Sewage Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Kugluktuk, Nunavut

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175 Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

March 2007

File No: N-O 09755

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuna Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Table of Contents

Figures

Appendices

1.0 Introduction

1.1 Hamlet Description

The Hamlet of Kugluktuk (formerly known as Coppermine), is situated on Coronation Gulf at the mouth of the Coppermine River. The Hamlet is situated on a rocky area on the west side of the Coppermine River, at latitude 67°49'N, longitude 115°06'W, as shown on Figure 1.

The community has a population of approximately 1,585 (2006), with an approximate 1.5 percent projected growth rate over the 20-year design period. Community infrastructure includes:

- A water treatment plant, which draws water from the Coppermine River and stores it for treatment
- Trucked water to holding tanks in each building
- A sewage lagoon which receives trucked sewage collected from holding tanks in each building
- Sewage treatment was historically via an exfiltration lagoon to a wetland discharging north to the ocean
- A new lagoon and wetland treatment area has been designed
- A Solid Waste Management Facility, which includes a bulky metals disposal area
- A contaminated soil pile, a waste oil and liquid waste storage area, and a battery and other materials storage area next to the lagoon
- Former honey bag pit next to the lagoon
- Several rock and sand quarries
- Diesel powered generators
- Two wind generators (one partially dismantled and the other currently off-line)
- Barge landing area.

The Hamlet of Kugluktuk is predominately residential with a few small commercial establishments including a hotel, several construction and contracting businesses, grocery store, and a variety of other small businesses. Hunting and fishing in the traditional manner is still a prime occupation for many of the inhabitants. Community buildings include a high school, an elementary school, arena, swimming pool, Hamlet office, public works yard, GN offices, and a police station. A layout of the entire community and infrastructure is displayed on Figure 2.

1.2 Nunavut Water Board License

The Hamlet of Kugluktuk operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB3KUG0308, dated July 15, 2003 (Appendix A). Part G, Section 1 requires that an Operation and Maintenance

(O&M) Plan be submitted for the facilities in accordance with applicable regulations and guidelines. This document was created to provide staff with O&M procedures for the proposed Sewage Treatment Facility. An amendment to the NWB license is being requested.

The O&M Plan of the Sewage Treatment Facility will be used in conjunction with the normal operating procedures. This document provides a list of tasks and procedures that will assist the Hamlet's operations staff in the O&M of the facility.

This O&M Plan should be updated when the amended NWB license is issued.

1.3 Climate

Kugluktuk is affected by Arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The mean annual air temperature is -12°C. Monthly averages range from -31°C in February to 10°C in July. Kugluktuk receives about 249 mm of precipitation per year, of which 134 mm falls as rain between June and September. Prevailing winds are from the east in the summer and from the southwest in the winter. The mean wind speed is approximately 15 km/hr. Climate details are included in Appendix B. Tracking weather conditions will be important during lagoon discharge in the summer.

1.4 Sewage Volumes

The Detailed Design Report (Nuna Burnside, March 2007) for the Improvements to the Sewage Lagoon and Solid Waste Facilities determined the projected population, associated waste requirements and sewage generation rates using information from the Nunavut Bureau of Statistics. The tables with the detailed calculations are included in Appendix C.

1.5 Health and Safety

Health and safety of workers and the public is the first priority while operating the Sewage Treatment Facility. The requirements of the Nunavut Safety Act must be followed at all times. All actions and operations must be undertaken with safety as the first priority.

Template forms to assist staff in operating the facility, planning and costing the short term and long term use of the facility are included in Appendix D.

1.6 Training

Staff training is an important aspect of the operation of a Sewage Treatment Facility. Staff must be adequately trained to follow this O&M Plan and operate the facility. This O&M Plan is dependent on sufficient site specific training to allow staff to operate the facility.

2.0 Sewage Collection and Delivery

The Hamlet of Kugluktuk provides trucked water and sewage services, as well as regular solid waste pickup for the Community's residents, businesses, and institutions.

The Sewage Treatment Facility operated by the Hamlet of Kugluktuk is located approximately 5 km from the Hamlet (Figure 2). Sewage is collected daily by truck from all the houses and occupied buildings with holding tanks, and discharged to the sewage lagoon located to the west-southwest of the community.

The lagoon is designed to receive municipal sewage only. The discharge of other liquid wastes is prohibited, unless it can be demonstrated that the waste quality will have not deleterious impact on the Sewage Treatment Facility.

The Environmental Guidelines for Industrial Waste Discharge in Nunavut (Government of Nunavut, 2002), provides a Decision Flow Chart for Managing an Industrial Waste Discharge. It also includes schedules of comparative criteria for evaluating the liquid waste.

Liquid wastes meeting the criteria are acceptable for discharge into the sanitary sewer system (Sewage Treatment Facility). Liquid wastes that do not meet the criteria must be pre-treated until they do, or be stored in the Hazardous Waste Storage Area for future disposal at a licensed facility located outside of the community.

3.0 Operation and Maintenance of the Sewage Treatment Facility

3.1 Overview

The Hamlet of Kugluktuk Sewage Treatment Facility consists of two main components:

- Lagoon
- Wetland Treatment System.

The facility operates by holding sewage collected from the community and trucked to the lagoon for approximately one year prior to discharge to a wetland treatment area. The discharged effluent migrates along an approximate 1.5 km wetland pathway to the ocean at Coronation Gulf (Figure 4).

Monitoring points are located at the discharge point from the lagoon, and at selected locations down stream including the final discharge point prior to entering the ocean.

The lagoon is sized to contain the annual volume of sewage in year 20 of the design life. The wetland treatment system is designed to gradually become a more biologically rich area, to provide natural biological attenuation processes as the discharge volume increases year by year (Figure 4).

The lagoon will be fenced and the wetland treatment area identified with signs to alert overland travellers. The wetland treatment area is not commonly travelled.

3.2 Sewage Collection Procedures

The following sewage collection operational procedures shall be carried out by the staff of the Hamlet of Kugluktuk on a daily basis dependent upon weather conditions:

- Household and commercial sewage holding tanks will be pumped out using a vacuum truck and hauled to the Sewage Treatment Facility

- Sewage from the vacuum truck will be discharged to the Sewage Lagoon, via a pair of flumes designed to prevent erosion of the lagoon wall

- Daily waste volumes deposited to the Sewage Lagoon (and trip counts) shall be recorded on the recording form attached in Appendix D

- In the event of an accident, a spill of sewage or petroleum products or a fire during sewage collection operations, the *Environmental Emergency Contingency Plan, Hamlet of Kugluktuk* shall be implemented (separate document).

3.3 Sewage Treatment Facility Design

3.3.1 Existing Lagoon and Honey Bag Pit

The existing sewage lagoon (Figure 3) will remain in operation until the new Sewage Treatment Facility is commissioned. This may take 2 years.

Once the new facility is commissioned, the existing lagoon will be desludged with the sludge transferred to the Solid Waste Disposal Facility for initial treatment in the landfarm followed by use as interim cover.

The honey bag pit next to the existing lagoon will be cleaned out in the same fashion. The metal spillways (flumes) will be re-used or transferred to the Bulky Metals Area. Once this is completed the lagoon berm will be pushed over to infill the lagoon and maintain the topography of the area.

3.3.2 New Sewage Treatment Facility

A detailed drawing of the new facility is displayed on Figure 5, and cross-section details are displayed on Figure 6. Details are displayed on Figure 7.

Trucks will discharge sewage onto discharge flumes. The lagoon will gradually fill throughout the year until mid-June of each year, when climatic conditions (Appendix B) are suitable for discharge. This would be when the discharge valve area is ice free, and the wetland treatment area vegetation has become active and green. Discharge should begin when the wetland is sufficiently recovered from winter and becomes biologically active. The 300 mm sized discharge valve will be opened and discharge will continue until approximately mid-October.

The lagoon is designed for an operational capacity of approximately 126,000 m^3 in year 20 of operation. Maximum flow rates through the discharge pipe is estimated to be 1.5 m^3/minute, depending on the height of the effluent in the lagoon. At this average flow rate of 1.5 m^3/minute, approximately 53 days are required to empty the lagoon when filled to capacity. This must be accomplished during the 120 day discharge window between mid-June and mid-October when conditions are optimum.

The lagoon is designed with a discharge pipe set at a level high enough so there is always a layer of water over the maximum thickness of sludge when it is fully discharged. This prevents “flow through” of sewage during the period of discharge and maintains active effluent treatment conditions during discharge.

As shown on Figure 7, the bottom of the discharge pipe is set at 0.35 m above the lagoon bottom. Maximum sludge depth is set at 0.3 m.

The lagoon will be desludged when the sludge level reaches approximately 0.3 m thick, which is estimated to occur in 5 to 10 years. Over the 20 year design life, desludging would be needed on two or three occasions.

The following procedures will be followed for decanting:

- Inform the NWB a minimum of 10 days prior to the planned discharge period
- Approximate mid-June – evaluate ice and Wetland Treatment Area conditions
- Once favourable conditions have been achieved, open the discharge valve 25 percent on Day 1, 50 percent on Day 2, 75 percent on Day 3, and 100 percent on Day 4
- Discharge will empty into an area in front of the exfiltration berm, which is designed to slow and spread the flow over a wide area and multiple channels, to maximize flow paths and minimize flow depths
- Monitor the discharge and Wetland Treatment Area
- Allow the discharge valve to remain open for the remainder of the 120 day discharge period until mid-October
- Approximately mid-October, evaluate climate conditions and close the valve prior to freeze up and prior to the Wetland Treatment Area becoming biologically inactive.

During the discharge period reduce the discharge rate or stop the discharge during high volume storm events that could cause flooding of the Wetland Treatment Area and overland flow. Re-start discharge when water levels return to normal.

The lagoon has been sufficiently sized, so it is unlikely that there will be “flow through” of raw sewage from one end of the lagoon to the other during the discharge period. Monitoring of the Sewage Treatment Facility and reporting will meet NWB license requirements.

The facility is designed for a minimum of 20 years of operation based on population growth projections. Maintenance, including de-sludging is scheduled when sludge thickness reaches 0.3 m throughout the 20 year period.

3.4 Sewage Lagoon Operational Procedures

The following operational procedures shall be carried out by the Hamlet of Kugluktuk, during lagoon decant operations:

- The Hamlet of Kugluktuk shall advise an Inspector and the Nunavut Water Board at least 10 days prior to starting the decant operations of the sewage lagoon
- Household and commercial sewage deposited to the Sewage Lagoon shall be decanted to the Wetland Treatment System via the outlet discharge piping
- Decant operations shall occur between mid June and mid October, dependant on weather conditions
- During decant operations, the sewage lagoon decant control structures and drainage features shall be inspected daily for defects or blockages, and repaired immediately as necessary
- During decant operations, effluent quality monitoring shall be undertaken in accordance with the terms and conditions outlined in the NWB water license, or at the direction of an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*
- Upon completion of decanting operations, the decant structure valve shall be closed and checked that flow has ceased, the lagoon berms inspected, and any required maintenance performed
- Monitoring and inspections will occur as outlined in the NWB license and described in this O&M Plan.

