Water Monitoring Plan

Cambridge Bay Soil and Water Treatment Facility
Nunavut Water Board Licence 1BR-CST1723

Cambridge Bay, Nunavut

Version 1

Kitnuna Environmental Ltd.
16-025

May 2017

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EXECUTIVE SUMMARY

This Plan outlines how KEL will complete the groundwater and effluent water monitoring program at the facility during its operation. Specifically, this document outlines when groundwater and effluent water monitoring and sampling will occur and the criteria that will be monitored for. This Plan also describes the steps that will be taken prior to construction to ensure the facility has not impacted the surrounding environment during operations. This groundwater monitoring program will be used as the basis for any additional groundwater monitoring and sampling that will be necessary during the lifetime of the facility with regards to proposed additions.

1.0 INTRODUCTION

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Kitnuna Environmental has been issued a water licence by the Nunavut Water Board (NWB) with approval to construct and operate a soil and water treatment facility (the Facility) in the Hamlet of Cambridge Bay. The Facility receives snow, water and soil contaminated with petroleum hydrocarbons. The Facility, operating under Water Licence 1BR-CST1723, is located adjacent to the Cambridge Bay Sewage Lagoon. The land is owned by the Hamlet of Cambridge Bay and has been leased to Kitnuna Environmental. The location of the Facility is illustrated on Figure 1.

This Water Monitoring Plan outlines the requirements for a groundwater and effluent water monitoring program set forth in Part D and Part K of the Licence. The requirements of the Monitoring Program defined in the licence are summarized as follows:

- Establish and maintain a groundwater monitoring program consisting of at least one monitoring station up-gradient of the Facility and two stations down-gradient;
- Establish and maintain a monitoring station at the final discharge point from the Waste Management Facility;
- Measure and record in cubic meters, the daily quantities of Effluent discharged from the Facility;
- Determine the GPS co-ordinates (in degrees, minutes, seconds) of all locations where wastes associated with the Facility are deposited; and
- Monitor compliance with respect to Part D, Item 7 by collecting a representative composite sample from a minimum of 5% of the total volume to be released from the final discharge point at Monitoring Program Station CST-1.

2.0 GROUNDWATER AND EFFLUENT MONITORING STATIONS

Initial groundwater work will be completed prior to operations commencing at the Facility and the information generated will be incorporated to the future version of this Plan, and be noted as Site baseline values.

Three shallow groundwater wells (CST-2 up-gradient, CST-3 down-gradient and CST-4 down-gradient) will be installed around the perimeter of the Facility. The placement will be chosen to best represent up-gradient and down-gradient conditions in the shallow groundwater and/or active layer. Installation details of each monitoring well will be included in an updated version of this Plan. Monitoring Station CST-1 will be the final discharge point from the Facility and its location will be included once determined.

Table 2-1: Monitoring Station ID and Locations

Monitoring Station ID	Northing	Easting
CST-1		
CST-2		
CST-3		
CST-4		

3.0 GROUNDWATER AND EFFLUENT MONITORING PARAMETERS

The parameters selected for groundwater monitoring and effluent discharge are in accordance with Part K, Item 5 of the Licence and are presented in the table below.

Table 3-1: Groundwater Monitoring Parameters

Parameters		
Total Copper	Total Suspended Solids	Total Coliform
Total Chromium	Total Hardness	Conductivity
Total Phosphorus	pH	Oil and Grease (visual)
Total Iron	Potassium	Polycyclic Aromatic Hydrocarbons (PAH)
Total Aluminum	Magnesium	Total Petroleum Hydrocarbons (TPH)
Total Lead	Sulphate	Total Mercury
Total Manganese	Calcium	Total Cobalt
Total Alkalinity	Ammonia Nitrogen	Chloride
Total Cadmium	Biochemical Oxygen Demand (BOD)	Total Phenols
Total Nickel	Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	Total Zinc
Total Arsenic	Nitrate-Nitrite	Sodium

4.0 SELECTED SITE GUDIELINES

The following guidelines have been selected for comparison and evaluation of groundwater and surface water in the vicinity of the Facility:

4.1. Groundwater

Federal Interim Groundwater Quality Guidelines (FIGQG) for Federal Contaminated Sites, November 2012; Table 3, Tier 1 Lowest Guideline for Commercial and Industrial Land Use

4.2. Effluent Discharge

Effluent discharge limits from the Waste Management Facility at Monitoring Station CST-1 as defined in Part D, Item 7 of 1BR-CST1723 for the Facility.

