FRANZ ENVIRONMENTAL INC.
CONSULTING ENGINEERING TECHNOLOGIES
AN ARCADIS COMPANY

Long Term Monitoring, 2014
CAM-F, Sarcpa Lake, Nunavut

FINAL REPORT

Prepared for:

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EXECUTIVE SUMMARY

ARCADIS Franz Canada Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to conduct the sixth year of long-term monitoring activities at the former CAM-F Distant Early Warning (DEW) Line site at Sarcpa Lake, Nunavut (the site) as prescribed by the CAM-F Sarcpa Lake Long Term Monitoring Plan. This project was completed under AANDC standing offer number 4600000861, order number 4500319928, dated July 17, 2014.

The CAM-F Sarcpa Lake site is located on the Melville Peninsula in the Baffin Region of Nunavut, 110 km southwest of Igloolik and 85 km west of Hall Beach. CAM-F was an Intermediate DEW line site constructed in 1957 and operated until 1963. The site was used as a scientific research station between 1977 and 1988.

An environmental remediation project was conducted at the site between 2005 and 2008. Activities included the demolition and disposal of buildings, structures and other debris, as well as the cleanup of hazardous materials. A secure soil disposal facility (SSDF) and non-hazardous waste landfill (NHWL) were constructed during remediation to contain some of the demolished materials and excavated soils. These structures and a hunting/emergency shelter cabin remain present at the site.

FRANZ conducted the field activities for the sixth year of the CAM-F long-term monitoring program on August 24th and 25th, 2014, while based in the nearby community of Hall Beach. The monitoring program included the following tasks: completing a health and safety plan; visually observing and photographically documenting the physical integrity of the SSDF and NHWL; natural environment monitoring; collecting landfill temperature data from previously installed thermistor strings at the SSDF; collecting groundwater samples from six monitoring wells previously installed and submitting the samples for laboratory analysis.

Based on physical observations from the 2014 field activities, it appears that the two landfills, the SSDF and NHWL, are performing as designed and continue to contain the enclosed waste. At no time during the present monitoring year has the active layer at the SSDF reached depths equal to or greater than the depth of the liner and the waste contained within.

Temperatures recorded in the SSDF indicate that the landfill was cooler in 2014 than in 2013. Thermal monitoring data suggest that the temperature below ground surface within the SSDF has decreased in 2013-2014, and is comparable to the low established in 2009. Thermal monitoring data indicate that the waste contained within the SSDF remained frozen year-round from 2012 to 2014.

In addition to physical and temperature observations, FRANZ collected groundwater samples to assess the performance of the SSDF and NHWL. Concentrations of contaminants of concern in groundwater were compared to historical groundwater results from 2006 to 2012. Concentrations of total lead in MW0602 and dissolved copper and total lead in MW0603 were above the upper limit of acceptability, which indicates an increasing trend in concentrations. FRANZ believes this increase is a result of non-standard sampling techniques (i.e. limited purging due to low recharge in monitoring well) and does not represent an actual trend. Groundwater sampling at these well locations will continue in the future and should be monitored closely. Increased monitoring frequency is not warranted at this time.

Additionally, several metals reported concentrations above the Canadian Council of Ministers of the Environment (CCME) Federal Interim Groundwater Quality Guidelines (FIGQGs) pathway specific guidelines for protection of freshwater life. FRANZ believes that as the freshwater life pathway is not applicable to site conditions, these concentrations are not of a concern at this time.

Physical and thermal observations of the landfills and results of the groundwater chemical analysis conducted during the 2014 site visit indicate that the containment facilities at CAM-F continue to operate as designed and that the site continues to pose no threat to human health or the natural environment. Areas of seepage at the SSDF identified in 2012 were not observed in 2014 due to drier conditions; however, FRANZ recommends continued monitoring of these areas in the future.

This executive summary should be read in conjunction with the main report and is subject to the same limitations described in Section 9.0.

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1.0 INTRODUCTION

ARCADIS Franz Canada Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to complete year six of the CAM-F DEW Line long-term monitoring plan. This project was completed under AANDC standing offer number 4600000861, order number 4500319928, dated July 17, 2014.

This report describes the monitoring activities completed in 2014 at the former DEW Line station at Sarcpa Lake, Nunavut. It was prepared in accordance with the AANDC Request for Proposal (RFP) dated May 29, 2014, FRANZ Proposal No. 5173b, dated June 23, 2014 and the Project Initiation Meeting held on August 15, 2014.

Throughout this report the former DEW Line site, CAM-F, at Sarcpa Lake, Nunavut, will be referenced as "the site."

1.1 Project Objectives

The objective of the 2014 long-term monitoring program was to complete the sixth monitoring event to assess the performance of the Secure Soil Disposal Facility (SSDF) and Non-Hazardous Waste Landfill (NHWL) to ensure that they are performing as intended. This included visual observations, chemical analyses (where warranted and possible) and interviews with members of the nearby community knowledgeable of local activities at the site to determine the condition of the natural environment and whether the site infrastructure is performing as designed.

1.2 Scope of Work

Consistent with previous years monitoring activity, the scope of work undertaken at the site in 2014 was as described in the 2007 CAM-F Sarcpa Lake Long-Term Monitoring (LTM) plan (INAC, 2007):

1. Visual monitoring of the NHWL and SSDF, including:
    - Checking the physical integrity of the SSDF and NHWL and observing any evidence of erosion, ponding, frost action, settlement and lateral movement and completing a visual monitoring checklist.
2. Taking photographs to document the condition of the SSDF and NHWL, and substantiate the recorded observations.
3. Active layer water (groundwater) monitoring of the SSDF and NHWL, including:
    - Collection of samples from the two monitoring wells installed downgradient of both the SSDF and NHWL and the one well installed upgradient of each.
    - Examination and analysis of the samples for colour, odour, hardness, pH, conductivity, temperature, total and dissolved metals (arsenic, cadmium,

chromium, cobalt, copper, lead, nickel, and zinc), polychlorinated biphenyls (PCBs), petroleum hydrocarbons (PHCs), major ions, total dissolved solids (TDS) and total suspended solids (TSS).

4. Soil Monitoring in the area around the SSDF and NHWL, including:
    - The collection of soil samples from the toe of the SSDF and NHWL in the vicinity of the monitoring wells, if warranted.
    - Analysis of the soil samples for metals (arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc), PCBs and PHCs.
5. Thermal monitoring of the SSDF, including:
    - Collection of data from automatic data loggers attached to 4 thermistor strings with beads at selected intervals to provide ground temperature profiles at various locations within the SSDF.
    - Servicing the dataloggers, as required.
6. Natural environment monitoring:
    - Documentation of observations of wildlife and evidence of wildlife present at the site.
    - Interview with member(s) of the local Hunters and Trappers Organization or other persons knowledgeable of the site; collection of anecdotal information.
7. Preparation of a report documenting the 2014 monitoring program.

To fulfil the scope of work as described above, FRANZ along with AANDC, devised a work plan that included the following tasks:

a) Preparation of a health and safety plan;
b) Preparation of a sampling plan for soil and groundwater;
c) Collection of groundwater samples from wells for chemical analysis;
d) Inspection of thermistor installations and collection of data logger information;
e) Interpretation of analytical data;
f) Visual inspection, measurement and photo documentation of the site;
g) Observing and investigating land use and wildlife trends; and
h) Reporting.

1.3 Report Format

The long-term monitoring report presented herein is structured as follows:

Section 1 – *Introduction:* Provides general background information and outlines the scope and objectives of this study.

Section 2 – *Background Information:* Describes the history, the regional and physical setting and the general characteristics of the site.

Section 3 – *Regulatory Guidelines:* Presents the evaluation guidelines used for the assessment of chemical impacts and provides context for the use of certain environmental quality guidelines to assess impacts and screen chemicals of concern.

Section 4 – *Investigative Methodology:* Presents the methodology, level of effort and details of the field investigations.

Section 5 – *Summary of SSDF Conditions:* Describes the physical characteristics and the chemical impacts, and distributions with respect to applicable regulatory guidelines of the SSDF.

Section 6 – *Summary of NHWL Conditions:* Describes the physical characteristics and the chemical impacts, and distributions with respect to applicable regulatory guidelines of the NHWL.

Section 7 – *Surrounding Areas and Natural Environment:* Describes the physical conditions of the remainder of the study area, including flora and fauna.

Section 8 – *Conclusions and Recommendations:* Presents main findings and conclusions as well as recommendations for the next visit to the site.

Section 9 – *Limitations*

Section 10 – *References*

Section 11 – *Closure*

2.0 BACKGROUND INFORMATION

2.1 Site Description

CAM-F Sarcpa Lake, Nunavut was an Intermediate Distant Early Warning (DEW) Line site, constructed in 1957 and abandoned in 1963. It was converted into a scientific research station in 1977 by the Science Institute of the Northwest Territories and the Department of Indian Affairs and Northern Development, and operated seasonally until 1988.

The CAM-F site consists of two main parts - the station area and the former construction camp area at Sarcpa Lake. Before remediation was completed in 2008, site facilities consisted of an airstrip, small module train, warehouse, garage, a Quonset hut, an Inuit house, two former landfill areas, and petroleum, oil and lubricants (POL) storage facilities; the site contained approximately 10,000 barrels of unknown contents, a radar tower that had been dismantled, other debris and contaminated soil. There were also small volumes of miscellaneous waste and chemical residues remaining from the research facility. The beach area at Sarcpa Lake included a former construction camp, remnants of which consisted primarily of scattered barrels of unknown contents (in and around the lake), abandoned construction equipment, and a small machine shop and generator pad.

A remediation project was conducted at the site between 2005 and 2008. The remediation involved the demolition and disposal of buildings, structures and other debris, as well as the cleanup of hazardous materials. A Secure Soil Disposal Facility (SSDF) and Non-hazardous Waste Landfill (NHWL) were constructed during remediation from July 2006 to September 2007 (Figures A-2 and A-3, Appendix A, respectively).

The SSDF was designed to contain non-hazardous contaminated soils. The design was based on the characteristics of the contaminants in the soil and the local geothermal and permafrost properties. The design uses permafrost as the primary containment barrier with both the contents and perimeter berms remaining in a frozen state. It was assumed that the SSDF would reach a frozen state within 3-4 years of construction, and ground temperature data loggers were installed at each of the four corners of the facility to monitor the freeze-back of the contents and berms. The thickness of the cover material was calculated to prevent the thaw of the contaminated soil even after 10 consecutive 1-in-100 warm years. In response to Arctic climate change studies, the initial design was modified in 2007 and an additional metre of cover was added, increasing the total cover material from 2.3 to 3.3 metres. The SSDF contains the following:

- Tier II contaminated soil (as defined by the DEW Line Cleanup Criteria, presented in INAC's Abandoned Military Site Remediation Protocol, AMSRP; and
- Soils impacted with benzene, toluene, ethylbenzene and xylenes (BTEX) and PHC fractions F1 and F2.

The NHWL was designed to contain non-hazardous materials only. It was constructed on the natural ground surface with the organic matter stripped and consists of four perimeter berms constructed of granular material. The non-hazardous waste was placed in the landfill in layers consisting of 0.5 m lifts of waste covered by 0.15 m of granular fill. The waste layers were compacted and a final cover consisting of a minimum of 3.3 m of granular fill was used to cap the landfill. The NHWL contains the following:

- Tier I contaminated soil (i.e., soil with lead content between 200 and 500 parts per million (ppm) and PCB content between 1 and 5 ppm);
- Soils impacted with PHC fractions F3 and F4;
- Non-hazardous demolition debris, such as timbers, plywood, and sheet metal;
- Non-hazardous debris, such as scrap metal and wood;
- Non-hazardous debris/soil excavated from landfills;
- Creosote timbers; and
- Double-bagged asbestos

The site is not regularly inhabited, and groundwater is not considered to be used for water supply purposes. Surface water was historically used for drinking water supply. The area is known to be frequently used by hunters and fishermen, who make use of the cabin that was restored during the remedial activity.

2.2 Previous Monitoring Programs

Prior to the field program, FRANZ reviewed the following reports pertaining to the CAM-F DEW Line site, which include previous site investigations and remedial activities:

- CAM-F Sarcpa Lake Long-Term Monitoring Plan, January 23, 2007, Indian and Northern Affairs Canada.
- CAM-F Borehole Logs, UMA/AECOM, July 24, 2006.
- CAM-F SSDF Monitoring Well Installations, February 17, 2005, UMA Engineering Ltd.
- Long Term Monitoring 2008, CAM-F DEW Line Site, NU, January 8, 2009, UMA Engineering Ltd.
- Long Term Monitoring 2009, CAM-F Sarcpa Lake, Nunavut, November 27, 2009, Franz Environmental Inc.
- Long Term Monitoring 2010, CAM-F Sarcpa Lake, Nunavut, December 10, 2010, Franz Environmental Inc.
- Long Term Monitoring 2011, CAM-F Sarcpa Lake, Nunavut, January 11, 2012, Franz Environmental Inc.
- Long Term Monitoring 2012, CAM-F Sarcpa Lake, Nunavut, January, 2013, Franz Environmental Inc.

- Abandoned Military Site Remediation Protocol, March 2009, Indian and Northern Affairs Canada, Contaminated Sites Program.

The 2014 monitoring program was the sixth of ten that are scheduled over a 25 year period. Information from the 2008, 2009, 2010, 2011, 2012, and 2014 investigations were incorporated into this year's sampling plan. Data collected in 2008-2014 were combined with the latest data, as well as that from pre-landfill construction in 2006 and 2007, and analyzed.

As part of the investigation, information was gathered though a member of the Hall Beach Hunters and Trappers Association. Land use by both humans and wildlife were discussed. Monitoring procedures adopted by AANDC for this site are based on those defined in the INAC Abandoned Military Site Remediation Protocol.

3.0 REGULATORY AND OTHER GUIDELINES

3.1 Guideline Review

Where guidelines were developed, criteria presented in the CAM-F Sarcpa Lake Long-Term Monitoring Plan (INAC, 2007) were used to compare both soil and groundwater analytical results. Federal and select provincial guidelines were applied where site-specific criteria were absent and/or were less strict the federal and provincial standards.

3.2 Groundwater

There are no groundwater guidelines provided in the CAM-F LTM plan. In the absence of site-specific guidelines, the AMSRP guidance on post-construction monitoring indicates that "comparison to background and baseline values is recommended." The AMSRP provides the following table for the assessment of analytical data in groundwater.

Table 3-1: Groundwater Assessment

Geochemical Assessment	Acceptable	Marginal	Significant	Unacceptable
Groundwater concentrations within average ± three standard deviations or within analytical variability	Performing as expected			
Increasing trend in contaminant data over 2 or more successive monitoring events (variation in excess of average ± three standard deviations or analytical variability)		Low risk of failure		
Groundwater concentrations in excess of three times average baseline concentrations in more than one monitoring event			Moderate risk of failure	
Where applicable, surface water concentrations in excess of surface water quality guidelines for the protection of aquatic life				Failure
Required Actions	Monitor as per schedule	Increase monitoring frequency. Monitor surface water quality, if applicable, in downgradient water bodies within 300 m.	Assess causes of increasing contaminant concentrations. Evaluate whether remediation is required.	Assess cause of contaminant concentrations. Develop remedial plan. Implement remedial plan.

This table is reproduced from AMSRP Chapter 11, Table 4.2

FRANZ has used historical data presented in previous reports to obtain the mean and standard deviation of monitoring conducted from 2006 to 2012 for comparison with results from the 2014 field program.

FRANZ obtained acceptable values for groundwater results from these tables (calculated as mean plus or minus three standard deviations). Maximum acceptable values from these ranges are presented in groundwater analytical tables in Appendix B.

For some parameters, specifically BTEX, PCBs and PHCs, sufficient data to support calculations of mean and standard deviation were not available. This is primarily due to the high frequency of not detected (nd) results for historical samples.

In May 2010, Environment Canada (EC) under Federal Contaminated Sites Action Plan (FCSAP) released the *Federal Interim Groundwater Quality Guidelines* (FIGQG) for Federal Contaminated Sites. The guidelines were released based on the observed need for federal custodians and others to apply appropriate groundwater guidelines at federal sites. Previously, a mixture of provincial standards, federal surface water guidelines, and drinking water quality guidelines were applied to groundwater at federal sites. The FIGQGs remove the need for this patchwork of regulations, which were not consistently applied at federal sites. The FIGQGs were updated in November, 2012.

The FIGQGs were not developed with the scientific rigour associated with the Canadian Environmental Quality Guidelines (CEQGs). Instead, Environment Canada requested the development of guidelines based on a review and evaluation of existing approaches in other jurisdictions.

The FIGQGs follow a tiered framework, consistent with the Canadian Soil Quality Guidelines development through the CCME. The tiers are:

- Tier 1: direct application of the generic numerical guidelines; specifically, application of the lowest guideline for any pathway;
- Tier 2: allows for the development of site-specific remediation objectives through the consideration of site-specific conditions, by modifying (within limits) the numerical guidelines based on site-specific conditions and focusing on exposure pathways and receptors that are applicable to the site; and
- Tier 3: use of site-specific risk assessment to develop Site-Specific Remediation Objectives.

The FIGQGs are based on the consideration of a number of potential receptors and exposure pathways, including:

- Groundwater transport to surface water at least 10 m from the contamination and subsequent exposure of freshwater and marine life;
- Direct contact of soil organisms with contaminated groundwater;
- Use of groundwater for irrigation water;
- Use of groundwater for livestock watering;

- Groundwater transport to surface water at least 10 m from the contamination and subsequent ingestion by wildlife;
- Migration of contaminant vapours to indoor air and subsequent inhalation by humans; and
- Use of groundwater for human consumption (i.e., drinking water).

