Baffinland Iron Mines Corporation

Mary River Project

Attachment 5: Fresh Water Supply, Sewage, and Wastewater Management Plan

Appendix 10D-3

DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
2012-01-18	F	Approved for Use Environmental Permit	R. Kapadia	J. Binns	S. Perry	
2011-12-21	E	Approved for Use	R. Kapadia	J. Binns	S. Perry	
2011-12-14	D	Approved for Use	R. Kapadia	J. Binns	S. Perry	
2011-11-24	C	Issue for Use – Environmental Permit	R. Kapadia	J. Binns	S. Perry	
2011-11-07	B	Issue for Use – Environmental Permit	R. Kapadia	J. Binns	J. Casson	
2011-09-14	A	Issued for Internal Review	R. Kapadia	J. Binns	J. Casson	
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1. Introduction

This document describes the fresh water supply and wastewater management plan for the various camp sites to be developed for the Mary River Project during the construction and operation phases of the project. This document supersedes the existing wastewater management plan (March 2010) and supports a submission being made to the Nunavut Impact Review Board (NIRB). Specifically, this document focuses on freshwater supply and wastewater treatment and disposal at Milne Port, Mine Site, Steensby Port and various rail camps.

2. Regulations, Standards, and Codes

As a minimum standard of acceptability, all actions undertaken will be compliant with appropriate sections of both Federal and Provincial legislation as indicated in the table below:

Table 2-1: Applicable Regulations, Standards and Codes

Number/Acronym	Title
AWWA	American Water Works Association
IBC	International Building Codes
NSF	National Sanitation Foundation
GCWQ	Guidelines for Canadian Drinking Water Quality
NWT Regulation 108-2009	Northwest Territories Water Supply System Regulations
Ontario Regulation 170/03	Safe Drinking Water Act, 2002
Nunavut Waters and Nunavut Surface Rights Tribunal Act, SC 2002, c 10	
Northwest Territories Water Act	
Northwest Territories Water Regulations (SOR/93-303)	
Ontario Drinking Water Quality Standards	
Canadian Fisheries Act	
Canadian Environmental Protection Act (1999)	
CCME Water Quality Guidelines for the Protection of Aquatic Life	
Ontario Guidelines for Sewage Works 2008	
CCME Guidelines for Compost Quality	
NSF/ANSI Standard 61	Drinking Water System Components

Number/Acronym	Title
AWWA Standard B100	Filtering Material
AWWA Standard B604	Granular Activated Carbon
OSHA	Occupational Safety and Health Administration

3. Sustainable Development Policy

Baffinland Iron Mines Corporation

At Baffinland Iron Mines Corporation, we are committed to conducting all aspects of our business in accordance with the principles of sustainable corporate responsibility and always with the needs of future generations in mind. Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and to create authentic relationships. We expect each and every employee, contractor, and visitor to demonstrate a personal commitment to this policy through their actions. We will communicate the Sustainable Corporate Policy to the public, all employees and contractors and it will be reviewed and revised as necessary on an annual basis.
These four pillars form the foundation of our corporate responsibility strategy:

1. Health and Safety
2. Environment
3. Investing in our Communities and People
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 from the very earliest of planning stages. Why? Because our people are our greatest asset. Nothing is as important as their health and safety.
- 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 and awareness. We allow our workers and contractors the right to stop any work if and when they see something that is not safe.

2.0 ENVIRONMENT

- We employ a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- We apply the principles of pollution prevention 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 pioneering new processes and more sustainable practices.

- We understand the importance of closure planning. We ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts.

3.0 INVESTING IN OUR COMMUNITIES AND PEOPLE

- We respect human rights and the dignity of others. We honour and respect the unique culture, values and traditions of the Inuit people.
- We contribute to the social, cultural and economic development of sustainable communities adjacent to our operations.
- 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.

4.0 TRANSPARENT GOVERNANCE

- We will take steps to understand, evaluate and manage risks on a continuing basis, including those that impact the environment, employees, contractors, local communities, customers and shareholders.
- We 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 environmental, safety, health, socio-economic commitments and set annual targets and objectives.
- We conduct all activities in compliance with the highest applicable legal requirements and internal standards
- We strive to employ our shareholder's capital effectively and efficiently. We demonstrate honesty and integrity by applying the highest standards of ethical conduct.

Tom Paddon
President and Chief Executive Officer
September 2011

4. Fresh Water

4.1 General Mitigation Measures for Water Use

4.1.1 Water Intakes

4.1.1.1 Engineering Intake Structures

Engineered intake structures will be designed to minimize erosion, avoid sediment issues, and provide protection from ice and peak water flow. Care will be taken to ensure that disturbance to aquatic environments is minimized during installation and maintenance of infrastructure. Rip rap used in construction will be clean, free of fine sediment, non-acid leaching, and non-metal generating.

4.1.1.2 Screens on Intake Pipes

All intakes will be screened in accordance with the Department of Fisheries and Oceans (DFO) Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO Guideline) to ensure no entrapment of fish. This guideline requires a 2.54 mm mesh size on the water intake pipeline to prevent entrainment of fish greater than 25 mm in length. It also requires a water withdrawal rate such that fish do not become impinged on the screen.

4.1.1.3 Selection of Short-Term Water Take Locations

Short-term water intake will be required at many locations for a variety of needs. This includes concrete manufacture, dust suppression, drill water, etc. A screening process will be used to confirm whether water sources are considered adequate as water take locations. Source selection begins by looking for the largest possible water body that is feasible for use. Lakes are considered first, followed by ponds and then large rivers. As per the regulations streams and creeks cannot be used for short term water take without prior approval of the Nunavut Water Board. The DFO guideline used for water take from water bodies is to restrict removal of water to a maximum of 5% of the total volume. During winter under ice conditions water must be drawn from below two (2) m of non-frozen water (as the top two (2) m of water contain the majority of oxygen for fish). During the open water season water taking guideline states that no significant drawdown can be caused. There must be no impact to fish or fish habitat.

4.1.2 Water Metering and Water Conservation Measures

Water meters are installed at strategic locations to monitor water consumption and enable the development of management strategies to reduce water usage/consumption. These strategies include the installation of low flow water taps, water use for drilling operation, etc.

