

**Environmental Monitoring Program
and Quality Assurance /
Quality Control Plan**

Hamlet of Arviat

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Prepared for:

Hamlet of Arviat

December 2010

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Executive Summary

The Hamlet of Arviat provides water supply, sewage treatment and disposal, and solid waste disposal services for the community.

An Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan dated May 2009 was prepared by Nuna Burnside Engineering and Environmental Ltd (Nuna Burnside), as required by the Nunavut Water Board (NWB) License Number NWB3ARV0308 which expired December 31, 2008. The Plan was updated and revised in May 2010.

A new licence (NWB 3AM-ARV1015) was issued by the NWB on August 23, 2010 and expires August 30, 2015.

This Plan is an update to the previous plan and includes the requirements outlined in the new water licence.

The plan should be reviewed annually and updated if required.

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1.0 Introduction

This Environmental Monitoring Program and Quality Assurance/Quality Control Plan for the Hamlet of Arviat, was prepared as a requirement of Nunavut Water Board License NWB 3AM-ARV1015, issued August 23, 2010 and expires August 31, 2015.

1.1 Hamlet of Arviat

The Hamlet of Arviat is located within the Kivalliq Region, Nunavut, at general latitude 61°6'N and general longitude 94°3'W (Figure 1). The Community is located approximately 225 km south of Rankin Inlet and 265 km north of Churchill Manitoba.

The topography surrounding the Hamlet of Arviat is relatively flat with a slight rise when moving inland away from Hudson Bay. Local bedrock is generally overlain by glacial fluvial sediments. Arviat is located in the physiographic region of the Hudson Bay lowlands, characterized by low topographic relief, occasional bedrock outcrops and glacial and glacio-fluvial overburden sediments. Boulder fields and eskers are common. Approximately 20 to 30 percent of the land is shallow ponds with depths of 1 m or less. Land between the ponds is marshy tundra vegetated by grasses and sedges.

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. The water, wastewater, and solid waste systems include the following facilities and services:

- A Water Supply Facility consisting of a water intake pumphouse on Wolf River, two water reservoirs, treatment system and truckfill station
- A Sewage Disposal Facility consisting of a sewage lagoon which receives trucked sewage collected from holding tanks in each building and sewage treatment via an exfiltration lagoon to a wetland discharging to the ocean
- A Solid Waste Management Facility, which includes a municipal solid waste landfill, a bulky metals storage area and hazardous waste storage area.

The locations of these activities are shown in Figure 2.

1.2 Purpose of Plan

The water and waste disposal facilities in the Hamlet of Arviat are operated under Nunavut Water Board (NWB) License NWB 3AM-ARV1015 issued on August 23, 2010 and expires August 31, 2015 (Appendix A). The license requires the Hamlet to conduct a monitoring program, which includes regular water quality sampling and reporting. As

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required by the license, this Quality Assurance/Quality Control Plan (QA/QC Plan) has been prepared to achieve the following objectives:

- To ensure that all samples taken in the field follow established procedures in order to maintain a high quality, so that the results obtained represent both the physical and chemical nature of the samples being taken
- To ensure best management practices (BMP) are used throughout the sampling program
- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and protocols to be followed when conducting environmental sampling under the monitoring program.

Although the QA/QC Plan is submitted to the Nunavut Water Board (NWB) as a condition of the water license, it is primarily intended to be read, understood, and implemented by Hamlet personnel responsible for environmental quality monitoring. The water license requires Hamlet personnel to adhere to these procedures, which should be applied to all water quality samples taken by the Hamlet. Contact information for the Hamlet is provided in Appendix B.

The plan should be reviewed annually and updated if required, due to changes in license requirement, site conditions, or other changes.

2.0 Environmental Monitoring Program

An environmental monitoring program has been established to ensure that the operations of the Hamlet are not impacting the environment and to comply with the Nunavut Water Board licence.

Part H of the NWB licence provides specific requirements for the monitoring program. The licence provides specific monitoring program stations where data for the monitoring program is to be collected (Appendix A). Based on studies completed in 2010, the monitoring program outlined in the licence has been re-evaluated and changes proposed. The proposed monitoring station locations are provided in Table 1.

Table 1 Monitoring Program Stations for Water License

| Station | Description | Frequency | Analysis Requirements |
|---------|---|--|--|
| ARV-1 | Raw water supply at the Wolf River Water Supply prior to treatment | Monthly and annual | Measure and record in cubic metres of water pumped from the river to the reservoirs |
| ARV-2 | Sampling of effluent at discharge collection pond of Solid Waste Disposal Facility This represents raw leachate prior to discharge into the contaminant attenuation zone (CAZ) | Monthly from May to August, Inclusive | <p style="text-align: center;">Water Quality Analysis</p> <ul style="list-style-type: none"> • BOD • Faecal Coliforms • pH • Conductivity • Total Suspended Solids • Ammonia Nitrogen • Nitrate-Nitrite • Total Phenols • Sulphate • Oil and Grease (visual) • Sodium • Potassium • Magnesium • Calcium • Total Arsenic • Total Cadmium • Total Copper • Total Chromium • Total Iron • Total Lead • Total Mercury • Total Nickel • Total Zinc |
| ARV-3 | Sampling of effluent discharge from the Final Discharge Point of the Solid Waste Disposal Facility This represents the final discharge from the CAZ | Water Quality: Monthly from May to August and prior to discharge of accumulated impacted water Acute toxicity: Annually | Water Quality: same as ARV-2 Acute toxicity: Acute toxicity tests for Rainbow Trout and Daphnia magna |

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| Station | Description | Frequency | Analysis Requirements |
|---------|--|---|---|
| ARV-4 | <p>Sampling of Effluent Discharge from Sewage Lagoon of the Sewage Disposal Facilities</p> <p>This represents the raw sewage discharge passing through the exfiltration portion of the berm prior to entering the wetland treatment area</p> | Monthly from May to August, Inclusive | <ul style="list-style-type: none"> • Same water quality parameters as ARV-2 • Organic Nitrogen • TKN |
| ARV-5 | <p>Sampling of Effluent Discharge within Wetland Treatment Area of the Sewage Disposal Facilities</p> <p>This represents an approximate mid-way sampling point to monitor the degree of attenuation being achieved within the wetland treatment area</p> | Monthly from May to August, Inclusive | Same water quality parameters as ARV-4 |
| ARV-6 | <p>Sampling of Effluent Discharge from Final Discharge Point of Wetland Treatment Area of the Sewage Disposal Facilities</p> <p>This represents the final discharge from the wetland treatment area</p> | <p>Water Quality: Monthly from May to August, Inclusive</p> <p>Acute toxicity: Annually</p> | <p>Water Quality: same as ARV-4</p> <p>Acute toxicity: Acute toxicity tests for Rainbow Trout and Daphnia magna</p> |
| ARV-7 | Water level in Wolf River | Monthly during periods of open water | Water level measurements |
| ARV-8 | Water level in Sewage Disposal Facility lagoon | Monthly during thawed conditions | Water level measurements |
| ARV-9 | Sewage Sludge removed from the Sewage Disposal Facility | Monthly | Record monthly and annual volumes of sludge (m ³) removed |

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| Station | Description | Frequency | Analysis Requirements |
|---------|---|---|---|
| ARV-10 | Sampling of discharge from the Bulky Metal Waste Area | Monthly during periods of observed flow | <ul style="list-style-type: none"> • CCME F1 to F4 • BTEX • Total Arsenic • Total Cadmium • Total Copper • Total Chromium • Total Iron • Total Lead • Total Mercury • Total Nickel • Total Zinc • Total Phenols |
| ARV-11 | Sampling of Discharge from the Hazardous Waste Storage Area | Monthly during periods of observed flow | Same water quality parameters as ARV-10 |

The monitoring station locations are shown in Figures 3 to 7. Upon approval from the NWB of the proposed changes, the monitoring stations will be incorporated into the Operation and Maintenance Plans for the facilities included in the Hamlet licence.

The monitoring program stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector. Signs may not be required when the sampling point varies from year to year. Each monitoring location must have its Global Positioning System (GPS) coordinates determined. This task should be completed after approval by the NWB and prior to the first sampling to be completed under this Plan.

Samples shall be taken at the same location during each sampling event. If flow volumes are not sufficient to collect a sample at sampling locations ARV-3, ARV-5 and ARV-6, sampling may be collected upstream of the locations where adequate flow volumes exist. The photographs in Appendix H show sampling locations and measuring points.

A new Solid Waste Disposal Facility with a Hydrocarbon Impacted Soil Storage and Treatment Facility (landfarm) is planned to be constructed within the timeline of this licence. Prior to commissioning of these facilities additional monitoring stations will need to be established and approved by the NWB. This plan will need to be updated to include those sampling locations.

Additional sampling and analysis may be requested by an INAC Inspector or the NWB.

3.0 Sampling Procedures and Protocols

To ensure quality of the monitoring program the following procedures and protocols shall be used for field sampling. These methods are consistent with the *Standard Methods for the Examination of Water and Wastewater* (Eaton et al., 2005) and have been approved by the Nunavut Water Board.

3.1 Sampling Location and Frequency

The monitoring program included in the water license includes specific requirements regarding sampling locations, sampling frequency and parameters to be analyzed. These are provided in Table 1. Monitoring locations are shown in Figures 3 to 7.

3.2 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers specific for the sampling program. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The sample containers for specific analysis are provided in Appendix C. The laboratory shall be contacted at least one month prior to the sampling event in order to ensure that containers are available for sampling. Laboratory contact information is provided in Appendix D.

3.3 Field Sampling Log

The individual collecting the samples shall record the following at each location at the time of sampling:

- Date of sampling
- Time of sampling
- Weather conditions
- Monitoring Station Number (i.e. ARV-1, ARV-2, etc.)
- Results of any field measurements (temperatures, pH, conductivity, etc.)
- Sampler shall also indicate if sample used preservatives
- Any unusual conditions
- Any deviation from standard procedures.

3.4 Field Measurements

No field measurements are required as part of the Hamlet sampling program, however, it is strongly recommended that the following readings be collected on site during the sampling, using appropriate portable field equipment:

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- pH
- Temperature
- Conductivity.

All instruments, glassware, etc. should be cleaned between each sample following manufacturer's recommended guidelines and/or BMPs.

3.5 General Procedures for Sample Collection

General procedures for sample collection are outlined below. Different laboratories have slightly different bottle requirements and sample handling protocols. Sampling technicians must receive site specific training and laboratory procedures must take precedence over other protocols.

- **Sample Locations and Sampling Frequency** – The location and frequency of each sampling option has been carefully selected, and is part of site design and layout, as well as the Water Board License. Sampling will follow their requirements. Diversions must be recorded and submitted to the Water Board for approval
- **Preparation** – Approximately one month prior to the sampling event the laboratory will be notified and the required bottles, blanks, and materials assembled. Plans for rapid return of the samples prepared
- **Field Collection** – At each sampling station the specified samples will be collected and field data recorded
- **Handling Storage and Transportation** – Approximate personal protective equipment (gloves, safety glasses, etc.) will be used when handling samples. Samples will be stored a 4°C and protected from freezing until delivered to the laboratory. Chain of custody for sampling, storage, and delivery must be maintained. Laboratory sample sheets will be filled in as per laboratory protocols
- **Delivery to Laboratory** – Samples will be delivered to the laboratory in the laboratory dictated method and within the hold times specified. Preplanning for rapid transport and delivery will usually be required.

3.6 Surface Water Sampling Procedures

All of the samples taken will be grab samples. Samples will normally be taken from natural lakes, streams, treatment ponds, or process streams. Where possible, samples shall be taken from just below the surface to avoid floating debris, which may contaminate the sample.

3.6.1 Freshwater Streams, Surface Drainage, and Wetlands

The samples shall be collected as close to the middle of the stream where water flows freely and is free of debris. Samples shall be collected upstream of the sampler. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially filled with the water to be sampled and rinsed with the lid in place. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed. Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.

If possible, bottles shall be plunged into the stream to a depth of approximately half the total stream depth, and allow it to fill with the mouth of the bottle facing upstream. Where stream is too shallow to allow for sample bottle to be filled completely, without disturbing bottom sediment of the streambed, the sampler may use a smaller container that has been properly rinsed to transfer sample to the larger bottle. Do not use a smaller sample bottle containing preservatives.