3.5 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the staff of the Hamlet of Kugluktuk during periodic and seasonal maintenance operations at the Sewage Treatment Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and surface grading in the summer, with any defects repaired as necessary
- Berms and fences shall be inspected monthly
- Ditches and drainage channels shall being inspected for erosion (once per month) during the summer, and repaired as necessary

- Site warning signage, which identifies the boundaries of the Sewage Treatment Facility (i.e. Sewage Lagoon and the Wetland Treatment Area) shall be inspected monthly, and repaired or replaced as necessary

- The discharge flume/spillways to the Sewage Lagoon shall be inspected for damage or displacement monthly, and repaired as necessary. The vehicle stop bollards located between the truck pad and the discharge spillway are particularly important

- Any airborne litter shall be removed from the Sewage Treatment Facility to the Hamlet landfill in the Spring and Autumn, or as required

- Any places where the liner is exposed will be examined after decant operations

- The Sewage Lagoon shall be inspected following decant operations, to determine the thickness of sludge which has accumulated in the lagoon since the previous inspection

- Desludging of the lagoons shall occur as required, based on the sludge thickness in the lagoon.

Forms to assist site staff in conducting the inspections and data recording are included in Appendix D.

The activities described above shall be completed by the staff of the Hamlet and details of any repairs shall be reported in the Annual Report submitted to the Nunavut Water Board, in compliance with the Hamlet's Water License.

3.6 Wetland Treatment Area

The Wetland Treatment Area is an integral part of the Sewage Treatment Facility. It consist of a meandering stream and wetland pathway, that reaches across the raised beach tundra a distance of approximately 1.5 km between the lagoon and Coronation Gulf (Figure 3). Monitoring of the existing wetland down stream of the existing lagoon has demonstrated that, even with raw sewage discharge in 2005, the wetland was providing adequate treatment such that the NWB license requirements were being met before discharging into Coronation Gulf. The Wetland Treatment Area for the new Sewage Treatment Facility is designed to increase in capacity for treatment slowly as the volume of discharge increases year to year. Continuous monitoring will allow ample warning if maintenance efforts such as diverting some of the flow into adjacent drainage systems is required.

As shown on Figure 4, there are several small drainage systems that could be used to expand the Wetland Treatment Area if required.

The proposed system operates as follows:

- Discharge of clarified sewage from the lagoon (retained from October to June)
- Discharge from the lagoon when climate and vegetation conditions are optimized
- Controlled discharge with monitoring
- Discharge is initially collected behind an exfiltration berm, which slows the flow and spreads it over a wider area. This expands the distribution and lengthens the flow path
- Additional areas are available to further expand the flow path (Figure 4), if required
- Monthly monitoring at four sampling stations in the Wetland Treatment Area to closely monitor impacts (Figure 3)
- Monthly collection descriptive data and measurements during discharge (refer to the Monitoring Plan and QA/QC Plan)
- Signs to alert the public and identify sample locations
- A small bridge (Figure 4) at the point where a snowmobile/A.T.V. trail crosses the stream.

Wetland Treatment Area maintenance, if required, would consist of the following:

- Enhancement of ditches to alter or lengthen flow paths
- Construction of exfiltration berms to slow the flow and lengthen the flow path
- Diversion of a portion of the flow into adjacent small drainage systems to expand the Wetland Treatment Area.

The operation of the Wetland Treatment Area is based on continued close monitoring at the four stations along the length of the flow path. This will provide ample forewarning of a potential problem such that maintenance measures can be implemented.

3.7 Sewage Treatment Facility Monitoring Program

3.7.1 Water License Requirements

As outlined in the NWB water license, regular monitoring of the effluent from the Sewage Treatment Facility is required. The Monitoring Program is to include effluent samples collected at various places including the Final Discharge Point of the Wetland Treatment System, during the months of June to October, inclusive. Effluent samples collected shall be analyzed for the following parameters:

- Biological Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Conductivity
- Oil and Grease (OGG) (Visual)
- Magnesium (Mg)
- Sodium (Na)
- Chloride (C1)
- Total Hardness
- Ammonia as Nitrogen (NH_3-N)
- Total Cadmium (Cd)
- Total Cobalt (Co)
- Total Chromium (Cr)
- Total Copper (Cu)
- Total Aluminium (Al)
- Total Mercury (Hg)
- Faecal Coliforms (FC)
- pH
- Nitrate and Nitrite as Nitrogen (NO_3-NO_2)
- Total Phenols (Total-P)
- Calcium (Ca)
- Potassium (K)
- Sulphate (SO_4)
- Total Alkalinity
- Total Zinc (Zn)
- Total Iron (Fe)
- Total Manganese (Mn)
- Total Nickel (Ni)
- Total Lead (Pb)
- Total Arsenic (As)
- Total Organic Carbon (TOC)

Additional analytical parameters, which could become a requirement of the NWB water license or be requested by an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act.* Other parameters can be added as needed.

Sampling completed by the Hamlet of Kugluktuk shall be in accordance with the Hamlet of Kugluktuk Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan, which has been prepared as a separate document.

A monitoring station will be established at the point where raw wastewater is off-loaded by the sewage trucks. Monthly and annual quantities of raw wastewater offloaded will be measured and recorded in the official operations logbook on a form similar to that presented in Appendix D.

3.7.2 Monitoring Locations

Monitoring stations are displayed on Figures 3 and 4. Until the lagoon is fully operational, the current monitoring stations for the existing lagoon will continue to be used. The following is a description of each monitoring location as outlined in the requested amendment to the NWB license:

Kug-1 Raw water supply (not part of the Sewage Treatment Facility)

Kug-2 Existing downstream sampling point for the existing lagoon (will be replaced once new system is operational)

Kug-2A Proposed discharge sampling point from the landfill retention period (not part of the Sewage Treatment Facility)

Kug-3 Current raw sewage sampling point (will be replaced when the new facility is commissioned)

Kug-3A Proposed raw sewage discharge sampling station

Kug-4 Current lagoon discharge sampling point (to be replaced when the new facility is commissioned)

Kug-4A Proposed lagoon discharge sampling point

WS-1 Surface water monitoring station in the Wetland Treatment Area. Upper portion of wetland immediately downstream from lagoon

WS-2 Surface water monitoring station in Wetland Treatment Area

WS-3 Surface water monitoring station in the downstream portion of the Wetland Treatment Area

WS-4 Final Effluent Discharge Point from the Sewage Treatment Facility at the point of discharge from the Wetland Treatment Area not Coronation Gulf. This is the point at which the facility must meet the establish effluent quality criteria for discharge.

Sampling locations will chosen more precisely once the facility has been constructed and GPS points taken. A sign will be erected to mark each location and alert the public.

3.7.3 Monitoring Procedures

General monitoring procedures are as follows:

- Sludge measurement – sludge measurements will be taken with a "sludge judge", which is an approximate 2 cm clear tube, which is pushed into the sludge and withdrawn and measured. Sampling will take place at the discharge pipe concrete retaining wall

- Water levels – water levels will be measured from a fixed point on the discharge pipe concrete training wall

- Lagoon discharge samples will be collected from the small pond that will form the discharge pipe and the discharge spreading exfiltration berm (Figures 3, 4, and 5)

- Raw sewage samples will be collected from the base of the input flume, after several consecutive loads have been dumped to obtain a representative sample of several loads. Samples will collected using a pole with bottle clamp

- All other samples will be collected from designated surface water sampling stations. Refer to the Monitoring Plan and QA/QC Plan document for sample collection and handling details.

3.7.4 Monitoring Results

Results of analytical testing and monitoring are to be recorded on a regular basis by the Hamlet's operation staff. Copies of the analytical certificates and Chain of Custody forms are to be kept for future reference to determine the effectiveness of the treatment facility. The monitoring results will be included in the Annual Monitoring Report.

3.7.5 Abandonment and Restoration

Part G of the Water License (Appendix B), requires the submission of Abandonment and Restoration Plan at least six months prior to abandoning any facilities and construction of new facilities to replace existing ones. This Detailed Design Report provides the required information for the exiting facilities.

The Sewage Treatment Facility consisting of the lagoon and Wetland Treatment Area, has been designed to meet the required 20 design period. It is expected that it could continue to operate for a significant period of time beyond 20 years. Desludging on a regular basis would extend its life as it approaches year 20. Once sewage volume exceeds the capacity of the lagoon, the lagoon can be expanded or an additional lagoon constructed. As shown in Figures 2 and 4, there is a large area to the northwest where a

new lagoon could be located. In addition, there is significant land area consisting of small drainage streams among raised beaches, which could be further developed to increase the size of the Wetland Treatment Area.

In the future, should the Sewage Treatment Facility no longer be required, abandonment would be straight forward as follows:

- Drain the lagoon during the discharge period
- Desludge the lagoon (as described previously)
- Remove the liner and appurtances for disposal t the Solid Waste Management Facility
- Open the berms to allow natural drainage
- Contour the area to match the surrounding tundra
- Berms would be regraded or left standing
- The Wetland Treatment Area would return to natural conditions.

The Sewage Treatment Facility O&M Plan provides details for site staff. The O&M Plan includes a short term and long term planning process, which would prompt the Hamlet to prepare for expansion and closure as the facility reaches the later years of its design life.

4.0 Emergency Response and Contingencies

In the event of an emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1: Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Kugluktuk – SAO	Kugluktuk	(867) 982-6500	(867) 982-3060
Government of Nunavut (Regional Engineer)	Cambridge Bay	(867) 983-4125	(867) 983-4123
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Kugluktuk	(867) 982-2222	(867) 982-3407
RCMP Detachment	Kugluktuk	(867) 982-1111	(867) 982-3390
Community Health Center	Kugluktuk	(867) 982-4531	(867) 982-3115

Contingency plans are designed to provide site staff with direction and options when there is an unexpected event or accident.

The Environmental Emergency Contingency Plan, Hamlet of Kugluktuk (prepared as a separate document) provides procedures and direction in the case of a spill or accident.

As outlined in the Contingency Plan, the health and safety of workers and the public are the first priority.

5.0 Reporting

The Nunavut Water Board License on Part B: General Conditions include the requirement to file an Annual Report with the NWB no later than March 31st of the next calendar year. The report shall include:

- Tabular summaries of all data generated under the "Monitoring Program"
- The monthly and annual quantities in cubic metres of freshwater obtained from all sources
- The monthly and annual quantities in cubic metres of each and all waste discharged
- A summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures
- A list of unauthorized discharges and summary of follow-up action taken
- A summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year
- A summary of any studies, reports and plans (i.e. Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned
- Any other details on water use or waste disposal requested by the Board by November 1st of the reporting year.

The format of the NWB Annual Report is included in Appendix D.

The creation of the report can be greatly simplified by staff regularly filling in and filing the Site Forms included in Appendix D. The forms include:

- Form 1 – Monthly Sewage Delivery Log – describing the day to day delivery of sewage and site activities
- Form 2 – Monthly Sewage Treatment Facility Inspection Form – to document the inspection and observation of the site operations and infrastructure
- Form 3 – Effluent Discharge Log – to document the decanting of the lagoon during the 120 day discharge period

- Form 4 – Sewage Treatment Facility Planning Form – which provides a list of items to be discussed by the site foreman and Hamlet Council related to short term and long term sewage handling and treatment decision making.

In addition to these forms, there would be sampling information and analytical data collected. The Monitoring Plan and QA/QC Plan (prepared as a separate document) outlines sample collection and analytical data handling protocols. Using the forms and following the procedures provided herein should make submitting the annual monitoring report relatively straight forward.

6.0 Summary

This Operation and Maintenance Plan (O&M) has been prepared based on the proposed new design for the Sewage Treatment Facility.

A Sewage Treatment Planning Form has been included in Appendix D, to assist the Hamlet in tracking and evaluating the various aspects of the Sewage Lagoon Treatment Facility including costs and long term planning.

