Baffinland Iron Mines Corporation

Surface Water and Aquatic Ecosystem Management Plan

BAF-PH1-830-P16-0026

Rev 6

Prepared By: Kendra Button
Department: Environment
Title: Environmental Coordinator
Date: April 29, 2020
Signature:

Approved By: Brian Marshall
Department: Operations
Title: General Manager
Date: April 29, 2020
Signature:

DOCUMENT REVISION RECORD*

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
3/17/2016	4	AV	JM	In support of the 2016 Work Plan
3/31/2019	5	AV	CM	Document issued for use.
4/29/2020	6	KB	BM	Document issued for use.

*For revisions prior to Rev. 4, refer to previous revisions of the Plan.

Item No.	Description of Change	Relevant Section
1	Restructured document to organize as per Baffinland's Management Plan structure.	Entire Document
2	Added responsibilities for erosion and sediment controls.	Section 4 (Previously 8) Roles & Responsibilities
3	Condensed section.	Section 4 (Previously 5) Regional Landscape
4	Additions to mitigation measures, added snow stockpile monitoring and fish protection measures during construction.	Section 6 (Previously 4) Mitigation Measures
5	Added landfill monitoring, dust suppressant details, landfarm management details and restructured to eliminate text duplication that was applicable to both Milne and Mary.	Section 7 (Previously 6) Surface Water Management
6	Added pit water management details.	Section 8 (Previously 7) Surface Water Management – Mining Operations
7	Added snow stockpile monitoring, trigger action response plan details, and updated monitoring site coordinates.	Section 9 (Monitoring)
8	Added snow stockpile monitoring.	Section 10.2 (Reporting)
9	References Section Added.	Section 11

TABLE OF CONTENTS

LIST OF TABLES

LISTS OF APPENDICES

1 INTRODUCTION

As required by Baffinland Iron Mines Corporation's (Baffinland) Type 'A' Water Licence No. 2AM-MRY1325 – Amendment No. 1 (Type 'A' Water Licence), issued by the Nunavut Water Board (NWB), the Surface Water and Aquatic Ecosystem Management Plan (SWAEMP) has been updated to reflect current operations at the Mary River Project (the Project). This Plan is a living document and will be revised, as required, based on future work scope modifications and associated approvals and in accordance with Baffinland's Type 'A' Water Licence, Commercial Lease – Q13C301 (Commercial Lease) between Baffinland and the QIA, the Project Certificate No. 005 (Project Certificate) issued by the Nunavut Impact Review Board (NIRB) and any subsequent requirements which may be issued for the Project.

1.1 PURPOSE

The purpose of this Plan is to outline how potential Project impacts on the quality and quantity of surrounding waters will be managed throughout the lifecycle of the Project. Management processes and procedures include practices implemented at the Project to limit the potential for adverse impacts to receiving waters, aquatic ecosystems, fish and fish habitat. This document details the systems in place to mitigate and manage drainage and runoff at Project facilities, address non-point discharges to surface waters, and assess those discharges in terms of water quality relative to their receiving water systems.

This document identifies the management strategies and general mitigation measures related to controlling sedimentation and erosion effects on aquatic ecosystems. Applicable monitoring programs and roles and responsibilities are identified.

1.2 REGULATORY FRAMEWORK

This Plan outlines the Project's policies and procedures to ensure compliance with the relevant terms, conditions and regulations outlined in the following regulatory instruments:

- Project Certificate No. 005,
- Type 'A' Water Licence (2AM-MRY1325),
- Type 'B' Water Licence (2BE-MRY1421),
- Commercial Lease, and,
- Milne Inlet Tote Road (Tote Road) Fisheries Authorization No. NU-06-0084 (DFO, 2007), and subsequent amendments for Project fish bearing water crossings.

Project activities are monitored for compliance with the regulatory instruments listed above. Where it is determined that Project activities fail to comply with the regulatory requirements, further assessment shall be completed to modify activities such that compliance is achieved or mitigation methods shall be implemented.

1.3 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 following Environmental Management and Monitoring Plans for the Project.

- Environmental Protection Plan (EPP) (BAF-PH1-830-P16-0008);
- Fresh Water Supply, Sewage and Wastewater Management Plan (FWSSWMP) (BAF-PH1-830-P16-0010);
- Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039);
- Roads Management Plan (BAF-PH1-830-P16-0023); and,
- Snow Management Plan (BAF-PH1-300-P16-0002).

2 BAFFINLAND'S CORPORATE POLICIES

Baffinland's Sustainable Development Policy (BAF-PH1-800-POL-0002) 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. The Sustainable Development Policy is provided in Appendix A.

Baffinland's Health, Safety and Environment Policy (BAF-PH1-800-POL-0001) is the company's commitment to achieve a safe, health and environmentally responsible workplace. The policy is provided in Appendix A.

All employees and contractors are expected to comply with the contents of both above mentioned policies.

3 TARGETED VALUED ECOSYSTEM COMPONENTS

Baffinland has identified the following targeted valued ecosystem components (VECs) to serve as indicators subject to this Plan:

- Water quantity;
- Surface water quality;
- Aquatic ecosystems;
- Fish; and,
- Fish habitat.

Water is considered a VEC and the protection of regional water quality and quantity is critical to the residents of Baffin Island. Long-term downstream users (i.e., local residents) have not been identified; however, there is potential for incidental water-use by hunters and visitors on adjacent lands. Potential effects to fish and fish habitat from either water withdrawal exceedances or compromised water quality and/or quantity have been identified.

Project activities will influence surface water through the following pathways:

- Water intakes required for potable water in camps, dust suppression and construction;
- Tote Road water crossings (i.e. culverts, bridges, etc.) and road maintenance;
- Sewage treatment and disposal at Milne Port and the Mary River Mine Site (Mine Site);
- Runoff from waste rock and ore stockpiles;
- Potential surface water runoff generated from developed Project areas; and,
- General site runoff from land disturbances.

A complete matrix of Project interaction with identified VECs is provided in the Project's Amended Final Environmental Impact Statement (FEIS), Volume 7 – *Freshwater Aquatic Environment*.

4 ROLES AND RESPONSIBILITIES

Responsibilities for the management and monitoring of the surface water flows and effluents at the Project are as follows.

4.1.1 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.

4.1.2 Mine Operations Manager / Superintendent

- Reports to the COO / General Manager
- Provides oversight for all Deposit No. 1 mining operations, including the operation, construction and maintenance of surface water management infrastructure at Deposit No. 1 mining areas, Waste Rock Facility and along the Mine Haul Road, including culverts, ditches, contact water, surface water management ponds and associated water treatment systems.
- In communication with the Environment Department, develop response plans to possible erosion and sediment issues from freshet and severe weather periods.

4.1.3 Crushing Manager / Superintendent

- Reports to the COO / General Manager
- Provides oversight for all ore crushing operations, including the operation, construction and maintenance of surface water management infrastructure at the Mine Site Crusher Facility, including culverts, ditches, surface water management ponds and any associated water treatment systems.
- In communication with the Environment Department, develop response plans to possible erosion and sediment issues from freshet and severe weather periods.

4.1.4 Site Services Manager / Superintendent

- Reports to the COO / General Manager
- Provides oversight for all Site Services operations, including the operation, construction and maintenance of surface water management infrastructure associated with Project service roads at the Mine Site and Milne Port.
- Responsible for managing water retained in containment areas associated with Project bulk fuel facilities and hazardous materials/waste storage areas, including landfarm and landfill facilities.
- In communication with the Environment Department, develop response plans to possible erosion and sediment issues from freshet and severe weather periods.

4.1.5 Road Maintenance Manager / Superintendent

- Reports to the COO / General Manager
- Provides oversight for all Road Maintenance operations, including the operation, construction and maintenance of surface water management infrastructure for the Tote Road that runs between Milne Port and the Mine Site, including culverts, bridges, ditches and swales.
- In communication with the Environment Department, develop response plans to possible erosion and sediment issues from freshet and severe weather periods.

4.1.6 Environment (Sustainable Development) Department

- Support the management of the Project's surface water management infrastructure by advising operational departments and obtaining the appropriate regulatory approvals for necessary changes and modifications.
- Advise operational departments on the implementation of the appropriate controls to manage surface water flows and effluents at the Project, including the implementation of sedimentation and erosion controls outlined in Section 5 of this Plan.
- The on-site Environment Department will have the lead role in conducting and managing all on-site aquatic effects monitoring programs at the Project, discussed in Section 4 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 surface water management and monitoring.

4.1.7 All Departmental Supervisors

- Report to their respective Departmental Manager / Superintendent
- Responsible for reading and understanding applicable sections of this Plan and directing departmental personnel on the appropriate mitigation measures and strategies for managing surface water flows and effluents in their Project area.
- Report any visual observations, or reports, of erosion and sediment issues to the Environment Department.
- Assist in implementing appropriate erosion and sediment control measures.

4.1.8 All Project Personnel

- Responsible to comply with the requirements of this Plan in the management of surface water flows and effluents at the Project.
- Report any visual observations of erosion and sediment issues to their respective supervisors.
- Assist in implementing appropriate erosion and sediment control measures.

5 REGIONAL LANDSCAPE, CLIMATE AND HYDROLOGY

The Qikiqtani Region of Baffin Island is characterized by long cold winters and short cool summers, with continuous daylight from approximately May to August, and continuous darkness from November through February.

5.1 REGIONAL LANDSCAPE

The Project lies within the zone of continuous permafrost, with an active layer thickness of up to two metres and a permafrost depth that may be as much as 700 m deep, based on extrapolation from temperature gradients measured in a 400 m-deep thermistor-instrumented drill hole located on site. The presence of permafrost greatly increases ground stability at depth but at surface it can affect the rates of soil erosion through the formation of ice wedges and patterned ground, pingos and palsas, massive ground ice, thermokarst, and mass wasting (i.e., solifluction).

5.2 CLIMATE

Regional data near the Project indicate a mean annual temperature of approximately -15°ᶜ. The long length of the sub-zero degree temperatures in this region results in a very short runoff period that typically occurs from June through September, but may extend to late October in systems where large lakes are present. The frigid temperatures also result in very low precipitation values for northern Baffin Island due to the combined effect of the low moisture carrying capacity of cold air and the scarcity of liquid water throughout much of the year. According to Natural Resources Canada, the mean annual total precipitation ranges from 200 to 400 mm in the Project area, classifying it as semi-arid.

5.3 REGIONAL HYDROLOGY

The extreme temperatures of the region, combined with permafrost ground conditions, result in a short period of runoff that typically occurs from June to September, extending into October in watersheds with significant lake surface areas. All rivers and creeks, with perhaps the exception of the very largest systems are frozen solid to the bottom during the winter months. The peak runoff period is quite short and the volume of the annual hydrograph is low, relative to the rest of Canada, due to the region's very low average annual precipitation However, the proportion of annual precipitation that is realized as runoff is very high, due to low temperatures (low evaporation) and the permafrost ground conditions (low infiltration) and minimal vegetative cover (low evapotranspiration). The groundwater flow is restricted to the upper one to two metres within the summer active layer.

Peak instantaneous flows are significant due to frozen ground conditions and the lack of tall vegetation to provide subsurface root systems. This in turn produces very rapid basin runoff response. In larger watersheds, peak instantaneous flows are typically produced by snowmelt during the freshet, but in smaller watersheds (less than a few hundred square kilometres) rainfall, or rain on snow may produce the

largest events and may occur at any time during the non-freeze period. Flood water levels in the smaller watersheds typically rise and fall very quickly with run-off response.

Baffinland continues to conduct hydrology monitoring at the Project, as required by the Project Certificate (conditions regarding the AEMP) and Type 'A' Water Licence. Details on the ongoing hydrology monitoring conducted at the Project is provided in Section 9 of this Plan.

5.4 Implementing Erosion and Sediment Control Measures in the Arctic

A greater level of understanding of the unique site conditions that influence the selection of appropriate sediment and erosion control measures has been achieved through the ongoing construction and operation of the Project. Influences from climate, topography, and limited vegetation combine to produce short-term, high intensity discharges throughout May, June and July. Due to the impeded vegetation growth rate, sediment and erosion control techniques that involve vegetative covers (i.e., hydro seeding and the use of erosion control blankets) have been dismissed as potential mitigation options. Furthermore, straw bales are not permitted in the Arctic due to the possibility of introducing foreign species.

6 MITIGATION MEASURES

6.1 General Erosion and Sedimentation Mitigation Measures

Ongoing construction and operations at the Project have the potential for soil disturbance and water diversions requiring sediment and erosion control planning to manage the discharge of site contact water. Best management practices, including preventative measures, shall be implemented throughout the lifecycle of the Project. The following section outlines the general measures used to mitigate potential environmental impacts arising from the storage and discharge of site contact water.

Monitoring of Project stream and river crossings, lakes and ponds adjacent to construction and operational areas will be completed during the life of the Project as outlined in Section 9 of this Plan. Subject to site-specific conditions, a variety of civil design structures or additional controls may be required to prevent localized erosion.

The deposition of debris or sediment into or onto any water body during the construction of access roads, site laydown pads and areas of other earthworks is prohibited. To prevent sedimentation into adjacent water bodies, stockpiling of debris must take place at a distance greater than 31 m from the ordinary high-water mark of nearby water bodies. In addition, removal of material below the ordinary high-water mark of any water body is prohibited, unless otherwise approved by the NWB.

