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Baseline Conditions Assessment, Environmental Monitoring, Reclamation and Post-Closure Plan Cambridge Bay Soil and Water Treatment Facility

Cambridge Bay, Nunavut

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Submitted to:

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May 17, 2019
Project: 64904.01

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Ltd. (GEMTEC) was retained by Nunavut Excavating 2007 Inc., to development a framework for the completion of a baseline conditions assessment, annual environmental monitoring plan, site reclamation plan and post-closure monitoring plan for the proposed Cambridge Bay Soil and Water Treatment Facility located in Cambridge Bay, Nunavut (hereafter referred to as the "site"). The general location of the site is illustrated on Figure A.1, provided in Appendix A.

Nunavut Excavating 2007 Inc. (NE), is proposing to develop and operate a soil and water treatment facility in Cambridge Bay, NU. The proposed facility is expected to operate for a period of five years and will be located adjacent to the hamlet of Cambridge Bay landfill. The proposed treatment facility is to be located at the following location: 69°07'40.56" N, 105°02'54.08" W.

1.1 Purpose

The purpose of this document is four-fold:

- To provide a summary of steps and measures taken to ensure the project site is sufficiently characterized prior to construction, such that existing impacts to soil, groundwater, surface water and sediment are identified;
- To prescribe to the satisfaction of the Nunavut Water Board an environmental monitoring plan to ensure that potential impacts to the local environment are identified and monitored on a regular basis;
- To identify site reclamation procedures; and
- To prescribe to the satisfaction of the Nunavut Water Board a post-closure monitoring plan to ensure that the site is reinstated back to its original state.

Readers of the document are also referred to the project's Environmental Protection Plan (NE, 2018a) for an overview of the project's environmental policy, summary of the environmental setting and summary of potential environmental effects.

The document presented herein has been prepared following the federal government guidance for landfarming petroleum hydrocarbon contaminated soils (SAIC, 2006).

1.2 Objective

The general objective of this document is to ensure that the performance of the treatment facility and environmental condition of the site following the operational period does not result in any increased risk to human health and the environment at the site.

This document is meant to be adaptive in its nature, such that information gathered during baseline sampling programme, through annual environmental monitoring or through facility

decommissioning and site reclamation can be used to adjust the proposed sampling and monitoring activities of subsequent work such that the objective of the document is maintained.

2.0 BASELINE CONDITIONS ASSESSMENT

Baseline environmental conditions will be assessed prior to construction of the proposed facility to determine the existing quality of various environmental media and to identify any existing or on-going sources of contamination in the vicinity of the proposed facility for the purpose of providing environmental quality benchmark data for which to compare the site reclamation quality objectives, following decommissioning of the proposed treatment facility.

2.1 Environmental Quality Guidelines

The Government of Nunavut Department of Environment has adopted the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CCME, 1991), including the Canada-Wide Standards for Petroleum Hydrocarbons in Soil (CCME, 2008), as such, environmental quality data for soil, groundwater and surface water during all aspects of the work described herein will be compared to the following environmental quality guidelines:

- Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME, 1999, with updates);
- Canada-Wide Standards for Petroleum Hydrocarbons in Soil (CCME, 2008);
- Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2007); and,
- Federal Interim Groundwater Quality Guidelines (Environment Canada, 2012).

2.2 Soil

Prior to construction of the proposed facility which encompasses an area of approximately 0.95 hectares (ha) surficial soil sampling will be undertaken to determine the concentration of heavy metals, petroleum hydrocarbons (PHCs) including benzene, toluene, ethylbenzene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs).

For the purpose of establishing baseline soil quality conditions within the footprint of the treatment facility and within its immediate vicinity, nine surficial soil sampling locations are proposed for collection and laboratory analysis of metals, PHCs/BTEX and PAHs. Surface soil sampling will be completed in a grid network to provide optimal aerial coverage within the proposed facility footprint.

For the purpose of this document, surficial soil is defined as soil or overburden material located between ground surface and 0.3 metres below ground surface. In addition to the nine surficial soil samples, one blind field duplicate will be collected and submitted for laboratory analysis for QA/QC purposes.

To augment surficial soil quality data, deeper soils within the active permafrost layer (active layer) will be investigated through installation of a shallow groundwater monitoring network further described in Section 2.3 below. As part of the groundwater monitoring well installation, one soil sample from each of the five proposed monitoring wells will be collected at a depth greater than 0.3 metres but within the active layer, which is assumed to range between 1.5 and 2.4 metres below ground surface (mBGS).

