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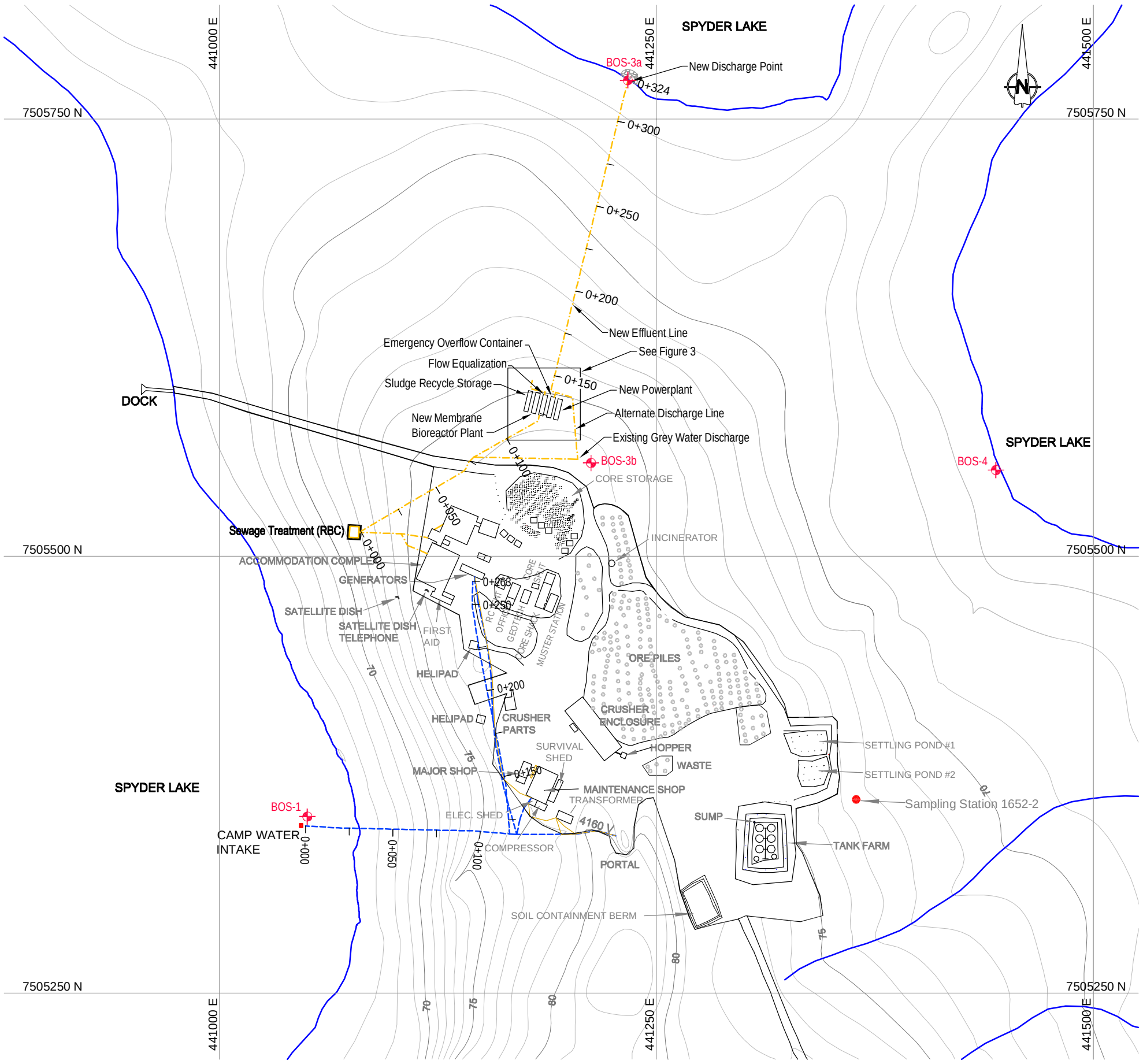


LEGEND

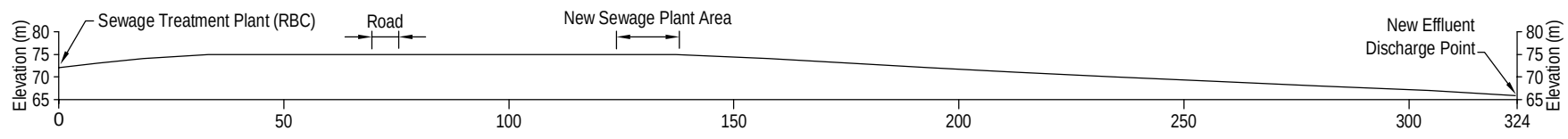
- Water Sampling Point
- Water Intake Pipe
- Sewage Pipe

BOSTON CAMP LAYOUT

0 20 40 60 80 100

Scale in Metres

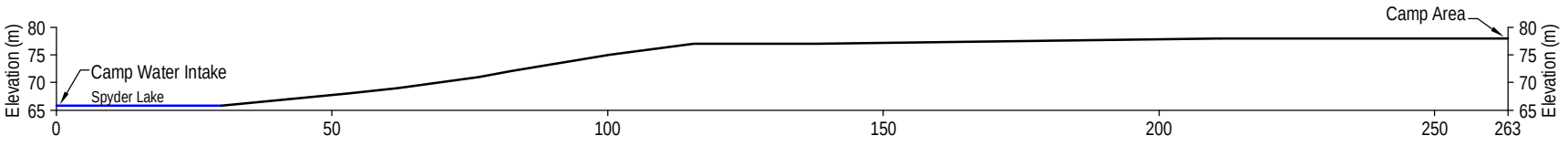
Note:
The discharge sampling point is either BOS-3a or BOS-3b depending on which is in use.



Sewage Discharge Profile

0 5 10 15 20 25

Scale in Metres



Water Intake Profile

0 10 20 30 40 50

Scale in Metres

Note:
New sewage plant data obtained from SNC Lavalin. Drawing titled "Boston Camp Membrane Bioreactor and Powerplant Plan", project number 334540, dwg number 1, dated January 15, 2009.

Topographic Information Supplied by BHP World Minerals Inc.
National Topographic Series (NTS) Maps
North American Datum (NAD) 1927

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1CM014.005
FILE NAME: BOSTON_Sewage Plan.dwg

HOPE BAY MINING LTD.

Hope Bay Gold Project

Sewage Management Plan

Boston Sewage Management Infrastructure

DATE:	APPROVED:	FIGURE:
Mar. 2009	MV/EMR	2

2 Applicable Legislation and Licence

2.1 Water Licence

The operation and maintenance of the waste water treatment facilities at the Boston exploration camp is currently regulated under the water license issued by the Nunavut Water Board pursuant to its authority under Article 13 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada* and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*. The water license is:

> Boston Advanced Exploration Project – License 2BB-BOS0712.

Part D, section 17 of that water license sets discharge standards that must be met by stating:

> All effluent discharged from the Sewage Disposal Facility at the Boston Project Monitoring Station BOS-3 (formerly 1652-3) shall meet and not exceed the following quality standards:

Table 2: Discharge Water Quality Requirements for Boston Camp at Discharge Monitoring Point BOS-3

Parameter	Maximum Average
pH	Between 6.0 & 9.5
Total Suspended Solids	100 mg/L
BOD_5	80 mg/L
Faecal Coliform	10,000 CFU/100 mL
Oil and Grease	No visible sheen

Monitoring Station BOS-3 is defined as the Sewage Disposal Facility final effluent discharge however monitoring at Station BOS-4 (treated sewage effluent prior to entry into Aimaoktatuk (Spyder) Lake) must also be conducted as required in the license.

Copies of relevant legal documents will be kept on file at the Boston Site. Management and safety personnel will provide an overview of the applicable regulations to all employees as part of their orientation training and through ongoing training.

A copy of the Nunavut Water Board issued License 2BB-BOS0712 is included as Appendix A.

2.2 Other General Guidance

Other documentation pertinent to the Waste Water Treatment Facilities include:

- Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, NWT Municipal and Community Affairs - Community Development, dated October 1996 by Diep Duong and Ron Kent

- Consolidation of Environmental Protection Act (RSNWT 1988c E.7)
- Consolidation of the Environmental Rights Act RSNWT 1988 c83 2nd Supp)
- Consolidation of Camp Sanitation Regulations
- Environmental Guideline for General Management of Hazardous Waste.