4.2 Fresh Water Sources

The source of fresh water for the mine sites as well as approximate consumptions during the construction phase will be as follows:

Table 4-1: Fresh Water Demand

Camp/ Site	Intake	Coordinates	Use	Construction Consumption (m^3/d)	Operation Consumption (m^3/d)
Milne Port	Phillips Creek (summer) 32 Km Lake (winter)	N:795254.299 E:502830.385	Domestic	52.3	13.8
			Industrial	15.2	15.2
Mary River (Mine Site)	Camp Lake	N:7914695.647 E:557818.253	Domestic	367.3	201.8
			Industrial	288.0	150.6
Steensby Port	ST 347 Lake (permanent camp) 3 Km lake (dust suppression and other minor uses)	**ST347** N:7804826.580 E:596600.563 **3 Km Lake** N:7800206.654 E: 596698.129	Domestic	100.0	100.0
			Industrial	325.8	141.6
Ravn River Area	Ravn Camp Lake	N:7895658.80 E:594510.99	Domestic	132.0	-
			Industrial	13.2	-
Mid-Rail Area	Nivek Lake (summer) Ravn Camp Lake (winter)	N:7876430.04 E:595602.59	Domestic	66.0	-
			Industrial	13.2	-
Cockburn Lake Tunnels Camp (Cockburn North Camp)	Cockburn Lake	N:7833929.50 E:603882.25	Domestic	66.0	-
			Industrial	33.9	-
Cockburn South Camp	Cockburn Lake	N:7820563.84 E:597661.01	Domestic	99.0	-
			Industrial	13.2	-

Note: The temporary Steensby Camp water source will be the ocean. The ocean water consumption is not shown above.

For remote fresh water requirements such as dust suppression, tunnelling, geotechnical and exploration drilling, some water may be drawn by truck from nearby lakes and ponds and used directly.

The dust suppressant will be DL-10. This is an asphalt based emulsion and as such some water will be consumed for the dilution of the solution. This is an approved dust suppressant as specified by the Nunavut Department of Sustainable Development Environmental Protection Service (Environmental Guideline for Dust Suppression).

For drilling/tunnelling activities a Calcium Chloride brine solution will be used.

4.3 Fresh Water System Process Description

The following sections describe the fresh water systems at the various sites.

Each site will also include a potable water treatment system which will produce drinking water for the personnel at the site during construction and operation phases. These systems will treat water to meet the Guidelines for Canadian Drinking Water Quality as well as the Ontario Drinking Water Quality Standards.

Minimum process equipment requirements will be based upon the Northwest Territories Water Supply System Regulations, NWT Regulation 108-2009, Ontario Design Guidelines for Drinking Water Systems 2008, Ontario Regulation 170/03 - Drinking Water Systems, the Procedure for Disinfection of Drinking Water in Ontario, as well as best management practice.

4.3.1 Milne Port

During the construction phase the on-site population will be approximately 150 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The existing fresh water equipment will not be used. The fresh water demand for construction and operation are shown on the drawing Milne Inlet - Water Supply Balance Block Flow Diagram document no. H337697-7000-10-002-0001

A heated and insulated pump house will be built with duty/standby pumps to deliver fresh water from Phillips Creek to a fresh water tank during summer. During winter fresh water from 32 Km lake will be trucked to the fresh water tank. Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and concrete manufacturing will be provided directly from nearby lakes and ponds by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use.

Note that during the 2012 Work period only ultraviolet disinfection is proposed as this is the existing technology and deemed suitable. For future phases of the project secondary disinfection by chlorination will be included based upon an evaluation of performance, operation and cost.

4.3.2 *Mary River Site*

For the existing system fresh water supply for the Mary River Camp was obtained using a diesel pump positioned adjacent to the shoreline of Camp Lake. Water was then pumped directly from the lake source to water storage tanks located at the camp. The system was originally designed for a camp population of 120 people.

During the construction phase the peak on-site population will be approximately 1000 people. This is in addition to the existing exploration camp which will continue to house up to 120 people. Two new potable water treatment systems will be installed to support the construction and operation phases. One of the potable water treatment systems will be for the construction phase only and will support a population of 500 people. The other potable system will be a permanent system to support the other 500 people during both construction and operation phases. The existing fresh water equipment will not be used for construction and a new fresh water distribution system will be installed. The fresh water demand for construction and operation are shown on the drawing Mine Site - Water Supply Balance Block Flow Diagram document no. H337697-4210-10-002-0001

A new heated and insulated pump house at Camp Lake will be built with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plants). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression, exploration drilling, quarry dust suppression, concrete and explosives manufacturing will be provided directly from nearby lakes using vacuum truck. Exploration drilling will continue throughout the construction phase.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use.

Note that during the 2012 Work period only ultraviolet disinfection is proposed as this is the existing technology and deemed suitable. For future phases of the project secondary disinfection by chlorination will be included based upon an evaluation of performance, operation and cost.

4.3.3 *Steensby Port Site*

During the construction phase the on-site population will be approximately 600 people. Half the camp personnel will be accommodated on a barge which will be equipped with potable water treatment systems. The potable system onboard the barge will be a reverse osmosis based system. The full configuration will include coagulation, filtration by media filter, reverse osmosis and chemical disinfection. The remaining personnel will be accommodated by a land based potable water treatment system. This system will continue to operate during the operation phase while the barge based system will only be used during the construction phase.

The existing fresh water equipment will not be used and a new fresh water distribution system will be installed. The fresh water demand for construction and operation are shown on the drawing Steensby Site - Water Supply Balance Block Flow Diagram Document No. H337697-4510-10-002-0001

For the land based system, a heated and insulated pump house will be built at Lake ST347 with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression, stockpile dust suppression, concrete and explosives manufacturing will be provided directly from nearby lakes using vacuum truck.

The land based potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine. The vessel based potable water treatment scheme will include the same equipment as well as a membrane based system to desalinate the seawater source.

4.3.4 *Mid-Rail Site*

During the construction phase the on-site population will be approximately 200 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Mid-Rail - Water Supply Balance Block Flow Diagram Document No. H337697-7000-10-002-0004.

A heated and insulated pump house will be built at Nivek Lake with duty/standby pumps to deliver fresh water to a fresh water tank during summer. During winter water will be trucked from Ravn Camp Lake to the fresh water tank. This tank will be located in close proximity to the new potable water treatment plant. Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

4.3.5 Ravn River Site

During the construction phase the on-site population will be approximately 400 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Ravn River - Water Supply Balance Block Flow Diagram Document No. H337697-7000-10-002-0003.

A heated and insulated pump house will be built at Ravn Camp Lake with duty/standby pumps to deliver fresh water to a fresh water tank (to be located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

4.3.6 Cockburn Tunnels Camp Site (Cockburn North Camp)

During the construction phase the on-site population will be approximately 100 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Cockburn Lake Tunnels Camp - Water Supply Balance Block Flow Diagram Document No. H337697-7000-10-002-0005.

