Hamlet of Arctic Bay

Quality Assurance / Quality Control Plan

July 2019

HAMLET OF ARCTIC BAY
BAFFIN REGION

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Appendices

1.0 Introduction

The purpose of this document is to provide guidance to ensure that environmental monitoring program samples collected in the field are done so with a high degree of quality, in order to ensure that they accurately reflect the physical and chemical nature of the matrix being tested. Hamlet of Arctic Bay Water Licence # 3BM-ARC1419 licensed community water supply system, sewage treatment facility and waste management Facilities: Landfill site and Metal site.

1.1 Background

The Municipality of Arctic Bay is a vibrant, traditional Community of Baffin Region with a population 830 in 2019 and located at Latitude $73^0$02'N and Longitude $83^0$05'W, on Borden Peninsula, Baffin Island. This safe harbour hamlet is situated upon a south-facing gravel beach on Adams Sound, which feeds into Admiralty Inlet, draining northwards to Lancaster Sound and the Northwest Passage.
Inhabited by nomadic arctic peoples for 5,000 years, it is also named 'Ikpiarjuk' which means 'the pocket' in Inuktitut, referring to the way the site is surrounded by protective hills on three sides.

Its sheltered shores and steep cliffs provide nesting habitat for many unique species of High Arctic birds and its sea waters are home to narwhals and bowhead whales. Every year in the spring a popular dog sledding race takes place between Arctic Bay and Igloolik that draws the best teams from across Nunavut.

Summer temperatures range from 0°C to 15°C. Protected from strong north winds, Arctic Bay enjoys a surprisingly stable climate. Fall and spring weather is variable, with temperatures between 0°C and -30°C. The snow begins to melt in May, but the sea ice doesn't break up until the end of July. Winter temperatures hover around -35°C yet can sometimes drop to -50°C on very rare occasions.
The Community infrastructure includes: (1) a water supply facility which draws water from a big Lake. Water is treated in the Truck fill station, filled the truck and delivered into holding tanks in each building.
(2) The Community has a single cell sewage lagoon which receives trucked sewage (wastewater) from the holding tanks in each building. The sewage is being naturally treated there before disposal to the wetland land for the receiving body.
(3) The Solid waste facility which includes domestic wastes, construction wastes, metal wastes and hazardous goods.

1.2 Population Projection

Presently in 2019, the population of Arctic Bay is approximately 830 people (Based on 2009 GN estimates). **Table 1** shows the population growth for the Hamlet over the lifetime of the new plant projected by Nunavut Bureau of Statistics.

Table 1: Population Projections for Kimmirut

Year	2019	2020	2021	2022	2023	2024	2025
Populatio	830	840	851	861	870	879	888

Source: Nunavut Bureau of Statistics.