Information pertaining the analytical laboratory is provided in Section 3.4 of the document.

2.3 Groundwater

To ensure potential impacts to shallow groundwater within the active layer associated with the up gradient landfill are documented prior to construction of the proposed treatment facility and to provide a means of detecting potential failures in the proposed treatment facility liner, a shallow groundwater monitoring network will be installed. The proposed monitoring well network is illustrated on Figure A.1 in Appendix A.

The assumed groundwater flow direction is towards the southeast, generally following the topography in the vicinity of the site. The proposed groundwater monitoring network will be installed such that two monitoring wells are located up gradient of the proposed treatment facility and three are located down gradient of the proposed treatment facility. The monitoring well spacing down gradient of the treatment facility will be approximately 30 metres cross gradient with monitoring wells installed approximately 10 metres from the proposed treatment facility.

Monitoring wells will be installed in accordance with applicable regulations and constructed of 51 mm diameter schedule 40 PVC with 1.0-metre-long slotted well screen and flush-jointed riser pipe to extend to one metre above ground surface, within a protective casing (screen lengths may vary depending on field conditions). Silica sand will be placed around the screened interval extending 0.3 metres above the top of the screened interval; a minimum of 0.3 meters of bentonite hole plug will be used to seal the borehole to ground surface. Monitoring wells will be instrumented with dedicated Waterra inertial hand pumps to facilitate monitoring well development and purging, and sampling of groundwater.

Baseline groundwater samples will be collected from the five-well groundwater monitoring network and submitted for metals, PHC/BTEX, PAHs and a subset for volatile organic compounds (VOCs). In addition to the laboratory analytical program, field measurements of dissolved oxygen, temperature, electrical conductivity, redox potential and pH will be recorded. Samples to be submitted for laboratory analysis will be collected directly into laboratory supplied and preserved sample containers and shipped to a CALA certified laboratory under chain-of-custody procedures.

Prior to the collection of groundwater samples, the depth to groundwater will be recorded to verify groundwater flow directions.

2.4 Surface Water

Based on the proposed treatment facility's location relative to a surface water feature, four surface water samples will be collected from locations identified on Figure A.1 to determine baseline surface water quality down gradient of the proposed treatment facility.

Surface water samples will be submitted for laboratory analytical analysis of heavy metals and PHCs. In addition to the laboratory analytical program, field measurements of dissolved oxygen, temperature, electrical conductivity, turbidity and pH will be recorded. Samples to be submitted for laboratory analysis will be collected directly into laboratory supplied and preserved sample containers and shipped to a CALA-certified laboratory under chain-of-custody procedures.

2.5 Natural Environment

A survey of the natural environment of the site will be completed prior to construction. The purpose of the natural environment survey is to identify the existing ecological setting of the site with a focus on vegetation and wildlife. Photographs of the sites physical setting prior to construction will be taken to aid in the assessment of reclamation efforts and post-closure monitoring.

3.0 ENVIRONMENTAL MONITORING

During operation of the proposed treatment facility, environmental monitoring will be undertaken on an annual basis during the brief summer period. The purpose of the environmental monitoring program is to ensure that groundwater beneath the site and surface water down gradient of the site is routinely monitored to ensure no impacts are occurring from the proposed treatment facility.

An additional component of the environmental monitoring program includes monthly samples of discharge water from the water treatment plant associated with the proposed treatment facility. The water treatment plant will separate pure phase hydrocarbons from melt water and bio pile runoff prior to filtering particulate matter and treatment of hydrocarbons through a series of activated carbon and clay vessels preceding discharge to ground surface. Before discharging treated water to the environment, the Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) regional inspector will be notified.

For more information pertaining to the operation of the water treatment facility, readers of this document are referred to the Waste Management Plan (NE, 2018b).

3.1 Visual Monitoring

Visual monitoring of site conditions will be documented monthly, including photographs, during operation of the proposed treatment facility. Visual monitoring of the site will provide information on the physical condition of the facility, noting any evidence of soil erosion, frost action, ground staining, groundwater seeps or oil sheens that may indicate an environmental concern.

Additionally, monthly visual monitoring of site conditions will aid in determining any impacts to the natural environment, including wildlife, vegetation and any other ecological features in the vicinity of the site.

3.2 Groundwater

Groundwater monitoring will occur annually during late summer to determine if any impacts associated with the proposed treatment facility are occurring. Groundwater monitoring will utilize the groundwater monitoring network installed at the site as part of the baseline conditions assessment described in Section 2.3 of this document.