A heated and insulated pump house will be built at Cockburn Lake with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

4.3.7 Cockburn South Camp Site

During the construction phase the on-site population will be approximately 400 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Cockburn South - Water Supply Balance Block Flow Diagram Document No. H337697-7000-10-002-0006.

A heated and insulated pump house will be built at Cockburn Lake with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

5. Sewage Treatment

5.1 Sewage Generation Rate

The estimated generation of sewage is based upon a per capita generation as shown below:

Table 5-1: STP Average Sewage Flow Design Basis

Parameter	Design Value	Source
Sewage Generation per Capita	300 L/person/day	Design Basis – Sewage Treatment Plant, Doc. No. H337697-4000-10-109-0002

Note: The rate of sewage generation given above may be reduced after a review of possible re-use of some sewage for urinal flushing. Additional reductions may be achieved by water conservation.

5.2 Sewage Discharge Criteria

The quality of the sewage treatment plant effluent shall be in accordance with the applicable site discharge limits as listed in the following table:

Table 5-2: Treated Sewage Discharge Limits

Parameter	Unit	NWB License Req.		Water Reclaim/ Reuse Req.	Design - Mary River/ Construction Camps	Design - Milne Inlet/ Steensby Port
		Milne Inlet	Mary River			
BOD_5	mg/L	100	30	10 – 20	< 10	< 20
TSS	mg/L	120	35	10 – 20	< 10	< 20
Faecal Coliform	cfu/100 mL	< 1000 counts per 100 ml	< 10,000 counts per 100 ml	N/A	< 200 counts per 100 ml	< 200 counts per 100 ml
Oil and Grease*	mg/L	No visible sheen	No visible sheen	N/A	No visible sheen	No visible sheen
pH	---	Between 6.0 and 9.5	Between 6.0 and 9.5	N/A	Between 6.0 and 9.5	Between 6.0 and 9.5
Toxicity	---	Final effluent not acutely toxic	Final effluent not acutely toxic	N/A	Final effluent not acutely toxic	Final effluent not acutely toxic
Ammonia	mg/L NH3-N	2	2	N/A	< 2	< 2
Total Phosphorus	mg/L	N/A	N/A	N/A	< 0.1	N/A
Turbidity	NTU	N/A	N/A	2 – 5	< 5	< 5
Escherichia Coli	cfu/100 mL	N/A	N/A	ND – 200	< 200 counts per 100 ml	< 200 counts per 100 ml
Thermo - tolerant Coliforms	cfu /100 mL	N/A	N/A	ND – 200	< 200 counts per 100 ml	< 200 counts per 100 ml

Source: Design Basis – Sewage Treatment Plant, Doc. No. H337697-4000-10-109-0002.

5.3 Treated Wastewater Generation and Discharge/Outfall Locations

Treated sewage and wastewater for the mine sites will be discharged to the following locations:

Table 5-3: Treated Effluent Generation and Discharge/Outfall Locations

Camp/Site	Discharge/Outfall Location		Coordinates	Treated Effluent (m^3/d)	
	Summer	Winter		Construction	Operation
Milne Inlet (Port)	Ocean at Milne Inlet		N: 7976482.047 E:503211.450	54.6	13.7
Mary River (Mine Site)	Mary River	Storage Pond	Mary River: N:7912429.349 E:562962.542	559.8	170.6
	Sheardown Lake for existing camp (see notes)			36 m^3/day to Sheardown Lake	
Steensby (Port)	Ocean at Steensby Port		N: 7801412.600 E: 593378.100	308.0	102.4
Ravn River Area	Conveyed to Mary River Sewage Treatment		N/A	N/A	
Mid-Rail Area	Conveyed to Mary River Sewage Treatment		N/A	N/A	
Cockburn Tunnels Area	Conveyed to Steensby Sewage Treatment		N/A	N/A	
Cockburn South Camp	Conveyed to Steensby Sewage Treatment		N/A	N/A	

Notes:

1. The treated effluent generated at the Mine Site and Steensby Port includes the treated sewage from the rail camps which is treated at these sites.
2. The sewage generated at the Mine Site from the existing 120-man camp will continue to be discharged to Sheardown Lake while sewage generated by the new sewage treatment systems will be discharged to Mary River (during summer) and a Storage Pond (during winter).

5.4 Sewage Treatment Process Description

The process description for the sewage treatment systems at each site are described in the sections that follow. Note that for design purposes originally a per capita sewage generation rate of 344L/person/day had been considered which is higher than the per capita potable water consumption rate (300L/person/day). This was to ensure that the sewage treatment systems would have a higher design allowance. For consistency 300L/person/day will now be used for both potable water consumption and sewage generation. Design allowances will be captured in the equipment specifications for the treatment equipment. Based upon the design allowances for the sewage treatment equipment there is some discrepancy between the water demand and waste generated as identified on the water supply and waste generation block flow diagrams.

During the previous design phases of the project a sewage generation rate of 224L/person/day was considered. However there were operational issues with those systems. To ensure that future sewage systems have sufficient capacity and to avoid the necessity of effluent holding ponds a higher generation rate is now considered for the future sewage treatment systems.

5.4.1 Milne Port

Currently sewage generated by the camp site is managed through an existing RBC type sewage treatment plant (Seprotech manufactured). Sludge is discharged to a dedicated waste pond. Treated effluent is stored in a small heated tank. The effluent is then withdrawn by a vacuum truck and if it meets discharge requirements it is discharged to the overland outfall which drains by gravity to the ocean. If the effluent doesn't meet the discharge requirements the vacuum truck delivers it to a local polishing/waste stabilization storage pond for additional treatment. During the winter, latrines are used and the waste collected is incinerated; any small quantities of grey water are collected in a greywater sump (that is located at least 31 meters above the ordinary high mark of any water body) and allowed to infiltrate into the ground.

For the construction and operation phase the existing RBC shall continue to operate. The camp population will increase during construction to approximately 160 people. To accommodate the additional sewage waste generated a new sewage treatment system (RBC based technology or superior) will be installed adjacent and in parallel to the existing unit. This new unit will be designed to meet the project sewage effluent discharge limits. The treated effluent will no longer be discharged using the current method. Instead treated effluent will be stored in a treated effluent tank. The effluent will then be pumped from the tank to an ocean discharge.