All Project infrastructure and activities that have the potential to influence any watercourse (i.e., culvert modifications, diversion of watercourses, modifications to the Milne Inlet Tote Road, and other areas of the Project site), will be designed and constructed in a manner that is consistent with the approach presented in the FEIS and the conditions of existing permits and authorizations. Construction and operational activities are prohibited from preventing and/or restricting the movement of water in identified fish bearing streams and rivers.

Prior to the development of new water related infrastructure and/or facilities, Baffinland will conduct an assessment to ensure sensitive landforms are not negatively impacted (i.e., ice-rich soils or easily erodible soil). Where it is determined that the infrastructure and/or facility developments will not negatively impact sensitive landforms, Baffinland will continue to ensure that all regulatory requirements are met.

6.1.1 SURFACE MATERIAL MANAGEMENT

The removal of surface material in Arctic regions can cause the underlying permafrost to melt and result in the pooling of water, destabilization of landforms and sedimentation and erosion issues. To mitigate possible permafrost degradation from surface material removal, the following measures will be implemented throughout the Project.

- Removal of surface material should be avoided where possible to reduce permafrost degradation and will occur only at approved locations;

- Areas will be graded by filling in low areas rather than cutting into high areas, where feasible;
- Pooling water will be diverted from low-lying areas through constructed drainages or pumping.
- The grade of low-lying areas with pooling water resulting from the removal of surface material will be restored with material from other construction projects when possible.
- Erosion control will be evaluated for areas where removal of surface material is required; and,
- Use of insulating material or erosion control material, such as concrete fabric or riprap, will be utilized to reduce erosion and potential permafrost degradation, as required.
- Fill material placed below 31m of the high water level mark, where specifically authorized, will be either erosion resistant or protected from erosion and only clean fill will be used.
- No waste material resulting from work activities will be left in a manner such that it can enter the water (e.g., by being left on the ice).

Additional guidance for managing surface material and mitigating permafrost degradation during construction and operations at the Project are provided in Baffinland's EPP (BAF-PH1-830-P16-0008) and Borrow Pit and Quarry Management Plan (BAF-PH1-830-P16-0004).

6.2 Erosion and Sedimentation Controls

Table 6-1 outlines the sedimentation and erosion controls used at the Project. These controls may be used alone or in combination to achieve a more effective control.

Table 6-1 – Sediment and Erosion Controls

Armouring	
Description	Used as a barrier between water flow and materials that are susceptible to erosion. Quarry rock and/or naturally occurring granular borrow material are used to protect underlying fine-grained material from scour and erosion.
Installation Locations	In areas of cuts and/or excavations and for installation of culverts, typically on exposed erodible slopes.
Substitute	Water diversion, berms, sumps and/or silt fencing may be used where armouring is not practical or where there is low risk of impacts to downstream receptors.
Benefits	Effective long term solution for preventing erosion and re-suspension of susceptible fine grained materials.
Riprap	
Description	A rock lining that can be installed along a ground surface or structure to prevent erosion of the underlying material and/or sediments.
Installation Locations	Along road and/or stream embankments and along the upstream and downstream ends of culverts. May also be installed at locations where existing flows may cause erosion of the present surface materials specifically where flows may become concentrated.
Performance Issues/Limitations	Potential limited material in various sizes available.

Benefits	Materials are local and are effective at protecting embankments from erosion. They may also be installed over non-woven geotextile (see below) to provide additional protection.
Gabion Baskets	
Description	Metal wire baskets filled with rip rap are used for slope stabilization by armoring the existing bank where erosion is weakening the slope.
Installation Locations	Eroding slopes and embankments that require stabilization to stop erosion.
Performance Issues/Limitations	Requires a lot of manpower, material and equipment to fill and install each gabion basket.
Benefits	Gabions can withstand strong erosion forces, providing significant stabilization to eroding slopes.
Concrete Fabric	
Description	Flexible concrete impregnated fabric installed along a ground surface or structure to prevent erosion of the underlying material and/or sediments. Rolled out at desired location and sprayed with water to set impregnated concrete.
Installation Locations	Installed in swales, ditches and areas with concentrated flows as well as along embankments and slopes.
Substitute	Riprap coupled with geotextile
Performance Issues/Limitations	Expensive. Large installations require heavy equipment for installation. Installation issues in colder temperatures.
Benefits	Permanent solution to control erosion and sedimentation. Quick installation with concrete achieving 80% strength within 24 hours. No mixing plant or equipment required.
Geotextile – Woven and Non-Woven	
Description	Low erodible lining material installed for temporary erosion control.
Installation Locations	Along stream embankments, water channels and/or ditches.
Performance Issues/Limitations	Required to be securely anchored and properly keyed in in order to be effective. Installed material is difficult to remove when it is no longer required.
Benefits	Easy to install and an effective erosion barrier that can be installed along a variety of embankments.
Polyacrylamides/Flocculants	
Description	Sediment and Turbidity Control Applicator Logs are solid form flocculants that are placed directly in the impacted watercourse to efficiently bind to particulate matter causing it to settle out providing clarification. Flocculants can also be used as an additive to surface water management ponds or sumps (temporary or permanent).
Installation Locations	Along stream embankments or directly in impacted channels and/or ditches. Product can also be used to settle out suspended sediment in dedicated/temporary surface water management ponds/sumps as required.
Performance Issues	Performance issues in colder temperatures.
Benefits	Cost effective.
Silt Fence	
Description	Geotextile or fabric barrier that impedes the flow of surface water which potentially may cause suspended solids to be deposited upstream of installation. Typically supported using rebar (secured to the fabric and wooden stake) and may be placed using methods such as digging a trench and backfilling material to ensure stability. Attempts are made to install silt fence in lines of equal elevation (along contour lines) to prevent channelling or focusing of the runoff.

	Standards for installation including trench excavation, insertion of fabric, and backfilling and compacting. Found on the Ontario Provincial Standard Drawing (OPSD) 219.110 Light Duty Silt Fence Barrier and 219.130 - Heavy Duty Silt Fence Barrier.
Installation Locations	Used in areas where surface water could potentially come into contact with disturbed sites causing elevated suspended solids. Typical installation locations are: • Downstream of drilling activities • Along roads where surface runoff is expected • Surrounding stockpiles of material or drill cuttings
Performance Issues	Not permeable enough to be placed in streams with greater than low flow. Very difficult to anchor the base against flow. Difficult to install rebar and dig trenches due to frozen ground conditions, weight and susceptibility to wind.
Substitutes	Coir logs, spring berms, sand bags.
Benefits	Effective in shoreline construction work where they are used to surround the installation of culvert crossings installed during open-water conditions. Can be used as diversion barriers around erosion prone areas and as flow impediment. Can be installed in a diagonal, staggered formation to create meanders and slow flow in higher velocity waters that would otherwise flow over a silt fence if installed across the flow.
Diversion/Collection Channel or Berm	
Description	Diversion/collection channels or berms are used to locally direct surface water runoff. Constructed using suitable materials to divert the surface water without causing erosion or suspension of additional sediment. Additionally, collection channels or berms may be constructed to collect runoff emerging from an area of soil disturbance. Also, used to ensure runoff is directed to a constructed mitigation measure such as an in-ground sump.
Installation Locations	Used in locations where diversion and/or collection of surface water is required. Diversion structures are installed to prevent runoff from entering a site where the surface soil has been disturbed and would cause suspension of sediment. May be constructed to collect runoff emerging from an area of soil disturbance.
Performance Issues/ Limitations	Permeability of the berms may be too high depending on material size availability.
Substitute	Silt fences can be used as an alternative to constructing a channel or berm.
Benefits	Effective method to direct runoff to a constructed mitigation measure such as an in-ground sump.
Check Dams	
Description	Constructed to slow surface runoff flows and create pooling to allow for suspended sediment particles to settle out. Designed to allow water to slowly flow through or over the check dam.
Installation Locations	Across small valleys, natural depressions or ditches where there is surface runoff.
Performance Issues/ Limitations	Potential limited material available in the various sizes required. Requires maintenance to excavate sediment build-up on the upslope side.
Substitutes	Containment Berms coupled with pumping.
Benefits	Surface water flow directions are unaltered. Sediment has time to settle out before reaching the receiving environment.
Containment Berm	
Description	Constructed to establish a sump, basin or pond to contain or collect water. The sump could be used to contain discharge water to allow settling of sediment before discharge or to temporarily contain the water for re-circulation (i.e., drilling activities).

	Constructed using native soils or acceptable man-made products which are nominally compacted to provide strength for the structure. Berm heights are minimized (typically <1 m).
Installation Locations	Across small valleys or around natural depressions to augment the capacity of the berms.
Performance Issues	Care must be taken when constructing berms to ensure the base is on a solid foundation. Pumping required for a controlled discharge of the berm. Permeability of the berm may be too high depending on material size availability .
Substitutes	In-ground sumps or portable containment sumps or tanks can be used in place of a containment berm.
Benefits	Effective structure in forming sumps, basins or ponds to contain water and settle out suspended solids prior to discharge or reuse.
In-Ground Sump	
Description	Constructed to establish a sump, basin or pond to contain or collect water, similar to the containment berm. Constructed by excavating a depression into soil to provide water containment.
Installation Locations	Used in areas where excavation of soil is possible and other control measures are impractical or ineffective.
Performance issues/ Limitations	Requires regrading of the excavated area when the sump is no longer needed to restore natural drainage patterns.
Substitutes	Containment berms, or portable containment sumps or tanks can be used in place of an in-ground sump.
Benefits	Excavated material from the sump can be used to construct a containment berm surrounding the sump to augment the capacity of the sump.
Portable Containment Sump	
Description	Used to establish a sump to contain water from a source such as a drill rig. Where required, can be connected together in a series to provide additional containment or settling capacity if required. Collected sediment or drill cuttings from the portable containment sumps are removed from the sumps as necessary and disposed of in pit locations approved by Baffinland management and located at distances of at least 31 m from water bodies.
Installation Locations	Used in areas where containment berms or in-ground sumps are impractical such as steep topography or in areas where overburden is not readily available.
Substitutes	Containment berms or in-ground sumps are used in place of a portable containment sump.
Benefits	Requires minimal excavation or construction to provide a level base for the sump.
Geotubes	
Description	A woven tube of geosynthetic fabric into which water is pumped to filter out and remove suspended solids in impacted water. Water pumped into the tube diffuses through the geosynthetic fabric across the length of the tube. Popular water treatment option for dewatering projects.
Installation Locations	Installed downstream of a pump on ground that is not erosion prone to prevent erosion and the suspension of sediments downstream of geotube.
Performance issues/Limitations	Non-passive water treatment method. Requires active pumping. Effectiveness limited by a maximum influx/pumping rate. Limited by the geotube material pore size in comparison to targeted sediment particle size.
Substitutes	Containment berms, portable containment sumps or tanks and/or chemical treatment can be used in place of a geotube to settle out suspended solids.

Benefits	Easy to deploy, inexpensive compared to chemical treatment or water filtering options. Can also be used as a containment berm to augment the capacity of a sump or temporary surface water management pond.
Bag Filters	
Description	Water treatment method where bag filters installed in line during active pumping filter out suspended solids.
Installation Locations	Installed in the discharge line to filter out suspended solids before the water is released to the receiving environment.
Performance issues/Limitations	Ineffective once they become clogged with sediment and require regular replacement. Requires monitoring of inlet pressures to ensure filters are changed. Limited by the filter pore size in comparison to targeted sediment particle size.
Substitutes	Geotubes, containment berms and portable sumps.
Benefits	Suspended sediments are captured in the bag filter, enabling both sediment removal and easy disposal of the sediment.
Spring Berms	
Description	Made up of a loose spring/coil covered with a geosynthetic fabric for filtering turbid water and removing suspended sediments.
Installation Locations	Across small channels and/or shallow outlets of in-ground sumps or ponds.
Performance issues / Limitations	Limited by the berm material pore size in comparison to targeted sediment particle size.
Substitutes	Silt fences or containment berms can be used in place of a spring berm.
Benefits	Easy to deploy, low cost and effective when combined with other mitigation measures.
Coir Logs	
Description	Coir fibre rolls constructed from coconut husks for filtering turbid water and removing suspended sediments.
Installation Locations	Across small channels and/or shallow outlets of in-ground sumps or ponds.
Performance issues / Limitations	Ineffective once when they become clogged with sediment. Heavy when wet and full of sediment, impeding effective removal.
Substitutes	Silt fences, spring berms.
Benefits	Natural, biodegradable option for removing suspended sediments. Minimal resources required for installation.
Floating Silt Curtains	
Description	Floating panels/sections made of geosynthetic fabric used to contain and limit the spread of turbid water in low flow environments (i.e. lakes, marine environment). Suspended vertically in the water column using floats and weights on the top and bottom of each section, respectively. Additional anchors used on shore to fix silt curtains in place.
Installation Locations	Installed in low flow environments such as stream/lake outfalls or in open water for large construction projects.
Performance issues/Limitations	Limited to low flow environments. Cannot be used to treat suspended solids in high flow environments (i.e. rivers, large streams). Effective deployment of multiple sections for large construction projects requires a significant level of knowledge, expertise, equipment and manpower.
Substitutes	None.
Benefits	Effective at containing turbid water/suspended solids in low flow/ open water settings. Able to connect multiple panels together for large scale construction projects (i.e.

	marine docks) or use single sections for small scale sedimentation control at stream/lake outfalls.
Molecords	
Description	Strips of fabric made of chenille fibers engineered to ensure rapid adhesion to particulates and suspended solids in turbid water. Turbid water streams are directed through draped sections of partially submerged molecords to remove suspended solids and particulates in impacted water.
Installation Locations	Used in multiple applications. Typical setups involve pumping turbid water through a series of molecords draped over a holding tank to remove particulates in turbid water.
Performance issues/Limitations	Limited effective lifespan. Must be replaced regularly based on particulate levels in impacted water streams requiring treatment.
Substitutes	Chemical treatment (i.e. flocculants)
Benefits	Effective alternative to chemical treatment. Effective at removing particulates without changing water chemistry. Easy to deploy.

