Hamlet of Naujaat

Environmental Monitoring Program and Quality Assurance/Quality Control Plan

Prepared for:

Nunavut Water Board

Table of Contents

Tables

Figures

1.0 Introduction

The water and waste disposal facilities in the Hamlet of Naujaat are operated under Nunavut Water Board (NWB) License NWB 3BM-NAU2126 issued on January 27, 2021 and expires January 26, 2026. The license requires the Hamlet to conduct a monitoring program, which includes regular water quality sampling and reporting. As 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 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. This document applied to the infrastructure as it currently is. Any updates to the infrastructure will require this document to be updated.

2.0 Environmental Monitoring Program

Part H of the NWB licence provides specific requirements for the monitoring program. Table 1 summarises the sampling locations, while Table 2 details the water quality sampling parameters.

Table 1 Monitoring Program Stations for Water License

Station	Description	Status
REP-1	Raw Water source intake at Nuviq Luktujuq Lake	**Active (Volume)** Daily, Monthly and Annually
REP-2	Runoff from the Solid Waste Disposal Facility culvert as noted in Interim Solid Waste Management Plan (2006)	**Active (Quality)** Monthly when run-off is observed.
REP-2A	Runoff from the Solid Waste Disposal Facility boulder seepage as noted in Interim Solid Waste Management Plan (2006)	**Active (Quality)** Monthly when run-off is observed
REP-3	Raw Wastewater at truck offload point (current offload point)	**Active (Volume)** Daily, Monthly and Annually
REP-3A	Raw Wastewater at truck offload point (new offload point to commence after construction of sewage lagoon)	**Active (Volume)** Daily, Monthly and Annually
REP-4	Pump discharge point from sewage lagoon (to commence after construction of sewage lagoon)	**Active (Quality and volume)** Monthly or once in the beginning, once in the middle and once near the end of the season (when flow is observed)
REP-4A	Spillway discharge point (to commence after construction of sewage lagoon)	**Active (Quality and volume)** Monthly or once in the beginning, once in the middle and once near the end of the season (when flow is observed)
REP-5	Effluent discharge and run-off from the Contaminated Soil Storage Area (controlled discharge)	**Active (Quality)** Monthly when run-off is observed
REP-6	Final discharge from Wetland Area into Hudson Bay	**Active (Quality)** Monthly or once in the beginning, once in the middle and once near the end of the season (when flow is observed)

Table 2 Water Quality Parameters

Station	Water Quality Parameters	
REP-2 REP-2a REP-5 REP-6	• Bicarbonate (HCO3) • Carbonate (CO3) • Hydroxide (OH) • Total Alkalinity (as CaCO3) • Total Ammonia (as N) • Biochemical Oxygen Demand • BOD Carbonaceous • Chloride (Cl) • Conductivity • Fecal Coliforms • Hardness (as CaCO3) • Mercury (Hg) • Nitrate (as N) • Nitrate+Nitrite (as N) • Nitrite (as N) • Oil and Grease • Phenols • Phosphorus (P) • Sulfate (SO4) • Aluminium (Al) • Arsenic (As) • Cadmium (Cd) • Calcium (Ca)	• Chromium (Cr) • Cobalt (Co) • Copper (Cu) • Iron (Fe) • Lead (Pb) • Magnesium (Mg) • Manganese (Mn) • Nickel (Ni) • Potassium (K) • Sodium (Na) • Zinc (Zn) • Total Organic Carbon • Total Suspended Solids • pH • Benzene • Toluene • Ethyl Benzene • o-Xylene • F1 (C6-C10) • F2 (C10-C16) • F3 (C16-C34) • F4 (C34-C50) • Total Hydrocarbons (C6-C50)

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.

A new Solid Waste Disposal Facility and Wastewater Treatment Facility 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 a CIRNAC 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 and Table 2. Monitoring locations are shown in Figure 1.