The generic guidelines are point estimates of a chemical concentration in groundwater associated with an approximate no- to low-effects level based on toxicological information about the chemical, along with a screening-level evaluation and environmental fate and transport and estimated intake rates, or exposure, by potential receptors.

As a result, the Table 1 *Federal Interim Groundwater Quality Guidelines*, *Generic Guidelines for Residential/Parkland Land Uses* Tier 1, Freshwater Life pathway for coarse grained soil (FIGQG Table 1 Tier 1) were referenced for comparison purposes.

4.0 INVESTIGATIVE METHODOLOGY

The monitoring program was carried out at the CAM-F DEW Line site on August 24 and 25, 2014. Weather conditions on August 24 were optimal with sunny skies, little wind and a temperature of 5ºC. Weather in August 25 was not ideal with a moderate breeze and intermittent rain. The monitoring program included the following tasks:

- Completing a health and safety kick-off meeting;
- Visually observing and photographically documenting the physical integrity of the landfills and the reporting on the observable conditions over the rest of the site;
- Natural environment monitoring and gathering information from knowledgeable persons regarding local wildlife and human activity;
- Collecting landfill temperature data from previously installed thermistor strings at the SSDF;
- Sampling of groundwater and soil (soils were only to be collected if evidence of leaching/seeping and staining was observed) from designated locations at the site; and
- Submission of soil and groundwater samples, including duplicates, for applicable laboratory analysis.

The field investigation procedures are described below.

4.1 Health and Safety Plan

Before commencing with site activities, a site-specific health and safety plan (HASP) was developed. The HASP identified and provided mitigative actions for potential physical and chemical hazards associated with the monitoring work. The HASP also contained a listing of emergency contact numbers and provided protocols to follow in the event of an emergency.

A copy of the HASP was presented to AANDC for review and approval before site activities began. This plan was distributed and discussed with all personnel involved in the investigative program prior to conducting any work on-site. A copy of the HASP has been retained on file at FRANZ and at the AANDC Nunavut Regional Office.

4.2 Visual Inspections

The physical integrity of the SSDF, NHWL, and surrounding areas were assessed using systematic visual observations and empirical measurements to record evidence of erosion, ponding, frost action, settlement and lateral movement of the landfills. A visual monitoring checklist, presented in the CAM-F LTM plan, was completed for each landfill. A photographic record was completed to document the condition of the structures and substantiate the visual observations. A portion of this photographic record appears in Appendix C; and is presented in its entirety on the accompanying CD ROM.

The 2014 visual inspection was conducted with the aid of a Trimble Pro XRT GPS unit to locate features of note and to collect GIS information to be used in report preparation. A detailed data dictionary was created prior to the site visit to capture all required information as outlined in the long-term monitoring plan. An SSF file and the data dictionary are included in the appended CD ROM to be used in future site investigations.

4.3 Wildlife Survey

FRANZ recorded observations of the natural environment made during the site visit including direct sightings of wildlife, other evidence of wildlife (e.g., droppings, tracks, feathers, fur), wildlife activities (migrating, nesting, etc.), numerical estimates of wildlife, and vegetation observations.

As part of the investigation, information was gathered from the wildlife monitor, Simon Curley, a member of the Hall Beach Hunters and Trappers Association. Land use by both humans and wildlife were discussed.

A discussion of the recorded observations and information obtained is presented in Section 7.0 of this report.

4.4 Thermistor Monitoring

A thermistor string was installed at each of the four corners of the SSDF in September 2007. Each string consists of 11 or 12 temperature sensing thermocouple beads connected to a Lakewood Systems UltraLogger data logger, programmed to continually record values twice daily at 0h00 and 12h00. During the 2014 site visit, all four data loggers were replaced with new, fully serviced data loggers from Lakewood Systems.

At the time of inspection all thermistor strings were functioning well with the exception of thermistor CAMF-03-VT. Thermistor CAMF-03-VT presented an error message and no data could be downloaded from the data logger; however, manual resistance readings from the installed thermocouple beads indicate that the installation is functioning as designed. A Complete Memory Transfer (CMT) was completed on the data logger, which was subsequently sent to Lakewood Systems in an attempt to recover any pertinent data that may be available for that unit.

At each thermistor string the resistances at each bead were measured manually, this data was converted to temperature values which were compared to the last values logged by the data loggers. The manual resistance check confirms the functionality of each bead, and the comparison with the logged data confirms that the analog data channels of the data logger are operating correctly, as expected the beads and loggers were performing well and the manually collected data had close agreement with the data collected by the data loggers. Manual resistance check data is presented in Table H-2 in Appendix H.

Upon completion of the manual resistance check, thermistor data for the period from August 6, 2012 to August 24, 2014 were downloaded from three of the four data loggers, using a laptop with Lakewood Systems' Prolog (v.1.198) software. Datasets from each data logger were inspected to ensure completeness and data validity prior to resetting the data logger units. Data logger battery voltages, memory usage, and programming were noted and a visual inspection of the housing equipment was performed. Thermistor inspection records are presented in Table H-1, Appendix H. All four of the data logger stations at CAM-F were replaced with new units supplied by Lakewood Systems in 2014. The four removed data loggers will be sent to Lakewood Systems for factory replacement of internal batteries and maintenance. The serial numbers for the newly installed data loggers and installation stations are summarized in the following Table 4-1.

Table 4-1: Summary of Newly Installed Data Loggers

Station ID	New Data Logger Serial Number
CAMF-01-VT	708141
CAMF-02-VT	14000723
CAMF-03-VT	08050018
CAMF-04-VT	13008014

The SSDF ground temperature record, containing continuous information since September 2007 was updated. A discussion, along with plots of temperature versus depth and time, are presented in section 5.4 and in Appendix H. Raw data is provided on the attached CD-ROM.

4.5 Groundwater Sampling

The groundwater sampling methodology conformed to guidance provided in the following documents:

- CCME EPC-NCS62E *Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites - Volume I: Main Report*, Dec 93 (CCME catalogue - http://www.ccme.ca/assets/pdf/pn_1101_e.pdf);
- CCME EPC-NCS66E *Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites - Volume II: Analytical Method Summaries*, Dec 93 (CCME catalogue - http://www.ccme.ca/assets/pdf/pn_1103_e.pdf);
- INAC *CAM-F Sarcpa Lake Long-Term Monitoring Plan* (INAC, 2009); and
- INAC *Abandoned Military Site Remediation Protocol*, Contaminated Sites Program (INAC, 2009).

Groundwater was sampled at one of the three predetermined locations: MW0604 at the SSDF. Groundwater was also sampled at the NHWL at two of the three predetermined locations: MW0602 and MW0603.

A Geopump peristaltic pump was used to purge the designated monitoring wells. A YSI 552 water quality meter was calibrated and used to measure in-situ field parameters including temperature, conductivity, dissolved oxygen, turbidity, pH and oxidation-reduction potential. Sampling took place when these parameters stabilized. Water samples submitted for total metals analyses were not field-filtered. Water samples submitted for dissolved metals were filtered in the field. Low groundwater recharge was observed in the monitoring wells sampled at the NHWL (MW0602 and MW0603). Because of the low groundwater recharge, wells were not purged prior to sampling.

Sampling locations were selected as described in *CAM-F Sarcpa Lake Long-Term Monitoring Plan* and were the same as those sampled during the previous years' monitoring events.

A summary of the samples that were collected and submitted for laboratory analysis during the groundwater sampling activities is provided in Table 4-2 below. Groundwater sample logs and notes are included in Appendix D.

Table 4-2: Summary of groundwater sample collection near the SSDF and NHWL.

Landfill Area		Sample	Analytical Parameters
NHWL	Downgradient	MW0602	- total and dissolved metals - PCBs - petroleum hydrocarbon fractions F1-F4 and BTEX - inorganics (major ions, TDS, TSS, colour, pH, conductivity)
		MW0603	
SSDF	Upgradient	MW0604*	

Note: * indicates a blind field duplicate collected (DUP601). Insufficient sample available to collect PCB and General Chemistry analysis in Duplicate Sample DUP601.

Water samples for laboratory analysis were stored in laboratory supplied coolers equipped with ice from the time of collection until delivery to the laboratory.

4.6 Soil Sampling

Soil monitoring point sampling was discontinued in favor of soil sample collection based on physical evidence and observation. No evidence of landfill leaching or staining was observed during the 2014 monitoring event, therefore no soil samples were collected.

4.7 Quality Assurance and Quality Control

Field personnel employed FRANZ's Quality Assurance/Quality Control (QA/QC) protocols, including appropriate techniques for soil sampling, sample storage, shipping and handling, as well as collection of duplicates.

4.7.1 Field

Groundwater samples were collected from monitoring wells and placed in appropriately sized and prepared laboratory vessels. Sample numbers were clearly marked on the containers. The water bottles were filled to capacity with minimum headspace and stored in coolers with ice to moderate temperature fluctuations during transport to the laboratory.

As a quality control measure, one groundwater blind field duplicate sample was collected and analyzed for PHC fractions F1-F4, BTEX, and metals (note, insufficient water was available for collection of PCBs and general chemistry for duplicate sample). The water samples were also analyzed for additional parameters, such as major ions, colour, pH, conductivity, total dissolved solids, etc.

The samples were transported to the project laboratory accompanied by a Chain of Custody form. Copies of the Chain of Custody forms are provided in Appendix E.

Analytical results from these samples were compared with the analytical results from previous annual monitoring events.

4.7.2 Laboratory

To assess the reliability of the laboratory data, duplicate samples were taken for approximately every five samples collected by FRANZ. One blind field duplicate was collected in the groundwater sampling program.

For water sample duplicates the field staff placed aliquots of approximately 50 percent of the container volume into each container until both containers were filled.

Analytical data quality was assessed by submission of the following:

- Groundwater sample MW0604 (primary) and DUP601 (water duplicate) were analyzed for PHCs, BTEX, total and dissolved metals.

Sampling procedures and laboratory analytical precision are evaluated by calculating the relative percent difference (RPD) for a sample and duplicate pair according the following equation:

$$RPD = | X_1 - X_2 | / X_{avg} \times 100$$

where: X_1 and X_2 are the duplicate concentrations and X_{avg} is the mean of these two values. The duplicate results were evaluated using criteria developed by Zeiner (1994), which draws from several data validation guidelines developed by the United States Environmental Protection Agency (USEPA). According to these criteria, the RPD for duplicate samples should be less than 20% for aqueous samples, and less than 40% for solid samples. RPDs can only be calculated when the compound is detected in both the original and the duplicate sample at a concentration five times above the reportable detection limit (or method detection limit - MDL). Alternative criteria are used to evaluate duplicate pairs where one or both of the results are less than five times the MDL, or where one or both of the results is less than the MDL (i.e. nd or 'not-detected'). The alternative criteria used for the evaluation of the data, adapted from Zeiner (1994), are presented in Table 4-3 below. When both concentrations are less than the MDL, no calculation/evaluation criterion is required.

Table 4-3: Criteria for the Evaluation of Blind and Duplicate Sample Results

Scenario	Result A	Result B	Criteria for Acceptance	
			Aqueous (water)	Soil (Soil)
A	nd	nd	Acceptable precision; no evaluation required	
B	nd	positive	result B – 0.5 x MDL < MDL	result B – 0.5 x MDL < 2 x MDL
C	positive and > 5 x MDL	positive and > 5 x MDL	RPD < 20%	RPD < 40%
D	positive and < or = 5 x MDL	positive	|result B – result A| < MDL[1]	|result B – result A| < 2 x MDL[1]

Source: Zeiner, S.T., Realistic Criteria for the Evaluation of Field Duplicate Sample Results, Proceedings of Superfund XV, November 29-December 1, 1994, Sheraton Washington Hotel, Washington, D.C. – modified to use Method Detection Limit (MDL) or Reportable Detection Limit (RDL) in lieu of the Quantitation Limit (QL), the Instrument Detection Limit (IDL) and/or Laboratory Reporting Limit (LRL).

Notes:

nd – not detected

RPD – relative percent difference, |result A - result B| / |(result A + result B)/2|

1. When result reported was less than half the quantitation limit, half the limit was used in the equation.

The precision is considered acceptable when the evaluation criteria are met or when both results are below the MDL. When the evaluation criteria are not satisfied, the following apply:

- nd vs. positive – unacceptable precision: the positive result is considered an estimate and the nd result is considered inconclusive.
- Positive vs. positive – unacceptable precision: the results are considered an estimate.

Refer to Appendix F for a discussion on QA/QC results.

4.8 Laboratory Analytical Program

Groundwater samples were sent to Maxxam Analytics in Ottawa, Ontario for chemical analyses of the target compounds previously identified. Maxxam is certified by the Canadian Association for Laboratory Accreditation, Inc. (CALA) and has an internal QA/QC protocol. The laboratory QA/QC documentation is provided with the analytical report and was reviewed by FRANZ as part of the QA/QC protocol. The laboratory certificates of analysis and chain of custody forms are presented in Appendix E.

5.0 SUMMARY OF SSDF CONDITIONS

5.1 Area Summary

The SSDF is located at north of the east end of the airstrip of the CAM-F site. The monitoring of the SSDF landfill included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. One groundwater sample was also collected at MW0604, on the north side of the SSDF.

The SSDF groundwater sample location and photographic viewpoints are shown on Figure A-2, Appendix A. The visual inspection report, including supporting photos and drawing, is presented in Sections 5.2 and 5.3 below.

5.2 Photographic Record

The photographic record of the SSDF has been completed as per the Statement of Work (Photographs 1 to 97; attached CD-ROM). Copies of the photographs that are referenced in the body of this document are provided in Appendix C. Photograph viewpoint numbers (as seen on Figure A-2; Appendix A) shown in red are included in Appendix C. The complete photographic record, including full-resolution photographs, is provided in the attached CD-ROM.

5.3 Visual Inspection Report

Monitoring consisted, in part, of visual observations of the SSDF to assess its physical integrity, by collecting evidence of erosion, ponding, frost action, settlement and lateral movement. A plan view of the SSDF indicating photographic viewpoints, observed salient features, and locations of ground water monitoring wells is presented in Figure A-2; Appendix A. The visual inspection of the SSDF and surrounding area was conducted on August 24, 2014. The visual monitoring checklist was completed using the format requested by AANDC and is presented as Table 5-3 of this report. Field notes relating to the visual inspection are included in Appendix G. Table 5-1 and
Table 5-2 present the preliminary visual inspection results for 2014 monitoring of the SSDF at CAM-F.

Table 5-1: Preliminary Visual Inspection Report SSDF Landfill

Feature	Presence (Y/N)	Severity Rating	Extent
Settlement	Y	Acceptable	Occasional
Erosion	Y	Acceptable	Occasional
Frost Action	N	Not Observed	None
Animal Borrows	N	Not Observed	None
Vegetation	Y	Acceptable	Isolated
Staining	N	Not Observed	None
Vegetation Stress	N	Not Observed	None
Seepage / Ponded Water	Y	Acceptable	Occasional
Debris Exposure	N	Not Observed	None

Feature	Presence (Y/N)	Severity Rating	Extent
Monitoring Well Condition	Y	Good condition - Acceptable	
Overall Landfill Performance	**Acceptable**		

Table 5-2: Preliminary Visual Inspection Report SSDF - Definitions

Performance / Severity Rating	Description
Acceptable	Noted features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion, settlement.
Marginal	Physical/environmental performance appears to be deteriorating with time. Observations may include an increase in size or number of features of note, such as differential settlement, erosion or cracking. No significant impact on landfill stability to date, but potential for failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability, such as significant changes in slope geometry, significant erosion or differential settlement; scarp development. The potential for failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include: • Debris exposed in erosion channels or areas of differential settlement. • Liner exposed. • Slope failure.
Extent	**Description**
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting greater than 50% of the surface area of the landfill

Based on the minimal erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the SSDF, with respect to containment, was rated as satisfactory. The evidence observed suggests the structure is performing as designed.

Settlement

The minor settlement that was observed over most of the southern half of the SSDF in 2009 was less evident in 2010 and not evident during the 2011 and 2014 site inspections, suggesting that the entire top of the SSDF has settled evenly. The depth of settling over the area is minimal (< 10 cm). No new settlement areas were identified during the 2014 monitoring event.

Settlement depression features A and B were observed to the north and northeast of the landfill extents, with no significant change from previous monitoring events (see Picture Viewpoint Numbers (VP) 54 and 55 Figure A-2; Appendix A). Other settlement depressions depicted on

Figure A-2, features E (VP 60-61), G (VP 65-66) and U (VP 87) were observed to be very minor and not significantly changed from the previous year. These settlement features do not pose any risk to the landfill integrity. The minor settlement cracking that was observed along the landfill's perimeter and located approximately 4 m up the face of the berm from the toe (see features C, D, F, K, M, and T; Figure A-2; Appendix A) was not significantly changed, with the exception that the cracking observed in previous years was less evident in 2014 than that observed in 2012.

Erosion

The small preferred-drainage channels observed in previous years at the toe on the southwest side of the SSDF are still apparent (see features I (VP 73-75), J (VP 95-96), N (VP 79-80), and Q (VP 82-84); Figure A-2; Appendix A). Based on a comparison with photo documentation from 2008-2012, there does not appear to be an appreciable increase in the length or depth of these channels. These channels were observed to be dry during the 2014 inspections.

Angular cobble has been exposed in a small, localized area, where fine-grained fill has been washed out on some of the structure's slopes and top, although no significant change from previous years is apparent. Potholes observed in 2008, 2009, 2010, 2011, and 2012 were not significantly changed in 2014.