As the camp workforce grows it is more economical to incorporate spare capacity into the sewage treatment system design to allow the unit to operate at more conservative flow rates rather than to rely on effluent holding ponds. In addition upsets are most likely during start-up and shut down of the units. Because there will be two units in service they can have their start ups and shut downs staggered so as to minimize the impact on capacity and effluent quality.

The effluent tank will have a hydraulic retention of time of two days (at minimum) based upon nominal flows. It is intended that the effluent tank will be at a low level during operation such that if sampling indicates that the effluent quality does not meet the applicable criteria further discharge can be prevented for a period in excess of a day to allow this effluent to be mixed, retreated, and retested. In addition this retention volume will allow for a minimal amount of recirculation through the STP using any spare STP capacity. This will improve the quality of the effluent in the tank. The volume is sufficient to allow for periodic sampling and testing of the treated effluent before discharge or reuse.

The existing waste storage ponds shall not be used or modified.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary. The incinerator design will consider the solids content of the sludge from the dewatering device.

5.4.2 Mary River Site

Currently the mine site has a functioning RBC based sewage treatment system designed to accommodate 120 people. As such the existing equipment will continue to be used during the 2012 period and beyond. Sludge is currently vacuumed from the RBC unit periodically and allowed to settle in Polishing Waste Stabilization Ponds (PWSPs); the supernatant from these ponds is tested, reprocessed and then discharged to Sheardown Lake.

For the construction and operation phase the existing RBC will continue to be operated with sludge and effluent discharged as described above. The camp population will increase during construction to a maximum size of 1000 people. This is in addition to the existing camp which will house up to 120 people. The new sewage treatment plants will be designed to process sewage from Ravn and Mid-Rail camps which will be conveyed to the Mary River permanent sewage treatment facility usually by truck. The new sewage treatment facilities will be RBC based technology or superior.

Treated sewage effluent will be stored in a treated effluent tank. The effluent tank will have a hydraulic retention of time of two days (at minimum) based upon nominal flows. It is intended that the effluent tank will be at a low level during operation such that if sampling indicates that the effluent quality does not meet the applicable criteria further discharge can be prevented for a period in excess of a day to allow this effluent to be mixed, retreated, and retested. In addition this retention volume will allow for a minimal amount of recirculation through the STP using any spare STP capacity. This will improve the quality of the effluent in the tank. The volume is sufficient to allow for periodic sampling and testing of the treated effluent before discharge or reuse. Treated effluent will be discharged to Mary River during summer and stored in a storage pond during winter. It is intended to eventually eliminate the need for winter storage if baseline studies of nearby water bodies (to be carried out in 2012) indicate that a suitable year-round discharge location can accommodate the treated effluent. Prior to discharge of stored sewage from the winter period the regional compliance officer will be notified.

The equalization tank that feeds the new sewage treatment plants will be sized to accommodate the sewage from the rail camps. The rail camp sewage will be added during periods of low sewage generation at the mine site in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary. The incinerator design will consider the solids content of the sludge from the dewatering device.

5.4.3 Steensby Site

During the construction and operation phase the camp population will increase to approximately 600 people.

During the 2012 Work phase the sewage generated by the workforce will be treated in an existing sewage treatment plant that is on-site but not yet installed. During the construction phase 300 people will be accommodated in a temporary sewage treatment system in place for the construction period. In addition the temporary sewage treatment plant will be designed to process sewage from the Cockburn lake rail camps which will be conveyed to the Steensby temporary sewage treatment facility by truck. The remaining workforce will be accommodated by a permanent sewage treatment system which will be the only facility to remain in service during the operation phase.

These sewage treatment plants will be housed in a temperature controlled areas and as such their performance will not be negatively impacted by arctic conditions.

Effluent from the sewage treatment plants will be stored in effluent tanks. The effluent tanks will have a hydraulic retention time of two days (at minimum) based upon nominal flows. It is intended that the effluent tank will be at a low level during operation such that if sampling indicates that the effluent quality does not meet the applicable criteria further discharge can be prevented for a period in excess of a day to allow this effluent to be mixed, retreated, and retested. In addition this retention volume will allow for a minimal amount of recirculation through the STP using any spare STP capacity. This will improve the quality of the effluent in the tank. The volume is sufficient to allow for periodic sampling and testing of the treated effluent before discharge or reuse. The new permanent sewage treatment facility will be RBC based technology or superior. Treated effluent will be discharged to the ocean.

The equalization tank that feeds the temporary sewage treatment plant will be sized to accommodate the sewage from the Cockburn Lake and Cockburn South rail camps. The rail camp sewage will be added during periods of low sewage generation at Steensby in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary. The incinerator design will consider the solids content of the sludge from the dewatering device.

The equalization tank that feeds the new sewage treatment plant will be sized to accommodate the sewage from the Cockburn Lake and Cockburn South rail camps. The rail camp sewage will be added during periods of low sewage generation at Steensby in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary.

5.4.4 Mid-Rail and Ravn River Sites

Sewage generated at these sites will be conveyed to the Mary River permanent sewage treatment facility. The sewage will be conveyed by air (helicopter) for a very short period before roads are built and thereafter by truck. During the first year when there will only be access to the camp via an ice road sewage can only be trucked from January to April. During the remaining months the sewage will be stored. Sewage storage facilities will be aerated to prevent the waste becoming septic (generating odours and noxious gases). Sludge will form and settle in the facility depending on how long the sewage resides there. This sludge will be withdrawn and delivered separately to the dewatering system at the mine site. Given the quantity of waste to be moved or stored every effort will be made to reduce this volume by using low flow showers and toilets and potentially segregating gray water to be treated and reused as urinal flush water. Other potential waste minimization techniques will also be reviewed. These will be evaluated during the detailed design. In addition the surrounding water bodies will be modelled and sampled to potentially support having sewage treatment and waste discharge near the camp sites.

The equalization tank at Mary River will be sized to provide sufficient residence time for freshly added sewage from the Mid-Rail or Ravn River to mix with sewage generated at the mine site. Given that sewage generation follows diurnal patterns the sewage from the remote sites will be added during the low generation periods at the mine site.