3 Sewage Management at the Boston Facility

3.1 Introduction

Waste water treatment in northern climates requires careful consideration to ensure that the local environment is not disturbed by the input of excessive wastes, nutrients or the creation of a chemical imbalance. The current Boston STP was installed in 1996. At the time it was one of the first facilities in Nunavut to provide primary and secondary treatment at an exploration site. It has aged and now needs to be replaced. HBML is continuing its permitted operation at the Boston facility in the Hope Bay area

Sewage from human activities at Boston has been processed via a packaged sewage treatment plant that uses biological activity to digest the sewage and reduce its biological oxygen demand (i.e., its ability to consume oxygen).

4 Boston Camp Existing Sewage Management

4.1 Boston Camp Sewage Management Plan (October 2007)

The current Boston Project sewage treatment facility is described in the *Waste Water Treatment Facility Operation and Maintenance Manual - Boston Advanced Exploration Project & Hope Bay Regional Exploration Project, Nunavut* issued by Miramar Hope Bay Ltd. in October 2007.

The sewage treatment facility at the Boston Camp currently consists of an S-40 ROTORDISK® Full Steel Packaged sewage treatment plant c/w 5,421 sq. ft. of combined bio-support media with a rated capacity of 28,000 litres/day.

The current sewage treatment plant is located to the northwest and down slope of the camp near the shore of Aimaoktatuk (Spyder) Lake as shown in Figure 1 and 2. The facility is set approximately 30 meters back from the lake shore and the treated effluent is discharged onto the tundra towards the centre of the peninsula immediately to the north of the camp. The drainage from this discharge point flows towards Aimaoktatuk (Spyder) Lake and enters the lake at a point downstream of the camp.

The existing S-40 ROTORDISK® facility at the Boston Camp is an aerobic sewage treatment plant. The unit is a high-efficiency packaged sewage treatment plants that use the process of rotating biological contactors (RBCs) to remove pollutants from wastewater. This process utilizes a fixed growth bacteria process, whereby bacteria are grown on a media surface that is rotated into and out of the wastewater. The treated wastewater flows through four zones, each with a progressively higher standard of treatment.

The sewage treatment plant consists of a primary settlement tank, the RBC tank and the secondary tank. The RBC tank is the aerobic section of the treatment plant and is divided into four stages.

Raw sewage gravity flows into the primary settlement tank, where settling separates heavy solids and the supernatant enters the aerobic section through the inlet slot located at the front of the RBC tank.

The aerobic section is made up of four stages. The first stage is comprised of one or two disk banks, representing 40% of the surface area of the RBC. The normal colour of the bacteria in the first stage is dark brown and it is at this stage that most of the BOD reduction occurs. The succeeding second, third and fourth stages are mounted on the rest of the shaft or another common shaft. Each stage has one disk bank each.

In the second stage, further reduction in BOD takes place and nitrifying bacteria start to predominate in the third and fourth stages. The fourth disk bank or last stage of the process has recycle buckets that introduce both fresh dissolved oxygen into the primary settlement tank and nitrifying bacteria present in the recycled water.

Partially treated water from the RBC then enters the secondary settling tank. Sloughed off biomass from the disks and other suspended solids is further settled in this chamber. A scum weir prevents the floating scum from leaving the chamber through the effluent pipe. The ROTORDISK® sewage treatment plants have three major steps in the purification process. In the primary settlement chamber, gross solids separate from the flow by either sinking or floating. In the Rotorzone, dissolved pollutants are broken down to simple, non-polluting compounds by the biological growth (biomass) which grows on the rotating disks. The final settlement chamber permits gravity separation of spent biological growth, which continually sloughs off the disks in the Rotorzone preceding it.

4.2 Sludge Removal Prior to 2008

In accessible southern locations a pump-out truck of the same type that pumps out septic tanks normally does the sludge removal. However the remote location of the Boston camp makes this approach problematic. Prior to 2008 sludge accumulations in the ROTORDISK® unit at the Boston camp were typically removed prior to the annual camp shut down (typically late Fall before Winter). This represents an annual operating season of approximately 6 months out of each year. The procedure used is as follows:

- During the annual shut down the site crew starts washing down the RBC units three days in advance of the final shutdown to wash the grey water and sewage through the four sections of the plant.

- Once this three days of flushing are complete then all waste water sources are shut down to facilitate the clean out process.

- The liquid content of the treatment plant is withdrawn by pumping out the liquid to expose the sludge. This process starts by pumping out the supernatant from the primary settlement

tank until the sludge begins to show up. The supernatant is pumped into section one of the Rotorzone. The pumping of supernatant is then halted.

- The sludge is then pumped into 205 litre drums which are set on pallets for latter ease of movement by fork equipped mobile equipment. The sludge pumping suction hose is placed down at a multiple number of points to help ensure complete removal of accumulated sludge deposits.

- Once the primary settlement tank is emptied the pumping of sludge is halted;

- The liquid content of section one of the Rotorzone is withdrawn by pumping out the liquid to expose the sludge. The supernatant from section 1 is pumped into section 2 of the Rotorzone until the sludge is exposed. The pumping of supernatant is then halted.

- The sludge is then pumped from section 1 into 205 litre drums. Once the section 1 tank is emptied the pumping of sludge is halted.

The process is then repeated for sections 2, 3 and 4 and for the final settlement chamber.

Typically this sludge clean out occurs at the end of the exploration season (October) which then facilitates shut down and winterization of the plant until the start of the next years exploration season (typically late February). If sludge clean out is occurring outside of the end of season shutdown of the camp, it should be noted that the biological growth on the disks should not be washed off, but left in place. The exception to this is if the disks have accumulated excess biomass due to sludge pump out being delayed past the indicated intervals.

4.3 Water License Requirements for Sludge Disposal

For the Boston Advanced Exploration Project, Part D Item 12 of the Water License (2BB-BOS0712) states:

> 12)"The licensee shall dispose of sludge removed from the Sewage Disposal Facility in a sump located a minimum of thirty (30) meters from the normal high water mark and such that they do not enter any water body".

In the same license Part D Item 13 and 14 states:

> 13) "If a Licensee contemplates the disposal and treatment of sludge on land, it shall submit to the Board for approval at least (4) four months prior to the disposal of Sludge a proposal which shall address, but not limited to:
>
> a. Location of disposal area
>
> b. Quantities and composition of sludge

c. Mitigation measures to control run-off and restrict access

d. A program for water quality monitoring

e. An implementation schedule

f. An executive summary of the proposal in English and Inuktitut.

14) The Licensee shall implement the proposal specified in this Part as and when approved by the Board."

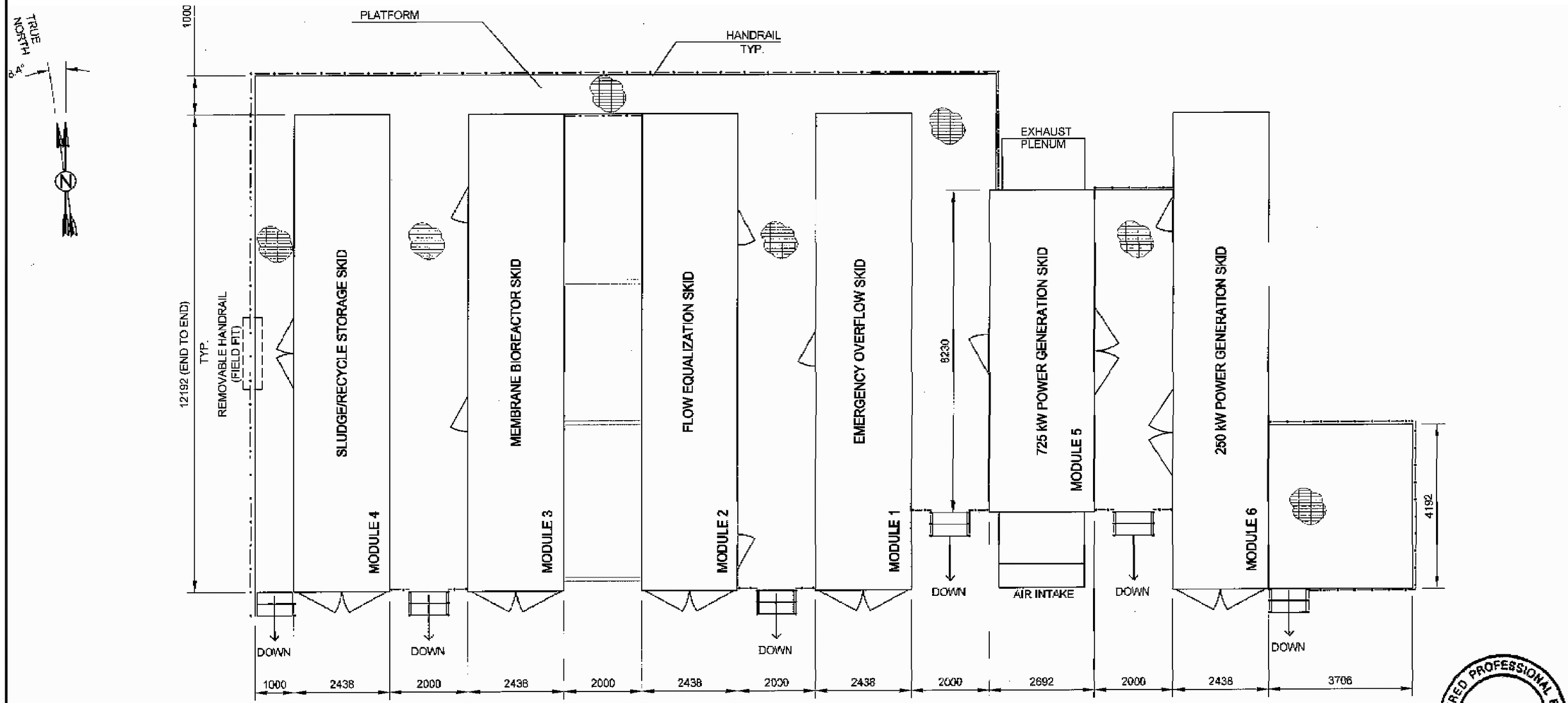
In the absence of an approved sludge disposal system at the Boston camp, all sludge is to be placed into drums, sealed and held in storage pending an alternative approved sludge disposal method.