The erosion observed in 2014 has not increased significantly since the 2012 landfill inspection.

Frost Action

No evidence of heaving or cracking was observed on the top or on the berms of the SSDF. Additionally, no frost action was observed at any of the thermistor housing units or at the surface near the monitoring wells.

Evidence of Burrowing Animals

Indications of burrowing animals were not observed on or around the SSDF in 2014, which is consistent with previous inspection observations.

Vegetation

Vegetative re-growth was observed mainly in one location (see feature S; Figure A-2; Appendix A) on the southeast corner of the SSDF berm. Additional indications of vegetative re-growth observed in 2011 and 2012 were confirmed in 2014. New growth was observed on the top of the landfill and mid-way up the south and east facing slopes of the landfill, the new growth is shown in Figure A-2; Appendix A, near previously identified features J, and T (VP 95-96, 94 and 97, and 92-93, respectively). It is believed that the previously identified passive seepage points may be contributing to the re-vegetation.

Staining

No staining on or around the SSDF was observed in 2014, which is consistent with previous inspection observations.

Ponded Water

As in previous years, no ponded was observed on top of the landfill in 2014. None of the previously identified ponded water area contained any standing water during the 2014 visual inspections (see Figure A-2; Appendix A).

Seepage Points

Five seepage points (see features I, J, N, and Q; Figure A-2; Appendix A) were observed along the southern toe of the landfill in 2011 and 2012. During the 2011 and 2012 inspections events, two of the active seepage points (I and J; Figure A-2; Appendix A) exhibited active flowing water. Two of the seepage points (I and Q; Figure A-2; Appendix A) terminated at standing ponded water. In comparison to previous site visits, no active seepage was observed during the 2014 site inspection.

These active seepage features directly correlate with the observations of erosion noted above. These features should be monitored closely, as they may present a pathway for landfill contents should the seepages worsen in subsequent years. Consideration could be given to collecting a soil sample in one of these locations should the seepage or erosion increase.

Passive Seepage

Four passive seepage points (formerly labelled as features H, L, P, and V) were identified in 2011; however, these features were not observed during the 2012 site visit. As in 2012, the passive seepage features were not observed during the 2014 site inspection. These seepage features are most likely directly related to heavy precipitation events. No rivulets or erosion channels associated with these passive seepage points were observed. As these features have not been observed in the past two inspection events, they have been removed from Figure A-2 in Appendix A.

Discussion

Based on the minimal erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the SSDF, with respect to containment, was rated as satisfactory. The evidence observed suggests the structure is performing as designed.

The visual inspection report, including supporting photos and drawing, is presented in Table 5-3 below.

Table 5-3: CAM-F Sarcpa Lake – SSDF Visual Inspection

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Near the road, 12 m east of northeast of MW604	20 m^2		0.02	<1%	Ponded water, increased in size in 2012, dry in 2014	Dry	54
Settlement	B	Near the road, 14 m north of the SSDF northwest corner	28 m^2		0.1	<1%	Large Depression: No significant change (NSC) 2012		55
Settlement	C	Along toe of the landfill, at the northwest corner of the SSDF	12	0.005	0.01	<1%	Minor cracking and a slightly low lying area; NSC 2014		56-57
Settlement	D	Along the northwest side of the landfill, 12 m south of the northwest corner of the SSDF	16	0.005	0.01	<1%	Minor settlement cracks; less evident/NSC 2014		58-59
Settlement	E	Along the side of the landfill , near toe of the SSDF along the west side, 31 m south of the northwest corner	16 m^2		0.12	<1%	Minor settlement and cracking, Pothole; NSC 2014		60-61
Settlement	F	Along the side of the landfill , near toe of the SSDF along the west side, 33 m north of the southwest corner	25	0.005	0.025	<1%	Minor settlement cracks; NSC 2014		67
Settlement	G	Along the side of the landfill , near toe of the SSDF along the west side, 35 m north of the southwest corner	0.03 m^3			<1%	Two small settlement features – potholes; NSC 2014		70
Seepage	H	Along the side of the landfill in the southwest corner of the SSDF	16 m^2		N/A	<1%	Dark, saturated soil, not actively running; not observed in 2014	Removed from Figure A2	71
Seepage	I	Toe of the landfill in the southwest corner of the SSDF	13.4 m^2		0.25	<1%	Seepage areas observed to be dry in 2014.	North ponded area - dry	73-75
			41 m^2		0.25	<1%		South ponded area - dry	
			7	1	0.15	<1%		North channel - dry	
			8.8	1	0.2	<1%		South channel - dry	
Seepage	J	14 m southeast from the southwest corner of the SSDF near the toe	7.3	0.5	0.15	<1%	Active Seepage; not flowing in 2014	Dry	-
Settlement	K	9 m east from the southwest corner of the SSDF alongside of landfill	13.6	0.005	0.01	<1%	Cracking; less evident in 2012; NCS 2014		76-77
Seepage	L	15 m east from the southwest corner of the SSDF alongside of landfill	19.7 m^2		N/A	<1%	Dark saturated soil – long linear feature; Not observed in 2012. Not observed in 2014.	Removed from Figure A2	17
Settlement	M	37 m east from the southwest corner of the SSDF alongside of landfill	16.5	0.01	0.05	<1%	Very minor settlement cracking; not observed in 2012 or 2014		78
Seepage	N	28 m east from the southwest corner of the SSDF near the toe	9.6	0.05	N/A	<1%	Seepage face and associated drainage; NSC 2014	Seepage Face	79-80
			40	0.4	0.3	<1%		Drainage channel	
Settlement	O	24 m west from the southeast corner of the SSDF alongside of landfill	12.5	0.005	0.01	<1%	Minor settlement cracking; Not observed 2014	Removed from Figure A2	81
Seepage	P	20 m west from the southeast corner of the SSDF alongside of landfill	42.9 m^2		N/A	<1%	Dark saturated soil; not observed in 2012 or 2014	Removed from Figure A2	26

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Seepage	Q	11 m west from the southeast corner of the SSDF at the toe of the landfill	12	0.05	N/A	<1%	Seepage face, associated drainage and ponded water; Soil saturated, but not running in 2014. No ponded water or soil staining in 2014.	Seepage Face	82-84
			0.25	0.45	0.25	<1%		West channel	
			0.15	0.4	0.15	<1%		East channel	
			42 m^2		0.2	<1%		Ponded water	
Seepage	R	Southeast corner of the SSDF at toe	11.1	0.1	N/A	<1%	Seepage face and saturated soil area with ponded water; less evident in 2012; dry in 2014	Seepage face - dry	23
			32 m^2		N/A	<1%		Saturated soil area - dry	
Vegetation	S	Southeast corner of the SSDF along the side slope	N/A			<1%	Area of vegetation; increased density of growth in 2012; NSC 2014	Vegetation establishing on top of landfill and along eastern and southern slopes	85, 91-97,
Settlement	T	40 m north from the southeast corner of the SSDF along the side slope	7.8	0.01	0.01	<1%	Settlement cracks; less evident in 2012; less evident in 2014	South crack	86
			8.9	0.01	0.01			North crack	
Settlement	U	28 m south from the northeast corner of the SSDF along the side slope	10.1 m^2		0.2	<1%	Settlement/depressions; not observed in 2012 or 2014	Removed from Figure A2	87
Seepage	V	18 m south from the northeast corner of the SSDF along the side slope	29 m^2		N/A	<1%	Dark saturated soil with very sparse vegetation; NSC 2012; not observed in 2014	Removed from Figure A2	36 and 38
Ponded Water	W	MW06-04	~55 m^2				Ponded/puddled water. No ponding observed in 2014	Removed from Figure A2	40, 90

Note: Measurements for relative location were taken from the landfill corner at the toe to the center of the feature of note.

5.4 Thermal Monitoring Data

As described in the initial annual monitoring report (UMA, 2008), two thermistor strings (01-VT and 02-VT) are installed from the SSDF surface to the top of the key trench, while two strings (03-VT and 04-VT) are installed from 1.5 m below the surface to the middle of the key trench.

A memory transfer was successfully performed on each thermistor data logger, with the exception of 03-VT which displayed an error message when attempting to completed the download. A complete memory transfer (CMT) was performed on 03-VT and the CMT file was sent to Lakewood Systems for analysis and potential data recovery. Lakewood Systems was able to retrieve some segments of data. Unfortunately, it appears as though the time stamps and clock as a whole were malfunctioning on 03-VT and there is no way to confirm that the readings are correct and that data correlates to the proper time frames. In addition, the data set retrieved appeared to cover a limited period of time, which does not correspond with the timeframe expected since the last site visit. Under these circumstances, FRANZ believes that the recovered data for 03-VT is unworkable and should not be included as part of the temperature trend data set. Email correspondence from Lakewood Systems Inc. is attached in Appendix I.

All thermistor beads positioned below the ground surface were found to yield temperatures within the standard ± 0.2 ºC margin of error when compared to field resistance readings, with the exception of bead 1 on VT01 (discrepancy of 1.4 ºC) and bead 1 and bead 2 on VT02 (discrepancy of 1.9 ºC and 0.8 ºC). Large discrepancies are noted in VT03 as the data was corrupt as mentioned above. A larger margin of error between manually and automatically recorded temperatures is considered acceptable for beads positioned above or near the ground surface, as is the case for bead 1 of string B and bead 1 of string C. The larger margin of error is attributable to fluctuation in atmospheric temperature over the duration of the test period. Although the discrepancies are large, the data from these beads are considered useable and was retained. Additional details of the manual verification test are presented in Table G-2, Appendix G.

The position of the 0ºC isotherm was calculated at each location from ground temperatures collected on August 24, 2014 and compared to the position as determined from the previous years' data (Table 5-4). The maximum depth of the active layer – depth to the 0 ºC isotherm, or permafrost – was also interpolated from the deepest points during the year at which temperatures straddled the freezing point. Regional climate and aggregate historical temperature data for the SSDF are plotted and presented Figures H-1 to H-6 in Appendix H. Temperature profile plots of (a, b, c) depth versus temperature and (d) temperature versus time for each thermistor string in 2012-2014 are presented in Figures H-7 to H-10, Appendix H.

Table 5-4: Maximum Depth to Permafrost in the SSDF (m). All values interpolated.

Thermistor	01-VT	02-VT	03-VT	04-VT
Max between Jan. 1 2008 to December 31, 2008 (date established (YYYY-MM-DD))	2.29 2008/08/17	2.33 2008/09/07	2.49 2008/10/08	2.12 2008/09/06
Max between Jan. 1 2009 to December 31, 2009 (date established (YYYY-MM-DD))	1.84 2009/09/07	2.23 2009/09/07	2.37 2009/09/06	2.23 2009/09/03
Max between Jan. 1 2010 to December 31, 2010 (date established (YYYY-MM-DD))	1.79 2010/09/09	2.26 2010/08/26	2.39 2010/09/10	2.27 2010/09/10
Max between Jan. 1 2011 to December 31, 2011 (date established (YYYY-MM-DD))	1.77 2011/08/28	2.15 2011/08/30	2.30 2011/08/29	2.19 2011/08/30
Max between Jan. 1 2012 to December 31, 2012 (date established (YYYY-MM-DD))	1.44 2012/09/02	1.89 2012/09/02	*NA	1.97 2012/09/08
Max between Jan. 1 2013 to December 31, 2013 (date established (YYYY-MM-DD))	1.52 2013/08/23	1.86 2013/08/24	*NA	1.89 2013/08/24
Max between Jan. 1 2014 to August 24, 2014 (date established (YYYY-MM-DD))	1.43 2014/08/07	1.76 2014/08/14	*NA	1.86 2014/08/16

*insufficient data to calculate a depth

From the data in Table 5-4, it would appear that the active layer did not thaw to as great of depth as in past years.

The average temperature of the thermistors also showed a decrease compared to the previous years. The contents of the landfill at the liner depth and below remained frozen throughout the year (see below Table 5-5 through Table 5-8).

Table 5-5: Average annual temperatures at 01-VT

Year	Thermistor ID	2008	2009	2010	2011	2012	2013	2014**
Depth below SSDF Surface (m)		1.8, 2.3	1.8, 2.3	1.3, 1.8	1.3, 1.8	1.3, 1.8	1.3, 1.8	1.3, 1.8
Average temperature	01-VT	-8.06 -7.59	-9.5 -9.32	-7.31 -7.37	-8.1 -7.79	-9.7 -9.48	-10.11 -9.47	-10.11 -9.79
Maximum temperature	01-VT	0.37 -0.39	1.51 -0.16	1.51 -0.10	1.06 -0.33	0.16 -0.67	0.13 -0.84	2.64 -0.12

**data to August 24, 2014

Table 5-6: Average annual temperatures at 02-VT

Year	Thermistor ID	2008	2009	2010	2011	2012	2013	2014**
Depth below SSDF Surface (m)		2.3, 2.8	1.8, 2.3	1.8, 2.3	1.8, 2.3	1.8, 2.3	1.8, 2.3	1.3, 1.8

Average temperature	**02-VT**	-7.1 -6.49	-9.11 -8.8	-6.74 -6.75	-8.11 -7.73	-8.97 -8.65	-9.64 -9.32	-12.97 -13.21
Maximum temperature	**02-VT**	0.37 -0.39	1.51 -0.16	1.51 -0.10	1.06 -0.33	0.16 -0.67	0.13 -0.84	2.64 -0.12

**data to August 24, 2014

Table 5-7: Average annual temperatures at 03-VT

Year	**Thermistor ID**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Depth below SSDF Surface (m)		2.4, 2.9	1.9, 2.4	1.9, 2.4	1.9, 2.4	*N/A	*N/A	*N/A
Average temperature	**03-VT***	-7.31, -6.74	-9.53, -9.33	-7.04, -7.09	-7.96, -7.74	*N/A	*N/A	*N/A
Maximum temperature	**03-VT***	0.17, 0.50	1.3, -0.04	1.2, 0.02	0.98, -0.21	*N/A	*N/A	*N/A

* insufficient data to calculate

Table 5-8: Average annual temperatures at 04-VT

Year	**Thermistor ID**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014****
Depth below SSDF Surface (m)		1.9, 2.4	1.9, 2.4	1.9, 2.4	1.9, 2.4	1.9, 2.4	1.5, 1.9	1.5, 1.9
Average temperature	**04-VT***	-9.53, -9.2	-10.43, -10.34	-7.78, -7.85	-8.53, -8.38	-9.46, -9.28	-10.58, -10.38	-13.67, -13.84
Maximum temperature	**04-VT***	0.29 -0.35	0.66 -0.28	0.66, -0.2	0.61, -0.31	0.098, -0.56	1.51, -0.02	1.73, -0.1

**data to August 24, 2014

Memory capacity of each data logger was 82% full. The data logger programming was amended to a 24 hour monitoring cycle during the August 2014 site visit to ensure the data loggers have the capacity to continue to record temperature data until the next site visit in August of 2017. Going forward, the data logger will record one data point per day at 12:00 hr instead of the previous two data points at 0:00 hr and 12:00 hr.

Additional details can be found in the thermistor annual maintenance monitoring report (Table H-1, Appendix H). Field notes relating to the thermistor inspection are included in Appendix G. A verification of the data collected by the thermistors was performed by comparing the logged temperature versus the recorded resistance. Results indicate that all temperature sensing beads of the three thermistor strings are functioning well. Details of the tests are presented in Table H-2, Appendix H. Additional thermistor inspection information concerning field monitoring issues and field verification options are included in Appendix H.

5.5 Analytical Results – Groundwater Samples

As described in section 4.5.1, one (MW0604) groundwater sample (plus one blind field duplicate) was submitted to Maxxam Analytics in Ottawa, Ontario for analyses of PHCs, metals,

PCBs and inorganic parameters from the SSDF. Analytical results are present in Appendix B, Tables B-1 through B-4.

PHCs

Laboratory analytical results for inorganics are shown in Table B-1; Appendix B. Concentrations for all parameters were below laboratory reportable detection limits and thus fall below the maximum acceptable concentrations. While historical data does not permit the meaningful calculation of mean and standard deviations for BTEX compounds, none of these compounds exceeded detection limits.

Metals

Laboratory analytical results for inorganics are shown in Table B-2; Appendix B. Concentrations of total and dissolved cadmium, total copper, total and dissolved lead and total zinc were reported above the CCME FIGQGs for freshwater life pathway for MW0604, however were below the upper limit of acceptability for each.

Inorganics

Laboratory analytical results for inorganics are shown in Table B-3; Appendix B. Concentrations of fluoride and dissolved sulphate were reported above the CCME FIGQGs for freshwater life pathway for MW0604, however were below the upper limit of acceptability for each.

PCBs

Laboratory analytical results for PCBs, and the maximum acceptable concentrations (based on historical results) are shown in Table B-4; Appendix B. As shown in the table, concentrations were below the RDLs and thus satisfy the standards applied to the site.

Laboratory certificates of analyses for the 2014 groundwater samples are provided in Appendix E.

6.0 SUMMARY OF NHWL CONDITIONS

6.1 Area Summary

The NHWL is located to the northwest of the airstrip. Monitoring of the NHWL included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. Groundwater samples were also collected at locations up- and downgradient of the NHWL.

A plan view of the NHWL indicating photographic viewpoints can be seen in Figure A-3, Appendix A. The visual inspection report, including supporting photos and drawing, is presented in sections 6.2 and 6.3 below.

6.2 Photographic Record

The photographic record of the NHWL was completed as per the Statement of Work. Copies of the photographs that are referenced in the body of this document are provided in Appendix C, where photograph captions provide the landfill viewpoint number (as seen in red on Figure A-3, Appendix A) where applicable. The complete photographic record, including full-resolution photographs, is contained in the attached CD-ROM.