Appropriate training for site staff is necessary as part of the implementation of this O&M Plan. This document should be reviewed and updated annually, and whenever the NWB Water License is amended or new relevant legislation is issued.

7.0 References

Department of Municipal and Community Affairs, Government of Northwest Territories, October 1996. *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories.* Queen's Printer: Yellowknife, Northwest Territories.

Government of Nunavut (2002), *Guideline: Industrial Waste Discharges in Nunavut.*

Nunavut Water Board, (2000). *Guidelines for the Discharge of Domestic Waste Water in Nunavut.*

National Research Council. August 2004. *National Guide to Sustainable Municipal Infrastructure: Optimization of Lagoon Operations*. Ottawa, Ontario.

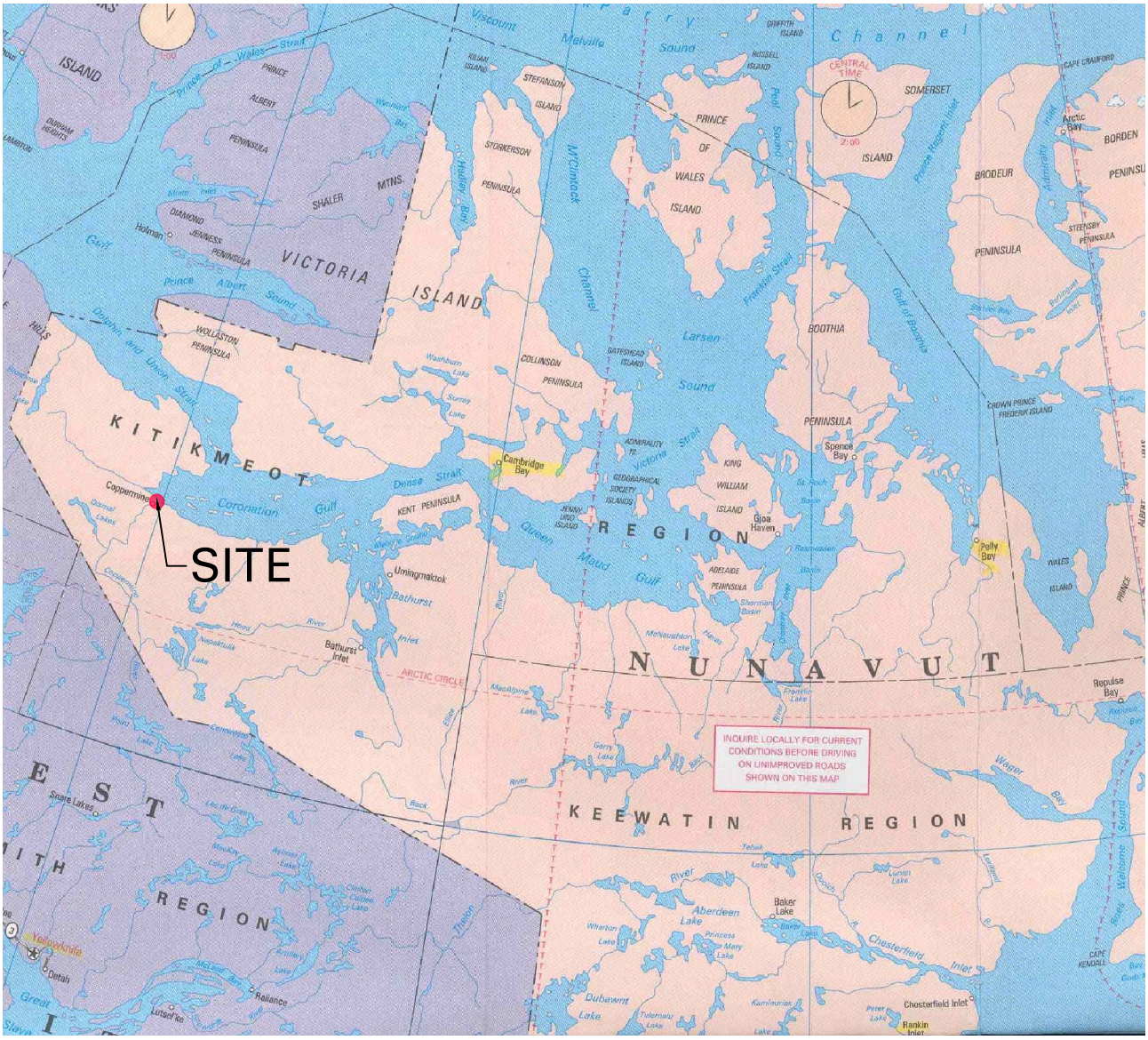
Nuna Burnside Engineering and Environmental Ltd. January 2005. *Schematic Design for the Improvements to the Sewage Lagoon and Solid Waste Facility for the Hamlet of Kugluktuk.* Cambridge Bay, Nunavut.

Nuna Burnside Engineering & Environmental Ltd., (2007). *Environmental Emergency Contingency Plan, Hamlet of Kugluktuk.*

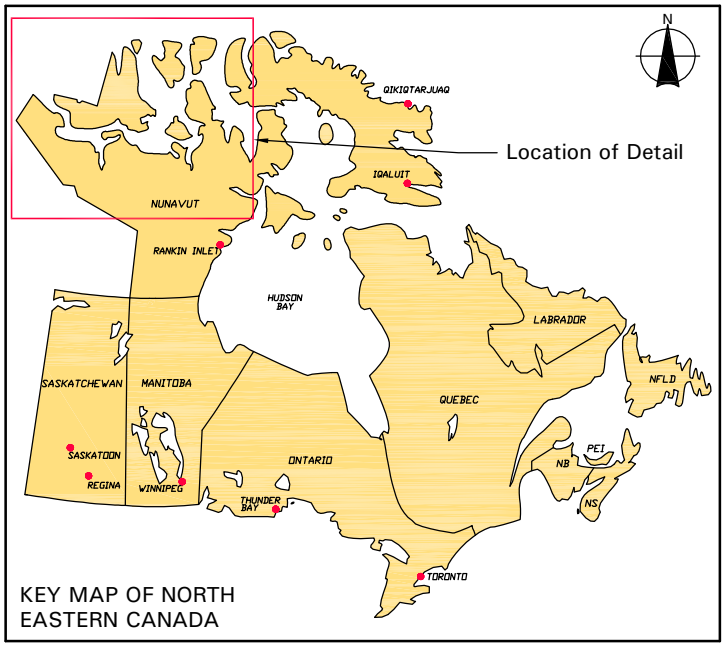
Nuna Burnside Engineering & Environmental Ltd., (2007). Monitoring Program and Quality Assurance/Quality Control Plan, *Hamlet of Kugluktuk.*

Nunavut Water Board. 15 July 2003. *Hamlet of Kugluktuk Water License NWB3KUG0308*. Gjoa Haven, Nunavut.

Figures



Map Reference:
Map of Canada
Published by the CAA



KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION

THE HAMLET OF KUGLUKTUK, NUNAVUT

SEWAGE TREATMENT FACILITY OPERATION AND MAINTENANCE (O&M) PLAN - MARCH 2007

March 2007
Project Number: FE009754

Prepared by: J. Amsen

Verified by: J. Walls

BURNSIDE

FE009754 O&M SL MARCH 2007 SL.DWG

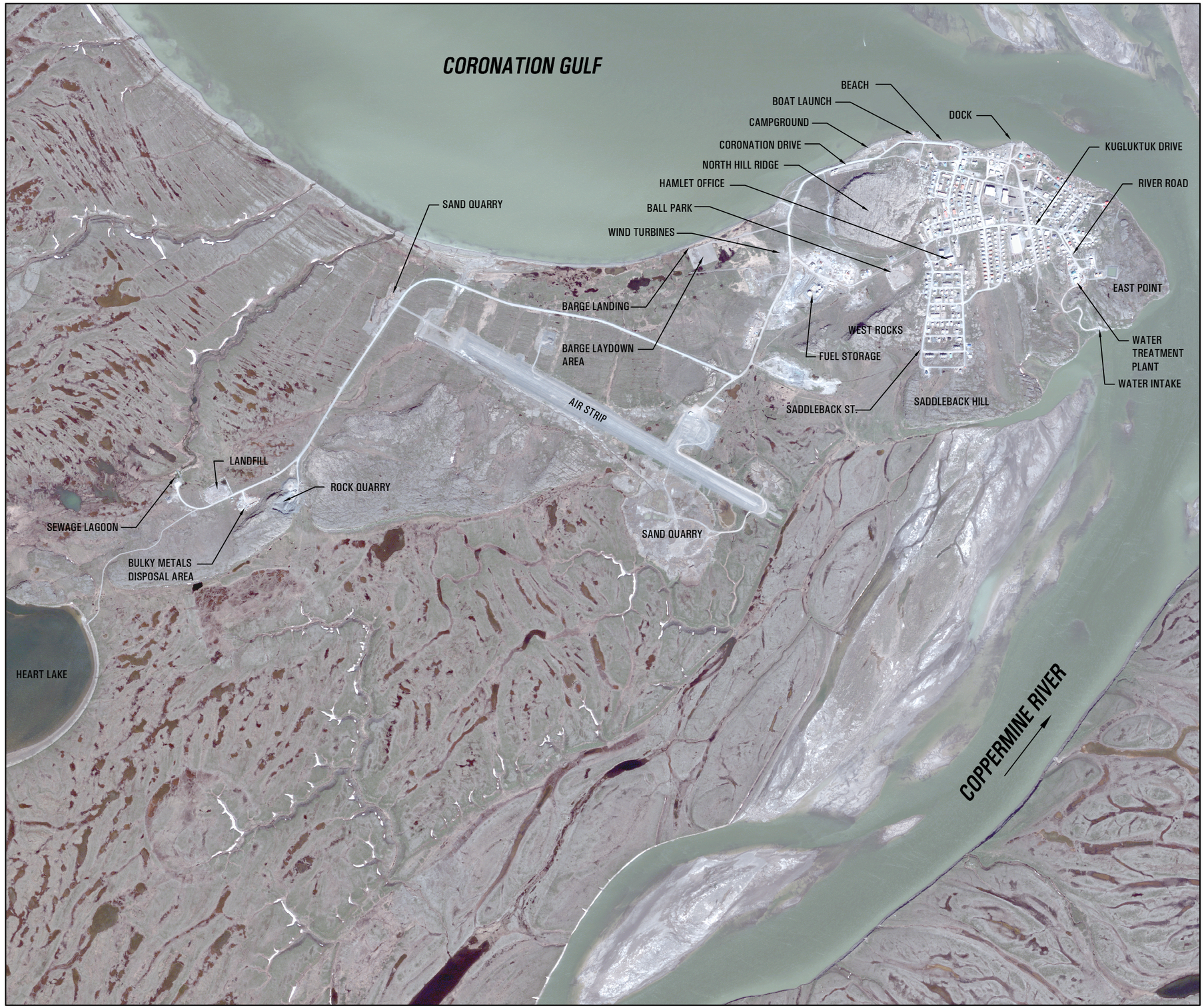


FIGURE 2

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION & MAINTENANCE (O&M) PLAN - MARCH 2007

KEY FEATURES OF COMMUNITY

Image Source: © Copyright 2002 DigitalGlobe Inc., All Rights Reserved.