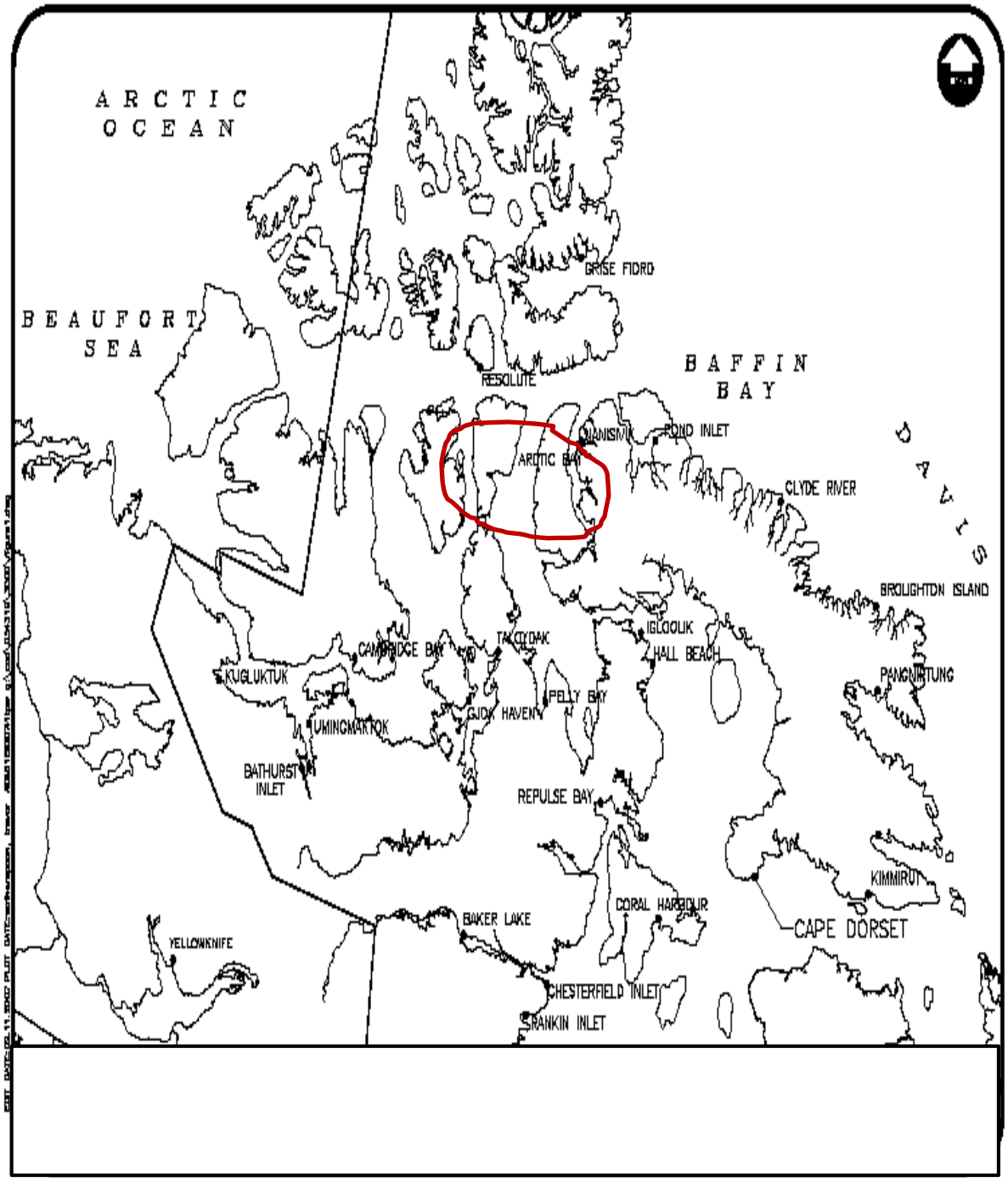

Figure -1: Location map of Arctic Bay in Nunavut

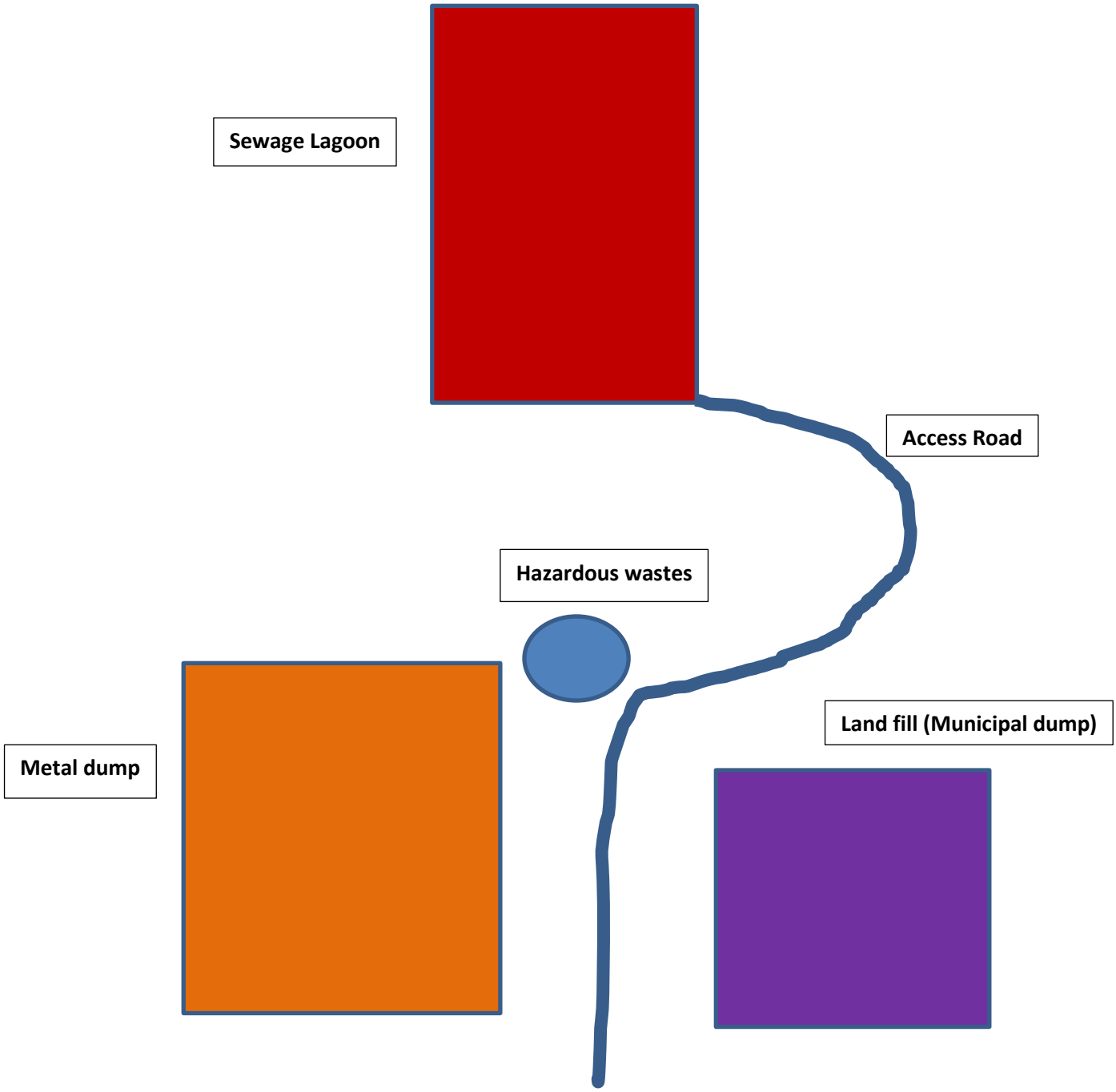

Fig.-3: Arctic Bay wastes sites

1.3 Contact List

The Hamlet of Arctic Bay has a Maintenance Management Operation System (MMOS) already in place. Regular maintenance will be conducted as outlined in this manual whereas specific work orders for sewage treatment facility and system will be passed through to the MMOS. A list of the individuals that are responsible for the operation and maintenance of the sewage treatment and waste disposal system are as follows:

Senior Administrative Officer	(867) 439-9917
Municipal Works Foreman	(867) 439-8260

1.4 Monitoring and Regulatory Requirement Program

Condition 10 of Part H of the water licence issued to the Hamlet requires that the Hamlet submit to the NWB for approval, a Quality Assurance / Quality Control (QA/QC) Plan prepared in accordance with "*Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan"* (Department of Indian and Northern Affairs Canada, July 1996), herein referred to as "The Guidelines".

1.5 Objectives

The objectives of this QA/QC plan are to: i) to ensure the reliability of the data collected during monitoring activities at the locations specified in the Hamlet's water licence, and ii) satisfy the requirement of the water licence.