6.3 Visual Inspection Report

The visual inspection of the NHWL and surrounding area was conducted on August 25, 2014. The visual monitoring checklist was completed using the format requested by AANDC and is presented as Table 6-3 of this report. Field notes relating to the visual inspection are included in Appendix G. Table 6-1 and Table 6-2 present the preliminary visual inspection results for 2012 monitoring of the NHWL at CAM-F.

Table 6-1: Preliminary Visual Inspection Report NWHL

Feature	Presence (Y/N)	Severity Rating	Extent
Settlement	Y	Acceptable	Occasional
Erosion	Y	Acceptable	Isolated
Frost Action	N	Not Observed	None
Animal Borrows	N	Not Observed	None
Vegetation	N	Not Observed	None
Staining	N	Not Observed	None
Vegetation Stress	N	Not Observed	None
Seepage / Ponded Water	N	Not Observed	None
Debris Exposure	N	Not Observed	None
Monitoring Well Condition	Y	Good condition - Acceptable	
Overall Landfill Performance	**Acceptable**		

Table 6-2: Preliminary Visual Inspection Report NHWL - Definitions

Performance / Severity Rating	Description
Acceptable	Noted features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion, settlement.
Marginal	Physical/environmental performance appears to be deteriorating with time. Observations may include an increase in size or number of features of note, such as differential settlement, erosion or cracking. No significant impact on landfill stability to date, but potential for failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability, such as significant changes in slope geometry, significant erosion or differential settlement; scarp development. The potential for failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include: • Debris exposed in erosion channels or areas of differential settlement. • Liner exposed. • Slope failure.
Extent	**Description**
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting greater than 50% of the surface area of the landfill

Settlement

Settlement on the landfill top (see features A and B) is similar to that described in previous years (two small locations on the northwest sector; refer to Figure A-3, Appendix A). There is no obvious cause to this settlement, which is considered minor. There is no evidence of significant water infiltration and no ponding was observed at or around the NHWL.

The same settlement areas (see features C and D) were also observed beyond the toe of the NHWL between the NW corner and the SW side (see Figure A-3, Appendix A) where maximum depth of settlement of 0.3 to 0.4 m is reached. A new area of minor settlement located approximately 25 m north of the NHWL was documented as feature E in 2012, which showed no significant change in the 2014 inspection (see Figure A-3, Appendix A).

Erosion

Evidence of erosion is similar to that observed in previous years: there exists minor erosion on the side slopes of the NHWL, likely due to down-slope washing of fine-grained fill between cobbles. There is no apparent downgradient erosion from the landfill.

Frost Action

No evidence of heaving or cracking was observed on the top or sides of the NHWL. There were no apparent signs of frost action observed in 2014.

Evidence of Burrowing Animals

Indications of burrowing animals were not observed.

Staining

Indications of staining on or around the NHWL were not observed.

Seepage Points

Small rills or erosion channels observed on the side slopes in 2009 were interpreted as evidence that seepage had occurred on all side slopes of the NHWL; no indication of rills or erosion channels associated with seepage were observed during the 2011, 2012, or 2014 site visits. As proposed above, evidence of apparent seepage may be closely linked to timing of precipitation events over the short term. No ponding within the vicinity of the NHWL was evident. Conditions seem relatively unchanged from previous inspections.

Debris

No debris within the vicinity of the NHWL was observed.

Discussion

Based on the very minimal erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the NHWL, with respect to containment, was again rated as satisfactory. The visual inspection report, including supporting photos and drawing, is presented in Table 6-3.

6.4 Analytical Results – Groundwater Samples

Two groundwater samples (MW0602 and MW0603) were submitted to Maxxam Analytics in Ottawa, Ontario for analyses of PHCs, metals, PCBs and inorganic parameters. Analytical results are discussed below.

PHCs

Analytical results for PHCs in groundwater are shown in Table B-1; Appendix B. Concentrations for all parameters were below laboratory reportable detection limits and thus fall below the maximum acceptable concentrations. While historical data does not permit the meaningful calculation of mean and standard deviations for BTEX compounds, none of these compounds exceeded detection limits.

Metals

Analytical results for dissolved and total metals in groundwater including the maximum acceptable concentrations (based on historical results) are shown in Table B-2; Appendix B. The groundwater sample collected from MW06-03 exhibited concentrations of dissolved copper (18 µg/L) above the maximum acceptable concentrations of 16 µg/L derived from the mean data as per the AMSRP. Lead was also reported in concentrations exceeding the maximum acceptable concentration of 5 µg/L in MW06-2 and MW06-3 with concentrations of 7.6 µg/L and 32 respectively µg/L. FRANZ believes this increase is a result of non-standard sampling techniques (i.e. limited purging due to low recharge in monitoring well) and does not represent an actual trend. Groundwater sampling at these well locations will continue in the future and should be monitored closely. Increased monitoring frequency is not warranted at this time.

Concentrations of dissolved copper, total and dissolved lead and total and dissolved zinc were also reported above the CCME FIGQGs for freshwater life pathway for MW0602. Additionally, concentrations of total and dissolved cadmium, total chromium, total and dissolved lead, and total and dissolved zinc were reported above the CCME FIGQGs for freshwater life pathway for MW0603.

Inorganics

Laboratory analytical results for inorganics are shown in Table B-3; Appendix B. Concentrations of fluoride were reported above the CCME FIGQGs for freshwater life pathway for MW0604, however were below the upper limit of acceptability.

PCBs

Laboratory analytical results for PCBs, and the maximum acceptable concentrations (based on historical results) are shown in Table B-4; Appendix B. As shown in the table, concentrations were below the RDLs and thus satisfy the standards applied to the site.

Laboratory certificates of analyses for the 2014 groundwater samples are provided in Appendix E.

Table 6-3: CAM-F Sarcpa Lake – NHWL Landfill Visual Inspection

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Top of NHWL, 24.6 m east from the northwest top ledge	12.9 m^2		0.02	<1%	Small depression; NSC in 2014		47-48
Settlement	B	Top of NHWL, 15.4 m east from the northwest top ledge	32.3 m^2		0.1	<1%	Large Depression; NSC in 2014		49
Settlement	C	3.3 m west of the west corner of the NHWL	6.6 m^2		0.02	<1%	Slight low area; NSC in 2014		50
Settlement	D	10.8 m southwest of the south corner of the NHWL	16.3 m^2		0.25	<1%	Settlement; NSC in 2014		-
Settlement	E	25 m north of the north corner of the NHWL	20 m^2		0.25	<1%	Slight low area; NSC in 2014	Maximum depth	27

7.0 SURROUNDING AREAS AND NATURAL ENVIRONMENT

The area surrounding the CAM-F DEW Line site was also inspected, including the borrow sources and re-graded areas. With the exception of the cabin area between the NHWL and SSDF, which is in frequent use, the site was found to be clean and in good order. A small amount of scattered debris including fuel drums is present around the hunting cabin. Re-grading of the borrow areas to the west of the NHWL was noted to be of lesser quality than at other re-graded areas.

Long-Term Monitoring plans for other, similarly managed AANDC sites recommend monitoring the following parameters to better understand the presence and temporal changes to wildlife and the natural environment:

- Wildlife sightings
- Other evidence of recent presence of wildlife (e.g. droppings, tracks)
- Wildlife activity (e.g. nesting, migration)
- Qualitative assessment of relative numbers versus previous years
- Revegetation of disturbed areas versus previous years

Information regarding these parameters was either gathered directly, through personal observation while on site or indirectly, through our wildlife monitor, a member of the Hall Beach Hunters and Trappers Association, who consulted knowledgeable local persons in the nearby community of Hall Beach.

Wildlife and Human Activity

From information from a member of the Hunters and Trappers Organization in Hall Beach, Simon Curley, the site is used for hunting and fishing. During the 2014 site visit, the following signs of wildlife were observed:

- Snow geese flew over on multiple occasions; tracks and scat were evident throughout the site.
- A raven was observed near the NHWL.
- Caribou tracks were observed throughout the site.
- Several sik sik's were observed.

Human activity was summarized as follows (based on direct observation and information provided by Mr. Curley):

- Sarcpa Lake is apparently used for fishing.
- The hunting cabin is well used.

- Several empty barrels were observed outside the cabin. Several barrels with small amounts of gasoline were also noted. These barrels have accumulated since the completion of the remediation work in 2008.

The site is used frequently by both local hunters and a variety of wildlife.

Re-establishment of Vegetation

Major site remedial work, comprised of excavation and construction activities, was completed in the summer of 2007, seven years prior to the 2014 site monitoring visit. Evidence of revegetation was initially observed in August 2011 and appears to have established further in 2014; however, given the regional setting of the CAM-F DEW Line site and growth observed at other, similar sites in the Nunavut region, it is reasonable to assume that it will continue to take many years for native vegetation to become fully re-established at the site.

8.0 CONCLUSIONS AND RECOMMENDATIONS

FRANZ conducted the field activities for the fifth year of the CAM-F long-term monitoring program on August 24 and 25, 2014, while based in the nearby community of Hall Beach.

Physical observations from the 2014 field activities suggest that there has been little significant change at the CAM-F DEW Line site and that both the SSDF and the NHWL are performing as designed and are containing the enclosed waste. Temperature data indicated that the temperature below ground surface decreased since last year and was comparable to the low established in 2009. The maximum depth of the active layer remains less than the depth to contaminated material.

Thermal monitoring infrastructure installed at the SSDF is performing well. All thermistors at CAM-F were replaced with new units supplied by Lakewood Systems to allow for factory maintenance on the previously installed data loggers. To avoid a data gap in the thermal monitoring due to insufficient memory storage for three years of 12hr data, the data loggers were reprogrammed during the 2014 monitoring event. Datalogger sampling frequency was reduced to record one data point per day at 12:00 hr instead of the previous two data points per day at 0:00 hr and 12:00 hr.

In addition to physical and temperature observations, FRANZ collected groundwater samples to assess the performance of the SSDF and NHWL. Concentrations of contaminants of concern in groundwater were compared to historical groundwater results from 2006 to 2012. Concentrations of total lead in MW0602 and dissolved copper and total lead in MW0603 were above the upper limit of acceptability. FRANZ believes this increase is a result of non-standard sampling techniques (i.e. limited purging due to low recharge in monitoring well) and does not represent an actual trend. Groundwater sampling at these well locations will continue in the future and should be monitored closely. Increased monitoring frequency is not warranted at this time.

Additionally, several metals reported concentrations above the Canadian Council of Ministers of the Environment (CCME) Federal Interim Groundwater Quality Guidelines (FIGQGs) pathway specific guidelines for protection of freshwater life. FRANZ believes that as the freshwater life pathway is not applicable to site conditions, these concentrations are not of a concern at this time. While an increase in chemical concentration from one sampling event to the next is worth noting, there are no other signs of landfill instability.

As a result of the physical and thermal observations and analytical results of the 2014 field program, FRANZ believes that the site is little changed from the last monitoring event in August 2012, that its facilities continue to operate as designed, and that the site poses no present threat to human health or the natural environment. FRANZ recommends continued monitoring of the

areas of seepage at the SSDF identified in 2012, but not observed in 2014 due to drier conditions.

9.0 LIMITATIONS

This report has been prepared exclusively for Aboriginal Affairs and Northern Development Canada. Any other person or entity may not rely upon the report without the express written consent from ARCADIS Franz Canada Inc. and Aboriginal Affairs and Northern Development Canada.

Any use, which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. ARCADIS Franz Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Some of the information presented in this report was provided through existing documents and interviews. Although attempts were made, whenever possible, to obtain a minimum of two confirmatory sources of information, ARCADIS Franz Canada Inc., in certain instances, has been required to assume that the information provided is accurate.

The conclusions presented represent the best judgment of the assessors based on current environmental standards and on the site conditions observed on August 23 and 24, 2014. Due to the nature of the investigation and the limited data available, the assessors cannot warrant against undiscovered environmental liabilities.

Should additional information become available, ARCADIS Franz Canada Inc. requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

There is no warranty, expressed or implied that the work reported herein has uncovered all potential environmental liabilities, nor does the report preclude the possibility of contamination outside of the areas of investigation. The findings of this report were developed in a manner consistent with a level of care and skill normally exercised by members of the environmental science and engineering profession currently practicing under similar conditions in the area.

A potential remains for the presence of unknown, unidentified, or unforeseen surface and sub-surface contamination. Any evidence of such potential site contamination would require appropriate surface and sub-surface exploration and testing.

If new information is developed in future work (which may include excavations, borings, or other studies), ARCADIS Franz Canada Inc. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required

10.0 REFERENCES

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Zeiner, S*.T., Realistic Criteria for the Evaluation of Field Duplicate Sample Results,* Proceedings of Superfund XV, November 29-December 1, 1994, Sheraton Washington Hotel, Washington, D.C.

11.0 CLOSURE

We trust that this information satisfies your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours truly,

ARCADIS Franz Canada Inc.

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Environmental Scientist

Andrew Henderson, B.A.Sc.
Environmental Engineer/Project Manager

Steve Livingstone, M.Sc., P. Geo.
Principal/Senior Reviewer

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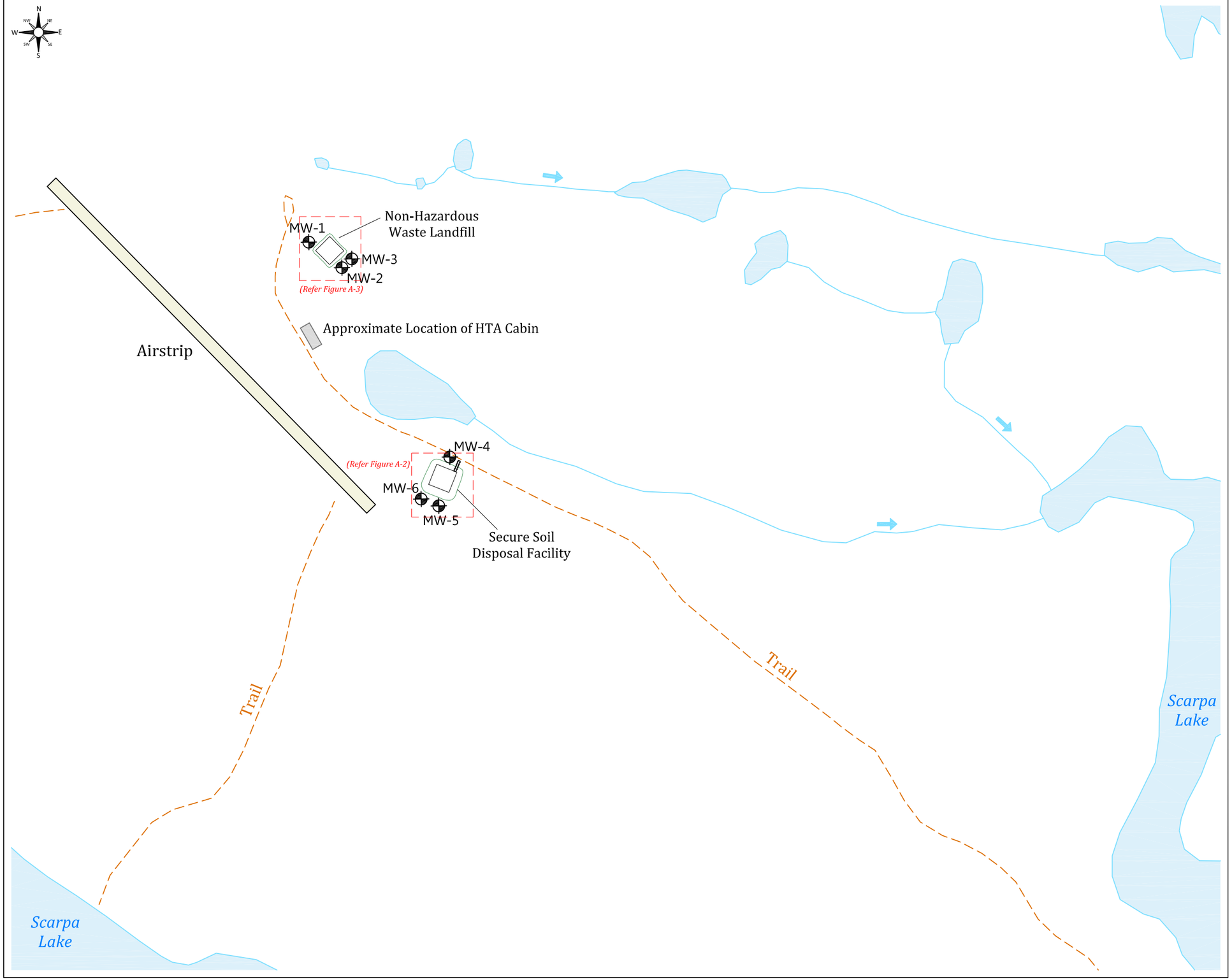
APPENDIX A