6.3 Erosion and Sedimentation Mitigation Measures at Water Crossings

Culverts that are installed along water crossings shall meet the following criteria:

- Install culverts at the same slope as the existing stream, where feasible;
- Minimize culvert lengths;
- Culverts with lengths that exceed 50 m may be considered barriers to fish passage due to darkness. Examine and consider methods to provide light inside culverts, where applicable;
- Compare culvert velocities to the velocity in the existing watercourse to determine fish passage potential. This information can be used to reassess design velocities under proposed conditions with the culvert installed; and
- With the channelization of flows and conveyance in culverts, the velocity of the flows may increase. This may be mitigated by placing rocks and boulders or manufactured culvert baffles inside the culverts (stream replication) to provide greater friction, thereby reducing velocities and increasing the flow depth and to provide resting locations for fish. Boulders may be bolted into place.

Table 6-2 outlines the mitigation measures implemented at the Project to control sedimentation and erosion at Project water crossings.

Table 6-2 – Control Measures at Water Crossings

Pumping	
Description	Pumps are used to transfer water from one side of the road/structure to another.
Installation Locations	At crossings where culverts are not installed, incorrectly installed, blocked, or not allowing sufficient flow. Pumping is required prior to culvert installation for dewatering. Pumps may also be used as a temporary solution during freshet or prior to culvert installation. In addition, siphons can be used as an alternative, but require a pump to prime the system and sufficient slop between upstream and downstream locations.
Performance Issues/Limitations	Ineffective during high flows. Erosion control measures are required at pump discharge points. The associated risk of fuel spills requires secondary containment. Temporary solution requiring additional resources. Additional considerations and mitigation measures (e.g. fish intake screens) are required in conjunction with pumping for fish bearing watercourses.
Benefits	Effective temporary solution to lower water levels in places where water levels are high or prior to culvert installation. Also, useful at low flow locations where culverts have not been installed.
Culvert	
Description	Pipes installed through embankments to allow the passage of water while maintaining access over the site. The size and/or number of culverts required for installation is determined by a hydraulic design study, conducted to assess suitable hydraulic design criteria to avoid flooding or washouts. Culvert flow capacities are assigned using hydraulic analysis methods assuming an appropriate return period with allowance for ice accumulation. Permitting process may be required for watercourses where authorizations are required depending upon watercourse classifications.
Installation Locations	At points where roads intersect streams, rivers or seasonal drainages (freshet) or at locations where there is potential for water to flow over roads.
Performance Issues/Limitations	Potential for siltation during installation. Requires labour, equipment and materials (compacted backfill) for proper installation. Concentration of flows cause potential for erosion at downstream discharge points. Increased velocities may prevent fish passage upstream through the culvert. Culverts may become perched, requiring installation of fish ladders. Clearing of snow and/or ice prior to spring freshet is required to minimize the potential for blockages.
Benefits	High flow capacities can be achieved depending on culvert selection. Culverts also permit fish passage under roads where crossings have been identified as fish habitat.
French Drain	
Description	A ditch or channel filled with rock to provide a flow path for water. The rock material can be covered with a non-woven geotextile to prevent the ingress of finer material which could reduce the permeability of the drain.
Installation Locations	At points where roads intersect streams/drainages and where fish passage is not a consideration. May be used as an alternative for a culvert if culverts are not available.
Performance Issues/Limitations	Ice blockage potential in French drains has not been adequately assessed. Long-term performance has not been assessed.
Benefits	Constructed of natural local and/or local materials.
Bridge	

Description	Bridges are required for the crossing of larger streams or rivers where culvert crossings are not feasible. The installation of bridges requires hydraulic design studies undertaken to evaluate suitable hydraulic design criteria to avoid flooding or any unexpected damage to the adjacent ground.
Installation Locations	Bridge locations are assessed using a river hydraulics analysis assuming an appropriate return period with an allowance for ice accumulation.
Performance Issues/ Limitations	Permitting process may be required for watercourses where authorizations are required depending upon watercourse classifications. Possibility for sediment on the bridges from vehicle crossings to build up and release into the water, requiring routing maintenance to ensure the platform prevents this release.
Arch Culvert	
Description	A culvert consisting of an arch with an open bottom such that native streambed is exposed. Arch culverts typically rest on foundations constructed on either side of the watercourse.
Installation Locations	Typically installed at locations where hydraulic efficiency, fish habitat, and/or fish passage are considered important.
Performance Issues/Limitations	Reduced potential for siltation during installation as water diversion structures are typically not needed. Requires labour, equipment and materials (compacted backfill) for proper installation. Clearing of snow and/or ice prior to spring freshet is required to minimize the potential for blockages.
Benefits	Maintains the original stream width and streambed materials and has increased hydraulic efficiency.
Armouring	
Description	Used as a barrier between water flow and roadside material. Clean quarry rock and/or clean naturally occurring granular borrow material are used to protect underlying fine-grained material from scour and erosion around crossings.
Installation Locations	Around culvert inlet/ outlets, typically on exposed erodible slopes.
Benefits	Effective long-term solution for preventing erosion and re-suspension of susceptible fine grained materials from runoff into crossings.
Temporary Steel Pipes	
Description	Temporary steel pipes may be installed to limit water interaction with site infrastructure and roads during the freshet period and severe weather events.
Benefits	This is an effective measure to limit sediment and erosion issues short term.

6.4 Mitigation Measures for Fish and Fish Habitat

The following subsections discuss the mitigation measures implemented at the Project to protect fish and fish habitat.

6.4.1 Freshet Mitigation

Extreme flows occurring during freshet can result in significant erosion and damage to water crossing structures. Operational protocols and plans, including the Snow Management Plan (BAF-PH1-300-P16-0002), Roads Management Plan (BAF-PH1-830-P16-0023) and the Sedimentation Mitigation Action Plan (Golder, 2016), have been developed to manage freshet's high flows and mitigate freshet's potential

negative impacts on surface water quality and associated infrastructure. Project protocols and plans include the following measures:

- Physically marking fish-bearing water crossings so that they can be easily identified in the spring, prior to snow/ice melt;
- Clearing snow from roads adjacent to water crossings and stockpiling snow in approved locations as outlined in Section 3 of the Snow Management Plan (BAF-PH1-300-P16-0002);
- Monitoring snow stockpiles during freshet as outlined in Section 5 of the Snow Management Plan (BAF-PH1-300-P16-0002);
- Monitoring culverts for clearance of snow and ice prior to the onset of freshet;
- Re-establishing flows by removing snow and ice blockages through excavation and steaming;
- Implementing the appropriate erosion and sedimentation mitigation measures, as outlined in Section 6.2 and 6.3 of this Plan;
- Ensuring sufficient fish migration passage through routine monitoring; and
- Monitoring Project water crossings and completing the appropriate repairs/modifications.

6.4.2 Fish Protection

Fish and fish habitat are present throughout streams and water bodies near Project infrastructure and have been identified as an important VEC for the Project. As such, several operational protocols and plans, including the Snow Management Plan (BAF-PH1-300-P16-0002), Dust Mitigation Action Plan (Golder, 2016) and Sedimentation Mitigation Action Plan (Golder, 2016), have been developed to prevent and mitigate negative impacts on fish and fish habitat at the Project. Project protocols and plans include the following measures:

- Construction of rocky ramps at locations where scour and erosion at culvert outlets are problematic;
- Monitoring Project water crossings and completing the appropriate repairs/modifications to improve fish passage;
- Adhering to the Fisheries and Oceans Canada (DFO) guidance "Guidelines for Use of Explosives In or Near Canadian Fisheries Waters, 1998" for work in or near fish bearing water, where feasible;[1]
- Using the silt curtains to prevent the dispersion of sediments during work activities in/near marine waters (dredging, piling, backfilling) and/or freshwater lakes;
- Ensuring compliance for Project activities with the No-Net-Loss principle (DFO, 2001) to prevent or mitigate direct or indirect fish and fish habitat losses;

[1] At locations where compliance with the DFO guidelines cannot be achieved, consultation with DFO will take place prior to blasting. Consultations with DFO and the QIA may be required to identify Project specific thresholds for blasting that would exceed the requirements of DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.

- Continued implementation of the Dust Mitigation Action Plan (Golder, 2016), Sedimentation Mitigation Action Plan (Golder, 2016) and Tote Road Earthworks Execution Plan (TREEP; Golder, 2017;) to address surface water drainage and water quality concerns at Project sites and mitigate potential impacts to fish and fish habitat;
- Implementing the appropriate erosion and sedimentation mitigation measures, as outlined in Section 6.2 and 6.3 of this Plan;
- Efforts will be made to not perform-instream work during the restricted activity window, June 30 - September 1, where there is water flowing and spawning habitat is present or at sites where fall spawning movements are occurring to avoid effects on Arctic Char spawning and egg incubation. The DFO will be consulted if instream work is required for applicable in-water work guidelines;
- If dewatering is required, salvage fish prior to dewatering and release to adjacent surface waters; if water is pumped from within a cofferdam prior to fish salvage, screens meeting criteria set out by DFO will be used;
- Design mitigation for potential effects of increased flows on fish habitat include channel widening, regrading, construction of habitat features (in fish bearing streams), and channel stabilization;
- All water intake hoses shall be equipped with a screen of an appropriate mesh size (as approved by the DFO) to ensure that fish are not entrained. Additionally, operators will ensure the water intake hoses withdraw water at such a rate that fish do not become impinged on the screen. Additional guidance regarding fish screens on water intakes is provided below; and,
- In developing Project quarries, efforts are made to ensure that a minimum 100 m naturally-vegetated buffer between the high-water mark of any fish-bearing water bodies and any permanent quarries with potential for acid rock drainage or metal leaching is maintained.

6.4.3 Operating Equipment In and Near Water

Surface water runoff from areas of intense vehicular activity is susceptible to contamination from minor spills and/or leakage of machinery and equipment. Additionally, machinery and equipment can cause inadvertent sedimentation and/or erosion following water body crossings. As such, the following mitigation measures will be followed to minimize potential impacts:

- Machinery will arrive at site in a clean condition and be maintained free of fluid leaks, invasive species and noxious weeds;
- Erosion and sediment control measures will be implemented prior to the start of any construction and maintained until all disturbed ground has been permanently stabilized;
- Low vegetative cover within 100 metres of a waterbody will be preserved unless effective erosion and sediment control measure are in place to protect water quality;
- Measures for managing water flowing onto the site, as well as water being pumped/diverted from the site, will be implemented such that sediment is filtered out prior to the water entering the waterbody (e.g., by discharging water to a vegetated area);

- No waste material resulting from work activities will be left in a manner such that it can enter the water;
- Machinery will be refuelled and serviced, and fuel and other materials will be stored, in such a way as to prevent any deleterious substances from entering the water. Such will occur at least 31 m from the high water mark; and,
- Limit fording of the watercourses by machinery to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, a temporary crossing structure will be constructed.
- Temporary ice crossings used in the winter season will have all sediment and impacted snow removed from the crossing prior to spring freshet, and the surface of the ice scarified to promote breakup.

7 SURFACE WATER MANAGEMENT

The following subsections describe how surface water runoff is managed at Milne Port, the Mine Site, and along the Tote Road, with the exception of mining operations. This section describes general surface water management for infrastructure not directly associated with the mining operations such as access roads, waste management facilities, laydowns and accommodation complexes. Refer to Section 8 of this Plan for information on the surface water management strategies associated with Deposit No. 1 mining operations.

Water balance and general site drainage/monitoring figures for the Project's Milne Port and Mine Site have been developed and are presented in Appendices A and B, respectively.

7.1 MILNE PORT AND MINE SITE

Key activities at Milne Port focus on managing ore transported to the Port from the Mine Site and materials and equipment received annually by conventional sealifts. During the open-water season (July – October), stockpiled ore is loaded onto ore carrier vessels for shipment to international markets while materials and equipment received by sealift vessels are unloaded using barges. Equipment and materials received from sealift vessels are placed in designated laydowns at Milne Port or transported overland by trucks to the Mine Site via the Tote Road. The Mine Site is located approximately 100 km inland from Milne Port. Main activities at the Mine Site include the management of the Project aerodrome and the mining, crushing and hauling of ore from the Nuluujaak Pit at Deposit No. 1.

7.1.1 IMPACTS ON SURFACE WATER

Surface water runoff from areas of intense vehicular activity is susceptible to contamination from minor spills and/or leakage of machinery and equipment. Mitigation measures identified in Section 5 of this Plan will be implemented at these sites to divert non-contaminated surface runoff away from these areas and minimize the potential for contamination. Surface water suspected to be impacted by hydrocarbons will be addressed using spill response absorbents and/or by transporting impacted surface water to containment areas, such as the Milne Port Landfarm Facility (refer to Section 7.1.2) or the Mine Site Hazardous Materials Containment Area 7 (MS-HWB-7) for temporary storage and subsequent treatment and discharge using the Project's mobile OWTS.

To minimize impacts on surface drainage and water quality, the Project footprint (i.e. laydowns, roads, quarries) is required to be constructed at least 31 m from the ordinary high-water mark of any water body unless otherwise approved by the NWB.