5.4.5 *Cockburn Tunnels (Cockburn North) and Cockburn South Sites*

Sewage generated at these sites will be conveyed to the Steensby permanent sewage treatment facility. The sewage will be conveyed by air (helicopter) for a very short period before roads are built and thereafter by truck. In the case of Cockburn South there will be year-round road access to allow for year-round trucking of sewage to Steensby. As such, at this site, the sewage storage tank capacity will be sized for a week of storage. At the north camp there will only be access to the camp via an ice road and as such sewage can only be trucked from January to April. During the remaining months the sewage will be stored. Sewage storage facilities will be aerated to prevent the waste becoming septic (generating odours and noxious gases). Sludge will form and settle in the facility depending on how long the sewage resides there. This sludge will be withdrawn and delivered separately to the dewatering system at the Steensby site. Given the quantity of waste to be moved every effort will be made to reduce this volume by using low flow showers and toilets and potentially segregating gray water to be treated and reused as urinal flush water. Other potential waste minimization techniques will also be reviewed. These will be evaluated during the detailed design. In addition the surrounding water bodies will be modelled and sampled to potentially support having sewage treatment and waste discharge near the camp sites.

The equalization tank at Steensby will be sized to provide sufficient residence time for freshly added sewage from the Cockburn Tunnels (Cockburn North) and Cockburn South camps to mix with sewage generated at the Steensby site. Given that sewage generation follows diurnal patterns the sewage from the remote sites will be added during the low generation periods at the Steensby site.

5.4.6 *Design Considerations from 'Lessons Learned'*

Previous studies had recommended the use of Polishing Waste Stabilization Ponds (i.e. Mary River Project Appendix 10D-3 Wastewater Management Plan SD-EMMP-003, March 31, 2010). The existing infrastructure at the Mary River (mine site) and Milne sites includes these ponds in part to allow for secondary treatment of the sewage treatment plant (STP) effluent which was not meeting the phosphorus discharge limit. However, based upon practical experience at the site with the STP it was projected that secondary polishing would not be required in the future.

Baffinland has incorporated the temporary storage ponds to be used during periods of start-up, shut-down or during periods of system upset. The stabilization ponds will not be required as part of the proposed new STP design, for the following reasons:

- The proposed new STPs will be modular with extra design capacity such that shut-downs and start-ups can be staggered to avoid performance issues or losses in system capacity;
- The STP trains will be better able to handle upsets by using the available spare capacity to operate the equipment at more conservative flow rates;

- The existing equipment was sized using a per capita sewage generation rate of 225 litres per person per day whereas the new equipment will be sized based upon a generation rate of 344 litres per person per day. This more conservative design basis will allow the equipment to operate at more conservative flow rates; and
- The existing equipment was designed to meet a phosphorus discharge criteria of 0.5 mg/L. The new STPs shall be designed to meet a much lower phosphorus discharge criteria of $<$0.1 mg/L (at the mine site).

Sewage Treatment equipment vendors will be assessed based upon their experience producing equipment for arctic environments.

6. Oily Water/Wastewater Treatment

6.1 Treated Oily Water Discharge Criteria

The quality of the oily water treatment plant effluent shall be in accordance with Metal Mining Effluent Regulations (MMER) and Guidelines: Industrial Waste Discharges in Nunavut (GIWDN) - prepared by the Department of Sustainable Development Environmental Protection Service – Nunavut. A summary is given below:

Table 6-1: Wastewater Effluent Discharge Limits

Parameter	GIWDN	MMER	Design Basis
Aluminum	1		<1
Ammonia	10		<10
Arsenic	1	0.5	<0.5
Barium	1		<1
Cadmium	0.1		<0.1
Biochemical Oxygen Demand	15		<15
Chlorine	1		<1
Chromium	0.1		<0.1
Copper	1	0.3	<0.3
Cyanide	0.1	1.0	<0.1
Fluoride	2		<2
Grease, Fat, Oil	15		<15
Iron	1		<1
Lead	0.05	0.2	<0.05
Mercury	0.006		<0.006
Nickel	1	0.5	<0.5
pH Range	6 – 10.5	6 – 9.5	6 – 9.5
Phenolic Compounds	0.02		<0.02
Phosphorous	1		<1
Silver	0.1		<0.1
Suspended Solids	15	15	<15
Tin	1		<1
Zinc	0.5	0.5	<0.5

Once a new water licence has been prepared by the Nunavut Water Board the criteria may be modified. The treated effluent will discharge to the locations identified in Section 5.3.

6.2 Oily Water/Wastewater Treatment Process Description

The process description for the oily water/wastewater treatment systems at each site are described in the sections that follow:

6.2.1 Milne Port

There currently exists an oily water treatment system to treat run-off from the fuel tank (bladder) farm. There are no additional construction and operation requirements to expand this farm. As such, the current practices will continue as long as required. During construction and operation the on-site fuel storage capacity will be greatly decreased and as such the existing oily water treatment system will be decommissioned and replaced with a smaller capacity trailer based system. This system would be similar to the system currently in use at the mine site. Any oily water generated from the new tank farm will be collected in a sump located at the new tank farm. The water will then be transported by vacuum truck to the existing oily water treatment plant. The nearby air strip run-off also has the potential for some oily water content. As such, this water will be collected through a drainage system and transported as needed by vacuum truck to the oily water treatment system.

Some small amounts of propylene glycol will be used for de-icing of aircraft. The spent propylene glycol will be collected, stored in containers and sent by ship off-site to a licensed treatment/disposal facility. Some interim treatment of the spent propylene glycol may occur to reduce the overall waste volume generated. This will be evaluated during the detailed design.

6.2.2 Mary River and Steensby Sites

Oily water may be generated from the following sources (this neglects minor oily water generated from accidental spills which will be handled by the spill management plan):

- Vehicle maintenance and wash facilities (i.e. truck wash, equipment and floor wash down water);
- Fuel tank farm run-off;
- Emulsion plant wash water;
- Freight dock; and
- Airstrip.

The vehicle maintenance and wash facility will have a sump located in close proximity to the maintenance facilities. Wash water produced in the maintenance facility (truck washing, equipment and floor washdown) will flow by gravity and be collected in the local sump. Suspended material in the wastewater will settle in the sump. Free oil in the wastewater will be removed by an oil/water separator system in order to meet the required oil discharge limits. The waste will then be further treated in the oily water treatment plant by activated carbon and clay to meet other specific parameters. The effluent will then be pH adjusted, if required, to meet discharge criteria.

Treated effluent from the oily water treatment plant will be pumped to discharge, or recycled and reused as washdown water at the maintenance shops. The separated waste oil will be stored in a local tank. Periodically, the oil will be drained and reused if possible or incinerated. Accumulated suspended solids will be periodically removed by bucket loader vehicle and sent to a land fill for disposal.

