Quality Assurance/Quality Control Plan

Submitted per Section J of Transport Canada (TC)'s Nunavut Water Board (NWB) Licence for the Resolute Bay Landfill Remediation Project (1BR-RBL1929).

Taken from p. 29-32 of the Post Closure Monitoring Plan.

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7.5.2 Action Levels

Based on the thermistor data for each time interval, a chart summarizing the soil temperature profile data results will be created to plot cumulative permafrost aggregation over time. Once readings are taken, node depths can be correlated with temperature readings to deduct the aggregation of permafrost. These results will be charted and analyzed appropriately.

For thermal monitoring, it is predicted that steady state permafrost aggradation will be reached after year 5 based on the maximum landfill vertical cover depth (See Appendix D). After this timeframe, the theoretical frost penetration front is expected to reach either the existing permafrost or the capped landfill waste.

Further statistical comparison to baseline expectations can be performed after the installation of thermistors. It is recommended that after year 5, subsequent monitoring events may be used for the statistical analysis to evaluate the steady state conditions of the permafrost, if required.

7.6 Quality Assurance and Quality Control

The water licence recommends the use of the guidance document *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 QAQC Plan* (INAC, 1996) for the development of the QA/QC plan for the LTM program. In recent years, however, the CCME has published updated guidance for conducting environmental site characterization projects, which is relevant to the current LTM plan. As a result, it is recommended the adoption of this newer guidance (CCME, 2016) as the basis for this QA/QC plan.

7.6.1 Certification and Training

The laboratory selected for each year of the LTM project will be certified by the Canadian Association for Laboratory Accreditation Inc. (CALA). This accreditation program includes an initial site assessment and regular evaluation of laboratory performance. The laboratory will be certified for each of the analytes to be tested.

ISO/IEC 17025:2017 is the international standard for testing and calibration laboratories. It "specifies the general requirements for the competence, impartiality and consistent operation of laboratories" and is applicable to all organizations performing laboratory activities. The lab selected for the LTM program will be ISO/IEC 17025 certified.

Field personnel will be trained to perform each sampling task in accordance with written standard operating procedures.

7.6.2 Sampling Methods

Sampling methods to be performed as noted in sampling plan, above. Any deviations from the sampling plan will be noted in field notes and in the final report.

The field assessor will use fresh disposable nitrile gloves for the collection of each sample. Any non-dedicated sampling equipment will be decontaminated with Alconox sample detergent and rinsed with distilled water between uses.

7.6.3 Field Equipment

For each piece of field equipment, the field assessor will note instrument type and model number in the field notes. Each piece of field equipment will be traceable and identifiable with a unique name or number, so that any equipment errors not noted in the field can be traced after the fact.

A field assessor will maintain calibration records for all equipment requiring calibration. Instrument inspection and maintenance records (whether internal or provided by an equipment supplier) will be retained and referenced where necessary.

7.6.4 Sample Handling, Custody and Analysis

Analytical protocols will be selected by the lab for all analysis required for the LTM program. The field assessor will confirm that these analytical protocols are acceptable before the field program begins.

Samples will be collected in jars provided by the project laboratory. Preservation will be provided by the project lab, and the field staff will preserve samples in accordance with laboratory instructions. The field assessor will note hold laboratory hold times for all analytes and make every effort to have samples to the lab before the hold time expires. Given the project location and attendant logistical challenges, some short-hold time analytes (e.g., nitrate/nitrite) may come close to or exceed laboratory hold time requirements. In this case, the field assessor will discuss interpretation of data on a case-by-case basis with the lab.

Samples will be placed into coolers with ice for preservation during the field program and for shipment to the lab. Samples will be shipped to the lab accompanied by chain of custody forms identifying samples, volumes, dates, and other pertinent information. Sample identification labels on jars will be written clearly in ink and cross-checked before shipment with chain of custody forms. The field assessor will use consistent sample identification numbers so that mistakes can be identified quickly.