Storage of hazardous materials (i.e. fuel and other hazardous materials) are contained within approved impermeable containment areas (lined with geomembranes). As required by the Type 'A' Water Licence, water within containment areas (i.e. hazardous materials containment, surface water management ponds, etc.) will be sampled and demonstrated to be in compliance with the relevant water quality discharge criteria prior to being discharged to the receiving environment.

7.1.2 Milne Port Landfarm Facility

The Milne Port Landfarm Facility (Landfarm Facility) consists of two geomembrane lined containment cells. The larger west cell is used as a landfarm for the biotreatment of soils contaminated by hydrocarbons from spills during the remediation season, or backhauled as required. The smaller east cell is used to contain hydrocarbon contaminated snow generated during winter operations. The east cell is also used as a repository for other sources of oily water at Milne Port and provides a practical location where oily water can be effectively treated at Milne Port using the Project's mobile Oily Water Treatment System (OWTS), or backhauled as required. As required by the Type 'A' Water Licence, hydrocarbon contaminated water contained with the Landfarm Facility is treated if necessary, sampled and demonstrated to be in compliance with relevant water quality discharge criteria prior to discharge. To prevent erosion and associated sedimentation concerns from such discharges, the appropriate erosion and sedimentation controls are installed (i.e. energy dissipaters, silt fences) at and downstream of the discharge outfall.

Mitigation measures for the landfarm are described in the Landfarm Operation Maintenance and Monitoring Manual (BAF-PH1-320-T07-0005).

7.1.3 Milne Port Ore Stockpile Facility

The Milne Port Ore Stockpile Facility (Ore Stockpile Facility) is equipped with surface water management ponds to manage and monitor runoff retained within its footprint. Surface water runoff is directed to the surface water management ponds by a network of ditches that run along the Ore Stockpile Facility's perimeter. Additional surface water management ponds and associated ditch infrastructure may be required to retain water from approved Ore Stockpile Facility expansions. Diversion berms may be constructed to direct water on the ore stockpile pad to the appropriate surface water management pond. The surface water management ponds have been designed to temporarily retain the Ore Stockpile Facility's surface water runoff and allow for the settling of the runoff's sediment load prior to being discharged to the receiving environment (Milne Inlet). As required by the Type 'A' Water Licence, runoff retained in the surface water management ponds is sampled and demonstrated to be in compliance with relevant water quality discharge criteria prior to discharge.

7.1.4 Landfill Facility

The Mine Site Landfill Facility is located just south of the NE Basin of Sheardown Lake. Both facility's monitoring stations, MS-MRY-13A and MS-MRY-13B, are sampled monthly during the open water season and are situated on a small stream down gradient of the Landfill Facility. The small stream drains into the NE Basin of Sheardown Lake on its southern shoreline. All runoff and seepage from the Landfill Facilities at Monitoring Stations MS-MRY-13A, MS-MRY-13B, and SP-08 will not exceed the following Effluent quality limits listed in Table 7 of the Type 'A' Water License.

7.1.5 Surface Water Direction and Quantity

The general drainage/monitoring figures for Milne Port and Mine Site provided in Appendix B show the local drainage routes and their flow direction. Estimated surface water runoff quantities for catchment areas were outlined in a Knight Piésold report provided in the FEIS, Volume 7 – *Freshwater Aquatic Environment*.

7.1.6 Mitigation Measures

Mitigation measures will include periodic site inspections, as outlined in Baffinland's EPP (BAF-PH1-830-P16-0008), to ensure existing drainage routes are maintained and surface water infrastructure is operating as designed. Erosion and sedimentation controls as outlined in Sections 6.2 and 6.3 of this Plan will be utilized as required to address erosion and sedimentation concerns from construction and ongoing operations at the Milne Port and Mary River sites. Routine monitoring shall be completed to ensure compliance with applicable regulations and prescribed threshold values.

As shown in Appendix B, drainage structures have been installed to divert surface water runoff to specific points of discharge to facilitate monitoring of site contact water as required by the Type 'A' Water Licence.

7.2 Tote Road

The Tote Road is the primary transportation route between Milne Port and the Mine Site and is used daily to transport ore, equipment, material, fuel, and supplies between the Project sites.

7.2.1 Impacts on Surface Water

The requirement and selection of effective sedimentation and erosion controls to be employed at areas along the Tote Road will be subject to Project authorizations and applicable DFO guidance, and informed by in field monitoring and site experience. Water crossings have been designed and constructed to minimize the potential loss of fish habitat. Erosion and sedimentation controls for water crossings as outlined in Section 6.3 of this Plan will be utilized as required to address erosion and sedimentation from construction and ongoing operations of the Tote Road. Scheduled monitoring for fish, fish habitat and water quality at water crossings along the Tote Road is outlined Section 9 of this Plan.

Construction areas established along the Tote Road will be designed and prepared such that surface water runoff is effectively channelled/diverted to allow for water quality monitoring to ensure compliance with Part D, Item 15 of the Type 'A' Water Licence.

To minimize impacts on surface drainage and water quality, the Project footprint (i.e. laydowns, roads, quarries) is required to be constructed at least 31 m from the ordinary high-water mark of any water body unless otherwise approved by the NWB.

7.2.2 Mitigation Measures

Erosion and sedimentation controls as outlined in Sections 6.2 and 6.3 of this Plan will be utilized as required to address erosion and sedimentation concerns along the Tote Road.

The Road Management Plan (BAF-PH1-830-P16-0023) describes mitigation for managing dust along the Tote Road, including the application of water, calcium chloride, and other dust suppressant products as approved by the Government of Nunavut. Dust suppressants will be applied in accordance with applicable guidelines to minimize runoff into local watercourses.

The Tote Road Earthworks Execution Plan (TREEP) (Golder, 2017) was developed to address sedimentation concerns observed along the Tote Road by improving the road's surface water drainage infrastructure. Improvements outlined in the TREEP include culvert extensions, lining drainage ditches with riprap, improving road bed material and stabilizing road embankments. Improvements outlined in the TREEP along with the Issued-For-Construction drawings developed by Hatch for the Early Revenue Phase of the Project will continue to be implemented along the Tote Road as required by Project operations. Scheduled monitoring of water quality, water quantity and fish passage at water crossings along the Tote Road, as detailed in Section 9 of this Plan, will be used to inform and prioritize Tote Road maintenance activities and surface water drainage improvements.

8 SURFACE WATER MANAGEMENT – MINING OPERATIONS

Surface water management infrastructure required for mining operations continue to be developed to ensure compliance with applicable regulations. Where required, these structures will be maintained throughout the lifecycle of the Project. Open pit mine and waste rock stockpile management activities and accountabilities will progress over time to accommodate future development and changes, management reviews, incident investigations, regulatory changes or other Project related modifications.

8.1.1 Mitigation Measures

Erosion and sedimentation controls as outlined in Sections 6.2 and 6.3 of this Plan will be utilized as required to address erosion and sedimentation concerns from construction and ongoing operations associated with Mining Operations. Routine monitoring shall be completed to ensure compliance with applicable regulations and prescribed threshold values.

8.1.2 Deposit No. 1 Mining Facilities

The following facilities have been designed and have, or will be, constructed at the Mine Site to facilitate Deposit No. 1 mining operations at the Project:

- Open Pit
- Mine Haul Road;
- Run-of-Mine (ROM) Ore Stockpile Facility;
- Crusher Facility; and,
- Waste Rock Facility.

The surface water runoff associated with these facilities is directed to appropriate water management ponds where it is monitored and treated if required to ensure effluent meets applicable water quality discharge criteria outlined in Baffinland's Type A Water Licence and Metal and Diamond Mining Effluent Regulations (MDMER). The details regarding mitigation measures associated with surface runoff from the above mentioned project facilities are addressed in Appendix H of the Fresh Water Supply, Sewage, and Wastewater Management Plan.

The general drainage/monitoring figure for the Mine Site, provided in Appendix B, shows the local drainage routes and their flow direction. Estimated surface water runoff quantities for Mine Site catchment areas were outlined in a Knight Piésold report provided in the FEIS, Volume 7 – *Freshwater Aquatic Environment*.

8.1.2.1 Open Pit

The open pit will be excavated using a conventional bench configuration with access via ramps. Movement of vehicles within the pit will be monitored by a central dispatching system in order to ensure worker health and safety and operational efficiency.

Predicted dimensions of the final open pit, determined by the preliminary design presented in the FEIS are:

- Maximum length: 2.0 km;
- Maximum width: 1.2 km; and
- Maximum depth: 465 m (northern side) to 195 m (southern side).

It is anticipated that groundwater inflows will be minimal below the active zone at the open pit. An assessment was completed to compare operations at three (3) mine sites at northern latitudes, including the Polaris, Ekati, and Diavik mines. From this assessment, it was determined that the Ekati mine is most similar to the Project's Mine Site. The Ekati pits were developed in competent granite that was cut by moderate faults. The base of permafrost at the Ekati mine was encountered at approximately 350 to 400 m. With the exception of the near surface layer, groundwater was not encountered in the pits until mining reached limits below permafrost. From the assessment, it was determined that the Project's Deposit No. 1 pit will receive negligible groundwater inflow below the active layer because mining activities will take place in competent bedrock characterized by colder mean temperatures, topographically higher elevations, minimal faulting, and a deeper permafrost zone.

Geotechnical investigations at Deposit 1 are detailed in the Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029). The thermistor monitoring indicates permafrost conditions will allow only shallow seasonal groundwater flows. It is anticipated that water inflows into the pit will be minor, consisting of shallow seasonal groundwater flows and direct contribution from precipitation events. Drifting snow is not expected to significantly contribute to in-pit water volumes.

Mining commenced on a hill crest outcrop, and will progress until Year 10 to 12 of operation at full production volume (based on a nominal 21.5 Mtpa) before an Open Pit is formed. Open Pit surface water may be transferred to a surface water management pond through truck transfer or pumping, and monitored and treated. if required. prior to discharge to the receiving environment. The current surface water management pond and associated FDP (MS-08) may be used to manage this pit surface water, where all effluent discharged is monitored to ensure it meets the applicable water quality discharge criteria outlined in Baffinland's Type 'A' Water License and MDMER.

8.1.2.2 Run-of-Mine Ore Stockpile Facility

Run-of-mine ore from the Deposit No. 1 is stockpiled prior to crushing activities at the Run-of-Mine (ROM) Ore Stockpile Facility located on the Mine Haul Road.

The surface water runoff from the ROM Facility's pad and ore stockpiles is directed to the ROM Facility's surface water management pond (ROM Facility Pond) using ditches that run along the Facility's perimeter. Runoff retained in the ROM Facility Pond will be monitored and treated if required to ensure effluent

discharged from the ROM Facility meets the applicable water quality discharge criteria outlined in Baffinland's Type 'A' Water Licence and MDMER.

Mitigation measures will include routine inspections of the ROM Facility to ensure surface water infrastructure, such as culverts, ditches and the ROM Facility Pond, are operating as designed and the use of a water treatment plant at the ROM Facility Pond, if required, to ensure effluent water quality compliance under the MDMER and Type 'A' Water Licence during controlled effluent discharges from the ROM Facility. Refer to the Project's Fresh Water Supply, Sewage and Wastewater Management Plan (FWSSWMP; BAF-PH1-830-P16-0010) for additional information on the water treatment processes approved for Project effluents.

8.1.2.3 Mine Site Crusher Facility

Run-of-mine ore from the Deposit No. 1 is processed by crushing ore into lump and fines at Mine Site Crusher Facility.

The surface water runoff from the Crusher Facility's pad and ore stockpiles is directed to the Crusher Facility's surface water management pond (Crusher Facility Pond) using ditches that run along the Facility's perimeter. Runoff retained in the Crusher Facility Pond will be monitored and treated if required to ensure effluent discharged from the Crusher Facility meets the applicable water quality discharge criteria outlined in Baffinland's Type 'A' Water Licence and MDMER.

Mitigation measures will include routine inspections of the Crusher Facility to ensure surface water infrastructure, such as culverts, ditches and the Crusher Facility Pond, are operating as designed and the use of a water treatment plant at the Crusher Facility Pond, if required, to ensure effluent water quality compliance under the MDMER and Type 'A' Water Licence during controlled effluent discharges from Crusher Facility. Refer to the FWSSWMP (BAF-PH1-830-P16-0010) for additional information on the water treatment processes approved for Project effluents.

8.1.2.4 Waste Rock Facility

Waste rock generated from mining operations on Deposit 1 will be directed to the Waste Rock Facility (WRF) located northeast of Deposit No. 1. Waste rock generated by Deposit No. 1 mining operations will be managed in accordance with the Project's Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029) and Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031). As additional geological, geotechnical and geochemical data is collected, Baffinland will continue update the Project's Phase 1 Waste Rock Management Plan and Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) to optimize the Project's waste rock management practices and strategies.

Surface water runoff from waste rock deposited at the WRF is directed to a surface water management pond (WRF Pond) using ditches and swales that run along the WRF's perimeter. Runoff retained in the

WRF Pond will be monitored and treated if required to ensure effluent discharged from the Facility meets the applicable water quality discharge criteria outlined in Baffinland's Type 'A' Water Licence and MDMER.

Mitigation measures will include routine inspections of the Waste Rock Facility to ensure surface water infrastructure, such as culverts, ditches and the WRF Pond, are operating as designed and the use of a water treatment plant at the WRF Pond to ensure effluent water quality compliance under the MDMER and Type 'A' Water Licence during controlled effluent discharges from WRF. Refer to the Project's Fresh Water Supply, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010) for additional information on the water treatment processes approved for Project effluents.

