W3	574158	7853237	Y		Y		
	Mary River Reference	G0-09-A	571264	7917344	Y	-	-	-	-
		G0-09	571546	7916317	Y	-	-	-	-
		G0-09-B	571248	7914682	Y	-	-	-	-
Mary River and Mary Lake System	Mary River	G0-03	567204	7912587	Mary River GO-09 Average	Not Applicable	Mary River GO-09 Average	Mary River GO-09 Average	Not Applicable
		G0-01	564459	7912984					
		F0-01	564483	7913015					
		E0-21	562444	7911724					
		E0-20	561688	7911272					
		E0-10	564405	7913004					
		E0-03	562974	7912472					
		C0-10	560669	7911633					
		C0-051	558352	7909170					
		C0-01	556305	7906894					
Mary River and Mary Lake System	Mary Lake (North Basin)	BL0-01	554691	7913194	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3	Not Applicable
		BL0-01-A	554300	7913378					
		BL0-01-B	554369	7913058					
	Mary Lake (South Basin)	BL0-03	552680	7906651	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3
		BL0-04	553817	7904886					
		BL0-05	554632	7906031					
		BL0-06	555924	7903760					
		BL0-05-A	554530	7906478					
		BL0-05-B	555034	7905692					
		BL0-09	554715	7904479					

NOTE:

1. Bold indicates lake water quality stations selected by Minnow for *in situ* profiling.

TABLE 3.9 REFERENCE AREAS FOR THE CAMP LAKE SYSTEM

Study System	Water Body	Representative Water Quality Station [d]			Reference Area used for each Study Component [a, b, c]				
		Station Identifier	Easting	Northing	Water Quality	Sediment Quality	Phytoplankton	Benthic Invertebrates	Fish
Reference Areas	Lotic Reference	CLT-REF3	567004	7909174	Y	-	Y	-	-
		CLT-REF4	568533	7907874	Y	-	Y	Y	-
		MRY-REF3	585407	7900061	Y	-	Y	-	-
		MRY-REF2	570650	7905045	Y	-	Y	-	-
	Reference Lake 3	REF-03-W1	575642	7852666	Y	Y	Y	Y	Y
		REF-03-W2	574836	7852744	Y		Y		
		REF-03-W3	574158	7853237	Y		Y		
Camp Lake System	Camp Lake Tributaries	I0-01	555470	7914139	Lotic Reference Average	Not Applicable	Lotic Reference Average	Not Applicable	Not Applicable
		J0-01	555701	7913773					
		K0-01	557390	7915030				CLT-REF4	
		L0-01	557681	7914959					
		L1-02	558765	7915121					
		L1-05	558040	7914935					
		L1-08	561076	7915068					
		L1-09	558407	7914885					
		L2-03	559081	7914425					
Camp Lake System	Camp Lake	JL0-01	557108	7914369	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3
		JL0-02	557615	7914750					
		JL0-07	556800	7914094					
		JL0-09	556335	7913955					
		JL0-10	557346	7914562					

NOTE:

1. Bold indicates lake water quality stations selected by Minnow for *in situ* profiling.

TABLE 3.10 REFERENCE AREAS FOR THE SHEARDOWN LAKE SYSTEM

Study System	Water Body	Representative Water Quality Station [d]			Reference Area used for each Study Component [a, b, c]				
		Station Identifier	Easting	Northing	Water Quality	Sediment Quality	Phytoplankton	Benthic Invertebrates	Fish
Reference Areas	Lotic Reference	CLT-REF3	567004	7909174	Y	-	Y	-	-
		CLT-REF4	568533	7907874	Y	-	Y	Y	-
		MRY-REF3	585407	7900061	Y	-	Y	-	-
		MRY-REF2	570650	7905045	Y	-	Y	-	-
	Reference Lake 3	REF-03-W1	575642	7852666	Y	Y	Y	Y	Y
		REF-03-W2	574836	7852744	Y		Y		
		REF-03-W3	574158	7853237	Y		Y		
Sheardown Lake System	Tributary 1	D1-00	560329	7913512	Lotic Ref. Avg.	Not Applicable	Lotic Ref. Avg.	CLT-REF4	Not Applicable
		D1-05	561397	7913558					
	Tributary 9	-	-	-	Not Applicable	Not Applicable	Not Applicable	CLT-REF4	Not Applicable
	Tributary 12	-	-	-					
	Sheardown Lake NW	DD-Hab9-Stn1	560259	7913455	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3
		DL0-01-1	560080	7913128					
		DL0-01-2	560353	7912924					
		DL0-01-4	560695	7913043					
		DL0-01-5	559798	7913356					
		DL0-01-7	560525	7912609					
Sheardown Lake System	Sheardown Lake SE	**DL0-02-3**	561046	7911915	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3	Reference Lake 3
		DL0-02-4	561511	7911832					
		DL0-02-6	560756	7912167					
		DL0-02-7	560952	7912054					
		DL0-02-8	561301	7911846					

NOTE:

1. Bold indicates lake water quality stations selected by Minnow for *in situ* profiling.

TABLE 3.11 PROPOSED WATER QUALITY MONITORING STATIONS

Lake	Station ID	Depth (m)	Description
Reference Lake 3	REF03-01	15.1	East end of southeast basin
	REF03-02	30.4	Centre of southeast basin
	REF03-03	37.5	Centre of northwest basin
Camp Lake	JLO-02	12.3	Littoral station near primary lake inlet (CLT1, CLT2)
	JLO-07	32.7	Deep basin, near centre of lake
	JLO-09	14.3	Near lake outlet
Sheardown Lake NW	DD-Hab9-Stn1	10.3	Near inlet from SDLT1
	DLO-01-2	17.5	Deep location, near centre of northwest basin
	DLO-01-7	11.4	Near lake outlet
Sheardown Lake SE	DLO-02-6	7.1	Near inlet from Sheardown Lake NW
	DLO-02-3	13.7	Deep location, near centre of southeast basin
	DLO-02-4	8.05	Near inlet from SDLT9
Mary Lake	BLO-1A	14.65	Deepest location at the north basin
	BLO-5	21	Near inlet from Mary River
	BLO-9	30	Deepest location at the south basin
	BLO-6	6.8	Near lake outlet

The original baseline water quality power analysis conducted by Knight Piésold (KP) in 2014 identified the number of water chemistry samples required to determine a difference between concentrations during baseline and half the AEMP benchmark ($\alpha = 0.1$, and probability $[1-\beta] = 0.8$) at a given station. This analysis indicated that, for certain parameters, five samples at a station were adequate to determine differences between the baseline and commercial mine operation periods. For the KP power analysis, seasonal data were grouped together and therefore it follows that data collected through the year be included in the analysis.

Since commercial mine operations commenced in 2015, nine water quality monitoring (surface) samples have been collected at each lake and stream station (three per year), which is adequate for testing differences to baseline conditions. Because within-lake data have shown very little spatial variability during each sampling event, station data can be grouped together for each lake. With the proposed three stations established at each lake, the grouping of the resulting nine samples per year for each lake will also be sufficient for determining annual differences from baseline concentrations while meeting conditions of the KP power analysis.

Notably, as indicated in the KP design, with the availability of data from the commercial mine operation period, a linear regression approach is now appropriate for evaluating significant changes in parameter concentrations over time and assisting with management decisions. The 2017 Freshwater Workshop was used to discuss the objectives

and methods of the initial power analysis regarding sample size (i.e., the assumptions used) and provide further rationale for the adequacy of three stations per lake in meeting these goals. Appendix C includes a technical memo prepared by Minnow Environmental for ECCC and INAC to further explain the power analysis and approach (ANOVA, data selection) presented to justify the proposed reduction in number of lake water quality monitoring stations under the CREMP.

Lake water quality stations selected by Minnow for *in situ* profiling are listed below.

- Camp Lake Station - JL0-07
- Sheardown Lake NW Station - DL0-01-2
- Sheardown Lake SE Station - DL0-02-3
- Mary Lake (North Basin) Station - BL0-1A
- Mary Lake (South Basin) Station - BL0-9
- Reference Lake 3 (NW Basin) Station - REF03-3

In addition to the recommendations pertaining to the lake water sampling program, Minnow also recommended the following modifications be made to the CREMP lotic (stream) water quality sampling program:

1. The addition of three stream water quality monitoring stations, including at lower Tom River, Sheardown Lake Tributary 9 and Sheardown Lake Tributary 12 (Minnow Recommendation 2,3; Minnow, 2016)
2. Discontinue water quality monitoring at stations L1-09 (Camp Lake Tributary 1) and D1-05 (Sheardown Lake Tributary 1) (Minnow Recommendation 1, 4; Minnow, 2016)
3. Discontinue water quality monitoring at stations GO-09A, GO-09B and C0-01 on the Mary River (Minnow Recommendation 5,6; Minnow, 2016)

Following further discussions with Minnow, regulators and stakeholders, Baffinland decided not to remove water quality stations L1-09 and D1-05 from the CREMP (Minnow Recommendation 1,4). Maintaining L1-09 and D1-05 in the CREMP will allow the program to better assess potential effects of Project roads (i.e., Tote Road) on nearby water bodies.

Upon further review of the Mary River GO-09 series reference stations, relatively high variability in concentrations of non-conservative parameters (e.g., aluminum, iron) related to natural turbidity differences was shown among the three GO-09 stations. Therefore, the three GO-09 stations, including GO-09A & B, will be maintained in the CREMP to better capture the influence of natural turbidity on parameter concentrations in the Mary River system.

CREMP water quality stations are monitored three (3) times per year. Stream water quality is monitored during the spring, summer and fall, whereas, lake water quality monitoring takes place during the winter (late April), summer and fall. This sampling frequency should be adequate to detect early warning flag concentrations and determine significance for most water quality parameters. The sampling frequency and schedule will be re-evaluated after the first three years of mine operation.

Water quality monitoring at Station CO-01 (Mary River) will be discontinued (Minnow Recommendation 6; Minnow, 2016). Upon further review, no substantial sources of dilution to the Mary River occur between the current C0-05 and C0-01 water quality monitoring stations. The original baseline water quality power analysis conducted by Knight Piésold (KP) in 2014 identified the number of water chemistry samples required to determine a difference between concentrations during baseline and half the AEMP benchmark ($\alpha = 0.1$, and probability $[1-\beta] = 0.8$) at a given station. Therefore, the same rationale provided above applies to station-level data collected for the stream water quality monitoring stations. Because data are assessed only at the station level, the suggested removal of mine–exposed stations CO-01 indicated above will not take away from the ability of the program to evaluate effects

in the affected waterbodies given that other existing stations maintained in the program provide the same information (i.e., no dilution between stations). Further discussion to this effect was presented at the 2017 Freshwater Workshop Station in response to ECCC Comment 5 (Appendix C). This revision of the AEMP (Rev. 2) has been updated to reflect all Minnow's recommendations listed above with exception of Minnow Recommendations 1 and 4 (removal of L1-09 and D1-05) and the removal of GO-09A & B, proposed in Minnow Recommendation 5.

The CREMP water quality (phytoplankton) monitoring stations recommended by Minnow are shown on Figure 3.2.

3.3.3 SEDIMENT QUALITY STUDY DESIGN

The key pathways of potential effects of the Project on sediment quality include:

- Sediment quality changes related to discharge of ore stockpile runoff to freshwater systems (immediate receiving environments: Mary River and Camp Lake Tributary 1);
- Sediment quality changes (primarily nutrients and TSS) related to discharge of treated sewage effluent (immediate receiving environments: Mary River and Sheardown Lake NW);
- Sediment quality changes due to direct deposition of dust in lakes and streams (Mine Area in zone of dust deposition); and
- Sediment quality changes due to dust deposition on land and subsequent runoff into lakes and streams (Mine Area in zone of dust deposition).

The key question related to the pathways of effect is:

- What is the estimated mine-related change in contaminant concentrations in the exposed area?

The primary issue of concern with respect to sediment quality is the effect of ore dust containing elevated metals being deposited on, or running off into lakes and streams. As such, the CREMP sediment quality monitoring program has historically focused upon waterbodies (lakes and streams) closest to the sources of ore dust.

Prior to 2016, the sediment quality monitoring program did not sample sediment at each lake benthic macroinvertebrate (BMI) station. Therefore, in effort to harmonize the sediment quality and benthic macroinvertebrate monitoring programs and refocus the lake benthic macroinvertebrate program solely on littoral (shallow) habitats, Minnow proposed the following recommendations:

1. Establish five (5) sediment quality/BMI stations located in littoral (shallow) habitat at each mine exposed study lake and Reference Lake 3 (Minnow Recommendation 15; Minnow, 2016).
2. Continue sediment quality monitoring at three (3) existing sediment quality stations located in profundal (deep) habitat at Reference Lake 3 and each mine exposed study lake, with the exception of Sheardown Lake SE, where profundal habitat is limited to only a small proportion of the lake (Minnow Recommendation 17; Minnow, 2016).

Table 3.12 outlines the recommended profundal sediment quality stations for inclusion in the CREMP.

