Government of Nunavut

Wetlands Assessment

Hamlet of Whale Cove, Nunavut

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Wetlands Assessment

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Executive Summary

The Government of Nunavut (GN), Department of Community and Government Services (CGS) retained **exp Services Inc.** (**exp**) to prepare a Screening Level Environmental Assessment (SLEA) under the *Canadian Environmental Assessment Act* in order to complete the detailed planning design for the sewage wetland upgrade for the Hamlet of Whale Cove, Kivalliq Region, Nunavut, hereinafter referred to as the 'Site'. In addition, the project included an assessment of the suitability of the existing wetland sewage treatment area to achieve further reduction of contaminants and pathogens before reaching Hudson Bay.

The purpose of the Wetlands Assessment is to determine if the Hamlet's existing wetland sewage treatment area is in compliance with the requirements of the Nunavut Water Board, water license number 3BM-WHA0914.

The objective of the Wetlands Assessment is to evaluate the efficiency of the wetlands area, as part of the current sewage treatment facility of the Hamlet, and its ability to effectively reduce contaminants and pathogens of effluent waters before discharging into Hudson Bay.

The results of the vegetation survey indicated that the plant community present at the wetlands area, which includes various mosses, grasses, sedges, willow species and other low-lying vegetation typical of a swamp/wetland region of the subarctic, are considered suitable for the phytoremediation processes that will treat sewage and remove contaminants. This phytoremediation is represented by the observation that contaminants such as total suspended solids (TSS), nutrients, pathogens, pH, total oil and grease, and biological oxygen demand (BOD) decline substantially between the upper and lower sections of the wetland. Due to this observed substantial decline, these contaminants are not regarded as a concern beyond the boundaries of the sewage treatment system. In addition, these observations indicate the assimilative capacity of the vegetation to attenuate these contaminants to low concentrations is occurring.

With these results in mind, this Wetlands Assessment revealed that the existing wetlands area as part of the existing sewage treatment system for the Hamlet is expected to effectively reduce contaminants and pathogens of effluent waters before discharging into Hudson Bay. In addition, this analysis identified the Hamlet's existing wetland sewage treatment area is in compliance with the requirements of the Nunavut Water Board, water license number 3BM-WHA0914.

It is noted that the subarctic tundra and wetland vegetation communities are sensitive to physical damage, and take a long time to recover from disturbances. Subarctic plants have slow growth rates and areas damaged by construction activities will not re-vegetate for several years. Damage to the wetlands would result in a decrease in treatment efficiency. Therefore, it is recommended that the wetlands area be protected from any construction activities and that equipment and vehicles do not enter the wetlands area to avoid long-term damage.

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Chapter 1 – Introduction

1 Introduction

The Government of Nunavut (GN), Department of Community and Government Services (CGS) retained **exp Services Inc.** (**exp**) to prepare a Screening Level Environmental Assessment (SLEA) under the *Canadian Environmental Assessment Act* (*CEAA*) in order to complete the detailed planning design for the sewage wetland upgrade for the Hamlet of Whale Cove, Kivalliq Region, Nunavut, hereinafter referred to as the 'Site'. In addition, the project included an assessment of the suitability of the existing wetland sewage treatment area to achieve further reduction of contaminants and pathogens before reaching Hudson Bay.

The purpose of the Wetlands Assessment is to determine if the Hamlet's existing wetland sewage treatment area is in compliance with the requirements of the Nunavut Water Board, water license number 3BM-WHA0914, a copy of which is included in Appendix A.

1.1 Background

The Hamlet of Whale Cove (Hamlet) is the proponent and Responsible Authority (RA) of the project, and as such, triggers the requirement for a screening level environmental assessment for the project under section 5(1)a of the *CEAA*. The Stakeholders for this project are the Hamlet of Whale Cove, the Government of Nunavut and the Nunavut Water Board.

Whale Cove is situated in the Southern Arctic Terrestrial Ecozone (Figure 1 included in Appendix B), and is characterized by continuous permafrost 90 to 100 % of the year. The Hamlet receives an average of 181.5 cm of rainfall and 119.7 cm of snowfall per year. Temperatures in the summer range between approximately 3 and 10^{o}C; and, in the winter between approximately -26 to -32^{o}C.

The subsurface stratigraphy at the Site is within the continuous permafrost zone, and is comprised of glacial till with lacustrine deposits of unconsolidated sand and gravel.

Whale Cove is a small, arctic community located on the western shore of Hudson Bay. It is located 161 km north of Arviat and 72 km south of Rankin Inlet. Whale Cove and the southern area of the community of Rankin Inlet has become one (1) district comprising 1,330 people (GN, 2011). The population of Whale Cove alone is approximately 350 people, and is expanding rapidly; it is made up of mainly inland and coastal Inuit, with occasional non-Inuit peoples (Atlas of Canada, 2004). Site photographs are located in Appendix C.

Due to the current population and trend for expansion, it is necessary to assess the suitability of the Hamlet's existing wetland sewage treatment area. This suitability is determined through the analysis of the current and required assimilative capacity. The determination of assimilative capacity requires an analysis of the total volume of wetland available to treat effluent, along with the consideration of total expected effluent volumes. If the existing wetlands are demonstrated to substantially reduce the loads of different contaminants that drain to Hudson Bay, then the assimilative capacity of the wetland will be confirmed. If the wetlands are unable to reduce the load of different contaminants that drain to Hudson Bay, then mitigation measures will need to be identified and implemented.

The Hamlet's existing wetland sewage treatment area is located approximately 300 m to the west of the community. It is comprised of a single cell lagoon, a berm and a wetlands area, as shown in Figures 1 and 2. The wetlands area is 35,850 m^2, with an average slope of 2.7 %. It is expected to treat effluent and remove total suspended solids (TSS), biological oxygen demand (BOD), nutrients and pathogens.

The subject property has a Sewage Disposal Facility license (3BM-WHA0914), which provides effluent quality limits for five (5) chemical parameters; including TSS, BOD, pH, fecal coliforms, and total oil and grease. The effluent quality limits at the downgradient location prior to discharging to Hudson Bay must

meet the compliance guidelines for TSS of 180 mg/L; BOD of 120 mg/L; pH between 6.0 and 9.0; fecal coliforms of 100,000 CFU per 100 mL; and, no visible sheen related to total oil and grease.

1.2 Objectives

The objective of the Wetlands Assessment is to evaluate the efficiency of the wetlands area, as part of the existing wetland sewage treatment area of the Hamlet, and its ability to effectively reduce contaminants and pathogens of effluent waters before discharging into Hudson Bay.

Chapter 2 –
Whale Cove Wetlands Area

2 Whale Cove Wetlands Area

A preliminary Site visit was undertaken by **exp** staff on August 15th and 16th, 2011, which included the collection of surface water samples to determine the general quality of the water throughout the sewage treatment area. A follow-up Site visit was undertaken by **exp** staff from September 12th through 14th, 2011 to carry out a vegetation survey of the wetlands area, to survey the Site and collect additional surface water samples. All areas of the Site were accessible during these Site visits.

2.1 Vegetation Community

As noted, Whale Cove is located within the Southern Arctic ecozone, characterized by long, cold winters and short, cool summers. The long hours of light and milder temperatures, when compared to more northerly ecozones, results in a longer growing season. This region also contains numerous surface water bodies and wetlands that serve as important wildlife habitat. Permafrost is continuous throughout the area, but there are active surface soil layers that thaw in the summer.

The wetlands area, located between the lagoon and Hudson Bay, is vegetated with subarctic tundra and subarctic wetland species, ranging in height from ground cover species to grasses up to 60 cm tall. This vegetation occurs in depressions (poorly drained, low-lying areas) between rock outcrops on both sides which provide some protection from wind.

A vegetation survey was carried out during the Site visit in September 2011, and is presented in Table 2-1. It should be noted that a complete plant list is not available, given that the current survey only reflects the late summer season flora only; the spring species are absent or not fully represented. Photographs of the Site are located in Appendix C.

Table 2-1: Representative Common Plant Species that occur at the Wetlands

Family	Common Name	Scientific Name
Moss (various)	Alpine club moss	*Lycopodium alpinum*
	Moss	*Sphagnum* sp.
Lichen (Teloschistaceae)	Lichen	*Caloplaca* sp.
Lichen (Rhizocarpaceae)	Map lichen	*Rhizocarpon geographicum*
Grass (Poaceae)	Blue grass	*Poa* sp.
	Fescue	*Festica vivipera*
	Alpine reed grass	*Calanagrostis purpurascens*
	Bluejoint	*Calamagrostis canadensis*
	Grasses	*Poa* spp.
Sedge (Cyperaceae)	Arctic cotton	*Eriophorum* spp.
	Sedges	*Carex* sp.
Willow (Salicaceae)	Net-veined willow	*Salix reticulate*
	Rock willow / arctic willow	*Salix arctica*
	Diamond-leaf willow	*Salix pulcha*
	Dwarf willow	*Salix herbacea*
	Willows	*Salix* sp.