9 MONITORING

9.1 ROUTINE INSPECTIONS

In addition to the specific monitoring and reporting requirements subject to applicable regulatory approvals, routine inspections of Project areas will be conducted. Routine surface water management inspections shall be conducted at drill sites, Project camp sites and infrastructure, roadways, and other areas associated with Project development. Where required, inspection locations will be modified to reflect current Project infrastructure and activities.

Table 9-1 outlines the basic components of typical routine inspections conducted at the Project. For the current compliance inspection forms used at the Project, refer to the Project's EPP (BAF-PH1-830-P16-0008).

Table 9-1 – Routine Inspections and Monitoring Requirements

Site / Area	Routine Inspections		
Milne Port **Mine Site**	- Water management systems and infrastructure - Sediment and erosion control structures - Fuel storage and transfer operations - Drip pans and equipment condition (i.e. leaks, hydrocarbon staining) - Use of secondary containment (i.e. lined containment areas, spill trays, etc.) - Water intakes - Flow meter readings - Land disturbance (i.e. vehicle rutting) - Spill kits - Snow stockpiles		
Tote Road	- Water management systems and infrastructure - Sediment and erosion control structures - Snow stockpiles		
Borrow Sites **Quarries**	- Drip pans and equipment condition (i.e. leaks, hydrocarbon staining) - Supervision of fuel transfer operations - Sediment and erosion control structures - Spill kits		
Drill Sites	*Pre-Drilling*	*Drilling Period*	*Post-Drilling*
	- Drill hole coordinates - Water source coordinates - Site photo - Water source photo - Distance to nearest water source	- Fuel leaks - Sediment and erosion control structures - Drip pans - Equipment condition - Rutting by vehicles	- Fuel leaks - Sediment and erosion control structures - Drip pans - Equipment condition - Rutting by vehicles

Site / Area	Routine Inspections		
	- Archaeological approval - Wildlife survey	- Water intake - Water management - Flow meter reading	- Water intake - Water management - Flow meter reading
Waste Rock Facility	- Water management systems and infrastructure - Sediment and erosion control structures - Drip pans and equipment condition (i.e. leaks, hydrocarbon staining) - Evidence of ARD/ML		
Bulk Fuel Storage Areas	- Primary containment structure - Evidence of hydrocarbon staining or leaks from containment devices - Equipment condition - Spill kits		
Explosives Storage Areas	- Primary containment structure - Access and security - Equipment condition		
Laydown and Storage Areas	- Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Fuel leaks - Drip pans - Equipment condition		

9.2 Trigger Action Response Plan (TARP) for Potential Erosion and Sediment

A Trigger Action Response Plan (TARP) for Potential Erosion and Sediment Release Events (Table 9-2) provides a summary of the monitoring required and responsibilities in managing environmental monitoring of erosion and sediment events. The TARP outlines indicators and triggers, and will be utilized to outline appropriate actions and responses to possible erosion and sediment release events. Associated responsibilities are also detailed in the TARP.

Table 9-2 - Trigger Action Response Plan - Erosion and Sediment Release Events

Trigger	Action	Response	Responsibility
Observations identifying potential causes of erosion and sediment issues.	Investigate and identify potential sources and activities that may lead to an exceedance in total suspended solids. This can include, but not limited to: construction based activities on land or near water (e.g. ditching, roads, signs of erosion, drilling, sediment deposition, run-off, etc.), effectiveness of erosion and sediment controls, contact water movement. Reference Table 6-1 for a list of erosion and sediment control measures. Refer to coordination meetings in preparation for freshet, and allocation of responsibilities as per each department. Ensure equipment is readily available.	Contact Baffinland Environment and assist in implementing appropriate control measures focused at the source of the issue.	All employees working for the Operation (via visual observation). Report to Supervisor immediately, who will report to Environment. Environment to appropriately allocate responsibilities and actions to various Departments based on specific needs.
Severe weather period in the forecast, as per on-site weather stations and weather alerts.	Assess risk for site and plan appropriate mitigation measures. This includes but is not limited to Table 6-1 Sediment and Erosion Controls. Complete snow removal in prioritized areas as per the Snow Management Plan.	Communicate with Environment to develop an incident (sediment release, melting event, freshet, high precipitation) specific response plan. Communicate plan to workforce which may include: • Implementing additional mitigation techniques and/or facilities • Reducing or re-scheduling tasks (e.g., Reduce activities to non-ground disturbing related tasks)	Environment Mine Operations Road Maintenance
TSS Exceedance of Water Licence Criteria	During and after a suspected exceedance of the authorized limit, water samples will be taken at key locations for TSS testing. Record results, investigate and communicate to external stakeholders in line with regulatory requirements and Baffinland's Spill Contingency Plan (BAF-PH1-830-P16-0036).	If sediment attributed to Project Infrastructure, review and modify controls. Communicate incident investigation outcomes with regulatory authority via follow up spill reports and the QIA NWB Annual Report for Operations.	All employees working for the Operation (via visual observation). Report to Supervisor immediately, who will report to Environment. Environment to appropriately allocate responsibilities and actions to various Departments based on specific needs.
Regulatory Feedback	Record feedback details, investigate and communicate to external stakeholders in line with Baffinland management plans.	If sediment is attributed to Project Infrastructure, review and modify controls. Respond to regulatory authority with outcomes of the investigation.	Environment Operations

9.3 Snow Management Monitoring

The monitoring of snowmelt and surface water runoff at the Mine Site and Milne Port will be monitored via the Surveillance Network Program (SNP) stipulated by the Project's Type 'A' Water License, and along the Tote Road via the Tote Road Monitoring Program (TRMP). Additional temporary monitoring locations may be established during freshet to support the SNP and TRMP for areas down gradient of snow stockpile locations. The frequency of water quality monitoring will be consistent with existing monitoring programs (i.e. SNP, TRMP). For further details, refer to Baffinland's Snow Management Plan (BAF-PH1-300-P16-0002) where it outlines the required monitoring of snow management and snow stockpiles at the Project.

9.4 Area-Specific Surface Water and Aquatic Ecosystem Monitoring

Baffinland has developed and/or implemented several monitoring programs at the Project to fulfill surface water and aquatic effects monitoring requirements outlined in the Project's Type 'A' Water Licence, Project Certificate and other applicable regulations (i.e. MDMER, etc.). The following subsections describe the area-specific freshwater monitoring requirements and monitoring programs conducted at Project.

9.4.1 Milne Port

Surface water and aquatic ecosystem monitoring programs implemented at Milne Port focus on meeting the monitoring requirements outlined in Schedule I of the Project's Type 'A' Water Licence.

9.4.1.1 Type 'A' Water Licence

Type 'A' Water Licence water quality and quantity monitoring requirements for surface water at Milne Port include:

- The monitoring of volumes and water quality of surface water runoff and storm water retained by Project infrastructure (e.g. surface water management ponds, containment areas) and discharged to the receiving environment;
- The monitoring of volumes and water quality of specific surface water drainage systems downstream of Project areas;
- The monitoring of water quality of surface water drainage downstream of active quarries and borrows sources; and,
- The monitoring of water volumes withdrawn from approved Milne Port water sources.

Volumes of effluent discharged from the Project infrastructure are monitored using inline flow meters and/or flow rate extrapolation. Weir boxes, water level data loggers and instream flow measurements are used to monitor flow volumes at monitored surface water drainages downstream of Project areas. Volumes of water withdrawn from approved water sources at Milne Port are monitored using inline flow meters. Water withdrawal limits for approved water sources at the Milne Port are outlined in Table 3 of the Type 'A' Water Licence and discussed further in the FWSSWMP (BAF-PH1-830-P16-0010).

Sampling frequency, monitored parameters and water quality discharge criteria for Milne Port monitoring stations are outlined in Part F and Schedule I of the Type 'A' Water Licence.

Table 9-3 provides the select storm water and surface water monitoring stations outlined in Schedule I of the Type 'A' Water Licence for Milne Port, including each monitoring station's current status. Monitoring requirements for developed quarries and borrow sources near Milne Port (i.e. Q1), as stipulated by the Type 'A' Water Licence, are discussed in Section 9.6 of this Plan.

Table 9-3 – Milne Port – Water Licence Monitoring Stations[2]

Monitoring Station	Description	UTM Coordinates (NAD83)		Status
		Easting (m)	Northing (m)	
MP-03	Milne Port Bulk Fuel Storage Facility - Storm water	503638	7976272	Active
MP-04	Milne Port Landfarm Facility - Storm water (Contaminated Snow/Water Containment)	503710	7975574	Active
MP-05	Milne Port Ore Stockpile Facility – East Surface Water Management Pond	503469	7976383	Active
MP-06	Milne Port Ore Stockpile Facility – West Surface Water Management Pond	503125	7976364	Active
MP-C-A	Surface water drainage downstream of construction and operation areas at Milne Port.	503214	7976483	Inactive
MP-C-B		503187	7975602	Active
MP-C-B01		502982	7975333	Active
MP-C-C		503436	7975427	Inactive
MP-C-D		503651	7976363	Inactive
MP-C-E		503736	7976346	Active
MP-C-F		503922	7976304	Active
MP-C-H		504113	7976509	Active
MP-C-J		502940	7974760	Active

9.4.2 TOTE ROAD

Surface water and aquatic ecosystem monitoring programs specific to the Tote Road focus on meeting the monitoring requirements stipulated by Baffinland's Type 'A' Water Licence and DFO authorizations for water crossings as well as fulfilling commitments made to stakeholders and regulators.

[2] Refer to Schedule I of the Type 'A' Water Licence for a complete list of all water licence monitoring stations at Milne Port.

9.4.2.1 Type 'A' Water Licence

Type 'A' Water Licence monitoring requirements for surface water along the Tote Road focus on:

- The monitoring of water volumes withdrawn from approved water sources along the Tote Road, outlined in Tables 2 and 3 of the Type 'A' Water Licence; and,
- The monitoring of water quality of surface water drainage downstream of active quarries and borrows sources.

Volumes of water withdrawn from approved water sources along the Tote Road are monitored using inline flow meters and/or flow rate extrapolation. Water withdrawal limits for approved water sources along the Tote Road are outlined in Tables 2-3 and 3 of the Type 'A' Water Licence and discussed further in the FWSSWMP (BAF-PH1-830-P16-0010).

Monitoring requirements for developed quarries and borrow sources stipulated by the Type 'A' Water Licence are discussed in Section 9.6 of this Plan.

9.4.2.2 Annual Assessment of Tote Road Fisheries Crossings

In accordance with Baffinland's DFO authorizations, Letters of Advice and other related amendments, Baffinland continues to conduct an annual assessment each year of identified fisheries water crossings along the Tote Road (HADD and compensation crossings). Annual assessments are conducted by a Professional Fisheries Biologist to confirm compliance with Baffinland's Fish Habitat No-Net-Loss and Monitoring Plan (Knight Pièsold, 2007) by assessing the presence of fish, changes in quality of fish habitat and condition of fish passage at each identified fisheries crossing. Concerns identified during the annual assessment are promptly addressed by the Project's Road Maintenance Department. It should be noted that two (2) fisheries crossings at the Mine Site (CV-187, CV-186) are included in this annual assessment.

9.4.2.3 Tote Road Monitoring Program (TRMP)

The Tote Road Monitoring Program (TRMP) was developed by Baffinland to monitor the water quality of surface water flows at select water crossing (culverts, bridges) along the Tote Road, with a primary focus on monitoring total suspended solids (TSS) concentrations upstream and downstream of Tote Road water crossings. Monitoring data collected under the TRMP is used by the Project to:

- Inform Project operations of potential water quality impacts from Project activities at water crossings along the Tote Road;
- Guide and prioritize Tote Road maintenance work, corrective actions and improvements projects for surface water management infrastructure;
- Adjust mitigation measures and management strategies for Project activities along the Tote Road; and,

- Expand the Project's understanding of natural water quality conditions along the Tote Road (upstream) and the natural factors that contribute to changes in surface water quality.

Water crossings monitored under the TRMP have been selected to give a geographically representative sample set of water crossings for each given watershed intersected by the Tote Road (Phillips Creek, Ravn River, Mary River). In selecting the Tote Road water crossings within each watershed, the following factors were considered:

- Key depositional habitats downstream of the Tote Road (e.g. fish habitat);
- Areas historically prone to sedimentation events;
- Historical borrow source locations; and,
- Existing monitoring locations and programs.

In addition to TSS, the TRMP monitors for additional parameters, including metals, nutrients, oil & grease, and routine chemistry, such as dissolved anions (e.g. chloride), turbidity and total dissolved solids (TDS).

For additional details on the TRMP's sampling frequency, monitored parameters and response action frameworks and action levels refer to the Project's Roads Management Plan (BAF-PH1-830-P16-0023). The Roads Management Plan also details the water quality monitoring that will be completed for construction activities at Project water crossings to mitigate potential sediment and erosion impacts to aquatic ecosystems.

9.4.3 Mine Site

Surface water and aquatic ecosystem monitoring programs specific to the Mine Site focus on fulfilling the monitoring requirements outlined in the Project's Type 'A' Water Licence, Project Certificate, and other applicable regulations, including MDMER.