Image Platform: Quick Bird (Satellite)
Image Acquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
March 2007
Project Number: FE009754

Projection: UTM Zone 16
Datum: NAD83

Prepared by: J. Amsen

Verified by: J. Walls

NUNA BURNSIDE

FE009754 O&M SL MARCH 2007 COMMUNITY PLAN.dwg

FIGURE 3

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY & OPERATION & MAINTENANCE (O&M) PLAN - MARCH 2007

REGIONAL VIEW OF SEWAGE LAGOON AND SOLID WASTE DISPOSAL FACILITY (LANDFILL)

Legend

- KUG-2 — SURFACE WATER SAMPLING LOCATION *(To be replaced once new facilities are in place)*
- WS-2 — WETLAND WATER SAMPLING LOCATION
- KUG-2A — PROPOSED SURFACE WATER SAMPLING LOCATION *(For new facilities)*
- OUTLINE OF WETLAND TREATMENT AREA (10 ha)
- OUTLINE OF EXPANDED WETLAND TREATMENT AREA (5.1 ha)
- OUTLINE OF POTENTIAL FUTURE WETLAND TREATMENT AREA *(If required)* (30 ha)

Image Source: © Copyright 2002 DigitalGlobe Inc., All Rights Reserved.

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 20 40 60 80 100 120 140 160 180 200 220 240
Meters

1:3000
March 2007
Project Number: FEO-09754

Projection: UTM Zone 16
Datum: NAD83

Prepared by: C. Reynolds

Verified by: J. Walls

BURNSIDE

FEO09754 O&M SL MARCH 2007 REGIONAL PLAN.dwg

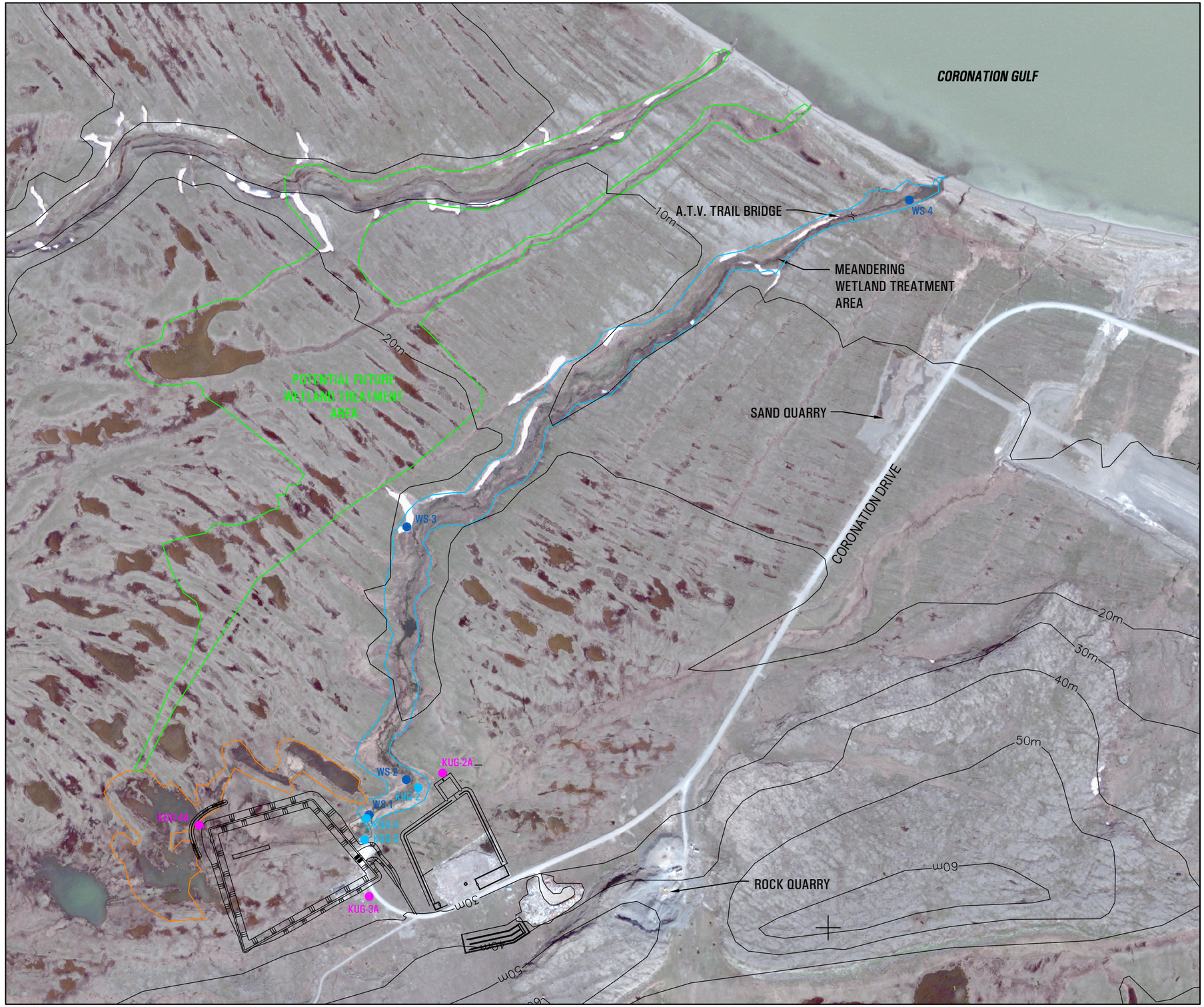


FIGURE 4

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION & MAINTENANCE (O&M) PLAN - MARCH 2007

SAMPLE LOCATIONS

Legend

- KUG-2 — SURFACE WATER SAMPLING LOCATION *(To be replaced once new facilities are in place)*
- WS-2 — WETLAND WATER SAMPLING LOCATION
- KUG-2A — PROPOSED SURFACE WATER SAMPLING LOCATION *(For new facilities)*
- 50m — EXISTING CONTOURS (m amsl) obtained from National Topographic Survey Digital Data Contour interval 10m
- OUTLINE OF WETLAND TREATMENT AREA (10 ha)
- OUTLINE OF EXPANDED WETLAND TREATMENT AREA (5.1 ha)
- OUTLINE OF POTENTIAL FUTURE WETLAND TREATMENT AREA *(If required)* (30 ha)

Image Source: © Copyright 2002 DigitalGlobe Inc., All Rights Reserved.

Image Platform: Quick Bird (Satellite)
Image Aquisition: 01 July, 2002
Spatial Resolution: 0.6m

N

0 100 200 300 400 500 600
Meters

1:7,500
March 2007
Project Number: FEO09754

Projection: UTM Zone 17
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

NUNA BURNSIDE

Revision #: 1

FEO09754 O&M SL MARCH 2007 SAMPLES.DWG

FIGURE 5

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION & MAINTENANCE (O&M) PLAN - MARCH 2007

LAGOON SITE PLAN

Legend

- KUG-2 — SURFACE WATER SAMPLING LOCATION *(To be replaced once new facilities are in place)*
- WS-2 — WETLAND WATER SAMPLING LOCATION
- KUG-2A — PROPOSED SURFACE WATER SAMPLING LOCATION *(For new facilities)*
- OUTLINE OF WETLAND TREATMENT AREA (10 ha)
- OUTLINE OF EXPANDED WETLAND TREATMENT AREA (5.1 ha)

N

0 10 20 30 40 50 60 70 80 90 100 110 120

Meters

1:1,500
March 2007
Project Number: FEO09754

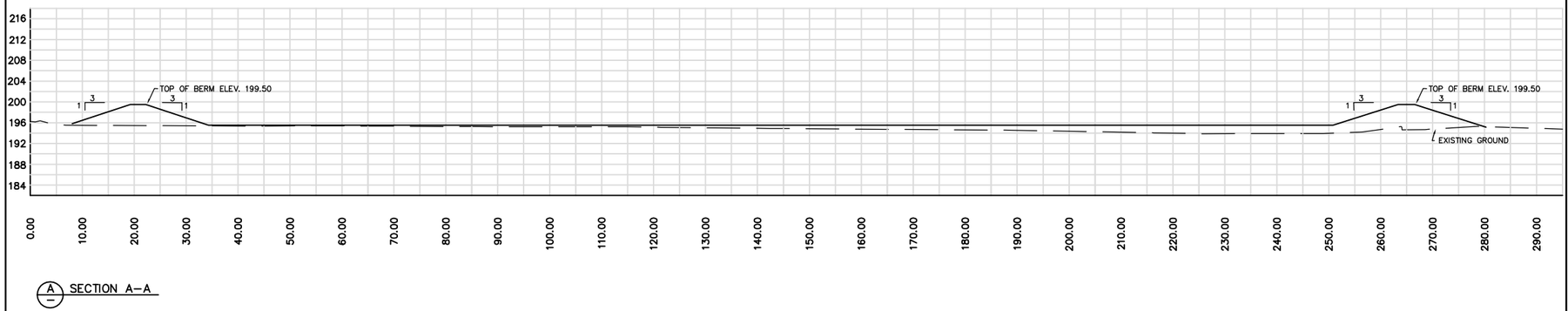
Prepared by: C. Sheppard

Verified by: J. Walls

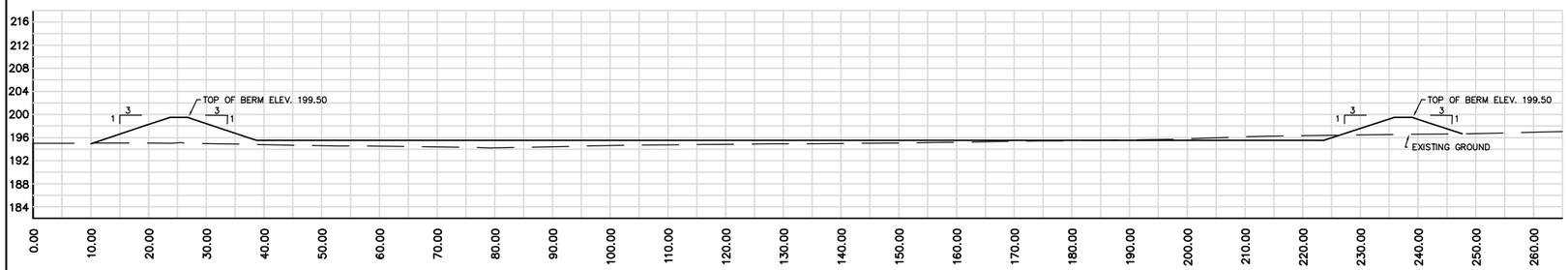
BURNSIDE

Revision #: 1

FEO09754 O&M SL MARCH 2007 SITE PLAN.DWG



A SECTION A–A



B SECTION B–B

FIGURE 6

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION & MAINTENANCE (O&M) PLAN - MARCH 2007

CROSS-SECTIONS

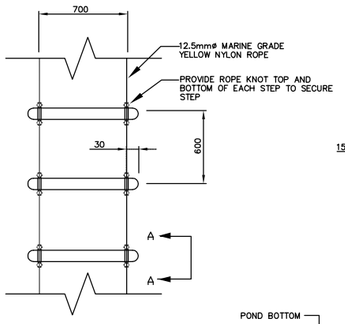
Scale: As Shown
March 2007
Project Number: FEO09754

Prepared by: C. Sheppard

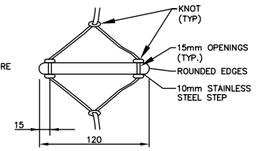
Verified by: J. Walls

Revision #: 1

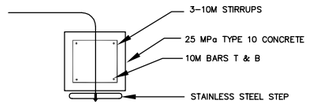
FEO09754 O&M SL MARCH 2007 XS.DWG



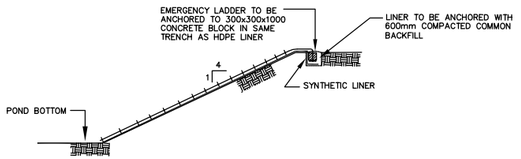
LADDER ASSEMBLY



SECTION A–A



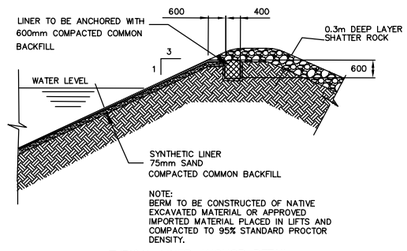
LADDER ANCHOR CONCRETE BLOCK DETAIL



ANCHOR INSTALLATION DETAIL

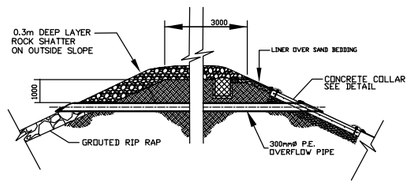
EMERGENCY LADDER DETAILS

N.T.S.