Family	Common Name	Scientific Name
Buckwheat (Polygonaceae)	Mountain sorrel	*Oxyria digyna*
Saxifrage (Saxifrageceae)	Saxifrage	*Saxifraga* sp.
Crowberry (Empetraceae)	Crowberry	*Empetrum nigrum*
Heath (Ericaceae)	Northern blueberry	*Vaccinium uliginosum*
	Bearberry	*Arctostaphylos* sp.
	Northern Labrador tea	*Rhododendron tomentosum*
Primrose (Onagraceae)	Fireweed	*Epilobium angustifolium*

The greatest species richness was present at the wetlands area of the Site. This richness was expected, given the overall large surface area, in addition to the combination of various habitats including terrestrial, semi-aquatic and aquatic environments. Major portions of the wetlands area were also protected from the wind by adjacent rock outcrops. In general, the majority of the Site was covered by moss, grasses, crowberries, bearberries and other low-lying vegetation typical of a swamp/wetland region of the subarctic. Various lichen species were present on the adjacent rock outcrops; whereas the majority of plants exist in low-lying areas to receive shelter from the wind. The existence of these plants in low-lying areas is an adaptation to increase survival in a harsh environment. Patches of taller grasses, sedges, northern Labrador tea and fireweed were scattered throughout the Site; and, several low-lying willow species were present. Fireweed plants are known to colonize at disturbed sites, and were abundant near the sewage outlet.

The western berm, located at the eastern-most edge of the wetlands area, was dominated by colonizing species including grasses, sedges and fireweed. It is noted that considerable evidence of wildlife foraging and nesting was observed at the berm.

Given that a complete plant list is not available since the current survey only reflects the late summer season, other plant species known to the subarctic Nunavut region are listed in Table 2-2.

Table 2-2: Other Plant Species Known to the Area

Family	Common Name	Scientific Name
Pink (Caryophyllaceae)	Mouse-ear chickweed	*Cerastium* sp.
	Moss-campion	*Silene acaulis*
Buttercup (Ranunculaceae)	Richardson's anemone	*Anemone richardsonii*
	Buttercup	*Ranunculus* sp.
	Anemone	*Anemone* sp.
Poppy (Papaveraceae)	Arctic poppy	*Papaver radicatum*
Rose (Rosaceae)	Mountain avens	*Dryas integrifolia*
	Blackberry	*Rubus fructicosus*
Saxifrage (Saxifrageceae)	Alpine saxifrage	*Saxifraga nivalis*
	Purple mountain saxifrage	*Saxifraga oppositifolia*
Heath (Ericaceae)	Mountain cranberry	*Vaccinium* sp.

All of the vegetation observed at the Site or expected to be present at the Site are highly adapted to the extreme conditions of the subarctic region. Various species are also adapted to disturbed Sites, including fireweed. As such, the composition of the common vegetation community observed to be present at the Site is considered suitable for the existing wetlands area as part of the long term sewage treatment system for the Hamlet of Whale Cove.

2.2 Water Quality

Site visits were undertaken by **exp** staff in August and September, 2011 to collect surface water samples from various locations of the sewage treatment system; specifically entering the sewage lagoon, leaving the lagoon, and finally discharging into Hudson Bay, to determine if the effluent meets the sewage disposal facility effluent quality limits (Figure 2). The findings and conclusions of the water quality investigation are presented in **exp's** report: *Water Sampling Report, Sewage Lagoon & Wetlands, Whale Cove, Nunavut*, dated December 21, 2011.

The contaminant and pathogen levels in the surface water samples taken across the system on August 16th and September 14th, 2011 are presented in Tables 2-3 and 2-4, respectively.

Table 2-3: Surface Water Results (August 16, 2011)

	Compliance Guidelines(1)	**Wetland Inlet (W01)**	**Wetland Middle (W03)**	**Wetland Left Side (W04)**	**Wetland Outlet (W02)**	**Percent Removal(2)**
Total suspended solids (mg/L)	180	320	<10	<10	<10	97 %
Biological oxygen demand (mg/L)	120	11	6	5	2	82 %
Fecal coliforms (CFU/100 mL)	100,000	24	11	5	6	75 %
pH	6.0 to 9.0	7.2	7.6	7.6	**9.8**	NA

(1) Compliance guidelines for effluent, as per the Sewage Disposal Facility license (3BM-WHA0914)

(2) Concentration reduction between the wetland inlet and the wetland outlet

Bold = Effluent concentration (at wetland outlet) in excess of compliance guideline; NA = not applicable

The surface water samples collected at the Site on August 16, 2011 revealed TSS, BOD and fecal coliforms levels were in compliance of effluent guidelines, as per the Sewage Disposal Facility license (3BM-WHA0914). The pH level at the wetland outlet was above compliance guidelines. The percent reduction of contaminants from the wetland inlet to the wetland outlet was between 75 to 97 %.

Table 2-4: Surface Water Results (September 14, 2011)

	Compliance Guidelines[1]	Untreated Sewage (SW1)	Lagoon Outlet (SW2)	Wetland Inlet (SW3)	Wetland Outlet (SW4)	Percent Removal[2]
Total suspended solids (mg/L)	180	150	<10	<10	<10	93 %
Biological oxygen demand (mg/L)	120	310	9	4	<2	99 %
Fecal coliforms (CFU/100 mL)	100,000	>2000	820	160	53	97 %
pH	6.0 to 9.0	7.6	7.7	7.6	8.3	NA

(1) Compliance guidelines for effluent, as per the Sewage Disposal Facility license (3BM-WHA0914)

(2) Concentration reduction between the wetland inlet (untreated sewage) and the wetland outlet

NA = not applicable

The surface water samples collected at the Site on September 14, 2011 revealed TSS, BOD, fecal coliforms and pH levels were in compliance of effluent guidelines, as per the Sewage Disposal Facility license (3BM-WHA0914). The percent reduction of contaminants from the untreated sewage to the wetland outlet was between 93 to 99 %.

Chapter 3 –
Phytoremediation and Contaminants Removal

3 Phytoremediation and Contaminants Removal

3.1 Phytoremediation

Phytoremediation is the use of plants to remediate or decontaminate soil, water or air. Plants are able to contain, degrade or eliminate metals, pesticides, solvents, explosives, crude oil and its derivatives, and various other contaminants from environmental media. Constructed treatment wetlands with cattails and reeds, for example, are often used to treat landfill leachate, acid mine drainage, sewage, industrial effluents and agricultural run-off (Kadlec and Knight, 1996).

Vegetated wetlands with lower growing vegetation such as grasses and mosses have been reported as equally successful biofilters for a number of contaminants and excess nutrients, including nitrogen compounds, phosphates, salts, metals, organic contaminants and pathogenic bacteria and viruses (also see Kadlec and Knight, 1996).

The plant community present at the wetlands area of Whale Cove can be described as tyical of habitats in northern subarctic latitudes. That is, the dominant vegetation includes mosses, grasses, sedges, willow species and other low-lying species. These plants have been reported as suitable for the phytoremediation processes that will treat sewage and include the removal of TSS, BOD, nutrients and pathogens (Kadlec and Knight, 1996; Galbrand et al. 2008).

3.2 Contaminants Removal

In order for the Hamlet to meet the objectives of the Sewage Disposal Facility license, the effluent quality limits at the downgradient location prior to discharging to Hudson Bay must meet the compliance guidelines, as presented in Table 3-1.

Table 3-1: Effluent Quality Limits for Whale Cove (Sewage Disposal Facility license 3BM-WHA0914)

Contaminant	Compliance Guidelines
Total suspended solids	180 mg/L
Biological oxygen demand	120 mg/L
Fecal coliforms	100,000 CFU/100 mL
pH	6.0 to 9.0
Total oil and grease	No visible sheen

3.2.1 Total Suspended Solids (TSS)

The majority of suspended solids are removed through sedimentation over time in the existing sewage lagoon. The TSS remaining in the wastewater will enter the wetlands area where the solids will be trapped and settle along the route to Hudson Bay. Sewage biosolids are a source of organic matter which will be utilized by bacteria and plants to grow and reproduce (MOE, 1996).

As noted, recent observations from August 16th, 2011 revealed that the percent reduction of TSS from the wetland inlet to the wetland outlet was high, at 97 %. Similarly, the reduction of TSS observed during September 14th, 2011 from the untreated sewage to the wetland outlet was also high, at 93 %. It is also noted that the levels of TSS present in effluent samples are well below sewage disposal effluent criteria for TSS of 180 mg/L.

These observations confirm that TSS at the Site is not a concern beyond the boundaries of the sewage treatment system.

3.2.2 Biological Oxygen Demand (BOD)

Removal of BOD will greatly depend on the oxygen supply, or aerobic conditions, provided within the wetlands area. Increased aeration throughout the treatment system will increase BOD removal efficiency. Use of aeration throughout the treatment system is expected to enhance the removal of BOD components from the water. This aeration system will result in water with elevated oxygen levels and result in the removal of BOD components that enter the wetland. Due to the elevation of oxygen levels in the water and lower BOD levels, it is unlikely that anaerobic conditions will occur, even under the ice.

As noted, recent observations from August 16th, 2011 revealed that the percent reduction of BOD from the wetland inlet to the wetland outlet was high, at 82 %. Similarly, the reduction of BOD observed during September 14th, 2011 from the untreated sewage to the wetland outlet was also high, at 99 %. It is also noted that the levels of BOD present in effluent samples are well below sewage disposal effluent criteria for BOD of 120 mg/L.

These observations confirm that BOD at the Site is not a concern beyond the boundaries of the sewage treatment system.

3.2.3 Pathogens

Pathogens present in sewage include fecal coliforms and *Escherichia coli*, which have a limited life span outside of their host organisms (i.e. warm-blooded animals). The majority of pathogen decline is expected in the treatment lagoon, where cell die off, sedimentation, filtration, absorption and predation greatly reduce coliform numbers (Martin and Johnson, 1995).