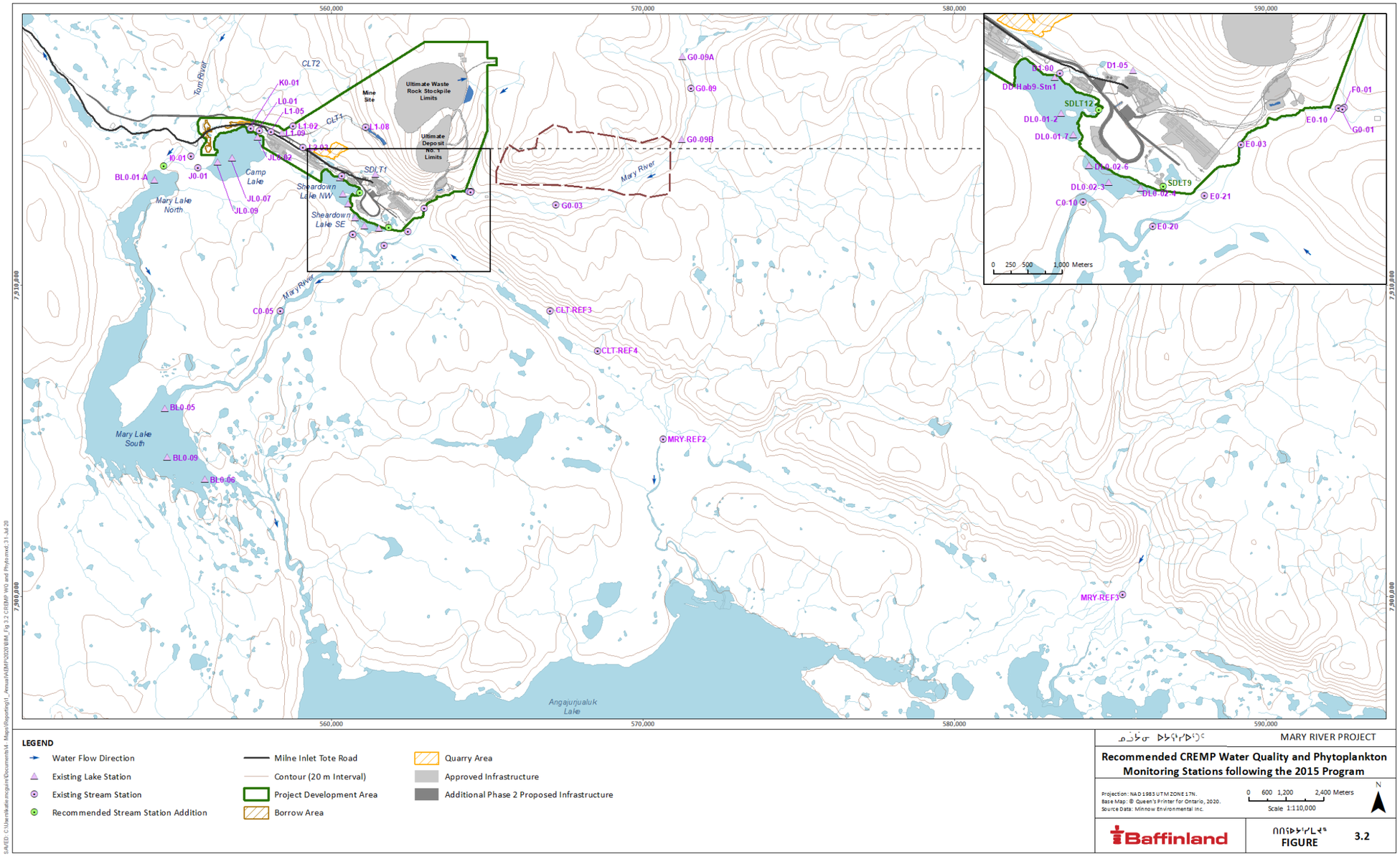

FIGURE 3.2 RECOMMENDED CREMP WATER QUALITY AND PHYTOPLANKTON MONITORING STATIONS FOLLOWING THE 2015 PROGRAM

TABLE 3.12 PROFUNDAL SEDIMENT QUALITY STATIONS

Lake	Station ID	Depth (m)	Sediment Profundal Station Description
Camp Lake	JLO-14	26.5	Central basin - east (inlet area)
	JLO-07	32.7	Central basin - middle
	JLO-11	28.8	Central basin - west (outlet area)
Sheardown Lake NW	DLO-01-5	23.1	Central basin - north
	DLO-01	20.8	Central basin - middle
	DLO-01-2	18.6	Central basin - south
Mary Lake	BLO-12	21.7	South basin - near Mary River Inlet
	BLO-10	18.7	South basin -middle
	BLO-08	26.7	South basin - near lake outlet

Littoral sediment sampling stations will be situated at the same locations as the littoral BMI stations. Utilizing the same littoral stations for both sediment quality and benthic macroinvertebrate community sampling will provide supporting information for interpretation and analysis of BMI results (e.g., metals concentrations) and allow the CREMP to establish potential linkages between sediment metal concentrations and their potential effects on benthic macroinvertebrates.

To the extent possible, littoral sediment quality/BMI stations proposed by Minnow were established at existing (historic) BMI stations. However, in some cases, new stations were established to ensure sufficient coverage of the lake, and to ensure that substrate properties for sampling stations are comparable among and within lakes.

In contrast, all profundal sediment quality stations recommended by Minnow were selected from existing sediment stations. Because the majority of Sheardown Lake is less than 12 meters deep and represents primarily littoral habitat, no profundal sediment quality stations were established in Sheardown Lake SE.

Lake sediment quality stations are positioned to allow for the evaluation of any spatial differences in sediment chemistry in order to determine potential gradients in metal concentrations associated with mine sources (i.e. mine exposed tributaries). At each station, field technicians will establish final locations for the sediment stations that are within depositional areas of the lake. This field fit of the sampling stations will likely result in some modifications to the gradient study design.

Moreover, in addition to modifications to the lake sediment quality program, Minnow also recommended that the CREMP sediment monitoring program focus solely on depositional lake environments and that CREMP sediment monitoring stations in streams and rivers be discontinued (Minnow Recommendation 10; Minnow 2016). This recommendation was based on the observation that the vast majority of streams and rivers in the Mary River Project Local Study Area (LSA) contain very limited depositional habitat suitable for the collection of fine sediments. As observed during the 2015 CREMP and baseline studies (KP, 2015), the general absence of any substantial accumulation of fine sediments within these watercourses preclude any meaningful assessment of potential mine-related influences on sediment quality within, along and/or between watercourses. As a result, all sediment quality stations in streams and rivers near the Mine Site have been removed from future CREMP studies, including this revision of the AEMP (Rev. 2). As presented at the Freshwater Workshop in 2017, Appendix C outlines Baffinland's detailed response to ECCC Comment 6.

In the long-term, sediment sampling under the CREMP will be conducted every three years, coinciding with biological monitoring studies. However, Baffinland will conduct sediment quality sampling annually for the first three years of mining. After monitoring three operating (mining) years, the sediment sampling program will be conducted on a three year cycle, consistent with the Environment Canada (2012) recommendations for EEM sampling. CREMP sediment quality and benthic monitoring stations recommended by Minnow are shown in Figure 3.3.

3.3.4 PHYTOPLANKTON

The following section provides a description of monitoring of phytoplankton under the CREMP, with an emphasis on monitoring of lakes in the Mine Area, where potential for eutrophication is greatest.

The key pathways of potential effects of the Project on phytoplankton communities include:

- Water quality changes related to discharge of ore or stockpile runoff to freshwater systems (immediate receiving environments: Mary River and Camp Lake Tributary 1);
- Water quality changes (primarily nutrients and Total Suspended Solids [TSS]) related to discharge of treated sewage effluent (immediate receiving environments: Mary River and Sheardown Lake NW);
- Water quality changes due to deposition of dust in lakes and streams (Mine Area in zone of dust deposition); and
- Water quality changes due to non-point sources, such as site runoff and use of ANFO explosives (Mine Area).

The key question related to the pathways of effect is:

- *What are the combined effects of point and non-point sources on phytoplankton abundance in Mine Area lakes?*

The primary issue of concern with respect to the phytoplankton community is related to nutrient enrichment and eutrophication, though effects on water clarity (e.g., changes in TSS) could also affect primary productivity. As such, the CREMP and the baseline data review focused upon waterbodies most at risk to eutrophication in relation to pathways of effect for the Project; in general, lakes (rather than streams) are most vulnerable to eutrophication in the Mine Area. Sheardown Lake NW will continue to receive treated sewage effluent discharge from the Mine Site Polishing Waste Stabilization Ponds (PWPs) in small volumes and may also be affected by dust deposition, stream diversions, and non-point sources. Although treated sewage effluent will be primarily discharged to the Mary River during the life of the Project, Mary Lake is the ultimate receiving environment for all point sources in the Mine Area, including discharge of treated sewage effluent, and is more vulnerable to effects of nutrient enrichment due to its lacustrine nature.

The selected indicator will be chlorophyll *a* and the benchmark will be 3.7 µg/L. Further description on the selection of a suitable indicator and derivation of the benchmark is provided in Section 3.1.2.

The monitoring area for phytoplankton includes Mine Area lakes, specifically Camp Lake, Mary Lake and Sheardown Lake NW and SE as well as selected streams. In addition, monitoring will be conducted at Reference Lake 3 (NSC, 2014b). Chlorophyll-a will be sampled at all water quality stations and will coincide with water quality sampling events.

Sampling has been conducted annually during the initial three years of mine operation. However, sampling frequency will be evaluated regularly (i.e., each year) to determine if modifications are warranted. Chlorophyll-*a* sampling in lakes will consist of two open-water periods (summer and late summer/fall) and once in late winter (April/May). Streams will be sampled three times in the open-water season (spring, summer, fall). Sampling of phytoplankton biomass and taxonomy occurs twice a year (summer and late summer/fall) and will be archived for analysis if Chlorophyll-*a* results warrant investigation.

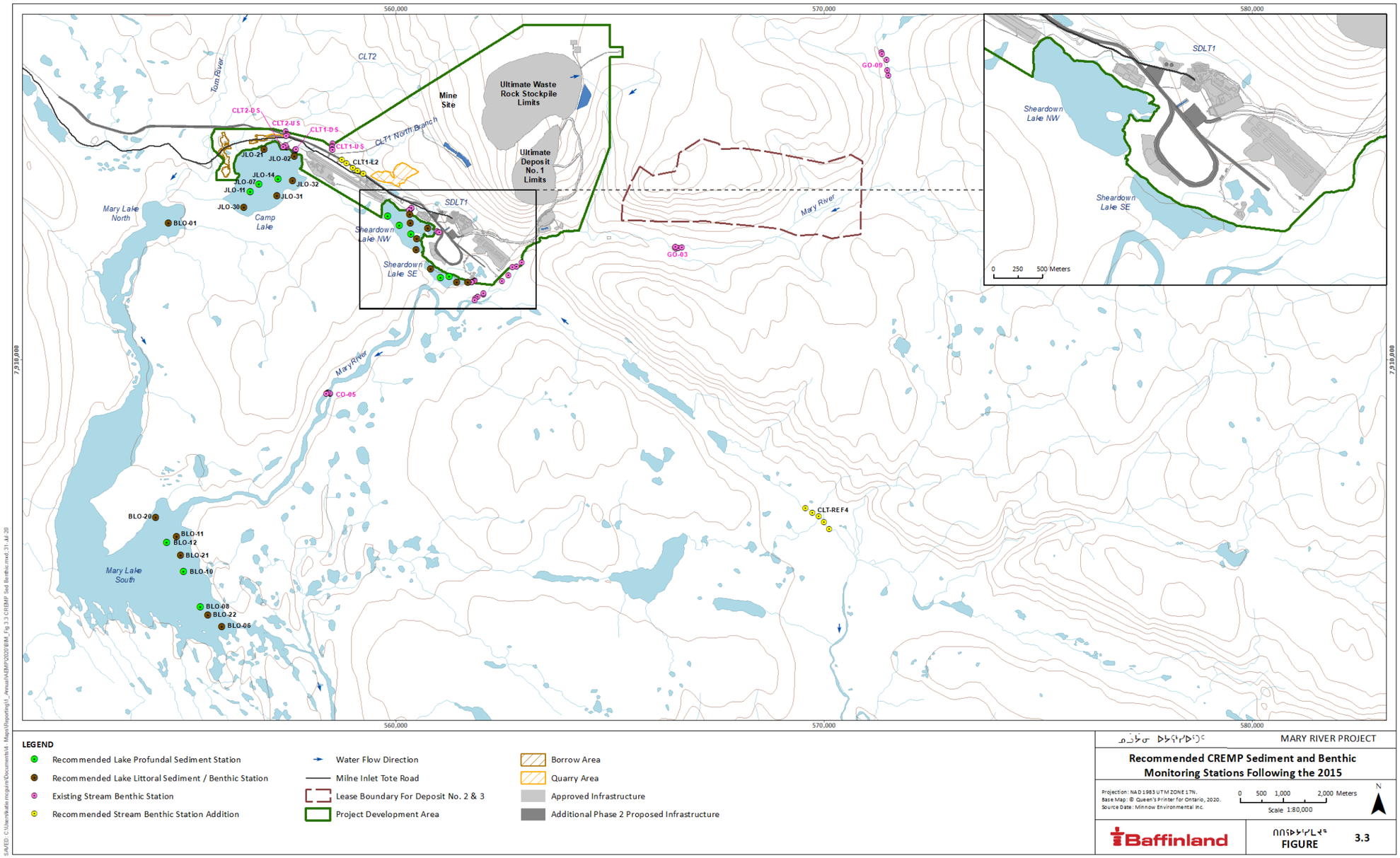

FIGURE 3.3 RECOMMENDED CREMP SEDIMENT AND BENTHIC MONITORING STATIONS FOLLOWING THE 2015 PROGRAM

Phytoplankton data will be assessed during each year of monitoring and will follow the assessment framework presented in Section 5.1.

3.3.5 BENTHIC INVERTEBRATES

Key questions were developed to guide the design of the monitoring program. These questions and metrics focus upon key potential effects identified in the FEIS, as well as metrics commonly applied for characterizing the BMI community.

The key pathways of potential effects of the Project on the BMI community include:

- Water quality changes related to discharge of ore stockpile runoff to freshwater systems (immediate receiving environments: Mary River and Camp Lake Tributary 1)
- Water quality changes (primarily nutrients and TSS) related to discharge of treated sewage effluent (immediate receiving environments: Mary River and Sheardown Lake NW)
- Water quality changes due to deposition of dust in lakes and streams (Mine Area in zone of dust deposition)
- Water quality changes due to non-point sources, such as site runoff and use of ANFO explosives (Mine Area)
- Changes in water levels and/or flows due to water withdrawals, diversions, and effluent discharges (i.e., alteration or loss of aquatic habitat)
- Changes in sediment quality due to effluent discharge and/or dust deposition
- Dust deposition in aquatic habitat (i.e., sedimentation)
- Effects of the Project on primary producers

The key question related to the pathways of effect is:

- *What are the combined effects of point and non-point sources, aquatic habitat loss or alteration, sedimentation, and changes in primary producers on BMI abundance and community composition in Mine Area lakes?*

A description of the selection of BMI indicators and derivation of benchmarks is provided in Section 3.1.3.

The overall objective of this program is the evaluation of mine related influences to benthic invertebrates in the Mine Area lakes and streams. The benthic invertebrate community survey is one of a main tools utilised for assessing mine-related influences on biota.

The monitoring area for BMI includes Mine Area lakes, specifically Camp, Sheardown NW and SE, and Mary lakes, and Sheardown Lake tributaries 1, 9, and 12, several sites on the Mary River located upstream and downstream of effluent discharges, and Camp Lake tributaries 1 and 2. In addition, monitoring is conducted at Reference Lake 3 along with BMI reference stream station CLT-REF4.