Field quality control will consist of the following samples:

- Field duplicates are collected in the field from the same location by placing aliquots of approximately ten percent of the total sample volume in both primary and duplicate sample containers alternately. Field duplicates should be “blind,” i.e., not identifiable as duplicates by their ID. This program proposes one duplicate sample be collected for every ten primary samples.
- A trip blank should be collected for volatile components for the program because volatile components can be introduced to samples from the atmosphere or from cross-contamination in transport. The trip blank is a laboratory-prepared sample of deionized water, known to contain no contaminants. The trip blank should be present during all sampling and returned to the

laboratory for analysis after the program is complete. One trip blank sample should be collected for each mobilization to the site.

Laboratory quality control will consist of the following methods:

- Laboratory duplicates will be analyzed by the lab based on their quality control program.
- Laboratory blanks, i.e., generic samples of a matrix prepared with known zero concentrations of analytes of concern, will be analyzed by the project lab based on its quality program.
- A Matrix spike is a sample of an analyte of concern with a known concentration in the matrix. Matrix spikes will also be included in the lab quality program.

Reportable detection limits for the program will be dependent on the capabilities of the project lab. A competent person will ensure that detection limits for all analytes are below relevant standards; however, it is possible that matrix interference, high concentrations of other analytes or limited sample volumes will result in increased detection limits in the program. A competent person will discuss each such event individually in the report.

7.6.5 Documentation and Record Keeping

The field assessor will record notes in a bound field book at the time of sampling. Some records (e.g., test pit logs) may be kept on dedicated forms. All records will be retained, and original forms will be used to transfer information to digital formats.

Sample details will be transmitted to the laboratory on chain of custody forms that will accompany samples. The lab will transmit sample analysis data to the departmental representative in electronic formats, both static (PDF) and manipulatable (Excel). The departmental representative will use electronic data to generate report tables.

Electronic data will be maintained on a secure, backed-up server. Field notes and forms will be scanned and retained in electronic format after use.

7.6.6 Data Validation

All sample identification will be cross-checked with field records, chain of custody forms and sample labels before shipping. Laboratory certificates of analysis will be cross-checked with field records to ensure that no errors were introduced by laboratory transcription. Where uncertainty is present, the report authors will make every effort to obtain and compare original bottles and labels from the lab for comparison with notes collected in the field.

Field and laboratory quality will be compared to industry standards as shown in Table 15 below. Evaluation methods are derived from the Site Characterization Guidance Manual (CCME, 2016).

Table 15: Data Quality Targets

Quality Control Measure	Evaluation and Mitigation
Field duplicate	Relative percent difference between the primary and duplicate sample should be less than 40 percent for water and 60 percent for soil. Where samples exceed the acceptable value, each analyte-matrix combination should be assessed across the program.
Trip blank	Concentrations of all analytes should be non-detect. Where this is not the case, an evaluation of sampling methodology, site conditions and shipping methods should be conducted.
Laboratory duplicate	Per laboratory quality program, but generally less than 20 percent for water and 30 percent for soil. If laboratory duplicates exceed acceptable range, discuss reasons for the exceedance with the laboratory and assess each analyte across the program.
Laboratory blank	Per laboratory quality program. If laboratory blanks contain detectable concentrations, discuss reasons for the detection with the laboratory and assess each exceeding analyte across the program.
Matrix spike	Per laboratory quality program. If laboratory spikes are outside the acceptable range, discuss reasons for the issue with the laboratory and assess each analyte across the program.

7.7 Reporting

Tabular summaries for all data and information are required annually by March 31 under Part B of the site water licence. A memo report is to be provided each year to describe the sampling methodology, quality assurance and quality control, and other relevant information collected in the field in addition to the tabular data summaries.

7.7.1 Nunavut Water Board Annual Reporting

The Nunavut Water Board Annual Reporting consists of the following:

- A summary report of Water use and Waste disposal activities;
- A list of unauthorized discharges and a summary of follow-up actions taken;
- A summary, including photographic records