As noted, recent observations from August 16th, 2011 revealed that the percent reduction of fecal coliforms from the wetland inlet to the wetland outlet was high, at 75 %. Similarly, the reduction of fecal coliforms observed during September 14th, 2011 from the untreated sewage to the wetland outlet was also high, at 97 %. It is also noted that the levels of fecal coliforms present in effluent samples are well below sewage disposal effluent criteria for fecal coliforms of 100,000 CFU/100 mL.

These observations confirm that pathogens at the Site, as represented by fecal coliforms, are not a concern beyond the boundaries of the sewage treatment system.

3.2.4 Nutrients

Sewage effluent is high in nutrients such as phosphorus and nitrogen compounds. Nutrient-rich waters may lead to eutrophic conditions, which involves prolific growth of algae and other aquatic plants. Eutrophication may eventually lead to the depletion of the water's natural oxygen supply, which is detrimental to aquatic life.

It is noted, however, that the subarctic wetland region to which the Hamlet of Whale Cove belongs is relatively nutrient poor, and nutrients are generally in short supply. Availability of additional nutrients is unlikely to result in significant eutrophication, where excess nutrients are in turn readily taken up by plants and metabolized. This will result in increased plant biomass and growth rates. As a consequence, more organic compounds will be available for bacteria in the rhizosphere. The presence of increased volumes of nutrients and organic compounds in the wetlands compared with surrounding habitats are thereby expected to increase bacterial growth and reproduction in the wetlands, and subsequently the degradation rate of contaminants. It is therefore unlikely that the nutrients at the Site will be a concern beyond the boundaries of the sewage treatment system.

3.2.5 pH

The pH of the sewage treatment system remained relatively neutral, fluctuating between 7.2 and 7.6 during August; and, between 7.6 and 8.3 during September, with the exception of 9.8 pH units detected at the wetland outlet sample (W02) on August 16th, 2011. However, it is noted that subsequent sampling

of the effluent taken on September 14th, 2011 revealed pH levels (8.3) within the sewage disposal effluent criteria between 6.0 and 9.0. As such, the fluctuation of pH levels at the Site is not considered to be a significant concern beyond the boundaries of the sewage treatment system.

3.2.6 Total Oil and Grease

The surface water samples collected during the August and September 2011 sampling events did not contain any visible sheen. As such, total oil and grease are not a concern beyond the boundaries of the sewage treatment system.

3.3 Interpretation

As noted, the Hamlet's existing wetland sewage treatment system is comprised of a lagoon with berm and a wetlands area. The wetland area shows plants that appear to be growing well and the community is composed of a range of different species and morphologies. Water sample collections at the inlet of the wetland are inferred to represent the contaminant loads that originate from the lagoon whereas the water sample collections at the wetland outlet are inferred to represent the contaminant loads that drain to Hudson Bay. Sample collections in this study identified that wetland water pH usually remained in the neutral range whereas all contaminants measured declined by at least 75% between the inlet and outlet of the wetland. Due to the maintenance of pH and the substantial decline in all contaminants, the performance of the wetland to assimilate sewage is interpreted to be confirmed. This confirmation identifies the assimilative capacity of the wetlands results in the release of water to Hudson Bay with low concentrations of contaminants at an appropriate pH.

This study documented a lagoon wetland system that supports plants that are growing vigorously and composed of a suite of different species. This documentation of a healthy plant community was also associated with the observation of substantial declines in contaminant concentrations between the inlet and outlet. By extention, these observations collectively suggest the existing sewage wetland treatment system is effective at removing contaminants. Thus, the Hamlet's existing wetland sewage treatment area can be regarded as is in compliance with the requirements of the Nunavut Water Board, water license number 3BM-WHA0914.

Chapter 4 –
Conclusions and Recommendations

4 Conclusions and Recommendations

4.1 Conclusions

The Wetlands Assessment revealed that the existing wetlands area as part of the existing sewage treatment system for the Hamlet of Whale Cove will effectively reduce contaminants and pathogens of effluent waters before discharging into Hudson Bay.

The observation of substantial declines of all measured contaminants between the wetland inlet and wetland outlet confirm the phytoremediation is occurring, as expected. In addition, this expectation of declining contaminant concentrations involves all parameters. With these observations, the assimilative capacity of the wetlands has been confirmed for the current volumes of sewage.

As such, the Hamlet's existing wetland sewage treatment area is in compliance with the requirements of the Nunavut Water Board, water license number 3BM-WHA0914.

4.2 Recommendations

The vegetation survey and water sampling programs conducted at the Site confirmed that the presence of native vegetation is functioning effectively as a sewage treatment wetland system.

It is noted that the subarctic tundra and wetland vegetation communities are sensitive to physical damage, and take a long time to recover from disturbances. Subarctic plants have slow growth rates and areas damaged by construction activities will not re-vegetate for several years. Damage to the wetlands would result in a decrease in treatment efficiency.

Therefore, it is recommended that the wetlands area be protected from any construction activities and that equipment and vehicles do not enter the wetlands area to avoid long term damage.

Chapter 5 –
General Limitations and Closure

5 General Limitations and Closure

The purpose of this report is to provide the Government of Nunavut with an evaluation of the efficacy associated with the existing wetland sewage treatment area at the Hamlet of Whale Cove; and, if the system is in compliance with the requirements of the Nunavut Water Board, water license number 3BM-WHA0914.

The information presented in this report is based on information provided by others and visual observations as identified herein. Achieving the objectives stated in this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice, we do not act as absolute insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

This report was prepared for the Government of Nunavut and may not be reproduced in whole or in part, without the prior written consent of **exp**, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Exp Services Inc.** accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The Wetlands Assessment was prepared based on the available site information and evaluated the potential effects posed on the environment based on the existing long term sewage treatment system for the Hamlet of Whale Cove. Should additional Site information become available, the Wetlands Assessment should be re-evaluated to determine if the conclusions presented in the report are still valid.

Closure

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

exp Services Inc.

Edyta Chorostkowska, M.Env.Sc., EPt
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Chapter 6 – References

6 References

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Appendix A –
Water License 3BMWHA0914

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NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI
OFFICE DES EAUX DU NUNAVUT

File No.: 3BM-WHA0914

June 18, 2009

Clayton Croucher
Senior Administrative Officer
Hamlet of Whale Cove
P.O. Box 120
Whale Cove, Nunavut X0B 0J0
Email: saowc@qiniq.com

RE: NWB Licence No. 3BM-WHA0914

Dear Mr. Croucher,

Please find attached Licence No. 3BM-WHA0914 issued to the Hamlet of Whale Cove by the Nunavut Water Board (NWB) 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*. The terms and conditions of the attached Licence related to water use and waste disposal are an integral part of this approval.

If the Licensee contemplates the renewal of this Licence, it is the responsibility of the Licensee to apply to the NWB for its renewal. The past performance of the Licensee, new documentation and information, and issues raised during a public hearing, if the NWB is required to hold one, will be used to determine the terms and conditions of the Licence renewal. Note that if the Licence expires before the NWB issues a new one, then water use and waste disposal must cease, or the Licensee will be in contravention of the *Nunavut Land Claims Agreement* (NLCA) and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA). However, the expiry or cancellation of a licence does not relieve the holder from any obligations imposed by the licence. The NWB recommends that an application for the renewal of this Licence be filed at least three months prior to the Licence expiry date.

If the Licensee contemplates or requires an amendment to this licence, the NWB may decide, in the public interest, to hold a public hearing. The Licensee should submit applications for amendment as soon as possible to give the NWB sufficient time to go through the amendment process. The process and timing may vary depending on the scope of the amendment, however a minimum of sixty (60) days is required from the time of acceptance by the NWB. It is the responsibility of the Licensee to ensure that all application materials have

been received and acknowledged by the Manager of Licensing.

The NWB strongly recommends that the Licensee consult the comments[1] received by interested persons on issues identified. This information is attached for your consideration.

Sincerely,

Thomas Kabloona
Nunavut Water Board
Chair

TK/tla/sl

Enclosure: Licence No. 3BM-WHA0914
Comments INAC, EC, GN-DoE and GN-DoCLEY

cc: Kivalliq Distribution List

[1] GN-DoE, April 20, 2009; GN-DoCLEY, March 19, 2009; INAC, April 20, 2009 and EC, April 20, 2009

P.O. Box 119
Gjoa Haven, NU X0B 1J0
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NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI
OFFICE DES EAUX DU NUNAVUT

DECISION

LICENCE NUMBER: 3BM-WHA0914

This is the decision of the Nunavut Water Board (NWB) with respect to an application received September 5, 2007 with supporting information submitted February 2, 2009 for a Licence renewal made by:

HAMLET OF WHALE COVE

to allow for the use of water and disposal of waste for the Hamlet of Whale Cove, located within the Kivalliq Region of Nunavut. With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence amendment and renewal.

DECISION

After having been satisfied that the application was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S. 12.3.2 of the *Nunavut Land Claims Agreement* (NLCA), the NWB decided that the application could proceed through the regulatory process. After reviewing the full submission of the Applicant and written comments expressed by interested parties, the NWB, having given due regard to the facts and circumstances, the merits of the submissions made to it and to the purpose, scope and intent of the *NLCA* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and determined that:

Licence Number 3BM-WHA0914 be issued subject to the terms and conditions contained therein. (Motion #: 2009-05-L03)

SIGNED this 10th day of ~~May~~ June, 2009 at Gjoa Haven, NU.