9.4.3.1 Type 'A' Water Licence

Type 'A' Water Licence water quality and quantity monitoring requirements for surface water at the Mine Site include:

- The monitoring of volumes and water quality of surface water runoff and storm water retained by Project infrastructure (e.g. surface water management ponds, containment areas) and discharged to the receiving environment;
- The monitoring of volumes and water quality of specific surface water drainage systems downstream of Project areas;
- The monitoring of water quality of surface water drainage downstream of active quarries and borrows sources; and,
- The monitoring of water volumes withdrawn from approved Mine Site water sources.

Volumes of effluent discharged from the Project infrastructure are monitored using inline flow meters and/or flow rate extrapolation. Weir boxes, water level data loggers and instream flow measurements are used to monitor flow volumes at monitored surface water drainages downstream of Project areas. Volumes of water withdrawn from approved water sources at the Mine Site are monitored using inline flow meters and/or flow rate extrapolation. Water withdrawal limits for approved water sources at the Mine Site are outlined in Table 3 of the Type 'A' Water Licence and discussed further in the FWSSWMP (BAF-PH1-830-P16-0010).

Sampling frequency, monitored parameters and water quality discharge criteria for the Mine Site monitoring stations are outlined in Part F and Schedule I of the Type 'A' Water Licence.

Table 9-4 provides the select storm water and surface water monitoring stations outlined in Schedule I of the Type 'A' Water Licence for the Mine Site, including each monitoring station's current status. Monitoring requirements for developed quarries and borrow sources near the Mine Site (i.e. QMR2), as stipulated by the Type 'A' Water Licence, are discussed in Section 9.8 of this Plan.

Table 9-4 – Mine Site – Water Licence Monitoring Stations[3]

Monitoring Station	Description	UTM Coordinates (NAD83)		Status
		Easting (m)	Northing (m)	
MS-MRY-6	Exploration Camp Bulk Fuel Storage Facility (Bladder Farm) - Storm water (Contaminated Snow/Water Containment)	558341	7914508	Active
MS-06	Mine Site Crusher Facility Surface Water Management Pond	561475	7913000	Active
MS-07	Run-of-Mine Ore Stockpile Facility Surface Water Management Pond	563473	7913064	Inactive
MS-08	Waste Rock Stockpile West Surface Water Management Pond	563217	7916789	Active
MS-09	Waste Rock Stockpile East Surface Water Management Pond	562984	7916316	Inactive
MS-MRY-09	Deposit No. 1 surface water drainage (including the Bulk Sample Open Pit)	561080	7915078	Active

[3] Refer to Schedule I of the Type 'A' Water Licence for a complete list of all water licence monitoring stations at the Mine Site.

Monitoring Station	Description	UTM Coordinates (NAD83)		Status
		Easting (m)	Northing (m)	
MS-MRY-10	Deposit No. 1 surface water drainage (including the Bulk Sample Open Pit)	563642	7914687	Active
MS-MRY-13A **MS-MRY-13B**	Non-Hazardous Waste Landfill Facility - Downstream Surface Water Drainage	560754 560642	7912484 7912527	Active
MS-C-A	Surface water drainage downstream.	561263	7913571	Active
MS-C-B		561454	7913537	Active
MS-C-C		561110	7913199	Active
MS-C-D		561008	7913280	Active
MS-C-E		560980	7913388	Active
MS-C-F		561797	7913278	Active
MS-C-G		561813	7911830	Active
MS-C-H		561162	7912067	Active

9.4.3.2 Metal & Diamond Mining Effluent Regulations

The MDMER were developed primarily under subsection 36(5) of the Fisheries Act and are designed to protect fish, fish habitat and fish use from effects in receiving waters from the release of effluents from metals and diamond producing mines. At the Mine Site, runoff and effluent managed at the Crusher Facility, Run-of-Mine Facility and Waste Rock Facility are regulated under the MDMER and are identified as monitoring locations MS-06, MS-07, MS-08 and MS-09 under the Type 'A' Water Licence, respectively.

Sampling frequency, monitored water quality parameters and discharge criteria for effluent discharges from facilities regulated under the MDMER at the Mine Site are fully discussed in the FWSSWMP (BAF-PH1-830-P16-0010)**.** For details on the Project's Environmental Effects Monitoring (EEM) Program required for receiving water bodies of regulated effluents under MDMER, refer to Project's Fresh Water Supply, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010) and the Project's AEMP (BAF-PH1-830-P16-0039), discussed in Section 9.4.3.3 below.

9.4.3.3 Aquatic Effects Monitoring Plan

The Aquatic Effects Monitoring Plan describes how monitoring of the aquatic environment will be undertaken at the Project. The Aquatic Effects Monitoring Program (AEMP) was identified as a follow-up monitoring program in Baffinland`s FEIS (Baffinland, 2012) and is prescribed by the Type 'A' Water Licence. The AEMP, specifically, is a monitoring program designed to:

- Detect the short-term and long-term effects of the Project's activities on the surrounding aquatic environment;
- Evaluate the accuracy of impact predictions;
- Assess the effectiveness of planned mitigation measures; and
- Identify additional mitigation measures to avert or reduce unforeseen environmental effects.

The AEMP focuses on the key potential impacts to freshwater environment valued ecosystems components (VECs), as identified in the FEIS and Addendum for the Early Revenue Phase (ERP). The freshwater VECs include water quantity, sediment quality, and freshwater biota and fish habitat. The AEMP has been structured to serve as an overarching 'umbrella' that conceptually provides an opportunity to integrate results of individually monitored but related aquatic monitoring programs.

The following are the component studies that comprise the Project's AEMP.

- Core Receiving Environment Monitoring Program (CREMP), provides a basis for the evaluation of any mine-related influences on water quality, sediment quality and/or biota (including phytoplankton, benthic invertebrates and/or fish) within aquatic environments located near the Mine Site.
- Lake Sedimentation Monitoring Program evaluates baseline and Project-influenced lake sedimentation rates at Sheardown Lake NW.
- Hydrometric Monitoring Program assesses flow in several streams and rivers near Project sites and supports the AEMP.
- Dustfall Monitoring Program evaluates dustfall rates in proximity to the Tote Road, Milne Port and Mine Site and informs aquatic effects monitoring programs on the potential effects of dust generated by the Project on surrounding aquatic ecosystems and water bodies.
- Stream Diversion Barrier Study was an initial study evaluating the potential for fish barriers under natural conditions and due to Project-related stream diversions. This study has been deferred due to the low impact anticipated by the reduced footprint of the Waste Rock Facility during the Early Revenue Phase of the Project.
- Environmental Effects Monitoring (EEM) Program, as required under the MDMER, includes both water quality, benthic and fish monitoring studies in the receiving water bodies of effluent discharges at the Mine Site.

Monitoring data collected requires a systematic data evaluation process, as well as management responses that would be taken, in response to certain data evaluation outcomes. An assessment and management response framework is described in detail in Section 5 of the Aquatic Effects Monitoring Plan. For additional details on the aquatic effects monitoring programs, refer to Baffinland's Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039).

9.4.4 Steensby Port

The construction of Steensby Port and associated railway has not commenced to date. As a result, water quality or quantity monitoring programs have not been initiated at the Steensby Port location. This plan will be updated prior to the commencement of construction of Steensby Port and the associated railway to reflect planned surface water management and monitoring.

9.5 Groundwater Monitoring

Condition 23 of the Project Certificate requires groundwater monitoring to be conducted at the Project. Initiated in 2017, Baffinland continues to conduct a preliminary groundwater monitoring program at the Project's Mine Site Landfill Facility to assess the feasibility and utility of monitoring groundwater quality near Project infrastructure using drive-point piezometers. The current monitoring program involves establishing shallow groundwater wells up-gradient and down-gradient of the Landfill Facility using drive-point piezometers and collecting water samples near the depth of the active layer during September of year; the time of year where the active layer should be at its maximum depth. As more data is collected and monitoring methodologies are further assessed, Baffinland will provide recommendations and plans to NWB and other agencies regarding the Project's groundwater monitoring program.

9.6 Type 'B' Water Licence Monitoring

Surface water monitoring requirements stipulated under the Type B Water Licence are related to exploration and geotechnical drilling programs and the establishment of satellite camps required to support these programs. Due to temporary and transitory nature of drilling programs, water quality monitoring programs will be established for drilling programs on as needed basis and in accordance with the monitoring requirements outlined in the Type 'B' Water Licence. Proposed water quality monitoring programs will be included in Baffinland's notification(s) to regulators and stakeholders for planned drilling programs and satellite camps.

9.7 Water Crossing Construction Monitoring

In order safely and effectively transport ore from the Mine Site to Milne Port, the Project roads network, including the Tote Road, continues to be upgraded to address concerns regarding surface water drainage, sedimentation and erosion, operations and safety.

Monitoring associated with construction activities at Project water crossings is detailed in the Project Roads Management Plan (BAF-PH1-830-P16-0023), including sampling frequency, monitored parameters, response action frameworks and action levels.

To limit the potential water quality impacts of maintenance and construction activities at Project water crossings during periods of flow, in water work will be avoided whenever feasible, with the majority of

water crossing maintenance and construction occurring before the onset of freshet (mid-May) and following freeze up (September/October).

9.8 Monitoring at Project Quarries and Borrow Sources

Aggregate and sand for the Project may be sourced from a number of approved borrow pits and quarries located at the Mine Site, Milne Port and along the Tote Road. Baffinland's Water Licence prescribes the conditions applying to the development of quarries and borrow pits. Baffinland manages the potential environmental effects of borrow pit and quarry development and operation through the Borrow Pits and Quarries Management Plan (BAF-PH1-830-P16-0004) and individual borrow source and quarry specific plans (BAF-PH1-830-P16-0032, BAF-PH1-830-P16-0040 and BAF-PH1-830-P16-0017). Monitoring locations for developed quarries and borrows sources are documented in these individual borrow source and quarry specific management plans.

Table 9-5 - Project Quarries and Borrow Sources – Water Licence Monitoring Stations

Monitoring Station	Description	UTM Coordinates (NAD83)		Status
		Easting (m)	Northing (m)	
MP-Q1-01	Downstream of Q1	503839	7974473	Active
MP-Q1-02		503827	7975418	Active
TR-BP-01	Borrow Pit at KM97	556056	7914847	Active
MQ-C-A	Downstream of QMR2	559478	7914398	Active
MQ-C-B		560076	7913889	Active
MQ-C-D		559421	7914221	Active
MQ-C-E	Downstream of D1Q2	563353	7913118	Active

In accordance with Part I, Items 24 of the Type 'A' Water Licence, during periods of flow and following major precipitation events, Baffinland conducts monthly water quality monitoring of surface water flows downstream of active quarries and borrows sources. Water quality parameters that are monitored are in accordance with Part I, Item 23 of the Type 'A' Water Licence.

In accordance with Part D, Item 15 of the Type 'A' Water Licence, weekly water quality sampling is also completed where it is determined that surface water runoff from active quarries flows directly or indirectly into a water body, to ensure that water quality of the flows is in compliance with the water quality criteria outlined in Part D, Item 15.

As required, Baffinland will implement best management practices including sediment and erosion control measures installed as per Section 5 of this Plan. Berms and other drainage control measures shall be established where necessary to minimize or prevent surface runoff from nearby water bodies entering active quarries and borrow sources. Details regarding specific mitigation measures are provided in the above mentioned quarry management plans.

9.9 CHANGES TO MONITORING PROGRAMS

Conditional to the Project's construction and/or operations activities, it may be determined that additional monitoring stations may need to be established to effectively assess, and adequately monitor site-specific surface runoff and effluents. In these cases, Baffinland will provide notification to the NWB and other relevant agencies, and update this Plan accordingly.

10 DATA MANAGEMENT AND REPORTING

10.1 DATA MANAGEMENT

The on-site Environmental Superintendent in concert with the corporate Sustainable Development team is responsible for data management and reporting related to surface water management and monitoring. The data management system includes conducting routine inspections and monitoring, and forwarding results to appropriate parties as prescribed by Baffinland's applicable approvals, permits and authorizations.

10.2 REPORTING

Table 10-1 summarizes the data reporting associated with the monitoring programs outlined Section 9 of this Plan.

Table 10-1 – Reporting Summary for Monitoring Programs

Monitoring Program	Applicable Regulatory Instrument	Reporting
Type 'A' Water Licence (Schedule I; Part I)	Type 'A' Water Licence	Monthly Monitoring Reports Annual QIA & NWB Report for Operations
Fisheries Crossings Assessment	Applicable DFO Authorizations and Letters of Advice	Annual DFO Tote Road Monitoring Report Annual QIA & NWB Report for Operations - Appendices
Tote Road Monitoring Program	-	Annual QIA & NWB Report for Operations - Appendices
Snow Stockpile Monitoring	-	Annual QIA & NWB Report for Operations - Appendices
MDMER (Effluent and Receiving Environment Water Quality Monitoring)	MDMER	Quarterly Effluent Monitoring Reports Annual ECCC MDMER Report
MDMER (Biological EEM)	MDMER	Annual QIA & NWB Report for Operations – Appendices Annual ECCC MDMER Report (for applicable years)
AEMP (excluding Dustfall Program)	Type 'A' Water Licence, Project Certificate	Annual QIA & NWB Report for Operations – Appendices
Groundwater Monitoring	Project Certificate	Annual QIA & NWB Report for Operations – Appendices
Type 'B' Water Licence (Part B, Item 6)	Type 'B' Water Licence	Annual QIA & NWB Report for Exploration and Geotechnical Activities
Dustfall Program	Type 'A' Water Licence Project Certificate	Annual Terrestrial Environment Monitoring Report

11 REFERENCES

BAF-PH1-300-P16-0002 – Snow Management Plan

BAF-PH1-320-T07-0005 - Landfarm Operation Maintenance and Monitoring Manual

BAF-PH1-800-POL-0001 – Health, Safety and Environment Policy

BAF-PH1-800-POL-0002 – Sustainable Development and Human Rights Policy

BAF-PH1-830-P16-0004 - Borrow Pit and Quarry Management Plan

BAF-PH1-830-P16-0008 – Environmental Protection Plan

BAF-PH1-830-P16-0010 – Fresh Water Supply, Sewage and Wastewater Management Plan

BAF-PH1-830-P16-0017 - Q1 Quarry Management Plan

BAF-PH1-830-P16-0023 – Roads Management Plan

BAF-PH1-830-P16-0029 – Phase 1 Waste Rock Management Plan

BAF-PH1-830-P16-0031 – Life of Mine Waste Rock Management Plan

BAF-PH1-830-P16-0032 – Borrow Source Management Plan – Kilometer 97

BAF-PH1-830-P16-0036 – Spill Contingency Plan

BAF-PH1-830-P16-0039 – Aquatic Effects Monitoring Plan

BAF-PH1-830-P16-0040 - QMR2 Quarry Management Plan

Baffinland Iron Mines Corporation (Baffinland), 2012. *Mary River Project - Final Environmental Impact Statement*. February.