The sludge that is generated at Boston Camp will be incinerated at the approved incinerator at Doris Camp.

4.4 Water Intake

Intake of freshwater water and discharge of waste will be from and to the same locations specified in the current license (Figure 2). The current water intake is upstream and in a separate arm of the lake from where residual water from the STP returns to the lake. Currently the water intake for the camp is approximately $3m^3/d$ and this is likely to increase to about $10m^3/d$ under full occupancy of 100 people. Total water use for the project under licence 2BB-BOS0712 is set at $100m^3/d$, so this will fall within the volumes that may be extracted.

The permanent freshwater supply pipeline intake point has been fitted with a screen to prevent the collection of fish and is in compliance with Part E of the Water Licence. The water volume pumped at the intake point in Aimaoktatuk (Spyder) Lake will be monitored at Station BOS –1. This monitoring point is defined as the water taken from a valve on the discharge end of the fresh water pump. Figure 3 provides information on the intake system and water delivery system to the Boston Camp.



GENERAL ARRANGEMENT PLAN

(N.T.S.)

REGISTERED PROFESSIONAL ENGINEER
L.K. CHAN
LORNSEE
2009/10/9

SRK Consulting Engineers and Scientists, Vancouver B.C.	**HOPE BAY MINING LTD.**	Sewage Management Plan
SRK JOB NO.: 1CM014.005	Hope Bay Gold Project	Boston Camp Membrane Bioreactor Plan and Details
FILE NAME: BOSTON_Sewage Plan.dwg		DATE: Apr. 2009 / APPROVED: MV/EMR / FIGURE: 3

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4.5 Effluent Discharge

Grey water effluent at the Boston Camp is currently discharged via pipeline from the ROTORDISK® sewage treatment plant (STP) on to the tundra approximately 100 m north of the camp facility in an area closer to the centre of the peninsula on which the camp is located. The flow from the discharge point is toward Aimaoktatuk (Spyder) Lake down slope and downstream from the camp.

A three-inch diameter permanent HDPE pipeline has been installed from the STP to the tundra discharge point north of the facility as shown in Figure 2. The effluent is fed into the discharge pipeline by pumps in the treatment plant. The discharge is direct to the tundra which drains to the west towards a Aimaoktatuk (Spyder) Lake downstream from the camp facility. A monitoring point BOS-3 has been established (and as required) to ensure the quality of the discharge water is monitored and the results reported. A second monitoring station, BOS-4 has also been established and is monitored as required to assess the quality of the runoff water from the discharge point prior to its entry into the lake downstream of the site. No changes are proposed to the current discharge location or the monitoring programs as a result of the installation of the new SaniBrane® Sewage Treatment Plant.

As with the other camps at Hope Bay, HBML intends to continue to manage the discharge point to ensure that soil erosion does not occur. Erosion protection in the form of a bed of armour rock placed at the discharge point or a diffuser system used to reduce the discharge energy will be provided as required. Erosion protection requirements will be monitored routinely at both the discharge point and the area down slope to ensure that erosion management is effective. The discharge dispersal area will also be fitted with silt curtains as required.

In winter, if the discharge point continues to be used, the discharge water will be distributed over a minimum 1ha area to form ice to a depth of 1m. During the spring thaw, this ice will slowly melt and flow away and is not anticipated to cause erosion as it is wide spread and slow melting. The discharge point will continually be moved in the local area to avoid ponding and minimise the potential for vegetation die back and permafrost damage.

5 Boston Camp Sewage Management Plan (2009)

5.1 Introduction

The SaniBrane® Sewage Treatment Plant will be installed as shown on Figure 2. The SaniBrane® plant has a been designed for the effective treatment of waste water from a 180 person camp and has capacity to accept raw sewage and sludge into its surge/conditioning tanks. Current Boston Camp capacity due to performance issues with the STP is 45. The new STP will first allow the capacity to step back up to 60 and then will in time allow camp expansion to at least 100 people. The new plant was sized to allow for incremental expansion of the camp over time. The maximum design capacity of the SaniBrane® plant is for 180 people at 280 l/person/d. In the event of a failure in the STP, an Emergency Storage and Overflow Container is provided to hold untreated sewage. Specific details on the SaniBrane® Membrane Bio-reactor (MBR) are presented in this section of the sewage management plan.

The Boston Camp will have a state of the art packaged MBR plant through the installation of a new SaniBrane® Membrane Bio-reactor (MBR) Sewage Treatment Plant. The MBR process was originally introduced in Japan where it was used in conjunction with membrane waste water treatment to treat and recycle water in high rise buildings. The treatment process operates both aerobically and anoxically and will treat the carbon fraction of the wastewater (the BOD) and address ammonia and other nitrogen containing compounds to some extent. Ammonia reductions exceeding 95% are possible with this type of plant. Although reducing ammonia is not a component of the water licence for this facility, it is consistent with HBML's intent to minimise its environmental footprint.

A regular cleaning process is necessary to maintain the membrane filter. Under continual operation (24/7) the SaniBrane® filter has a life of between 3 to 5 years before requiring replacement. With cleaning and extremely good sewage preparation and screening, 7 years of life may be possible.

One significant feature of the processes is that, with the exception of the final sludge handling, the sludge management process is entirely enclosed within the process vessels which make the facility more "operator friendly" by reducing operator exposure to noxious gases and liquids. This results in a more pleasant work environment for operators and living environment for nearby residents of the Boston Camp.

5.2 Description of the SaniBrane® Sewage Treatment Plant

The SaniBrane® Membrane Bio-reactor STP for HBML's Boston Camp was designed to treat municipal strength sewage and is housed in six - 40 foot-long containers (Figure 4).

The plant is designed to the following specifications:

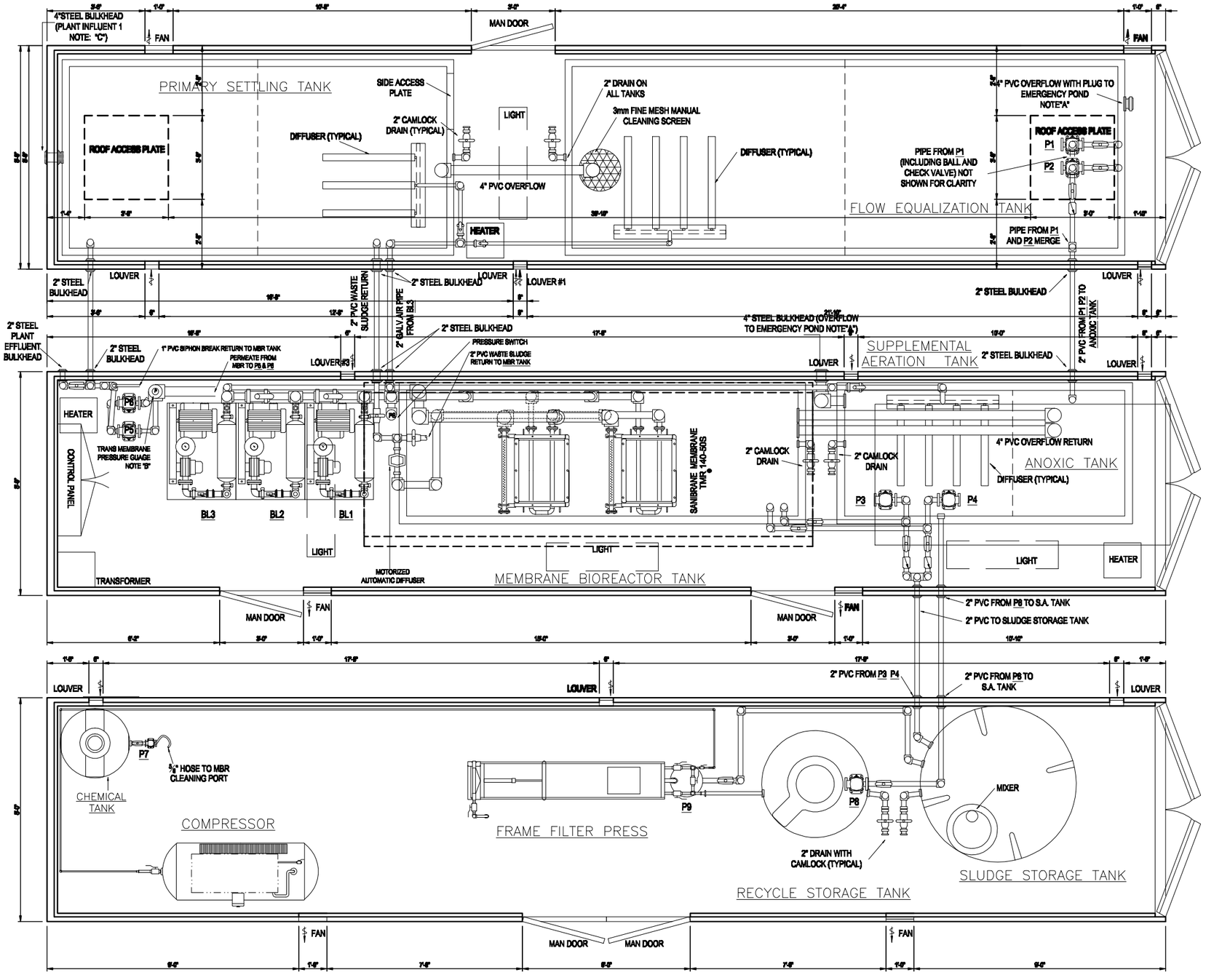
- Maximum flow 28,000 L/d
- Minimum daily flow 2,800l/d
- Average hourly flow (ADF/24) 1,170L/h
- Instantaneous peak flow 3,500L/h
- Dry solids production 2.8kg/d

The effluent discharge is expected to have the following characteristics:

- 10 mg/L BOD_5
- 10 mg/L TSS
- 10 mg/L NH_3-N
- 200 fecals/100ml.

As a result, it is anticipated that effluent quality will be equal to or better than the quality requirements specified in the Nunavut Water Board Water Licence 2 BB-BOS0712, which specifies Maximum Average Concentrations for TSS, BOD_5 and Fecal Coliforms of:

- 100 mg/L TSS
- 80 mg/L BOD_5
- 10,000 CFU/100 ml Fecal Coliforms.



REVISION	DATE	DESCRIPTION
6	09-AUG-07	REVISED AS BUILT
5	17-JUL-07	BLOWER LAYOUT MODIFIED
4	13-JUL-07	MIXER ADDED TO SLUDGE STORAGE TANK

SANITHERM ENGINEERING LTD.
SUITE 100 - 340 BROOKSBANK AVENUE, NORTH VANCOUVER, BC, V7J 2C1, CANADA
TEL: (604) 986 - 9168
FAX: (604) 986 - 5377
E-MAIL: saneng@sanitherm.com
WEBSITE: www.sanitherm.com

PROJECT: 180 MAN CAMP						PROJ. NO.
CLIENT: MIRAMAR DORIS NORTH						REV. NO. 6
TITLE: SANIBRANE® MBR-GENERAL LAYOUT KEY PLAN						
DRAWN BY: T.Y.	CHECKED BY	DATE: 09-AUG-07	SCALE: N.T.S.	DRAWING NO. 070072-A3622-P01		

5.3 Description of the SaniBrane® MBR STP Process

The SaniBrane® MBR STP system consists of the following major processes:

- Pre-treatment
  - Primary settling
  - Equalization
- Biological treatment and effluent separation
  - Anoxic treatment
  - Aeration
  - Membrane reactor
- Treated effluent discharge
- Sludge de-watering
- Clean In-Place (CIP) system.

5.3.1 Pre-treatment – Primary Settling

Wastewater enters the STP flowing into the primary settling tank, divided by a bulkhead into two sections. Settling occurs in the first section while aeration for odour control and some mixing is provided by coarse bubble diffusers in the second section. Wastewater then flows from the primary settling tank into the equalization tank through a basket screen.

5.3.2 Pre-treatment - Equalization

The purpose of equalization tank is to provide a reservoir to smooth the fluctuating wastewater feed, allowing the downstream biological process to be fed at a constant rate. The equalization tank is divided into two sections by a bulkhead. The equalization tank (EQ) is designed to hold a varying volume between 0 and approximately 3880 L at an average flow of approximately 0.946 L/s (15 USGPM).

The tank is provided with coarse bubble aeration for mixing and freshening to reduce potential odours. The system is vented to the outside through air blowers. Two submersible equalization pumps are located in the tank and provide the forward flow at the controlled rate of 0.946 L/s (15 USGPM). The pumps will operate with one primary duty pump running at design flow and one in standby. The standby pump automatically responds if the primary duty pump fails as the system is controlled by a Programmable Logic Controller (PLC). The tanks are equipped with level switches and alarms. The flow to the anoxic tank is set by throttling ball valves. By the end of equalization actual removal of any organic contaminants (BOD, Ammonia-N, etc.) has been minimal and incidental. Aeration in the equalization tank may remove 5% of the BOD and some organics may have been collected by screening.

5.3.3 Biological Treatment and Effluent Separation – Anoxic Tank

The anoxic tank is divided into two by a bulkhead to form an anoxic and supplemental aeration tank. The flow into this tank is influent from the equalization tank and a recycle flow from the membrane reactor tank of two to four times the influent flow. The mixing of streams forms a mixed-liquor-suspended-solids (MLSS) concentration of ~10,000 to 20,000 mg/L. The recycle flow contains high levels of nitrates (NO_3-N), the end products of nitrification (ammonia removal). Under anoxic conditions (zero dissolved oxygen), the nitrates will be removed and in the conversion will remove a portion of the BOD. To achieve anoxic conditions, the tank is generally not aerated, but mixing is provided by coarse bubble diffusers, using a manual ball valve on the air line.

The process is PLC controlled with level switches, pumps and alarms being controlled. In the event of high flows the equalization tank pumps are stopped. In the event that low levels of effluent liquid are available for processing, timers are activated and the process enters into a sleep mode. Sleep mode involves periodically turning on blowers for scouring in the membrane modules and provides minimal mixing to the EQ basin. Until the EQ basin has been reactivated and raised levels in the Anoxic Tank, the entire system stays in sleep mode. Transfer pumps forward the partially treated liquid to the membrane reactor.

5.3.4 Membrane Reactor

This step in the process provides the same aeration purpose as the previous step with the added purpose of separating the biological solids from the flow stream and thereby creating a highly treated, acceptable effluent for disposal (Figure 5). Also like the previous tank the MLSS will be ~10,000 to 20,000 mg/L.

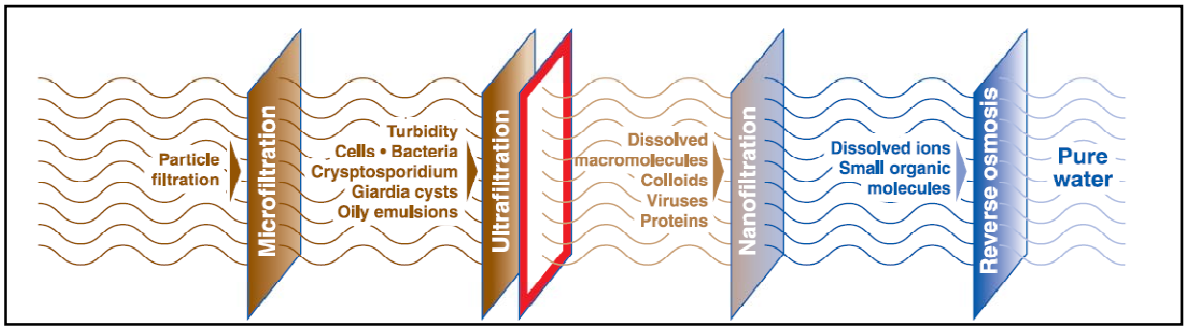


Figure 5: The 0.08 Micron Pore Size of the SaniBrane® Membrane Shown in Red and the Quality of the Water that is Produced with Different Types of Filtration

The aluminum MBR tank houses one membrane module that acts as both the aeration and the separation device. Air is provided to the unit from the membrane blower, serving primarily as a cleaning or scouring mechanism, but simultaneously providing air for mixing and process oxygenation. Two blowers are used, a primary duty blower and a standby blower.