Figures



Legend

- Lake
- River
- Trail
- Water Flow Direction
- Monitoring Well Location

Title: Site Features

FRANZ ENVIRONMENTAL INC.
CONSULTING ENGINEERING TECHNOLOGIES

Project: CAM-F, Scarpa Lake, NU 1697-1401

Date: December 2014

Client: Aboriginal Affairs and Northern Development Canada

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Figure A-1

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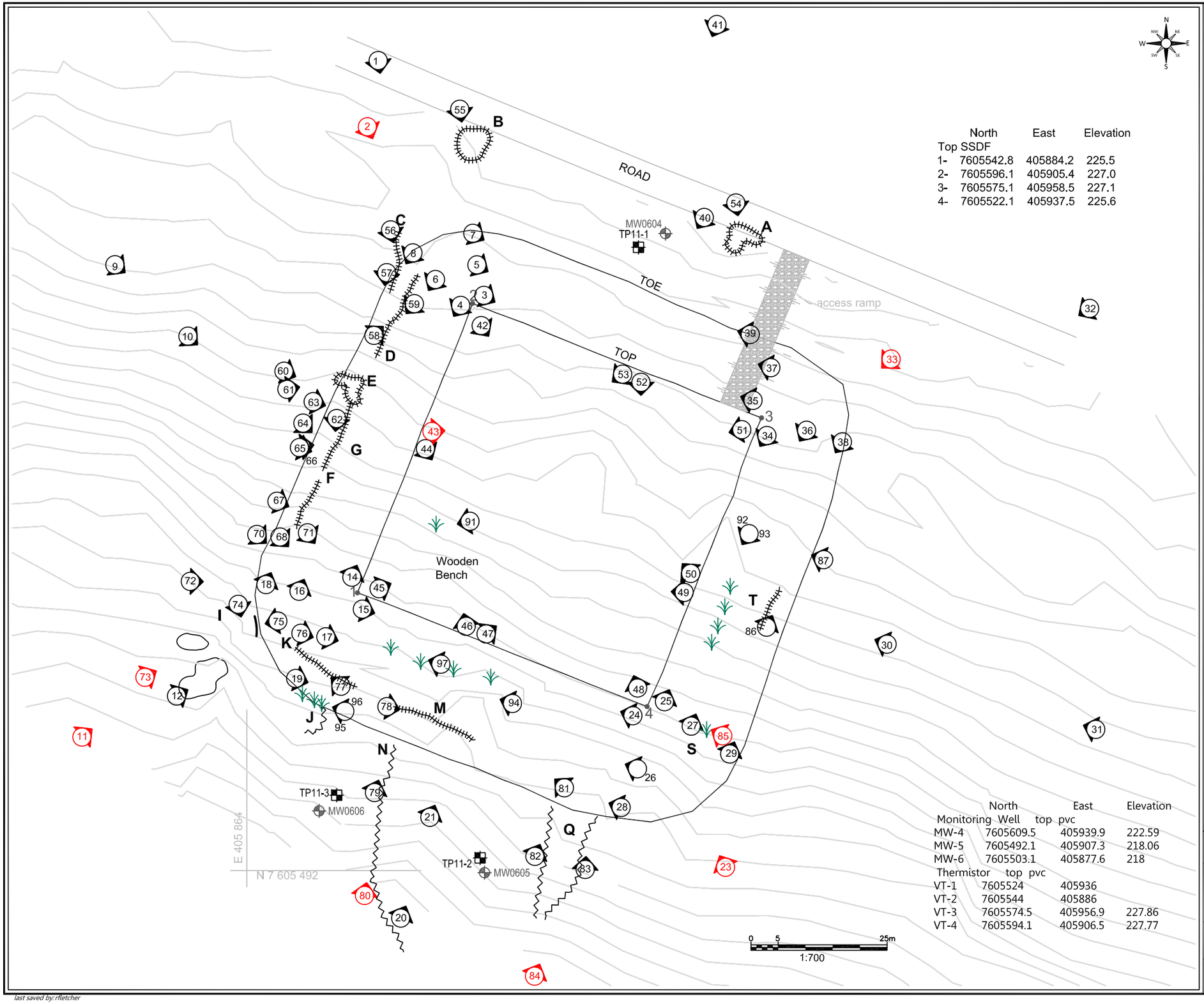

	North	East	Elevation
Top SSDF			
1-	7605542.8	405884.2	225.5
2-	7605596.1	405905.4	227.0
3-	7605575.1	405958.5	227.1
4-	7605522.1	405937.5	225.6

	North	East	Elevation
Monitoring Well top pvc			
MW-4	7605609.5	405939.9	222.59
MW-5	7605492.1	405907.3	218.06
MW-6	7605503.1	405877.6	218
Thermistor top pvc			
VT-1	7605524	405936	
VT-2	7605544	405886	
VT-3	7605574.5	405956.9	227.86
VT-4	7605594.1	405906.5	227.77

Legend

- MW — Monitoring Well Locations
- TP — Test Pit Locations
- 25 — Picture Viewpoint Number
- 25 — Viewpoint Photograph Included in Appendix C
- Erosion Channel (blue = active)
- Cracking
- Area of Depression/Settlement
- Vegetation Cover

Note:
Picture numbers refer to photograph names as they appear in Appendix C

Title: Secure Soil Disposal Facility

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: CAM-F Sarcpa Lake, NU 1697-1401

Date: December 2014

Client: Aboriginal Affairs and Northern Development Canada

Scale: Scale as shown

Figure A-2

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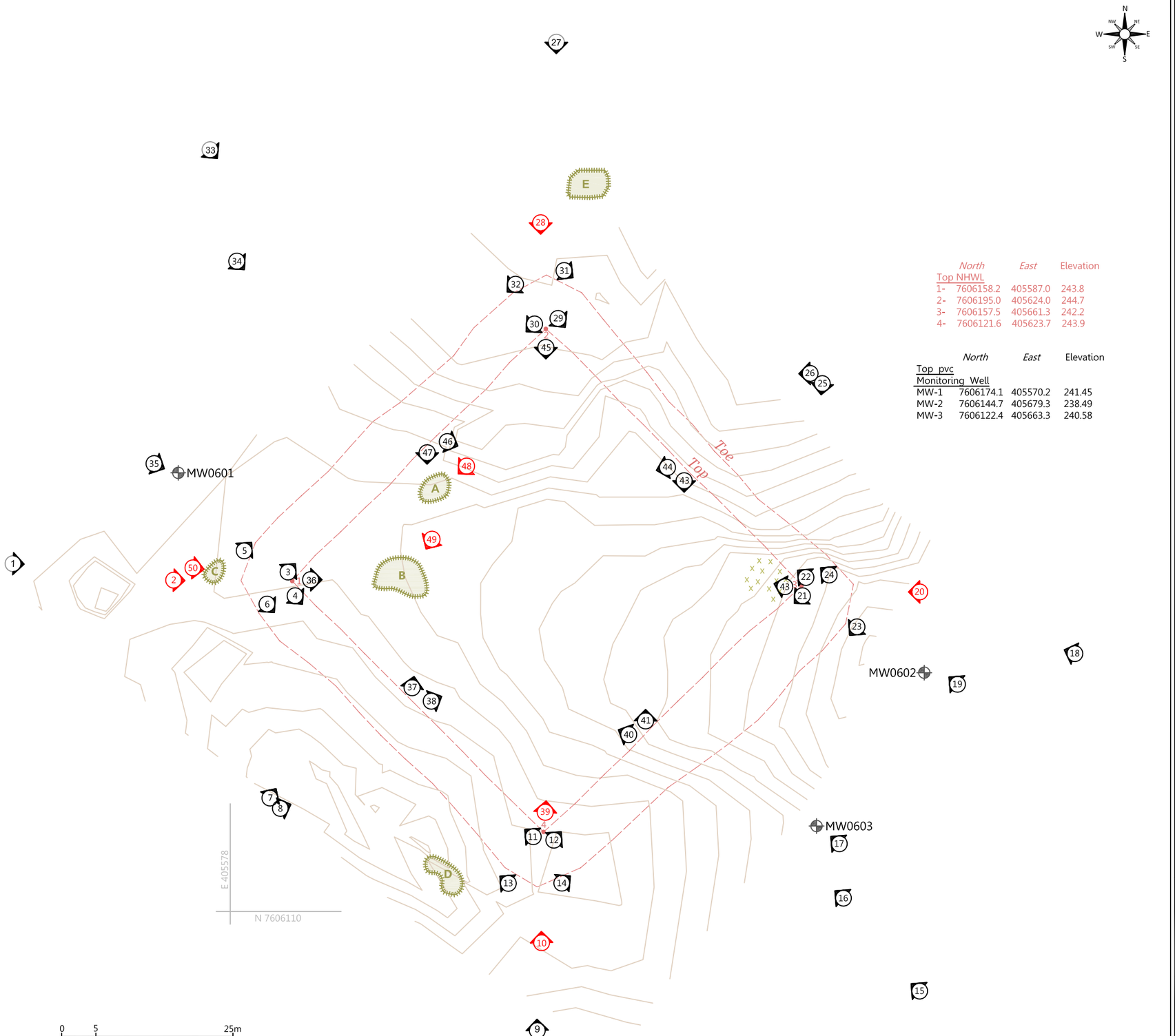

	North	East	Elevation
Top NHWL			
1-	7606158.2	405587.0	243.8
2-	7606195.0	405624.0	244.7
3-	7606157.5	405661.3	242.2
4-	7606121.6	405623.7	243.9

	North	East	Elevation
Top pvc Monitoring Well			
MW-1	7606174.1	405570.2	241.45
MW-2	7606144.7	405679.3	238.49
MW-3	7606122.4	405663.3	240.58

Legend

- MW — Monitoring Well Locations
- 25 — Picture Viewpoint Number
- A — Settlement
- Poor Grading
- 25 — Viewpoint Photograph Included in Appendix C

Title: Non-Hazardous Waste Landfill

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: CAM-F Sarcpa Lake, NU 1697-1401

Date: December 2014

Client: Aboriginal Affairs and Northern Development Canada

Scale as shown

Figure A-3

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APPENDIX B

Analytical Results Tables

Table B-1
Ground Water Chemical Concentrations 2014 - PHCs

PARAMETER	Guidelines		RDL	NHWL			SSDF					
									Duplicate Evaluation			
Sample ID	CCME FIGQGs[1]	Upper Limit of Acceptability[2]		MW0601	MW0602	MW0603	MW0604	DUP0601	Scenario*	RPD (%)	Acceptable	MW0606
Date					2014/08/25	06/08/2012	2014/08/24	2014/08/24				
BTEX & F1 Hydrocarbons (ug/L)												
Benzene	140	Not Available	0.2	--	<0.20	<0.20	<0.20	<0.20	A	---	Y	--
Toluene	83	Not Available	0.2	--	<0.20	<0.20	<0.20	<0.20	A	---	Y	--
Ethylbenzene	1100	Not Available	0.2	--	<0.20	<0.20	<0.20	<0.20	A	---	Y	--
o-Xylene	NA	Not Available	0.2	--	<0.20	<0.20	<0.20	<0.20	A	---	Y	--
p+m-Xylene	NA	Not Available	0.4	--	<0.40	<0.40	<0.40	<0.40	A	---	Y	--
Total Xylenes	3900	Not Available	0.4	--	<0.40	<0.40	<0.40	<0.40	A	---	Y	--
F1 (C6-C10)	810	222	25	--	<25	<25	<25	<25	A	---	Y	--
F1 (C6-C10) - BTEX	NA	222	25	--	<25	<25	<25	<25	A	---	Y	--
F2-F4 Hydrocarbons												
F2 (C10-C16 Hydrocarbons)	1300	175	100	--	<100	<100	<100	<100	A	---	Y	--
F3 (C16-C34 Hydrocarbons)	NC	175	100	--	<200	<100	<200	<200	A	---	Y	--
F4 (C34-C50 Hydrocarbons)	NC	175	100	--	<200	<100	<200	<200	A	---	Y	--
Reached Baseline at C50	NC	N/A	N/A	--	Yes	Yes	Yes	Yes	NC	NC	NC	--

Notes:

1 = Table 1: Federal Interim Groundwater Quality Guidelines, Generic Guidelines for Residential/Parkland Land Use (mg/L), Tier 1, Freshwater Life pathway for coarse grained soils.

2 = Upper Limit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are clcaulated using mean of previous sampling rounds +3 standard deviations.

* = See Quality Assurance and Quality Control section for scenario rationale.

N/A = Not Applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds CCME guideline

Table B-2
Ground Water Chemical Concentrations 2014 - Metals

PARAMETER	CCME FIGQGs[1]	Upper Limit of Acceptability[2]	Lowest RDL	NHWL			SSDF							
Sample ID				**MW0601**	**MW0602**	**MW0603**	**MW0604**	**DUP0601**	**Duplicate Evaluation**				**MW0605**	**MW0606**
Date				06/08/2012	06/08/2012	06/08/2012	06/08/2012	06/08/2012	Scenario*	RPD (%)	Value (ug/L)	Acceptable	06/08/2012	06/08/2012
Metals (ug/L)														
Dissolved Arsenic (As)	5	2	0.2	--	<0.2	0.3	<0.2	<0.2	A	---	---	Y	--	--
Total Arsenic (As)	5	3	0.2	--	0.41	0.94	<0.2	<0.2	A	---	---	Y	--	--
Dissolved Cadmium (Cd)	0.017	1	0.02	--	<0.02	**0.038**	**0.021**	**0.021**	D	---	0.000	Y	--	--
Total Cadmium (Cd)	0.017	1	0.02	--	<0.02	**0.25**	<0.020	**0.027**	B	---	0.017	Y	--	--
Dissolved Cobalt (Co)	NA	129	0.3	--	0.61	0.91	<0.3	0.55	B	---	0.400	N	--	--
Total Cobalt (Co)	NA	139	0.3	--	1.3	3.5	0.6	0.61	D	---	0.010	Y	--	--
Dissolved Chromium (Cr)	8.9	10	1	--	2.1	<1	<1	<1	A	---	---	Y	--	--
Total Chromium (Cr)	8.9	77	1	--	6.4	**25**	<1	<1	A	---	---	Y	--	--
Dissolved Copper (Cu)	2	16	0.2	--	<0.2	**18**	<0.2	<0.2	A	---	---	Y	--	--
Total Copper (Cu)	2	55	0.2	--	**9.8**	**38**	**2.4**	**2.1**	C	13	---	Y	--	--
Dissolved Nickel (Ni)	83	53	0.2	--	<0.2	<0.2	<0.2	<0.2	A	---	---	Y	--	--
Total Nickel (Ni)	83	94	0.2	--	0.89	4.5	<0.2	<0.2	A	---	---	Y	--	--
Dissolved Lead (Pb)	2	5795	0.5	--	**3.7**	**8.3**	**3.2**	**3.3**	C	3	---	Y	--	--
Total Lead (Pb)	2	5	0.5	--	**7.6**	**32**	**3.9**	**3.8**	C	3	---	Y	--	--
Dissolved Zinc (Zn)	10	4266	3	--	**25**	**110**	**9.2**	<3	B	---	7.700	N	--	--
Total Zinc (Zn)	10	4482	3	--	**53**	**410**	**11**	**11**	D	---	0.000	Y	--	--

Notes:

1 = Table 1: Federal Interim Groundwater Quality Guidelines, Generic Guidelines for Residential/Parkland Land Use (mg/L), Tier 1, Freshwater Life pathway for coarse grained soils.

2 = Upper Limit of Acceptability is determined as described in Report Section 3.1. Upper limits of acceptability are calculated using mean of baseline data +3 standard deviations.

* = See Quality Assurance and Quality Control section for scenario rationale.

α = Total value assumed same as dissolved value.

β = Dissolved value assumed same total value.

γ = Value a function of water hardness.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds CCME guideline

21 = Exceeds Upper Limit of Acceptability

Table B-3
Ground Water Chemical Concentrations 2014 - Inorganics

PARAMETER		Guidelines		Lowest RDL	NHWL			SSDF		
		CCME FIGQGs[1]	Upper Limit of Acceptability[2]		MW0601	MW0602	MW0603	MW0604	MW0605	MW0606
Sample ID										
Date					--	06/08/2012	--	06/08/2012	--	--
Inorganics	**Units**									
Colour	TCU	NC	118	2	--	8	--	4	--	--
Conductivity	umho/cm	NC	5040	1.0	--	660	--	810	--	--
Total Dissolved Solids	mg/L	3000	NC	10	--	386	--	578	--	--
Hardness ($CaCO_3$)	mg/L	NC	NC	0.5	--	--	--	--	--	--
Fluoride (F-)	mg/L	0.12	NC	0.10	--	**0.17**	--	**0.53**	--	--
Orthophosphate (P)	mg/L	NC	NC	0.010	--	<0.010	--	<0.010	--	--
pH	pH	6.5-9.0	7.62-8.35	N/A	--	8.14	--	8.09	--	--
Total Suspended Solids	mg/L	NC	NC	10	--	80	--	<10	--	--
Dissolved Sulphate (SO4)	mg/L	100	NC	5	--	33	--	**210**	--	--
Dissolved Chloride (Cl)	mg/L	NC	NC	1	--	8	--	12	--	--
Nitrite (N)	mg/L	0.060	NC	0.010	--	<0.010	--	<0.010	--	--
Nitrate (N)	mg/L	13.0	NC	0.10	--	2.94	--	3.43	--	--
Nitrate + Nitrite	mg/L	NC	NC	0.10	--	2.94	--	3.43	--	--

Notes:

1 = Table 1: Federal Interim Groundwater Quality Guidelines, Generic Guidelines for Residential/Parkland Land Use (mg/L), Tier 1, Freshwater life pathway for coarse grained soils.

2 = Upper Limit of Acceptability is determined as described in Report Section 3.1. Upper limits of acceptability are calculated using mean of baseline data +3 standard deviations.

* = See Quality Assurance and Quality Control section for scenario rationale.