1.6 Scope of Work

This QA/QC Plan covers the environmental monitoring undertaken at the Hamlet's truck fill station, solid waste disposal site, and the existing Sewage Disposal Facility.

1.7 Definitions

The following definitions that are relevant to this plan include:

Quality Assurance is a system that ensures that quality control procedures are correctly performed and documented.

Quality Control refers to the established procedures observed both in the field and in the laboratory, designed to ensure that the resulting end data meet intended quality objectives.

Trip Blank is a sample of clean water that was prepared by the analytical laboratory and shipped to the sample site in the cooler along with the empty sample bottles. This trip blank sample remains unopened and is transported back to the laboratory with the monitoring program samples. The trip blanks is analyzed by the laboratory along with the monitoring program samples. The purpose of the trip blank is the assess contamination introduced during shipping and field handling procedures.

CALA refers to the Canadian Association for Laboratory Accreditation, formally known as the Canadian Association for Environmental Analytical Laboratories (CAEAL).

Chain of Custody Documentation refers to the documentation that accompanies samples sent to an analytical laboratory. It is a legal document which ensures that the sample taken at a specific site is the same sample received in the laboratory. It also provides information on the sample condition and integrity as received by the laboratory.

2 Field Sampling

2.1 Sampling Procedures

All sampling, sample preservation and analyses is to be conducted in accordance with methods described in the current edition of *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association, American Water Works Association, and Water Environment Federation, most current edition).

To obtain meaningful results from the analyses, the following six factors are of particular importance:

- Sample collection as per schedule and location.
- Correct usage of container/sample bottle for parameter being tested.
- Correct labelling of sample bottles and filling out record/field sheet.
- Correct procedure for field sampling.
- Proper and timely shipment of samples to the laboratory.
- Timely delivery of samples to the laboratory from the air cargo facility.

2.2 Sampling Collection

Refer to the *Environmental Monitoring Program Checklist*, found in Appendix C for specific details on the sampling locations, equipment and sampling methods.

2.2.1 Locations

The water licence issued to the Hamlet (3BM-ARC1419) by the NWB specifies twelve monitoring stations across the licensed facilities as mentioned in Part H: Conditions applying to the Monitoring Program.

The following table-2 includes the geographic coordinates for the 12 monitoring stations described above.

Table-2

Monitoring station	Description	Frequency	Status
ARC-1	Raw water supply intake at Marcil Lake	Volume, Monthly and Annually	Active Volume
ARC-2	Raw Sewage from pump out truck	N/A	Inactive
ARC-3	Raw wastewater Discharge (South Berm)	Volume Monthly and Annually Water Quality Three times	Active(volume, water quality)
ARC-4	Lagoon Pump discharge (North Berm)	Volume Monthly and Annually Water Quality Three times	Active(volume, water quality)
ARC-5	Ocean water 5 m inside the Ocean	Volume Monthly and Annually Water Quality Three times	Not required any more
ARC-6a	Well sampling	Volume Monthly and Annually Water Quality Three times	Not required any more
ARC-6b	Surface water at the end of wetland	Three times	Active water quality
ARC-7	Water Five metres from effluent waste water treatment Facility entering	Once per year	Active (Water quality)
ARC-8	Sewage sludge	TBD	Active (Volume, Quality)
ARC-9	Run-off from the Solid waste Facility	Water quality (Annually during periods of runoff or seepage)	Active (water quality)
ARC-10	Thermistors	TBD	(Temperature)
ARC-11	Standpipes	TBD	(Temperature)
ARC-12	Settlements	TBD	(Temperature)

2.2.2 Sampling Equipment

Dedicated latex or nitrile gloves (i.e., one pair per sample) are to be used during sample handling. Dedicated sampling equipment such as sampling poles (see photo below for an example) are to be cleaned with soap and water after each sample is collected to prevent cross-contamination.