Following purging of three monitoring well volumes, groundwater will be collected from all five monitoring wells once annually. Groundwater samples will be submitted for laboratory analysis of metals, PHC/BTEX, PAHs and if VOCs are detected in groundwater during the baseline conditions assessment, a subset of two groundwater samples will be submitted for analysis of VOCs. Augmenting the laboratory analytical program, field measurements of dissolved oxygen, temperature, electrical conductivity, redox potential and pH will be recorded. Samples to be submitted for laboratory analysis will be collected directly into laboratory supplied and preserved sample containers and shipped to a CALA certified laboratory under chain-of-custody procedures.

Prior to the collection of groundwater samples, the depth to groundwater will be recorded to verify groundwater flow directions.

3.3 Surface Water

Routine environmental monitoring of surface water adjacent to the proposed treatment system will occur monthly during the ice-free period of the year which is assumed to be the months of July, August and September. The requirement for monthly sampling during the ice-free period is to ensure that potential impacts associated with the treatment facility and the proposed water treatment plant whose treated water is proposed to discharge to ground surface (NE, 2018b) will be identified and remedial actions taken in a timely manner, if necessary.

Surface water monitoring will occur at four locations as indicated in Section 2.4 and as illustrated on Figure A.1. Surface water monitoring will include four samples collected and submitted monthly during the ice-free period for analysis of metals and PHCs, in addition to the collection of field measurements for dissolved oxygen, temperature, electrical conductivity, turbidity and pH.

Samples to be submitted for laboratory analysis will be collected directly into laboratory supplied sample containers and shipped to a CALA-certified laboratory under chain-of-custody procedures.

3.4 Water Treatment Plant Discharge

As described in Waste Management Plan (NE, 2018b) for the proposed treatment facility, a mobile water treatment plant will treat PHC impacted melt water and runoff from the proposed treatment facility prior to discharge to the local environment. The proposed treatment plant will consist of an oil-water separator, filter sock, activated carbon and clay filtration vessels.

During operation of the water treatment plant, samples of the discharge water will be sent to a CALA-certified analytical laboratory for analysis of PHC/BTEX parameters monthly or following the treatment of 2,500 litres, which ever occurs more frequently, to ensure the water treatment plant is operating effectively and that discharged water meets regulatory criteria. The proposed discharge location is the small watercourse located approximately 40 m east of the proposed treatment facility, south of the existing road. Discharge water will be conveyed to the small watercourse through a discharge pipe connected to the treated water storage tank. The proposed discharge location is illustrated on Figure A.1.

Pure phase product captured in the oil water separator will be containerized and disposed of in accordance with applicable regulations governing the disposal of waste oil.

3.5 Quality Assurance and Quality Control

The proposed QA/QC program will consist of standard sampling protocols, the collection and submission of blind field duplicate soil, groundwater and surface water samples, and media-specific field and trip blanks.

Samples collected for laboratory analysis will be collected directly into laboratory supplied, and appropriately preserved sample containers. All sample containers used for the collection and submission of environmental quality samples for laboratory analysis will be supplied and appropriately preserved by the laboratory and stored in coolers with ice packs. All samples selected for laboratory analysis will be shipped in custody-sealed coolers to Maxxam Analytics of Yellowknife, NWT, under chain of custody procedures and analysed within their respectively holding periods.

Blind duplicate samples will be collected at a frequency of one per year or at a frequency of one in every 10 samples, whichever is greater, for each media investigated and for each analysis suite analysed.

During each sampling event where VOCs (including BTEX specific samples) are collected from soil, groundwater or surface water, a field blank will be prepared. The purpose of a field blank is to assess ambient contamination from field conditions during the sampling event. Field blanks will be prepared in the field by pouring laboratory supplied deionized water into a sampling container. Furthermore, to ensure a robust QA/QC programme, trip blanks will also be utilized when sampling and submitting samples for volatile parameters. Trip blanks consist of a laboratory

prepared blank that is shipped to the site along with the empty sample containers and accompanies the sample shipment back to the lab following completion of the sampling event. The purpose of the trip blank is to assess contamination introduced during shipping and field handling procedures.

Field and trip blanks will be shipped to Maxxam Analytics of Yellowknife, NWT, under chain of custody procedures along with other environmental samples collected as part of this project.

The QA/QC program will also include internal laboratory QC performed by Maxxam Analytics of Yellowknife, NWT. A laboratory quality assurance and quality control acceptance letter is provided in Appendix B of this document.