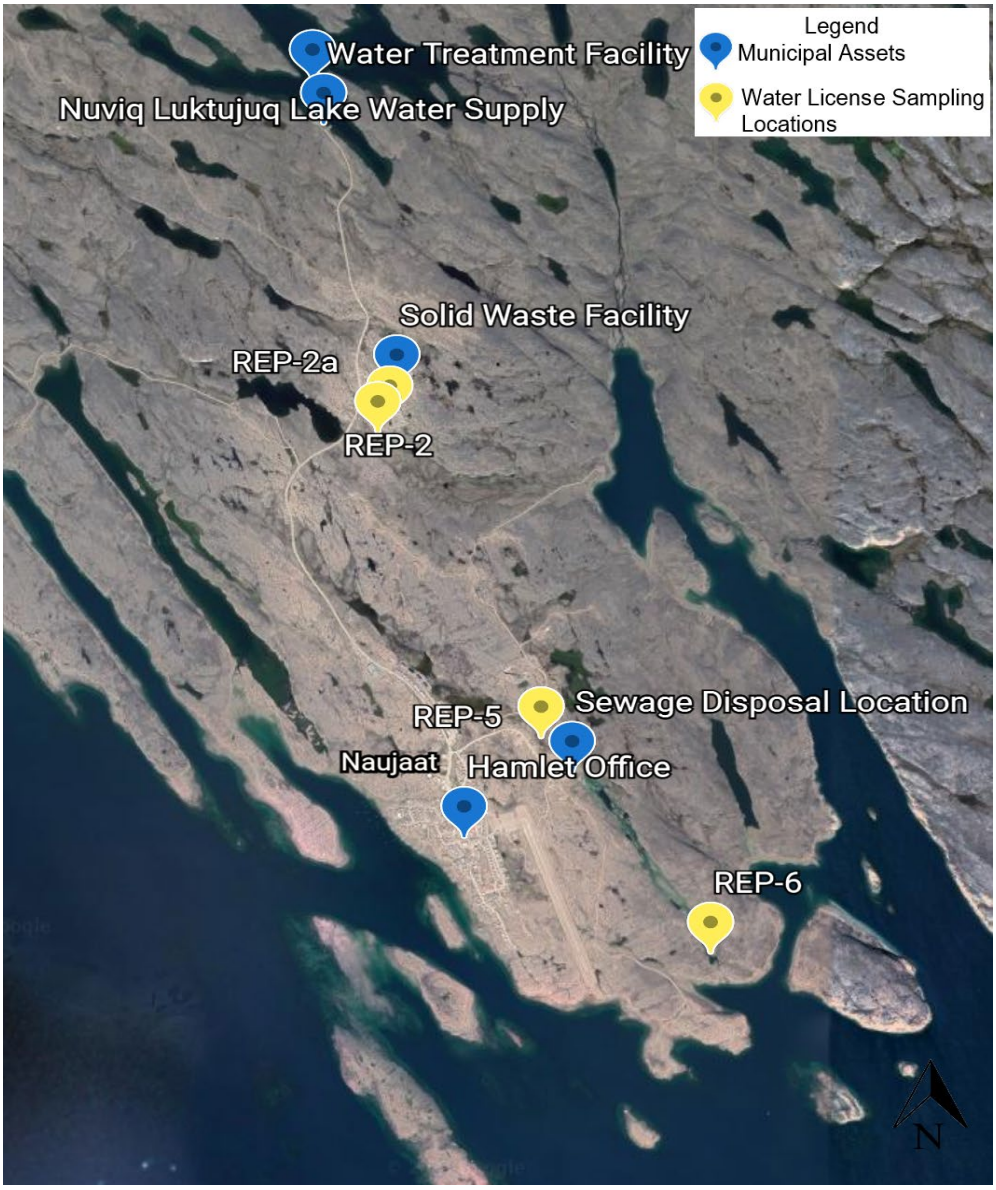

Figure 1 Naujaat Water License Sampling Locations

3.2 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Containers to be used shall be obtained directly from the laboratory. 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 A. The laboratory shall be contacted at least one month prior to the sampling event to ensure that containers are available for sampling.

3.3 Field Sample 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., REP-1, REP-2, etc.)
- Results of any field measurements.
- Sampler shall also indicate if sample used preservatives.
- Any unusual conditions
- Any deviation from standard procedures.

An example Sampling Log is included in Appendix B.

3.4 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 –Appropriate personal protective equipment (gloves, safety glasses, etc.) will be used when handling samples. Samples will be stored a 4ºC 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, as much as possible.

3.5 Surface Water Sampling Procedures

All 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.

3.5.1 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.

3.5.2 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.

3.6 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., REP-1)

- Date and time of collection
- Parameter to be analyzed.
- Preservatives
- Project number identifier
- Bottle number 1 of ___.

3.7 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 4ºC. 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.

3.8 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 4ºC. 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.

3.9 Water Volume and Water Level Measurements

The NWB license includes measuring the monthly and annual volume of water pumped from Nuviq Luktijuq Lake (REP-1). This is measured by delivery volumes of the Water Delivery Trucks.

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 Naujaat.

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. Trip Blanks are a blank solution put in the same type of bottle used for an environmental sample and kept with the set of sample bottles before and after sample collection. At least one trip blank per sampling event will be used. QA/QC samples should make up at least 10% of total samples collected.

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. QA/QC samples should make up at least 10% of total samples collected.

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. 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 Naujaat as outlined in this report (Appendix C).

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. 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. 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.

Figures

Appendix A

Water License Monitoring Program Sampling Guide

Appendix B

Sampling Log

Appendix C

Laboratory Approval of QA/QC