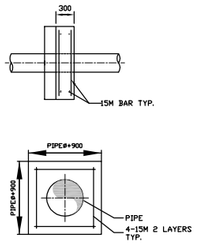
TYPICAL LINER ANCHOR DETAIL

N.T.S.



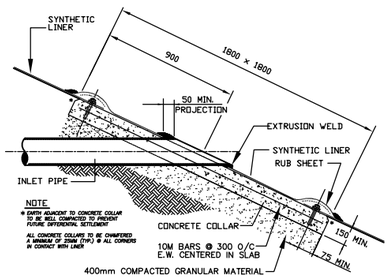
TYPICAL OVERFLOW DETAIL

N.T.S.



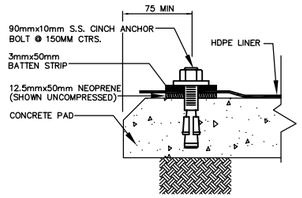
CONCRETE COLLAR

N.T.S.



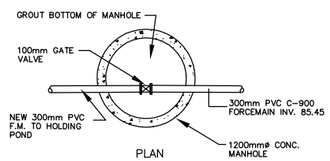
TYPICAL LINER PENETRATION DETAIL

N.T.S.

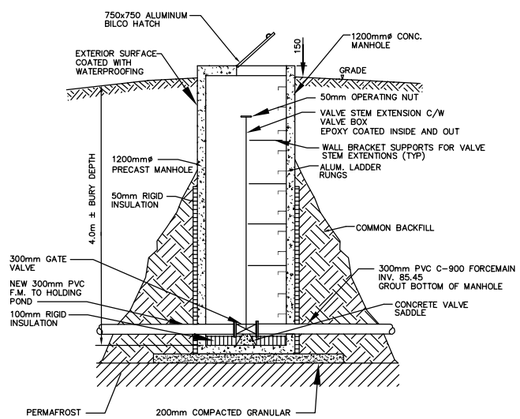


TYPICAL ANCHOR BOLT DETAIL

N.T.S.



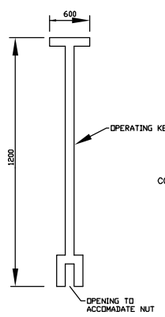
PLAN



SECTION

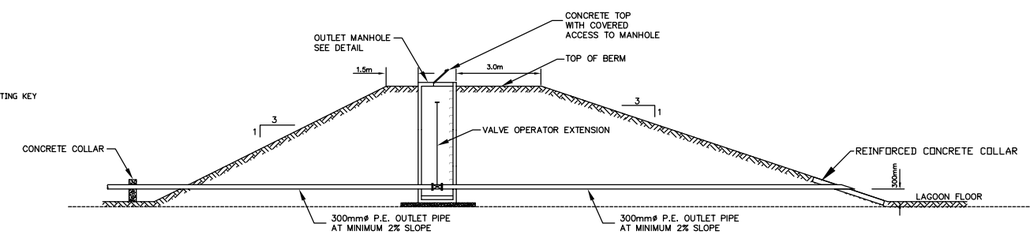
OUTLET MANHOLE DETAIL

N.T.S.



OPERATING KEY

N.T.S.



LAGOON OUTLET CHAMBER

N.T.S.

FIGURE 7

HAMLET OF KUGLUKTUK
SEWAGE TREATMENT FACILITY OPERATION & MAINTENANCE (O&M) PLAN - MARCH 2007

LAGOON DETAILS

N.T.S.
March 2007
Project Number: FEO09754

Prepared by: C. Sheppard

Verified by: J. Walls

Revision #: 1

FEO09754 O&M SL MARCH 2007 DETAILS.DWG

Appendix A

Nunavut Water Board License

P.O. BOX 119
GJOA HAVEN, NU X0B 1J0
TEL: (867) 360-6338
FAX: (867) 360-6369

kNK5 wmoEp5 vtmpq
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

DECISION

LICENCE NUMBER: NWB3KUG0308

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence dated July 15, 2003, made by:

Hamlet of Kugluktuk

to allow for the use of water and disposal of waste for the Hamlet at Kugluktuk, Nunavut. With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence.

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 Claim Agreement* (NLCA), the NWB decided that the application could proceed through the regulatory process. After reviewing the 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 *Nunavut Land Claims Agreement* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and furthermore to delegate its authority to approve the application to the Chief Administrative Officer pursuant to S. 49(a) of the NWNSRTA and determined that:

Licence Number NWB3KUG0308 be issued subject to the terms and conditions contained therein. (Motion #: 2003-35)

SIGNED this 20th day of November 2003 at Gjoa Haven, NU.

Original signed by:

_____

Philippe di Pizzo
Chief Administrative Officer

TABLE OF CONTENTS

I. BACKGROUND

Kugluktuk is located immediately west of the mouth of the Coppermine River on Coronation Gulf at 67°50'N, 115°15'W, 595 air km north of Yellowknife. The Hamlet extends inland to cover a rocky knoll. The town site is underlain by Precambrian sedimentary and volcanic rock. Dolomite and shale, interspersed with volcanic rock, form steep outcrops in the vicinity of the settlement. The buildings along the shore are perched on consolidated beach deposits. Directly behind this ridge is a low, marshy area. There are numerous exposed bedrock surfaces in the community. Surficial deposits in the area include talus and deltaic deposits. The angular talus, derived primarily from the mechanical breakdown of dolerite, ranges in size from silt to boulders but is commonly found as course sand or fine gravel. Kugluktuk is underlain by permafrost. The thickness of the active layer ranges from less than 0.5 m to over 1 m in the sandy waterfront area. Permafrost features such as polygonal ground and thaw-related instability affect the raised delta surfaces and strongly influence their drainage characteristics. Grasses, sedges, heather, mosses, and lichens grow in limited soils. Willow and alder thickets are common in wetland depressions. Kugluktuk receives an average of 10.3 cm of rainfall and 100.7 cm of snowfall per year. Mean annual precipitation totals 20.2 cm. July mean high and low temperatures are 13.8° C and 5.6° C. The January mean high and low temperatures are -26.4° C and -33.8° C. The winds are generally south-west and annually average 16.6 km/h.

II. PROCEDURAL HISTORY

On July 15, 2003, an application for the renewal of water license N3L4-1526, was filed by Ferguson Simek Clark Environmental Consultants (Yellowknife) on behalf of the Hamlet of Kugluktuk. The previous water licence was issued by the Northwest Territories Water Board on 1 July 1998 and valid until June 30, 2003. In consideration of the application for renewal the Nunavut Water Board publicly posted notice of this application, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S.55.1 and Article 13 of the *Nunavut Land Claims Agreement,* on July 23, 2003. An assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet was then undertaken, so that the Board could make a fully informed decision on the merits of application. This assessment process included the referral of the application to a variety of Federal, Territorial and local organizations for their review and comment. As no public concern was expressed, the NWB waived the requirement to hold a public hearing for the application.

Based upon the results of the detailed assessment, which was completed, including consideration of any potential accidents, malfunctions, or cumulative environmental effects that the overall project might have in the area, the Board delegated to the Chief Administrative Officer authority to approve the application pursuant to S. 13.7.5 of the *Agreemen*t.

III. ISSUES

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, 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 the annual Department of Indian Affairs and Northern Development (DIAND) site inspection and the compliance record of the Applicant. Specifically, the August 9, 2001 DIAND Inspection Report indicated that:

1. The Licensee has failed to produce Annual Reports from 1996-2001;
2. Water supply field pH , turbidity, and iron concentration exceeded the levels recommended in the *Guidelines for Canadian Drinking Water Quality*;
3. Sewage treatment system effluent concentrations of ammonia and phenol exceeded the levels recommended in the *Canadian Guidelines for the Protection of Freshwater Aquatic Life*;
4. Sewage treatment effluent contained noteworthy concentrations of faecal coliforms (1,470,000 CFU/100ml);
5. Solid waste disposal site effluent concentrations of iron and zinc exceeded the levels; and
6. The sewage treatment system effluent evidenced a significant toxicity, as determined by a MicroTox EC_{50} assessment.

Additionally, the NWB brings to the attention of the Licensee their failure to provide the Board with the as-built plans and drawings for the modifications to the Sewage Disposal Facilities, as required by Part D, Item 3 of Water License N7L4-1526. The Board requests that these as-built plans and drawings be forwarded by the Licensee within ninety (90) days following issuance of this license.

In review of the application, DIAND, has recommended a licence term of five (5) years. The NWB concurs that a term of five (5) years is appropriate, and will allow enough time for the Hamlet to establish a consistent compliance record with the terms and conditions of its licence. It will also ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under its licence to the satisfaction of the NWB.

The NWB has imposed the requirement to produce an Annual Report. These Reports are for the purpose of ensuring that the NWB has an accurate annual update of municipal activities during a calendar year. This information is maintained on the public registry and is available to any interested parties upon request. The Licensee's attention is drawn to the attached standard form for completing the Annual Report (see Attachment I).

The NWB has also imposed on the Licensee the requirement to produce an Operations and Maintenance Manual for their sewage and solid waste operations. The purpose of an Operation and Maintenance Manual is to assist Hamlet staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Hamlet is

capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996; see Attachment II).

Water Use

The Municipality currently receives water from Coppermine River. Water is treated using membrane filtration, which is accomplished in a twin train Harmsco filtration system, and stored in a 320 m^3 tank. The water receives a chlorine treatment prior to trucked-service distribution. Water consumption is projected to reach 53,475 m^3 *per annum* in 2003 and 60,533 m^3 *per annum* by 2008.

No serious concerns were raised by the parties in their written submissions as to the amount of water required by the Applicant or the manner in which this water will be used. Issues related to the quality of water produced by the present water treatment system were identified, but are currently being addressed by the Applicant and the Department of Community Government and Transportation, Government of Nunavut. DIAND has provided specific recommendations regarding volume usage limits, as well as recommending that the Applicant to be required to maintain a monitoring station at the water intake area KUG-1 in order to monitor the volume of water used. The Board concurs with these recommendations, and has set the terms and conditions in the water licence, which govern, water usage accordingly. The Board also recommends that the Hamlet and the Department of Community Government and Transportation take whatever steps are necessary to address the water quality issues identified in the August 9, 2001 DIAND Inspection Report.