Thomas Kabloona
Nunavut Water Board
Chair

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I. BACKGROUND

The Hamlet of Whale Cove is located within the Kivalliq Region of Nunavut, at general latitude 62°11'N and general longitude 92°35'W, approximately 80 km south of Rankin Inlet in a narrow inlet projecting northeastward from the head of Spence Bay. In 2006, the Hamlet had a population of 353.

Whale Cove is located in a zone of continuous permafrost and receives an average of 10.6 cm of rainfall and 118 cm of snowfall per year.

II. PROCEDURAL HISTORY

The NWB advised the Hamlet of Whale Cove, via electronic mail on May 7, 2007, that the Hamlet's municipal water Licence would expire on August 31, 2007. The Hamlet submitted a three-page application for water Licence renewal on September 5, 2007, which was acknowledged by the NWB in correspondence of October 2, 2007.

On September 27, 2007, the NWB issued a separate water Licence to the Hamlet of Whale Cove for the construction and operation of a new landfarm facility to contain and treat hydrocarbon contaminated soil (3BM-WCL0712). The Licence issued for the landfarm facility was a new and separate licence, which did not cover the use of water and disposal of waste for municipal activities associated with the Hamlet's expired municipal water Licence (NWB3WHA0207).

Having not received additional information to support the renewal of municipal Licence NWB3WHA0207, the NWB wrote to the Hamlet on June 25, 2008 requesting that a Water Licence Application Supplementary Questionnaire and a written summary of existing water use and waste disposal facilities be submitted. In its letter, the NWB also requested that the Hamlet update the information on file concerning the Hamlet's water use and waste disposal operations.

The Hamlet retained Nuna Burnside Engineering and Environmental Ltd (Nuna Burnside) to complete the application to renew municipal Licence NWB3WHA0207. In February, 2009, Nuna Burnside on behalf of the Hamlet, submitted a comprehensive application package, which included:

- Water Licence Application, previously received September 5, 2007;
- Compliance submission letter, received February 11, 2009;
- English Executive Summary, received February 20, 2009;
- Environmental Emergency Contingency Plan, received February 20, 2009;
- Environmental Monitoring Program & QAQC, received February 20, 2009;
- Sewage Treatment O&M Plan, received February 20, 2009;
- Solid Waste Management Facility O&M Plan, received February 20, 2009;
- Supplementary Questionnaire, received February 20, 2009;
- Water Licence Annual Report, received February 20, 2009; and

- Water Supply Facility O&M Plan, received February 20, 2009.

The scope of the renewal application includes a request for a five (5) year renewal of ongoing operations of the existing Water Supply Facilities, Sewage Disposal Facility and Solid Waste Disposal Facility.

Considering the landfarm is located within the landfill area, the application also requested that Licence 3BM-WCL0712, issued for the construction and operation of the landfarm, be incorporated into the renewal of Licence NWB3WHA0207 with the benefit of having all operation, maintenance and reporting requirements under one Licence.

The Nunavut Water Board publicly posted notice of the application, in accordance with Section 55.1 of the *Act* and Article 13 of the *Nunavut Land Claims Agreement* (NLCA), on March 18, 2009. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for review and comment.

As no public concern was expressed, the NWB waived the requirement to hold a public hearing and proceeded with the application process.

The NWB received comments on the application from interested parties, including Environment Canada (EC), the Government of Nunavut Department of Environment (GN-DoE), Indian and Northern Affairs Canada (INAC) and the Government of Nunavut Department of Culture, Language, Elders and Youth (GN-CLEY) on or prior to April 20, 2009.

Based upon the results of the detailed assessment, including consideration of any potential accidents, malfunctions, or impacts to water that the overall project might have in the area, the Board approved the application and has issued Licence 3BM-WHA0914.

III. ISSUES

Term of Licence

In accordance with Section 45 of the *Act*, the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors, including the results of INAC site inspections and the compliance record of the Applicant. In review of the previous water licence NWB3WHA0207 inspection reports and administrative requirements set out in the licence, the NWB has noted the following issues of non-compliance:

a. No annual reports received by the NWB for 2002 to 2007;
b. Unacceptable water quality discharge from the landfill;
c. Lack of a device capable of measuring water intake volumes;
d. Monitoring requirements have not been met; and
e. Plans required by the NWB had not submitted (during the term of the Licence);

In review of the application and the comments received from interested parties, there were no comments provided with respect to the Hamlet's request for a term of five (5) years for the Licence renewal. Although the Board has recently issued municipal licences for terms of two (2) years where compliance issues have been of a concern, the Board finds that a five (5) year term is warranted in this case, as the application information submitted in February 2009 was comprehensive and inclusive of most outstanding compliance items. The NWB views this application submission as a significant step towards achieving full compliance with the renewed Licence.

Annual Report

The NWB would like emphasize the **requirement to produce an Annual Report** for submission not later than March 31st of the year following the calendar year being reported. During the term of the previous Licence, the NWB did not receive any Annual Reports. The requirement to produce Annual Reports is to ensure that the NWB has an accurate and timely annual update of municipal activities during a calendar year. This information is maintained on the Public Registry and is available to interested parties upon request. A *"Standardized Form for Annual Reporting"* is available for use from the NWB file transfer protocol (ftp) site under the Public Registry link at the NWB Website.

Link = ftp://nunavutwaterboard.org/ADMINISTRATION/Standardized%20Forms/

Operational Plans

The NWB notes that the Licensee has submitted, with the application, the following Operation and Maintenance Plans which were a requirement under the previous Licence:

a. *Environmental Emergency Contingency Plan Hamlet of Whale Cove* (December 2008);
b. *Environmental Monitoring Program & QA/QC Plan Hamlet of Whale Cove* (December 2008);
c. *Sewage Treatment Facility O&M Plan Hamlet of Whale Cove* (December 2008);
d. *Solid Waste Management Facility O&M Plan Hamlet of Whale Cove* (December 2008); and
e. *Water Supply Facility O&M Plan Hamlet of Whale Cove* (December 2008).

These plans, and comments received regarding them, have been reviewed. The NWB has approved the above plans, however, the plans must be revised for resubmission with the 2009 Annual Report (due not later than March 31, 2010). These revisions are to consider the comments received from parties during the review, to incorporate Licence conditions applicable to the O&M Plans, and to combine the plans under one O&M Manual.

Following their first revision, the plans shall be reviewed annually and revised by the Licensee as necessary to reflect any changes in operation, maintenance and/or technology. The details on the

requirements of the revised O&M Plans can be found under Part F, Item 2. This condition has combined the required O&M Plans into one O&M Manual for ease of reference.

In addition, the NWB also notes the comments received by GN-DoE and EC recommending that the Licensee submit a Sludge Management Plan for the Sewage lagoon. The Plan should include periodic removal and disposal of sewage sludge and sewage disposal methods during desludging maintenance. Estimates should be made of the quantities of sludge likely to be produced, the required frequency of extraction from the lagoons; and operational procedures developed for environmentally sound removal and disposal. These procedures should include sludge characterization to ensure disposal options are appropriate and methods of dealing with sewage while the lagoon is being desludged. This Plan is required as part of the O&M Manual requested in Part F, Item 1 of the Licence.

Water Use

The Hamlet of Whale Cove currently utilizes Fish Lake as a source of potable water with the authorized quantity not to exceed 30,000 cubic metres annually. The renewal did not request a change in the amount of water licensed for municipal use and no concerns were raised by the parties in their written submissions regarding the amount of water required by the Hamlet, the manner in which it is obtained or the manner in which this water will be used. The NWB has therefore, renewed the terms and conditions associated with water use by the Hamlet.

The NWB does however note the observation made by the Inspector that the water intake does not have a device capable of measuring the amount of water withdrawn from Fish Lake. Such a device is a requirement of the Licence in order to monitor the volume of water used by the Hamlet. This information is required as part of the Annual Report. The Licensee is required to install the appropriate device.

Sewage

The Hamlet of Whale Cove currently provides trucked sewage collection services for the Community's residents, businesses and institutions. The trucked sewage is discharged to the Sewage Disposal Facilities, consisting of a Sewage Lagoon and wetland area

Sewage is stored in the lagoon and slowly filters through the constructed berm discharging down gradient for final treatment via filtering and biological uptake by plants and micro-organisms in a wetland area for approximately 600 m before discharging into Hudson Bay.

An important point that the NWB notes is that monitoring data is not available for effluent quality. In order to determine the performance of the wetland as a secondary treatment system, the Board further requires that the quality of effluent leaving the wetland be monitored. This is consistent with monitoring proposed in the Sewage Treatment Facility O&M Plan. It is the Licensee's responsibility to comply with the monitoring requirements.

EC commented that effluent standards for sewage treatment should, at the very least, meet the parameters set in the '*Guidelines for the discharge of treated municipal wastewater in the Northwest Territories*' and that these parameters should be met at the final discharge point for the Sewage Lagoon (end-of-pipe) and not at the end of the wetland. The NWB agrees and the discharge point from the Sewage Lagoon is renewed as the Final Discharge Point and will be where effluent quality limits must be met. The existing effluent quality limits have been retained.

As noted by EC in its April 20, 2009 submission, the Licensee must also ensure that any effluent discharged from the system's Final Discharge Point and the Landfarm is in compliance with Section 36(3) of the *Fisheries Act*. According to Section 36(3) of the *Fisheries Act*, no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water. The Licensee is advised that compliance with this Licence does not absolve the Licensee from the responsibility to comply with other applicable legislation.