3.6 Annual Environmental Reporting

An annual report will be prepared summarizing the proposed treatment facility's operations and measures taken to ensure compliance with environmental regulations. Annual environmental monitoring activities will be summarized including methodologies employed, QA/QC measures implemented, results of laboratory testing, comparison of environmental quality data to regulatory guidelines and baseline environmental quality data, and provide recommendations for on-going environmental monitoring and operation of the proposed treatment facility.

If impacts to the environment are detected during the annual monitoring program outlined above, steps will be taken to revise this monitoring program such as increasing the monitoring frequency, establishment of additional monitoring locations or implementation of engineering controls to ensure that environmental impacts are managed in a responsible manner.

Table 1 below provides an approximated schedule of the anticipated annual monitoring activities associated with the proposed treatment facility. A listing of chemicals to be analysed as part of the baseline conditions assessment, annual environmental monitoring, site reclamation and during post-closure monitoring, is provided in Appendix A of the Waste Management Plan (NE, 2018b) prepared in support of this project.

Table 1 – Annual Environmental Monitoring Schedule

Task	Date
Visual Monitoring	Monthly (January to December)
Groundwater Monitoring	August 15th
Surface Water Monitoring	July 15th, August 15th, September 15th
Treatment Plant Discharge	June 30th, July 15th, August 15th, September 15th

Note: Treatment plant discharge sampling may occur more frequently than the dates presented above based on the volume of effluent treated, see Section 3.3.

4.0 DECOMISSIONING AND SITE RECLAMATION

Decommissioning of the proposed facility is expected to occur approximately five years after the facility is constructed. Following decommissioning, a soil sampling program will be implemented to determine the horizontal and vertical extent of soil impacts.

Soil collected following decommissioning will be compared to the appropriate regulatory guidelines and to the baseline data set collected prior to construction. If contaminants are identified in soil following decommissioning, at a concentration greater than the average concentration established for the site during the baseline conditions assessment (presented in Section 2.0), then remedial measures will be undertaken.

Remedial measures are likely to include removal of site soils identified as exceeding the baseline condition. Excavated soils will be disposed of in accordance with regulatory guidelines. Following the removal of any excavated soil, site soils will be stabilized through planting of native vegetation or through other vegetative cover means, compatible with surrounding vegetation and land uses.

During any remedial excavation, measures such as soil wetting and installation of silt fencing will be undertaken to ensure that excess dust is not generated and that erosion of disturbed soil does not enter adjacent surface water features.

Following the successful reclamation of site soils, a report will be prepared outlining the results of the soil sampling programme, a summary of any remedial measures taken and provide recommendations for inclusion in the post-closure monitoring plan presented below.

5.0 POST-CLOSURE MONITORING

Following the successful decommissioning and reclamation of the site, a post-closure monitoring program will be instituted at the site. The post-closure monitoring program will monitor groundwater beneath the site and surface water down gradient of the site for a one-year period, or annually (as described in Section 3.2 and Section 3.3, respectively) until potential impacts to groundwater and surface water are addressed and concentrations of contaminants have returned to established site baseline conditions.

5.1 Groundwater Monitoring

Groundwater monitoring during post-closure will endeavour to utilize the proposed groundwater monitoring network described in Section 2.3 of this document. However, if during decommissioning of the proposed treatment facility, retention of the groundwater monitoring wells is not possible a new groundwater monitoring network will be installed at the site. If a new groundwater monitoring network is required for post-closure monitoring, a network of five wells is proposed, including: one background monitoring location, located up gradient of the proposed treatment facility, one monitoring location within the foot print of the decommissioned facility and three down gradient monitoring well locations.

The post-closure groundwater analytical program will consist of five samples plus one blind field duplicate for analysis of heavy metals, PHCs and any other potential contaminant identified during the annual monitoring program for the site. Augmenting the laboratory analytical program, field measurements of dissolved oxygen, temperature, electrical conductivity, redox potential and pH will be recorded.

5.2 Surface Water Monitoring

The post-closure monitoring program for surface water will consist of the same four surface water monitoring locations utilized throughout the baseline conditions assessment and the environment monitoring programme (Section 2.4 and Section 3.3, respectively). The post-closure surface water analytical programme will include analysis of heavy metals, PHCs and any other potential contaminants identified during the annual monitoring program for the site. Augmenting the laboratory analytical programme, field measurements for dissolved oxygen, temperature, electrical conductivity, turbidity an pH will be recorded.