Deposit of Waste

Sewage

The Hamlet of Kugluktuk utilizes a Sewage Disposal Facility approximately 5.0 km west of the Municipality. A gravel berm provides limited retention of sewage prior to discharge to an undefined wetland where it receives additional treatment prior to discharge to the marine environment. Specific comments relevant to sewage disposal operations in the Hamlet were provided by DIAND, and Environment Canada. Both DIAND and Environment Canada requested that the Applicant provide information to the NWB on how the Municipality plans to address the operational and environmental issues evidenced in the August 9, 2001 DIAND Inspection Report. Additionally, Environment Canada recommended that a minimum of 1 m of freeboard should be maintained at all retention structures, and that All Terrain Vehicle (ATV) traffic be restricted in the wetland area so as to prevent soil erosion and damage to vegetation from compromising the effectiveness of the wetland treatment of the sewage.

DIAND and Environment Canada also recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans. Additionally, DIAND provided recommendations concerning effluent discharge criteria, which are consistent with the *Guidelines for the Discharge of*

Treated Municipal Wastewater in the Northwest Territories (Northwest Territories Water Board; 1992), as well as specific recommendations concerning the Monitoring Program.

The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. The Monitoring Program is established to collect data on water quality to assess the effectiveness of treatment for protection of public health and to assess potential impacts to the environment associated with the municipal facilities. The Board also draws the attention of the Licensee to their requirements to implement the Quality Assurance/Quality Control (QA/QC) Plan to be provided by the NWB. The purpose of the QA/QC Plan is to ensure that samples taken in the field as part of the Monitoring Program will maintain a high quality, so as to accurately represent the physical and chemical nature of the samples being taken. It should also be noted that while minimum sampling requirements have been imposed, additional sampling may be requested by an Inspector.

Solid Waste

The Hamlet's solid waste management site is located approximately 4.5 km from the community. Waste is segregated, with a generic landfill area, a bulky wastes area, and a sealift container for hazardous wastes. Combustible wastes are burned regularly, and the landfill is compacted and covered on a yearly basis.

Recommendations relevant to solid waste disposal operations in the Hamlet were provided by DIAND and Environment Canada. Both DIAND and Environment Canada recommended that preventative measures be implemented to prevent standing water noted at the toe of the solid waste site from escaping the facility. Environment Canada also recommended that the Municipality undertake a waste composition study, which will assist the Municipality to plan for the long term waste disposal needs of the community. The Board concurs that the Hamlet should give serious consideration to this recommendation, and recommends that discussions be commenced with the Department of Community Government and Transportation to determine potential assistance which may be available to the Hamlet to undertake such a study.

DIAND and Environment Canada recommended that the Hamlet develop appropriate Operations and Maintenance and Spill Contingency Plans for their solid waste operations. DIAND and Environment Canada further recommended that the Hamlet segregate hazardous materials such as waste oils and batteries from municipal solid waste, and that these materials be disposed of off-site in an approved facility. DIAND and Environment Canada recommended the appropriate management of waste oil at the solid waste site, so as to prevent the deposition of hydrocarbons into water in contravention of the *Fisheries Act*. The Board concurs with these recommendations, which are reflected in the terms and conditions of the Water Licence. Additionally, both Environment Canada and DIAND recommended the installation of appropriate fencing at the bulky waste and hazardous waste disposal sites, so as to improve security on the sites. The Board concurs that the Hamlet should give serious consideration to this recommendation, and in the interim take whatever steps are practicable to implement this recommendation.

LICENCE NWB3KUG0308

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 KUGLUKTUK

(Licensee)

of **KUGLUKTUK, NUNAVUT, X0E 0E0**

(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 **NWB3KUG0308**

Water Management Area **NUNAVUT 05**

Location **KUGLUKTUK, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **64,000 CUBIC METRES ANNUALLY**

Date of Licence **NOVEMBER 20, 2003**

Expiry Date of Licence **NOVEMBER 30, 2008**

Dated this 20th of November 2003 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

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 Kugluktuk, Nunavut (67°50'N, 115°15'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: **NWB3KUG0308**

"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;

"Average Concentration" means the arithmetic mean of the last four consecutive analytical results for contained in composite or grab samples collected from the Waste Disposal Facility's final discharge point;

"Average Concentration For Faecal Coliforms" means the geometric mean of the last four consecutive analytical results for faecal coliforms contained in composite or grab samples collected from the Waste Disposal Facility's final discharge point;

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

"Chief Administrative Officer" means the Executive Director of the Nunavut Water Board;

"Commercial Waste Water" means water and associated waste generated by the operation of a commercial enterprise, but does not include toilet wastes or greywater;

"Composite Sample" means a water or wastewater sample made up of four (4) samples taken at regular periods over a 24 hour period;

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

"Final Discharge Point" means an identifiable discharge point of a Waste Disposal Facility beyond which the Licensee no longer exercises care and control over the quality of the Effluent;

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

"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;

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

"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 quality 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 decant structures designed to contain and treat sewage as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on July 1, 2003 and illustrated in Drawing Nos. 2003-0060-EN1/2;

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

"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 and Solid Waste Disposal Facilities, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Coppermine River, as described in the Application for Water Licence filed by the Applicant on July 1, 2003, and illustrated in Drawing Nos. 2003-0060-EN1/2.

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:

i. tabular summaries of all data generated under the "Monitoring Program";

ii. the monthly and annual quantities in cubic metres of fresh water obtained from all sources;

iii. the monthly and annual quantities in cubic metres of each and all waste discharged;

iv. 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;

v. a list of unauthorized discharges and summary of follow-up action taken;

vi. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

vii. a summary of any studies, reports and plans (e.g., Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;

viii. any other details on water use or waste disposal requested by the Board by November 1st of the year being reported; and

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.

4. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall, within ninety (90) days after the first visit of the Inspector, post the necessary signs, where possible, to identify the stations of the "Monitoring Program." All signage postings shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an 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.

8. Any communication with respect to this Licence shall be made in writing to the attention of:

(i) Chief Administrative Officer:

Executive Director
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369

(ii) Inspector Contact:

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4298
Fax: (867) 979-6445

(iii) Analyst Contact:

Taiga Laboratories
Department of Indian and Northern Affairs
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2781
Fax: (867) 669-2718

9. 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 Inuktitut.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from Coppermine River using the Water Supply Facilities or as otherwise approved by the Board.

2. The annual quantity of water used for all purposes shall not exceed 64,000 cubic metres.

3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.

4. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all Sewage to the Sewage Disposal Facilities or as otherwise approved by the Board.

2. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Station KUG-4 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1 x 10^6CFU/dl
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Oil and grease	No visible sheen
pH	between 6 and 9

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, shall be maintained at all dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

4. The Licensee shall advise an Inspector at least ten (10) days prior to initiating any decant of the sewage lagoon.

5. The Sewage Disposal Facility shall be maintained and operated, to the satisfaction of an Inspector in such a manner as to prevent structural failure.

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

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

8. The Licensee shall submit to the Board for review within six (6) months of the issuance of this license a report identifying each Final Discharge Point. The report shall at least include:

    a. Plans, specifications and a general description of each Final Discharge Point together with its specific geo-referenced location;

    b. A description of how each Final Discharge Point is designed and maintained.

9. If, during the term of this Licence, additional Final Discharge Points are identified, the Licensee shall submit the information as required by Part D, Item 8 for each new Final Discharge Point within 30 days after the discharge point is identified and at least 60 days prior to depositing Effluent from the new Final Discharge Point and/or proposed changes are made to a Final Discharge Point.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval design drawings stamped by a qualified engineer registered in Nunavut 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:

    i. the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;

    ii. said modifications do not place the Licensee in contravention of the Licence or the *Act*;

    iii. 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

    iv. the Board has not rejected the proposed modifications.

3. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met may be carried out only with written approval from the Board.

4. The Licensee shall provide as built plans/drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before March 31, 2004 submit to the Board for approval, a Plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996). This Plan shall specifically address the waste disposal and operational issues related to the Sewage Disposal Facility and the Solid Disposal Facility, which were identified in the August 9, 2001 DIAND Inspection Report.

2. The Licensee shall implement the Plan specified in Part F, Item 1 as and when approved by the Board.

3. The Licensee shall revise the Plan referred to in Part F, Item 1, if not acceptable to the Board. The revised Plan shall be submitted to the Board for approval within thirty (30) days of notification of the Board decision

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

    i. employ the appropriate contingency plan as provided for in the Operation Maintenance Plan;
    ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
    iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

5. In the absence of a contingency plan contained within an approved Operation and Maintenance Plan, and should during the period of this Licence an unauthorized discharge of waste occur, or if such a discharge is foreseeable, the Licensee shall:

    i. take whatever steps are immediately practicable to protect human life, health and the environment;
    ii. without delay seek guidance from the Departments of Community Government and Transportation and Sustainable Development with regards to mitigation and remedial actions required to address the discharge;

ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and
iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

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 and the construction of new facilities to replace existing ones. The Plan shall include, but not be limited to where applicable:

   i. water intake facilities;
   ii. the water treatment and waste disposal sites and facilities;
   iii. petroleum and chemical storage areas;
   iv. any site affected by waste spills;
   v. leachate prevention;
   vi. an implementation schedule;
   vii. maps delineating all disturbed areas, and site facilities;
   viii. consideration of altered drainage patterns;
   ix. type and source of cover materials;
   x. future area use;
   xi. hazardous wastes; and
   xii. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

2. The Licensee shall implement the plan specified in Part G, Item 1 as and when approved by the Board.

3. The Licensee shall revise the Plan referred to in Part G, Item 1 if not approved. The revised Plan shall be submitted to the Board for approval within thirty (30) days of receiving notification of the Board's decision.

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

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Monitoring Station	Description
KUG-1	Raw water supply at Coppermine River prior to treatment
KUG-2	Effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facilities
KUG-3	Raw Sewage at truck offload point
KUG-4	Effluent discharge from the Final Discharge Point of the Sewage Disposal Facilities

2. The Licensee shall sample monthly at Monitoring Station KUG-2 and KUG-4 during the months of May to August, inclusive. Samples shall be analyzed for the following parameters:

BOD	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Ammonia Nitrogen
Nitrate-Nitrite	Oil and Grease (visual)
Total Phenols	Sulphate
Sodium	Potassium
Magnesium	Calcium
Total Arsenic	Total Cadmium
Total Copper	Total Chromium
Total Iron	Total Lead
Total Mercury	Total Nickel
Total Zinc	

3. The Licensee shall measure and record in cubic metres the monthly and annual quantities of water pumped from Monitoring Station KUG-1 for all purposes.

4. The Licensee shall measure and record in cubic metres the monthly and annual quantities of raw sewage offloaded from trucks at Monitoring Station KUG-3 for all purposes.

5. Additional sampling and analysis may be requested by an Inspector.

6. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence.

7. 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.

8. All analyses shall be performed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Certified Laboratory, or as otherwise approved by an Analyst.

9. The Licensee shall measure and record the annual quantities of sewage solids removed from the Sewage Disposal Facility.

10. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Monitoring Program" in the Licensee's Annual Report, as required *per* Part B, Item 1.

