The Collection of Landfill Monitoring Data at the CAM-M Cambridge Bay Site – 2005 Final Report

Prepared for
Defence Construction Canada

Submitted by
Gartner Lee Limited

January 2006

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Distribution:
8 Defence Construction Canada
1 Gartner Lee Limited
1 Kitnuna Corporation

January 12, 2006

Mr. Thuc Nyugen
Defence Construction Canada
Constitution Square, Suite 1720
350 Albert Street
Ottawa, ON K1A 0K3

Dear Mr. Farah:

Re: GLL 50-714 – DRAFT Report for the 2005 Collection of Landfill Monitoring Data at the CAM-M Dew Line Site, Cambridge Bay, Nunavut

We are pleased to submit ten hard copies of the 2005 Final Report on the Collection of Landfill Monitoring Data at the CAM-M Dew Line Site in Cambridge Bay, Nunavut. This report documents the data collected from our site visit to the CAM-M Site on August 16th, 17th, 18th, 19th, and 20th, 2005. In addition to the hard copy reports, we have also attached one digital data disc to the report which contains:

- All numeric data files including analytical results, thermistor data and associated graphs submitted in MS Excel 97;
- All text files submitted in MS Word 97;
- All drawings submitted in AutoCAD Version 2000;
- All photographic records of the geotechnical inspection submitted in digital format and in hardcopy in the location specific report as well;
- All photographic records of the soil samples collected at each location. These have been provided as an attachment to the main report and include an index of the photo numbers and the locations;
- All photographic records of the condition of the monitoring wells. These have been provided as attachments to the main report and include an index of the photo numbers and the locations; and
- All field notes have been attached to each specific landfill investigation report.

From the visual analysis, there does not appear to be any significant erosion or cover issues for the landfills with the exception of a small settlement of top of the West landfill and some minor erosion rills on the other landfills. These settlements are documented in the report and shown in the attached photo logs.

Detectable concentrations of hydrocarbons were noted in the soil samples submitted from designated locations MW6, MW6-SW, MW5 and MW4 at the Main Landfill – North, MW-3 at the Main Landfill – South, MW13 at the DCC Tier II Landfill, CM-6 at the Western Landfill, CM-10 at the Airport Landfill, and CM-4 at the South Shore Landfill. With the exception of MW6 and CM-4, the reported concentrations are not considered to be significant; Defence Construction Canada (DCC) should compare the laboratory results to their internal DEW Line Site Guidelines to confirm whether the analytical results have exceeded their guidelines. A detectable concentration of PCB was noted in the lower sample submitted at CM-4 located at the South Shore Landfill. The sample exceeds the CCME Guidelines for Agricultural soil use and should be compared to the internal DEW Line Site Guidelines to determine whether the analytical results have exceeded the DCC guidelines.

The water results and thermal monitoring results indicate that approximately half of the wells monitored were frozen and a sufficient volume of water could not be obtained for analysis. A full suite of groundwater samples were collected from all wells at the Main Landfill – South and only wells MW7 and MW8 at the Main Landfill - North. DCC should compare the laboratory results to their internal DEW Line Site Guidelines to confirm whether the analytical results are in compliance.

All of the thermistors were downloaded successfully. The batteries were also replaced, and data loggers reset in accordance with the instructions provided by other consultants representing DCC. Thermistor ITS1 (A&B) reached its memory capacity on February 11, 2005. This data logger was reset and has enough memory to continuously log data until January 2008.

Scheduling of the field program for mid August appears to have been successful in improving the potential for recovering groundwater samples, compared to the previous year.

If you have any questions or comments concerning this report, please do not hesitate to call me.

Yours very truly,
KITNUNA CORPORATION AND GARTNER LEE LTD

AHK / Attach.

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1. Introduction

The Department of National Defence (DND) in co-operation with Nunavut Tunngavik Incorporated (NTI) has developed a Landfill Monitoring Plan to address post closure monitoring requirements for the landfills at the DEW Line sites. Defence Construction Canada (DCC) is managing the clean-up monitoring programs on behalf of DND. Kitnuna Corporation and Gartner Lee Limited in a joint venture were awarded the contract for the purposes of providing services for the collection of landfill monitoring data at the CAM-M Cambridge Bay Site in the Nunavut Settlement Area for 2005. This report will provide the procedures and the results for interpretation on the monitoring completed in 2005.

2. Background

The CAM-M Cambridge Bay site is located on the southern coast of Victoria Island at 69 07' north latitude and 105 07' west longitude. The community of Cambridge Bay is located approximately 3 km east of the site. Access to the site is gained from a gravel road connecting Cambridge Bay to the site. The CAM-M site was a former radar site on the DEW line.

The site was constructed and operated by a civilian contractor for the United States Air Force (U.S.A.F.) until 1991. As part of the North American Aerospace Defence Modernization Program, the CAM-M site was decommissioned in 2000. During the clean-up of the site, the existing landfills were remediated, an engineered extension was constructed at an existing landfill to contain non-hazardous demolition, and a new engineered landfill was constructed to contain contaminated soil. These landfills are identified as:

a) Main Landfill North;
b) Main Landfill South (existing landfill with extension);
c) South Shore Landfill;
d) West Landfill;
e) Airstrip Landfill; and
f) Tier II Soil Disposal Facility (new landfill).