When taking the sample, sufficient room shall be left to allow for the addition of preservatives, if required.

3.6.2 Lakes or Ponds

Surface sampling shall be collected using the same procedures as streams. Sample bottles shall be plunged to approximately 150 mm (6 inches) below the water surface.

3.7 Sample Identification

All samples collected are to be labelled according to standard identification procedures (Name of sampler, time and date of sampling, sample identifier, sampling method and type of sample). Sample labels shall be water-resistant, and prepared prior to going into the field.

The individual samples will be labelled with the following information:

- Sample ID #
- Monitoring Station Name (e.g. ARV-1)
- Date and time of collection
- Parameter to be analyzed
- Preservatives
- Project number identifier
- Bottle number 1 of ____.

3.8 Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the Laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the Laboratory. If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical problems with transport aircraft, all samples must be stored in a refrigerator at 4°C. Samples must not be frozen.

In all cases where samples cannot be delivered to the lab on the same day, specific preservatives must be added to the samples to prevent chemical changes that may alter the concentration of the parameters of interest. The samples must be preserved within two hours of sampling. Usually, samples can be preserved away from the field at the end of the site visit. In most cases, the laboratory can fill the bottles with preservative, and then ship them to the Hamlet to be filled and sent back for analysis. Analysis specific preservation and holding times are provided in Appendix C.

3.9 Sample Transportation

The main objective of the sampler is to minimize any chemical changes to the sample between the time it is collected and delivery to the laboratory. Heat, light and agitation can all impact the water chemistry and the samples shall be protected from these effects.

Effluent and surface water samples shall be stored and transported at a temperature of 4°C. Coolers and ice packs need to be available and are usually provided by the laboratory. Upon arrival at the laboratory, samples shall be refrigerated as soon as possible.

3.10 Water Volume and Water Level Measurements

The NWB license includes measuring the monthly and annual volume of water pumped from Wolf Creek (ARV-1). This can be accomplished in several ways such as:

- Accurate recording of pump on and off times in a log, and periodic measurements of a timed discharge into a known volume (45 gal drum)
- Accurate measurements of the volume of water in the reservoir and calculations of how much volume each cm of water level raise represents at various depths. As the level rises the volume pumped can be calculated.

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The NWB license includes (ARV-7) monitoring the water level in Wolf River monthly during periods of open water. This can be accomplished by using a rod and level to measure the water level from the established datum on the front of the pumphouse skid.

The water level in the sewage lagoon (ARV-8) can be measured with a rod and level from the datum established on the truck stop plate at the discharge point. The photos in Appendix H show the locations of the sampling points and measuring points.

Measuring a water level from an established datum (fixed point of known elevation) can be easily accomplished using a rod and level as follows:

- Set up the level at a position where it can easily sight on the datum and the water to be measured
- Place the stadia rod on the datum and record the reading
- Place the stadia rod on the surface of the water and record the reading
- The datum elevation plus the datum stadia rod reading minus water level stadia rod reading will give you the elevations of the water level.

The datum bench mark elevations (metres above sea level) are as follows:

- Sewage lagoon, ARV-8 at the top of the north edge of the steel truck stop – 14.18 masl
- Wolf Creek, ARV-7 at the top of the southeast side skid of the pumphouse – 8.53 masl.

4.0 Quality Assurance and Quality Control

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Arviat.

4.1 Quality Assurance

Quality Assurance (QA) is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality (Wilson, 1995). As such the accuracy of the analytical results can be stated with a high level of confidence. A high level of quality assurance can be achieved by applying the following principles:

- Personnel involved in water sampling and analysis are well trained
- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean
- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized best management practices (BMP)
- Laboratory and field instruments are calibrated according to manufacturers recommendations or recognized as good operating practice
- Supplies used in sampling and analysis are of consistent high quality and are not expired.

4.2 Quality Control

Quality Control (QC) is a set of specific procedures used to measure the quality of the data produced and correct deficiencies in the sampling or analyses, as they occur. Quality control is used by the analyst and sampler to achieve standards of measurement for the three principles components of quality: precision, accuracy and reliability.

Most commercial laboratories undertake QA/QC procedures with the volume of sample sent for analysis. Reports are usually provided with the Certificates of Analysis. It is recommended that the suggested QA/QC protocols by the laboratory be followed.

To ensure that the monitoring program maintains accepted quality control, field blanks and duplicate samples should be collected. These samples are collected and analyzed for the sample parameters listed in the monitoring program in the license as part of a quality control check on monitoring activities.

4.2.1 Field Blanks

Field Blanks are samples that the lab uses to identify any environmental impacts caused during sample collection or sample transportation. Field Blanks shall accompany the sampler into the field, labelled as field blanks, preserved in the field and submitted to the laboratory with the field samples.

4.2.2 Replicate or Duplicate Samples

Replicate or duplicate samples involves collecting more than one sample for a given sampling station subject to specific analysis. Standard procedures used for the routine sampling shall be applied. The replicate or duplicate samples are useful in identifying problems with accuracy and sampling methods.

Once per operating season for each active monitoring station a set of duplicate samples will be taken, representing as many of the routine analysis as possible. Where possible this shall be carried out in conjunction with sampling completed by INAC.

4.3 Lab Accreditation

The water licence requires that all analyses be performed by a laboratory that is accredited according to ISO/IEC Standard 17025. All laboratories that are accredited by the Canadian Association for Laboratory Accreditation Inc. (CALAI) meet this standard. A list of CALAI laboratories is included in Appendix D. As required by the water licence, a letter from an accredited laboratory is attached accepting the quality assurance and quality control plan for the Hamlet of Arviat as outlined in this report (Appendix E).

Ideally, the same laboratory will be used for sample analysis each sampling event, to ensure consistency in methodology and reporting. Although all accredited laboratory should be able to provide the same result for a particular sample, some variation is expected, which is why consistent laboratory services are recommended.

Analytical methods and accreditation are usually dictated by the guideline criteria being followed. In most cases, the guideline criteria are the Canadian Environmental Quality Guidelines (CCME, 2007). These guidelines specify bottles, hold times, preservatives, sampling protocols, as well as lab accreditation, and analytical methodologies. These guidelines or equivalent standard will be used. Prior to any sampling, this information should be reviewed to ensure consistency with regulation and standards.

5.0 Laboratory Analysis and Reporting

The laboratory will perform the analysis of all samples as outlined herein. The results shall be received by the Hamlet within the time frame agreed to with the laboratory. The results shall contain the limits of detection used for analysis of each parameter as supplied by the laboratory. The Hamlet may request clarification of the analysis by contacting the NWB Technical Advisor and a review of the analysis will be provided upon request.

The laboratory results are compared to the limits of the Water Licence for each parameter, and/or to other comparative criteria such as the Canadian Environment Water Quality Guidelines. A copy of these guidelines is included in Appendix F.

Results of the monitoring program are reported in the Annual Report as required in the water license. The Annual Report must be submitted by March 31 of the year following the calendar year for which the report has been submitted. A copy of the NWB Annual Report Form is included in Appendix G.

The content of the Annual Report and Guideline Criteria is outlined in the following documents:

- Solid Waste Management Facility Operations and Maintenance Plan
- Sewage Treatment Facility Operations and Maintenance Plan
- Water Supply Facility Operations and Maintenance Plan.

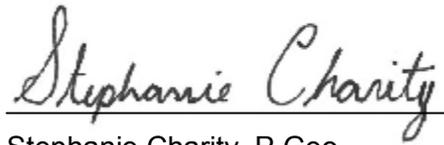
These reports will need to be updated upon NWB approval of this plan.

6.0 Summary

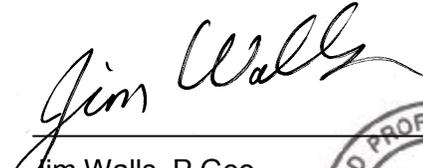
This Environmental Monitoring Program and QA/QC Plan has been prepared specifically for the Water Supply Facility, Sewage Disposal Facility, and Solid Waste Management Facility in the Hamlet of Arviat. These facilities are included in the Nunavut Water Board licence 3AM-ARV1015.

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

Respectfully Submitted:


Stephanie Charity, P.Geol.

December 24, 2010
Date


Jim Walls, P.Geol.



December 24, 2010
Date

7.0 References

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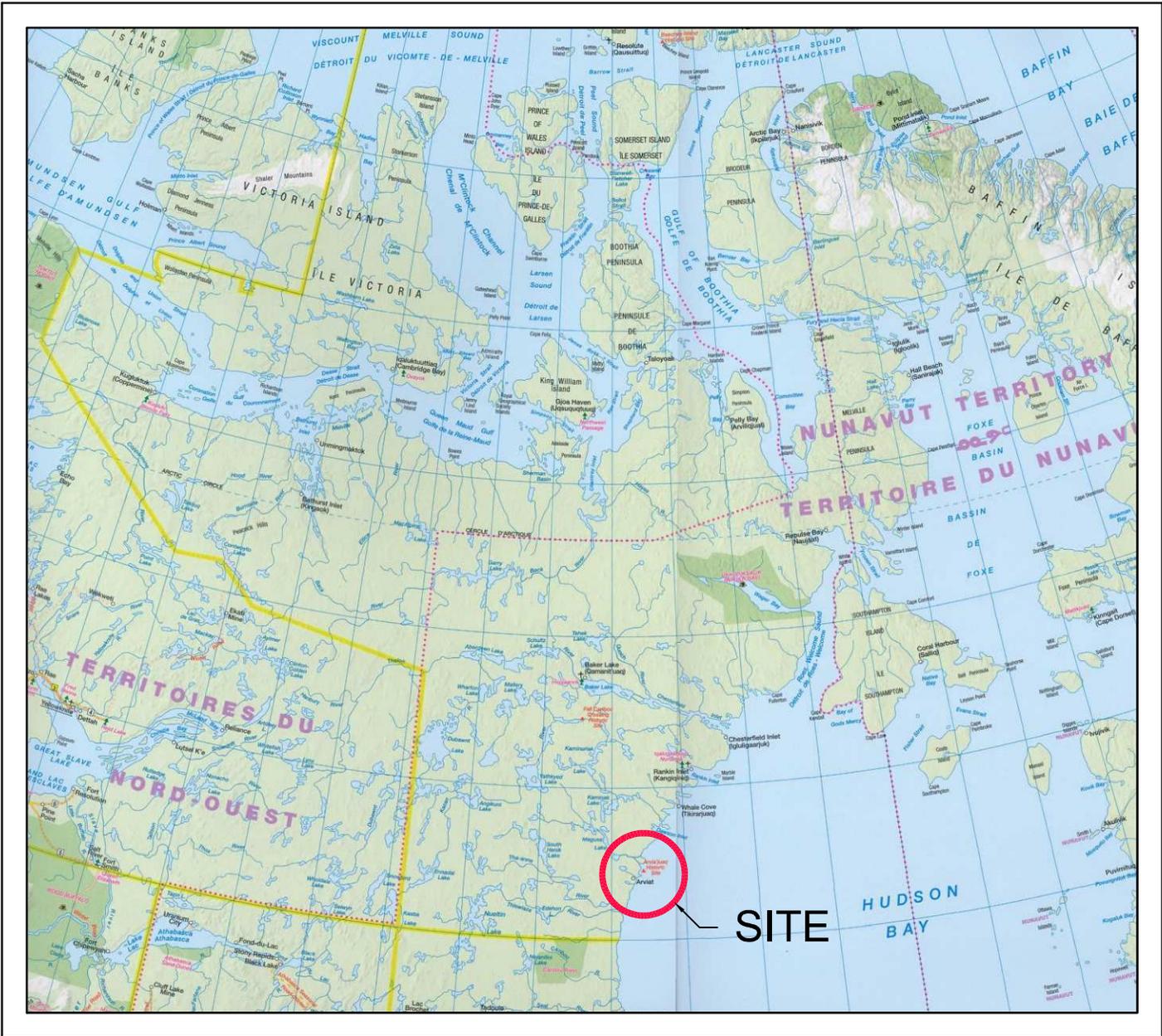
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Figures