NC = No Criteria

\- Not Analyzed

RDL= Reportable Detection Limit

20 = Exceeds CCME guideline

21 = Exceeds Upper Limit of Acceptability

Table B-4
Ground Water Chemical Concentrations 2014 - PCBs

PARAMETER	Guidelines		RDL	NHWL			SSDF		
	CCME FIGQGs[1]	Upper Limit of Acceptability[2]		MW0601	MW0602	MW0603	MW0604	MW0605	MW0606
Sample ID									
Date				06/08/2012	06/08/2012	06/08/2012	06/08/2012	06/08/2012	06/08/2012
PCBs (ug/L)									
Aroclor 1016	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1221	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1232	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1242	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1248	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1254	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1260	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1262	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Aroclor 1268	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--
Total PCB	NC	Not Available	0.05	--	<0.05	--	<0.05	--	--

Notes:

1 = Table 1: Federal Interim Groundwater Quality Guidelines, Generic Guidelines for Residential/Parkland Land Use (mg/L), Tier 1, Freshwater life pathway for coarse grained soils.

2 = Upper Limit of Acceptability is determined as described in Report Section 3.1. Upper limits of acceptability are calculated using mean of baseline data +3 standard deviations.

* = See Quality Assurance and Quality Control section for scenario rationale.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds CCME guideline

21 = Exceeds Upper Limit of Acceptability

APPENDIX C

Site Photographs

Northwest corner of the SSDF. Viewpoint 2 (Figure A-2; Appendix A). Photograph reference P8240002 (CD-ROM).
Direction photo taken: SE

Southwest corner of the SSDF. Viewpoint 11 (Figure A-2; Appendix A). Photograph reference P8240011 (CD-ROM).
Direction photo taken: NE

Southeast corner of the SSDF. Viewpoint 23 (Figure A-2; Appendix A). Photograph reference P8240023 (CD-ROM).
Direction photo taken: NW

Northeast corner of the SSDF. Viewpoint 33 (Figure A-2; Appendix A). Photograph reference P8240033 (CD-ROM).
Direction photo taken: SW

Top of the SSDF. Viewpoint 43 (Figure A-2; Appendix A). Photograph reference P8240043 (CD-ROM). Direction photo taken: E

Vegetation on south slope of SSDF. Viewpoint 85 (Figure A-2; Appendix A). Photograph reference P8240085 (CD-ROM). Direction photo taken: E

Active seepage identified in 2012 at the southwest corner. Dry in 2014. Viewpoint 73 (Figure A-2; Appendix A). Photograph reference P8240073 (CD-ROM). Direction photo taken: NE

Active erosion from active seepage along the south toe of the SSDF. Dry in 2014. Viewpoint 80 (Figure A-2; Appendix A). Photograph reference P8240080 (CD-ROM). Direction photo taken: N

Ponded water from the active seep near the southeast corner of the SSDF. Dry in 2014. Viewpoint 84 (Figure A-2; Appendix A). Photograph reference P8240084 (CD-ROM). Direction photo taken: SE

South corner of the NHWL. Viewpoint 10 (Figure A-3; Appendix A). Photograph reference P8250010 (CD-ROM). Direction photo taken: N

East corner of the NHWL. Viewpoint 20 (Figure A-3; Appendix A). Photograph reference P8250020 (CD-ROM).
Direction photo taken: W

West corner of the NHWL. Viewpoint 28 (Figure A-3; Appendix A). Photograph reference P8250028 (CD-ROM).
Direction photo taken: S

Top of the NHWL from west corner. Viewpoint 39 (Figure A-3; Appendix A). Photograph reference P8250039 (CD-ROM). Direction photo taken: N

Feature A – small depression on top of the NHWL. Viewpoint 48 (Figure A-3; Appendix A). Photograph reference P8250048 (CD-ROM). Direction photo taken: SW

Feature B – large depression on top of the NHWL. Viewpoint 49 (Figure A-3; Appendix A). Photograph reference P8250049 (CD-ROM). Direction photo taken: S

Feature C –Slight low area near the west corner of the NHWL. Viewpoint 50 (Figure A-3; Appendix A). Photograph reference P8250050 (CD-ROM). Direction photo taken: W

APPENDIX D

Monitoring Well Sampling Records and Notes

Groundwater Sampling

Project: 1697-1401

Franz Personnel: K. Krug
Weather: Partly Sunny /~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 25th	Month: 08	Year: 2014
Monitoring Well ID:	**MW0601**		
Coordinates of Well	Easting: 405570.2		Northing: 7606174.1
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
	Frozen		
Volume Purged (L):	NA - Frozen		
Sampling Equipment:	NA - Frozen		

Measured Data

Well Depth (mbgs):	1.966		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	Frozen					
Stick Up (mags):	0.6					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
Temperature (◦C):	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
Conductivity (mS/cm):	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
DO:	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Well Frozen at 1.966 m below top of casing
Could not install lock to to heaving/settlement of casing

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project: 1697-1401

Franz Personnel: K. Krug
Weather: Partly Sunny /~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 25th	Month: 08	Year: 2014
Monitoring Well ID:	**MW0602**		
Coordinates of Well	Easting: 405679.3		Northing: 7606144.7
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	Insuficient water recharge to collect field chemistry - all water jarred as sample		
Sampling Equipment:	Geopump brand persistaltic pump		

Measured Data

Well Depth (mbgs):	2.03
Water Depth (mbgs):	1.892
Stick Up (mags):	0.7

Field Chemistry

Name and # unit:	**Readings ***	
pH:	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Temperature (◦C):	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Conductivity (mS/cm):	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
DO:	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	

Sample Analysis	**Y/N**	**# of Bottles**	**Duplicate Information**
PHC	Y	11	
PCB Total	Y		
Total Metals	Y		
Dissolved Metals	Y		
General	Y		

Comments/ Notes:

Insuficient water recharge to collect field chemistry - all water jarred as sample

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project: 1697-1401

Franz Personnel: K. Krug
Weather: Partly Sunny /~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 25th	Month: 08	Year: 2014
Monitoring Well ID:	**MW0603**		
Coordinates of Well	Easting: 405663.3		Northing: 7606122.4
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	Insuficient water recharge to collect field chemistry - all water jarred as sample		
Sampling Equipment:	Geopump brand persistaltic pump		

Measured Data

Well Depth (mbgs):	2.552
Water Depth (mbgs):	2.44
Stick Up (mags):	0.63

Field Chemistry

Name and # unit:	**Readings ***	
pH:	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Temperature (◦C):	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Conductivity (mS/cm):	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
DO:	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	

Sample Analysis	**Y/N**	**# of Bottles**	**Duplicate Information**
PHC	Y	11	
PCB Total	Y		
Total Metals	Y		
Dissolved Metals	Y		
General	Y		

Comments/ Notes:

Insuficient water recharge to collect field chemistry - all water jarred as sample

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project: 1697-1401

Franz Personnel: K. Krug
Weather: Rain/~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 24th	Month: 08	Year: 2014
Monitoring Well ID:	**MW0604**		
Coordinates of Well	Easting: 405939.9		Northing: 7605609.5
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	~2 L		
Sampling Equipment:	Geopump brand persistaltic pump and YSI 552 water quality meter		

Measured Data

Well Depth (mbgs):	1.580
Water Depth (mbgs):	1.115
Stick Up (mags):	0.52

Field Chemistry

Name and # unit:		**Readings ***
pH:	1	6.86
	2	7.36
	3	7.45
	4	7.52
	5	7.57
	6	
	7	
	8	
	9	
	10	
	11	
Temperature (◦C):	1	2.70
	2	3.26
	3	3.25
	4	3.01
	5	2.89
	6	
	7	
	8	
	9	
	10	
	11	
Conductivity (mS/cm):	1	539.00
	2	514.00
	3	485.00
	4	466.00
	5	464.00
	6	
	7	
	8	
	9	
	10	
	11	
DO (mg/L):	1	18.66
	2	14.63
	3	14.25
	4	13.41
	5	13.20
	6	
	7	
	8	
	9	
	10	
	11	

Sample Analysis	**Y/N**	**# of Bottles**	**Duplicate Information**
PHC	Y	11	DUP601
PCB Total	Y		
Total Metals	Y		DUP601
Dissolved Metals	Y		DUP601
General	Y		

Comments/ Notes:

Insufficient sample to collect full round of duplicate analysis. Dup had 7 jars and parent had 11 jars.

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project: 1697-1401

Franz Personnel: K. Krug
Weather: ~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 24th	Month: 08	Year: 2014
Monitoring Well ID:	**MW0605**		
Coordinates of Well	Easting: 405907.3		Northing: 7605492.1
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
	Frozen		
Volume Purged (L):	NA - Frozen		
Sampling Equipment:	NA - Frozen		

Measured Data

Well Depth (mbgs):	1.835		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	Frozen					
Stick Up (mags):	0.67					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
Temperature (◦C):	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
Conductivity (mS/cm):	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
DO:	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Well Frozen at 1.835 m below top of casing

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project: 1697-1401

Franz Personnel: K. Krug
Weather: ~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 24th	Month: 08	Year: 2014
Monitoring Well ID:	**MW0606**		
Coordinates of Well	Easting:405877.6		Northing:7605503.1
	GPS unit: N/A		WP #: N/A
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
	Frozen		
Volume Purged (L):	NA - Frozen		
Sampling Equipment:	NA - Frozen		

Measured Data

Well Depth (mbgs):	1.910
Water Depth (mbgs):	Frozen
Stick Up (mags):	0.72

Field Chemistry

Name and # unit:	Readings *		Sample Analysis	Y/N	# of Bottles	Duplicate Information
pH:	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
Temperature (◦C):	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
Conductivity (mS/cm):	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
DO:	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Well Frozen at 1.910 m below top of casing

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

APPENDIX E

Laboratory Certificates of Analysis and Chain of Custody Forms

Your Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Your C.O.C. #: 48067702, 480677-02-01

Attention:Julie Dittburner

Franz Environmental Inc
329 Churchill Ave N
Suite 200
Ottawa, ON
K1Z 5B8

Report Date: 2014/09/11
Report #: R3152531
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B4F8676
Received: 2014/08/28, 10:35

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride by Automated Colourimetry (1)	2	N/A	2014/09/03	CAM SOP-00463	EPA 325.2 m
Colour (1)	2	N/A	2014/09/03	CAM SOP-00412	SM 22 2120 m
Conductivity (1)	2	N/A	2014/09/02	CAM SOP-00414	SM 22 2510 m
Petroleum Hydro. CCME F1 & BTEX in Water (1)	4	N/A	2014/09/03	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (1)	3	2014/09/06	2014/09/07	CAM SOP-00316	CCME PHC-CWS m
Fluoride (1)	2	2014/08/30	2014/09/02	CAM SOP-00449	SM 22 4500-F C m
Nitrate (NO3) and Nitrite (NO2) in Water (1, 2)	2	N/A	2014/09/02	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Polychlorinated Biphenyl in Water (1)	2	2014/09/02	2014/09/05	CAM SOP-00309	EPA 8082 m
pH (1)	2	N/A	2014/09/02	CAM SOP-00413	SM 4500H+ B
Orthophosphate (1)	2	N/A	2014/09/02	CAM SOP-00461	EPA 365.1 m
Sulphate by Automated Colourimetry (1)	2	N/A	2014/09/02	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (1)	2	N/A	2014/09/02	CAM SOP-00428	SM 22 2540C m
Total Suspended Solids (1)	2	N/A	2014/09/02	CAM SOP-00428	SM 22 2540D m

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Analytics Mississauga
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Your Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Your C.O.C. #: 48067702, 480677-02-01

Attention:Julie Dittburner

Franz Environmental Inc
329 Churchill Ave N
Suite 200
Ottawa, ON
K1Z 5B8

Report Date: 2014/09/11
Report #: R3152531
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B4F8676
Received: 2014/08/28, 10:35

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Parnian Baber, Project Manager
Email: pbaber@maxxam.ca
Phone# (613) 274-0573
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

RESULTS OF ANALYSES OF WATER

Maxxam ID		XJ0613	XJ0613	XJ0615		
Sampling Date		2014/08/24	2014/08/24	2014/08/25		
COC Number		480677-02-01	480677-02-01	480677-02-01		
	Units	**MW0604**	**MW0604 Lab-Dup**	**MW0602**	**RDL**	**QC Batch**
Inorganics						
Colour	TCU	4	4	8	2	3731774
Conductivity	umho/cm	810	800	660	1.0	3731813
Total Dissolved Solids	mg/L	578		386	10	3732584
Fluoride (F-)	mg/L	0.53	0.50	0.17	0.10	3731815
Orthophosphate (P)	mg/L	<0.010		<0.010	0.010	3731783
pH	pH	8.09	8.14	8.14	N/A	3731816
Total Suspended Solids	mg/L	<10		80	10	3732580
Dissolved Sulphate (SO4)	mg/L	210		33	1	3731784
Dissolved Chloride (Cl)	mg/L	12		8	1	3731782
Nitrite (N)	mg/L	<0.010		<0.010	0.010	3731480
Nitrate (N)	mg/L	3.43		2.94	0.10	3731480
Nitrate + Nitrite	mg/L	3.43		2.94	0.10	3731480

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		XJ0616		
Sampling Date		2014/08/25		
COC Number		480677-02-01		
	Units	**MW0603**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons				
Benzene	ug/L	<0.20	0.20	3733994
Toluene	ug/L	<0.20	0.20	3733994
Ethylbenzene	ug/L	<0.20	0.20	3733994
o-Xylene	ug/L	<0.20	0.20	3733994
p+m-Xylene	ug/L	<0.40	0.40	3733994
Total Xylenes	ug/L	<0.40	0.40	3733994
F1 (C6-C10)	ug/L	<25	25	3733994
F1 (C6-C10) - BTEX	ug/L	<25	25	3733994
Surrogate Recovery (%)				
1,4-Difluorobenzene	%	100		3733994
4-Bromofluorobenzene	%	100		3733994
D10-Ethylbenzene	%	107		3733994
D4-1,2-Dichloroethane	%	100		3733994

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		XJ0613	XJ0615		
Sampling Date		2014/08/24	2014/08/25		
COC Number		480677-02-01	480677-02-01		
	Units	**MW0604**	**MW0602**	**RDL**	**QC Batch**
PCBs					
Aroclor 1016	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1221	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1232	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1242	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1248	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1254	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1260	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1262	ug/L	<0.05	<0.05	0.05	3732208
Aroclor 1268	ug/L	<0.05	<0.05	0.05	3732208
Total PCB	ug/L	<0.05	<0.05	0.05	3732208
Surrogate Recovery (%)					
Decachlorobiphenyl	%	114	116		3732208

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

O.REG 153 PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		XJ0613	XJ0614	XJ0615		
Sampling Date		2014/08/24	2014/08/24	2014/08/25		
COC Number		480677-02-01	480677-02-01	480677-02-01		
	Units	**MW0604**	**DUP0601**	**MW0602**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons						
Benzene	ug/L	<0.20	<0.20	<0.20	0.20	3733994
Toluene	ug/L	<0.20	<0.20	<0.20	0.20	3733994
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	0.20	3733994
o-Xylene	ug/L	<0.20	<0.20	<0.20	0.20	3733994
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	0.40	3733994
Total Xylenes	ug/L	<0.40	<0.40	<0.40	0.40	3733994
F1 (C6-C10)	ug/L	<25	<25	<25	25	3733994
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	25	3733994
F2-F4 Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	100	3738641
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	200	3738641
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	200	3738641
Reached Baseline at C50	ug/L	Yes	Yes	Yes		3738641
Surrogate Recovery (%)						
1,4-Difluorobenzene	%	101	101	100		3733994
4-Bromofluorobenzene	%	95	97	96		3733994
D10-Ethylbenzene	%	108	109	107		3733994
D4-1,2-Dichloroethane	%	103	102	101		3733994
o-Terphenyl	%	100	100	100		3738641

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

TEST SUMMARY

Maxxam ID: XJ0613
Sample ID: MW0604
Matrix: Water

Collected: 2014/08/24
Shipped:
Received: 2014/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	AC	3731782	N/A	2014/09/03	Deonarine Ramnarine
Colour	SPEC	3731774	N/A	2014/09/03	Christine Pham
Conductivity	COND	3731813	N/A	2014/09/02	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	3733994	N/A	2014/09/03	Simon Xi
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	3738641	2014/09/06	2014/09/07	Dorina Popa
Fluoride	F	3731815	2014/08/30	2014/09/02	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3731480	N/A	2014/09/02	Chandra Nandlal
Polychlorinated Biphenyl in Water	GC/ECD	3732208	2014/09/02	2014/09/05	Joy Zhang
pH	PH	3731816	N/A	2014/09/02	Surinder Rai
Orthophosphate	AC	3731783	N/A	2014/09/02	Alina Dobreanu
Sulphate by Automated Colourimetry	AC	3731784	N/A	2014/09/02	Alina Dobreanu
Total Dissolved Solids	SLDS	3732584	N/A	2014/09/02	Niki Shah
Total Suspended Solids	SLDS	3732580	N/A	2014/09/02	Niki Shah

Maxxam ID: XJ0613 Dup
Sample ID: MW0604
Matrix: Water

Collected: 2014/08/24
Shipped:
Received: 2014/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Colour	SPEC	3731774	N/A	2014/09/03	Christine Pham
Conductivity	COND	3731813	N/A	2014/09/02	Surinder Rai
Fluoride	F	3731815	2014/08/30	2014/09/02	Surinder Rai
pH	PH	3731816	N/A	2014/09/02	Surinder Rai

Maxxam ID: XJ0614
Sample ID: DUP0601
Matrix: Water

Collected: 2014/08/24
Shipped:
Received: 2014/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	3733994	N/A	2014/09/03	Simon Xi
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	3738641	2014/09/06	2014/09/07	Dorina Popa

Maxxam ID: XJ0615
Sample ID: MW0602
Matrix: Water

Collected: 2014/08/25
Shipped:
Received: 2014/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	AC	3731782	N/A	2014/09/03	Deonarine Ramnarine
Colour	SPEC	3731774	N/A	2014/09/03	Christine Pham
Conductivity	COND	3731813	N/A	2014/09/02	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	3733994	N/A	2014/09/03	Simon Xi
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	3738641	2014/09/06	2014/09/07	Dorina Popa
Fluoride	F	3731815	2014/08/30	2014/09/02	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3731480	N/A	2014/09/02	Chandra Nandlal

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

TEST SUMMARY

Maxxam ID: XJ0615
Sample ID: MW0602
Matrix: Water

Collected: 2014/08/25
Shipped:
Received: 2014/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Polychlorinated Biphenyl in Water	GC/ECD	3732208	2014/09/02	2014/09/05	Joy Zhang
pH	PH	3731816	N/A	2014/09/02	Surinder Rai
Orthophosphate	AC	3731783	N/A	2014/09/02	Alina Dobreanu
Sulphate by Automated Colourimetry	AC	3731784	N/A	2014/09/02	Alina Dobreanu
Total Dissolved Solids	SLDS	3732584	N/A	2014/09/02	Niki Shah
Total Suspended Solids	SLDS	3732580	N/A	2014/09/02	Niki Shah

Maxxam ID: XJ0616
Sample ID: MW0603
Matrix: Water

Collected: 2014/08/25
Shipped:
Received: 2014/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	3733994	N/A	2014/09/03	Simon Xi

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Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.7°C
Package 2	6.0°C
Package 3	2.3°C

Results relate only to the items tested.