Run-off from the tank fuel storage areas will have to be treated by a local oily water separator system that will be used as needed. The resulting water will be discharged directly to the receiving body (Mine Site - Mary River, Steensby – Ocean). The water will be periodically tested such that if any parameter is out of compliance the water will be removed by vacuum truck and treated in the vehicle maintenance shop wastewater treatment plant.

Run-off water from the freight dock will be collected and treated in a manner similar to the treatment scheme for the run-off from the tank fuel storage areas.

The emulsion plant shall be supplied with its own wastewater treatment plant which utilizes an evaporation system to evaporate the water leaving solid residue and oil. This residue will be tested for toxicity and if necessary taken off-site for disposal in a licensed facility otherwise the waste will be land filled.

Run-off water from the air strip run-off also has the potential for some oily water content. As such, this water will be collected through a drainage system and transported as needed by vacuum truck to the vehicle maintenance shop wastewater treatment plant.

Small amounts of propylene glycol will be used for de-icing of aircraft. The spent propylene glycol will be collected, stored in containers and sent by ship off-site to a licensed treatment/disposal facility. Some interim treatment of the spent propylene glycol may occur to reduce the overall waste volume generated. This will be evaluated during the detailed design.

Some dust suppression solution will be applied to roads at both Mary River and Steensby sites. The suppressant will be DL-10. This is an asphalt based emulsion and as such some water will be consumed for the dilution of the solution. This is an approved dust suppressant as specified by the Nunavut Department of Sustainable Development Environmental Protection Service (Environmental Guideline for Dust Suppression).

In addition some Calcium Chloride solution will be used for drilling activities. The spent brine will be applied to nearby roads as a dust suppressant. This is an approved dust suppressant as specified by the Nunavut Environmental Protection Service.

6.2.3 *Rail Camps*

Two tunnels are to be built along the railway and a small amount of water will be consumed in the tunnelling operation. Calcium Chloride brine solution is used for tunnelling. This waste brine generated during the tunnelling will be collected and disposed of as per the Waste Management Plan for Construction, Operation and Closure (Appendix 10D-4). In addition some Calcium Chloride solution will be used for drilling activities.

7. Operations and Maintenance (O & M)

The regular operation and maintenance plans for the proposed treatment systems are given below. These plans relate to the sewage, potable and oily water treatment systems:

7.1 Potable Water Treatment System O & M Plan

7.1.1 Regular Maintenance Schedule

The system will be designed for fully automatic operation, and only requires limited supervision and regular maintenance.

The following recommended maintenance schedule is subject to regulations from local government, and instructions from original equipment manufacturers.

The recommended maintenance schedule is common for all potable treatment plants.

Table 7-1: Recommended Maintenance Schedule- Potable Treatment Plants

Items	Description
Daily	• Alarm check. • Chemical storage level check. • Controller time check. • Pressure gauge check.
Monthly	• Turbidity analyzer check/calibration. • Residual chlorine/pH analyzer check/calibration.
Annual	• Filter media level check, and refill if required. • UV lamp replacement.

7.1.2 Monitoring Plan

The monitoring plan is subject to local regulations of drinking water and other related codes. The following instruments will be provided to monitor the operation and performance of system.

- Inlet flow meter: to monitor feed flow, backwash flow, rinse flow and filtered flow;
- Effluent turbidity analyzer: to monitor turbidity in produced water; and

- Effluent pH/residual chlorine analyzer: to monitor pH and residual chlorine of produced water.

The PLC system in control panel will totalize raw water, produced water, backwash water, chemical injection, pump running time etc.

Raw water and treated water storage/distribution system will be monitored by systems from others.

Periodically sampling and lab test for raw water and treated water will be applied to ensure the treated water meeting drinking water standards. The frequency of the sampling and testing will be determined by the ministry and outlined in the certificate of approval.

7.2 Sewage Treatment System O & M Plan

7.2.1 Regular Maintenance Schedule

The system(s) are designed for automatic operation, and only require limited supervision and regular maintenances.

The following recommended maintenance schedule is subject to regulations from local government, and instructions from original equipment manufacturer.

The recommended maintenance schedule is common for all sewage treatment plants.

Table 7-2: Recommended Maintenance Schedule - Sewage Treatment Plants

Items	Description
Daily	• Check inlet valves for proper operation. • Check all pressure relief valves are not stuck. • Check submersible pumps for proper operation. • Check leakage of the system. • Ensure there are no air locks in the suction of the chemical pumps. • If chemical pumps are running check the discharge tube for pulsing to verify liquid flow. • Adequate chemical solution in chemical tank; mix more chemical as required. • Alarm check. • Chemical storage level check. • Controller time check. • Check pressure gauge. • Check rotation of RBC, motor and drive for any abnormality.

Items	Description
Monthly	• Turbidity analyzer check/calibration. • Check lubrication of all gear reducers and bearings. • Ensure all bolts and nuts are tight and secure. • Tighten all loosed fasteners, fittings, connections and mountings. • pH analyzer check/calibration.
Annual	• Filter media level check, and refill if required. • UV lamp replacement. • Clean the chemical injector fittings at the process piping. • Clean check valves of the chemical pumps at suction and discharge. • The processor battery lamp of the PLC controller needs to be checked every half year. The lithium battery may need to be replaced every 3 years.

7.2.1.1 *Monitoring Plan*

The monitoring plan is subject to relevant Federal and Provincial laws and regulations as stipulated in the certificate of approval.

The PLC control panel supplied with each plant will have a color touch screen HMI panel for the monitoring the status of all system components including RBC trains, pressure filters, dewatering system, chemical injection systems, pumps etc. Alarms or error messages will be shown if there is system failure and equipment faults.

Periodically sampling by operators and lab tests for raw sewage and treated effluent will be applied to ensure effluent meeting treated sewage requirement. The frequency of the sampling and testing will be determined by the ministry and outlined in the certificate of approval.

7.3 Milne Site Oily Water Treatment System O & M Plan

7.3.1 *Regular Maintenance and Monitoring Schedule*

Regular system maintenance entails routine inspection of mechanical and electrical components.

It is recommended that the system be inspected weekly to ensure that all components are in good working order. Spare parts lists will be included with the Operations and Maintenance Manuals, with critical spare parts and system expendables highlighted. Recommended stock quantities will also be given.

Additional, non-routine maintenance will be required throughout the life of the equipment. The recommended spare parts list and appropriate site stock levels are designed to keep the system running continuously with only scheduled downtime.