Map Reference:
Map Art Publishing

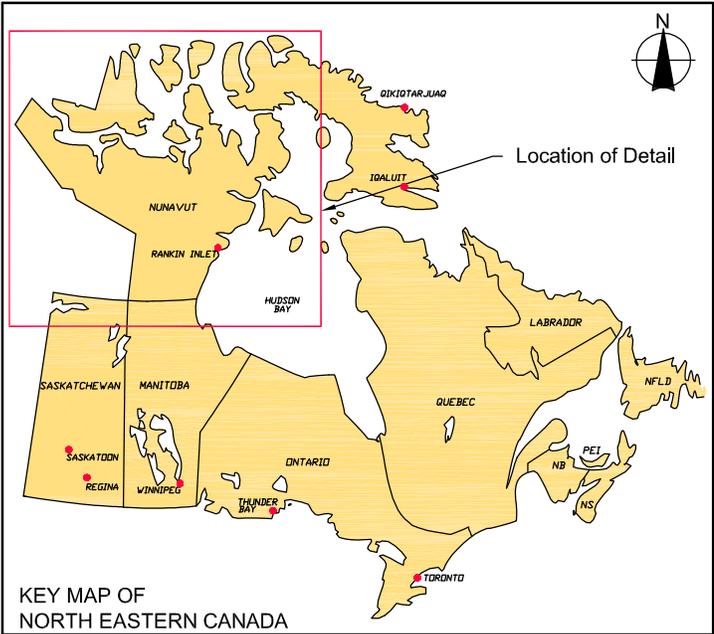


FIGURE 1 - SITE LOCATION MAP
HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT

ENVIRONMENTAL
MONITORING PROGRAM
AND QA/QC PLAN

December, 2010
 Project Number: N-O15746
 Prepared by: C. Dickie
 Verified by: S. Charity

N-O15746 EMP QAQC PLAN 2010 SL.dwg

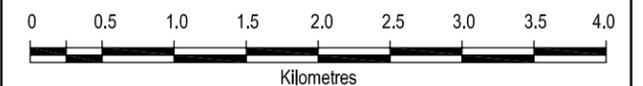
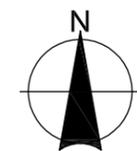
FIGURE 2
HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
MONITORING PROGRAM AND QA/QC PLAN

COMMUNITY PLAN



Satellite Image Source:
 Background colour satellite image obtained from Google Earth Pro.

Map Source:
 Background physical features obtained from the National Topographic Database Website.



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 December, 2010
 Project Number: N-015746

Projection: UTM Zone 15
 Datum: NAD83

Prepared by: C. Dickie

Verified by: S. Charity





FIGURE 3

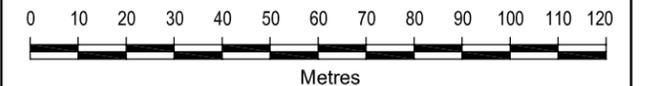
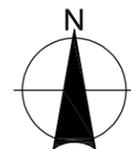
**HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
MONITORING PROGRAM AND QA/QC PLAN**

**WATER SUPPLY FACILITY
MONITORING LOCATIONS**

LEGEND

- MONITORING STATION LOCATION
- ▶ WATER FLOW DIRECTION

Satellite Image Source:
Background colour satellite image obtained from Google Earth Pro. © Google Earth
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December, 2010
Project Number: N-015746
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Projection: UTM Zone 15
Datum: NAD83
Verified by: S. Charity





FIGURE 4

**HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
MONITORING PROGRAM AND QA/QC PLAN**

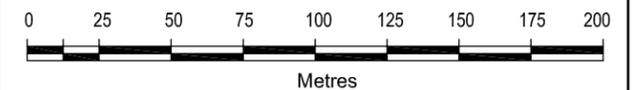
**SEWAGE DISPOSAL FACILITY
MONITORING LOCATIONS**

LEGEND

- MONITORING STATION LOCATIONS
- - - WETLAND TREATMENT AREA
- ➔ FLOW DIRECTION

Satellite Image Source:
Quickbird Satellite Image ©Digital Globe Inc., Date 2008

Map Source:
Background physical features obtained from the National Topographic Database Website.



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December 2010
Project Number: N-015746

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Dickie

Verified by: S. Charity



FIGURE 5

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
MONITORING PROGRAM AND QA/QC PLAN

SOLID WASTE MANAGEMENT
FACILITY - MONITORING
LOCATIONS - LANDFILL

LEGEND

- MONITORING STATION LOCATION
- CONTAMINANT ATTENUATION ZONE

LANDFILL AND SEWAGE LAGOON ACCESS ROAD

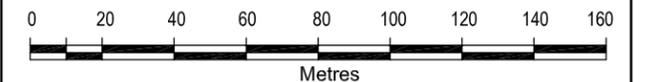
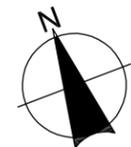
LANDFILL

SEWAGE LAGOON
(OUT OF SERVICE)

ARV-2A

ARV-3

Satellite Image Source:
Quickbird Satellite Image ©Digital Globe Inc., Date 2008



1:2,000
December, 2010
Project Number: N-O157460

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Dickie

Verified by: S. Charity





FIGURE 6

**HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
MONITORING PROGRAM AND QA/QC PLAN**

**SOLID WASTE MANAGEMENT
FACILITY - MONITORING
LOCATIONS - BULKY
METALS WASTE AREA**

LEGEND

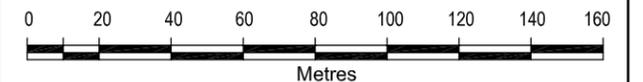
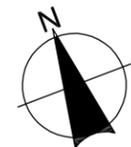
● MONITORING STATION LOCATION

BULKY METALS WASTE AREA

ARV-10

ROAD TO COMMUNITY

Satellite Image Source:
Quickbird Satellite Image ©Digital Globe Inc., Date 2008



1:2,000
October, 2010
Project Number: N-O157460
Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Dickie
Verified by: S. Charity





FIGURE 7

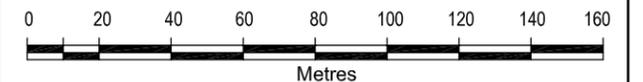
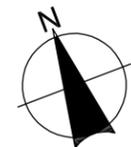
HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
MONITORING PROGRAM AND QA/QC PLAN

**SOLID WASTE MANAGEMENT
 FACILITY - MONITORING
 LOCATIONS - HAZARDOUS
 WASTE STORAGE AREA**

LEGEND

● MONITORING STATION LOCATION

Satellite Image Source:
 Quickbird Satellite Image ©Digital Globe Inc., Date 2008



1:2,000
 December, 2010
 Project Number: N-O157460
 Projection: UTM Zone 15
 Datum: NAD83

Prepared by: C. Dickie
 Verified by: S. Charity



Appendix A
Nunavut Water Board License



NUNAVUT WATER BOARD

WATER LICENCE NO: 3AM-ARV1015

Hamlet of Arviat, Nunavut



NUNAVUT WATER BOARD

LICENCE NO: 3AM-ARV1015

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NUNAVUT WATER BOARD

WATER LICENCE No. 3AM-ARV1015

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 ARVIAT

(Licensee or Applicant)

ARVIAT, NUNAVUT X0C 0E0

(Mailing Address)

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

Licence Number/Type: 3AM-ARV1015 TYPE "A"

Water Management Area: NUNAVUT 06

Location: ARVIAT, KIVALLIQ REGION, NUNAVUT
LATITUDE: 61° 06' 30" N, LONGITUDE: 94° 03' 31" W

Classification: MUNICIPAL UNDERTAKING

Purpose: DIRECT USE OF WATER AND DEPOSIT OF WASTE

Quantity of Water use not
to Exceed: EIGHTY-SIX THOUSAND (86,000)
CUBIC METRES PER ANNUM

Date of Licence Issuance: AUGUST 23, 2010

Expiry of Licence: AUGUST 31, 2015

This Licence, issued and recorded at Gjoa Haven, Nunavut, includes and is subject to the annexed conditions.

Thomas Kabloona,
Nunavut Water Board
Chair

APPROVED
BY:

Minister of Indian and
Northern Affairs
Canada

DATE LICENCE APPROVED: _____

PART A: SCOPE, DEFINITIONS AND ENFORCEMENT

1. SCOPE

- a. This Licence allows for the use of Water and disposal of Waste including operation of a Water Supply Facility, Solid Waste Disposal Facility, Hazardous Waste Storage Area, Bulky Metals Area, and Sewage Disposal Facility; as well as construction and operation of a New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, upon approval by the Board, by the Hamlet of Arviat, Nunavut for a municipal undertaking (Latitude 61° 06' 30" N and Longitude 94° 03' 31" W);
- b. This Licence is issued subject to 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 Act, or other statutes imposing more stringent conditions relating to the quantity, type or manner under which any such Waste may be so deposited, this Licence shall be deemed 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 all applicable legislation, guidelines and directives.

2. DEFINITIONS

In this Licence, these definitions apply and changes may be made at the discretion of the Board.

“**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 and/or 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;

“**Applicant**” means the Licensee;

“**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*;

“Bulky Metals Area” comprises the area and associated structures designed to contain bulky metal waste as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

“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;

“Engineer” means a professional engineer registered to practice in Nunavut in accordance with the *Consolidation of Engineers and Geoscientists Act S. Nu 2008, c.2* and the *Engineering and Geoscience Professions Act S.N.W.T. 2006, c.16 Amended by S.N.W.T. 2009, c.12*;

“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;

“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 Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists 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*;

“Hazardous Waste Storage Area” comprises the area and associated structures designed to contain Hazardous Waste as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

“Hydrocarbon Impacted Soil Storage and Treatment Facility” means an area designed to treat Petroleum Hydrocarbon-Impacted Soil, as referred to in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

“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 a 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, Waste and Waste deposition, to assess impacts to the freshwater aquatic environment of an appurtenant undertaking;

“New Solid Waste Disposal Facility” comprises the area and associated structures designed to contain solid waste as referred to in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

“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;

“Petroleum Hydrocarbon Impacted Soil” means soil in which the primary petroleum product present, as determined by laboratory analysis consistent with that described in the *Canada-Wide Standards for Petroleum Hydrocarbons in Soil*, generally consists of fuel oil, diesel fuel, gasoline and/or jet fuel;

“Sewage” means all Toilet Wastes and Greywater;

“Sewage Disposal Facilities” comprises the area, including wetland and engineered lagoon designed to contain Sewage as described in the Application for Water Licence filed by the Applicant on September 2, 2003, and illustrated in Arviat Sewage Lagoon drawings prepared by FSC Architects and Engineers for Government of Nunavut, Job No. 507-340, FSC Project No. 2003-0440-003, Submission for Tender July 11th, 2003;

“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 as described in the Application for Water Licence filed by the Applicant on September 2, 2003;

“Toilet Wastes” means all human excreta and associated products, but does not include Greywater;

“Waste” means, as defined in section 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 including the Sewage Disposal Facilities, Solid Waste Disposal Facilities, Hazardous Waste Storage Area, Bulky Metals Area, and upon approval by the Board, New Solid Waste Disposal Facility, and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

“Water” means water as defined in section 4 of the Act;

“Water Supply Facilities” comprises the area and associated intake infrastructure at the Wolf River Water Supply, as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009 and illustrated in Arviat Water Supply Filtration Upgrade drawings prepared by Dillon Consulting for Government of Nunavut Public Works and Services, Issued for Tender, April 2008, Project No. 078254; Figure 4 – Hamlet of Arviat Water Licence Submission Wolf River Water Intake drawing prepared by Nuna Burnside, December 2008, Project Number N-O15746;

“Work Plan” refers to the electronic document (letter) from Jim Walls, P.Geo., Nuna Burnside Engineering and Environmental Ltd., to Bryan Purdy, Government of Nunavut Community Government Services, Re: Work Plan to Address INAC, DFO, and NWB Licence Compliance Issues GN File 08-3025 Hamlet of Arviat, Nunavut File No. N-0 15746.1, dated June 23, 2010.