Solid Waste

The Hamlet of Whale Cove is currently using a Solid Waste Disposal Site located approximately 3km southwest of the community. The site covers an area of approximately 1.2 ha. The Solid Waste Disposal Facilities include a landfill, bulky metals disposal area, household hazardous waste depot and a Landfarm.

There are a number of significant issues with solid waste management identified in the Solid Waste Management Facility O&M Plan:

> It is not clear how the [landfill] site was selected, given its proximity to Hudson Bay, the problem with water seepage in the fill area and snow drifting. The site was originally constructed to be accessed from the base of a hill requiring up hill filling.
> This is not an ideal location for a landfill site. It is too close to Hudson Bay (50 m), it has poor access requiring trucks to drive to the bottom of the hill and then up into the waste area (original design). There is very little cover material easily accessible. The site has no provision to bury bulky metals and did not include a hazardous waste storage area. No documentation or design drawings were available to address this issue. The fencing on the west side is not stable and regularly fills down. There is no information available to indicate how the original designers planned to operate the site. There was no NWB license amendment submission for the site following its construction. (Pg. 1)

The NWB notes that the Solid Waste Management Facility O&M Plan outlines measures to improve the existing Solid Waste Management Facility, including repairing the perimeter fence, regrading to address water management issues, and the hazardous waste storage area located near

the entrance gate on the south side of the access road. By approving the O&M Plan the NWB expects those measures to be implemented. To this end, the NWB requires that the Licensee submit a follow-up report by October 30, 2009, which demonstrates their implementation.

Further, the NWB notes the Nuna Burnside letter received February 11, 2009 stating that the landfill is being modified and that a rehabilitation plan will be prepared and submitted. Given the issues with solid waste disposal facilities the NWB believes this plan is important. The Licensee is reminded that changes to the solid waste facility may require an amendment to the Licence and that an Abandonment and Restoration Plan will be required for decommissioning any existing facility.

Landfarm

Related to solid waste management is the Landfarm Facility which is located within the landfill area. The renewal application recommended that the landfarm Licence be combined with the renewed municipal water Licence. No comments were received on this proposal. The NWB agrees with the benefit of having all operation, maintenance and reporting requirements under one Licence and has incorporated the conditions of 3BM-WCL0712 into this Licence 3BM-WHA0914.

For consistency with other licenses issued by the NWB and other the facilities operated by the Licensee, the Hamlet is required to submit an O&M Plan for the Landfarm Facility as part of the O&M Manual requested in Part F, Item 1. To be consistent with the compliance parameters of other landfarms in Nunavut, the NWB has also added the requirement to monitor for the additional regulated parameters of Benzene, Toluene, and Ethylbenzene in effluent from the Landfarm. The limits are based on the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. The NWB has removed the requirement to test effluent for acute toxicity because of the logistical issue of delivering samples to a laboratory within the required timeframe.

Finally, the Licensee is reminded that as-built plans for the Landfarm Facility were required by Part B, Item 1(ii) of Licence 3BM-WCL0712 and to date have not been submitted. Theses As-built plans are again, required to be submitted, within ninety (90) days of issuance of the Licence in accordance with Part E, Item 4.

Modifications and Construction

For construction and modifications of licensed facilities, the NWB generally requires that final design reports, accompanied by “for construction drawings” are provided, that are stamped and signed by a qualified engineer which provides assurance to the Board that proper engineering practices will be in place through all phases of construction and operation. Such design reports will be required when the Licensee submits its rehabilitation plan for the solid waste facilities.

Abandonment, Restoration and Closure

To ensure that all existing end-of-life facilities are reclaimed in an appropriate manner, the NWB requires Licensees to submit an *Abandonment and Restoration Plan* (A&R Plan). This Plan is to be submitted at least six (6) months prior to final closure of any licensed facility or upon submission of the final design drawings for the construction of new facilities to replace existing ones. The requirements for the Plan are outlined in Part G, Item 1 of this Licence. An A&R Plan will be required to remediate the Solid Waste management Facilities upon submission of a plan to construct a new facility.

Monitoring Program

A significant issue with the previous Licence was the lack of monitoring data collected and reported in accordance with the required Monitoring Program. This issue was highlighted in the 2008 Inspection report. It is the Licensee's responsibility to comply with the Monitoring Program under Part H of the Licence.

The volume of water taken at the raw water intake is to be measured monthly and reported annually in order for the NWB to have an accurate measurement of the volume of water use by the Hamlet. As this water use volume is also an important factor in the design and sizing of a wastewater treatment facility for hamlets, the information is considered to be of dual importance. A device must be installed in order to achieve this.

During seasonal flow from the Sewage Disposal Facilities, sampling shall be performed monthly at the point of discharge from the Sewage lagoon. Similarly, the wetland area downstream of the Sewage Lagoon is also to be sampled monthly during periods of observed flow. Weekly inspections for observed flow will need to be conducted from May to August inclusive at the wetland area point of discharge in order to verify compliance with the Licence and to assess the treatment efficiency of the wetland area.

In its submission, Environment Canada (EC) highlighted the importance of the development of a Canada Wide Strategy for the Management of Municipal Waste Water Effluents (CWS MMWWE) and that EC would be working towards the development of a regulation under the Fisheries Act in support of this strategy. The focus is on setting maximum allowable limits for BOD_5, residual chlorine and TSS in municipal wastewater effluent. There will be a period of up to five years during which northern issues are examined and practical limits put forth for wastewater quality. For the Hamlet, this may eventually impact the Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) discharge criteria. For now, the NWB has retained the limits from the previous Licence.

Finally, the monitoring requirements from Licence 3BM-WCL0712 have been incorporated into this Licence and the monitoring requirements of Licence NWB3WHA0207 have been renewed herein.

IV. LICENCE 3BM-WHA0914

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF WHALE COVE

(Licensee)

of

P.O. BOX 120, WHALE COVE, NUNAVUT X0C 0J0

(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water for a period subject to restrictions and conditions contained within this Licence:

Licence Number	**3BM-WHA0914**
Water Management Area	**NUNAVUT 05**
Location	**WHALE COVE, KIVALLIQ REGION, NU (Latitude 62°11'N and Longitude 92°35'W)**
Purpose	**WATER USE AND WASTE DISPOSAL**
Description	**MUNICIPAL UNDERTAKINGS**
Quantity of Water Not to Exceed	**30,000 CUBIC METRES ANNUALLY**
Date of Licence	**JUNE 10, 2009**
Expiry Date of Licence	**MAY 31, 2014**

Dated this 10th day of June, 2009 at Gjoa Haven, NU.

Thomas Kabloona
Nunavut Water Board
Chair

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste for municipal undertakings at the Hamlet of Whale Cove, Kivalliq Region, Nunavut (62°11' N; 92°35'W);

b. This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be subject to such requirements; and

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

2. Definitions

In this Licence: **3BM-WHA0914**

"Act" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

"Amendment" means a change to original terms and conditions of this Licence requiring correction, addition or deletion of specific terms and conditions of the Licence; modifications inconsistent with the terms of the set terms and conditions of the Licence;

"Analyst" means an Analyst designated by the Minister under Section 85 (1) of the *Act*;

''Appurtenant undertaking'' means an undertaking in relation to which a use of waters or a deposit of waste is permitted by a licence issued by the Board;

"Board" means the Nunavut Water Board established under the *Nunavut Land Claims Agreement*;

"Effluent" means treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond, landfarm or a treatment plant;

"**Engineer**" means a professional engineer registered to practice in Nunavut in accordance with the *Engineering, Geological and Geophysical Act (Nunavut)* S.N.W.T. 1998, c.38, s.5;

"Final Discharge Point" in respect of an effluent means an identifiable discharge point of a facility beyond which the operator of the facility no longer exercises control over the quality of the effluent. For Sewage, the Final Discharge Point is located at the Sewage lagoon discharge point prior to entering the wetland area;

"Freeboard" means the vertical distance between water line and the designed maximum operating height on the crest of a dam or dyke's upstream slope;

"Geotechnical Engineer" means a professional engineer registered with the Association of Professional Engineers, Geologist and Geophysicists of Nunavut and whose principal field of specialization is with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments;

"Grab Sample" means a single water or wastewater sample taken at a time and place representative of the total discharge;

"Greywater" means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes;

"Hazardous Waste" means waste classified as "hazardous" by Nunavut Territorial or Federal legislation, or as "dangerous goods" under the *Transportation of Dangerous Goods Act*.