Two effluent pumps are associated with the membrane reactor tank. One operates as a primary duty pump with the other as a standby unit and is responsible for removing treated effluent from the module at a rate of 0.946 L/s (15 USGPM).

This module is again protected by level switches, alarms and the PLC. The float switches in the membrane tank act to prevent the water level above the membrane module from falling to a level where the unit can be affected. On low level alarms, the permeate pumps are deactivated. In addition, to shut down due to low levels, the permeate pumps cannot be operated if scouring air is cut off. To this end the blower pressure supply is monitored. Failure to supply air because of motor failure or failure to pressurize the line, possibly due to blockage or V-belt failure, prevents the effluent pumps from operating. This prevents poor quality effluent from leaving the SaniBrane® unit. Failure of the main membrane blower will trigger an alarm as well as result in a start-up of the standby unit. Recycle liquid flow continues regardless of equalization pump or effluent pump operation.

The effluent removed by the permeate pump is discharged to the tundra, while overflow from the MBR tank is recycled back to the anoxic tank.

5.3.5 Effluent Discharge

Effluent discharge will continue to occur via pipeline from the Boston Camp SaniBrane® sewage treatment plant to the tundra discharge point 100 m north of the Camp or to a new discharge point directly to Spyder Lake.

Spyder Lake Discharge: A three-inch diameter permanent HDPE pipeline has been laid from the STP to the Spyder Lake discharge point as shown in Figure 2. The currents in Spyder Lake flow in a north / northwest direction. This takes effluent away from the shoreline and away from the potable water intake. The shoreline is poorly vegetated, gravel washed, lacustrine environment with unsorted granular sizes ranging up to large cobble. Such cobble would be used in engineering practice as shoreline protection. Therefore, an effluent discharge into this environment is unlikely to cause erosion. A Sanibrane plant is one of only a few sewage treatment processes capable of meeting the Fisheries Act. and would have little influence on water quality and not need to be diluted.

Tundra Discharge: A three-inch diameter permanent HDPE pipeline has been laid from the STP to the tundra discharge point shown in Figure 2. This is the same discharge point previously established under the current license and described in *Waste Water Treatment Facility Operation and Maintenance Manual - Boston Advanced Exploration Project & Hope Bay Regional Exploration Project, Nunavut*. The effluent will be fed into the discharge pipeline by pumps in the treatment plant. The discharge will be direct to the tundra which will drain to the west towards a large lake Aimaoktatuk [Spyder] Lake. In the Water Licence, regular sampling of the effluent a Station BOS-3 is required to ensure the quality of the discharge water is maintained and reported. Monitoring point BOS-04 will also require sampling. BOS-04 is located near the shore of the lake and is designed to characterize runoff water from the discharge point prior to its entry into Aimaoktatuk (Spyder) Lake.

In winter, if the tundra discharge point continues to be used, the discharge water will be distributed over a wide area of minimum 7800 m^2 to form ice to a depth of 1m. During the spring thaw, this ice will slowly melt and flow away and is not anticipated to cause erosion as it is wide spread and slow melting. The vegetation in the area may however become damaged by the ice and if die back occurs erosion could occur. As with the other camps at Hope Bay, HBML intends to manage the discharge point to ensure that soil erosion and vegetation die back does not occur. Erosion protection in the form of a bed of armour rock placed at the discharge point or a diffuser system used to reduce the discharge energy will be provided. Erosion protection needs will be monitored routinely at the discharge point and the down slope area to ensure that erosion management is effective. The discharge dispersal area will also be fitted with silt curtains as required.

5.3.6 Sludge Dewatering, Destruction and Use

Sludge dewatering is a manual process. The operator directs some of the flow from the anoxic and supplemental aeration tank via pumps to the sludge holding tank. Polymers can be added for thickening in the sludge mixing tank, using the mixer for agitation. The solution is pumped to a plate and frame press with filtrate directed to the sump from where it is periodically pumped back to the anoxic and supplemental aeration tank by submersible pump. Dried sludge is collected in a sludge hopper and is removed for disposal in a suitable facility or in an approved incinerator. Currently, the plan is to continue to dispose of sludge as specified in Part D Item 12 of the Water License (2BBBOS0712) which states:

> "The licensee shall dispose of sludge removed from the Sewage Disposal Facility in a sump located a minimum of thirty (30) meters from the normal high water mark and such that they do not enter any water body".

In the same license Part D Item 13 and 14 states:

> 13) If a Licensee contemplates the disposal and treatment of sludge on land, it shall submit to the Board for approval at least (4) four months prior to the disposal of Sludge a proposal which shall address, but not limited to:
>
> a. Location of disposal area;
>
> b. Quantities and composition of sludge;
>
> c. Mitigation measures to control run-off and restrict access;
>
> d. A program for water quality monitoring;
>
> e. An implementation schedule; and
>
> f. An executive summary of the proposal in English and Inuktitut.
>
> 14) The Licensee shall implement the proposal specified in this Part as and when approved by the Board.

In the absence of an approved sludge disposal location at the Boston camp, all sludge will be placed into drums, sealed and held in storage pending an alternative approved sludge disposal method. Sludge could be incinerated at Doris Camp in the approved incinerator.

Consistent with HBML's intent to operate in the most responsible manner and conserve natural resources to the maximum extent possible, methods are currently being investigated to maximize opportunities to use the dried sludge as a fuel or fertilizer for re-vegetation if the material is found to be chemically suitable.

SaniBrane® sludge will have a typical solids content of 25-30 % after the frame press. This will give it the consistency of top soil. This material can be further composted or it can be incinerated. If the material can be further processed and subjected to composting at high enough temperatures to destroy remaining pathogens, the compost could possibly be used as a source of fertilizer for future site rehabilitation. The sludge would need to be acceptable to local regulators as well as comply with regulations in terms of metal content and pathogen content. Furthermore the sludge is reported to sustain combustion at 50% solids. If the sludge can be adequately dried it could be used as a source of fuel, possibly even to sustain composting temperatures at high enough levels. Burning of the sludge would need to comply with emission requirements and the ash would need to be safely disposed of in an appropriate facility. HBML is committed to investigating these and other opportunities to ensure their environmental footprint is reduced as far as possible.

5.3.6 CIP System – Organic Cleaning

A mild solution of sodium hypochlorite (0.5%) is added to the membrane modules for cleaning once or twice per year. The need for this cleaning process is determined from monitoring of the trans-membrane pressure. This will involve daily monitoring of the pressure reading between the discharge headers in the MBR Tank and the discharge pressure on the effluent pump. A reading indicating a rise of 20kPa (3psi) from the initial recorded reading requires a planned cleaning.

A chemical feed pump introduces the sodium hypochlorite solution to the module. After adding 500L (130 Gallons) to the module, the system will be allowed to soak for several hours. If an inorganic cleaning is required, a solution of oxalic acid or citric acid would be used instead of sodium hypochlorite.

The cleaning agents will generally be consumed and their oxidizing potential reduced during the cleaning process. Under normal circumstances the water from the plant would be discharged as part of the effluent stream. As the effluent stream is being discharged to the tundra, the water from the cleaning process will be collected and returned to the frontend of the sewage treatment plant. This will ensure that any oxidizing potential is completely consumed and that the water is subjected further normal dilution and treatment with new raw sewage.

5.3.7 UV Disinfectiuon

The treated sewage will be sterilized using a UV based disinfection system fitted with a UV intensity monitor to ensure optimal operation is maintained at all times.

5.3.7 SaniBrane® Operation and Maintenance

The rounded design parameters for the SaniBrane® plant are

- 180 person capacity
- 285 L/person/day (75 USG/person/day)
- Two 30 000L (8000 USG) emergency storage tanks.

The specific process includes primary settling, sludge management, and chemical cleaning to ensure minimal manual interface with the STP, effluent and sewage sludges and discharge water.