Benthic invertebrate composition, distribution and relative abundance of dominant groups, including metal-sensitive taxa, naturally differ significantly between littoral (shallow) and profundal (deep) habitats of area lakes. The sampling of benthic invertebrates at profundal depths can confound the evaluation of mine related effects on biota due to the fact that at deeper depths natural factors, such as low oxygen and food resources, become more important drivers in shaping BMO community structure than mine-related contaminants. Because of this, Minnow recommended in 2016 that benthic invertebrate community sampling stations be established solely in littoral habitats (Minnow Recommendation 15; Minnow, 2016). In implementing Minnow's recommendation in this revision of the AEMP (Rev. 2), five (5) replicate stations are sampled in each lake and coincide with each study lakes five (5) littoral sediment quality stations. Utilizing the same littoral stations for both sediment quality and benthic invertebrate community sampling provides supporting information for interpretation and analysis of benthic invertebrate results (e.g., metals concentrations) and allow the CREMP to establish potential linkages between

sediment metal concentrations and their potential effects on benthic invertebrates (Minnow Recommendation 16; Minnow 2016). Minnow's recommended BMI community monitoring stations for Mine Area lakes monitored under the CREMP are presented in Figure 3.4.

To reflect Minnow's additional recommendations, the following have been incorporated; (1) discontinuing BMI monitoring on the two upper reaches of Sheardown Lake Tributary 1 (Minnow Recommendation 12; Minnow, 2016), (2) adding BMI monitoring station CLT1-L2 near water quality station L2-03 to monitor the effect of mine-influenced water quality changes on BMI communities (Minnow Recommendation 11; Minnow, 2016) and (3) establishing a stream reference BMI community station at CLT-REF4 (Minnow Recommendation 13; Minnow, 2016).

Timing of sampling will be concentrated within a single sampling season; benthic invertebrate sampling has been consistently conducted in the mine area in late summer/fall. This is an ecologically relevant time for sampling and is most appropriate considering the effluent discharge regime (i.e., discharge during the open-water season only), hydrology (i.e., streams/rivers freeze solid), and dust deposition (i.e., introduction during the open-water season).

As existing baseline data for Reference Lake 3 and stream reference station CLT-REF4 are minimal the monitoring program will primarily focus upon before-after comparisons of key metrics within the mine area waterbodies, with an emphasis on Mine Site area lakes.

BMI data will be assessed during each year of monitoring and would follow the assessment framework presented in Section 5.1.

3.3.6 FISH (ARCTIC CHAR)

Key questions were developed to guide the design of the fish monitoring program. The key pathways of potential residual effects of the Project on Arctic char include:

- Water quality changes related to discharge of ore stockpile runoff to freshwater systems (immediate receiving environments: Mary River and CLT-1)
- Water quality changes related to discharge of treated sewage effluent (immediate receiving environments: Mary River and Sheardown Lake NW)
- Water quality changes due to deposition of dust in lakes and streams (Mine Area in zone of dust deposition)
- Water quality changes due to non-point sources, such as site runoff and use of ANFO explosives (Mine Area)
- Changes in water levels and/or flows due to water withdrawals, diversions, and effluent discharges (i.e., alteration or loss of aquatic habitat)
- Dust deposition (i.e., sedimentation) in Arctic char spawning areas (habitat) and on Arctic char eggs
- Effects of the Project on primary and secondary producers. The key question related to the pathways of effect is:
- *What are the combined effects of point and non-point sources, sedimentation, habitat loss or alteration, and changes in primary or secondary producers on Arctic char in Mine Area lakes (Sheardown Lake NW and SE, Camp Lake, and Mary Lake) and streams?*

Given that there are only two fish species present in the area, fish monitoring in the Mine Area would be limited to successful capture of sufficient numbers of both fish species in the exposure areas. In most lakes and streams in the exposure area, Arctic char is sufficiently abundant that successful capture of enough fish for monitoring purposes is possible. In contrast, ninespine stickleback are absent or uncommon in a number of waterbodies. For these reasons only a single species, Arctic char, is targeted under the CREMP.

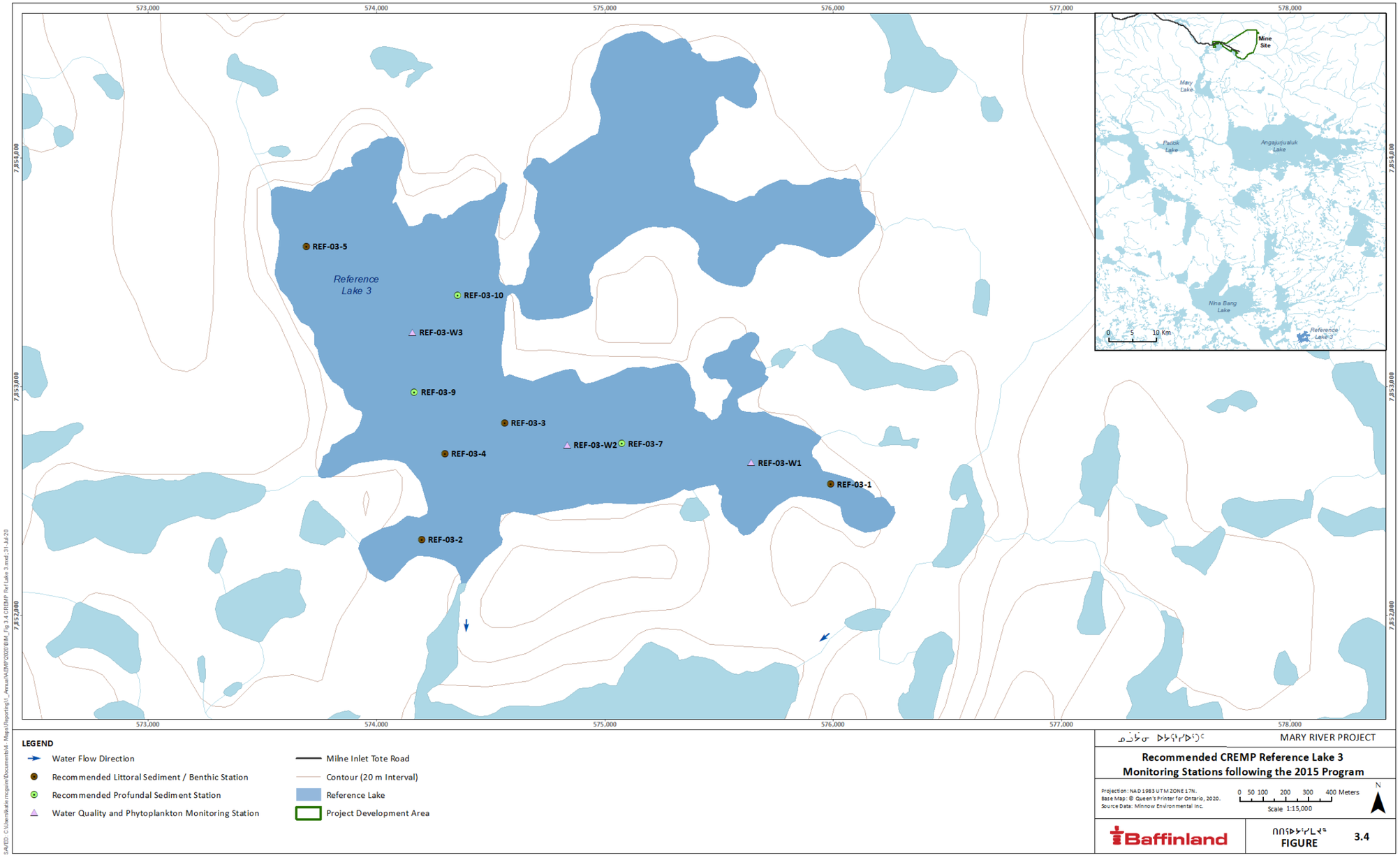

FIGURE 3.4 RECOMMENDED CREMP REFERENCE LAKE 3 MONITORING STATIONS FOLLOWING THE 2015 PROGRAM

Non-lethal sampling methods will be used to the extent possible to minimize impacts of monitoring on the Arctic char populations. As a result, metrics that can be reliably obtained from live fish will be included in the CREMP. Metrics will include indicators of fish growth, condition, and reproduction. The evaluation and selection of indicators and benchmarks for Arctic char are presented in Section 3.1.4.

The monitoring area for Arctic char includes Mine Area lakes, specifically Camp Lake, Mary Lake and Sheardown Lake NW and SE. Monitoring of lakes is a key component of the CREMP because the Mine Area lakes provide overwintering and spawning habitat, support the full range of age classes, and because they may be affected differently than streams. In addition, monitoring will be conducted at Reference Lake 3, and potentially in one reference stream. The lake-based Arctic char sampling program is designed to be non-lethal and is focused upon obtaining measures of metrics for juvenile and adult fish using standardized sampling methods (i.e., standard gang index gillnetting and shoreline backpack electrofishing).

After completing the 2015 CREMP field program, Minnow recommended two (2) modifications to the CREMP adult Arctic char survey in order to reduce the amount of incidental mortalities and optimize gill net capture rates.

1. Reduce the non-lethal adult Arctic char sample size to 50 fish per study lake (Minnow Recommendation 18; Minnow, 2016); and
2. Standardize mesh size of gill nets used to optimize capture rates for adult Arctic char (Minnow Recommendation 19; Minnow, 2016).

Based on data collected during the 2015 CREMP, power analysis conducted by Minnow indicated that total samples sizes for the adult fish survey can be reduced by half (i.e., 50 fish) while still maintaining the ability to detect changes between lakes and/or between study periods with sufficient power. Power analysis results for comparisons between baseline and 2015 and 2016 adult Arctic char health for the primary non-lethal endpoint of condition (i.e., length-at-weight relationship. Based on generally accepted Critical Effect Sizes (CES) for EEM fish studies of 10% for condition, reduced sample sizes for adult Arctic char are justified for all mine lakes.

By reducing the number of adult Arctic char targeted from 100 to 50 at each of the AEMP mine lakes, it is anticipated that the number of incidental mortalities will be reduced by half, the influence of which on the population is likely greater than any other potential mine-related effect. This reduction in sample size, as supported through the power analysis using the 2015 and 2016 data, will not affect the ability of the program to meet study objectives (i.e., to determine effects on fish population health) while conserving fish populations of the study lakes. Because the results of previous power analysis have been used as justification for determination of appropriate sample sizes for the AEMP water quality sampling component by ECCC (i.e., Comments 4 and 5), a similar rationale can be used for the AEMP fish monitoring component. Additional information can be found in Appendix C, 2017 Freshwater Workshop Information Circular (Baffinland response to ECCC Comment 7).

Additionally, during the 2015 CREMP the majority of adult Arctic char were captured in net mesh sizes ranging from 38 - 64 mm, which was also similar to the most efficient mesh size used to capture adult Arctic char during previous CREMP studies. As a result, the fish CREMP study design has been modified to reflect Minnow Recommendations 18 and 19.

Fish data will be assessed during each year of monitoring and follow the assessment framework presented in Section 5.2. The fish revised CREMP study design and baseline data review is described in detail in North/South Consultants Inc., 2014.

3.4 TARGETED STUDIES

As described in Section 1, specific effects monitoring (or targeted monitoring) programs/studies have been identified to address specific questions or potential impacts. These programs or studies are relatively confined in terms of spatial and/or temporal scope. Targeted environmental studies relate to specific environmental concerns that require further investigation or follow-up but are not anticipated to be components of the core monitoring program. The Lake Sedimentation Monitoring Program, Dustfall Monitoring Program, and the Stream Diversion Barrier Study are the targeted studies identified in this AEMP.

3.4.1 LAKE SEDIMENTATION MONITORING PROGRAM

A specific effects monitoring study will be conducted to monitor effects related to the introduction of dust, and other sources of suspended solids, in surface waters and subsequent deposition in aquatic habitat (NSC, 2014c).

Sedimentation rates will be monitored in Sheardown Lake NW through deployment of sediment traps, as described in detail in NSC (2014c). In brief, the program will involve year-round deployment of sediment traps in different lake habitat types for the analysis of total dry weight of sediment. Traps will be emptied and redeployed after ice-off and in fall to provide measures of seasonal (i.e., open-water and ice-cover season) deposition rates. This sampling program was initiated in 2013 and continues to be conducted. Through comparisons of the measured sedimentation at Sheardown Lake NW to sedimentation amounts known to adversely affect salmonid egg survival that are available from published literature, the current lake sedimentation monitoring program will provide a strong scientific basis for the determination of any sediment deposition effects on Arctic char egg survival at Sheardown Lake NW.

To provide a more definitive estimate of sediment accumulation thickness, additional sediment traps were deployed at Sheardown Lake NW beginning in summer (July) 2018 following the ice-cover period. These sediment traps are larger than the typical sediment traps used in the program and have been sized to acquire enough material to determine dry bulk density (i.e., approximately 10 g dry weight of material). Baffinland will continue to monitor for bulk density as part of the program.

3.4.2 DUSTFALL MONITORING PROGRAM

The amended NIRB Project Certificate No. 005 included requirements for dustfall monitoring. In 2013, Baffinland implemented a dustfall monitoring program as part of the TEMMP that meets the requirements (Baffinland, 2014). A description of this program is included in the Air Quality Management Plan. The dustfall monitoring program consists of operating dustfall buckets positioned along transects radially out from the main development areas: Milne Port, the Tote Road and the Mine Site, along with reference dustfall monitoring stations. Dustfall measurements (the amount of dustfall per unit time) are completed monthly and the dustfall are analyzed to determine the metals composition of the dust.

The dustfall monitoring results are reviewed to estimate the annual deposition (rates, quantities) and chemical composition of dust entering aquatic systems along representative distance transects at right angles to the Tote Road and radiating outward from Milne Port and the Mine Site, as per PC Condition #21.

3.4.3 INITIAL STREAM DIVERSION BARRIER STUDY

A streamflow reduction barrier study was identified as a follow-up program in the FEIS (Baffinland, 2012). The Initial Stream Diversion Barrier Study was developed by Knight Piésold (2014c).

The primary objectives of the study are to monitor the effects of both increases and reductions in streamflow at several Mine Site streams and to further understand how Project-related reductions in streamflow may result in the creation of fish barriers that have the potential to occur at low flows. The monitoring program may identify the need for mitigation measures to address Project-related fish stranding.