Baffinland Iron Mines Corporation (Baffinland), 2013. *Mary River Project - Early Revenue Phase - Addendum to the Final Environmental Impact Statement*. June.

Fisheries and Oceans Canada, 2001. *Policy for the Management of Fish Habitat*. Cat. No. Fs 23-98/1986E ISBN 0-662-15033-3. January 9.

Fisheries and Oceans Canada, 2007. Milne Inlet Tote Road (Tote Road) Fisheries Authorization No. NU-06-0084

Golder Associates Ltd. (Golder), 2016. *Dust Mitigation Action Plan*.

Golder Associates Ltd. (Golder), 2016. *Sedimentation Mitigation Action Plan*.

Golder Associates Ltd. (Golder), 2017. *Mary River Project - Tote Road Earthworks Execution Plan*. April. Rev. 0. Report Number: 1667708.

Knight Piésold 2007. *Baffinland Iron Mines Corporation - Mary River Project - Bulk Sampling Program - Fish Habitat No Net Loss and Monitoring Plan*. Ref. No. NB102-00181/10-4, Rev. 0, August 30.

Nunavut Water Board (NWB), 2015. *Licence No. 2AM-MRY1325 – Amendment No. 1.*

Wright, D.G., and G.E. Hopky, 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Can. Tech. Rep. Fish. Aquat. Sci. 2017: iv + 34p.

APPENDIX A

CORPORATE POLICIES

Baffinland Iron Mines Corporation

SUSTAINABLE DEVELOPMENT POLICY

BAF-PH1-800-POL-0002

Rev 1

Approved By: Brian Penney
Title: Chief Executive Officer
Date: March 7, 2016
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

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 and ArcelorMittal's Human Rights Policy which applies to all employees and affiliates globally.

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 Sustainable Development and Human Rights Policy is communicated to the public, all employees and contractors and it will be reviewed and revised as necessary on a regular basis. These four pillars form the foundation of our corporate responsibility strategy:

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

1.0 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.

2.0 ENVIRONMENT

- Baffinland employs a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- Baffinland applies 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.
- Baffinland ensures that an effective closure strategy is in place at all stages of project development to ensure reclamation objectives are met.

3.0 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.
- 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.

4.0 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.

4.1 FURTHER INFORMATION

Please refer to the following policies and documents for more information on Baffinland's commitment to operating in an environmentally and socially responsible manner:

Health, Safety and Environment Policy
Workplace Conduct Policy
Inuktitut in the Workplace Policy
Site Access Policy
Hunting and Fishing (Harvesting) Policy
Annual Report to Nunavut Impact Review Board

ArcelorMittal Canada Sustainability and Corporate Responsibility Report

If you have questions about Baffinland's commitment to upholding human rights, please direct them to contact@baffinland.com.

Brian Penney
Chief Executive Officer
March 2016

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.

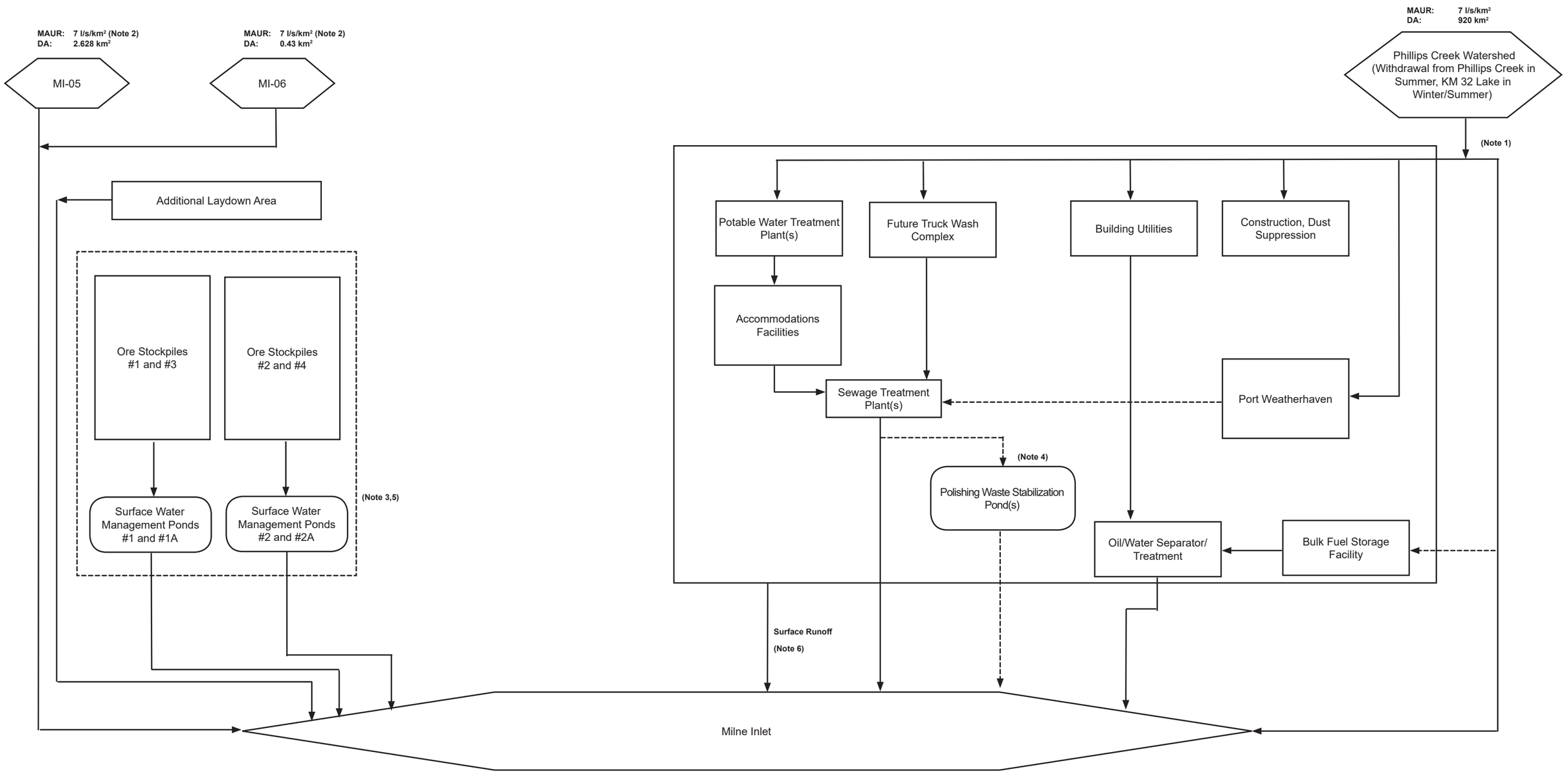
We have a responsibility to provide a safe workplace and utilize systems of work to meet this goal. All employees must be clear in understanding the personal responsibilities and accountabilities in relation to the tasks we undertake.

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

APPENDIX B

SITE WATER BALANCE – FIGURES



LEGEND

- Impacted Watershed
- Development Areas
- Surface Water Management Pond
- Continuous Or Watershed Flow
- Intermittent Flow
- A/AA 100,000 — Annual Volume (m^3/year)
- MAUR — Mean Annual Unit Runoff ($l/s/km^2$)
- DA — Drainage Area (km^2)

NOTES:

1) Raw water supply flow rate from Philips Creek (Summer) & KM32 Lake (Winter/Summer) are currently equal to or less than Type A water license 2AM-MRY1325 Amendment No. 1 flow rate limit of 367.5 m^3/day (134,000 m^3/year).
2) Mean Annual Unit Runoff (MAUR) in watersheds MI-05 and MI-06 likely range between 5 and 7.1/s/km^2. Part of the MI-06 natural catchment will be used for proposed infrastructure construction.
3) Ore stockpiles receive only precipitation and no surface water runoff from surrounding areas.
4) Use of Polishing Waste Stabilization Pond(s) will occur on a contingency basis only, should off-spec treated sewage effluent be produced.
5) Per Hatch Project Memo H349000-2133-10-220-0001, the runoff coefficient from ore stockpiles is zero and only road and pad runoff reports to surface water management ponds.
6) Plant site receives only precipitation-runoff and no surface water runoff from surrounding areas.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	26MAR'19	ISSUED WITH TRANSMITTAL	SEF	RAC

BAFFINLAND IRON MINES CORPORATION

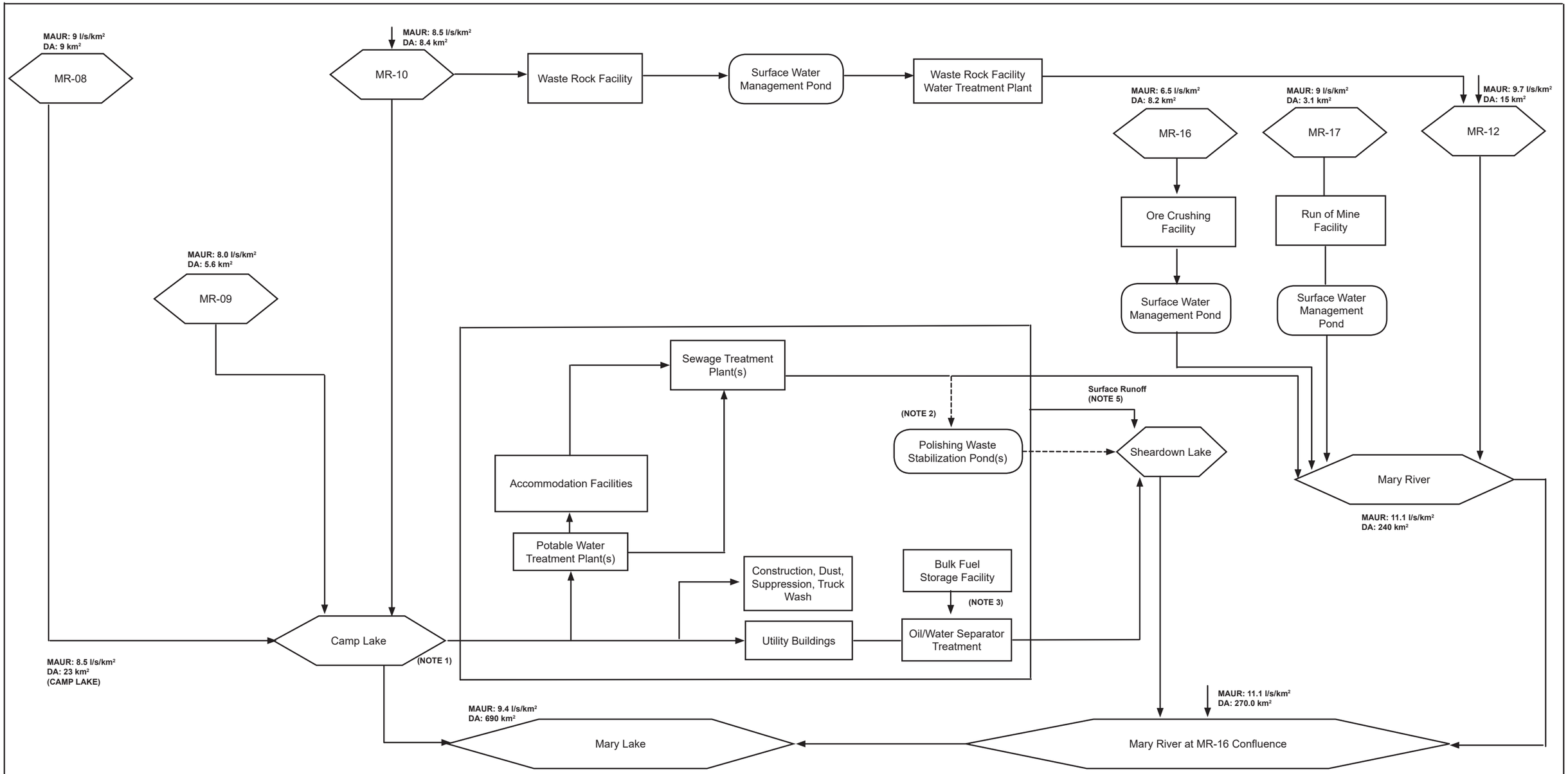
MARY RIVER PROJECT

MILNE PORT
SITE WATER BALANCE - BLOCK FLOW DIAGRAM

Baffinland

PA NO. NB102-181/54 | REF. NO. NB19-00251

FIGURE A.1 | REV 0



LEGEND

- Impacted Watershed
- Development Areas
- Surface Water Management Pond
- Continuous or Uncontrolled Flow
- Intermittent Flow
- A/AA 100,000 — Annual Volume (m^3/year)
- MAUR — Mean Annual Unit Runoff (l/s/km^2)
- DA — Drainage Area (km^2)

NOTES:

1) Raw water supply flow rate from Camp Lake are equal to or less than Type A Water Licence 2AM-MRY1325 Amendment No. 1 flow rate limit of 657.5 m^3/day (240,000 m^3/year) total.
2) Use of Polishing Waste Stabilization Pond and Sheardown Lake discharge will occur on a contingency basis only, should capacity be exceeded through the sewage treatment system discharging to Sheardown Lake.
3) Bulk fuel storage area runoff drained to environment if quality satisfies discharge requirements; otherwise is conveyed to oil/water separator for treatment prior to discharge.