A comprehensive operations manual is attached in Appendix B. The manual is not repeated in summary form here as the plant has complex start-up, normal operation and maintenance procedures. The full operation manual as supplied by the supplier is regarded as the key document for the SaniBrane® plant.

Regular maintenance of the SaniBrane® plant is required to maintain high water quality effluent and availability of service. The table below refers to the routine maintenance items on the plant (Table 3).

Table 3: Routine Maintenance Requirements for the SaniBrane® System

Item No.	Tag No.	Equipment	Task	Frequency
1.	B1, B2 & B3	Sutorbilt 3MV - P Blower	Check gear case oil level and top up as required to maintain proper level	Daily
			Drain and replace gear case oil	Every 1500 hours
			Grease drive end bearings	Every 500 hours
			Check blower inlet filters and replace as necessary	Weekly
2.	Air Compressor	Ingersoll - Rand 2545E10V	Lubricate level	Fill as needed
			Drain receiver tank condensate (if automatic draining device is not provided) open manual drain valve and collect and dispose of condensate accordingly	Daily or as required
			Check system oil pressure on lubricated models while compressor is hot	Daily or as required
			Observe operation of safety/relief valves while compressor is running. Replace if not operating freely. Inspect air filters, replace as necessary	Weekly
			1. Inspect for air leaks by squirting soapy water around joints and watch for bubbles 2. Check tightness of screws and bolts 3. Change petroleum lubricant while crankcase is warm, drain compressor oil and clean oil sight glass 4. Replace oil filter and change lubricant (if necessary) on pressure lubricated models 5. Install maintenance pack, change synthetic lubricant while crankcase is warm, replace filter element	Monthly Monthly 3/500 (months/operating hours) whichever occurs first 6/1000 (months/operating hours) whichever occurs first 12/2000 (months/operating hours) whichever occurs first
3.	P1, P2, P3, P4 & P8	Tsurumi Pumps	Bearing Lubrication	As required upon inspection
			Major Overhaul	As required depending on pump performance.
			Motor Inspection with the following tasks: 1) Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water etc. Oily vapour, paper, pulp, textile lint etc., can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure. 2) Use an Ohmmeter (“Megger”) periodically to ensure that the integrity of the winding insulation has been maintained. Record the Ohmmeter readings. Immediately investigate any significant drop in insulation resistance. 3) Check all electrical connectors to be sure that they are tight.	Every 500 hours or every three (3) months or whichever occurs first.

Item No.	Tag No.	Equipment	Task	Frequency
4.	Star Poly Press	Star Poly Press 470MM	Check pressure regularly Check for press leaks, look around o-rings for cracks	As required depending on press performance Daily
			Check filter cloths are not detached and that they are torn Caution: Do not over tighten valves in hydraulic system	Regularly During maintenance
5.	P5 & P6	Grundfos CR1-2 Permeate/Effluent Pumps	Motor Inspection with the following tasks: 1) Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water etc. Oily vapour, paper, pulp, textile lint etc., can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure. 2) Use an Ohmmeter ("Megger") periodically to ensure that the integrity of the winding insulation has been maintained. Record the Ohmmeter readings. Immediately investigate any significant drop in insulation resistance. 3) Check all electrical connectors to be sure that they are tight.	Every 500 hours or every three (3) months or whichever occurs first.
6.	P9	Little Giant PE 2.5 Centrifugal Chemical Clean Pump	Inspect impeller and body for excessive build-up or clogging and repair as required.	Upon significant decrease in pump performance.
7.	MBR	SaniBrane®™ TMR 140-50S	Observe and record trans-membrane pressure.	Daily
			Perform Chemical Clean of membranes	During start-up perform weekly; During normal operation, perform within seven (7) days of observation of a trans-membrane pressure of 20kPa (3psi)

5.3.8 Critical Operating Limits

The following points are noted amongst others by the manufacturer as critical operational limits that must be met to ensure proper system operation, maximum lifespan and good effluent quality. For a complete list of installation, operation and maintenance requirements refer to the manufacturer's manuals, parts of which are presented in Appendix C.

- The SaniBrane® sewage treatment plant is designed to treat normal human domestic waste from toilets, showers, laundry and kitchens
- It is not designed to treat industrial wastes, chemical cleaning agents, bactericides or any product that is toxic to the bacteria that forms to biologically treat the human waste
- Only biodegradable detergents and products can be used in effluent feeds
- Kitchen grease traps must be well serviced to prevent overloading the SaniBrane® system with oils and grease
- Plastic, rubber and other non-biodegradable items must be kept out of the sewage flow
- The SaniBrane® unit must be protected from freezing. Maintain the temperature from 5º to 40° C (41° to 104° F)
- The effluent discharge from the SaniBrane® unit must not be used for drinking water
- SaniBrane® effluent water should be water quality tested for suitability before it is used again
- To protect the membranes and prevent clogging, design the peripheral equipment in such a way that the raw water is supplied to the membrane submerged basin via a screen with openings 3 mm or less
- Avoid applying pressure to the permeate side
- Do not use raw ground water for start up testing. If it contains a large amount of iron, manganese, calcium and/or silica it may cause clogging the membrane.

5.3.9 Potential Operational Failures and Alternatives

Critical components such as discharge pumps, blowers and sewage transfer pumps are supplied in duplicate on the SaniBrane® plant. The primary duty equipment can therefore be replaced by a standby duplicate piece of equipment. In essence, no critical component of the plant should be able to fail. In the event that there is a failure in the plant the interlocks in the system have been arranged so that the SaniBrane® plant goes into sleep mode and partially treated effluent cannot be pumped from the system. In the event that there is an electrical supply failure the plant will shut down and it will not be possible to treat sewage and therefore it will not be possible for partially treated sewage to be discharged to the tundra. The sewage treatment process includes two 8000 gallon holding tanks in place at the Boston Camp site to hold sewage. These tanks will be used as an emergency sewage holding system in the event that there is a temporary failure in the plant. No untreated sewage can be discharged to the environment. The tanks can hold two days of sewage flow.

5.3.10 Electrical Power

SaniBrane® plant and Effluent Discharge System

This unit will draw a maximum 200 KW of power. The four (one at 725kW and three at 225 kW) gensets will be used to supply the power for the Boston Camp Sewage Treatment Plant.

6 Transition from ROTORDISK® to SaniBrane®

The ROTORDISK system will be kept operational during the installation of the SANIBRANE system and will be maintained operational until the Sanibrane system is operating to specification. Once the new system is fully operational and operating the old ROTORDISK plant will be turned off and decommissioned. The old plant will then be removed from the site by trailer and shipped away for suitable disposal.

7 STP Performance and Environmental Monitoring

7.1 Operator Training

An on- site training program will be developed to cover all aspects of the infrastructure associated with sewage management facilities (i.e. piping, pumping, uptake and discharge) and the Sewage Treatment Plant, its operation, maintenance, monitoring, sample collection, preservation and record keeping. The training will also include an identification of activity related risks, knowledge and use of job specific Personal Protective Equipment (PPE), as well as training in the proper handling, storage, and disposal of all hazardous substances and/or waste dangerous goods associated with the facility.

The training will be both job-specific and equipment specific and will be provided to any site personnel assigned the responsibility to oversee, inspect, maintain , monitor, assess performance and report on the facilities, its discharges and discharge location. The training program will be reviewed as required by site management, with a full review of the training program completed as least once per calendar year.

7.2 Freshwater Intake

The existing Boston water license allows HBML to take and use fresh water from Aimaoktatuk (Spyder) Lake. The location of the intake point is Station BOS-1. The volume taken at this point is not to exceed 100 cubic meters per day unless otherwise approved by the Board. Water monitoring at this location will be completed as per the requirements of the water license.

7.3 Discharge Monitoring

Part J of the Water License 2BB-BOS0712 requires the following monitoring in relation to the STP:

1. Monthly samples are to be taken during periods of discharge from the sewage treatment plant (i.e. monthly in the months when the sewage treatment plant is in operation) to be taken from the following two sampling points:

    a. Sample Station BOS-3 (formerly SNP station 1652-3) Sewage Treatment Plant final discharge; and

    b. Sample Station BOS-4 (formerly SNP station 1652-4) Treated sewage effluent prior to entry into Aimaoktatuk (Spyder) Lake.

The samples should be analyzed at an accredited external laboratory for the following parameters:

- Biochemical Oxygen Demand (BOD)

- Total Suspended Solids
- Faecal Coliforms
- pH.

Each sample should also be visually assessed for visible oil and grease sheen.