In addition to maintenance, monitoring the system performance and effluent quality are also necessary. It is further recommended that a flow totalizer be used at the effluent discharge to accurately summate the volume of treated water being released. This in conjunction with the quality data from the various system flows will allow forecasting for media and consumable change-out as well as waste oil and sludge generation. Residual contaminants below the regulatory limits can also be used in conjunction with treated volumes to determine area loadings over certain periods of time.

7.3.2 *Influent Pump*

When starting up influent pump make sure all valves are open to allow the process to flow. The influent pump is a gas powered pump. The start up procedure for the pump is:

- Make sure there is oil and gas in each of the tanks;
- Turn the gas switch on;
- Turn the on switch on;
- If the pump has not been running for an extended period of time make sure the choke is on;
- If it has been running for an extended period of time the choke does not have to be on.
- Make sure the throttle in on a low setting;
- Pull the ignition cord until the pump starts; and
- Increase the throttle to your desired throughput.

7.3.3 *Particle Filter*

The maximum pressure across the particle filter can be 14 psig. This would indicate that the particle filter has become plugged and must be changed. The bag and spaghetti media are to be changed out once a month during operation.

7.3.4 *Clay Absorption Media Filter*

The media will be changed depending on the differential pressure across the housing. When handling the material a repertory mask must be worn due to inhalation of the silica dust. The MSDS for the material should be reviewed before handling this material.

7.3.5 *MyCelx Filtration System*

The MyCelx filtration system has three polymeric surfactant vessels. The first two vessels operate at 30 and 28 psig respectively. The pressure across the third vessel can decline to as low as 2 psig. At this point the filter cartridges have to be changed.

7.3.6 *Granular Activated Carbon (GAC)*

The frequency of GAC change out is to be determined by testing the internal and external TOG after the first GAC train. When an indication that the GAC was not removing enough TOG, the media would be changed.

A joint maintenance/monitoring log should be kept to ensure all operational data and changes/responses are properly documented.

These guidelines are recommended as a minimum to ensure proper operation, health, safety and protection of the surrounding environment. If corporate or regional policies in effect or enacted require more stringent monitoring, the scope and schedule should be adjusted to meet these requirements.

7.4 Steensby and Mine Site Oily Water Treatment System O & M Plan

7.4.1 *Regular Maintenance and Monitoring Schedule*

Regular system maintenance entails routine inspection of mechanical and electrical components. It is recommended that the system be inspected weekly to ensure that all components are in good working order. Spare parts lists will be included with the Operations and Maintenance Manuals, with critical spare parts and system expendables highlighted. Recommended stock quantities will also be given.

Operational maintenance is mainly comprised of waste removal and expendable replacement in addition to some preventative maintenance on mechanical components. Maintenance activities, locations and their recommended frequencies are given below.

Table 7-3: Maintenance Activities, Locations and Their Recommended Frequencies

Maintenance Task	Location	Frequency
Sludge Removal	Primary clarifier	Twice/week
Oil Removal	Waste oil storage	Weekly
De-emulsifier chemical refill (if applicable)	Chemical room	TBD
Sulfuric acid chemical refill (if applicable)	Chemical room	TBD
Alum chemical refill	Chemical room	TBD
Sodium hydroxide chemical refill	Chemical room	TBD
Polymer chemical refill	Chemical room	TBD

Maintenance Task	Location	Frequency
Clay chemical refill	Chemical room	TBD
Filter Bag change-out	Media room	Daily
Organoclay change-out	Media room	Every two month
Carbon change-out (both)	Media room	Every two month
Pump seals	Various	Annually

Additional, non-routine maintenance will be required throughout the life of the equipment. The recommended spare parts list and appropriate site stock levels are designed to keep the system running continuously with only scheduled downtime.

In addition to maintenance, monitoring the system performance and effluent quality are also necessary. It is further recommended that a flow totalizer be used at the effluent discharge to accurately summate the volume of treated water being released. This in conjunction with the quality data from the various system flows will allow forecasting for media and consumable change-out as well as waste oil and sludge generation. Residual contaminants below the regulatory limits can also be used in conjunction with treated volumes to determine area loadings over certain periods of time.

Monitoring tasks, locations and frequencies are listed in the table below. The prefix, GI, in the task column denotes "General Inspection".

Table 7-4: Monitoring Tasks, Locations and Frequencies

Monitoring Task	Location	Frequency
GI – Clarifier (levels, appearance, pump operation)	Primary clarifier	Daily
Sample – Clarifier	Primary clarifier	Quarterly/Monthly
GI – OWS (levels, appearance, dosing pump)	OWS room	Daily
Sample – OWS Inlet	OWS room	Quarterly/Monthly
GI – Chemical Treatment (tanks, totes, levels, appearance, mixers, dosing pumps, effluent pump, pressures)	Chemical room and Lamella plate clarifier room	Daily
Sample – Chemical treatment inlet	Tank 1 – Lamella plate clarifier room	Quarterly/Monthly
Sample – Chemical treatment effluent	Pump outlet – Lamella	Quarterly/Monthly

Monitoring Task	Location	Frequency
	plate clarifier room	
GI – Bag Filtration (units, pressures)	Media room	Daily
GI – Media Vessels (units, pressures, backwash pump, treated water storage)	Media room	Daily
Sample – Organoclay effluent	Media room – post organoclay	Quarterly/Monthly
Sample – Primary carbon effluent	Media room – post Primary carbon	Quarterly/Monthly
Sample – Effluent water	Media room – effluent water storage tank	Quarterly/Monthly
GI – Miscellaneous (vertical heaters, air compressors, air dryers, controls)	Various	Daily

A joint maintenance/monitoring log should be kept to ensure all operational data and changes/responses are properly documented.

The monitoring guidelines are recommended as a minimum to ensure proper operation, health, safety and protection of the surrounding environment. If corporate or regional policies in effect or enacted require more stringent monitoring, the scope and schedule should be adjusted to meet these requirements.

8. Contingency Measures

Design criteria for the potable, sewage and oily water treatment systems have been reviewed and revised to provide additional safety factor.

The sewage treatment systems will be located sufficiently remote from surface water bodies. The sewage treatment systems will be fully enclosed units. In the event of a spill of untreated or partially treated sewage from these facilities, Baffinland will follow the procedures in its spill response plan. Sewage spills are treated the same as more immediately hazardous hydrocarbon based spills.

9. Sampling, Monitoring, and Reporting

Generally, sampling and monitoring of the potable and wastewater treatment systems will include the following:

- Regular sampling of sewage and wastewater discharge in accordance with water licence requirements;
- More frequent internal process sampling (minimum once per week) and monitoring (daily) to identify potential upset conditions early that could lead to non-compliance;
- Record of volumes of sewage and wastewater effluent discharged and sludge generated in accordance with water licence requirements;
- Completion of daily checklists related to the O & M requirements for the facilities and the reporting of any upset conditions that require action; and
- Aquatic effects monitoring program to confirm/validate environmental predictions.