REV	DATE	DESCRIPTION	PREP'D	RVW'D
1	29MAR'19	ISSUED WITH TRANSMITTAL	SEF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MINE SITE
SITE WATER BALANCE - BLOCK FLOW DIAGRAM

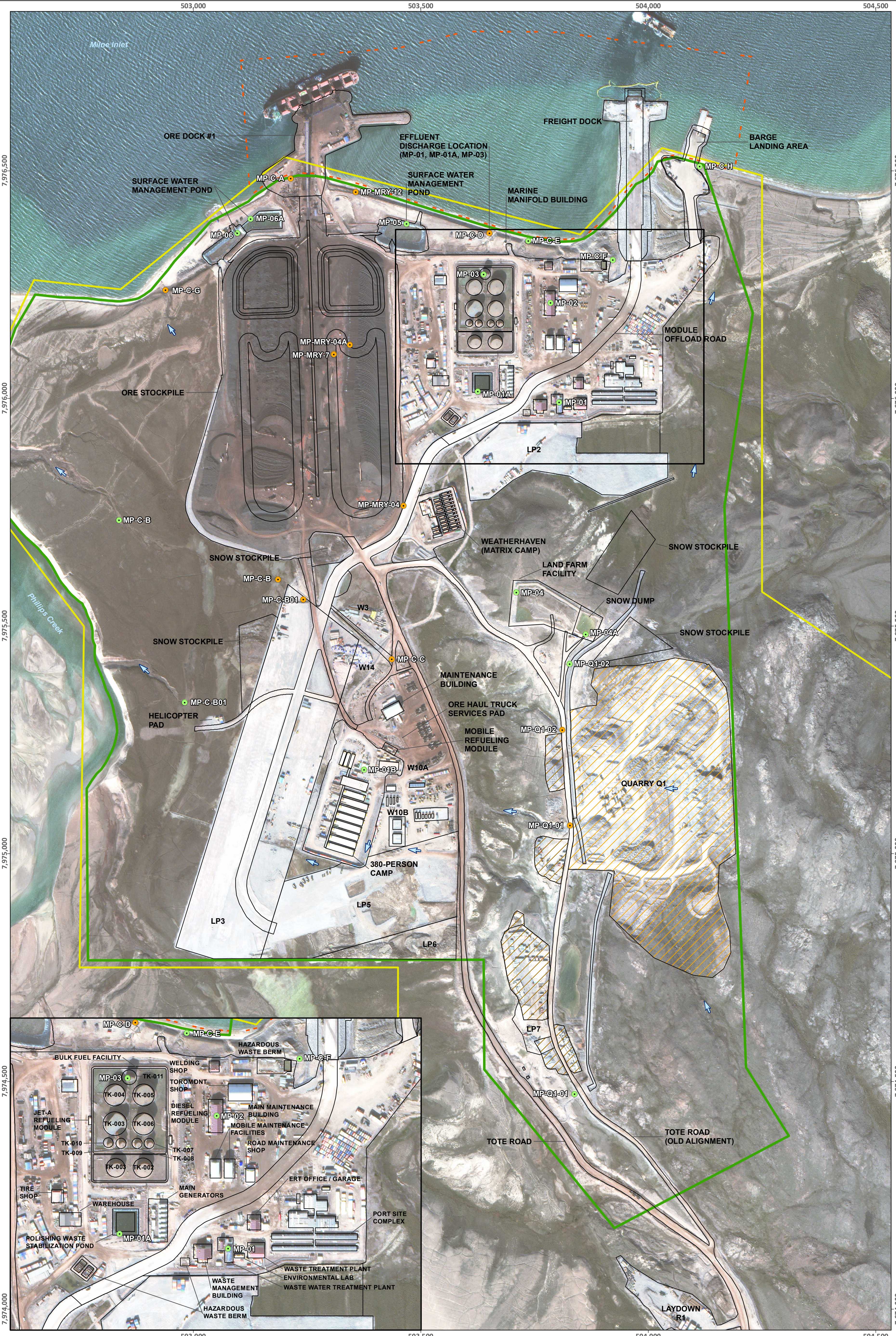
Baffinland

PA NO. NB102-181/54 | REF. NO. NB19-00268

FIGURE A.2 | REV 1

APPENDIX C

SITE DRAINAGE AND MONITORING FIGURES



503,000
503,500
504,000
504,500
7,976,500
7,976,000
7,975,500
7,975,000
7,974,500
7,974,000
Milne Inlet
ORE DOCK #1
EFFLUENT DISCHARGE LOCATION (MP-01, MP-01A, MP-03)
SURFACE WATER MANAGEMENT POND
SURFACE WATER MANAGEMENT POND
FREIGHT DOCK
BARGE LANDING AREA
MARINE MANIFOLD BUILDING
MP-C-A
MP-MRY-12
MP-06A
MP-06
MP-05
MP-C-D
MP-C-E
MP-C-F
MP-C-H
MP-C-G
MP-03
MP-02
MODULE OFFLOAD ROAD
MP-MRY-04A
MP-MRY-7
ORE STOCKPILE
MP-01A
MP-01
LP2
MP-MRY-04
MP-C-B
WEATHERHAVEN (MATRIX CAMP)
SNOW STOCKPILE
LAND FARM FACILITY
MP-C-B
MP-C-B01
MP-04
SNOW DUMP
Phillips Creek
W3
MP-04A
SNOW STOCKPILE
SNOW STOCKPILE
MP-C-C
W14
MP-Q1-02
MAINTENANCE BUILDING
MP-C-B01
ORE HAUL TRUCK SERVICES PAD
HELICOPTER PAD
MP-Q1-02
MOBILE REFUELING MODULE
MP-01B
W10A
QUARRY Q1
W10B
MP-Q1-01
380-PERSON CAMP
LP5
LP3
LP6
LP7
MP-Q1-01
TOTE ROAD
TOTE ROAD (OLD ALIGNMENT)
LAYDOWN R1
MP-C-D
MP-C-E
HAZARDOUS WASTE BERM
MP-C-F
BULK FUEL FACILITY
WELDING SHOP
MP-03
TK-011
TOROMONT SHOP
TK-004
TK-005
JET-A REFUELING MODULE
DIESEL REFUELING MODULE
MP-02
MAIN MAINTENANCE BUILDING
TK-003
TK-006
MOBILE MAINTENANCE FACILITIES
TK-010
TK-009
TK-007
TK-008
ROAD MAINTENANCE SHOP
TK-003
TK-002
TIRE SHOP
MAIN GENERATORS
ERT OFFICE / GARAGE
WAREHOUSE
PORT SITE COMPLEX
POLISHING WASTE STABILIZATION POND
MP-01A
MP-01
WASTE TREATMENT PLANT
ENVIRONMENTAL LAB
WASTE WATER TREATMENT PLANT
WASTE MANAGEMENT BUILDING
HAZARDOUS WASTE BERM

SAVED: C:\Users\katie.mcguire\Documents\4 - Maps\Reporting\1_Annual\SWAMP\BIM_Fig 1 MilnePort SNP.mxd; 24-Mar-20

LEGEND

- Foreshore Lease Boundary
- Borrow Area
- Quarry Area
- Project Development Area
- Commercial Lease Boundary
- Current Infrastructure
- Drainage Direction

SNP Monitoring Station

- Active
- Inactive

ᓄᓘᔪᓂ ᐅᔭᕐᓯᐅᕐᑏ

MARY RIVER PROJECT

Milne Port Drainage and Water Licence Monitoring Stations

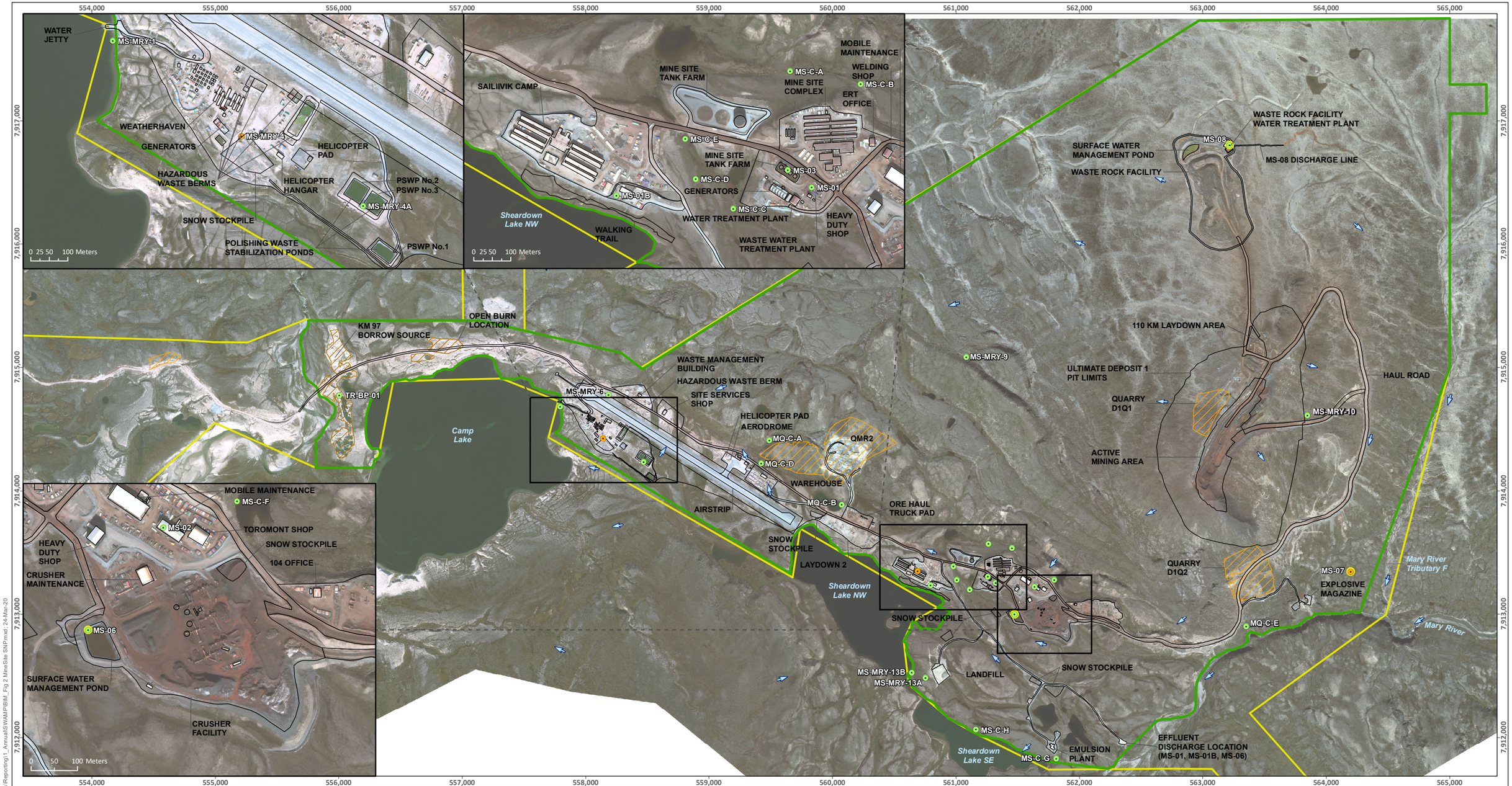
Projection: NAD 1983 UTM ZONE 17N.
Base Map: © 2019 Digital Global, Inc.
Imagery and Infrastructure are representative as of August 2019.

0 25 50 100 150 200 Meters
Scale 1:8,000

N

Baffinland

ᑎᑎᖅᐅᔭᕐᓯᒪᔪᖅ
FIGURE 1



LEGEND

- Borrow Area
- Quarry Area
- Project Development Area
- Commercial Lease Boundary
- Current Infrastructure
- Drainage Direction

SNP Monitoring Station

- Active
- Inactive
- Active SNP / MDMER

ᓄᓇᕗᑦ ᐅᕙᖓᓄᐃᑦ MARY RIVER PROJECT

Mine Site Drainage and Water Licence Monitoring Locations

Projection: NAD 1983 UTM ZONE 17N.
Base Map: © 2019 Digital Global, Inc.
Imagery and Infrastructure are representative as of August 2019.

0 100 200 400 600 800 Meters
Scale 1:30,000

N

Baffinland

ᑎᑎᕈᐅᖏᓐᓄᑦ FIGURE 2

SAVED: C:\Users\katie.mcguire\Documents\4 - Maps\Reporting\1_Annual\SNWMP\BIM_Fig 2 MineSite SNP.mxd: 24-Mar-20