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.
- 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. This Licence incorporates a previously issued Type B licence, NWB3ARV0308, to the Hamlet of Arviat, which allowed for the use of water and disposal of waste.
2. In the event of a conflict between the previously issued Type B licences and this Type A Licence, the condition of this Type A Licence prevails.
3. The Licensee shall file an annual report with the Board for review, no later than March 31st

of the year following the calendar year being reported, which shall contain the following information collected during that period:

- a. Tabular summaries of all data generated under the Monitoring Program;
 - b. The monthly and annual quantities of freshwater obtained from all sources;
 - c. The monthly and annual quantities of Wastes removed for disposal from Water Supply Facilities and Waste Disposal Facilities;
 - d. A summary of modifications and/or major maintenance work carried out on Water Supply Facilities and Waste Disposal Facilities including all associated structures and facilities;
 - e. A list of unauthorized discharges and summary of follow-up actions taken;
 - f. Any revisions to approved plans and manuals as required by Part B, Item 12, submitted in the form of an addendum;
 - g. A summary of the status of implementation of the Work Plan, including an indication of the status of the funding required to carry out the Work Plan and an estimated timeframe for receipt of the necessary funding;
 - h. A fiscal update of the Licensee's funding commitments associated with all facilities governed by this Licence including all associated structures and facilities for the upcoming year and identifying shortfalls in such funding commitments for the previous year;
 - i. A summary of abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;
 - j. A summary of any studies, reports and plans requested by the Board that relate to Waste disposal, Water use or reclamation, and a brief description of any future studies planned; and
 - k. Any other details on water use or waste disposal requested by the Board by November 1st of the year being reported.
4. 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.
 5. The Monitoring Program and compliance dates specified in the Licence may be modified at the discretion of the Board.
 6. Metres, 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.
 7. The Licensee shall, within ninety (90) days after the first visit by the Inspector following approval of this Licence, post the necessary signs, to identify the stations of the Monitoring Program. All signage postings shall be in Inuktitut and English.
 8. 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.

9. In the event that a plan is not found acceptable to the Board, the Licensee shall, within thirty (30) days of notification by the Board, provide a revised version to the Board, for approval in writing.
10. The Licensee shall, for all plans submitted under this Licence, implement the plan as approved by the Board in writing.
11. 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 conditions 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.
12. The Licensee shall review the plans and manuals referred to in this Licence as required by changes in operation and/or technology and revise accordingly. Revisions to the plans or manuals are to be submitted in the form of an addendum to be included with the annual report required by Part B, Item 3, complete with a revisions list detailing where significant content changes are made.
13. The Licensee shall ensure a copy of this Licence is maintained at the municipal office and at the site of operation at all times.
14. Any communication with respect to this Licence shall be made in writing to the attention of:

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

15. Any notice made to an Inspector shall be made in writing to the attention of:

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

16. The Licensee shall submit one (1) paper copy and one (1) electronic copy of all reports, studies, and plans to the Board or as otherwise requested by the Board. Reports or studies submitted to the Board by the Licensee shall include an executive summary in English and

Inuktitut.

17. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the Board, is received by the Board and maintain on file a copy of the acknowledgment of receipt issued by the Manager of Licensing.
18. This Licence is assignable as provided for in Section 44 of the Act.
19. The expiry or cancellation of this Licence does not relieve the Licensee from any obligation imposed by the Licence, or any other regulatory requirement.
20. The Licensee shall file a Water Licence Renewal Application with the Board no later than September 1, 2014.

PART C: CONDITIONS APPLYING TO WATER USE AND MANAGEMENT

1. The Licensee shall obtain all freshwater from Wolf River at Monitoring Program Station ARV-1 as otherwise approved by the Board in writing.
2. The annual quantity of water used for all purposes shall not exceed eighty-six thousand (86,000) cubic metres per annum, or as otherwise approved by the Board in writing.
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 submit to the Board for approval in writing by December 31, 2010, as-built drawings stamped and signed by an Engineer confirming compliance with the DFO guideline "Freshwater Intake End of Pipe Fish Screen Guideline". The drawings shall include information regarding the operating capacity of the pump used and the intake screen size.
5. The Licensee shall not remove any material from below the ordinary high water mark of any Water body.
6. The Licensee shall not cause erosion to the banks of any body of Water and shall provide necessary controls to prevent such erosion.
7. Sediment and erosion control measures shall be implemented prior to and maintained during construction and operation to prevent entry of sediment into Water.
8. The Licensee shall submit to the Board for review by December 31, 2010, the Water balance assessment for Wolf River and an assessment of the potential effects of drawdown of Wolf River on the aquatic environment. The assessment shall include recommended mitigation measures and an implementation schedule.

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

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL AND MANAGEMENT

1. The Licensee shall direct all Sewage to the Sewage Disposal Facility.
2. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Program Station ARV-4 shall not exceed the following Effluent quality limits, or as otherwise approved by the Board in writing:

| Parameter | Maximum Concentration of any Grab Sample |
|------------------------|--|
| Fecal Coliform | 1 x 10 ⁴ CFU/dl |
| BOD ₅ | 80 mg/l |
| Total Suspended Solids | 100 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 in writing, shall be maintained at all dams, dyke or structures intended to contain, withhold, divert or retain Water or Wastes.
4. The Licensee shall provide at least ten (10) days notification to an Inspector, prior to initiating any planned discharges from any Waste Disposal Facility.
5. The Licensee shall submit to the Board for approval in writing by December 31, 2010, a Sewage Disposal Facility Report. The Report shall include:
 - a. As-built drawings and design plans of the Sewage Disposal Facility (including the lagoon and wetland) signed and stamped by an Engineer;
 - b. A preliminary discharge and wetland hydrology assessment;
 - c. The results of an inspection by a Geotechnical Engineer of the Sewage Disposal Facility lagoon including its berms and an evaluation of the impact of sewage seepage through the lagoon berms on the environment;
 - d. An evaluation of the long term impacts of the Sewage Disposal Facility on the environment;
 - e. A Sludge Management Plan that addresses sludge assessment and disposal methods. The Plan shall be incorporated in to the Sewage Disposal Facility Operations and Maintenance Manual referred to in Part F Item 1b;
 - f. Recommended measures to optimize the Sewage Disposal Facility; and
 - g. A schedule for implementing recommended measures.
6. The Licensee shall, prior to commissioning of the New Solid Waste Disposal Facility, or as otherwise approved by the Board in writing:

- a. Dispose of and contain all non-Hazardous, non-bulky metal, solid Waste at the Solid Waste Disposal Facility;
 - b. Dispose of and contain all bulky metal Waste at the Bulky Metals Area; and
 - c. Segregate and securely store all hazardous materials and Hazardous Waste within the Hazardous Waste Storage Area in a manner as to prevent the deposit of deleterious substances into any Water, until such a time that the materials have been removed for proper disposal at a licensed facility.
7. The Licensee shall not open burn plastics, wood treated with preservatives, electric wire, styrofoam, asbestos or painted wood to prevent the deposition of Waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding Waters, or as otherwise approved by the Board in writing.
8. The Licensee shall maintain records of all Waste removed from site and records of confirmation of proper disposal of removed Waste. These records shall be made available to an Inspector upon request.
9. The Licensee shall store and contain all Petroleum Hydrocarbon Impacted Soil in a manner as to prevent the deposit of deleterious substances into any Water.
10. The Licensee shall submit to the Board for approval in writing, at least sixty (60) days prior to the commissioning of a Hydrocarbon Impacted Soil Storage and Treatment Facility, a Hydrocarbon Impacted Soil Storage and Treatment Facility Management Plan including proposed Effluent quality limits for Monitoring Program Station ARV-10.
11. The Licensee shall dispose of all Effluent from contaminated soil areas and the Hydrocarbon Impacted Soil Storage and Treatment Facility, that exceed Effluent quality limits approved by the Board in Part D Item 14 (c) and Part D Item 10 respectively, off site at a licensed hazardous waste facility, or as otherwise approved by the Board in writing.
12. The discharge locations for all treated Effluents from the Hydrocarbon Impacted Soil Storage and Treatment Facility and contaminated soil areas shall be located at a minimum of thirty one (31) 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.
13. The Licensee shall, prior to the removal of any treated soil from the Hydrocarbon Impacted Soil Storage and Treatment Facility, obtain written documentation from the Government of Nunavut Environmental Protection Service, confirming that the soils have been treated in accordance with the Government of Nunavut's "*Environmental Guideline for Contaminated Site Remediation, 2009*" for its intended use.
14. The Licensee shall submit to the Board for approval in writing by December 31, 2010, a Solid Waste Management Report. The Report shall include:

- a. As-built drawings of the Solid Waste Disposal Facility, Hazardous Waste Storage Area, and Bulky Metals Area, signed and stamped by an Engineer;
 - b. Capacity assessment of the Solid Waste Disposal Facility;
 - c. An inventory and assessment of contaminated soil and water at the Solid Waste Disposal Facility, Bulky Metals Area, and Hazardous Waste Storage Area, and a plan for the treatment and disposal of contaminated soil and water including proposed Effluent quality limits for Monitoring Program Station ARV-11;
 - d. Recommendations for Water and wastewater containment, treatment, and drainage control. This Plan shall be incorporated into the Solid Waste Disposal Facility Operations and Maintenance Plan referred to in Part F Item 2d.
 - e. Recommended measures to optimize solid waste management; and
 - f. A schedule for implementing recommended measures.
15. Licensee shall implement measures to ensure hazardous materials and/or leachate from the Waste Disposal Facilities does not enter Water.
 16. Licensee shall, annually between the months of June and September, undertake a geotechnical inspection to be carried out by a Geotechnical Engineer that takes into account all facilities intended to contain, withhold, divert or retain Water or Wastes. The inspection shall be conducted in accordance with the Canadian Dam Safety Guidelines, where applicable.
 17. The Licensee shall, within sixty (60) days of completion of the geotechnical inspection referred to in Part D, Item 16, submit to the Board for review, the Geotechnical Engineer's inspection Report. The Licensee shall include a cover letter outlining an implementation plan to address the recommendations of the Geotechnical Engineer.
 18. The Licensee shall maintain and operate all Water Supply Facilities and Waste Disposal Facilities in such a manner as to prevent structural failure.

PART E: CONDITIONS APPLYING TO MODIFICATIONS AND CONSTRUCTION

1. The Licensee shall, at least sixty (60) days prior to construction of the New Solid Waste Disposal Facility and/or the Hydrocarbon Impacted Soil Storage and Treatment Facility, or any dams, dykes or structures intended to contain, withhold, divert or retain Water or Wastes, submit to the Board, for approval in writing, final design Plans and construction drawings signed and stamped by an Engineer.
2. The Licensee shall obtained approval from the Board in writing prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain Water or Wastes.
3. The Licensee may, without written approval from the Board, carry out Modifications 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 to include:
 - i. A description of the facilities and/or works to be constructed;
 - ii. The proposed location of the structure(s);
 - iii. Identification of any potential impacts to the receiving environment;
 - iv. A description of any monitoring required, including sampling locations, parameters measured and frequencies of sampling;
 - v. Schedule for construction;
 - vi. Drawings of engineered structures signed and stamped by an Engineer; and
 - vii. Proposed sediment and erosion control measures.
 - b. The proposed Modifications do not place the Licensee in contravention of the Licence or the Act;
 - c. The Board has not, within 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;
4. Modifications for which any of the conditions referred to above have not been met can be carried out only with approval from the Board in writing.
 5. The Licensee shall provide as-built plans and drawings of the construction and/or Modifications referred to in Part E of this Licence within ninety (90) days of completion of the Construction or Modification. These plans and drawings shall be signed and stamped by an Engineer.