"**Inspector**" means an Inspector designated by the Minister under Section 85 (1) of the Act;

"Landfarm Facility" means an area designed to biologically treat Type B soils, as described in the Application for Water Licence filed by the Hamlet of Whale Cove on June 2, 2006;

"Licensee" means the holder of this Licence;

"Modification" means an alteration to a physical work that introduces new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion, and changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

"Monitoring Program" means a monitoring program established to collect data on surface water and groundwater to assess impacts to the freshwater aquatic environment of an appurtenant undertaking;

"Nunavut Land Claims Agreement" (NLCA) means the "*Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*", including its preamble and schedules, and any amendments to that agreement made pursuant to it;

"Sewage" means all toilet wastes and greywater;

"Sewage Disposal Facilities" comprises the area and engineered lagoon designed to contain Sewage as described in the Application for Water Licence filed by the Applicant on April 2, 2002;

"Sewage Sludge" means the semi-solid sewage material which settles at the bottom of the Sewage lagoon;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste (landfill site) as described in the Application for Water Licence filed by the Applicant on April 2, 2002;

"Toilet Wastes" means all human excreta and associated products, but does not include greywater;

"Treatment Objective" means the treatment objective for the Landfarm Facility which is based on the Canadian Council of Ministers of the Environment (CCME), 2001 *Canada – Wide Standard for Petroleum Hydrocarbon in Soil*, for Industrial land use; or as determined by the Government of Nunavut, Environmental Protection Service based on the 2002 *Environmental Guideline for Site Remediation*;

"**Type A Soil**" means soil contaminated with hydrocarbons in which the primary petroleum product present in the soil as determined by laboratory analysis consists of lubricating oil and grease;

"**Type B Soil**" means soil contaminated with hydrocarbons in which the primary petroleum product present in the soil as determined by laboratory analysis consists of fuel oil and/or diesel fuel and /or gasoline;

"Waste" means, as defined in S.4 of the Act, any substance that, by itself or in combination with other substances found in water, would have the effect of altering the quality of any water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any water that would have that effect

because of the quantity or concentration of the substances contained in it or because it has been treated or changed, by heat or other means;

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities, Solid Waste Disposal Facilities, and Landfarm Facility, as described in the Application for Water Licence filed by the Applicant on April 2, 2002, and June2, 2006, with supplemental information.

"Water Supply Facilities" comprises the intake infrastructure at Fish Lake, as described in the Application for Water Licence filed by the Applicant on April 2, 2002;

3. Enforcement

a. Failure to comply with this Licence will be a violation of the *Act*, subjecting the Licensee to the enforcement measures and the penalties provided for in the *Act*;
b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the *Act*; and
c. For the purpose of enforcing this Licence and with respect to the use of water and deposit or discharge of waste by the Licensee, Inspectors appointed under the *Act*, hold all powers, privileges and protections that are conferred upon them by the *Act* or by other applicable law;

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported which shall contain the following information:

a. tabular summaries of all data generated under the "Monitoring Program";
b. the monthly and annual quantities in cubic metres of fresh water obtained at the Water Supply Facilities;
c. the monthly and annual quantities in cubic metres of all Effluent discharged;
d. a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and facilities;
e. a list of unauthorized discharges and summary of follow-up action taken;
f. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;
g. Any addendum with updates or revisions for manuals and plans (i.e., *Operations and Maintenance Manual*) as required by changes in operation and/or technology;
h. a summary of any studies or reports requested by the Board that relate to water use and waste disposal or restoration, and a brief description of any future studies planned; and
i. any other details on water use or waste disposal requested by the Board by

November 1st of the year being reported;

2. The Licensee shall comply with the "Monitoring Program" described in this Licence, and any amendments to the "Monitoring Program" as may be made from time to time, pursuant to the conditions of this Licence.

3. The "Monitoring Program" and compliance dates specified in the Licence may be modified at the discretion of the Board in writing.

4. Meters, devices or other such methods as approved by the Board in writing, used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee.

5. The Licensee shall maintain the necessary signs to appropriately identify the stations of the Monitoring Program. Signs are to be posted in the Official Languages of Nunavut, following confirmation of location by the Inspector.

6. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130), any spills of Waste which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Water Supply or Waste Disposal Facilities.

7. The Licensee shall ensure a copy of this Licence is maintained at the Municipal Office at all times. Any communication with respect to this Licence shall be made in writing to the attention of:

(a). Manager of Licensing:
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: licensing@nunavutwaterboard.org

(b). Inspector Contact:
Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4295
Fax: (867) 979-6445

8. The Licensee shall submit one paper copy and one electronic copy of all reports, studies, and plans to the Board. Reports or studies submitted to the Board by the Licensee shall include a detailed executive summary in both English and Inuktitut.

9. The Licensee shall ensure that all documents and correspondence submitted by the Licensee to the Board are received and acknowledged by the Manager of Licensing.

10. The Licensee shall, for all Plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted, cannot be undertaken without subsequent written Board approval and direction. The Board may alter or modify a Plan if necessary to achieve the legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the Plan.

11. The Licensee shall, for all Plans submitted under this Licence, implement the Plan as approved by the Board in writing.

12. Every Plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of this Licence, and any additional terms and condition imposed upon approval of a Plan by the Board become part of this Licence. All terms and conditions of the Licence should be contemplated in the development of a Plan where appropriate.

13. This Licence is not assignable except as provided in Section 44 of the Act.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from Fish Lake using the Water Supply Facilities or as otherwise approved by the Board in writing.

2. The annual quantity of water used for all purposes shall not exceed thirty thousand (30,000) cubic metres.

3. The Licensee shall equip all water intake hoses with a screen of an appropriate mesh size to ensure that fish are not entrained and shall withdraw water at a rate such that fish do not become impinged on the screen.

4. The Licensee shall not remove any material from below the ordinary high water mark of any water body unless otherwise approved by the Board in writing.

5. The Licensee shall not cause erosion to the banks of any body of water and shall provide necessary controls to prevent such erosion.

6. Sediment and erosion control measures shall be implemented prior to and maintained during the operation to prevent entry of sediment into water.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all Sewage to the Sewage Disposal Facilities.

2. The Licensee shall locate areas designated for waste disposal at a minimum distance of thirty (30) metres from the ordinary high water mark of any water body such that the quality, quantity or flow of water is not impaired, unless otherwise authorized by the Board.

3. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Program Station WHA-3, shall not exceed the following effluent quality limits:

Parameter	Maximum Concentration of any Grab Sample
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Fecal Coliforms	1×10^6 CFU/100 mL
Oil and grease	No visible sheen
pH	between 6 and 9

4. The Licensee shall maintain at all times, a freeboard of at least 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board in writing, for all dams, dykes or other structures intended to contain, withhold, divert or retain water or wastes.

5. The Sewage Disposal Facilities shall be maintained and operated in such a manner as to prevent structural failure.

6. The Licensee shall treat, to the Treatment Objective, Type B Soil in the Landfarm Facility, in a manner in accordance with the Plans submitted to the Board by the Licensee on June 2, 2006, with supplemental information and any subsequent revisions approved by the Board in writing.

7. All water from dewatering contaminated soil areas and discharge of effluent at Monitoring Station WHA-6 at the Landfarm Facility, shall not exceed the following effluent quality limits:

Parameter	Maximum Concentration of any Grab Sample (µg/L)
pH	6 to 9 (units)
Oil and Grease	5000
Arsenic (total)	100

Parameter	Maximum Concentration of any Grab Sample (µg/L)
Cadmium (dissolved)	10
Chromium (dissolved)	100
Cobalt (dissolved)	50
Copper (dissolved)	200
Lead (dissolved)	50
Mercury (total)	0.6
Nickel (dissolved)	200
PCB (total)	1000
Phenols	20
Zinc (total)	500
Benzene	370
Toluene	2
Ethylbenzene	90

8. If effluent does not meet the effluent quality limits of Part D, Item 7 above, it shall be considered hazardous waste and disposed off-site at an approved facility.

9. The discharge location for all treated effluents described in Part D, Items 7 shall be to the satisfaction of an Inspector and shall be located at a minimum of thirty (30) metres from the ordinary high water mark of any water body and where direct or indirect flow into a water body is not possible and no additional impacts are created.

10. The Licensee shall dispose of soils containing contaminants in excess of *Canadian Environmental Protection Act* (CEPA) Guidelines of site at an approved treatment facility.

11. The Licensee shall, prior to the removal of any treated soil for future use, confirm with the Government of Nunavut, Environmental Protection Service that the soils have been treated so as to meet the legislatively-required Treatment Objective.

12. The Licensee shall provide at least ten (10) days notice to an Inspector, of the intent to discharge effluent from the Sewage Disposal Facility or the Landfarm Facility.

13. The Licensee shall dispose of and permanently contain all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Board in writing.

14. The Licensee shall segregate and store all hazardous materials and/or hazardous waste within the Solid Waste Disposal Facilities in a manner to prevent the deposit of deleterious substances into any water, until such a time that the materials have been removed for proper disposal at an approved facility.

15. The Licensee shall implement measures to ensure leachate from the Solid Waste Disposal Facility does not enter water.

16. All pump out water from excavation and borrow pits shall be pumped to an area approved by an Inspector.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval in writing, construction design drawings stamped by a qualified Engineer, sixty (60) days prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

2. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Waste Disposal Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

    a. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;
    b. these modifications do not place the Licensee in contravention of the Licence or the Act;
    c. the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and
    d. the Board has not rejected the proposed modifications.

3. Modifications for which all of the conditions referred to in Part E, Item 2, have not been met may be carried out only with written approval from the Board. The Licensee shall provide as-built plans and drawings of the Modifications referred to in this Licence within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

4. The Licensee shall provide to the NWB for review, as-built plans and drawings, stamped and signed by an Engineer, within ninety (90) days of completion of construction or, if already constructed, as is the case for the Landfarm, within ninety (90) days of issuance of this Licence.

5. All activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage.

6. The Licensee shall implement and maintain sediment and erosion control measures prior to and during activities carried out under this Part, to prevent the release of sediment and minimize erosion.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall submit to the Board for review, a Solid Waste Disposal Facilities Update Report and photographic record by October 31, 2009, which demonstrates the implementation of the measures recommended in the *Solid Waste Management Facility O&M Plan,* to improve the existing current facility.