2. Once annually during the open water season a sample of treated sewage effluent should be taken at Sample Station BOS-4 (formerly SNP station 1652-4) prior to entry into Aimaoktatuk (Spyder) Lake. The sample should be sent for acute lethality toxicity testing at an accredited lab in the south using the following two procedures:

    a. Acute Lethality to Rainbow Trout, *Oncorhynchus mykiss* (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13); and

    b. Acute Lethality to *Daphnia magna* (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14).

3. The daily volume in cubic meters of treated sewage effluent at Sample Station BOS-3 (Sewage Treatment Plant final discharge) must be measured, recorded and reported to the Nunavut Water Board within the monthly and annual reports.

4. The annual quantity of sludge in cubic meters removed from the sewage treatment plants must be measured, recorded and reported to the Nunavut Water Board with the monthly and annual reports.

A monitoring program summary report is required to be submitted to the Nunavut Water Board for review within thirty (30) days following the month being reported.

HBML will continue the monitoring program related to the STP facility as required under the Boston Project Water Licence from the Nunavut Water Board.

The objective of monitoring is to measure:

- The performance of the waste water treatment facilities
- Ensure that treated water from the Waste Water Treatment Facility meets the appropriate discharge standards
- Assess water quality in the receiving water environment.

All treated effluent discharged from the STP at the Boston Project Monitoring Station BOS-3 during operation phase must meet and not exceed the following quality standards:

Table 4: Discharge Water Quality Requirements for Boston Camp at Discharge Monitoring Point BOS-3

Parameter	Maximum Average	Maximum Allowable in a Grab Sample
pH	6-9	9
Total Suspended Solids	100 mg/L	100 mg/L
BOD_5	80 mg/L	80 mg/L
Faecal Coliform	10,000 CFU/100 mL	10 x 10^4 CFU/100 mL (10,000 CFU/100 mL)
Total Oil and Grease	5 and no visible sheen	10 and no visible sheen

7.4 Sample Containers

Sample containers vary in size and material of construction, depending on the analysis to be conducted. The method used to analyze for a particular parameter dictates the minimum size of the sample bottle. HBML will confirm and use only those containers recommended by the analytical laboratory conducting the analysis. In each instance, it will use clean, chemically-resistant polyethylene bottles and closures with inert liners supplied by the accredited external laboratory analyzing the samples. Typically these will be 1 litre sample bottles (for pH, BOD and TSS).

In the event that samples to be analyzed for oil and grease are collected, a suitable glass container will be used as hydrocarbons are attracted to the walls of plastic bottles and may not be released when sample aliquots are transferred from the bottle for analysis.

Monthly samples collected for analysis of Faecal Coliform must be shipped in sterilized sample bottles provided by the external lab. Bottles to be used for bacterial testing must be autoclaved (sterilized). These samples must get to the laboratory within 24 hours of sampling so special planning is required as to how and when the samples are shipped to ensure that they arrive at the lab in a timely manner. It is recommended that the lab be contacted ahead of the planned sampling so that they can provide guidance as to shipping procedures, volume of sample required and appropriate sample shipping containers. No preservatives may be used on these samples as this would negate the test validity.

7.5 Data Collection During Sampling

Details of sampling are to be recorded in a field logbook. The individual collecting the samples should record the:

- Date and time that sampling was conducted
- Sampling stations visited
- Samples taken at each station
- Name of the person who performed the sampling or took the measurements
- Results of any field measurements
- Sample preservation state.

Additional information can be useful when inquiries are made into the meaning of sample data at a later date. The sampler should record any information that may have a bearing on water quality, such as:

- Weather conditions
- Stream/discharge flow rates
- Unusual conditions at the site
- Any necessary deviations from standard procedures or sampling location.

When sampling and sample preservation is completed, the bottles should be clearly marked with all information that the laboratory analyst will need to report the result. As a minimum, the following information should be included:

- Sample location (Station number)
- Date of sampling
- Parameters to be analyzed
- Preservation method used
- Name or initials of sampler
- Temperature and pH where applicable.

As the samples are to be sent to an external laboratory, the company and property name must also be included. In some cases permanent markers can be used to identify sample bottles, however these markings can be erased with wear and may not be clearly legible. Whenever possible, and always when sending samples to external laboratories, mark the bottles with pre-printed gummed labels. Labels should only be applied to dry surfaces.

A major objective of the field sampler is to minimize any chemical changes to the sample between the time of sample collection and delivery to the laboratory, and which may alter the concentration of the parameter of interest. Heat, light, and agitation can all impact the water chemistry and the samples should be protected from these effects. Samples should be delivered to the analytical laboratory as soon as possible after collection. All samples should be stored in the manner prescribed by the analytical laboratory and transported at a temperature <10 degrees Celsius. Coolers and ice packs are to be used for field transportation and samples should be refrigerated as soon as possible following arrival at the laboratory. A chain of custody form should be completed for each sampling shipment. The original should be sent to the external laboratory while a copy should be filed on-site accordingly. A follow-up call should be made to the external environmental laboratory ensuring that samples were received as scheduled.

7.6 Preservation of Samples

All samples will be preserved and stored in an appropriate manner for the analysis being conducted and in the manner prescribed by the analytical laboratory conducting the analysis.

7.7 Quality Control During Sampling

The following QA/QC procedures are to be implemented during sampling:

7.8 Field Blanks

Field blanks are samples of pure water that are subjected to exactly the same procedures as routine samples, following which they are analyzed for the same parameters as the field samples. Any measurement of the parameter of interest, above method detection limits, will indicate any analytical error, impurities in the laboratory distilled water supply, contaminated sample preservatives, or contamination of the sample during the handling process. Combined with the results of other quality control procedures, analysis of field blanks can help in the identification of sources of contamination. New sample bottles will be used and prepared using distilled water from the normal laboratory water supply. This set will represent all of the parameters routinely analyzed. They will be preserved in the field and submitted to the laboratory identified as field blanks.

7.9 Duplicate Sampling

Replicate sampling (or sometimes referred to as duplicate sampling) is the collection of more than one sample for a given analysis at a given location. The replicate samples are collected, handled, and analyzed using the standard procedures applied to routine samples. Replicate sampling, combined with the results of other quality control procedures, can help indicate sources of error and is particularly useful in identifying problems with accuracy and sampling methods. Once per operating season, for each active water license sampling station, a set of duplicate samples will be taken, representing as many of the routine analyses as possible. Where possible, this should be carried out in conjunction with audit sampling conducted by the designated inspector. Replicate sampling should alternate between the prescribed sampling stations. These results will be included in the reports provided to the NWB.

7.10 Acute Lethality Testing

Once annually during the open water season a sample of treated sewage effluent must be taken at Sample Station BOS-4 (formerly SNP station 1652-4) prior to entry into Aimaoktatuk (Spyder) Lake. The sample must be sent for acute lethality toxicity testing at an accredited lab for analysis using the following specified procedures.

Lethality testing can only be run at an accredited toxicity testing laboratory most likely in Edmonton. The samples must be received by the laboratory within 24 hours of collection (sampling) so special planning is required as to how and when the samples are shipped to ensure that they arrive at the lab

in a timely manner. The analytical laboratory should be contacted ahead of the planned annual sampling so that they can provide guidance as to shipping procedures, volume of sample required and appropriate sample shipping containers. A volume of greater than 25 litres may be required to conduct these analyses. No preservatives may be used on these samples as this would negate the test validity.

7.11 Chemical Storage and Spill Response

A site wide materials management plan with a particular focus on all hazardous substances and waste dangerous goods that are or could potentially be located on the site is currently being developed. That plan will provide material specific Standard Operating Procedures (SOPs) for the handling, transportation, storage and spill response measures for all hazardous substances and waste dangerous goods on site, including those associated with the Sewage Treatment Plant and its operation (i.e. Sodium hypochlorite, oxalic acid, citric acid, incinerator ash, etc.).

A Sewage Treatment Facility specific "SOP" will be included in that site wide plan. That SOP will provide specific requirements on the handling, transportation, storage and spill response measures for all hazardous substances and waste dangerous goods associated with the sewage treatment process.

All chemicals associated with the sewage treatment facility will store in an appropriate location and in appropriate containers with secondary containment (based on the type of material) as required. Efforts will be made to ensure that only the volume of material required for one year's activity is stored on site at any time. An appropriately stocked Spill Response Kit will also be located in close proximity to the storage area, as will the relevant Material Safety Data Sheets (MSDS). The spill response kit will be inspected at least once every year to ensure that the materials are readily available and not stale dated. Any materials used from the spill kit will be replaced as soon as practical after use.