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Maxxam Job #: B4F8676
Report Date: 2014/09/11

QUALITY ASSURANCE REPORT

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3732208	Decachlorobiphenyl	2014/09/05	130	60 - 130	127	60 - 130	125	%				
3733994	1,4-Difluorobenzene	2014/09/03	101	70 - 130	101	70 - 130	103	%				
3733994	4-Bromofluorobenzene	2014/09/03	102	70 - 130	102	70 - 130	95	%				
3733994	D10-Ethylbenzene	2014/09/03	111	70 - 130	111	70 - 130	109	%				
3733994	D4-1,2-Dichloroethane	2014/09/03	101	70 - 130	104	70 - 130	105	%				
3738641	o-Terphenyl	2014/09/07	100	60 - 130	102	60 - 130	101	%				
3731480	Nitrate (N)	2014/09/02	100	80 - 120	99	80 - 120	<0.10	mg/L	NC	25		
3731480	Nitrite (N)	2014/09/02	102	80 - 120	104	80 - 120	<0.010	mg/L	NC	25		
3731774	Colour	2014/09/03			100	85 - 115	<2	TCU	NC	25		
3731782	Dissolved Chloride (Cl)	2014/09/03	NC	80 - 120	103	80 - 120	<1	mg/L	1.6	20		
3731783	Orthophosphate (P)	2014/09/02	99	75 - 125	101	80 - 120	<0.010	mg/L	NC	25		
3731784	Dissolved Sulphate (SO4)	2014/09/02	NC	75 - 125	99	80 - 120	<1	mg/L	NC	20		
3731813	Conductivity	2014/09/02			101	85 - 115	<1.0	umho/cm	0.87	25		
3731815	Fluoride (F-)	2014/09/02	102	80 - 120	96	80 - 120	<0.10	mg/L	5.2	20		
3731816	pH	2014/09/02			102	98 - 103			0.60	N/A		
3732208	Aroclor 1016	2014/09/05					<0.05	ug/L	NC	40		
3732208	Aroclor 1221	2014/09/05					<0.05	ug/L	NC	40		
3732208	Aroclor 1232	2014/09/05					<0.05	ug/L	NC	40		
3732208	Aroclor 1242	2014/09/05					<0.05	ug/L	NC	30		
3732208	Aroclor 1248	2014/09/05					<0.05	ug/L	NC	30		
3732208	Aroclor 1254	2014/09/05					<0.05	ug/L	NC	30		
3732208	Aroclor 1260	2014/09/05	102	60 - 130	108	60 - 130	<0.05	ug/L	NC	30		
3732208	Aroclor 1262	2014/09/05					<0.05	ug/L	NC	40		
3732208	Aroclor 1268	2014/09/05					<0.05	ug/L	NC	40		
3732208	Total PCB	2014/09/05	102	60 - 130	108	60 - 130	<0.05	ug/L	NC	40		
3732580	Total Suspended Solids	2014/09/02					<10	mg/L	NC	25	97	85 - 115
3732584	Total Dissolved Solids	2014/09/02					<10	mg/L	2.4	25	100	90 - 110
3733994	Benzene	2014/09/03	107	70 - 130	112	70 - 130	<0.20	ug/L	NC	30		
3733994	Ethylbenzene	2014/09/03	116	70 - 130	120	70 - 130	<0.20	ug/L	NC	30		
3733994	F1 (C6-C10) - BTEX	2014/09/03					<25	ug/L	NC	30		
3733994	F1 (C6-C10)	2014/09/03	107	70 - 130	104	70 - 130	<25	ug/L	NC	30		
3733994	o-Xylene	2014/09/03	115	70 - 130	119	70 - 130	<0.20	ug/L	NC	30		

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Maxxam Job #: B4F8676
Report Date: 2014/09/11

QUALITY ASSURANCE REPORT(CONT'D)

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3733994	p+m-Xylene	2014/09/03	111	70 - 130	112	70 - 130	<0.40	ug/L	NC	30		
3733994	Toluene	2014/09/03	110	70 - 130	112	70 - 130	<0.20	ug/L	NC	30		
3733994	Total Xylenes	2014/09/03					<0.40	ug/L	NC	30		
3738641	F2 (C10-C16 Hydrocarbons)	2014/09/07	105	50 - 130	96	60 - 130	<100	ug/L	NC	30		
3738641	F3 (C16-C34 Hydrocarbons)	2014/09/07	103	50 - 130	99	60 - 130	<200	ug/L	NC	30		
3738641	F4 (C34-C50 Hydrocarbons)	2014/09/07	108	50 - 130	110	60 - 130	<200	ug/L	NC	30		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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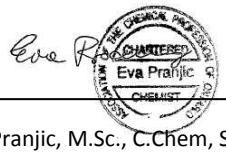
Maxxam Job #: B4F8676
Report Date: 2014/09/11

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Site Location: CAM-F
Sampler Initials: JD

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

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Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-Free:800-563-6266 Fax:(905) 817-5777 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION:		REPORT INFORMATION(if differs from invoice):		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#10988 Franz Environmental Inc	Company Name:		Quotation #:	B44130	Maxxam Job #:	Bottle Order #:
Contact Name:	Invoices, Lillian & Julie	Contact Name:	Julie Dittburner & Catherine	P.O. #:			480677
Address:	329 Churchill Ave N Suite 200	Address:		Project #:	1697-1401: AANDC DEW Line	Chain of Custody #:	Project Manager:
	Ottawa ON K1Z 5B8			Project Name:	CAM-F	C#480677-02-01	Parnian Baber
Phone:	(613) 721-0555 Fax: (613) 721-0029	Phone:	Fax:	Site #:			
Email:	jdittburner@franzenvironmental.com, lellis@franzenviro	Email:	jdittburner@franzenvironmental.com, cleblanc@franzen	Sampled By:			

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
- ☐ Table 1 ☐ Res/Park ☐ Medium/Fine
- ☐ Table 2 ☐ Ind/Comm ☐ Coarse
- ☐ Table 3 ☐ Agri/Other ☐ For RSC
- ☐ Table ___

Other Regulations
- ☒ CCME ☐ Sanitary Sewer Bylaw
- ☐ Reg 558 ☐ Storm Sewer Bylaw
- ☐ MISA Municipality ___
- ☐ PWQO
- ☐ Other ___

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): (Metals / Hg / Cr VI)	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Polychlorinated Biphenyl in Water	O.Reg 153 Petroleum Hydrocarbons (Water)	Total Dissolved Solids	Total Suspended Solids	Nitrate (NO3) and Nitrite (NO2) in Water/pH/ Chloride	Orthophosphate/ Sulphate/ Colour	CCME Metals (low Level), dissolved	CCME Metals (low Level), total	Conductivity/ Fluoride	BTEX	# of Bottles	Comments
1		MW0604	Aug 24 2014	PM	GW	Y	✓	✓	✓	✓	✓	✓	✓	✓	✓		11	
2		DUP0601	↓	↓	GW	Y		✓					✓	✓			7	
3		MW0602	Aug 25 2014	AM	GW	Y	✓	✓	✓	✓	✓	✓	✓	✓	✓		10	limited sample for gen chem/TDS
4		MW0603	↓	↓	GW	Y							✓	✓	.	✓	5	
5																		
6																		
7																		
8																		
9																		
10																		

28-Aug-14 10:35
Parnian Baber
B4F8676
HP6 ENV-720

REC'D IN OTTAWA

onice

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
J. Dittburner / J. Dittburner	14/08/25	5:30pm	Kelsey Pilon Kelsey Pilon	14/08/28	10:35			5,5,4,6,6,6	Present	✓	
			[illegible] BRADBRYAN	2014/08/29	11:15				Intact	✓	

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

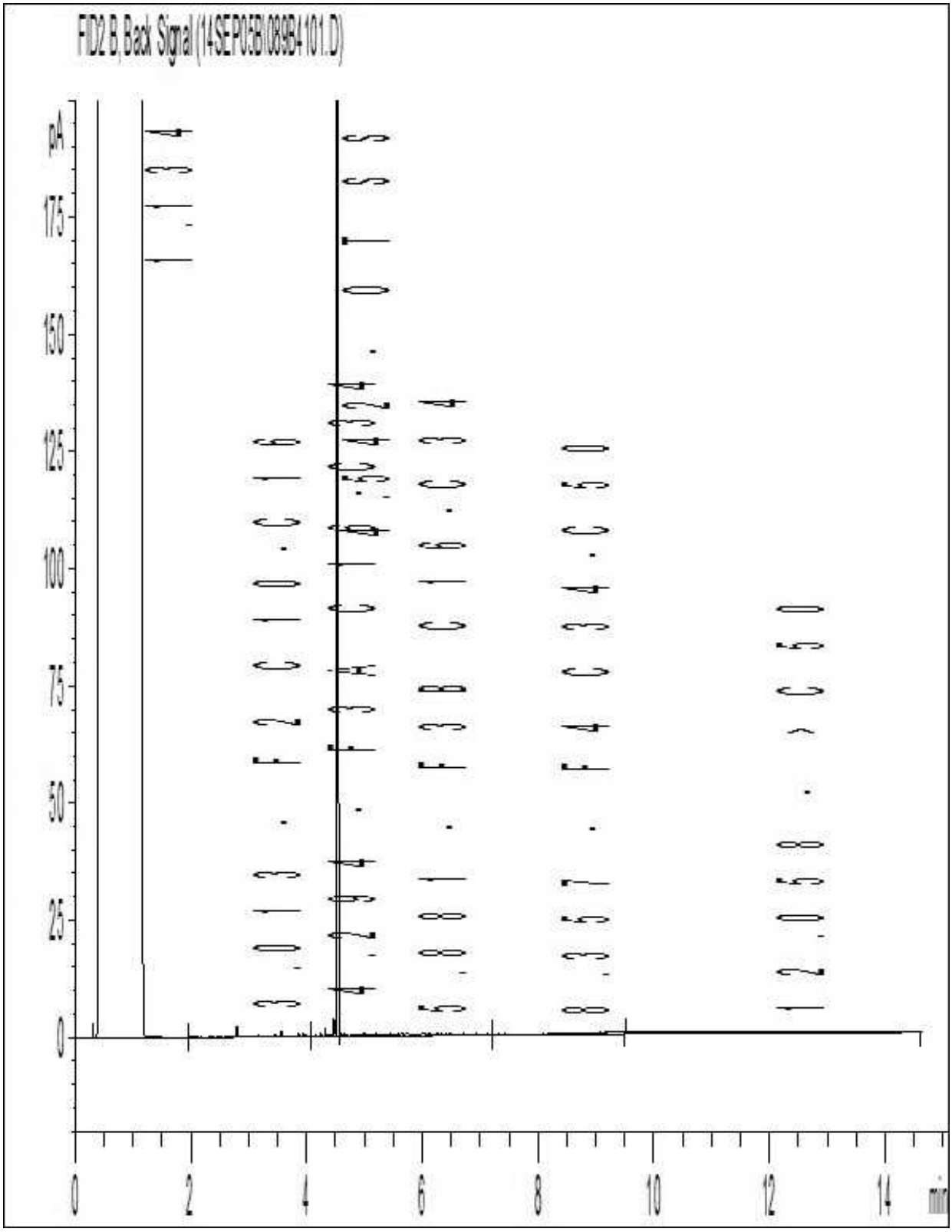
71617

3,1;3

Maxxam Job #: B4F8676
Report Date: 2014/09/11
Maxxam Sample: XJ0613

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Project name: CAM-F
Client ID: MW0604

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

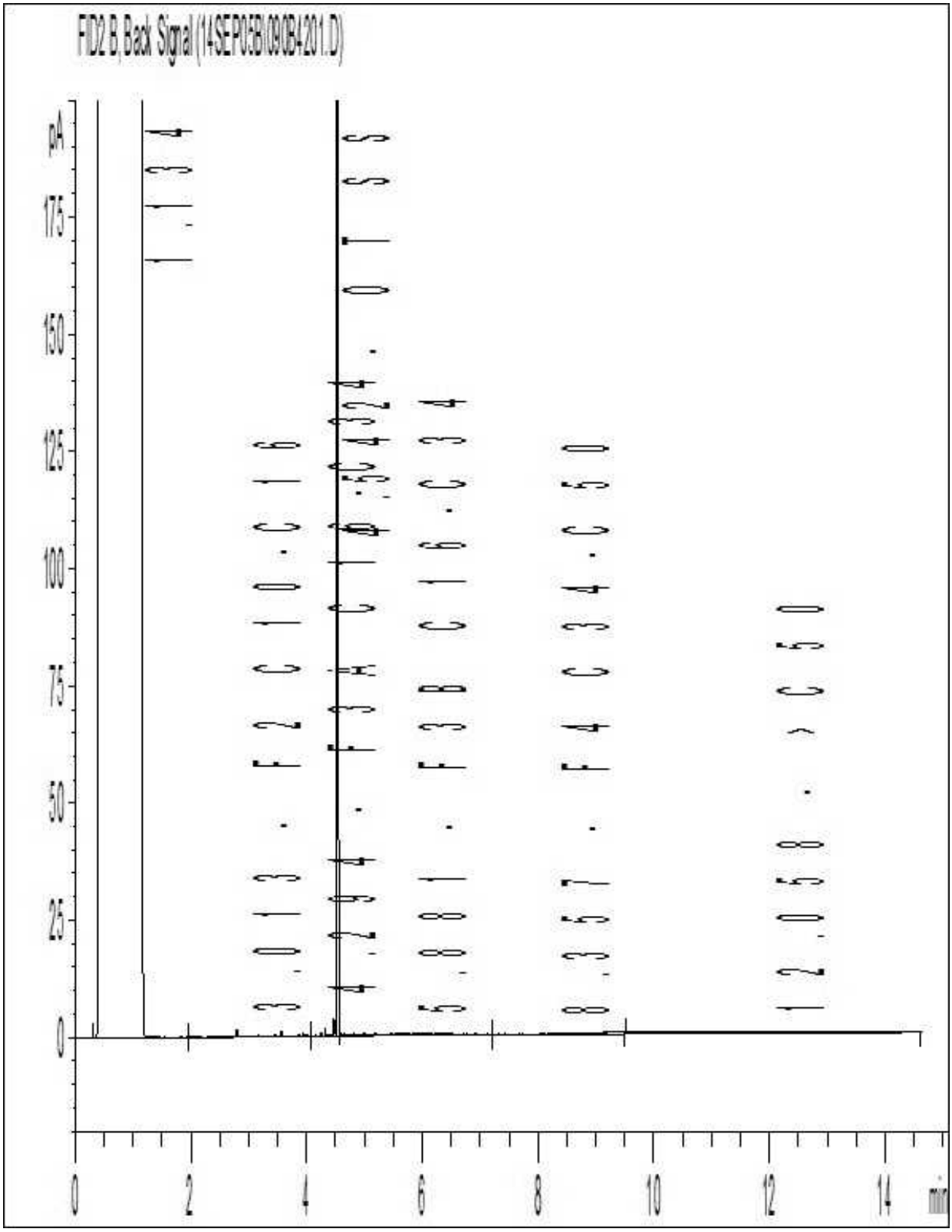


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B4F8676
Report Date: 2014/09/11
Maxxam Sample: XJ0614

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Project name: CAM-F
Client ID: DUP0601