PART F: CONDITIONS APPLYING TO OPERATIONS AND MAINTENANCE

1. The Licensee shall, within sixty (60) days following Board approval of the Sewage Disposal Facility Report referred to in Part D, Item 5, submit to the Board, for approval in writing, a revision to the Plan entitled “Sewage Treatment Facility Operation and Maintenance (O&M) Plan, Hamlet of Arviat” May 2009, revised May 2010, to address the following:
 - a. Requirements of the Licence;
 - b. Sludge Management Plan referred to in Part D Item 5e; and
 - c. Results of the Sewage Disposal Facility Report referred to in Part D Item 5.
2. The Licensee shall, within sixty (60) days following Board approval of the Solid Waste Disposal Facility Report referred to in Part D Item 14, submit to the Board, for approval in writing, a revision to the Plan entitled “Solid Waste Management Facility Operation and Maintenance (O&M) Plan, Hamlet of Arviat” January 2009, revised May 2010, to address the following:
 - a. Requirements of the Licence;
 - b. Bulky Waste Management Plan;

- c. Hazardous Waste Management Plan including Hazardous Waste containment and segregation measures, and procedures for the movement of Hazardous Waste;
 - d. Recommendations for Water and wastewater containment, treatment, and drainage control as referred to in Part D Item 14(d); and
 - e. Results of the Solid Waste Disposal Facility Report referred to in Part D Item 14.
3. The Licensee shall, at least three (3) months prior to commissioning the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, submit to the Board, for approval in writing, a revised Solid Waste Management Facility Operations and Maintenance (O&M) Plan referred to in Part F Item 2 to address the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility.
4. The Licensee shall, in preparation of the revised plan referred to in Part F, Item 3, consult Environment Canada for guidance related to Petroleum Hydrocarbon Impacted Soils storage and treatment facility design, siting, operation, monitoring, sampling and analytical methods, decommissioning and closure, as well as record keeping and reporting.
5. The Licensee shall, by December 31, 2010, submit to the Board for review, an Addendum to the approved Plan entitled “Environmental Emergency Contingency Plan, Hamlet of Arviat” May 2009, revised May 2010, to address reviewers’ comments including the following:
 - a. Procedures for the movement of Hazardous Waste;
 - b. Contact information for the Government of Nunavut Department of Environment Manager of Pollution; and
 - c. Detailed information regarding clean-up methods/procedures for spills on Water or ice.
6. If, during the period of this Licence, an unauthorized discharge of Waste and or Effluent occurs, or if such discharge is foreseeable, the Licensee shall:
 - a. Employ as required, the approved Environmental Emergency Contingency Plan referred to in Part F Item 5;
 - b. Report the incident immediately via the 24-Hour Spill Reporting Line (867) 920-8130 and to the Inspector at (867) 975-4295; and
 - c. For each spill occurrence, submit a detailed report to the Inspector, no later than thirty (30) days after initially reporting the event, which includes the amount and type of spilled product, the GPS location of the spill, and the measures taken to contain, clean up and restore the spill site.

PART G: CONDITIONS APPLYING TO ABANDONMENT, RESTORATION AND CLOSURE

1. The Licensee shall, by December 31, 2010, submit to the Board, for review, an interim Abandonment and Restoration Plan for the Solid Waste Disposal Facility, Bulky Metals Area, Hazardous Waste Storage Area and any contaminated sites identified in the Solid Waste Management Report referred to in Part D Item 14 (c). The Plan shall incorporate, where applicable, the appropriate sections described in Part G Item 3.
2. The Licensee shall, by December 31, 2010, submit to the Board, for approval in writing, a Final Abandonment and Restoration Plan for the two abandoned sewage lagoons. The Plan shall incorporate, where applicable, the appropriate sections described in Part G Item 3.
3. The Licensee shall, at least six (6) months prior to abandoning any facilities or upon submission of final design drawings for the construction of new facilities to replace existing ones, submit to the Board, for approval in writing, a Final Abandonment and Restoration Plan for the facilities being decommissioned. The Plan shall incorporate, where applicable, information on the following:
 - a. Water intake facilities;
 - b. The water treatment and waste disposal sites and facilities;
 - c. Former dump sites;
 - d. Petroleum and chemical storage areas;
 - e. Any site affected by waste spills;
 - f. Leachate prevention;
 - g. An implementation and completion schedule;
 - h. Maps delineating all disturbed areas, and site facilities;
 - i. Consideration of altered drainage patterns;
 - j. Type and source of cover materials;
 - k. Future area use;
 - l. Hazardous Wastes; and
 - m. A proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.
4. The Licensee shall carry out progressive reclamation of any Water Supply Facilities and Waste Disposal Facilities no longer required for the Licensee's operations.
5. In order to promote growth of vegetation and the needed microclimate for seed deposition, all disturbed surfaces shall be prepared by ripping, grading, or scarifying the surface to conform to the natural topography.
6. The Licensee shall, prior to the use of reclaimed soils that have been contaminated by hydrocarbons, or soils referred to in Part D, Item 14(c), consult with the Government of Nunavut, Department of Environment and obtain written confirmation that the soil meets

the objectives as outlined in the Government of Nunavut's *Environmental Guideline for Contaminated Site Remediation*, March 2009 (Revised).

7. The Licensee shall complete the restoration work within the time schedule specified in an approved Abandonment and Restoration Plan, or as subsequently revised and approved by the Board in writing.
8. The Licensee shall complete all restoration work prior to the expiry of this Licence.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

| Station Number | Description | Frequency | Status |
|-----------------------|---|---|--|
| ARV-1 | Raw water supply at Wolf River prior to treatment. | Monthly | Active (Volume) |
| ARV-2a | Effluent from the discharge point of the Solid Waste Disposal Facility. | <u>Quality</u> Monthly during the months of May to August and prior to discharge of accumulated impacted water. <u>Acute Toxicity</u> Annually | Active (Quality and Acute Toxicity) |
| ARV-2b | Effluent from the discharge point of the New Solid Waste Disposal Facility. | <u>Quality</u> Monthly during the months of May to August and prior to discharge of accumulated impacted water. <u>Acute Toxicity</u> Annually | Active (Quality and Acute Toxicity) |
| ARV-3 | Raw Sewage at truck offload point. | Monthly | Not active |

| | | | |
|--------|---|--|---|
| ARV-4 | Effluent from the discharge point of the Sewage Disposal Facility (end of Wetland). | <u>Quality</u> Monthly during the months of May to August. <u>Acute Toxicity</u> Annually | Active (Quality and Acute Toxicity) |
| ARV-5 | Discharge from the Bulky Metal Waste Area. | Monthly during periods of observed flow. | New (Quality) |
| ARV-6 | Discharge from the Hazardous Waste Storage Area. | Monthly during periods of observed flow. | New (Quality) |
| ARV-7 | Water level in Wolf River. | Monthly during periods of open water. | New (Water level) |
| ARV-8 | Water level in Sewage Disposal Facility lagoon. | Monthly during thawed conditions. | New (Sewage level) |
| ARV-9 | Sewage Sludge removed from the Sewage Disposal Facility. | Monthly | New (Volume) |
| ARV-10 | Effluent from the Final Discharge Point of the Hydrocarbon Impacted Soil Storage and Treatment Facility | To be determined in accordance with Part D Item 10 | New (To be determined in accordance with Part D Item 10) |
| ARV-11 | Effluent discharge from dewatering contaminated soil areas. | To be determined in accordance with Part D Item 14 (c) | New (To be determined in accordance with Part D Item 14 (c)) |

2. The Licensee shall, by December 31, 2010, maintain a water level Monitoring Program Station (ARV-7) at Wolf River.
3. The Licensee shall, by December 31, 2010, maintain a lagoon level Monitoring Program Station (ARV-8) at the Sewage Disposal Facility.
4. The Licensee shall provide the GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of all locations where sources of Water are utilized for all purposes and at all Monitoring Program Stations.
5. The Licensee shall confirm the locations and GPS coordinates for all Monitoring Program Stations referred to in Part H Item 1 with an Inspector.

6. The Licensee shall determine the locations and GPS coordinates of any additional Monitoring Program Stations required for any new Waste Disposal Facilities with an Inspector.
7. The Licensee shall measure and record in cubic metres, the monthly and annual quantities of Water extracted for all purposes at Monitoring Program Station ARV-1.
8. The Licensee shall carry out, at a minimum, weekly inspections at Monitoring Program Stations ARV-2a, ARV-5, ARV-6, and Station ARV-2b upon commissioning of the New Solid Waste Disposal Facility, from May to August inclusive, to identify Effluent or Water flow in order to fulfill the monitoring requirements of Part H, Item 9. A record of inspections shall be retained and made available to an Inspector upon request.
9. The Licensee shall sample monthly at Monitoring Program Stations ARV-2a, ARV-4, ARV-5, ARV-6, and Station ARV-2b upon commissioning of the New Solid Waste Disposal Facility, during the months of May to August, inclusive. Samples shall be analyzed for the following parameters:

| | |
|------------------------|-------------------------|
| BOD ₅ | 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 | Total Phosphorous |

10. The Licensee shall conduct the following acute toxicity tests at Monitoring Program Stations ARV-2a and ARV-4, and Station ARV-2b upon commissioning of the New Solid Waste Disposal Facility, once annually between June and September, approximately mid-way through the discharge period:
 - a. Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout (Reference Method EPS 1/RM/13), July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time
 - b. Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna (Reference Method EPS 1/RM/14), July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time.

11. The Licensee shall, when flow volumes at Monitoring Program Stations ARV- 2a, ARV-2b and ARV-4 are not sufficient to conduct the tests required by Part H Item 10, collect samples upstream where adequate flow volume exists.
12. The Licensee shall record water elevation monthly, during open water at Monitoring Program Station ARV-7.
13. The Licensee shall record water elevations monthly during thawed conditions at Monitoring Program Station ARV-8.
14. The Licensee shall measure and record in cubic metres the monthly and annual quantities of Sewage sludge removed from the Sewage Disposal Facility at Monitoring Program Station ARV-9.
15. The Licensee shall submit to the Board for review, by December 31, 2010 a revision to the approved Plan entitled “Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan, Hamlet of Arviat” May 2009, revised May 2010, to address the following:
 - a. All monitoring requirements listed under Part H of the Licence;
 - b. A covering letter from an accredited laboratory confirming acceptance of the Quality Assurance/ Quality Control (QA/QC) Plan for analyses to be performed under this Licence as required under Part H, Item 17.
16. The Licensee shall, at least six (60) days prior to commissioning the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, submit to the Board, for approval in writing, a revision to the Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan, referred to in Part H Item 15, to address the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility.
17. The Licensee shall annually review the QA/QC Plan referred to in Part H, Item 15 and modify it as necessary. The revised QA/QC Plan shall be submitted to the Board for review, accompanied by a current approval letter from an accredited lab and shall meet the standards as set out in Part H, Item 20 and Part H, Item 21 of the Licence.
18. The Licensee shall measure and record the volume of all contaminated soil, from all locations entering the Hydrocarbon Impacted Soil Storage and Treatment Facility.
19. The Licensee shall assess and record the concentration of Petroleum Hydrocarbon Impacted Soil entering any Hydrocarbon Impacted Soil Storage and Treatment Facility from all sources, as per the CCME *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil, User Guide, January 2008*.

20. 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.
21. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.
22. The Licensee shall include all of the data and information required by the Monitoring Program in the Licensee's Annual Report, as required per Part B, Item 3(a) or as otherwise requested by an Inspector.
23. Modifications to the Monitoring Program may be made only upon written request and subsequent approval of the Board in writing.

provide the findings with recommendations by December 31, 2010⁸⁵ as well as the commitments outlined in the Licensee's Work Plan.⁸⁶

Specifically, Part D Item 5 of the Licence requires the Licensee to submit to the Board for approval in writing by December 31, 2010 a Sewage Disposal Facility Report. The Report shall include:

- a. As-built drawings and design plans of the Sewage Disposal Facility (including the lagoon and wetland) signed and stamped by an Engineer;
- b. A preliminary discharge and wetland hydrology assessment;
- c. The results of an inspection by a Geotechnical Engineer of the Sewage Disposal Facility lagoon including its berms and an evaluation of the impact of sewage seepage through the lagoon berms on the environment;
- d. An evaluation of the long term impacts of the Sewage Disposal Facility on the environment;
- e. A Sludge Management Plan that addresses sludge assessment and disposal methods. The Plan shall be incorporated in to the Sewage Disposal Facility Operations and Maintenance Manual;
- f. Recommended measures to optimize the Sewage Disposal Facility; and
- g. A schedule for implementing recommended measures.