Although the potential for a spill is judged to be low, the potential does exist for such an event to happen. In any and all cases of an unanticipated discharge, spill or upset condition on the site, the policy is as follows:

1. Protect the health and safety of persons in the area
2. Protect the environment.
3. Protect the facility and equipment.

In the event that an unanticipated discharge or spill does occur, personnel shall:

Respond Quickly Without Compromising Health and Safety

1. Identify spilled material

BE ALERT – DO NOT COMPROMISE YOUR ON SAFETY OR THAT OF OTHERS

1. Assess the hazard of persons in the vicinity
2. Attend to injured if possible and safe to do so.
3. Assess the character of the spill
4. Inform immediate Boston Supervisor Phone 604-759-2338
5. Inform Site Manager at Doris Phone 604-759-4708 (if further assistance is needed)
6. Stop product flow if safe to do so
7. Contain and recover spilled material as soon as possible

7.12 Off-Specification Effluent Quality

The potential does exist for isolated, short term discharges of treated sewage effluent which does not meet the discharge limits due to equipment malfunction or operator error, however as discussed previously, system design limits the potential for partially treated sewage to be discharged to the tundra. Notwithstanding this design feature and in order to minimize the potential for such an event to happen, specific site personnel will be properly trained and assigned to regularly inspect the sewage treatment facilities and to oversee the effective operation and maintenance of the facility.

Response to such an event will be to identify and correct the original cause and the implementation of additional monitoring of the downstream environment to assess the level, if any, of the impact of the discharge.

In the unlikely event that analysis does indicate that a monitoring sample exceeded the specified discharge limit, HBML will, as soon as possible upon receiving the analytical results:

- Re-sample the effluent and submit the sample for appropriate analysis
- Conduct a detailed inspection of the entire STP and all associated facilities to identify the cause of the off specification discharge and ensure that the facility is operating within the prescribed parameters and operational limits
- Correct the original cause
- If necessary, implement additional monitoring of the downstream environment to assess the level, if any, of the impact of the off specification discharge.

Due to the relatively short duration of such a condition, residual environmental effects resulting from such an event are likely to be negligible.

8 STP Facility Management

The focus of management of the STP facility will be safety and environmental responsibility.

Employees working in the STP facility will be trained prior to commencement of work so that they are aware of the health and safety risks associated with the waste water treatment. The following two absolute points of compliance will be part of training:

- No person is to drink the water in the SaniBrane® plant or the water that is discharged from it to the tundra
- Furthermore working with sewage requires adequate protection for operators. General and specific requirements are presented in the following sections.

8.1 Health and Safety General Requirements

Some chemical agents used for chemical cleaning are harmful when they come in contact with skin. In handling chemicals, operators should wear protective goggles, protective gloves and other protectors. Before using chemicals, the details on Material Safety Data Sheets (MSDS) should be checked. If chemicals come into contact with skin, the MSDS actions for each chemical should be followed. Table 6 indicates which chemicals and volumes will likely be used for the SaniBrane® system.

There are four primary exposure pathways to chemicals within the Waste Water Treatment Facility:

- Inhalation
- Ingestion
- Skin contact
- Eye contact.

Skin contact will be prevented by issuing suitable personal protective equipment to employees working in the STP Facility. Personal Protective Equipment is summarized in Table 5.

Eye contact is unlikely under normal circumstances. Where hand work is to be carried out in the STP facility with the risk of eye contact, protective goggles will be required.

Table 5: General Emergency Response Procedures for the Sewage Treatment Plant

Personal Protection	
Ventilation	Use adequate ventilation. Check that the plant's ventilation fans are operating before entering.
Respiratory protection	Use organic cartridge respirator.
Eye protection	For splash protection, use chemical goggles and face shield
Skin protection	Use gloves resistant to the material being used, i.e., neoprene or nitrile rubber. Use protective garments to prevent excessive skin contact.
Health Hazard Data	
Acute effects of overexposure	Eye: May cause mild irritation, with stinging and redness of eyes.
	Skin: May cause infection especially if cuts are present.
	Inhalation: May cause irritation to nose, throat or lungs. Headache, nausea, may occur.
	Ingestion: Swallowing may produce abdominal pail, nausea and vomiting.
First Aid and Emergency Procedures	
Eye	Flush eyes with running water for at least 15 minutes. If irritation or adverse symptoms develop, seek medical attention.
Skin	Immediately wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.
Inhalation	Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.
Ingestion	Seek medical attention.
Fire	
Fire extinguishing media	Dry chemical, foam, or carbon dioxide.

8.2 Specific Health and Safety Requirements for the SaniBrane® Plant

Various oxidizing chemicals will be used on the SaniBrane® STP facility as indicted in Table 6.

Table 6: Details of Chemicals and Volumes Needed for Cleaning the SaniBrane® Sewage Treatment Plant

Contaminant	Chemical	Solutions Concentration	Amount Used	Hold time
Organic matter	Sodium hypochlorite	2,000 – 6,000 mg/L (effective chlorine concentration) (pH is about 12)	5L/ element (1.32 USG)	1 to 3 hours
Inorganic matter	Oxalic acid	0.5 - 1.0 wt %	5 L/element (1.32 USG)	1 to 3 hours
Inorganic matter	Citric acid	1.0 – 3.0 wt%	5 L/element (1.32 USG)	1 to 3 hours

Specific safety measures associated with the oxidizing chemicals are presented in Table 7.

Table 7: Specific Safety Measures Associated with SaniBrane® Cleaning Chemicals

Agent	Sodium Hypochlorite Solution/NaClO	Oxalic Acid $(COOH)^2$	Citric Acid/ $HOOCCH_2C(OH)(COOH)CH_2COOH$
CHEMICAL HANDLING PRECAU-TIONS	Ventilate well. Avoid heat sources and sparks. Also avoid contact with acids.	Keep away from acids and bases.	Keep away from strong acids and bases.
	Handle the chemical container with great care. Avoid toppling, bumping or dragging it.		
	Take care to prevent leaks, spill over or splattering. Do not cause dust or vapour.		
	Firmly seal the container after use.		
	Do not eat or drink except in a designated place.		
	Keep gloves in a designated area away from any rest area or lunch rooms.		
	Forbid unauthorized entry to the place where chemicals are handled.		
	Wear appropriate protectors to avoid inhalation, eye or skin contact, and direct contact with your clothes.		
	To handle chemicals outdoors, provide local ventilation.		
	After using chemicals, thoroughly wash your hands and face and rinse out your mouth.		

Specific storage requirements for the oxidizing chemicals can be found in Table 8 and in Figure 6.

Table 8: SaniBrane® Cleaning Chemical Storage Requirements

Agent	Sodium Hypochlorite Solution/ NaClO	Oxalic Acid $(COOH)^2$	Citric Acid $HOOCCH_2C(OH)(COOH)CH_2COOH$
STORAGE PRECAUTIONS	Store container in a dark, cold place. Avoid direct sunlight. Firmly seal to prevent direct contact with air.		
	For storage, use corrosion-resistant containers.		

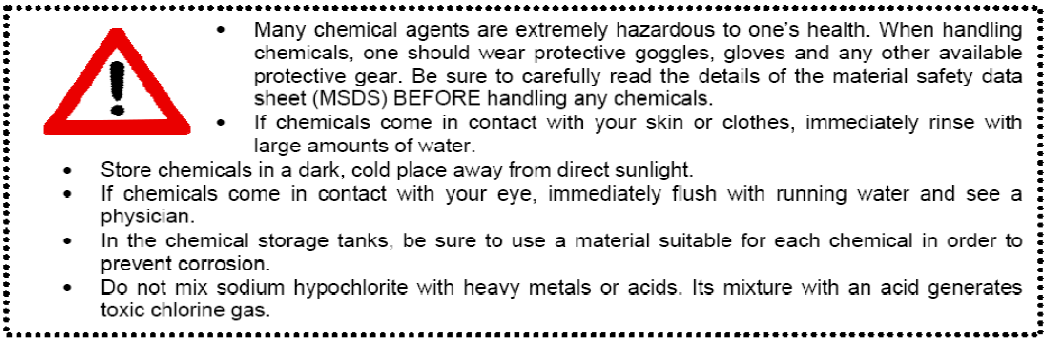


Figure 6: Extract from SaniBrane® Operations Manual Relating to Specific Precautions Required with Membrane Cleaning Chemicals

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This report, "**Boston Advanced Exploration Project: Operation and Maintenance Manual for the Waste Water Treatment Facility, Hope Bay, Nunavut, Canada**", has been prepared by SRK (Consulting) Canada Inc.

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