The initial study conducted in 2013, focused on obtaining a better understanding for baseline flow conditions and, in particular, the frequency and duration of the occurrence of fish barriers and fish stranding in five (5) Mine Site streams (see Figure 2.3):

- CLT-1
- CLT-2
- SDLT-1
- SDLT-9
- SDLT-12

This initial study was exploratory in nature with the following objectives (which contribute to the primary objectives stated above):

- Develop an understanding of low-flow conditions that may result in barriers to fish passage within two (2) tributaries of Camp Lake and three (3) tributaries of Sheardown Lake.
- Document fish presence throughout the stream length under various flow conditions. It is important to document upstream access during spring freshet, since high water velocities in the spring can prevent fish passage. It is also important to document the downstream passage of fish in the fall, when they are returning to overwintering habitat in the lakes.

The five (5) streams of interest were monitored in the spring and fall of 2013. Low and high flow periods were targeted where possible. In spring, all five (5) streams were visually assessed to monitor for potential barriers and obstructions to upstream fish passage. Surveys documented conditions within the monitoring streams between the upstream fish barriers and their outlets into Camp Lake and Sheardown Lake. Implementation of these visual assessments by an experienced biologist allowed for the effective determination of whether perceived barriers resulted in the prevention of fish migration within each tributary, and thus electrofishing surveys were not deemed necessary for the assessment. During the 2013 field program, the combination of visual observations of barriers, fish presence and associated flows at the time of the survey were used to determine the conditions in which fish migration will be limited within each tributary under various flow conditions.

Other monitoring programs will contribute data relevant to this study. For example, Baffinland`s hydrology monitoring program includes stream gauges on three streams monitored under this program, and the freshwater biota monitoring will be undertaken as part of the CREMP. Monitoring data from both these programs will be used in the analysis of data from the Initial Stream Diversion Monitoring Study.

The reduced production rate associated with the ERP resulted in a considerably smaller mining footprint (open pit and waste rock stockpile) than was originally envisioned with Project-related stream diversions. As such, Project-related stream diversions during ERP operations are negligible; and as a result, this study has been discontinued.

Resumption of this study will depend upon the schedule and size of the Project. The approved full production (rail) phase of the Project will result in meaningful reductions in streamflow and therefore monitoring under this study will be required to identify Project-related fish barriers and fish stranding. Baffinland will endeavour to initiate this study one year prior to the start of the full production (rail) phase of the Project.

3.5 QUALITY ASSURANCE AND QUALITY CONTROL

Each of the monitoring programs comprising the AEMP follows standard QA/QC measures as follows:

- Staffing the Project with experienced and properly trained individuals
- Ensuring that representative, meaningful data are collected through planning and efficient research
- Using standard protocols for sample collection, preservation, and documentation
- Calibrating and maintaining all field equipment

Various additional QA/QC measures are implemented for each of the component studies, as described below.

3.5.1 WATER AND SEDIMENT QUALITY

A strict QA/QC program is in place to ensure that high quality and representative data are obtained in a manner that is scientifically defensible, repeatable and well documented. This program aims to ensure that the highest level of QA/QC standard methods and protocols are used for the collection of all environmental media samples. Quality assurance is obtained at the project management level through organization and planning, and the enforcement of both external and internal quality control measures. In addition to those standard QA/QC measures listed in Section 6 above, the following QA/QC procedures and practices will be implemented in water and sediment quality programs:

- Internal Quality Control:
  - Collecting duplicate, blank, filter and travel blank samples for submission for analysis (approximately 10% of overall samples)
- External Quality Control:
  - Employing fully accredited analytical laboratories for the analysis of all samples
  - Determining analytical precision and accuracy through the interpretation of the analysis reports for the blind duplicate, blank, filter and travel blank samples

The field sampling protocols being applied to the water and sediment quality program (KP, 2014b) is presented as an appendix of the Water and Sediment Quality CREMP Study Design in Knight Piésold (2014a).

The quality of the data obtained for a project is assessed via their adherence to the pre-set Data Quality Objectives (DQOs). DQOs provide a means of assessing whether the data in question are precise, accurate, representative, and complete. The results from QA/QC samples are reviewed to determine if sample contamination occurred. These data are further used to determine if the contamination occurred during collection, handling, storage, or shipping. Upon receipt from the laboratory, the data are uploaded into a database along with copies of field notes, photos, Sample Receipt Confirmations, Microsoft Excel data, and Certificates of Analysis.

3.5.2 BENTHIC INVERTEBRATE SURVEY

Field sub-samples will be collected from each BMI replicate station, to compensate for the spatial variability encountered with these organisms. Sub-samples collected from Sheardown Lake NW in 2013 were analysed separately to evaluate precision and to advise on study design. The results of this analysis indicated a high level of precision associated with five sub-samples and the CREMP will therefore continue to collect five sub-samples but will pool the sub-samples in the field.

Appropriate QA/QC measures related to processing and identification of BMI samples, as outlined in the EEM technical guidance document will be followed and are described below (Environment Canada, 2012). These

measures will incorporate the proper steps related to re-sorting, sub-sampling and maintenance of a voucher collection, as needed. The voucher collection will be taxonomically analysed by a second qualified invertebrate taxonomist.

BMI samples will be sorted with the use of a stereomicroscope. Samples will be washed through a 500 micron sieve and sorted entirely, except in the following instances: those samples with large amounts of organic matter (i.e., detritus, filamentous algae) and samples with high densities of major taxa. In these cases, samples will be first washed through a large mesh size sieve (3.36 mm), to remove all coarse detritus, leaves, and rocks. Large organisms such as leeches, crayfish, late instar dragonflies, stoneflies, and mayflies retained in the sieve will be removed from the associated debris. The remaining sample fraction will be sub-sampled quantitatively, if necessary. For QA/QC evaluation, the sorted sediments and debris will be re-preserved and retained for up to six months following submission of reports under the CREMP or EEM programs. For those samples that were sub-sampled, sorted and unsorted fractions will be re-preserved separately. Sorted organisms will be re-preserved.

All invertebrates will be identified to the lowest practical level, usually genus or species level. Chironomids and oligochaetes will be mounted on glass slides in a clearing media prior to identification. In samples with large numbers of oligochaetes and chironomids, a random sample of no less than 20% of the selected individuals from each group will be removed from the sample for identification, up to a maximum of 100 individuals.

Following identification and enumeration, a detailed list of individuals collected will be submitted for each replicate station. The list will be in a standard spreadsheet format.

3.5.3 FISH

QA/QC technical procedures will be utilized for all field sampling, laboratory analysis, data entry and data analysis.

The fish ages will be determination by experienced technicians and a minimum of 10% of fish ageing structures that are processed will be independently and blindly aged by a second technician.

All data entered electronically will undergo a 100% transcription QA/QC by a second person to identify any transcription errors and/or invalid data.

3.5.4 DATA EVALUATION

All data will be entered into an electronic database with controlled access. Screening studies will be employed to check for transcription errors or suspicious data points. An individual not responsible for entering the data will confirm that the data entered represents the original.

4.0 ROLES AND RESPONSIBILITIES

The personnel responsible for implementing this plan and their respective roles are described in Table 4.1.

TABLE 4.1 ROLES AND RESPONSIBILITIES FOR AEMP

Position	Responsibilities
Chief Operations Officer (COO)/General Manager	• Reports to the Chief Executive Officer • Responsible for providing oversight for all Project operations and allocating the necessary resources for the operation, maintenance and management of Project infrastructure
Environmental Superintendent	• Manage all on-site aquatic effects monitoring programs at the Project, discussed in Sections 3 and 5 of this Plan • Conduct inspections and monitoring to ensure compliance with applicable regulations and commitments • Report incidents to senior management and the appropriate regulatory agencies and stakeholders • Provide training sessions to operational departments on the appropriate mitigation measures and strategies for managing surface water flows and effluents at the Project • The on-site Environmental Superintendent in concert with the corporate Sustainable Development team is responsible for data management and reporting related to the Aquatic Effect Monitoring Plan
Inuit Monitor (ISP)	To be defined by QIA
QIA Regulatory Manager (IIBA)	• Directs QIA's onsite environmental resources • Liaise with Baffinland's Permitting and Compliance Manager and/or Environmental Superintendents • Reviews regulatory submissions on behalf of the QIA • Member of the QIA-Baffinland Adaptive Management Working Group
QIA Environmental Monitor (IIBA)	• Monitors implementation of commitments, environmental compliance, and QIA interests • Participate in routine compliance inspections and monitoring alongside Baffinland staff • Participate follow-up corrective action undertaken regarding non-compliance events including spills • Weekly reporting to the QIA Regulatory Manager • Presents annual monitoring data to communities • The core responsibilities of this position are described completely in the IIBA
QIA Construction Inspector (ICA 8.3.1)	• To be defined by QIA
QIA Construction Monitor (ICA 8.2.2 (j))	• To be defined by QIA

Position	Responsibilities
All Departmental Supervisors	• Reports to the Departmental Manager / Superintendent • Responsible for reading and understanding applicable sections of this Plan and directing departmental personnel on the requirements to understand applicable sections • Report any visual observations, or reports, of suspected aquatic ecosystem effects to the Environment Department • Assist in implementing appropriate mitigation measures
All Project Personnel	• All Project personnel will be responsible to comply with the requirements of the Plan as appropriate • Report any visual observations of suspected aquatic ecosystem effects to their respective supervisors • Assist in implementing appropriate mitigation measures

5.0 DATA ASSESSMENT AND RESPONSE FRAMEWORK

5.1 STEPS IN DATA ASSESSMENT AND RESPONSE

Monitoring data collected through the AEMP requires a systematic data evaluation process, as well as management responses that would be taken, in response to certain data evaluation outcomes. A common assessment (data evaluation) and management response framework will be implemented. This multi-step process includes the following.

Step 1 - Data Management and Evaluation

This step includes the QA/QC; comparisons to the AEMP benchmark and to reference and/or baseline; and review of the data using various tools such as Exploratory Data Analysis (EDA) and Statistical Data Analysis (SDA), to determine if change is occurring. A change may be detected statistically or qualitatively, relative to benchmarks, baseline values and/or spatial or temporal trends. A change may be statistically significant, but professional judgement will also be applied using the various evaluation tools to detect a change qualitatively.

If Step 1 does not detect change, then no action is required. If a change is observed, then further evaluation of the data for that/those indicator(s) will be carried out under Step 2.

Step 2 - Determining Whether the Observed Change is Mine-Related

Step 2 involves determining if the changes in the indicator(s) of concern are due to the Project or due to natural variability or other causes.

Project activities with the potential to induce the observed change will be reviewed to identify potential Project-related causes or sources. This could include evaluating effluent quality, discharge regime/rates, and loading, dust deposition, and other point/non-point sources as required. Also, any evidence of potential natural causes (i.e., a major erosional event such as a slumping riverbank) will be investigated. Sampling data sheets and site personnel will be a source of this information.

This question will be addressed using EDA and subsequently using SDA. EDA will be completed to visualize overall data trends, and could include evaluating spatial patterns, to examine the spatial extent and pattern of observed changes.

The exploratory data analyses could include comparisons of data from Mine Area streams to data from reference streams and comparisons of Mine Area Lakes to reference lake(s). This can further assist with determining whether the observed changes were due to natural variability or the Project. Graphical analyses may be used to confirm assumptions required for statistical testing (normality, sample size, independence). Differences in fish and other biotic endpoints between mine-exposed and reference areas will be preferentially tested using pair-wise, single factor ANOVA. Prior to ANOVA, all data will be evaluated for normality and homogeneity of variance to ensure that applicable statistical test assumptions will be met. In instances in which normality cannot be achieved through data transformation, non-parametric Mann-Whitney U-test statistics will be used to confirm the statistical results from the ANOVA using transformed data. Similarly, in instances in which variances of normal data could not be homogenized by transformation, pair-wise comparisons will be conducted using Student's t-tests assuming unequal variance to confirm the statistical findings of the ANOVA tests. SDA will be used as outlined in the individual assessment frameworks and can be applied to the parameters of interest to test the primary hypothesis for the effects of mine-related change.

If the Step 2 analysis concludes that the changes in water quality parameters of concern are, or are likely, due to the Project, the assessment will proceed to Step 3. If it is concluded the observed differences relative to baseline conditions are not due to the Project, no management response will be required.

Step 3 - Determine Action Level

If the evaluation conducted in Step 2 has indicated with some certainly that the measured change is Project-related, Step 3 involves determination of the action level associated with the observed monitoring results through comparisons to the benchmark. Three (3) levels of action have been identified: low, moderate, and high; and the response actions range from increased monitoring and data analysis (e.g., trend analysis); identification of possible sources; to risk assessment and/or mitigation. The specifics for each aquatic component (water and sediment quality, phytoplankton, benthic invertebrates and Arctic char) are summarized in Table 5.1 and are described further in each of the component study designs. Below is a generic description of each of the levels of response.

If the benchmark is not exceeded, a **low action response** would be undertaken and could include any number of potential responses, including the following:

- Evaluate temporal trends
- Identify likely source(s) and potential for continued contributions
- Confirm the site-specific relevance of benchmark and establish a site-specific benchmark, if necessary
- Further evaluation of data (for example, for water quality, review dissolved metals data or supporting variables)
- Based on evaluations, determine next steps

If the benchmark is exceeded and it is concluded to be Project-related, a **moderate action level response** would be undertaken and could include, in addition to analyses identified for a low action response, the following:

- Consider a Weight-of-Evidence (WOE) evaluation and/or risk assessment, considering other monitoring results collectively with the indicator that has changed, to evaluate effects on the ecosystem
- Evaluate the need for and specifics of increased monitoring (e.g., increasing the extent, duration, frequency, number and/or type of samples collected)
- Evaluate the need for and specifics of additional monitoring (e.g., confirmation monitoring) and/or modifications to the CREMP
- Consider results of the trend analysis (i.e., trend analysis indicates an upward trend) and evaluation of potential pathways of effect (i.e., causes of observed changes) to determine if management/mitigation is required; and
- Identify next steps based on the above analyses. Next steps may include those identified for the high action level response

A quantitative trigger for the **high action level response** has not been identified as the need for additional study and/or mitigation will depend on the ultimate effects of the observed increases in the indicator parameter(s) of concern on the lakes as a whole. Also, the benchmark may need to be revised in consideration of ongoing monitoring results. The precise relationships between water quality, sediment quality and lower trophic level changes and the collective effects on fish is difficult to predict and therefore actions undertaken under a moderate action level response will attempt to explore these relationships to advise on overall effects to the ecosystem. Results would be discussed with regulatory agencies and the next steps would be identified. Additional actions that may be implemented in a subsequent phase (i.e., high action level response) could include:

- Implementation of increased monitoring to further assess the potential for effects and/or define magnitude and spatial extent if warranted
- Implementation of mitigation measures or other management actions that may be identified under the moderate action level response (see the mitigation toolkit in Section 5.3)

Management actions will be implemented as identified in the low and moderate action responses for each aquatic component, based on assessment of whether the change is mine-related, and the action level determined relative to the benchmark(s). In the instance of detecting change among multiple stressors, action will be implemented according to a weight of evidence evaluation.