Environmental monitoring samples collected for analysis of selected chemical parameters are to be placed directly into new pre-cleaned, laboratory-supplied sample bottles. All monitoring samples are to be placed in clean coolers for transportation to the subcontract laboratory. The samples are transported/submitted under Chain of Custody documentation. Included on a Chain of Custody form is the client information, the sample information, the analyses requested, the relevant regulations, the turnaround time for the analytical results, comments, and temperature of the samples at the time they arrived in the laboratory. An example of a completed Chain of Custody form is included in Appendix D.

2.2.3 Sampling Methods

Please see Appendix E for the Environmental Monitoring Program Schedule. As a general recommendation, please refrain from using insect repellant, disinfection hand gel or other chemical products before and during sample collection. Also, please refrain from smoking during sample collection.

2.2.3.1 *Wastewater Sampling*

Wastewater influent samples are collected from the active sewage disposal facility (Stations ARC-3, ARC-4, ARC-6a, ARC-6b, and ARC-7) three times annually following item 2, Part H of the Water Licence. Samples are collected from the lagoon effluent flow by immersing the sample bottle into the flow to a depth of 5 to 10 cm (if possible). The sampling container is filled with influent wastewater and the sample bottle is raised neck first to prevent sample spillage.

2.2.3.2 *Solidwaste Disposal Facility*

Landfill runoff is collected once monthly during periods of observed flow from Station ARC-9. Runoff samples are collected from the receiving water body by immersing the sample bottle into the runoff stream neck first to a depth of 5 to 10 cm (if possible). The sampling container is filled with runoff and the sample bottle is raised neck first to prevent sample spillage.

2.3 Sample Handling

All water samples are to be collected in laboratory-supplied containers with the proper preservative, where applicable. A complete list of parameter handling and preservatives can be found in Appendix C.

All sample containers are to be tightly sealed and properly labelled with the sample ID, date and time of sample collection, location of sample collection and parameters to be analyzed. The outside of the bottles are to be cleaned with soap and water after sampling and dried off prior to placing the samples in the cooler. The samples are to be stored on ice in a cooler until delivery to the laboratory. A chain of custody form is to be filled out completely and is used to track the samples and placed in the cooler with the samples, in a ziplock bag. Keep the last page of the Chain of Custody and give it to the Hamlet Foreman for their records.

The following checks are generally performed by the laboratory upon receipt:

- Verification of the integrity and condition of all sample coolers.
- Verification of the integrity and condition of all sample containers.
- Checks for leakage, cracked or broken closures or containers, evidence of grossly contaminated container exteriors or shipping cooler interiors, and obvious odours, etc.
- Verification of receipt of complete documentation for each container.
- Verification that sample identification numbers on sample transmittal forms corresponds to sample identification numbers on the sample containers.
- Verifications that holding times were met and samples were kept cool during transit.

2.4 Quality Assurance and Quality Control Program

Cross contamination is a common source of error in sampling procedures. QC samples help identify when and how contamination might occur. There are various types of QC samples. For the purposes of the Hamlet's environmental monitoring, GN-CGS recommends the collection and analyses of blind duplicate QA/QC samples.

GN-CGS recommends the following number of quality control samples based on the total number of samples collected:

- 10% blind duplicates.

If the total number of samples collected is less than ten, include at a minimum, one blind duplicate.

It is essential to account for the number of blind duplicate samples to be submitted when placing the bottle order with the contract laboratory.

3 Laboratory Analysis

3.1 Laboratory Accreditation

As indicated in the Guidelines, the Hamlet should use an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA); formally known as the Canadian Association for Environmental Analytical Laboratories (CAEAL) for the monitoring program for NWB Licence 3BM-ARC1419. Appendix F includes a copy of the laboratory's CALA accreditation certificate and a list of the parameters for which they are certified.