Solid Waste including Bulky Metal Waste and Hazardous Waste

As identified by INAC⁸⁷ at the Hearing, the Hamlet operates a Bulky Metal Waste Area and Hazardous Waste Storage area in addition to the Solid Waste Disposal Facility, and these areas are not addressed in the expired licence NWB3ARV0308. To address this issue, the Board requires the Licensee as a condition in Part D Item 6 of the Licence to, unless otherwise approved by the Board in writing:

- a. Dispose of and contain all non-hazardous, non-bulky metal, solid waste at the Solid Waste Disposal Facility;
- b. Dispose of and contain all bulky metal waste at the Bulky Metals Area; and
- c. Segregate and securely store all hazardous materials and Hazardous Waste within the Hazardous Waste Storage Area in a manner as to prevent the deposit of deleterious substances into any water, until such a time that the materials have been removed for proper disposal at a licensed facility.

To address the issues presented by parties regarding solid waste disposal including management of contaminated soils⁸⁸, and runoff management⁸⁹, the Board accepts the Licensee's request to include conditions in the Licence to conduct studies and provide the

⁸⁵ Transcript, Jim Walls, Nuna Burnside, at p. 35-36, lines 22-11.

⁸⁶ Exhibits 3 and 4, Work Plan to Address INAC, DFO and NWB License Compliance Issues, from Jim Walls to Bryan Purdy, dated June 23, 2010.

⁸⁷ Transcript, Ian Parsons, INAC, at p. 76 -77, lines 15-8

⁸⁸ Transcript, Ian Parson, INAC, at p. 76-77, lines 21-2 and Paula Smith, INAC, at p. 92-93, lines 26-13.

⁸⁹ Transcript, Ian Parsons, INAC, at p. 76, lines 5-8 and Paula Smith, EC, at p. 92, lines 10-23.

Appendix B
Contact List for Arviat

Contact Information Hamlet of Arviat

| Contact | Location | Phone Number | Fax Number |
|--|--------------|----------------|----------------|
| Hamlet of Arviat - SAO | Arviat | (867) 857-2841 | (867) 857-2519 |
| 24 Hour NWT / Nunavut Spill Report Line | Yellowknife | (867) 920-8130 | (867) 873-6924 |
| INAC - Water/Wastewater Resources Manager | Iqaluit | (867) 975-4550 | (867) 979-6445 |
| Gouvernement of Nunavut Regional Engineer | Rankin Inlet | (867) 645-8156 | (867) 645-8196 |
| Environment Canada - Inspector | Iqaluit | (867) 975-4644 | (867) 979-4594 |
| Fire Department | Arviat | (867) 857-2525 | - |
| RCMP Detachment | Arviat | (867) 857-1111 | - |
| Community Health Centre | Arviat | (867) 857-3100 | - |

Appendix C
Sample Container, Preservation, and
Holding Times

Sample Containers, Preservation and Holding Times

| Parameter | Sample Container | Preservation | Holding Time |
|--|---------------------------|--|--------------|
| Faecal Coliforms (FC) | 250 mL Sterilized Plastic | Sodium Thiosulfate | 30 Hours |
| Biological Oxygen Demand (BOD ₅) | 500 mL Plastic | None | 4 Days |
| Electrical Conductivity (EC) | 500 mL Plastic | None | 14 days |
| pH | 500 mL Plastic | None | 4 days |
| Total Suspended Solids (TSS) | 500 mL Plastic | None | 7 days |
| Sodium | 500 mL Plastic | None | 28 days |
| Potassium | 500 mL Plastic | None | 28 days |
| Magnesium | 500 mL Plastic | None | 28 days |
| Calcium | 500 mL Plastic | None | 28 days |
| Sulphate (SO ₄) | 500 mL Plastic | None | 28 days |
| Total Phosphorus | 120 mL Plastic | Sulfuric Acid | 30 Hours |
| Total Copper | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Iron | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Lead | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Nickel | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Zinc | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Arsenic | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Chromium | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Cadmium | 120 mL Plastic | Nitric Acid | 30 Days |
| Total Mercury | 120 mL Glass | HNO ₃ and K ₂ Cr ₂ O ₇ | 28 days |
| Nitrate-Nitrogen | 250 mL Plastic | None | 5 Days |
| Nitrite-Nitrogen | 250 mL Plastic | None | 5 Days |
| Ammonium Nitrogen (NH ₃) | 120 mL Plastic | Sulfuric Acid (H ₂ SO ₄) | 30 Days |
| TKN (Total Khejdahl Nitrogen) | 250 mL Glass | Sulfuric Acid (H ₂ SO ₄) | 10 Days |
| Organic Nitrogen | 250 mL Glass | Sulfuric Acid (H ₂ SO ₄) | 10 Days |
| Total Phenols | 120 mL Glass | Sulfuric Acid (H ₂ SO ₄) | 30 days |
| Total Oil and Grease | 1000 mL Glass | Hydrochloric Acid (HCl) | 28 Days |
| CCME F1 | 40 mL Glass Vials (x3) | Sodium Bisulfate | 7 days |
| CCME F2-F4 | 1000 mL Amber Glass | None | 14 days |
| BTEX | 40 mL Glass Vials (x3) | Sodium Bisulfate | 7 days |
| VOCs | 40 mL Glass Vials (x3) | Sodium Bisulfate | 14 days |
| PAHs | 1000 mL Amber Glass | None | 20 days |

Above is description of bottles ordered from AGAT Laboratories, a different lab may provide different bottles and hold times.

Appendix D
Contact Information for CALAI
Laboratories

Contact Information for Canadian Association for Laboratory Accreditation Inc. (CALAI) Laboratories

| Services | Laboratory | Lab Location | Shipping Address | Contact Information |
|-----------------------------------|--|--------------|--|--|
| Water and Soil Quality Analysis | ALS Lavoboratory Group - Environmental Divisiotn | Winnipeg | 1329 Niakwa Road East, Unit 12 Winnipeg, MB R2 3T4 | Phone: (204) 255-9720 Fax: (204) 255-9721 |
| | | Yellowknife | 75 Con Road, Yellowknife, NWT X1A 2M1 | Phone: (861) 766-5308 Fax: (867) 920-4238 |
| | Taiga Environmental Laboratory | Yellowknife | 4601-52 Avenue, Yellowknife, NWT X1A 2R3 | Phone: (867) 669-2788 Fax: (867) 699-2718 |
| | AGAT Laboratories Limited | Mississauga | 5835 Coopers Avenue, Mississauga, ON L4Z 1Y2 | Phone: (905) 501-9998 or 1-800-856-6261 Fax: (905) 501-0589 |
| Environmental Toxicology Analysis | AquaTox Testing and Consulting Inc. | Guelph | 11B Nicholas Beaver Rd, R.R.3, Guelph, ON N1H 6H9 | Phone: (519) 763-4412 Fax: (519) 763-4419 |

Appendix E

Laboratory Approval of QA/QC Plan



AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL 905-712-5100
FAX 905-712-5122
www.agatlabs.com

January 7, 2010

Nuna Burnside Engineering and Environmental Ltd.
15 Townline,
Orangeville, Ontario

Subject: Acceptance of QA/QC Plan – Hamlet of Arviat, Nunavut (File No: N-O 157460)

Dear Ms. Charity,

This letter serves to confirm AGAT Laboratories Ltd acceptance of the “Environmental Monitoring and Quality Assurance and Quality Control Plan, Hamlet of Arviat” for the analysis to be performed under Licence No. 3AM-ARV1015.

Regards,

Nick Boulton

QA Officer

AGAT Laboratories Ltd

Appendix F
Canadian Water Quality Guidelines for
Aquatic Life



Canadian Water Quality Guidelines for the Protection of Aquatic Life

SUMMARY TABLE

Update 7.0
September 2007

Summary of Canadian water quality guidelines for the protection of aquatic life.

| Parameter ^a | Freshwater | | Marine | |
|---|---|-------------------|---|-------------------|
| | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b |
| Acenaphthene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Acridine [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Aldicarb | 1 ^c | 1993 | 0.15 ^c | 1993 |
| Aldrin + Dieldrin ^d | 0.004 ^{e,f} | 1987 | | |
| Aluminium ^d | 5–100 ^g | 1987 | | |
| Ammonia (total) | see factsheet | 2001 | | |
| Ammonia (un-ionized) | 19 ^h | 2001 | | |
| Aniline | 2.2 ⁱ | 1993 | Insufficient data | 1993 |
| Anthracene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Arsenic ^j | 5.0 ^k | 1997 | 12.5 ^c | 1997 |
| Atrazine | 1.8 ⁱ | 1989 | | |
| Benz(a)anthracene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Benzene ^j | 370 ^{e, k} | 1999 | 110 ^c | 1999 |
| Benzo(a)pyrene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| 2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane [See DDT (total)] | | | | |
| Bromacil | 5.0 ^{e,i} | 1997 | Insufficient data | 1997 |
| Bromoform [See Halogenated methanes, Tribromomethane] | | | | |
| Bromoxynil | 5.0 ⁱ | 1993 | Insufficient data | 1993 |
| Cadmium | 0.017 ^{e,l} | 1996 | 0.12 ⁱ | 1996 |
| Captan | 1.3 ^c | 1991 | | |
| Carbaryl | 0.20 ⁱ | 1997 | 0.32 ^{e,i} | 1997 |
| Carbofuran | 1.8 ⁱ | 1989 | | |
| Carbon tetrachloride [See Halogenated methanes, Tetrachloromethane] | | | | |
| Chlordane ^d | 0.006 ^{e,f} | 1987 | | |
| Chlorinated benzenes | | | | |
| Monochlorobenzene | 1.3 ^{e,k} | 1997 | 25 ^{e,k} | 1997 |
| 1,2-Dichlorobenzene | 0.70 ^{e,k} | 1997 | 42 ^{e,k} | 1997 |
| 1,3-Dichlorobenzene | 150 ^{e,k} | 1997 | Insufficient data ^k | 1997 |
| 1,4-Dichlorobenzene | 26 ^{e,k} | 1997 | Insufficient data ^k | 1997 |
| 1,2,3-Trichlorobenzene | 8.0 ^{e,k} | 1997 | Insufficient data ^k | 1997 |
| 1,2,4-Trichlorobenzene | 24 ^{e,k} | 1997 | 5.4 ^{e,k} | 1997 |
| 1,3,5-Trichlorobenzene ^d | Insufficient data ^k | 1997 | Insufficient data ^k | 1997 |

Continued.

SUMMARY TABLE

**Canadian Water Quality Guidelines
for the Protection of Aquatic Life**

Update 7.0

| Parameter ^a | Freshwater | | Marine | |
|--|---|-------------------|---|-------------------|
| | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b |
| Chlorinated benzenes—Continued | | | | |
| 1,2,3,4-Tetrachlorobenzene | 1.8 ^{c,k} | 1997 | Insufficient data ^k | 1997 |
| 1,2,3,5-Tetrachlorobenzene ^d | Insufficient data ^k | 1997 | Insufficient data ^k | 1997 |
| 1,2,4,5-Tetrachlorobenzene ^d | Insufficient data ^k | 1997 | Insufficient data ^k | 1997 |
| Pentachlorobenzene | 6.0 ^{c,k} | 1997 | Insufficient data ^k | 1997 |
| Hexachlorobenzene ^d | Insufficient data ^{e,l,k} | 1997 | Insufficient data ^k | 1997 |
| Chlorinated ethanes | | | | |
| 1,2-Dichloroethane | 100 ^{e,i} | 1991 | Insufficient data | 1991 |
| 1,1,1-Trichloroethane | Insufficient data | 1991 | Insufficient data | 1991 |
| 1,1,2,2-Tetrachloroethane | Insufficient data | 1991 | Insufficient data | 1991 |
| Chlorinated ethenes | | | | |
| 1,1,2-Trichloroethene (Trichloroethylene; TCE) | 21 ^{e,i} | 1991 | Insufficient data | 1991 |
| 1,1,2,2-Tetrachloroethene (Tetrachloroethylene; PCE) | 111 ^{e,i} | 1993 | Insufficient data | 1993 |
| Chlorinated methanes [See Halogenated methanes] | | | | |
| Chlorinated phenols ^d | | | | |
| Monochlorophenols | 7 | 1987 | | |
| Dichlorophenols | 0.2 | 1987 | | |
| Trichlorophenols | 18 | 1987 | | |
| Tetrachlorophenols | 1 | 1987 | | |
| Pentachlorophenol (PCP) | 0.5 | 1987 | | |
| Chlorine, reactive [See Reactive chlorine species] | | | | |
| Chloroform [See Halogenated methanes, Trichloromethane] | | | | |
| 4-Chloro-2-methyl phenoxy acetic acid [See MCPA] | | | | |
| Chlorothalonil | 0.18 ^c | 1994 | 0.36 ^c | 1994 |
| Chlorpyrifos | 0.0035 | 1997 | 0.002 ^c | 1997 |
| Chromium | | | | |
| Trivalent chromium (Cr(III)) | 8.9 ^{c,k} | 1997 | 56 ^{c,k} | 1997 |
| Hexavalent chromium (Cr(VI)) | 1.0 ^k | 1997 | 1.5 ^k | 1997 |
| Chrysene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Colour | Narrative | 1999 | Narrative | 1999 |
| Copper ^d | 2–4 ^m | 1987 | | |
| Cyanazine | 2.0 ^{c,i} | 1990 | | |
| Cyanide ^d | 5 (as free CN) | 1987 | | |
| DDAC (Didecyl dimethyl ammonium chloride) | 1.5 ^c | 1999 | Insufficient data | 1999 |
| DDT (total) ^d (2,2-Bis(<i>p</i> -chlorophenyl)-1,1,1-trichloroethane; dichloro diphenyl trichloroethane) | 0.004 ^{e,f} | 1987 | | |
| Debris (litter/settleable matter) | | | Narrative ^c | 1996 |