Mitigation measures will be evaluated and implemented on a case-by-case basis, based on an issue-specific assessment of the situation, and action level. Exceedance of a benchmark triggers a moderate action response. Moderate Action Responses may include mitigation measures that are easily implemented at low-cost and in a short timeframe. Such mitigation measures may already be identified as contingency or adaptive management measures within various management plans for the Project.

One of the moderate action responses is to develop a High Action Responses, which will be implemented if the trend over time is a continued change relative to the benchmark (increase in the magnitude of the effect). High Action Responses will be reviewed by key regulatory agencies prior to implementation.

The low, moderate, and high-risk conditions and associated responses are outlined in the Trigger Action Response Plans (TARPs) presented in Table 5.1.

5.2 REPORTING

Reporting of AEMP component studies is conducted based on an annual reporting cycle. Under the MDMER Baffinland submits an annual report to ECCC, which is also publicly available on Baffinland's Document Portal. The EEM studies are reported on 3 year-cycles as required under MDMER.

AEMP component study monitoring results for the CREMP and Lake Sedimentation Study are appended to the QIA/NWB Annual Report for Operations. A monitoring results summary is also presented in the effects evaluation section of the NIRB Annual Report.

Monitoring results from the Dustfall Monitoring Program will be reported in the Air Quality & Noise Abatement Management Plan (AQNAMP), appended to the NIRB Annual Report, required by the Project Certificate No. 005.

The AEMP Annual Report will provide a compilation, assessment and interpretation of findings across monitoring programs, and present an evaluation of effects. Revisions to study designs or management response actions will be summarized and discussed for each key issue.

The AEMP will be updated periodically, as required. Updates to the AEMP will be filed with the QIA/NWB Annual Reports in accordance with Schedule B, Section g, Item (ii) of the Amended Type A Water Licence. Updates to the AEMP may consist of modifications to study designs, or termination of shorter-term targeted studies accompanied by adequate rationale.

TABLE 5.1 TRIGGER ACTION RESPONSE PLANS FOR AQUATIC EFFECTS MONITORING

Monitoring Plan	Objective	Performance Indicators	Activity Being Monitored	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
MDMER Effluent Monitoring	Detect short-term and long-term effects of the Project's activities on the aquatic environment resulting from the Project Evaluate the accuracy of impact predictions Assess the effectiveness of planned mitigation measures Identify additional mitigation measures to avert or reduce unforeseen environmental effects	Deleterious substances (As, Cu, Pb, Ni, Zn, TSS, Ra-226) and pH	Mine effluent discharges	Addressed in the Fresh Water Supply, Sewage and Wastewater Management Plan					
		Acute Lethality Testing: Rainbow trout, Daphnia magna		Addressed in the Fresh Water Supply, Sewage and Wastewater Management Plan					
MDMER Effluent and Water Quality Monitoring Studies		Effluent characterization: hardness, alkalinity, EC, temperature, Al, Cd, Fe, Hg, Mo, Se, NO_3-N, Cl, Cr, Co, SO_4, Tl, U, P, Mn, NH_3-N		Addressed in the Fresh Water Supply, Sewage and Wastewater Management Plan Note there are Hg and Se discharge limits in effluent characterization that trigger a fish tissue study, if exceeded.					
		Sublethal toxicity testing (fish and/or invertebrate and/or macrophyte and/or algal species)		Addressed in the Fresh Water Supply, Sewage and Wastewater Management Plan					
		Water Quality Monitoring at exposure and reference areas: temperature, dissolved oxygen, pH, hardness, alkalinity, EC, salinity (marine only), deleterious substances and effluent characterization parameters		Receiving water quality subject to the AEMP benchmarks established for the CREMP (see below)					
MDMER Biological Monitoring Studies		Critical Effects Sizes for Arctic char health: Total body weight at age: ± 25% of reference mean Liver weight at total body weight: ± 25% of reference mean Total body weight at length (condition): ± 10% of reference mean Age: ± 25% of reference mean		Fish health endpoint at effluent-exposed area significantly different from reference area (ρ <0.1) but within Critical Effect Size(s), or significantly different from reference area at a magnitude outside of Critical Effect Size(s) in one and/or non-consecutive studies.	Fish health endpoint at effluent-exposed area significantly different from (ρ <0.1), and at a magnitude outside of Critical Effect Size(s), compared to reference area, for two consecutive assessments.	To be determined based on outcome of moderate pre-defined response.	<u>Env't Dept</u>: Continue with scheduled monitoring as prescribed in the regulations to confirm difference; determine if there are contributing factors in effluent (review deleterious substances monitoring of effluent and acute lethality testing results).	<u>Env't Dept</u>: Conduct investigation of cause of the consistent differences between effluent-exposed area and reference area consistent with the MDMER; develop high risk response threshold and evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. <u>Responsible Dept(s)</u>: Implement plan to address potential mine-related inputs and sources.	Env't Dept: Conduct further investigation to confirm cause is consistent with results of investigation conducted under the moderate risk response action; evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. <u>Responsible Dept(s)</u>: Implement plan to address potential mine-related inputs and sources.
		Critical Effects Sizes for benthic invertebrate community: Density: ± 2 SD of reference mean Simpson's Evenness Index: ± 2 SD of reference mean Taxa Richness: ± 2 SD of reference mean		Benthic endpoint at effluent-exposed area significantly different from reference area (ρ <0.1) but at a magnitude within Critical Effect Size(s), or significantly different from reference area at a magnitude outside of Critical Effect Size(s) in one and/or non-consecutive studies.	Benthic endpoint at effluent-exposed area significantly different from (ρ <0.1), and at a magnitude outside of Critical Effects Size(s), compared to reference area, for two consecutive assessments.	To be determined based on outcome of moderate pre-defined response.			

Monitoring Plan	Objective	Performance Indicators	Activity Being Monitored	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
MDMER Biological Monitoring Studies	Detect short-term and long-term effects of the Project's activities on the aquatic environment resulting from the Project Evaluate the accuracy of impact predictions Assess the effectiveness of planned mitigation measures Identify additional mitigation measures to avert or reduce unforeseen environmental effects	Fish Tissue Study[1] Mercury (Hg) in muscle tissue: low risk threshold is MDMER effect concentration (0.5 µg/g wet weight); moderate risk threshold is low risk threshold and consistent effects in one or more other study components which links results to the Project	Mine effluent discharges	Total Hg in fish tissue exceeds MDMER threshold for an effect on fish tissue from Hg (0.2 µg/g wet weight) in fish tissue at an exposure area and is a statistically significant increase (ρ <0.1) over the reference area.	Total Hg in fish tissue exceeds MDMER threshold for an effect on fish tissue from Hg (0.5 µg/g wet weight) in fish tissue at an exposure area and is a statistically significant increase (ρ <0.1) over the reference area.	To be determined based on outcome of moderate pre-defined response.	Env't Dept: Conduct follow-up monitoring and trend analysis to determine if Hg in fish tissue is increasing with time. Review the results of other component studies. Determine if there are other project-related Hg sources other than mine effluent. Responsible Dept(s): Implement a review of mine-related processes to determine if sources can be mitigated.	Env't Dept: Conduct follow-up monitoring and trend analysis to determine if Hg in fish tissue is increasing with time. Determine if there are other project-related Hg sources other than mine effluent. Evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. Responsible Dept(s): Develop and implement action(s) to reduce Hg emissions.	Env't Dept: Conduct further investigation to confirm cause is consistent with results of investigation conducted under the moderate risk response action; evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. Responsible Dept(s): Implement plan to address potential mine-related inputs and sources.
		Fish Tissue Study[3] Selenium (Se) in muscle and/or whole-body tissues: low risk threshold is 100% increase relative to reference; moderate risk threshold is United States Environmental Protection Agency chronic effects criterion of 11.3 µg/g dry weight (USEPA, 2016)		Total Se in fish tissue from an exposure area exceeds the Critical Effects Size (100% increase relative to reference).	A low risk condition for two consecutive assessments with Se concentrations in fish tissue exceeding the USEPA (2016) chronic effects criterion (11.3 µg/g dry weight).	To be determined based on outcome of moderate pre-defined response.	Env't Dept: Conduct follow-up monitoring and trend analysis to determine if Se in fish tissue is increasing with time. Review the results of other component studies. Determine if there are other project-related Se sources other than mine effluent. Responsible Dept(s): Implement a review of mine-related processes to determine if sources can be mitigated.	Env't Dept: Conduct follow-up monitoring and trend analysis to determine if Se in fish tissue is increasing with time. Determine if there are other project-related Se sources other than mine effluent. evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. Responsible Dept(s): Develop and implement action(s) to reduce Se emissions.	Env't Dept: Conduct further investigation to confirm cause is consistent with results of investigation conducted under the moderate risk response action; evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. Responsible Dept(s): Implement plan to address potential mine-related inputs and sources.
Lake Sedimentation Monitoring	Detect short-term and long-term effects of the Project's activities on the aquatic environment resulting from the Project Evaluate the accuracy of impact predictions Assess the effectiveness of planned mitigation measures Identify additional mitigation measures to avert or reduce unforeseen environmental effects	Sedimentation (i.e., amount of sediment accumulation) in Sheardown Lake	Dustfall, erosion and sedimentation	Sediment accumulation during the ice-cover / Arctic char egg incubation period exceeds thickness of 0.15 mm (see Note 4).	Annual sediment accumulation during the ice-cover / Arctic char egg incubation period exceeds 0.54 mm (see Note 5).	Annual sediment accumulation during the ice-cover / Arctic char egg incubation period exceeds 1 mm (see Note 6)	Env't Dept: Detailed review of existing sediment and erosion control measures and implementation of additional control measures. Assess trends to determine if sediment levels are increasing in the project area. Responsible Dept(s): Implement precautionary mitigation to avoid potential threshold exceedance during the next open water season[6].	Env't Dept: Conduct a review annual and historical data, and assess effects based on a multiple lines of evidence study with the other component studies of the AEMP; establish proposed high action response. Responsible Dept(s): Implement plan to address mine-related inputs and sources during the next open water season[7].	Env't Dept: To be determined if the moderate risk threshold is exceeded; may include further study such as in-situ or laboratory study on egg mortality, and adjustments to mine operations to stop or reverse the observed effect. Responsible Dept(s): Implement plan to address potential mine-related inputs and sources.

Monitoring Plan	Objective	Performance Indicators	Activity Being Monitored	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
Core Receiving Environment Monitoring Program (CREMP)	Detect short-term and long-term effects of the Project's activities on the aquatic environment resulting from the Project Evaluate the accuracy of impact predictions Assess the effectiveness of planned mitigation measures Identify additional mitigation measures to avert or reduce unforeseen environmental effects	Water and Sediment Quality AEMP benchmarks	Dustfall, erosion and sedimentation	Mine-related changes below AEMP benchmarks and/or within baseline or reference condition.	Mine-related changes that results in one or more parameters exceeding the AEMP benchmarks and/or concentration(s) observed during baseline and at an applicable reference area.	Establish if moderate risk condition status is reached.	Env't Dept: Conduct temporal trend analysis; confirm site specific relevance of threshold; determine next steps as part of annual reporting. Responsible Dept(s): Implement precautionary mitigation to avoid potential threshold exceedance during the next open water season[6].	Env't Dept: Weight of evidence evaluation / risk assessment; evaluate need for and specifics of increased monitoring as required to further assess mine contribution; evaluate and implement most appropriate action(s) from the AEMP Action Toolkit if trend analysis suggests continued increase; develop high risk response threshold as part of annual reporting. Responsible Dept(s): Implement plan to address mine-related inputs and sources during the next open water season[7].	Env't Dept: Conduct further investigation to confirm cause is consistent with results of investigation conducted under the moderate risk response action; evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. Responsible Dept(s): Implement plan to address potential mine-related inputs and sources.
		Phytoplankton Chlorophyll a		<3.7 µg/L (maintain oligotrophic status).	>3.7 µg/L (maintain oligotrophic status) that does not reflect a similar change at an applicable reference area.	Establish if moderate risk condition status is reached.	Env't Dept: Conduct temporal trend analysis; confirm site specific relevance of threshold; determine next steps as part of annual reporting. Responsible Dept(s): Implement precautionary mitigation to avoid potential threshold exceedance during the next open water season[3].	Env't Dept: Weight of evidence evaluation / risk assessment; evaluate need for and specifics of increased monitoring; evaluate and implement most appropriate action(s) from the AEMP Action Toolkit if trend analysis suggests continued increase; evaluate benchmark and condition of BMI community to assess ecological effects; develop high risk response threshold and action(s) as part of annual reporting. Responsible Dept(s): Implement plan to address mine-related inputs and sources during the next open water season[7].	Env't Dept: Conduct further investigation to confirm cause is consistent with results of investigation conducted under the moderate risk response action; evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit. Responsible Dept(s): Implement plan to address potential mine-related inputs and sources.
		Benthic Invertebrates Critical Effects Sizes: Density: ± 2 SD of baseline or reference mean Simpson's Evenness Index: ± 2 SD of baseline or reference mean Taxa Richness: ± 2 SD of baseline or reference mean		Benthic endpoint at mine-exposed area significantly different from reference area (ρ <0.1) but at a magnitude within Critical Effect Size(s), or significantly different from reference area at a magnitude outside of Critical Effect Size(s) in one and/or non-consecutive studies[8].	Benthic endpoint at mine-exposed area significantly different from (ρ <0.1), and at a magnitude outside of Critical Effects Size(s), compared to reference area, for two consecutive assessments[8].	Establish if moderate risk condition status is reached.	Env't Dept: Conduct temporal trend analysis; confirm site specific relevance of threshold; determine next steps and implement timeline as part of annual reporting. Responsible Dept(s): Implement next steps and/or precautionary mitigation to avoid potential	Env't Dept: Weight of evidence evaluation / risk assessment; evaluate need for and specifics of increased monitoring as required to further assess mine contribution; evaluate and implement most appropriate action(s) from the AEMP Action Toolkit if trend analysis suggests continued increase; develop high	Env't Dept: Conduct further investigation to confirm cause is consistent with results of investigation conducted under the moderate risk response action; evaluate and implement most appropriate action(s) from the AEMP Action Level Toolkit.