The monitoring program will identify upset conditions related to the sewage treatment plants which will be immediately reported to the Camp Manager for corrective action.

9.1 Potable Water System Sampling, Monitoring and Reporting

9.1.1 Sample Points

Untreated Fresh water will be sampled at the following points:

Milne
Phillips Creek
N: 7975254
E: 502830

32 Km Lake
N:7951862
E:521714

Mine Site
Camp Lake
N: 7914696
E: 557818

Steensby
Lake ST347
N: 7804827
E: 596601

3 Km Lake
N:7800207
E:596698

Treated potable water will be sampled from the potable treatment plant effluent.

9.1.2 *Sampling Frequency and Analysis*

Samples will be taken monthly from the water source that is being used by the camp. Treated potable water will be sampled monthly as well. The water samples will be tested for the following parameters as required:

Calcium, Magnesium, Sodium, Potassium, Aluminum, Arsenic, Boron, Barium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Vanadium, Zinc, Tin, pH, Conductivity, Alkalinity as CaCO3, TDS (COND-CALC), TSS (total suspended solids), Turbidity, Phenols, N-NH3, SO4, Cl, Br,N-NO2, N-NO3, NO2 + NO3 as N, Mercury, Hardness as CaCO3, COD (chemical oxygen demand), Oil and Grease

A comparison of the sampling results to the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic life as well as the Guidelines For Canadian Drinking Water Quality (GCDWQ) will be completed.

9.2 Sewage Treatment System Sampling, Monitoring and Reporting

9.2.1 *Sample Points*

Treated Sewage will be sampled at the following points:

Milne
N: 795764
E: 503462

Mine Site
N: 7913347
E:561141

Steensby
N:7803154
E: 596181

9.2.2 *Sampling Frequency and Analysis*

Samples will be taken monthly from the effluent of the sewage treatment plants. The water samples will be tested for the parameters identified in the discharge criteria.

A summary of the regulated parameters is given below:

Treated Sewage Discharge Limits

Parameter	Unit	Design - Mary River	Design - Milne Inlet / Steensby Port
BOD_5	mg/L	<10	<20
TSS	mg/L	<10	<20
Faecal Coliform	cfu / 100 mL	< 200 counts per 100 ml	< 200 counts per 100 ml
Oil and Grease*	mg/L	No visible sheen	No visible sheen
pH	—	Between 6.0 and 9.5	Between 6.0 and 9.5
Toxicity	—	Final effluent not acutely toxic	Final effluent not acutely toxic
Ammonia	mg/L NH3-N	<2	<2
Total Phosphorus	mg/L	< 0.1	N/A
Turbidity	NTU	< 5	< 5
Escherichia Coli	cfu / 100 mL	< 200 counts per 100 ml	< 200 counts per 100 ml
Thermo - tolerant Coliforms	cfu / 100 mL	< 200 counts per 100 ml	< 200 counts per 100 ml

9.3 Oily Water Treatment System Sampling, Monitoring and Reporting

9.3.1 Sample Points

Treated wastewater will be sampled at the following points:

Milne
N: 795764
E: 503462

Mine Site
N: 7913347
E:561141

Steensby
N:7803154
E: 596181

9.3.2 Sampling Frequency and Analysis

Samples will be taken monthly from the effluent of the wastewater treatment plants. The water samples will be tested for the parameters identified in the GIWDN and MMER guidelines.

A summary of the GIWDN and MMER regulated parameters is given below:

Parameter	GIWDN (mg/L)	MMER (mg/L)
Aluminum	1	
Ammonia	10	
Arsenic	1	0.5
Barium	1	
Cadmium	0.1	
Biochemical Oxygen Demand	15	
Chlorine	1	
Chromium	0.1	
Copper	1	0.3
Cyanide	0.1	1.0
Fluoride	2	
Grease, Fat, Oil	15	
Iron	1	
Lead	0.05	0.2
Mercury	0.006	
Nickel	1	0.5
pH Range	6 – 10.5	6 – 9.5
Phenolic Compounds	0.02	
Phosphorous	1	
Silver	0.1	
Suspended Solids	15	15
Tin	1	
Zinc	0.5	0.5

10. Roles and Responsibilities

The responsibilities for implementing this plan are divided among the various entities as follows:

- HSE Manager: shall have overall responsibility for making sure that the plan is implemented as outlined and in accordance with the commitments provided in the Environmental Impact Statement, and shall undertake monitoring, review and auditing of the activities of the EPCM contractor;
- Environmental Lead: shall provide onsite direction of all water supply and wastewater treatment activities; and shall be responsible for the supply of potable water in their working areas in accordance with this document. Contractors will be responsible for the offsite transportation and final disposal of all hazardous waste generated as a result of their activities.

11. Table of Concordance

Discussions were held between BIM and the various responsible regulatory agencies regarding the contents of the environmental impact statement. As a result of those meetings BIM has committed to address specific requirements identified by the regulators in the text of the environmental impact statement. The table below highlights those areas of this management plan that address specific requirements.

Table 11-1: Commitments from Technical Meeting (Iqaluit, October 18, 2011 - October 20, 2011)

Item	Draft Commitment with Agency Input (October 26)	BIM Revised Commitments (Submitted October 28)	Section
229	• Provide an updated wastewater management plan for future larger construction and operation camps within FEIS. ◆ The plan will describe how equalization tanks will be used at the Mine Site and Steensby Site to accommodate surges in sewage received from the satellite construction camps.	no change	5.4.2, 5.4.3, 5.4.4, 5.4.5
230	• Clarify how propylene glycol used for aircraft de-icing is to be managed and how downstream receivers will be protected against potential dissolved oxygen depletion.	no change	6.2.1, 6.2.2
247	• Provide a discussion on alternative disposal methods for brine (leftover from tunnelling activities) and alternatives to the use of brine for dust suppression.	no change	4.2, 6.2.2, 6.2.3
248	• Provide an update and discussion on uses of calcium chloride (CaCl) at the Mary River site.	no change	6.2.3
264	• Provide the following within the FEIS: the source characteristics and quantities of each effluent discharge to water, as well as maps: showing locations of discharge points, and effluent discharge criteria.	no change	5.3

Note: The section column lists the section within this document where the commitment has been addressed.