Continued.

| Parameter ^a | Freshwater | | Marine | |
|---|---|-------------------|---|-------------------|
| | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b |
| Deltamethrin | 0.0004 | 1997 | Insufficient data | 1997 |
| Deposited bedload sediment [See Total particulate matter] | | | | |
| Dibromochloromethane [See Halogenated methanes] | | | | |
| Dicamba | 10 ^{e,i} | 1993 | | |
| Dichlorobenzene [See Chlorinated benzenes] | | | | |
| Dichlorobromomethane [See Halogenated methanes] | | | | |
| Dichloro diphenyl trichloroethane [See DDT (total)] | | | | |
| Dichloroethane [See Chlorinated ethanes] | | | | |
| Dichloroethylene [See Chlorinated ethanes, 1,2-Dichloroethane] | | | | |
| Dichloromethane [See Halogenated methanes] | | | | |
| Dichlorophenols [See Chlorinated phenols] | | | | |
| 2,4-Dichlorophenoxyacetic acid [see Phenoxy herbicides] | | | | |
| Diclofop-methyl | 6.1 | 1993 | | |
| Didecyl dimethyl ammonium chloride [See DDAC] | | | | |
| Diethylene glycol [See Glycols] | | | | |
| Di(2-ethylhexyl) phthalate [See Phthalate esters] | | | | |
| Diisopropanolamine (DIPA) ^{aa} | 1600 ^c | 2005 | Insufficient data | 2005 |
| Dimethoate | 6.2 ^c | 1993 | Insufficient data | 1993 |
| Di- <i>n</i> -butyl phthalate [See Phthalate esters] | | | | |
| Di- <i>n</i> -octyl phthalate [See Phthalate esters] | | | | |
| Dinoseb | 0.05 | 1992 | | |
| Dissolved gas supersaturation | Narrative | 1999 | Narrative | 1999 |
| Dissolved oxygen | 5500–9500 ^{k,n} | 1999 | >8000 and Narrative ^{c,k} | 1996 |
| Endosulfan ^d | 0.02 | 1987 | | |
| Endrin ^d | 0.0023 ^{e,f} | 1987 | | |
| Ethylbenzene ^j | 90 ^{e,k} | 1996 | 25 ^{e,k} | 1996 |
| Ethylene glycol [See Glycols] | | | | |
| Fluoranthene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Fluorene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Glycols | | | | |
| Ethylene glycol | 192 000 ^k | 1997 | Insufficient data | 1997 |
| Diethylene glycol | Insufficient data ^k | 1997 | Insufficient data | 1997 |
| Propylene glycol | 500 000 ^k | 1997 | Insufficient data | 1997 |
| Glyphosate | 65 ^c | 1989 | | |

Continued.

SUMMARY TABLE

**Canadian Water Quality Guidelines
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| Parameter ^a | Freshwater | | Marine | |
|---|-------------------------------------|-------------------|-------------------------------------|-------------------|
| | Concentration (µg·L ⁻¹) | Date ^b | Concentration (µg·L ⁻¹) | Date ^b |
| Halogenated methanes | | | | |
| Monochloromethane (Methyl chloride) ^d | Insufficient data | 1992 | Insufficient data | 1992 |
| Dichloromethane (Methylene chloride) | 98.1 ^{c,i} | 1992 | Insufficient data | 1992 |
| Trichloromethane (Chloroform) | 1.8 ^{c,i} | 1992 | Insufficient data | 1992 |
| Tetrachloromethane (Carbon tetrachloride) | 13.3 ^{c,i} | 1992 | Insufficient data | 1992 |
| Monobromomethane (Methyl bromide) ^d | Insufficient data | 1992 | Insufficient data | 1992 |
| Tribromomethane (Bromoform) ^d | Insufficient data | 1992 | Insufficient data | 1992 |
| Dibromochloromethane ^d | Insufficient data | 1992 | Insufficient data | 1992 |
| Dichlorobromomethane ^d | Insufficient data | 1992 | Insufficient data | 1992 |
| HCBd [See Hexachlorobutadiene (HCBd)] | | | | |
| Heptachlor (Heptachlor epoxide) ^d | 0.01 ^{e,f} | 1987 | | |
| Hexachlorobenzene [See Chlorinated benzenes] | | | | |
| Hexachlorobutadiene (HCBd) | 1.3 ^{c, k} | 1999 | | |
| Hexachlorocyclohexane (Lindane) ^d | 0.01 | 1987 | | |
| Hypochlorous acid [See Reactive chlorine species] | | | | |
| Imidacloprid ^{aa} | 0.23 ^c | 2007 | 0.65 ^c | 2007 |
| Inorganic fluorides | 120 ^c | 2002 | | |
| 3-Iodo-2-propynyl butyl carbamate [See IPBC] | | | | |
| IPBC (3-Iodo-2-propynyl butyl carbamate) | 1.9 ^c | 1999 | | |
| Iron ^d | 300 | 1987 | | |
| Leuc ^d | 1.7 ^c | 1987 | | |
| Lindane [See Hexachlorocyclohexane] | | | | |
| Linuron | 7.0 ^c | 1995 | Insufficient data | 1995 |
| MCPA (4-Chloro-2-methyl phenoxy acetic acid; 2-methyl-4-chloro phenoxy acetic acid) | | | | |
| MCPA | 2.6 ^c | 1995 | 4.2 ^c | 1995 |
| Mercury ^v | | | | |
| Inorganic Mercury ^v | 0.026 | 2003 | 0.016 ^{c,w} | 2003 |
| Methylmercury ^v | 0.004 ^{c,w} | 2003 | | |
| Methyl bromide [See Halogenated methanes, Monobromomethane] | | | | |
| Methyl chloride [See Halogenated methanes, Monochloromethane] | | | | |
| 2-Methyl-4-chloro phenoxy acetic acid [See MCPA] | | | | |
| Methylene chloride [See Halogenated methanes, Dichloromethane] | | | | |
| Methyl tertiary-butyl ether [See MTBE] | | | | |
| Metolachlor | 7.8 ^c | 1991 | | |
| Metribuzin | 1.0 ^c | 1990 | | |
| Molybdenum ^j | 73 ^c | 1999 | | |
| Monobromomethane [See Halogenated methanes] | | | | |
| Monochloramine [See Reactive chlorine species] | | | | |

Continued.

| Parameter ^a | Freshwater | | Marine | |
|--|---|-------------------|---|-------------------|
| | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b |
| Monochlorobenzene [See Chlorinated benzenes] | | | | |
| Monochloromethane [See Halogenated methanes] | | | | |
| Monochlorophenols [See Chlorinated phenols] | | | | |
| MIBE (methyl <i>tertiary</i> -butyl ether) | 10 000 ^c | 2003 | 5 000 ^c | 2003 |
| Naphthalene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Nickel ^d | 25–150 ^p | 1987 | | |
| Nitrate | 13 000 ^{c,q,y} | 2003 | 16 000 ^{c,q,y} | 2003 |
| Nitrite ^d | 60 ^z | 1987 | | |
| Nonylphenol and its ethoxylates | 1.0 ^{e,t} | 2002 | 0.7 ^{e,t} | 2002 |
| Nutrients | Guidance Framework ^x | 2004 | Guidance Framework ^{aa,bb} | 2007 |
| Organotins | | | | |
| Tributyltin | 0.008 ^c | 1992 | 0.001 ^c | 1992 |
| Tricyclohexyltin | Insufficient data | 1992 | Insufficient data | 1992 |
| Triphenyltin | 0.022 ^{c,i} | 1992 | Insufficient data | 1992 |
| Oxygen, dissolved [See Dissolved oxygen] | | | | |
| PAHs [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| PCBs [See Polychlorinated biphenyls (PCBs)(total)] | | | | |
| PCE [See Chlorinated ethenes, 1,1,2,2-Tetrachloroethene] | | | | |
| PCP [See Chlorinated phenols, Pentachlorophenol] | | | | |
| Pentachlorobenzene [See Chlorinated benzenes] | | | | |
| Pentachlorophenol [See Chlorinated phenols] | | | | |
| Pernethrin ^{aa} | 0.004 ^c | 2006 | 0.001 ^c | 2006 |
| pH ^d | 6.5–9 | 1987 | 7.0–8.7 and Narrative | 1996 |
| Phenanthrene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Phenols (mono- & dihydric) | 4.0 ^k | 1999 | | |
| Phenoxy herbicides ^{d, q} | 4.0 | 1987 | | |
| Phosphorus | Guidance Framework ^x | 2004 | Guidance Framework ^{bb} | 2007 |
| Phthalate esters | | | | |
| Di- <i>n</i> -butyl phthalate | 19 ^c | 1993 | Insufficient data | 1993 |
| Di(2-ethylhexyl) phthalate | 16 ^c | 1993 | Insufficient data | 1993 |
| Di- <i>n</i> -octyl phthalate | Insufficient data | 1993 | Insufficient data | 1993 |
| Picloram | 29 ^c | 1990 | | |
| Polychlorinated biphenyls (PCBs) (total) ^d | 0.001 ^{e,f} | 1987 | 0.01 ^{e,f} | 1991 |

Continued.