Monitoring Plan	Objective	Performance Indicators	Activity Being Monitored	Condition Status			Pre-defined Response(s)		
				Low Risk	Moderate Risk	High Risk	Low Risk	Moderate Risk	High Risk
Core Receiving Environment Monitoring Program (CREMP)		Critical Effects Sizes for Arctic char health: Total body weight at age: ± 25% of baseline or reference mean Total body weight at length (condition): -10% of baseline reference mean Relative abundance of YOY (% composition of YOY) OR relative age-class strength: ± 25% of baseline or reference mean Age: ± 25% of reference mean	Dustfall, erosion and sedimentation	Fish health endpoint at mine-exposed area significantly different from reference area (ρ <0.1) but within Critical Effect Size(s), or significantly different from reference area at a magnitude outside of Critical Effect Size(s) in one and/or non-consecutive studies.	Fish health endpoint at mine-exposed area significantly different from (ρ <0.1), and at a magnitude outside of Critical Effect Size(s), compared to reference area, for two consecutive assessments.	Establish if moderate risk condition status is reached.	threshold exceedance during the next open water season[3].	risk response threshold and action(s) as part of annual reporting. Responsible Dept(s): Implement plan to address mine-related inputs and sources during the next open water season[3].	Responsible Dept(s): Implement plan to address potential mine-related inputs and sources.
Fish Passage Monitoring	Safeguard fish habitat and fish passage	Fish presence/absence	Water crossings	Addressed in the Surface Water and Aquatic Ecosystem Management Plan					

NOTES:

1. A Hg fish tissue study is required if the annual mean concentration of Hg in effluent >0.10 µg/L, unless (i) the results of the previous two biological monitoring studies indicate no effect on fish tissue from mercury, or (ii) the method detection limit used in respect of mercury for the analysis of at least two of four effluent samples in a calendar year is equal to or greater than 0.10 µg/L.
2. Two consecutive assessments refer to two sampling events based on frequency of sampling for each program (annually for CREMP and within 36 months of the previous MDMER biological study).
3. A Se fish tissue study is required if the annual mean concentration of Se in effluent is >5 µg/L and/or the grab sample Se concentration is >10 µg/L.
4. Upper range of natural sedimentation rate of 50 mg/cm^2/year, converted to a sediment thickness using the measured dry bulk density of sediment in Sheardown Lake.
5. Predicted sediment accumulation in FEIS Volume 7, Section 3.4.2.3.
6. FEIS threshold carried forward into the lake sedimentation program.
7. Subject to feasibility and regulatory approval as identified during the evaluation of next steps.
8. For performance indicators related to fish health and benthic invertebrate communities, MDMER critical effect sizes (CES) have been adopted as the basis for defining risks and guiding responses. These CES have bounds in both the positive (higher) and negative (lower) direction of a reference area mean, and therefore differences between two study areas can have a magnitude within these bounds or fall outside of these bounds. Because use of the terminology “exceeds the CES threshold” normally has a connotation in the positive direction, such terminology does not adequately account for large differences in the negative direction. Similarly, describing a difference as “lower than the CES threshold” can be construed as meeting a criterion when in fact it could be a large negative difference that does not meet the criterion. For these cases, use of the terminology “within” and “outside” of a CES more adequately reflects whether a difference meets or does not meet a criterion.

5.3 MITIGATION TOOLKIT

The preliminary Moderate and High Action Pre-Defined Responses to be implemented in the event of an exceedance of a moderate risk or high risk threshold are outlined in Table 5.2. These responses should not be considered exhaustive and may be supplemented pending the results of adaptive management investigations and subsequent QIA approval.

Note - The Moderate and High Action Pre-Defined Responses are preliminary and subject to further review and assignment into specific Moderate and High Risk categories before finalization of the adaptive management components of the Environmental Management Plans, currently planned for August 2021. Even when finalized these responses should not be considered exhaustive and may be supplemented pending the results of adaptive management investigations and subsequent QIA approval.

TABLE 5.2 FRESHWATER ENVIRONMENT - MODERATE AND HIGH ACTION PRE-DEFINED RESPONSES

Mitigation	Key Stressor	Potential Responses
Avoid/reduce	Dust emissions	• Redesign engineering controls. • Spray (or respray piles) with approved dust suppressant. • Research for alternate dust suppression products. • Evaluate surface watering and sprinkler system options via mister trucks or trailers. • Where applicable, install or redesign conveyor shrouding for fugitive dust. • Further evaluate blasting practices. • Conduct review of new technology and solutions available on the market for dust control. • Reduction or cessation of activity • Adapt production rate to environmental conditions. • Develop site-specific risk-based guidelines. • Complete risk assessment
	Erosion and sedimentation	• Stabilize eroding surfaces with rip rap or other measures. • Install sediment control infrastructure (i.e., check dams). • Explore redesign of water conveyance structures and culverts. • Construct diversion ditches or berms. • Direct non-contact water away from site infrastructure. • Conduct review of new technology and solution available on the market for erosion and sedimentation control. • Explore options for temporary vegetation of disturbed land (progressive reclamation).
	Water management	• Assess potential use and effectiveness of batch water treatment with reagents, and/or flocculants. • Construct water management structures (i.e., additional settlement ponds, dams etc.). • Install stream specific water treatment plant. • Implement alternate water treatment technologies (i.e., permeable reactive barriers).
Compensation	Any/all stressors	• Compensation under ICA or WCA.

6.0 REVIEW OF PLAN EFFECTIVENESS

An important element of Baffinland's management system is reviewing the continued suitability, adequacy and effectiveness of each management plan. This will occur through an annual review process as well as scheduled updates.

6.1 ANNUAL REVIEW OF COMPLIANCE AND UNANTICIPATED EFFECTS

Baffinland conducts internal inspections and audits throughout the year, as described in Section 5.2. Throughout the year, immediate corrective actions are taken as appropriate to address instances of non-compliance, as well as unanticipated effects observed. Follow-up corrective actions may also be required. These immediate and follow-up corrective actions are documented in the annual report.

One follow-up corrective action may be to revise mitigation measures or monitoring programs described in the applicable management plans. During the annual reporting cycle, Baffinland staff will review instances of non-compliance as well as unanticipated effects and determine if a review of plan effectiveness is appropriate. This process is articulated on Figure 6.1. The results of this annual review will be reported in the annual report. Management plan updates that result from this process will also be filed with the annual report.

Part of this annual review cycle is the incorporation of IQ, which may include feedback from the Inuit Committee and/or community observations. This process may occur annually whether repeat non-compliance and/or unanticipated effects are identified (Figure 6.1).

6.2 SCHEDULED UPDATES

In addition to the annual review cycle described above, scheduled Plan reviews will occur according to the schedule presented in Table 6.1.

TABLE 6.1 PLAN REVIEW SCHEDULE

Review Event	Description	Responsibility
Prior to construction	Incorporate any additional requirements specified in the DFO Fisheries Act Authorization and Amended Water Licence	General Manager or designate Superintendent Operations or designate Superintendent Engineering or designate Superintendent Maintenance or designate Superintendent Environment or designate
Post-construction	Mandatory management review	
Every 3 years during operation	Mandatory management review	

Plan updates will be recorded in the Document Revision Record located at the front of the Plan. Each plan update will be provided to the QIA for review and approval before being finalized for implementation.

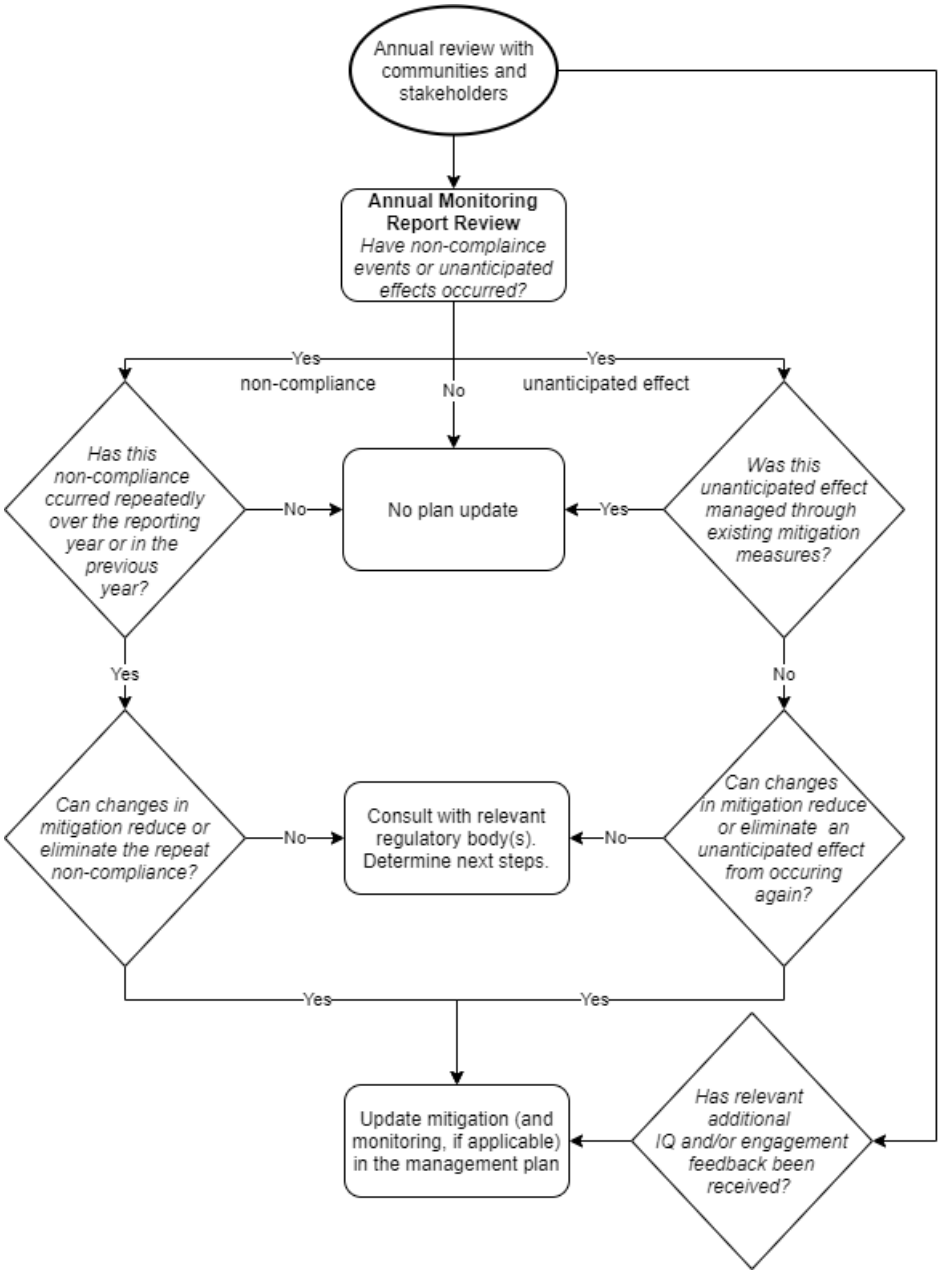

FIGURE 6.1 ANNUAL REVIEW OF PLAN EFFECTIVENESS

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Appendix A
Corporate Policies

Baffinland Iron Mines Corporation

Health, Safety and Environment Policy

BAF-PH1-800-POL-0001

Rev 2

Approved By: **Brian Penney**

Title: **Chief Executive Officer**

Date: **April 20th, 2018**

Signature: 

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
05/07/15	0	EM	TP	For Use
03/07/16	1	JS	BP	Minor edits
04/20/18	2	TS	SA/BP	Minor edits

This Baffinland Iron Mines Corporation Policy on Health, Safety and Environment is a statement of our commitment to achieving a safe, healthy and environmentally responsible workplace. We will not compromise this policy for the achievement of any other organizational goals.

We implement this Policy through the following commitments:

- Continual improvement of safety, occupational health and environmental performance
- Meeting or exceeding the requirements of regulations and company policies
- Integrating sustainable development principles into our decision-making processes
- Maintaining an effective Health, Safety and Environmental Management System
- Sharing and adopting improved technologies and best practices to prevent injuries, occupational illnesses and environmental impacts
- Engaging stakeholders through open and transparent communication.
- Efficiently using resources, and practicing responsible minimization, reuse, recycling and disposal of waste.
- Reclamation of lands to a condition acceptable to stakeholders.

Our commitment to provide the leadership and action necessary to accomplish this policy is exemplified by the following principles:

- As evidenced by our motto “Safety First, Always” and our actions Health and Safety of personnel and protection of the environment are values not priorities.
- All injuries, occupational illnesses and environmental impacts can be prevented.
- Employee involvement and active contribution through courageous leadership is essential for preventing injuries, occupational illnesses and environmental impacts.
- Working in a manner that is healthy, safe and environmentally sound is a condition of employment.
- All operating exposures can be safeguarded.
- Training employees to work in a manner that is healthy, safe and environmentally sound is essential.
- Prevention of personal injuries, occupational illnesses and environmental impacts is good business.
- Respect for the communities in which we operate is the basis for productive relationships.

We have a responsibility to provide a safe workplace and utilize systems of work to meet this goal. All employees must be clear in understanding the personal responsibilities and accountabilities in relation to the tasks we undertake.

The health and safety of all people working at our operation and responsible management of the environment are core values to Baffinland. In ensuring our overall profitability and business success every Baffinland and business partner employee working at our work sites is required to adhere to this Policy.

Brian Penney
Chief Executive Officer
April 2018

Sustainable Development Policy

At Baffinland Iron Mines Corporation (Baffinland), we are committed to conducting all aspects of our business in accordance with the principles of sustainable development & corporate responsibility and always with the needs of future generations in mind. Baffinland conducts its business in accordance with the Universal Declaration of Human Rights.

Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and with utmost respect for the cultural values and legal rights of Inuit. We expect each and every employee, contractor, and visitor to demonstrate courageous leadership in personally committing to this policy through their actions. The four pillars of our corporate responsibility strategy are:

1. Health and Safety
2. Environment
3. Upholding Human Rights of Stakeholders
4. Transparent Governance

Health and Safety

- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness, where everyone goes home safe everyday of their working life. Why? Because our people are our greatest asset. Nothing is as important as their health and safety. Our motto is “Safety First, Always”
- We report, manage and learn from injuries, illnesses and high potential incidents to foster a workplace culture focused on safety and the prevention of incidents
- We foster and maintain a positive culture of shared responsibility based on participation, behaviour, awareness and promoting active courageous leadership. We allow our employees and contractors the right to stop any work if and when they see something that is not safe

Environment

- Baffinland employs a balance of the best scientific and traditional Inuit knowledge to safeguard the environment
- We apply the principles of pollution prevention, waste reduction and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation
- We continuously seek to use energy, raw materials and natural resources more efficiently and effectively. We strive to develop more sustainable practices. We strive to develop more sustainable practices
- Baffinland ensures that an effective closure strategy is in place at all stages of project development to ensure reclamation objectives are met

Upholding Human Rights of Stakeholders

- We respect human rights, the dignity of others and the diversity in our workforce. Baffinland honours and respects the unique cultural values and traditions of Inuit
- Baffinland does not tolerate discrimination against individuals on the basis of race, colour, gender, religion, political opinion, nationality or social origin, or harassment of individuals freely employed
- Baffinland contributes to the social, cultural and economic development of sustainable communities in the North Baffin Region

Sustainable Development Policy

- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions
- We expect our employees and contractors, as well as community members, to bring human rights concerns to our attention through our external grievance mechanism and internal human resources channels. Baffinland is committed to engaging with our communities of interest on our human rights impacts and to reporting on our performance

Transparent Governance

- Baffinland will take steps to understand, evaluate and manage risks on a continuing basis, including those that may impact the environment, employees, contractors, local communities, customers and shareholders.
- Baffinland endeavours to ensure that adequate resources are available and that systems are in place to implement risk-based management systems, including defined standards and objectives for continuous improvement.
- We measure and review performance with respect to our safety, health, environmental, socio-economic commitments and set annual targets and objectives.
- Baffinland conducts all activities in compliance with the highest applicable legal & regulatory requirements and internal standards.
- We strive to employ our shareholder's capital effectively and efficiently and demonstrate honesty and integrity by applying the highest standards of ethical conduct.

Brian Penney
Chief Executive Officer
March 2016

Anti-Bribery and Anti-Corruption Policy

1. Purpose

The purpose of this policy is to define the requirements of Baffinland Iron Mines Corporation ('Baffinland') that the directors, officers, employees, contractors and representatives are required to follow. The directors, employees and contractors are expected to conduct reasonable due diligence on third parties when promoting Baffinland's business.

2. Scope

This policy applies to all directors, officers, employees, contractors and representatives of Baffinland, performing any function whatsoever.

3. Responsibilities

It is the responsibility of all directors, employees, contractors and representatives of Baffinland to follow the Company's anti-bribery and anti-corruption policy, which prohibits the following:

- Under no circumstances shall an officer, director, employee, or any third party acting on Baffinland's behalf, give or pay (or make an offer, promise, or grant authority to pay) anything of value to a government official or any other person or entity, including those in the private or commercial sector, where the gift or payment is intended to induce the recipient to misuse his or her position or to obtain an improper business advantage.
- Employees are not authorized to make "facilitation" or expediting payments to facilitate or secure the performance of certain routine, non-discretionary functions or routine government actions. Employees may only pay official service fees which are publicly posted on fee schedules and for which payment is properly documented.
- An employee's violation of this policy will result in disciplinary action, which may include termination and/or notice to appropriate enforcement agencies. A third party's violation of this policy may lead to the suspension or termination of any or all agreements and/or notice to appropriate enforcement agencies.
- All employees shall participate in annual anti-bribery and anti-corruption training that are arranged by Baffinland.
- All employees shall annually sign an Acknowledgement Form confirming their understanding of this policy and the consequences of non-compliance.
- Employees will not provide gifts or hospitality with the intention of persuading anyone to, or rewarding anyone for, acting improperly or misusing his or her authority.
- Contributions of money or services on behalf of Baffinland to any political parties or individual politicians in any region, trade unions or union members may only be made in accordance with applicable law and all requirements for public disclosure must be fully complied with. Such contributions are subject to the prior written approval of the Baffinland's General Counsel.

If employees, directors, officers, contractors or representatives are concerned about any non-compliance, please submit your concerns or complaints to the Baffinland ConfidenceLine, a service provided by an independent third party, 'Xpera' HR Services Inc. The reporting contact details are as follows:

Contact details for Xpera HR Services Inc:

- Phone Number: +1 888-455-8662
- Address: 101 - 8333 Eastlake Drive, Burnaby, British Columbia. V5A 4W2 Canada
- Email address: confidenceline@xpera.ca

4. Protocol

4.1 Definitions

4.1.1 Bribery

Bribery can be defined as the offering, giving, receiving, or soliciting of anything of value to influence an act or a decision. Payments, benefits or other advantages extended to domestic or foreign public or government officials or employees, to obtain or maintain business are strictly prohibited. Similarly, directors, employees, contractors and representatives who deal with government representatives will not, under any circumstance personally, accept any benefit or advantage offered by a government representative.

Furthermore, directors, employees, contractors and representatives must not act outside of the scope of their official roles in order to assist private entities or persons in their dealings with the Company where this would result in unwarranted preferential treatment to any person or organization.

4.1.2 Facilitation Payments

Facilitation payments, which are payments to government officials or representatives to expedite routine services, are prohibited.

4.2 Protocol

4.2.1 Government Relations

All directors, employees, contractors and representatives shall conduct their dealings with government officials and employees in compliance with the Criminal Code (Canada), Corruption of Foreign Public Officials Act (Canada) (the "CFPOA"), the Foreign Corrupt Practices Act (United States) (the "FCPA") and local laws.

4.2.2 Books and Records

Prior to paying or authorizing a payment to a domestic or foreign official or government employee, directors, employees, contractors and representatives must ensure that no part of such payment is to be made for any purpose other than that to be fully and accurately recorded in the Company's books and records.

4.2.3 Gifts and Entertainment

Baffinland expects employees, contractors and representatives to conduct business in a way that avoids even the perception of illegal or unethical conduct, when offering or receiving entertainment, gifts, or favours, the following standards should be followed:

- The entertainment, gift or favour should be incidental or customary hospitality and of nominal value; it cannot be meant or perceived to influence the recipient's judgment or to secure preferential treatment for the giver.
- The receipt or the giving by any director, employee, contractor or representative for entertainment, gift or benefit valued at more than CAD $500 one-time or cumulatively should be disclosed to the individual's immediate supervisor and must be recorded in the Company's Gift/Benefit Register, located on Baffinland's SharePoint Site. In addition, the individual is responsible for any personal income tax implications. Purchasers involved in a bid process should reject all entertainment, gifts or favours.
- **Gift/Benefit Register Link:** http://finance.baffinland.com/Lists/GiftBenefit%20Register%20%20List

4.2.4 Reporting

Should a director, employee, contractor or representative be solicited for or offered a bribe or incentive of any type, or suspect that a bribe or incentive will be solicited for, directors, employees, contractors and representative are required to report their concern to any of the following:

- Chief Executive Officer
- General Counsel
- Chief Financial Officer
- Director, Internal Audit

Any violation of this policy following a review of the situation, may lead to disciplinary action, including dismissal of the director, employee, contractor or representative for cause.

4.3 Enforcement

Any violation of this policy following a review of the situation, may lead to disciplinary action, including dismissal of the director, employee, contractor or representative for cause.

Please refer to **Appendix A** for Baffinland Anti-Bribery and Anti-Corruption policy acknowledgement document.

5. References and Records

Criminal Code of Canada: https://laws-lois.justice.gc.ca/PDF/C-46.pdf
Corruption of Foreign Public Officials Act (CFPOA): https://laws-lois.justice.gc.ca/PDF/C-45.2.pdf
Foreign Corrupt Practices Act (FCPA): https://www.justice.gov/criminal-fraud/foreign-corrupt-practices-act

Human Resources

Anti- Bribery and Anti- Corruption Policy

BAF-PH1-700-POL-0022 r0

Brian Penney
President & CEO

APPENDEX A: Anti-Bribery and Anti-Corruption Policy Acknowledgement Document

I acknowledge receipt of "Anti-Bribery and Anti-Corruption policy"; I confirm that I have read and understood this policy and that I will abide by its provisions in handling the business of the Company.

(Please print)

_____

Name

_____

Department

_____

Date and place

_____

Signature

Please complete this acknowledgement document and forward it to Baffinland Human Resources Department. This document will be placed in your employee file.

Code of Business Conduct Policy

1. Purpose

The purpose of this policy is to define the minimum requirements for Baffinland Iron Mines Corporation's ("Baffinland") directors, officers, employees, contractors and representatives in order to follow the Code of Business Conduct ("Code").

Baffinland values honesty and integrity in its management practices and in all its business transactions. It is vital for the Company that we adopt these values and maintain the relationship of trust with all individuals and companies with whom Baffinland has a business dealing with. Each new director, officer, employee, contractor and representative is required to certify their awareness and compliance with this Code. All Baffinland officers and employees will be required to reiterate their awareness and compliance to the Code on an annual basis. Declining to certify their awareness and compliance to the Code may lead to disciplinary action, up to and including termination for cause.

2. Scope

This Code of Conduct applies to all directors, officers, employees, contractors and representatives of Baffinland. It is designed to help understand the ethical and legal obligations in handling Baffinland's business. Although this code does not cover every issue that may arise, it is intended to establish guidelines to which Baffinland personnel can refer to, in situations where the proper course of conduct may not seem clear.

The guidelines set out in this code are mandatory and, as such, must be observed by all Baffinland personnel at all times.

3. Responsibilities

It is the responsibility of all directors, officers, employees, contractors and representatives of Baffinland to adhere to this Code of Business Conduct and report any actual or suspected violations to their supervisors, the General Counsel, President & CEO, CFO, Human Resources (HR) or Director, Internal Audit, in a timely manner.

3.1 Competition and Anti-trust

Baffinland is committed to strict observance compliance of the competition and antitrust laws of the countries in which it does business and to avoid any conduct that could be considered illegal.

Agreements or arrangements may be considered illegal even if they are not in writing, since the conduct of the party involved can be sufficient to establish that a violation has occurred. Consequently, no Baffinland personnel may take part in any formal or informal discussions, agreements, arrangements, projects or accords with current or potential competitors related to pricing, terms of sale or bids, allocation of customers or any other activity that restrains or could restrain free and open competition.

The courts may impose large fines and, in certain circumstances, lengthy prison terms for violations of antitrust laws, and these penalties may be imposed on both employees and companies. In view of the serious legal consequences, at both the civil and criminal levels, to which such violations could expose the Company, Baffinland will take the necessary steps that may be warranted against employees who disobey these laws. Ignorance, overzealousness, good faith or the

argument that time did not permit the advice of the General Counsel to be sought will not be accepted as an excuse. All questions in the competition/antitrust area should be submitted to the General Counsel before any action is taken.

4. Protocol

4.1 Exemptions

A waiver of any provision of this code will only be given if it is deemed absolutely appropriate under the circumstances. Any change in or waiver of this Code may be made only by the Board or by a Board Committee and will be promptly disclosed as required by law or regulation.

Although the various matters dealt with in this Code do not cover the full spectrum of employee activities, they are indicative of Baffinland's commitment to the maintenance of high standards of conduct and are to be considered representative of the type of behavior expected from employees in all circumstances.

4.2 Reporting Code Violations

All officers and managers at all levels shall maintain an "open door" policy regarding questions of business conduct as they relate to this Code and its applicability. Employees, contractors and representatives shall be encouraged to raise their concerns regarding potential code violations. Concerns regarding violations to the Code can be reported anonymously to Baffinland ConfidenceLine.

- Phone Number: +1 888-455-8662
- Address: 101 - 8333 Eastlake Drive, Burnaby, British Columbia. V5A 4W2. Canada.
- Email address: confidenceline@xpera.ca

Retaliation against any employee or contractor who, in good faith, reports a concern about any illegal or unethical conduct will not be tolerated. Persons involved in illegal or unethical conduct may be subject to disciplinary action up to and including termination. Reporting a Code violation knowing it to be false may also result in disciplinary action up to and including termination.

If a member of management receives a report of any alleged violation of the Code, he or she must promptly inform the the Audit Committee Chairperson, General Counsel, President & CEO, CFO, Human Resources (HR) or Director, Internal Audit. An investigation will be conducted to determine whether a violation has in fact occurred.

Any director, officer, employee, contractor or representative who withholds information during the course of an investigation regarding a possible violation of the Code is subject to disciplinary action, up to and including termination.

4.3 Legal Compliance

Compliance with Laws and Regulations

The Company and its employees shall comply with all laws, rules and regulations and governmental requirements of those jurisdictions in which it conducts business. Baffinland's activities are subject to complex, changing and, in some

cases, conflicting laws, in Canada and abroad. Ignorance of the law is not a defense and is not acceptable. Moreover, agreements or arrangements need not be in writing for a contravention to be inferred from the conduct of the parties.

Baffinland employees must diligently seek to avoid conduct which might be interpreted as being in contravention of laws governing the affairs of the Company. Employees must not permit their decisions to be improperly influenced nor shall they improperly influence the decisions of others, irrespective of any perceived benefits to the Company.

4.4 Third Party Relationships

Conflicts of Interest

In discharging their duties, directors, officers, employees, contractors and representatives must act honestly and in good faith with a view to Baffinland's best interests. Directors, officers, employees, contractors and representatives must avoid situations involving a conflict between their personal interests and the interests of the Company. Actions taken, and decisions made by any director, officer, employee, contractor or representative should be documented and based on impartial and objective assessment of the facts in each situation, free from influence by gifts and, favors and the like, which may adversely affect the director, officer, employee, contractor and representative's judgments.

Gifts and Entertainment

Employees must not profit from their position with Baffinland so as to derive personal benefits conferred on them by persons who deal or seek to deal with the Company. Consequently, accepting any personal benefit, such as a sum of money, a gift, a loan, services, pleasure trips or vacations, special privileges or living accommodations or lodgings, with the exception of promotional items of modest value, is forbidden.

Any entertainment accepted or given must also be of a modest nature. In general, offers of entertainment in the form of meals and drinks may be accepted or given, provided that they are inexpensive, infrequent and, as much as possible, reciprocal.

The receipt or the giving by any director, employee, contractor or representative of entertainment, gift or benefit valued at more than CAD $500 one-time or cumulatively should be disclosed to the individual's immediate supervisor and must be recorded in the Company's Gift/Benefit Register, located on Baffinland's SharePoint Site.