The locations of the various landfills are shown on Figure 1. Access to the landfills was gained through on-site roads. The baseline monitoring of the landfills commenced in 1999/2000. Monitoring occurred every year until 2005. After this year, monitoring frequency at this site will decrease until 2025.

Figure 1. Dew Line Clean Up Monitoring Plan

2.1 Project Objectives

The objective of the landfill monitoring program is to collect sufficient information to assess the performance of the landfill from a geotechnical and environmental perspective. The landfill monitoring plan specified the requirements for the visual inspection as well as the chemical and thermal monitoring of the landfills. The long term monitoring plan consists of visual monitoring for signs of settlement, collection of soil and groundwater samples to evaluate the effectiveness of the leachate containment system, and monitoring of the sub-surface ground temperatures along the toe of and in the main body of the landfill.

2.2 2005 Monitoring Event

On August 17, 18, 19 and 20, 2005 the field data collection event was conducted at the CAM-M DEW Line site. The monitoring event consisted of visual inspections, soil sampling, groundwater sampling, and thermal monitoring of the landfills at designated locations.

At each of the landfill locations mentioned above, a field inspection was conducted to observe whether there were any visual signs of impact (such as seepage or stressed vegetation caused by the landfill) and for physical stability. Photographic records of the landfill were taken to show the condition of the landfill and any area of concern that was observed. The observations and the photographic record for each of the landfills is discussed individually in the Site reports presented in Appendices A through F.

Soil sampling was conducted at all of the designated landfills for 2005. Groundwater sampling was conducted at the Main Landfill – North, Main Landfill – South and the DCC Tier II Soil Disposal Facility. Generally, soil samples were collected at depths of 0.10 m and approximately 0.40 - 0.50 m, although there were some variations in sample depths dependent on the ground conditions. The soil samples were analyzed for Polychlorinated Biphenyls (PCBs), total petroleum hydrocarbons (TPHs), and inorganic elements.

The terms of reference (TOR) specified analysis of TPH in accordance to the total of the Canadian Council of Ministers of the Environment (CCME) fractions F1-F3. These fractions represent the carbon range C6-C34. The initial analysis of TPH was analyzed for carbon ranges C10-C32. The following steps were taken to characterize the petroleum fractions.

1. Identify which samples had detectable levels of TPH.
2. Establish “safe” criteria for sample re-analysis. An upper limit for detectable hydrocarbons was set at 500 mg/kg for sample re-analysis.
3. Re-analyze samples exceeding the 500 mg/kg limit for CCME fractions F1-F4. These samples include: TP65, TP17 and TP18.

4. Review and re-calculate all samples that had detectable levels of TPH to encompass CCME fractions F2 and F3 for better characterization.
5. Review all chromatograms for the presence of "spikes" in the upper portion of CCME fraction F1.

The analytical results for each sampled landfill are discussed individually in the Site reports presented in Appendices A through F.

Where possible, groundwater elevations were measured at each observation well for the landfills designated to be monitored in 2005. The monitoring conditions and field measurements were documented and collected at each monitoring well. The field measurements included the following: presence and thickness of free product (if applicable), depth to bottom of well, height stick up and a visual inspection of the condition of the observation well. Groundwater samples were collected from the 2005 designated observation wells that had sufficient water volumes to obtain samples. The water samples were obtained utilizing a peristaltic pump for low flow extraction. Disposable tubing was used in every well. The samples were analyzed for PCBs, TPHs, and inorganic elements.

The field methods for collecting the groundwater samples followed the QA/QC protocols and sampling requirements as requested in the Terms of Reference. The monitoring wells were purged at a rate equivalent or less than 100 ml/min with a peristaltic pump. Field chemistry measurements were taken at monitoring wells that were sampled. Further discussion regarding the field measurements, the field chemistry and the analytical results are discussed in the Site reports presented in Appendices A, B and F. The development of the well records and well condition records are appended to the relevant sections in Appendices A, B and F.

Thermal Monitoring was conducted at the Main Landfill – North, Main Landfill – South, and the DCC Tier II Soil Disposal Facility in 2005. The data was downloaded from the system using the Lakewoods Systems Ltd. software. The information downloaded are further discussed in the individual Site Reports presented in Appendices A, B and F.

3. Landfill Monitoring

As requested by DCC, Gartner Lee has presented the landfill monitoring reports as individual reports under the cover of this main report. The Landfill Monitoring Reports for each locality are presented in the appendices of this main report as follows:

Appendix A	Main Landfill North;
Appendix B	Main Landfill South (existing landfill with extension);
Appendix C	South Shore Landfill;
Appendix D	West Landfill;
Appendix E	Airstrip Landfill; and
Appendix F	Tier II Soil Disposal Facility (new landfill).

All information collected that is relevant to these individual areas is presented in these sections or as attachments at the end of the sections.