3.2 Method Detection Limits

The method detection limits (MDLs) are provided on the contract laboratory's Certificates of Analysis.

4 Reporting Requirements

4.1 General Submissions

As a condition of NWB Licence 3BM-ARC1419 (Appendix B), the Hamlet is required to submit an Annual Report to the NWB, no later than March 31st of the year following the calendar year reported. Among other requirements, the annual report is required to include tabular summaries of all analytical data generated under the Monitoring Program (compared to the Maximum Average Concentrations – provided in Part D of the NWB Licence 3BM-ARC1419 where applicable).

5 References

Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan, Department of Indian and Northern Affairs Canada, July 1996.

Standard Methods for the Examination of Water and Wastewater, American Public Health Association, American Water Works Association, and Water Environment Federation, 22nd Edition, 2012.

Appendix A:
Environmental Monitoring Program Checklist, Summary of Sample Bottle Requirements

HAMLET OF KIMMIRUT ENVIRONMENTAL MONITORING PROGRAM CHECKLIST

PRE-SAMPLING ACTIVITIES		
Bottle Order	At least two weeks before upcoming environmental sampling (see Environmental Monitoring Program Schedule in Appendix E), send a request to the contract laboratory for the appropriate sample sets (bottles) for the required sampling test groups (see Conditions 2 & 4 of Part H of Nunavut Water Board Licence 3BM-KIM 0911	☐
Personal Protective Equipment	Ensure that the required personal protective equipment (PPE), such as latex gloves, is on hand before commencing the environmental monitoring program.	☐
Bottle Shipment	Ensure that the bottle shipment has arrived from the contract laboratory in time for the sampling program and verify the integrity of all sampling containers. Report any missing or broken bottles to the contract laboratory as soon as possible, so that replacement bottles may be shipped.	☐
Sampling Location Inspections	Perform an initial inspection of all routinely-monitored sampling locations before the commencement of the monitoring program. Make note of any equipment damage or conditions that may prevent the collection of the environmental monitoring program samples.	☐
GENERAL SAMPLING INSTRUCTIONS		
Prevention of Cross-Contamination	Ensure that any laboratory provided sampling instructions are strictly followed. Latex or nitrile gloves should be worn during sampling and should be replaced with fresh gloves after all sample containers are filled at each sampling location. Dedicated sampling equipment such as sampling poles should be cleaned with soap and water after each sample is collected to prevent cross-contamination. As a general recommendation, please refrain from using insect repellant, disinfection hand gel or other chemical products before and during sample collection. Also, please refrain from smoking during sample collection.	☐
Sample Care (including Packing of Cooler)	All sample containers should be tightly sealed and properly labelled with the sample ID, date and time of sample collection, location of sample collection and parameters to be analyzed. The outside of the bottles should be cleaned with soap and water and dried prior to placing the samples in the cooler. The samples should be stored on ice in a cooler until delivery to the laboratory. A chain of custody form should be filled out completely and be used to track the samples and placed in the cooler with the samples, in a ziplock bag. Keep the last page of the Chain of Custody and give it to the Hamlet Foreman for their records.	☐
RAW WATER SUPPLY		
Sampling Station ARC-1	Station ARC-1 is a raw water supply (from Marcil Lake) volume monitoring location. The water licence does not require the collection of any water samples from this location. Measure and record (in m^3) the monthly and annual quantities of water pumped from Station ARC-1.	☐
SOLID WASTE DISPOSAL FACILITIES		
Sampling Station ARC-9	Landfill runoff is collected once monthly during periods of observed flow (see Schedule in Appendix E for timing and list of parameters to be sampled). Runoff samples are collected from the flow at ARC-9 by immersing the sample bottle into the runoff stream neck first to a depth of 5 to 10 cm (if possible). The sampling container is filled with runoff and the sample bottle is raised neck first to prevent sample spillage.	☐