Table 4-1: Effluent Discharge Guideline

Parameter	Maximum Allowable Concentration
pH	6.0 to 9.0
Total Suspended Solids	50 mg/L
Oil and Grease	15 mg/L and no visible sheen
Total Lead	0.001 mg/L
Benzene	0.370 mg/L
Toluene	0.002 mg/L
Ethylbenzene	0.090 mg/L
Xylenes	0.18 mg/L

5.0 MONITORING AND SAMPLING FREQUENCY

Due to the geographical location of the Facility and the short operational season, groundwater monitoring and sampling will occur once annually during summer operations. This event will be planned for the period of maximum thaw, when it is anticipated that the active layer will have the highest amount of groundwater available. In the event of an unplanned or accidental release of untreated material from the Facility, additional monitoring and sampling will be evaluated and implemented as necessary.

Effluent monitoring and sampling will occur as per the requirements set forth in Part K, Item 4 of the Licence, by collecting a representative composite sample from a minimum of 5% of the total volume to be discharged.

Annual groundwater monitoring and sampling, along with effluent sampling, will be in place for the lifetime of the Facility, with all results being reported in the Annual Report required under Part B, Item 1 of the Licence.

6.0 MONITORING AND SAMPLING METHODOLOGY

During each groundwater sampling event, each monitoring well will be assessed to determine its overall state and condition. Any issues will be noted and if necessary repairs will be completed.

Monitoring wells will be measured for depth to LNAPL (if present) and the depth to groundwater from the top of the well casing using an interface probe. Measurements will be taken prior to any purging or sampling and the interface probe will be cleaned with a solution such as Alconox after measuring each well.

Prior to sample collection wells will be purged to remove stagnant water. This will be completed by removing three well volumes of water from the well, or until field parameters stabilize indicating that representative groundwater has entered the well casing. Purging will be completed using dedicated equipment such as bailers, polyethylene tubing or a low flow bladder pump with tubing.

Field parameters will be analyzed using a portable multimeter and recorded in the field so that they can be incorporated into the Annual Report. Any visual observations (sediment, sheen etc.) will also be noted and recorded.

Following purging and collection of field parameters, groundwater samples will be collected from the monitoring wells using dedicated sampling equipment and placed into laboratory supplied sample containers. Effort shall be taken to avoid collecting any suspended solids in each sample which could alter the analytical results. Specific sampling requirements including field filtering and preserving will be reviewed with the laboratory to ensure that all samples are collected correctly in the field. Field personnel will take care to avoid cross contamination when switching between well locations and will ensure to wear new, clean disposable gloves prior to collecting each sample.

Effluent samples will be collected directly from the water treatment plant or water storage tank into laboratory provided sample bottles. Field personnel will implement the same quality assurance and dedicated equipment measures as described in the groundwater methodology. Effluent monitoring will be recorded on an Effluent Discharge Tracker sheet, which can be found in Appendix A.

All samples will include at least the following information: a unique sample number, sample type, name of collector, date and time of collection, place of collection and samples preservative. All pertinent information will be recorded in a field log book, including at a minimum: purpose of sampling, location of sampling point, name of field personnel, type of sample, method of sampling, date and time of sampling and preservation (if any).

To minimize the potential for volatilization or biodegradation between sampling and analysis, samples will be kept as cool as possible without freezing. Where necessary samples that require preservation will be done so following the instructions provided by the laboratory with the sample container delivery. Samples will be placed on ice and packaged for transportation and delivery to the laboratory for analysis within the laboratory designated hold-times. While in transportation the samples will be under a Chain of Custody that will be received, and signed upon arrival at the laboratory. Samples will be submitted to a laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA) for the required analysis. The analyses will be performed in accordance with approved methods as recognized by CALA.

7.0 QUALITY ASSURANCE & QUALITY CONTROL (QA/QC)

7.1. Sample Handling

Samples will be collected and handled while wearing disposable nitrile gloves which are changed prior to collecting each sample to ensure no cross contamination occurs.

7.2. Field Quality Controls

Quality controls that will be employed during the monitoring program include the collection of groundwater samples using dedicated tubing and cleaning and rinsing the bladder pump in between wells. Samples will be temperature preserved to maintain integrity and will be transported to the laboratory to ensure receipt within the selected parameters hold times.

7.3. Blind Field Duplicates

Blind field duplicates will be collected at a rate of 1 per 10 samples collected, or at a minimum, one duplicate per sampling event. The duplicate samples will be collected, transported and submitted to the laboratory in the same manner as all other samples.

7.4. Laboratory QA/QC Program

Water samples will be submitted to a laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA). Accredited labs conduct an internal quality control program to ensure that the equipment used in the laboratory is producing acceptable results.