2. The Licensee shall submit to the Board with the 2009 Annual Report no later than March 31, 2010, an updated consolidated Operations and Maintenance (O&M) Manual, consisting of the previously submitted Plans:

   a. *Environmental Emergency Contingency Plan Hamlet of Whale Cove* (December 2008);
   b. *Environmental Monitoring Program & QA/QC Plan Hamlet of Whale Cove* (December 2008);
   c. *Sewage Treatment Facility O&M Plan Hamlet of Whale Cove* (December 2008);
   d. *Solid Waste Management Facility O&M Plan Hamlet of Whale Cove* (December 2008); and
   e. *Water Supply Facility O&M Plan Hamlet of Whale Cove* (December 2008).

   and prepared where appropriate, in accordance with the *"Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories; 1996"*. The updated Manual shall take into consideration the comments received during the application review process and include the following:

   f. Updated sampling locations, parameters and timing required under the Licence;
   g. Updated *Environmental Emergency Contingency Plan* to include the information requirements under Part H, Item of Licence 3BM-WCL0712;
   h. A *Landfarm Management Plan*;
   i. A *Sewage Sludge Management Plan*; and
   j. An approved QA/QC Plan as required by Part H, Item 13.

3. The Licensee shall review the O&M Manual referred to in Part F, Item 2 as required by changes in operation and/or technology and modify accordingly. Revisions are to be submitted in the form of an Addendum to be included with the Annual Report.

4. An inspection of all engineered facilities related to the management of water and waste shall be carried out annually in July or August by a Geotechnical Engineer. The engineer's report shall be submitted for review to the Board within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan addressing each of the Engineer's recommendations.

5. The Licensee shall perform more frequent inspections of the engineered facilities at the request of an Inspector.

6. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:

   a. employ the appropriate contingency measures as approved for the Hamlet of Whale Cove;
   b. report the incident immediately via the 24-Hour Spill Reporting Line at (867) 920-8130 and to the Inspector at (867) 975-4295; and
   c. submit to the Inspector, a detailed report on each occurrence, not later than thirty (30) days after initially reporting the event, that provides the necessary information on the location (including the GPS coordinates), initial response action, remediation/clean-up, status of response (ongoing, complete), proposed disposal options for dealing with contaminated materials and preventative measures to be implemented.

PART G: CONDITIONS APPLYING TO ABANDONMENT, RESTORATION AND CLOSURE

1. The Licensee shall submit to the Board for approval an *Abandonment and Restoration Plan* at least six (6) months prior to abandoning any facilities or upon submission of the final design drawings for the construction of new facilities to replace existing ones. Where applicable, the Plan shall include information on the following:

   a. water intake facilities;
   b. the water treatment and waste disposal sites and facilities;
   c. petroleum and chemical storage areas;
   d. any site affected by waste spills;
   e. leachate prevention;
   f. an implementation schedule;
   g. maps delineating all disturbed areas, and site facilities;
   h. consideration of altered drainage patterns;
   i. type and source of cover materials;
   j. future area use;
   k. hazardous wastes; and
   l. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

2. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

3. All disturbed areas shall be stabilized and re-vegetated as required, upon completion of work, and restored as practically as possible to a pre-disturbed state.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

1. The Licensee shall maintain Monitoring Program Stations at the following locations:

Monitoring Program Station Number	Description	Status
WHA-1	Raw water supply intake at Fish Lake.	Active (Volume)
WHA-2	Runoff from the Solid Waste Disposal Facilities.	Active
WHA-3	Final Discharge Point for effluent from the Sewage Disposal Facilities prior to the wetland area.	Active
WHA-4	Effluent outfall area from the wetland area.	Active (new)
WHA-5	Soil entering the Landfarm.	(previously WCL-1) Active
WHA-6	Effluent discharged from the Landfarm Facility containment sump at the controlled point of release.	(previously WCL-2) Active
WHA-7	Monitoring well located up gradient of the Solid Waste Disposal Facilities.	(previously WCL-3) Active
WHA-8	Monitoring well located down gradient of the Solid Waste Disposal Facility.	(previously WCL-4) Active

2. The Licensee shall measure and record, in cubic metres, the monthly and annual quantities of water pumped at Monitoring Program Station WHA-1, for all purposes.

3. The Licensee shall sample monthly at Monitoring Program Station WHA-2, WHA-3 and WHA-4 during periods of observed flow and annual discharges, to be analyzed for the following parameters:

Biochemical Oxygen Demand (BOD_5)	Fecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease (visual)	Total Phenols
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Total Hardness	Total Alkalinity

Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Cobalt	Total Manganese
Total Chromium	Total Nickel
Total Copper	Total Lead
Total Aluminum	Total Arsenic

4. The Licensee shall carry out inspections at Monitoring Program Stations WHA-2 and WHA-4 weekly from May to August inclusive, to determine effluent or water flow in order to fulfill the monitoring requirements of Part H, Item 3. A record of inspections shall be retained and made available to an Inspector upon request.

5. The Licensee shall measure and record the volume of all soil, from all locations entering the Landfarm Facility at Monitoring Program Station WHA-5.

6. The Licensee shall assess and record the concentration of petroleum hydrocarbon contaminated soil entering the Landfarm Facility (WHA-5) from all sources, as per the CCME *Canada-Wide Standard for Petroleum Hydrocarbons in (PHC) in Soil*.

7. The Licensee shall sample prior to discharge at Monitoring Program Station WHA-6, to verify compliance with the effluent quality limits under Part D, Item 7.

8. The Licensee shall install groundwater monitoring wells at the Landfarm Facility. These wells shall be located with at least one located upstream of the facility for background data collection (WHA-7) and at least one downstream of the facility (WHA-8).

9. The Licensee shall sample at Monitoring Program Stations WHA-7 and WHA-8 once annually in the summer, giving consideration to adequate ground thaw and obtaining a representative groundwater sample. Samples shall be analyzed for the following parameters:

Biochemical Oxygen Demand (BOD_5)	Fecal Coliforms
Total Suspended Solids	pH
Conductivity	Nitrate-Nitrite
Oil and Grease	Total Phenols
Magnesium	Calcium
Sodium	Potassium
Chloride	Sulphate
Sulphate	Total Mercury
Total Hardness	Total Alkalinity
Ammonia Nitrogen	Total Zinc
Total Cadmium	Total Iron
Total Aluminum	Total Manganese
Total Chromium	Total Nickel

Total Copper Total Lead
Total Arsenic
TPH (Total Petroleum Hydrocarbons)
PAH (Polycyclic Aromatic Hydrocarbons)
BTEX (Benzene, Toluene, Ethylbenzene, Xylene)

10. Additional monitoring stations, sampling and analysis may be requested by an Inspector.

11. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board in writing.

12. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025 for all required analyses. The accreditation shall be current and in good standing.

13. The Licensee shall submit to the Board upon approval by an analyst, for inclusion with the O&M Manual, required under Part F, Item 2(j), a Quality Assurance/Quality Control (QA/QC) Plan. The Plan shall include up to date sampling methods to all applicable standards, acceptable to an accredited laboratory as required by Part H, Item 11 and Part H, Item 12. The Plan shall include a covering letter from the accredited laboratory and analyst, confirming acceptance of the Plan for analyses to be performed under this Licence.

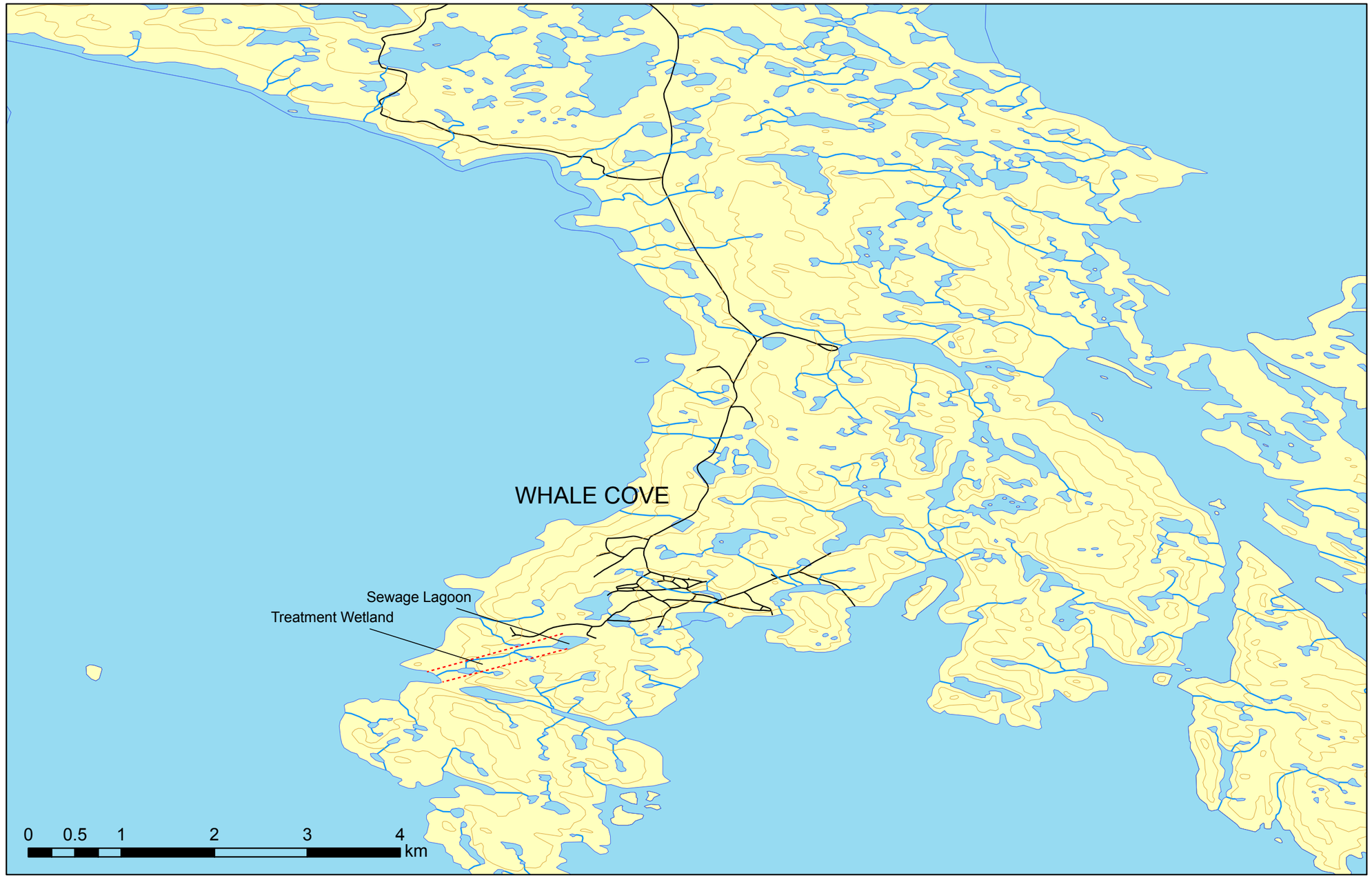
14. The Licensee shall annually review the Quality Assurance/Quality Control Plan in Part H, Item 13 and modify it as necessary. Proposed modifications shall be submitted to the accredited laboratory for approval.