4. Quality Assurance/Quality Control

A total of six (6) blind duplicate soil samples were collected for submission at soil sample locations MW 7 (0.5 m), MW 6-SW (0.1 m), CM-2 (0.1 m), CM-5 (0.1 m), CM-11 (0.5 m) and CM-8 (0.5 m). Samples MW 7, MW-6-SW and CM-5 were submitted to ALS Environmental in Vancouver for analysis, samples CM-2, CM-11 and CM-8 were submitted to Maxxam PSC Analytical Services in Vancouver for analysis.

A total of 6 duplicate pairs for soil were submitted for analysis. Each sample was analysed for 11 parameters yielding a total of 66 sets of numbers to be calculated for relative percent difference (RPD). Of the sixty six (66) RPDs calculated, thirty six (36) sets returned a value of "n/a" due to one or both concentrations being below the detection limit. Twenty six (26) sets returned an acceptable RPD of below 30% and four (4) sets returned unacceptable RPDs over 30%.

Duplicate pair TP19 and TP57 returned a value of 68% RPD for mercury. Due to the low concentrations of Mercury, a higher variance is likely. The method detection limit (MDL) for Mercury is 0.05 mg/kg; as both samples are within three times the MDL, a higher RPD is expected. Duplicate pair TP42 and TP61 returned a RPD of 31% for Nickel and duplicate pair TP38 and 62 returned a RPD of 41% for Copper and 30% for Nickel. Both of the duplicate pairs are located at the Airport Landfill. Soils in this area range from peat and fine sandy silt in a plant root matrix near surface to fine sand and gravel near 0.4 m. A slight change in matrix within the same sample depth may be enough affect the concentration.

Blind duplicates were taken at groundwater sample locations MW 1 and MW 14. The duplicate of MW 1 was submitted to ALS Environmental and the duplicate of MW 14 was submitted to Maxxam PSC Analytical Services. All duplicates for water were within the acceptable range of 30% RPD.

For the soil and groundwater samples collected, a blind duplicate was collected approximately every tenth sample collected. Tables used for the calculation of RPDs are located in Appendix H.

Duplicate soil samples were submitted for archival purposes to the Environmental Services Group Ops Centre within the Royal Military College in Kingston, Ontario. The soil samples submitted and the corresponding sample locations are documented in Table 1.

Table 1. Environmental Services Group Blind Duplicates

Sample Identification	Duplicate of Sample	Sample Location	Depth (m)	Landfill
TP58	TP32	MW-14	0.5	Main-South
TP59	TP49	CM-1	0.1	South Shore
TP60	TP38	CM-8	0.5	Airport

5. Conclusions

From the visual analysis during the site visit, there does not appear to be any significant erosion or cover issues with the exception of settlement at the West Landfill. It is not clear if the settlement areas or depth of depression has increased, based on comparison to the observations in 2004. The surrounding surface and side slopes of the landfill appear unaffected, leading to the conclusion that this is a localised occurrence, it is suggested that remedial action be considered. The settlement should be monitored on a yearly basis.

Soil samples were collected at the designated locations in 2005. Two samples were collected at the majority of the locations. One soil sample was omitted at testpit located at CM-9 in the Airport landfill. Minor concentrations of detectable hydrocarbons were noted in at least one test pit at every landfill. Inspections of the chromatograms reveal that the minor hydrocarbon concentrations are likely caused by naturally occurring organics in the peat found on site. The chromatograms and field observations agree with the correlation of naturally occurring organics in the peat layer. Significant concentrations of hydrocarbons were noted at MW 6 at the Main Landfill – North and CM-4 in the South Shore Landfill. Defense Construction Canada should compare the laboratory results to the their internal DEW Line Site guidelines to determine whether the analytical results exceed those guidelines.

In 2005, groundwater samples were collected from 7 of the 14 monitoring wells at the site. The timing of the sampling appears to have occurred during maximum thaw. There does not appear to be any significant issues with groundwater issues.

6. Limitations

This report has been prepared as an assessment of the environmental condition of the subject site located in Cambridge Bay, Nunavut. The monitoring and investigation programs as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The assessment of environmental conditions and possible hazards at this Site has been made using the results of chemical analysis of soil/sediment and pore water from a limited number of locations. The Site conditions between sampling locations have been inferred based on conditions observed at sampling locations. Subsurface conditions may vary from those encountered at the sample locations. Additional study, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of study. However, it is never possible, even with exhaustive sampling and testing, to dismiss the possibility that part of a Site may be contaminated and remain undetected.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibility of such third parties. GLL accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on the information contained in this report.

The content of this report is based on information collected during our investigation, our present understanding of the Site conditions, and our professional judgement in light of such information at the time of this report. This report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, GLL should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

If you should have any questions regarding this report, please contact the undersigned at your convenience.

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Appendices

Appendix A

Landfill Monitoring Report – Main Landfill North

Appendix B

Landfill Monitoring -
Main Landfill South (existing landfill with extension)

Appendix C

Landfill Monitoring - South Shore Landfill

Appendix D

Landfill Monitoring - West Landfill

Appendix E

Landfill Monitoring - Airstrip Landfill

Appendix F

Landfill Monitoring - Tier II Soil Disposal Facility (new landfill)

Appendix G

Laboratory Reports

Appendix H

QA/QC