The relative percent difference (RPD) was calculated on duplicate sample results by the following formula:

$$RPD\% = \left| \frac{(C1 - C2)}{[\frac{C1 + C2}{2}]} \right| \times 100\%$$

C1 and C2 are the concentration values of the sample and the duplicate. An RPD% greater than 20% indicates a value that may be less reliable than other results.

8.0 BASELINE GROUNDWATER CONDITIONS

Baseline groundwater conditions will be obtained during the first annual water monitoring program prior to operations at the Site. Results will be reported in the Annual Report, along with an updated version of this Plan to form the basis for comparison of sample results from subsequent groundwater sampling events.

9.0 ACTION LEVELS

The action levels that are described in the following section are established to trigger Corrective Actions. Results from groundwater monitoring and sampling will be evaluated against the Action Levels and if a contaminant of concern has an exceedance, corrective action planning will be initiated. Action Levels will be determined once baseline groundwater conditions have been obtained.

10.0 CORRECTIVE ACTIONS

Corrective Actions shall be evaluated and/or implemented if one of the following occurs:

- Measurable LNAPL detected in any of the groundwater monitoring wells;
- An unplanned or accidental release of waste material from the Facility; and/or
- Groundwater concentrations of one or more of the monitored parameters exceed Action Level.

10.1. Step 1 of Corrective Actions

During Step 1 of Corrective Actions, the action level exceedance will be evaluated to determine the likelihood that it occurred from operations at the Facility. If the exceedance occurs from a contaminant that is present at the facility, then additional sampling shall occur to determine the trend of the exceedance. In the event an unplanned or accidental release of waste material occurs, samples will be collected to determine if any impacts have been cause to groundwater. Based on the nature of on the unplanned release, sample quantity and follow up needs will be determined and provided to the Inspector and the NWB.

If an Action Level exceedance is deemed to be anomalous based on subsequent sampling, then no further remedial action will be taken and monitoring will return to annually as outlined in this Plan. If subsequent sampling indicates a stable or increasing trend, then Step 2 of Corrective Actions will be implemented.

As part of Step 1 Corrective Actions, operations and maintenance practices will be reviewed to determine conditions that triggered the exceedance and to assess the probability that the exceedance is directly related to the operation of the Facility and not due to other factors which may have the ability to affect groundwater in the area. The outcome of this assessment will be discussed with the Inspector and the NWB in the event it is believed an action level was triggered for a reason other than the day to day operations of the Facility.

In the event LNAPL is detected in any monitoring well, then Step 2 of Corrective Actions shall be implemented.

10.2. Step 2 of Corrective Actions

If it is believed that an exceedance occurs from operations of the Facility and subsequent sampling during Step 1 indicates that concentrations are stable or increasing, then KEL will prepare a Remedial Action Plan (RAP) to further investigate the impacts or LNAPL detection. The RAP will be submitted to the Inspector and the NWB for review, comment and approval. KEL will implement the RAP once it is approved. If necessary, KEL will implement immediate actions to help mitigate impacts while awaiting a formal RAP.

11.0 ANNUAL REPORTING

All results from groundwater and effluent discharge sampling will be included in the Annual Report fulfilling the requirements set forth in the Licence. Any additional monitoring or sampling undertaken in response to an Action Level exceedance will also be recorded and presented in the Annual Report.

12.0 REFERENCES

American Water Works Association/Water Environment Foundation. 2012. Standard Methods for the Examination of Water and Wastewater.

Environment Canada. 2012. Federal Contaminated Sites Action Plan (FCSAP) Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites.

Government of Nunavut Department of Environment. 2014. Environmental Guideline for the Management of Contaminated Sites.

Nunavut Water Board. 2017. Water Licence No. 1BR-CST1723 Cambridge Bay Soil and Water Treatment Facility..

FIGURES

Proposed Cambridge Bay Soil and Water Treatment Facility

File: 16-025_16STF.dwg Date: December-19-16 4:45:34 PM

PHOTO SOURCE: GOOGLE EARTH

Facility Location

NOT TO SCALE

KEL

Date: 19-DEC-16	Drawn: JF	PROPOSED CAMBRIDGE BAY SOIL AND WATER TREATMENT FACILITY	Figure: 1
File name: 16-025_16STF-A.dwg	Approved: DRAFT		

APPENDIX A

Effluent Discharge Tracker Sheet

Cambridge Bay Soil and Water Treatment Facility

Effluent Discharge Tracker

Date (DD/MM/YY)	Inspector	Discharge Time		Discharge Notes (volume est.), Sample info	Inspection Findings	
		Start	Finish		Erosion	Repairs Required

**placing an X in a shaded box requires entry into Maintenance Log and follow-up.*

Office Back-up: Date (DD/MM/YY) Initial _____