15. The Licensee shall measure and record the annual quantities of Sewage Sludge removed from the Sewage Disposal Facilities.

16. The Licensee shall include all of the data and information required by the “Monitoring Program” complete with an interpretation and discussion of the results, in the Licensee's Annual Report, as required *per* Part B, Item 1, or as requested by an Inspector.

17. Modifications to the Monitoring Program may be made only upon written approval of the Board.

Appendix B – Figures



Legend

- Contour
- River/Stream
- Road
- Approx. Wetland Boundary

exp Services Inc.
1595 CLARK BOULEVARD
BRAMPTON, ONTARIO L6T 4V1

(905) 793-9800
(905) 793-0641

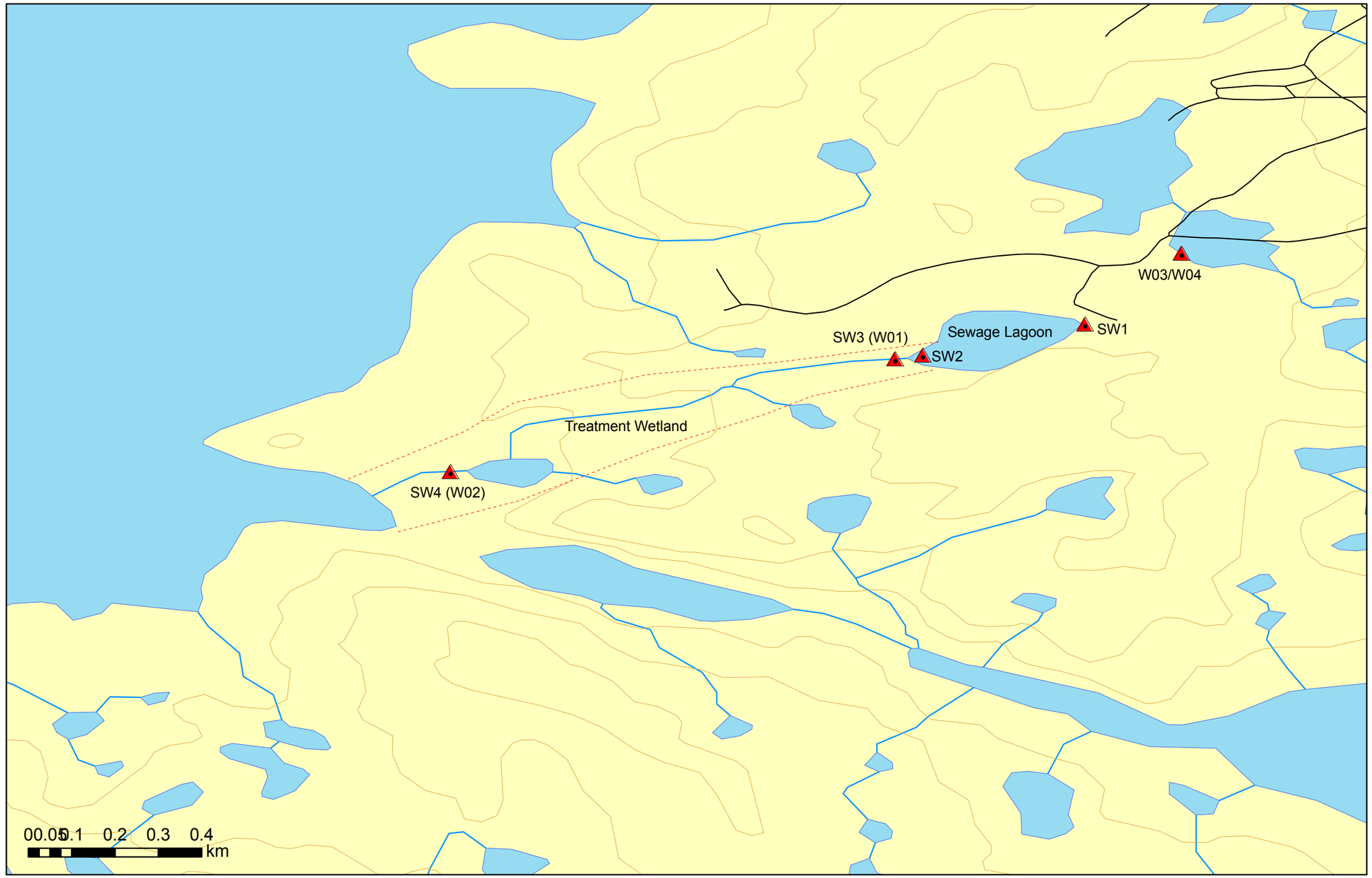
PROJECT TITLE:

Wetlands Assessment
Sewage Lagoon and Wetland
Whale Cove, Nunavut

DRAWING TITLE:

SITE LOCATION PLAN

PROJECT No.: OTT-00201369-A0	DWN: EE
SCALE: AS NOTED	CHKD: DF/EC
DATE: JANUARY 2012	FIG. No.: 1



Legend

- Contour
- River/Stream
- Road
- Approx. Wetland Boundary
- Approx. Surface Water Monitoring Location
- W0# Sample Collected by exp August 2011
- SW# Sample Collected by exp Sept. 2011

exp Services Inc.
1595 CLARK BOULEVARD
BRAMPTON, ONTARIO L6T 4V1

(905) 793-9800
(905) 793-0641

PROJECT TITLE:

Wetlands Assessment
Sewage Lagoon and Wetland
Whale Cove, Nunavut

DRAWING TITLE:

SITE PLAN & SURFACE
WATER MONITORING POINTS

PROJECT No.: OTT-00201369-A0	DWN: EE
SCALE: AS NOTED	CHKD: DF/EC
DATE: JANAURY 2012	FIG. No.: 2

Appendix C –
Site Photographs

Photograph No. 1: Sewage Lagoon Inlet (East Berm)

Photograph No. 2: Sewage Lagoon Inlet Channel (East Berm)

Photograph No. 3: Sewage Deposit into Sewage Lagoon

Photograph No. 4: Base of Sewage Inlet Channel (East Berm)

Photograph No. 5: Typical Shoreline of Sewage Lagoon

Photograph No. 6: Fireweed Plants

Photograph No. 7: Evidence of Wildlife Browse

Photograph No. 8: Shoreline of Sewage Lagoon (South of Inlet)

Photograph No. 9: Typical Vegetation Present Throughout the Site

Photograph No. 10: Rock Willow Present Throughout the Site

Photograph No. 11: Shoreline of Sewage Lagoon made up of Rock Outcrops with Various Patches of Low-Lying Vegetation

Photograph No. 12: Typical Vegetation Present Throughout the Site

Photograph No. 13: West End of Sewage Lagoon; West Berm Visible (with Tall Grasses)

Photograph No. 14: Existing Outlet Berm (West Berm)

Photograph No. 15: View from the West Berm to the Downgradient Wetlands; Ocean in the Background (Looking West)

Photograph No. 16: Minor Berm Seepage (West Berm)

Photograph No. 17: Beginning of Wetlands (Adjacent to West Berm)

Photograph No. 18: Evidence of Wildlife Habitat Throughout the Wetlands

Photograph No. 19: Various Water Courses Throughout the Wetlands

Photograph No. 20: Various Water Courses Throughout the Wetlands Among Moss Beds

Photograph No. 21: Arctic Squirrels Observed Throughout the Site

Photograph No. 22: Midway at the Wetlands; View Towards the Ocean

Photograph No. 23: Wetlands Area Protected by Adjacent Rock Walls (North and South of the Wetlands)

Photograph No. 24: Downgradient Wetlands Area, Near Water Course

Photograph No. 25: Evidence of Wildlife

Photograph No. 26: Downgradient Surface Water Sampling Point
(Facing East Toward Sewage Lagoon)

Photograph No. 27: Least Sandpiper Observed Throughout the Site

Photograph No. 28: Outlet to the Ocean