Gift/Benefit Register Link: http://finance.baffinland.com/Lists/GiftBenefit%20Register%20%20List

In case of continuing doubt, employees should consult their direct Supervisor or the General Counsel.

4.5 Fair Competition

Subject in all cases to the provisions of the Inuit Impact and Benefit Agreement (IIBA) in place between Baffinland and the Qikiqtani Inuit Association, the following shall apply:

All procurement decisions shall be based exclusively on normal commercial considerations, such as quality, price, availability, service, reputation and other factors impacting the product, service or supplier. Customers and potential customers of Baffinland shall be provided with equal rights to make purchasing decisions based on the same competitive terms.

Baffinland will neither seek, encourage nor tolerate special favors or arrangements with suppliers or customers that impair, or give the appearance of impairing, fair commercial relationships. Under no circumstances is it acceptable to offer, give, solicit or receive any form of bribe, kickback, or inducement in fact or in appearance.

4.6 Dealing with Public or Government Officials

Baffinland's funds, assets, property or services must not be used to induce any public or government officials, in any country, to perform any action in violation of, or refrain from performing, their lawful duty. All directors, officers, employees, contractors and representatives shall conduct their dealings with government officials and employees in compliance with the Corruption of Foreign Public Officials Act (Canada) (the "CFPOA"), criminal code of Canada and local laws in such a way that Baffinland's integrity and reputation, the government and the government officials or employees, will not be brought into question.

Baffinland will also comply with the anti-corruption laws of the countries in which it conducts business, including the US Foreign Corrupt Practices Act. Baffinland will not directly or indirectly offer or give anything of personal value to any government official, including employees of state- owned enterprises, for the purpose of influencing any act or decision in order to assist the Company in obtaining or retaining business or to direct business to anyone. Baffinland will also ascertain that any agents that Baffinland engages to conduct business on behalf of the Company are reputable and that they also will comply with these guidelines.

4.7 Community Relations

Baffinland is committed to conducting its business responsibly within the communities associated with it's operations, and to making a positive contribution to the well-being and development of such communities. Every director, officer, employee, contractor and representative shall reflect this commitment in his or her everyday dealings and respect the different cultures, dignity and rights of individuals where Baffinland carries out its activities.

4.8 Outside Directorship

Baffinland employees may not serve as directors of any outside business organization unless such service is specifically approved by Baffinland management.

4.9 Confidentiality

Baffinland's records, reports, documents, processes, plans and methods are considered by the Company to be confidential and should not be revealed to outside parties without proper authorization.

Information and documents pertaining to the Company are to be used strictly for the performance of Baffinland personnel's duties and may be disclosed or communicated to persons outside the Company only to the extent that the information in question is needed by such persons in connection with their business relations with the Company, or where the information is already in the public domain or is required to be disclosed by law or court order. In case of doubt as to whether the information may be disclosed and to whom it may be sent, Baffinland personnel should consult their supervisor or the Legal Department.

Employees are required, for the duration of their employment with the Company and after their employment terminates, to keep such information confidential and to use the utmost discretion when dealing with sensitive or privileged information. Such information includes, in addition to the technology used by the Company, intellectual property, business and financial information relating to sales, earnings, balance sheet items, business forecasts, business plans, acquisition strategies and other information of a confidential nature.

Confidential information must not be discussed with or disclosed to any unauthorized persons, whether Company personnel or persons outside the Company. Necessary steps must be taken to ensure that documents containing confidential information, when sent by electronic media, are transmitted through secured means. Similarly, appropriate security measures must be taken when destroying documents that contain confidential information.

Public statements on behalf of the Company can be made exclusively by authorized persons. Any request for information concerning the Company that originates with the media or a government agency should be directed to the General Counsel.

4.10 Enforcement

Any violation of this policy following a review of the situation, may lead to disciplinary action, including dismissal of the director, officer, employee, contractor or representative for cause.

4.11 Appendices

Additional sections covered under this policy are:

a) Corporate Board of Directors
b) Political Activities
c) Corporate Opportunities
d) Fair Dealing
    1. Customer Relations
    2. Offering Gifts and Entertainment
    3. Supplier Relations
    4. Personal Information
e) Protection and Proper Use of Company Assets
    1. Accuracy of Records
    2. Property of the Company
    3. Email and Internet

f) Respecting the Baffinland Community
    1. Work Environment Free of Harassment and Discrimination
    2. Occupation Health and Safety
    3. Respect for the Environment
    4. A Shared Responsibility

Please refer to **Appendix A** for descriptions of the aforementioned sections.
Please refer to **Appendix B** for Baffinland Code of Business Conduct acknowledgement document.

5. References and Records

Human Resources
Code of Business Conduct Policy
BAF-PH1-700-POL-0023 r0

Brian Penney
President & CEO

APPENDIX A: Additional Areas Covered under Code of Business Conduct Policy

Corporate Boards of Directors

Before agreeing to sit on the Board of Directors of a business corporation, an employee must obtain the authorization from Baffinland Management. The purpose of this step is to ensure that there is no possible conflict of interest.

Political Activities

Employees who run for an elected office are required to inform the Human Resource Department or the General Counsel. Employees who wish to participate in activities of a political or public nature must do so in a personal capacity only and during non-working hours.

Corporate Opportunities

The directors, officers or employees, are prohibited from (a) taking personal opportunities that are not properly within the scope of the Company's activities, (b) using corporate property, information or position for personal gain, and (c) competing with the Company; unless otherwise authorized by the Board of Directors or the General Counsel.

Fair Dealing

Customer Relations

The Company's prosperity is founded on customer satisfaction. Baffinland expects us to preserve the quality of our customer relations by maintaining business relationships that are based on integrity, fairness and mutual respect. Only clear, concrete, pertinent and honest information is to be given to customers. We must be careful to avoid making any statement to a customer that could be misinterpreted. The Company does not tolerate the making of promises to customers which may be impossible to keep, including promises regarding product quality and characteristics, delivery times and prices.

Offering Gifts and Entertainment

The Company expects all personnel to refrain from offering gifts or granting favours outside the ordinary course of business to current or prospective customers, their employees or agents or any person with whom the Company has a contractual relationship or intends to negotiate any agreements.

Employees who are called upon to do so may incur reasonable expenses for the entertainment of current or prospective customers or other persons who deal with the Company, provided that such entertainment is in keeping with the person's position and is related to business discussions and that appropriate accounts are kept. Employees must record gifts in value excess of CAD $500.

Supplier Relationships

Subject in all cases to the provisions of the Inuit Impact and Benefit Agreement (IIBA) in place between Baffinland and the Qikiqtani Inuit Association, the following shall apply:

Suppliers of the Company are to be chosen in consideration of objective criteria, based on quality, reliability, price, utility and performance or service. Suppliers are to be treated justly, fairly and honestly. Fees and commissions are to be paid to consultants only in the course of ordinary business relations. Any fees must be substantiated by documentation demonstrating that the amount charged is representative of the value of services rendered.

Personal Information

Personal information, that is, information relating to an individual that allows that individual to be identified, is protected, among other things, by laws in most of the jurisdictions where Baffinland is conducting business. Baffinland fully supports the objectives of such legislation and applies rigorous measures to ensure compliance with its provisions. Any collection, retention, use or communication to third parties of personal information must be carried out in a manner that is respectful of the individual and in compliance with the law at all times. Personal information is to be used strictly for the performance of respective duties and may be disclosed to third parties only where such disclosure has been authorized by the individual concerned. Such information must be kept in a secure location. In case of doubt as to the handling of personal information, Baffinland personnel should consult the Human Resources or the Legal Department.

Protection and Proper Use of Company Assets

Accuracy of Records

The books, records, files and statements of Baffinland must accurately reflect the entirety of the Company's assets and liabilities, as well as all of its operations, transactions and any other items related to its business, without omission or concealment of any kind, in accordance with applicable standards and regulations.

All transactions must be authorized and carried out in accordance with the instructions of management. Transactions must be recorded in a manner that will allow accurate financial statements to be prepared and the utilization of assets to be accounted for.

Company sensitive data or information is not to be destroyed without the authorization of the respective supervisor. Such authorization will be granted only if it is in compliance with applicable laws and Company policy.

Company Property

The protection of the Company's property by each Baffinland personnel is a matter of integrity and honesty. All Baffinland personnel must use any property of the Company entrusted to them in an appropriate manner, ensure that it is secure, and prevent theft, damage and premature wear from occurring. Company property must be used exclusively for the business of the Company and must not to be used for personal purposes unless there is permission from their supervisor.

Baffinland encourages initiative, creativity and innovation on the part of its employees. Nevertheless, intangible property such as inventions, ideas, documents, software, patents and other forms of intellectual property related to the Company's business, created or conceived by employees in connection with the performance of their duties, belongs, on that basis, to the Company. Subject to any mandatory applicable law, Baffinland personnel may not derive profit

from, or apply for a patent in their personal name for, any creation or invention conceived or made by them in the course of performing our duties.

Software developed or acquired by the Company may not be reproduced or tampered with, nor may it be used for any purposes other than those intended by the Company. Software that is not owned or licensed by the Company is not to be used on the work premises or in the Company's business.

E-mail and the Internet

Baffinland owns the e-mail and internet systems used in the workplace and thus all personnel should use these systems for work-related communications. Although each Baffinland personnel has an individual password to access the e-mail and internet systems, the Company reserves the right, subject to applicable law, to access and monitor the use of these systems in appropriate circumstances.

Baffinland strictly prohibits the use of e-mail and internet systems for any improper or illegal purpose, including the transmission of messages that may be viewed as insulting or offensive to another person, such as messages, cartoons or jokes that could be construed as harassment of others on the basis of race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sexual orientation, gender identity, gender expression, age, record of offences, marital status, family status or disability.

Respecting the Baffinland Community

Work Environment Free of Harassment and Discrimination

Baffinland is committed to providing a work environment that is free of any form of sexual or other harassment, whether it be harassment by an employee or harassment by an employee of a customer or supplier or vice-versa.
Baffinland is committed to ensuring that each employee is treated with fairness and dignity; accordingly, any discriminatory practice based on race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sexual orientation, gender identity, gender expression, age, record of offences, marital status, family status or disability will not be tolerated. The Company seeks to provide its employees with equal opportunity for advancement without discrimination. However, distinguishing between individuals based on the aptitudes or qualifications required for a particular employment does not constitute discrimination.

An employee who believes he or she has been the victim of, or a witness to, a situation involving harassment or discrimination should report the incident to the employee’s Supervisor or reporting contact. If the worker’s supervisor or reporting contact is the person engaging in the workplace violence or harassment, or if the harassment activities persist, the complainant should report to the Vice President Sustainable Development & Human Resources. If the complainant does not feel it is possible to discuss the incident with Human Resources, he/she should contact the Baffinland’s General Counsel. All such reports will be treated in confidence. Incidents will be fully-investigated and those responsible will be disciplined accordingly.

Baffinland permits family members of existing employees to work for the Company, provided that they are evaluated and selected objectively and on the basis of the same criteria as other candidates and provided that their respective positions will not be potentially in conflict or collusion.

Occupational Health and Safety

Baffinland makes every effort to provide its employees with a healthy and safe work environment, to conduct regular inspections so as to eliminate any dangerous conditions or behavior and their causes, and to develop programs dedicated to our safety and well-being. All Baffinland personnel must abide by the Company's standards in safety matters, do their part to maintain a healthy and safe work environment and take the necessary steps to ensure their own safety and the safety of others.

Respect for the Environment

Respecting and protecting the environment is an important value to which Baffinland subscribes. Employees must comply at all times with the environmental legislation applicable to Baffinland, and they have an important role to play in implementing the guidelines issued by the Company in this regard.

A Shared Responsibility

Each director, officer, employees, contractor and representative is responsible for adhering to the values of Baffinland in their daily lives and for making every effort to ensure that their rules of conduct are respected by all. Conduct that is contrary to these rules is punishable by disciplinary action up to and including termination of employment, in compliance with all applicable laws and procedures.

APPENDIX B: Code of Business Conduct Policy Acknowledgement Document

I acknowledge receipt of "Baffinland Code of Business Conduct"; I confirm that I have read and understood this policy and that I will abide by its provisions in handling the business of the Company.

(Please print)

_____
Name

_____
Department

_____
Date and place

_____
Signature

Please complete this acknowledgement document and forward it to Baffinland Human Resources Department. This document will be placed in your employee file.

Appendix B
Concordance with Project Authorizations

Tables B.1 and B.2 show the terms and conditions of the Project's Type A Water Licence (2AM-MRY1325 - Amendment No. 1) and the Project Certificate No. 005 and the location within the Aquatic Effects Monitoring Plan.

TABLE B.1 CONCORDANCE TABLE WITH TYPE A WATER LICENCE TERMS AND CONDITIONS

Part	Item	Condition	Section
I	1	The Board has approved with the issuance of the Licence, for the Construction Phase of the Project, the plan entitled *Aquatic Effects Monitoring Program (AEMP) Framework*, dated February 2013, applicable during the Construction Phase of the Project.	Superseded by final plan under Item 2
	2	The Licensee shall submit to the Board, for approval in writing, at least sixty (60) days following approval of this Amendment, a revised version of the Plan entitled Aquatic Effects Management Plan (BAF-PH1-830-P16-0039, Rev 0), June 27, 2014, that addresses the relevant comments received from intervening parties during the review period for the Plan. The Plan under this condition, once approved, will supersede the Plan referenced in Part I, Item 1.	This plan

TABLE B.2 CONCORDANCE TABLE WITH PROJECT CERTIFICATE TERMS AND CONDITIONS

No.	Condition	Section
21	The Proponent shall ensure that the scope of the Aquatic Effects Monitoring Plan (AEMP) includes, at a minimum:	
	a. monitoring of non-point sources of discharge, selection of appropriate reference sites, measures to ensure the collection of adequate baseline data and the mechanisms proposed to monitor and treat runoff, and sample sediments; and	4.2
	b. measures for dustfall monitoring designed as follows: i. To establish a pre-trucking baseline and collect data during Project operation for comparison; ii. To facilitate comparison with existing guidelines and potentially with thresholds to be established using studies of Arctic char egg survival and/or other studies recommended by the Terrestrial Environment Working Group (TEWG); and, iii. To assess the seasonal deposition (rates, quantities) and chemical composition of dust entering aquatic systems along representative distance transects at right angles to the Tote Road and radiating outward from Milne Port and the Mine Site.	3.5 (reference to dustfall monitoring); 4.3.1 and Appendix F (related lake sedimentation monitoring program); Air Quality and Noise Abatement Management Plan (dustfall monitoring program)