11. Modifications to the Monitoring Program may be made only upon written approval of the Chief Administrative Officer.

Appendix B
Climate Data

Climate Normals for Kugluktuk

Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Temperature: Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-27.8	-27.4	-25.3	-17	-5.3	5.2	10.7	8.8	2.8	-7.2	-19.6	-25.5		C
Standard Deviation	3.8	4.2	3.2	3	3.2	2	2	1.9	1.5	2.5	4.3	3.4		C
Daily Maximum (°C)	-23.7	-23	-20.6	-12.1	-1.4	9.5	15.4	13.1	6	-4	-15.7	-21.4		C
Daily Minimum (°C)	-31.9	-31.7	-29.8	-21.8	-9.2	0.8	6	4.5	-0.4	-10.3	-23.4	-29.6		C
Extreme Maximum (°C)	0.8	-1.2	-0.1	14	19.8	31.1	34.9	29.2	22.6	13.4	2.8	27.4		
Date (yyyy/dd)	1981/16	1980/07	1999/22	2000/06	1994/24	1996/25	1989/15	2000/01	1994/01	1988/06	1983/03	1999/19		
Extreme Minimum (°C)	-46.9	-47.2	-47	-39.7	-30.2	-12.1	0.3	-4.4	-18.9	-35.4	-41	-44.5		
Date (yyyy/dd)	2002/21	1998/20	1979/05	1979/04	1983/03	2000/01	1978/04+	1995/29	2000/26	1996/29	1985/24	1977/12		
Precipitation: Precipitation:														
Rainfall (mm)	0	0	0	0.6	5.8	12.8	36.3	40.8	32.1	5.1	0	0	133.5	C
Snowfall (cm)	15.4	16.5	16	17.8	16.6	2.7	0	0.3	8.1	34.1	19.7	18.6	165.8	C
Precipitation (mm)	11	9.9	10.6	13.3	19.5	15.1	36.3	41.1	39	29.5	12.6	11.5	249.4	C
Average Snow Depth (cm)	35	43	47	48	28	3	0	0	0	9	20	28		C
Median Snow Depth (cm)	36	42	47	49	28	1	0	0	0	9	19	28		C
Snow Depth at Month-end (cm)	38	45	48	42	15	0	0	0	2	17	24	32		C
Extreme Daily Rainfall (mm)	0	0	0	7.4	20.6	27.4	30.5	53.7	28.8	19.3	3.4	0		
Date (yyyy/dd)	1978/01+	1978/06+	1978/01+	1980/27	1992/27	1987/13	1983/10	1982/12	1983/07	1980/08	2001/17	1977/01+		
Extreme Daily Snowfall (cm)	26.2	24.6	8.6	16	21	13	0.4	5	13.5	23	12.4	26		
Date (yyyy/dd)	1988/01	1981/21	2000/27	1980/30	1993/07	1991/05	1985/07	1986/23	1981/22	1981/29	1981/06	1994/25		
Extreme Daily Precipitation (mm)	25.8	9.1	6	16	21.8	27.4	30.5	53.7	28.8	23	12.4	14.8		
Date (yyyy/dd)	1988/01	1981/21	1990/07+	1980/30	1978/25	1987/13	1983/10	1982/12	1983/07	1981/29	1981/06	1994/25		
Extreme Snow Depth (cm)	80	92	104	107	128	64	3	0	23	43	49	73		
Date (yyyy/dd)	1993/30+	1993/22+	1991/31	1991/03+	1993/08	1993/01	1986/01+	1978/01+	1981/24	1995/29	1992/30	1994/26+		

Climate Normals for Kugluktuk

Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Days with Maximum Temperature: Days with Maximum Temperature:														
<= 0 °C	31	28.3	31	28.4	18.7	1.1	0	0	2.5	23.1	29.6	30.9		C
> 0 °C	0.05	0	0	1.6	12.3	28.9	31	31	27.5	7.9	0.45	0.08		C
> 10 °C	0	0	0	0.04	0.91	12	25.6	20.8	5.4	0.1	0	0.08		C
> 20 °C	0	0	0	0	0	2.5	6	3.9	0.22	0	0	0.08		C
> 30 °C	0	0	0	0	0	0.09	0.26	0	0	0	0	0		C
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0		C
Days with Minimum Temperature: Days with Minimum Temperature:														
> 0 °C	0	0	0	0	0.95	17.9	31	27.7	14	0.71	0	0		C
<= 2 °C	31	28.3	31	30	30.8	20.7	2.7	7.6	22.7	30.9	30	31		C
<= 0 °C	31	28.3	31	30	30.1	12.1	0	3.3	16	30.3	30	31		C
< -2 °C	31	28.3	31	29.8	27.1	5.1	0	0.59	8.6	27.7	30	31		C
< -10 °C	30.9	28.2	30.9	28	12.8	0.09	0	0	0.39	14.6	28.6	30.9		C
< -20 °C	28.7	26.7	28.5	18.4	2	0	0	0	0	3.1	20	27.9		C
< - 30 °C	20.1	18	16.5	4.7	0.05	0	0	0	0	0.29	6.6	16.2		C
Days with Rainfall: Days with Rainfall:														
>= 0.2 mm	0	0	0	0.35	2.1	6.4	10.2	12.5	10.4	1.9	0.05	0		C
>= 5 mm	0	0	0	0.04	0.27	0.65	2.6	2.4	1.9	0.27	0	0		C
>= 10 mm	0	0	0	0	0.18	0.13	0.78	0.73	0.65	0.09	0	0		C
>= 25 mm	0	0	0	0	0	0.04	0.04	0.23	0.04	0	0	0		C
Days With Snowfall: Days With Snowfall:														
>= 0.2 cm	9.4	9.8	10.7	9.4	6.5	1.6	0.09	0.27	3.9	13.9	11.7	10.1		C
>= 5 cm	0.52	0.65	0.35	0.87	0.86	0.17	0	0.05	0.52	2.1	0.91	0.63		C
>= 10 cm	0.13	0.04	0	0.17	0.27	0.04	0	0	0.09	0.55	0.18	0.25		C
>= 25 cm	0.04	0	0	0	0	0	0	0	0	0	0	0.04		C

Climate Normals for Kugluktuk

Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Days with Precipitation: Days with Precipitation:														
>= 0.2 mm	8.6	9.1	10	8.9	7.3	7.4	10.2	12.6	12.9	14.5	10.7	9.4		C
>= 5 mm	0.3	0.22	0.17	0.52	1	0.83	2.6	2.4	2.3	1.7	0.18	0.33		C
>= 10 mm	0.04	0	0	0.13	0.45	0.17	0.78	0.73	0.74	0.32	0.05	0.08		C
>= 25 mm	0.04	0	0	0	0	0.04	0.04	0.23	0.04	0	0			
Days with Snow Depth: Days with Snow Depth:														
>= 1 cm	31	28.3	31	30	29.5	9.8	0.7	0	2.4	25.5	29.9	31		C
>= 5 cm	31	28.3	31	29.9	26.1	6.4	0	0	0.7	17.8	29.1	31		C
>= 10	31	28.3	31	29.8	22.8	3.1	0	0	0.39	11.4	25.7	31		C
>= 20	22.9	24.6	26.6	25.7	16.8	1.4	0	0	0.13	4.8	12	20.5		C
Wind: Wind:														
Speed (km/h)	19	18.5	15.6	13.4	13.9	14	14.4	15.5	16.8	17.4	16.8	18.2		C
Most Frequent Direction	SW	SW	SW	SW	E	E	E	E	E	SW	SW	SW		C
Maximum Hourly Speed	93	76	83	72	74	61	67	74	74	80	83	93		
Date (yyyy/dd)	1988/01	1978/08+	1980/03	1984/16	1986/28	1995/26	1991/25	1986/22+	2002/24	1982/27	1994/19	1983/25		
Direction of Maximum Hourly Speed	NW	S	NW	E	NW	NW	N	NW	NW	NW	NW	NW		
Maximum Gust Speed	106	106	106	83	89	74	81	83	85	89	100	104		
Date (yyyy/dd)	1988/01	1978/06	1980/03	1984/16	1986/28	1992/11+	1988/23	1984/10+	1983/28	1982/27	1994/05	1983/26		
Direction of Maximum Gust	NW	SW	NW	E	NW	W	NW	NW	NW	NW	NW	NW		
Days with Winds >= 52 km/hr	1.8	2.7	1.7	0.9	0.6	0.1	0.2	0.8	1.2	1.3	0.9	2.2		C
Days with Winds >= 63 km/hr	0.5	0.8	0.4	0.2	0.3	0	0	0.2	0.4	0.5	0.2	0.7		C

Climate Normals for Kugluktuk

Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Degree Days: Degree Days:														
Above 24 °C	0	0	0	0	0	0	0	0	0	0	0	0		C
Above 18 °C	0	0	0	0	0	0.6	3.1	0.8	0	0	0	0		C
Above 15 °C	0	0	0	0	0	1.8	12.3	5.7	0	0	0	0		C
Above 10 °C	0	0	0	0	0.1	13.8	60.3	37.7	2.3	0	0	0		C
Above 5 °C	0	0	0	0	1.9	56.7	178.7	129.1	20.6	0.3	0	0		C
Above 0 °C	0	0	0	0.3	14	160.6	332.2	274.9	100.3	5.2	0	0		C
Below 0 °C	855.2	783.1	782.7	510.1	177.8	6	0	0	15.8	225.4	581.5	790.4		C
Below 5 °C	1010.2	924.5	937.7	659.7	320.7	52.2	1.5	9.2	86.1	375.5	731.5	945.4		C
Below 10 °C	1165.2	1065.8	1092.7	809.7	474	159.2	38.1	72.8	217.9	530.2	881.5	1100.4		C
Below 15 °C	1320.2	1207.2	1247.7	959.7	628.9	297.3	145.1	195.8	365.6	685.2	1031.5	1255.4		C
Below 18 °C	1413.2	1292	1340.7	1049.7	721.9	386	228.9	283.9	455.6	778.2	1121.5	1348.4		C
Bright Sunshine: Bright Sunshine:														
Total Hours		75.8	161.8	221.7	242.5	376.2	342.9	213.2	88.2	52.4	19.7			C
Days with measurable		18	25.8	25.8	25.9	28.6	29.4	27.4	21.1	15.9	9.1			C
% of possible daylight hours		34.8	44.8	47.2	38	52.3	48.7	39.5	22.1	18.1	12.8			C
Extreme Daily	5.2	8.4	12.9	17.2	22.9	24	24	19.1	14.1	10.5	6.4	1		C
Date (yyyy/dd)	1998/30	1980/27	1997/28	1994/28	1985/31	1981/09+	1982/05+	1987/01	2000/01	1988/02	2000/05	1981/01		
Humidex: Humidex:														
Extreme Humidex	0.3	-1.7	-0.3	7.9	19.8	30.3	36.8	36.8	22.7	12.3	2.2	-1.5		
Date (yyyy/dd)	1981/16	1980/07	1999/22	1995/28	1994/24	1996/25	1989/15	1992/02	1994/01	1988/06	1983/03	1999/24		
Days with Humidex >= 30			0	0	0	0	0.5	0.2	0	0	0	0		C
Days with Humidex >= 35			0	0	0	0	0.1	0	0	0	0	0		C
Days with Humidex >= 40			0	0	0	0	0	0	0	0	0	0		C

Climate Normals for Kugluktuk

Information provided by http://www.climate.weatheroffice.ec.gc.ca/Kuglugtuk Nunavut