ACTIVE SEWAGE DISPOSAL FACILITY		
Sampling Station ARC-3,ARC-4 and ARC-5	Wastewater effluent samples are collected from the active sewage effluent flow monthly from May to August minimum 3 times. Wastewater effluent samples are collected from the Sewage effluent flow at KIM-3 by immersing the sample bottle into the sewage flow neck first to a depth of 5 to 10 cm (if possible). The sampling container is filled with effluent wastewater and the sample bottle is raised neck first to prevent sample spillage.	☐

Checklist Performed By:

Name	Signature	Date

Sample Bottle Requirements for Parameters Listed in Conditions 2 and 3 of Part H of Nunavut Water Board Licence No. 3BM-ARC1419.

Parameter	Recommended Sample Container	Preservative	Hold Time
Alkalinity	250 mL plastic	None	14 days
Anions (Br, Cl, F, NO_3, NO_2, PO_4, SO_4)	250 mL plastic	None	5/28 Days
Biochemical Oxygen Demand (BOD_5)	500 mL plastic	None	4 days
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	500 mL plastic	None	4 days
Carbon, Total Organic (TOC)	250 mL plastic	H_2SO_4 (pH < 2)	10 days
Conductivity	250 mL plastic	None	28 days
Dissolved ICPMS, ICP Metals	250 mL plastic	None - if not field filtering	60 days
Total ICPMS, ICP Metals - NOT FILTERED	250 mL plastic	HNO_3 (pH < 2)	30 days
Nitrogen - Ammonia (NH_3 - N) / Total Kjeldahl Nitrogen (TKN)	250 mL plastic	H_2SO_4 (pH < 2)	10 days
Phenolics – Total	120 mL amber glass	H_2SO_4 (pH < 2)	30 days
Solids - (TS, TSS, TDS)	500 mL plastic	None	7 days
Microbiological (incl. faecal coliforms)	300 mL plastic - Sterilized	$Na_2S_2O_3$	48 hours
Total Hardness	500 mL plastic	None	28 days

Appendix B:
Environmental Monitoring Program Schedule

Kimmirut Monitoring Program Schedule Nunavut
Water Board Licence No. 3BM-ARC 1419

Monitoring	Location	Month												
Station ID	**Description**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
ARC-1	Raw water supply from Marcil Lake	V	V	V	V	V	V	V	V	V	V	V	V	V
ARC-9	Runoff from Solid Waste Disposal Facilities					LR[1]	LR[1]	LR[1]	LR[1]					
ARC-3,4 ,and 5	Effluent of Wastewater to Wastewater Facilities (active at the time of sampling)					WW[2]	WW[2]	WW[2]	WW[2]					
Test Groups														
V	Volume (m^3)													
LR	Landfill Runoff	(Biochemical Oxygen Demand (BOD_5), pH, Total Suspended Solids (TSS), nitrate-nitrite, total phenols, total hardness, magnesium, sodium, total arsenic, total copper, total iron, total mercury, faecal coliforms, conductivity, ammonia nitrogen, oil & grease (visual), total alkalinity, calcium, potassium, sulphate, total cadmium, total chromium, total lead, total nickel)												
WW	Wastewater Effluent	(Biochemical Oxygen Demand (BOD_5), Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Total Suspended Solids (TSS), pH, conductivity, oil & grease (visual), faecal coliforms, nitrate-nitrite, total phosphorus, magnesium, sodium, chloride, total hardness, ammonia nitrogen, total phenols, calcium, potassium, sulphate, total alkalinity, total trace metals (including Al, Sb, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Sn, Sr, Tl, Ti, U, V, Zn), total arsenic, total mercury, Total Organic Carbon (TOC))											

[1] TBD by operational staff - samples to be collected one week prior to proposed discharge date, once at the beginning of discharge and weekly thereafter until cessation of discharge.

[2] Once annually in the summer, given due consideration to adequate ground thaw and obtaining a representative groundwater sample.