SUMMARY TABLE

**Canadian Water Quality Guidelines
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| Parameter ^a | Freshwater | | Marine | |
|--|---|-------------------|--|-------------------|
| | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b |
| Polycyclic aromatic hydrocarbons (PAHs) | | | | |
| Acenaphthene | 5.8 ^c | 1999 | Insufficient data | 1999 |
| Acridine | 4.4 ^c | 1999 | Insufficient data | 1999 |
| Anthracene | 0.012 ^c | 1999 | Insufficient data | 1999 |
| Benz(a)anthracene | 0.018 ^c | 1999 | Insufficient data | 1999 |
| Benzo(a)pyrene | 0.015 ^c | 1999 | Insufficient data | 1999 |
| Chrysene | Insufficient data | 1999 | Insufficient data | 1999 |
| Fluoranthene | 0.04 ^c | 1999 | Insufficient data | 1999 |
| Fluorene | 3.0 ^c | 1999 | Insufficient data | 1999 |
| Naphthalene | 1.1 ^c | 1999 | 1.4 ^c | 1999 |
| Phenanthrene | 0.4 ^c | 1999 | Insufficient data | 1999 |
| Pyrene | 0.025 ^c | 1999 | Insufficient data | 1999 |
| Quinoline | 3.4 ^c | 1999 | Insufficient data | 1999 |
| Propylene glycol [See Glycols] | | | | |
| Pyrene [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Quinoline [See Polycyclic aromatic hydrocarbons (PAHs)] | | | | |
| Reactive chlorine species (hypochlorous acid and monochloramine) | 0.5 and Narrative | 1999 | 0.5 and Narrative | 1999 |
| Salinity | | | <10% fluctuation ^c | 1996 |
| Selenium ^d | 1.0 | 1987 | | |
| Silver ^d | 0.1 | 1987 | | |
| Simazine | 10 | 1991 | | |
| Streambed substrate [See Total particulate matter] | | | | |
| Styrene | 72 ^c | 1999 | | |
| Sulfolane ^{aa} | 50 000 ^c | 2005 | Insufficient data | 2005 |
| Suspended sediments [See Total particulate matter] | | | | |
| TCE [See Chlorinated ethenes, 1,1,2-Trichloroethene] | | | | |
| Tebuthiuron | 1.6 ^c | 1995 | Insufficient data | 1995 |
| Temperature | Narrative ^s | 1987 | Not to exceed $\pm 1^{\circ}\text{C}$ and Narrative ^c | 1996 |
| Tetrachlorobenzene [See Chlorinated benzenes] | | | | |
| Tetrachloroethane [See Chlorinated ethanes] | | | | |
| Tetrachloroethene [See Chlorinated ethenes] | | | | |
| Tetrachloroethylene [See Chlorinated ethenes, 1,1,2,2-Tetrachloroethene] | | | | |

Continued.

| Parameter ^a | Freshwater | | Marine | |
|--|---|-------------------|---|-------------------|
| | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b | Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) | Date ^b |
| Tetrachloromethane [See Halogenated methanes] | | | | |
| Tetrachlorophenols [See Chlorinated phenols] | | | | |
| Thallium ^j | 0.8 | 1999 | | |
| Toluene | 2.0 ^{e,j,k} | 1996 | 215 ^{e,k} | 1996 |
| Total particulate matter | | | | |
| Deposited bedload sediment | Insufficient data | 1999 | Insufficient data | 1999 |
| Streambed substrate | Narrative | 1999 | Narrative | 1999 |
| Suspended sediments | Narrative | 1999 | Narrative | 1999 |
| Turbidity | Narrative | 1999 | Narrative | 1999 |
| Toxaphene ^d | 0.008 ^{e,f} | 1987 | | |
| Triallate | 0.24 ^c | 1992 | | |
| Tribromomethane [See Halogenated methanes] | | | | |
| Tributyltin [See Organotins] | | | | |
| Trichlorobenzene [See Chlorinated benzenes] | | | | |
| Trichloroethane [See Chlorinated ethanes] | | | | |
| Trichloroethene [See Chlorinated ethenes] | | | | |
| Trichloroethylene [See Chlorinated ethenes, 1,1,2-Trichloroethene] | | | | |
| Trichloromethane [See Halogenated methanes] | | | | |
| Trichlorophenols [See Chlorinated phenols] | | | | |
| Tricyclohexyltin [See Organotins] | | | | |
| Trifluralin | 0.20 ⁱ | 1993 | | |
| Triphenyltin [See Organotins] | | | | |
| Turbidity [See Total particulate matter] | | | | |
| Zinc ^d | 30 | 1987 | | |

^aUnless otherwise indicated, supporting documents are available from the National Guidelines and Standards Office, Environment Canada.

^bThe guidelines dated 1987 have been carried over from *Canadian Water Quality Guidelines* (CCREM 1987) and no fact sheet was prepared. The guidelines dated 1989 to 1997 were developed and initially published in CCREM 1987 as appendixes on the date indicated. They are published as fact sheets in this document. Other guidelines dated 1997 and those dated 1999 are published for the first time in this document.

^cInterim guideline.

^dNo fact sheet created. For more information on this guideline, please refer to *Canadian Water Quality Guidelines* (CCREM 1987).

^eThis guideline (originally published in *Canadian Water Quality Guidelines* [CCREM 1987 + Appendixes] in 1987 or 1991 [PCBs in marine waters]) is no longer recommended and the value is withdrawn. A water quality guideline is not recommended. Environmental exposure is predominantly via sediment, soil, and/or tissue, therefore, the reader is referred to the respective guidelines for these media.

^fThis substance meets the criteria for Track 1 substances under the national CCME Policy for the Management of Toxic Substances (PMTS) (i.e., persistent, bioaccumulative, primarily the result of human activity, and CEPA-toxic or equivalent), and should be subject to virtual elimination strategies. Guidelines can serve as action levels or interim management objectives towards virtual elimination.

^gAluminium guideline = $5 \mu\text{g}\cdot\text{L}^{-1}$ at pH <6.5
= $100 \mu\text{g}\cdot\text{L}^{-1}$ at pH \geq 6.5

^hAmmonia guideline: Expressed as μg unionized ammonia- L^{-1} . This would be equivalent to $15.2 \mu\text{g}$ ammonia-nitrogen- L^{-1} . Guideline for total ammonia is temperature and pH dependent, please consult factsheet for more information.

ⁱGuideline value slightly modified from CCREM 1987 + Appendixes due to re-evaluation of the significant figures.

^jThe technical document for the guideline is available from the Ontario Ministry of the Environment.

^kSubstance has been re-evaluated since CCREM 1987 + Appendixes. Either a new guideline has been derived or insufficient data existed to derive a new guideline.

SUMMARY TABLE**Canadian Water Quality Guidelines
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^kCadmium guideline = $10^{(0.86(\log(\text{hardness})) - 3.2)}$

^mCopper guideline = 2 µg·L⁻¹ at a water hardness of 0–120 mg·L⁻¹ (soft to medium) as CaCO₃
= 3 µg·L⁻¹ at a water hardness of 120–180 mg·L⁻¹ (hard) as CaCO₃
= 4 µg·L⁻¹ at a water hardness >180 mg·L⁻¹ (very hard) as CaCO₃

ⁿDissolved oxygen for warm-water biota: early life stages = 6000 µg·L⁻¹
other life stages = 5500 µg·L⁻¹
for cold-water biota: early life stages = 9500 µg·L⁻¹
other life stages = 6500 µg·L⁻¹

^oLead guideline = 1 µg·L⁻¹ at a water hardness of 0–60 mg·L⁻¹ (soft) as CaCO₃
= 2 µg·L⁻¹ at a water hardness of 60–120 mg·L⁻¹ (medium) as CaCO₃
= 4 µg·L⁻¹ at a water hardness of 120–180 mg·L⁻¹ (hard) as CaCO₃
= 7 µg·L⁻¹ at a water hardness >180 mg·L⁻¹ (very hard) as CaCO₃

^pNickel guideline = 25 µg·L⁻¹ at a water hardness of 0–60 mg·L⁻¹ (soft) as CaCO₃
= 65 µg·L⁻¹ at a water hardness of 60–120 mg·L⁻¹ (medium) as CaCO₃
= 110 µg·L⁻¹ at a water hardness of 120–180 mg·L⁻¹ (hard) as CaCO₃
= 150 µg·L⁻¹ at a water hardness >180 mg·L⁻¹ (very hard) as CaCO₃

^qThe guideline of 4.0 µg·L⁻¹ for phenoxy herbicides is based on data for ester formulations of 2,4-dichlorophenoxyacetic acid.

^rThe technical document for the guideline is available from British Columbia Ministry of Environment, Lands and Parks.

^sTemperature: (for more information, see CCREM 1987)

Thermal Stratification: Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins.

Maximum Weekly Average Temperature: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded.

Short-term Exposure to Extreme Temperature: Thermal additions to receiving waters should be such that the short-term exposures to maximum temperatures are not exceeded. Exposures should not be so lengthy or frequent as to adversely affect the important species

^tExpressed on a TEQ basis using NP TEFs, see Table 2 in factsheet.

^uFor protection from direct toxic effects; the guidelines do not consider indirect effects due to eutrophication.

^vMay not prevent accumulation of methylmercury in aquatic life, therefore, may not protect wildlife that consume aquatic life; see factsheet for details. Consult also the appropriate Canadian Tissue Residue Guideline for the Protection of Wildlife Consumers of Aquatic Biota.

^wMay not fully protect higher trophic level fish; see factsheet for details.

^xCanadian Guidance Framework for Phosphorus is for developing phosphorus guidelines (does not provide guidance on other freshwater nutrients). It provides Trigger Ranges for Total Phosphorus (see Guidance Framework for Phosphorus factsheet):

ultra-oligotrophic <4 µg·L⁻¹

oligotrophic 4–10 µg·L⁻¹

mesotrophic 10–20 µg·L⁻¹

meso-eutrophic 20–35 µg·L⁻¹

eutrophic 35–100 µg·L⁻¹

hyper-eutrophic >100 µg·L⁻¹

^yGuidelines are expressed in µg nitrate·L⁻¹. These values are equivalent to 2900 µg nitrate-nitrogen·L⁻¹, and 3600 µg nitrate-nitrogen·L⁻¹, for freshwater and marine respectively.

^zGuideline is expressed as µg nitrite-nitrogen·L⁻¹. This value is equivalent to 197 µg nitrite·L⁻¹.

^{aa}Supporting documents are available from the Canadian Council of Ministers of the Environment at http://www.ccmec.ca/publications/ceqg_reqe.html?category_id=125

^{bb}The Canadian Guidance Framework for the Management of Nearshore Marine Systems is for developing nutrient (phosphorus and nitrogen) guidelines for nearshore marine systems. Refer to factsheet for details

Reference

CCREM (Canadian Council of Resource and Environment Ministers). 1987. Canadian water quality guidelines. Prepared by the Task Force on Water Quality Guidelines.

Reference listing:

Canadian Council of Ministers of the Environment. 2007. Canadian water quality guidelines for the protection of aquatic life: Summary table. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

For further scientific information, contact:

Environment Canada
National Guidelines and Standards Office
351 St. Joseph Blvd.
Gatineau, Quebec, K1A 0H3
Phone: (819) 953-1550
Facsimile: (819) 956-5602
E-mail: ceqg-rcqe@ec.gc.ca
Internet: <http://www.ec.gc.ca/ceqg-rcqe>

For additional copies, contact:

CCME Documents
Toll Free: (800) 805-3025
www.ccm.ca

Aussi disponible en français

Appendix G
Annual Monitoring Report Form

NWB Annual Report

Year being reported: ▼

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):

License Requirements: the licensee must provide the following information in accordance with

▼ ▼

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): | <input type="text"/> |
| Water Quantity: | <input type="text"/> Quantity Allowable Domestic (cu.m) |
| | <input type="text"/> Actual Quantity Used Domestic (cu.m) |
| | <input type="text"/> Quantity Allowable Drilling (cu.m) |
| | <input type="text"/> 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

Additional Details:

Revisions to the Abandonment and Restoration Plan

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;

Additional Details:

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

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: | <input type="text"/> |
| Fax: | <input type="text"/> |
| email: | <input type="text"/> |

Appendix H
Photographs

Water Supply Facility



ARV-1 - Raw water supply at Wolf River prior to treatment.
Notes: Record volume of flow pumped from intake (ARV-1).



ARV-7 - Water level in Wolf River.
Notes: Survey water level from SE corner of pumphouse (Benchmark).

Solid Waste Disposal Facility



Ponded water outside landfill discharge point.



ARV-2 - Effluent from discharge point of the Solid Waste Disposal Facility.
Notes: Water quality sample taken in front of culvert.



ARV-2 - Effluent from discharge point of the Solid Waste Disposal Facility.
Notes: Water quality sample taken in front of culvert.



ARV-3 - Wetland down gradient of landfill, edge of Contaminant Attenuation Zone.
Notes: Water quality sample.



ARV-10 - Discharge from Bulky Metal Waste Area.
Notes: Water quality sample.



ARV-11 - Discharge from Hazardous Waste Storage Area.
Notes: Water quality sample.

Sewage Disposal Facility



ARV-4 - Effluent from the discharge point of the Sewage Disposal Facility.
Notes: Water quality sample.



ARV-5 - Description: Wetland Treatment Area.
Notes: Water quality sample.



ARV-8 - Water level in Sewage Disposal Facility lagoon.
Notes: Survey water level based on back east corner top of offload block (Benchmark).



Level set up to survey benchmark and water level of sewage lagoon.



ARV-9 - Sewage sludge removed from the Sewage Disposal Facility.
Notes: Volume of sludge removed.