Wind Chill: Wind Chill:														
Extreme Wind Chill	-64.3	-64.4	-65	-54.4	-39.7	-15.6	-6.2	-11.8	-22.9	-46.5	-54.1	-61.5		
Date (yyyy/dd)	1990/26	1985/21	1979/05	1979/04	1983/04	1978/09	1985/21	1995/29	1992/25	1996/27	1985/25	1984/09		
Days with Wind Chill < -20	30.7	28.1	30.4	25.5	7.8	0	0	0	0.2	10.5	27.1	30.7		C
Days with Wind Chill < -30	28.4	25.3	27.2	14.7	1.2	0	0	0	0	2.4	18.8	27.1		C
Days with Wind Chill < -40	22.3	18.9	17.2	4.6	0	0	0	0	0	0.2	8.1	18		C
Humidity: Humidity:														
Average Vapour Pressure (kPa)			0.1	0.2	0.4	0.7	1	0.9	0.6	0.4	0.1	0.1		C
Average Relative Humidity - 0600LST (%)			78.4	82.8	87.4	84.1	81.9	87.7	88.8	87	81.5	78		C
Average Relative Humidity - 1500LST (%)			78.4	83	84.1	71.2	64.2	68.4	75.9	84.9	81.1	78.3		C
Pressure: Pressure:														
Average Station Pressure (kPa)	101.6	101.7	101.8	101.8	101.7	101.2	101.1	101	101	101.2	101.4	101.5		C
Average Sea Level Pressure (kPa)	101.9	102	102.1	102.1	102	101.5	101.4	101.3	101.3	101.5	101.7	101.8		C
Visibility (hours with): Visibility (hours with):														
< 1 km	21.2	29.8	18.6	23.6	27.9	9	11.1	5.9	4.8	9.1	11.8			D
1 to 9 km	138.3	129.8	122.9	101.1	74.9	23.2	26	27.7	45	106	97.9			D
> 9 km	584.6	518.1	602.5	595.3	641.2	687.8	706.9	710.4	670.2	628.9	610.3			D
Cloud Amount (hours with): Cloud Amount (hours with):														
0 to 2 tenths	298.4	261.5	290	240.6	171	188.4	146.1	111.1	80.2	105.5	200.2			D
3 to 7 tenths	136	130.8	132.5	120.3	106.3	151.6	181	155.6	105.7	89.9	140.8			D
8 to 10 tenths	309.6	285.4	321.5	359.1	466.7	380.1	416.9	477.4	534.1	548.6	379.1			D

Appendix C
Projected Water Requirements and Sewage Generation Rates

Table 4
Sewage Generation Rate for the Hamlet of Kugluktuk, Nunavut

Planning Year	Calendar Year	Total Population[1]	Projected Sewage generation[2] (lpcd)	Projected Volume (litres/day)	Projected Volume (litres/year)	Projected Sludge Quantity (kg/annum)	Cumulative Sludge Volume[3] (m^3)	BOD (mg/l)	TSS (mg/l)	T-PO_4 (mg/l)	TKN (mg/l)	Faecal Coliforms (C.F.U./100ml)
0	2006	1585	136.5	216,281	78,942,629	28,926.3	964.2	329.8	351.8	16.9	87.9	6.96E+07
	2007	1618	137.2	222,012	81,034,472	29,528.5	1,948.5	328.0	349.8	16.8	87.5	6.92E+07
	2008	1653	138.0	228,145	83,273,074	30,167.3	2,954.1	326.0	347.8	16.7	86.9	6.88E+07
	2009	1686	138.8	233,980	85,402,593	30,769.5	3,979.7	324.3	345.9	16.6	86.5	6.85E+07
	2010	1720	139.6	240,043	87,615,768	31,390.0	5,026.1	322.4	343.9	16.5	86.0	6.81E+07
5	2011	1760	140.5	247,245	90,244,352	32,120.0	6,096.7	320.3	341.7	16.4	85.4	6.76E+07
	2012	1793	141.2	253,242	92,433,157	32,722.3	7,187.5	318.6	339.8	16.3	85.0	6.73E+07
	2013	1827	142.0	259,472	94,707,414	33,342.8	8,298.9	316.9	338.0	16.2	84.5	6.69E+07
	2014	1859	142.8	265,385	96,865,621	33,926.8	9,429.8	315.2	336.2	16.1	84.1	6.65E+07
	2015	1893	143.5	271,719	99,177,554	34,547.3	10,581.4	313.5	334.4	16.0	83.6	6.62E+07
10	2016	1928	144.3	278,295	101,577,760	35,186.0	11,754.2	311.8	332.5	15.9	83.1	6.58E+07
	2017	1965	145.2	285,308	104,137,484	35,861.3	12,949.6	309.9	330.6	15.8	82.6	6.54E+07
	2018	2000	146.0	292,000	106,580,000	36,500.0	14,166.3	308.2	328.8	15.8	82.2	6.51E+07
	2019	2041	146.9	299,911	109,467,392	37,248.3	15,407.9	306.2	326.7	15.7	81.7	6.47E+07
	2020	2076	147.7	306,725	111,954,570	37,887.0	16,670.8	304.6	324.9	15.6	81.2	6.43E+07
15	2021	2107	148.5	312,835	114,184,737	38,455.3	17,952.6	303.1	323.3	15.5	80.8	6.40E+07
	2022	2139	149.2	319,082	116,465,007	39,032.1	19,253.7	301.6	321.7	15.4	80.4	6.37E+07
	2023	2171	149.9	325,470	118,796,633	39,617.6	20,574.3	300.1	320.2	15.3	80.0	6.34E+07
	2024	2203	150.7	332,002	121,180,905	40,211.9	21,914.7	298.7	318.6	15.3	79.6	6.30E+07
	2025	2236	151.4	338,683	123,619,146	40,815.1	23,275.2	297.2	317.0	15.2	79.2	6.27E+07
20	2026	2270	152.2	345,514	126,112,716	41,427.3	24,656.1	295.6	315.4	15.1	78.8	6.24E+07
	2027	2304	153.0	352,501	128,663,012	42,048.7	26,057.7	294.1	313.7	15.0	78.4	6.21E+07
	2028	2339	153.8	359,648	131,271,469	42,679.4	27,480.3	292.6	312.1	15.0	78.0	6.18E+07
	2029	2374	154.6	366,958	133,939,561	43,319.6	28,924.3	291.1	310.5	14.9	77.6	6.15E+07
	2030	2409	155.4	374,435	136,668,802	43,969.4	30,390.0	289.6	308.9	14.8	77.2	6.11E+07
25	2031	2445	156.2	382,084	139,460,748	44,629.0	31,877.6	288.0	307.2	14.7	76.8	6.08E+07

Reference: Nunavut Bureau of Statistics, 2000. "Nunavut: Community Population Projections 2000 - 2020".

Note: 1) The Nunavut document referenced above was utilized up to 2020. A population growth of 1.5% was applied to the subsequent years (2021 - 2031).

2) The projected sewage generation is based on the Nunavut water usage formula [100 L/c/d x (1 + 0.00023 x population)].

3) A value of 3% dry solids is assumed for the liquid sludge accumulating at the bottom of the lagoon.

Appendix D
Site Forms

Form 1
Monthly Sewage Delivery Log
Hamlet of Kugluktuk

Month: _____ **Truck #: _____**

Date	Number of Trips	Volume per Trip	Total Daily Volume (liters)	Comments and Concerns
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				

Date	Number of Trips	Volume per Trip	Total Daily Volume (liters)	Comments and Concerns
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Monthly Totals				

Form 2
Monthly Sewage Treatment Facility Inspection Form
Hamlet of Kugluktuk

Inspected By:_____ Date:_____

Wind Direction:_____ Temperature:_____

Precipitation:_____ Ground Cover:_____

Issues and Conditions	Description/Condition/Problems	Action/Maintenance Required
Health and Safety (dangers and concerns)		
Wildlife		
Access Road (condition, ditches, snow, surface, etc.)		
Signs		
Inlet Flume		
Berms and Fences		
Sewage Level		

Issues and Conditions	Description/Condition/Problems	Action/Maintenance Required
Sludge Thickness		
Gate Value at Discharge Manhole		
Odours/Appearance		
Wetland Treatment Area		
Equipment (septic truck, pump, etc.)		
Complaints		
Site Planning (discharge schedule)		
Other Issues and Concerns		

Form 3
Effluent Discharge Log
Hamlet of Kugluktuk

Month: _____ **Truck #: _____**

Date	Time Value Opened	Time Value Closed	Discharge Period (days)	Approximate Flow Rate m^3/day	Approximate Volume Discharged m^3	Start Lagoon Depth (cm)	End Lagoon Depth (cm)	Change in Depth (cm)	Approximate Volume Change (m^3)	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										

Date	Time Value Opened	Time Value Closed	Discharge Period (days)	Approximate Flow Rate m^3/day	Approximate Volume Discharged m^3	Start Lagoon Depth (cm)	End Lagoon Depth (cm)	Change in Depth (cm)	Approximate Volume Change (m^3)	Comments
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Monthly Totals										

Form 4
Sewage Treatment Facility Planning
Hamlet of Kugluktuk

Prepared By: _____

Date: _____

Sewage Treatment Planning Issue	Current Operations	To Do Items and Schedule
Health and Safety		
Site Inspection Results/Concerns		
Current Volume		
Wetland Treatment Area		
Environmental Monitoring		
Annual Reporting		

Sewage Treatment Planning Issue	Current Operations	To Do Items and Schedule
Nunavut Water Board License Requirements		
Staffing		
Equipment		
Costs		
Other Issues/Concerns		

Appendix E
Annual Monitoring Report Format

NWB Annual Report **Year being reported:** Select

License No: **Issued Date:**
Expiry Date:

Project Name:

Licensee:

Mailing Address:

Name of Company filing Annual Report (if different from Name of Licensee please clarify relationship between the two entities, if applicable):

General Background Information on the Project (*optional):

Licence Requirements: the licensee must provide the following information in accodance with

Select Select

A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; drill waste management; solid and hazardous waste management.

Water Source(s):
Water Quantity:
- Quantity Allowable Domestic (cu.m)
- Actual Quantity Used Domestic (cu.m)
- Quantity Allowable Drilling (cu.m)
- Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal
- ☐ Solid Waste Disposal
- ☐ Sewage
- ☐ Drill Waste
- ☐ Greywater
- ☐ Hazardous
- ☐ Other:

Additional Details:

A list of unauthorized discharges and a summary of follow-up actions taken.

Spill No.: (as reported to the Spill Hot-line)
Date of Spill:
Date of Notification to an Inspector:
Additional Details: (impacts to water, mitigation measures, short/long term monitoring, etc)

Revisions to the Spill Contingency Plan

Select

Additional Details:

Revisions to the Abandonment and Restoration Plan

Select

Additional Details:

Progressive Reclamation Work Undertaken

Additional Details (i.e., work completed and future works proposed)

Results of the Monitoring Program including:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where sources of water are utilized;

Select

Additional Details:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where wastes associated with the licence are deposited;

Select

Additional Details:

Results of any additional sampling and/or analysis that was requested by an Inspector

Select

Additional Details: (date of request, analysis of results, data attached, etc)

Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported.

Select

Additional Details: (Attached or provided below)

Any responses or follow-up actions on inspection/compliance reports

Select

Additional Details: (Dates of Report, Follow-up by the Licensee)

Any additional comments or information for the Board to consider

Date Submitted:		
Submitted/Prepared by:		
Contact Information:	**Tel:**	
	Fax:	
	email:	