5.3 Natural Environment

A survey of the natural environment of the site will be completed following the post-closure monitoring period. The purpose of the natural environment survey is to confirm that no permanent ecological affects attributable to the proposed treatment facility have occurred and the ecological function of the site following decommissioning and site reclamation is equivalent to the pre-construction ecological function of the site.

5.4 Post-Closure Monitoring Report

The post-closure monitoring report will be prepared following year one of post-closure monitoring period summarizing the results of the post-closure monitoring activities outlined above. The post-closure monitoring report will summarize methodologies employed, QA/QC measures implemented, results of laboratory testing, comparison of environmental quality data to regulatory guidelines and baseline environmental quality data, provide conclusions relating the post-closure monitoring objectives described above, and provide recommendations for further post-closure monitoring or remediation, if necessary. The proposed post-closure monitoring schedule will follow the annual environmental monitoring schedule outlined in Table 1 of Section 3.6.

6.0 REFERENCES

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life.

Canadian Council of Ministers of the Environment (CCME). 2008. Canada-Wide Standards for Petroleum Hydrocarbons in Soil.

Environment Canada. 2012. Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminates Sites.

Nunavut Excavating Ltd. (NE) 2018a. Environmental Protection Plan – Cambridge Bay Soil and Water Treatment Facility. July.

Nunavut Excavating Ltd. (NE) 2018b. Waste Management Plan – Cambridge Bay Soil and Water Treatment Facility. June.

SAIC Canada (SAIC). 2006. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. Prepared for Contaminated Sites Division and Emergencies Engineering Technologies Office, Environmental Technology Centre, Environment Canada. May 31.

APPENDIX A

Figure A.1 – Site Layout

LEGEND

- PROPOSED SOIL AND WATER TREATMENT FACILITY LOCATION
- PROPOSED MONITORING WELL
- PROPOSED SURFACE WATER MONITORING LOCATION
- TREATED DISCHARGE WATER HOLDING TANK
- DISCHARGE PIPE/OUTLET

Scale 1:2500

0 50 100 150m

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Drawing: SITE LAYOUT

Client: NUNAVUT EXCAVATING 2007 INC.

Project		CAMBRIDGE BAY SOIL & WATER TREATMENT FACILITY CAMBRIDGE BAY, NUNAVUT
64904.01		
Drwn by: P.C.	Chkd by: D.P.	
Date: MAY 2019	Rev.: 0	**FIGURE A.1**

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APPENDIX B

Laboratory Acceptance Letter

Maxxam Analytics
9331 48 ST NW
Edmonton, AB T6B 2R4
Main: (780) 577 7100
maxxam.ca

March 26, 2019

To whom it may concern:

This is to confirm that Maxxam Analytics Edmonton is accredited to ISO/IEC 17025:2017 by the Standards Council of Canada (SCC) for specific listings included on our scope of accreditation. This scope is available on SCC's website (https://www.scc.ca/en/system/files/client-scopes/114_e.pdf) and includes:

Petroleum Hydrocarbons (PHCs)
Polycyclic Aromatic Hydrocarbons (PAHs)
Benzene, Toluene, Ethylbenze & Xylenes (BTEX)
Volatile Organic Carbons (VOCs)

In addition, Maxxam Analytics Edmonton confirms that we have the capacity to analyze for these tests at the following frequency:

Baseline Program
Soils: 15 samples for metals, PHCs/BTEX and PAHs
Groundwater: 6 samples for metals, PHCs/BTEX and PAHs, 1 sample for VOCs
Surface Water 5 samples for metals, PHCs/BTEX and PAHs

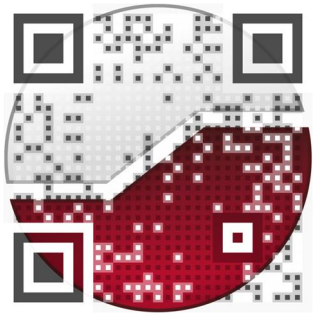
Annual Program (five year period)
Groundwater: 6 samples for metals, PHCs/BTEX and PAHs, 1 sample for VOCs
Surface Water: 4 samples for metals, PHCs/BTEX and PAHs monthly for four months.
Treatment Plant Discharge: 1 sample monthly for four months for PHCs/BTEX

Post-Closure Program
Soils: 10 samples for metals, PHCs/BTEX and PAHs
Groundwater: 6 samples for metals, PHCs/BTEX and PAHs, 1 sample for VOCs
Surface Water 5 samples for metals, PHCs/BTEX and PAHs

Sincerely,

Rhonda Reid
Sr. QA Manager, Edmonton/BVCC

experience • knowledge • integrity



civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

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