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

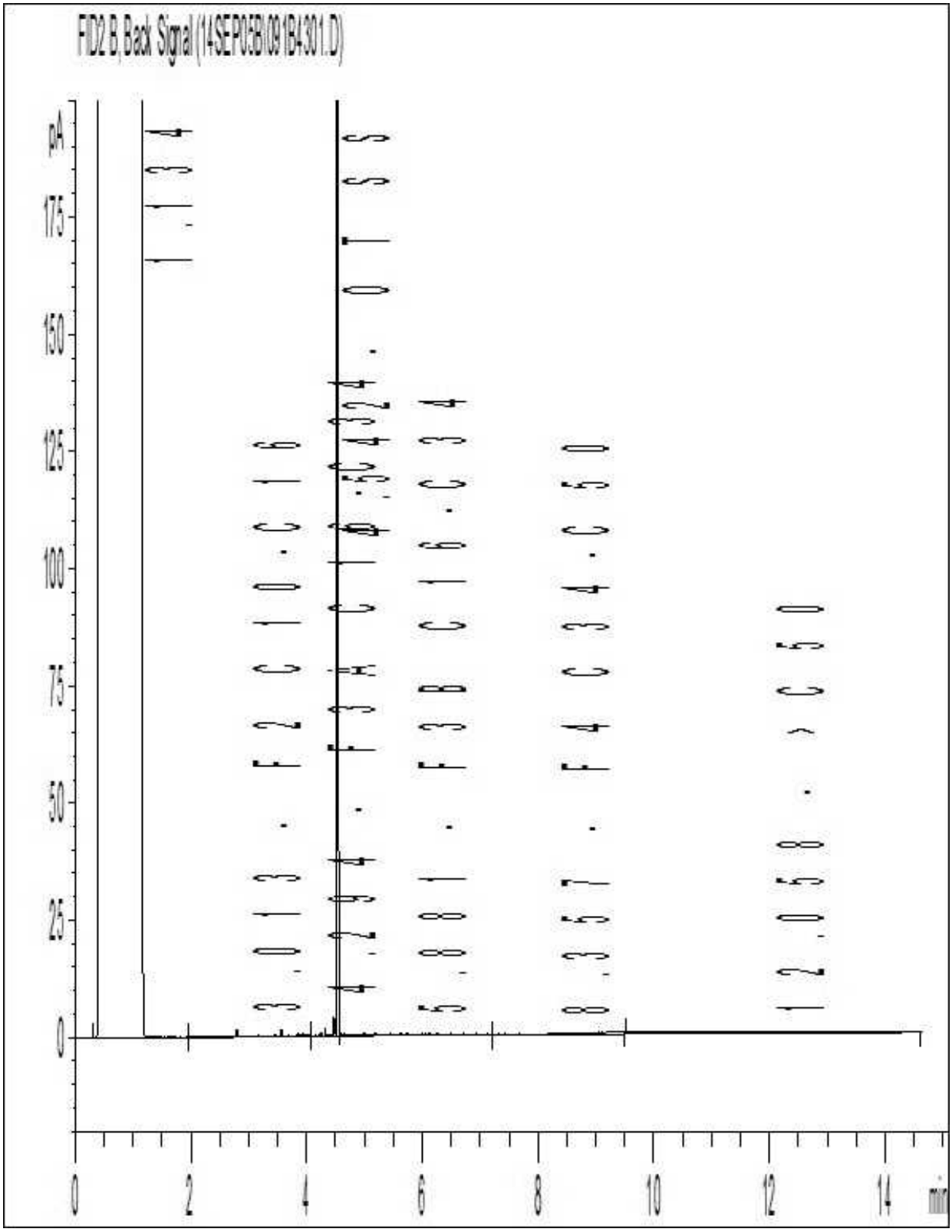


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B4F8676
Report Date: 2014/09/11
Maxxam Sample: XJ0615

Franz Environmental Inc
Client Project #: 1697-1401: AANDC DEW Line
Project name: CAM-F
Client ID: MW0602

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: MB4F8676
Site Location: 1697-1401:AANDC DEW LINE
Your C.O.C. #: B4F8676

Attention: SUB CONTRACTOR
MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2014/09/08
Report #: R1637752
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B477292
Received: 2014/09/03, 08:30

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Cadmium - low level CCME - Dissolved	4	N/A	2014/09/08	AB SOP-00043	EPA 200.8 R5.4 m
Cadmium - low level CCME (Total)	4	2014/09/03	2014/09/06	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICP - Dissolved	4	N/A	2014/09/05	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP - Total	4	2014/09/04	2014/09/05	AB SOP-00014 / AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	4	N/A	2014/09/05	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS - Total	4	2014/09/04	2014/09/05	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4 m

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Cynny Hagen, Project Manager Assistant
Email: CHagen@maxxam.ca
Phone# (403) 735-2273

==========

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Total cover pages: 1

Maxxam Job #: B477292
Report Date: 2014/09/08

MAXXAM ANALYTICS
Client Project #: MB4F8676
Site Location: 1697-1401:AANDC DEW LINE

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		KM6815	KM6817	KM6819	KM6821		
Sampling Date		2014/08/24	2014/08/24	2014/08/25	2014/08/25		
COC Number		B4F8676	B4F8676	B4F8676	B4F8676		
	UNITS	**MW0604 (XJ0613-02R)**	**DUP0601 (XJ0614-02R)**	**MW0602 (XJ0615-02R)**	**MW0603 (XJ0616-01R)**	**RDL**	**QC Batch**
Low Level Elements							
Dissolved Cadmium (Cd)	ug/L	0.021	0.021	<0.020	0.038	0.020	7624014
Elements							
Dissolved Aluminum (Al)	mg/L	0.0070	0.0074	0.019	0.0089	0.0030	7626033
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	7626033
Dissolved Arsenic (As)	mg/L	<0.00020	<0.00020	<0.00020	0.00030	0.00020	7626033
Dissolved Barium (Ba)	mg/L	<0.010	<0.010	0.048	0.026	0.010	7625670
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7626033
Dissolved Boron (B)	mg/L	<0.020	0.021	0.87	<0.020	0.020	7625670
Dissolved Calcium (Ca)	mg/L	65 (1)	66	110	44	0.30	7625670
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0021	<0.0010	0.0010	7626033
Dissolved Cobalt (Co)	mg/L	0.00050	0.00055	0.00061	0.00091	0.00030	7626033
Dissolved Copper (Cu)	mg/L	0.0053 (2)	0.0051 (2)	0.011 (1)	0.018	0.00020	7626033
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	<0.060	<0.060	0.060	7625670
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	7626033
Dissolved Lithium (Li)	mg/L	0.031	0.033	<0.020	<0.020	0.020	7625670
Dissolved Magnesium (Mg)	mg/L	48	48	22	14	0.20	7625670
Dissolved Manganese (Mn)	mg/L	0.023	0.023	0.0043	0.018	0.0040	7625670
Dissolved Molybdenum (Mo)	mg/L	0.0097	0.0097	0.0010	0.0018	0.00020	7626033
Dissolved Nickel (Ni)	mg/L	0.0032	0.0033	0.0037	0.0083	0.00050	7626033
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	7625670
Dissolved Potassium (K)	mg/L	5.9	6.0	5.9	6.0	0.30	7625670
Dissolved Selenium (Se)	mg/L	0.00041 (3)	0.00042 (3)	<0.00020	0.00020	0.00020	7626033
Dissolved Silicon (Si)	mg/L	2.0	2.0	2.9	3.1	0.10	7625670
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	7626033
Dissolved Sodium (Na)	mg/L	41	43	14	6.0	0.50	7625670
Dissolved Strontium (Sr)	mg/L	0.17	0.17	0.11	0.13	0.020	7625670
Dissolved Sulphur (S)	mg/L	74	76	11	2.0	0.20	7625670
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	7626033
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7626033
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7626033

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results within acceptable limits of precision.
(2) Dissolved greater than total. Reanalysis yields similar results.
(3) Dissolved greater than total. Results are within limits of uncertainty(MU).

Maxxam Job #: B477292
Report Date: 2014/09/08

MAXXAM ANALYTICS
Client Project #: MB4F8676
Site Location: 1697-1401:AANDC DEW LINE

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		KM6815	KM6817	KM6819	KM6821		
Sampling Date		2014/08/24	2014/08/24	2014/08/25	2014/08/25		
COC Number		B4F8676	B4F8676	B4F8676	B4F8676		
	UNITS	**MW0604 (XJ0613-02R)**	**DUP0601 (XJ0614-02R)**	**MW0602 (XJ0615-02R)**	**MW0603 (XJ0616-01R)**	**RDL**	**QC Batch**
Dissolved Uranium (U)	mg/L	0.083	0.082	0.0099	0.0085	0.00010	7626033
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7626033
Dissolved Zinc (Zn)	mg/L	0.0092	0.012 (1)	0.025	0.11	0.0030	7626033

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results within acceptable limits of precision.

Maxxam Job #: B477292
Report Date: 2014/09/08

MAXXAM ANALYTICS
Client Project #: MB4F8676
Site Location: 1697-1401:AANDC DEW LINE

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		KM6815	KM6817	KM6819	KM6821		
Sampling Date		2014/08/24	2014/08/24	2014/08/25	2014/08/25		
COC Number		B4F8676	B4F8676	B4F8676	B4F8676		
	UNITS	**MW0604 (XJ0613-02R)**	**DUP0601 (XJ0614-02R)**	**MW0602 (XJ0615-02R)**	**MW0603 (XJ0616-01R)**	**RDL**	**QC Batch**
Low Level Elements							
Total Cadmium (Cd)	ug/L	<0.020	0.027	<0.020	0.25	0.020	7624134
Elements							
Total Aluminum (Al)	mg/L	0.020	0.019	1.1	2.5	0.0030	7625399
Total Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	7625399
Total Arsenic (As)	mg/L	<0.00020	<0.00020	0.00041	0.00094	0.00020	7625399
Total Barium (Ba)	mg/L	<0.010	<0.010	0.057	0.058	0.010	7625408
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7625399
Total Boron (B)	mg/L	0.022	0.035	0.94	0.025	0.020	7625408
Total Calcium (Ca)	mg/L	64	68	110	65	0.30	7625408
Total Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0064	0.025	0.0010	7625399
Total Cobalt (Co)	mg/L	0.00060	0.00061	0.0013	0.0035	0.00030	7625399
Total Copper (Cu)	mg/L	0.0024	0.0021	0.0098	0.038	0.00020	7625399
Total Iron (Fe)	mg/L	<0.060	0.060	1.4	4.1	0.060	7625408
Total Lead (Pb)	mg/L	<0.00020	<0.00020	0.00089	0.0045	0.00020	7625399
Total Lithium (Li)	mg/L	0.035	0.036	<0.020	<0.020	0.020	7625408
Total Magnesium (Mg)	mg/L	48	52	24	21	0.20	7625408
Total Manganese (Mn)	mg/L	0.024	0.026	0.028	0.10	0.0040	7625408
Total Molybdenum (Mo)	mg/L	0.011	0.011	0.0011	0.0025	0.00020	7625399
Total Nickel (Ni)	mg/L	0.0039	0.0038	0.0076	0.032	0.00050	7625399
Total Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	0.21	0.10	7625408
Total Potassium (K)	mg/L	6.1	6.2	6.2	7.4	0.30	7625408
Total Selenium (Se)	mg/L	0.00041	0.00038	<0.00020	0.00023	0.00020	7625399
Total Silicon (Si)	mg/L	2.1	2.2	5.2	9.0	0.10	7625408
Total Silver (Ag)	mg/L	<0.00010	<0.00010	0.00044	0.0023	0.00010	7625399
Total Sodium (Na)	mg/L	47	43	14	7.2	0.50	7625408
Total Strontium (Sr)	mg/L	0.18	0.19	0.12	0.18	0.020	7625408
Total Sulphur (S)	mg/L	77	78	11	2.4	0.20	7625408
Total Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	7625399
Total Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7625399
Total Titanium (Ti)	mg/L	<0.0010	<0.0010	0.064	0.17	0.0010	7625399
Total Uranium (U)	mg/L	0.086	0.089	0.011	0.011	0.00010	7625399
Total Vanadium (V)	mg/L	<0.0010	<0.0010	0.0028	0.0060	0.0010	7625399

RDL = Reportable Detection Limit

Maxxam Job #: B477292
Report Date: 2014/09/08

MAXXAM ANALYTICS
Client Project #: MB4F8676
Site Location: 1697-1401:AANDC DEW LINE

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		KM6815	KM6817	KM6819	KM6821		
Sampling Date		2014/08/24	2014/08/24	2014/08/25	2014/08/25		
COC Number		B4F8676	B4F8676	B4F8676	B4F8676		
	UNITS	**MW0604 (XJ0613-02R)**	**DUP0601 (XJ0614-02R)**	**MW0602 (XJ0615-02R)**	**MW0603 (XJ0616-01R)**	**RDL**	**QC Batch**
Total Zinc (Zn)	mg/L	0.011	0.011	0.053	0.41	0.0030	7625399

RDL = Reportable Detection Limit

Maxxam Job #: B477292
Report Date: 2014/09/08

MAXXAM ANALYTICS
Client Project #: MB4F8676
Site Location: 1697-1401:AANDC DEW LINE

Package 1	-0.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

General Comments

Sample KM6815-01: Dissolved greater than total for Cd. Results are within limits of uncertainty(MU).

Results relate only to the items tested.

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB4F8676
P.O. #:
Site Location: 1697-1401:AANDC DEW LINE

Quality Assurance Report

Maxxam Job Number: CB477292

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7625399	HC7	Matrix Spike	Total Aluminum (Al)	2014/09/05		90	%	80 - 120
			Total Antimony (Sb)	2014/09/05		101	%	80 - 120
			Total Arsenic (As)	2014/09/05		102	%	80 - 120
			Total Beryllium (Be)	2014/09/05		109	%	80 - 120
			Total Chromium (Cr)	2014/09/05		102	%	80 - 120
			Total Cobalt (Co)	2014/09/05		99	%	80 - 120
			Total Copper (Cu)	2014/09/05		95	%	80 - 120
			Total Lead (Pb)	2014/09/05		100	%	80 - 120
			Total Molybdenum (Mo)	2014/09/05		109	%	80 - 120
			Total Nickel (Ni)	2014/09/05		98	%	80 - 120
			Total Selenium (Se)	2014/09/05		104	%	80 - 120
			Total Silver (Ag)	2014/09/05		97	%	80 - 120
			Total Thallium (Tl)	2014/09/05		103	%	80 - 120
			Total Tin (Sn)	2014/09/05		105	%	80 - 120
			Total Titanium (Ti)	2014/09/05		97	%	80 - 120
			Total Uranium (U)	2014/09/05		104	%	80 - 120
			Total Vanadium (V)	2014/09/05		107	%	80 - 120
			Total Zinc (Zn)	2014/09/05		98	%	80 - 120
		Spiked Blank	Total Aluminum (Al)	2014/09/05		96	%	80 - 120
			Total Antimony (Sb)	2014/09/05		98	%	80 - 120
			Total Arsenic (As)	2014/09/05		98	%	80 - 120
			Total Beryllium (Be)	2014/09/05		104	%	80 - 120
			Total Chromium (Cr)	2014/09/05		99	%	80 - 120
			Total Cobalt (Co)	2014/09/05		99	%	80 - 120
			Total Copper (Cu)	2014/09/05		94	%	80 - 120
			Total Lead (Pb)	2014/09/05		99	%	80 - 120
			Total Molybdenum (Mo)	2014/09/05		102	%	80 - 120
			Total Nickel (Ni)	2014/09/05		97	%	80 - 120
			Total Selenium (Se)	2014/09/05		99	%	80 - 120
			Total Silver (Ag)	2014/09/05		94	%	80 - 120
			Total Thallium (Tl)	2014/09/05		99	%	80 - 120
			Total Tin (Sn)	2014/09/05		100	%	80 - 120
			Total Titanium (Ti)	2014/09/05		92	%	80 - 120
			Total Uranium (U)	2014/09/05		100	%	80 - 120
			Total Vanadium (V)	2014/09/05		103	%	80 - 120
			Total Zinc (Zn)	2014/09/05		98	%	80 - 120
		Method Blank	Total Aluminum (Al)	2014/09/05	<0.0030		mg/L	
			Total Antimony (Sb)	2014/09/05	<0.00060		mg/L	
			Total Arsenic (As)	2014/09/05	<0.00020		mg/L	
			Total Beryllium (Be)	2014/09/05	<0.0010		mg/L	
			Total Chromium (Cr)	2014/09/05	<0.0010		mg/L	
			Total Cobalt (Co)	2014/09/05	<0.00030		mg/L	
			Total Copper (Cu)	2014/09/05	<0.00020		mg/L	
			Total Lead (Pb)	2014/09/05	<0.00020		mg/L	
			Total Molybdenum (Mo)	2014/09/05	<0.00020		mg/L	
			Total Nickel (Ni)	2014/09/05	<0.00050		mg/L	
			Total Selenium (Se)	2014/09/05	<0.00020		mg/L	
			Total Silver (Ag)	2014/09/05	<0.00010		mg/L	
			Total Thallium (Tl)	2014/09/05	<0.00020		mg/L	
			Total Tin (Sn)	2014/09/05	<0.0010		mg/L	
			Total Titanium (Ti)	2014/09/05	<0.0010		mg/L	
			Total Uranium (U)	2014/09/05	<0.00010		mg/L	
			Total Vanadium (V)	2014/09/05	<0.0010		mg/L	
			Total Zinc (Zn)	2014/09/05	<0.0030		mg/L	
		RPD	Total Aluminum (Al)	2014/09/05	NC		%	20

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB4F8676
P.O. #:
Site Location: 1697-1401:AANDC DEW LINE

Quality Assurance Report (Continued)

Maxxam Job Number: CB477292

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7625399	HC7	RPD	Total Antimony (Sb)	2014/09/05	NC		%	20
			Total Arsenic (As)	2014/09/05	NC		%	20
			Total Beryllium (Be)	2014/09/05	NC		%	20
			Total Chromium (Cr)	2014/09/05	NC		%	20
			Total Cobalt (Co)	2014/09/05	NC		%	20
			Total Copper (Cu)	2014/09/05	NC		%	20
			Total Lead (Pb)	2014/09/05	NC		%	20
			Total Molybdenum (Mo)	2014/09/05	3.7		%	20
			Total Nickel (Ni)	2014/09/05	NC		%	20
			Total Selenium (Se)	2014/09/05	NC		%	20
			Total Silver (Ag)	2014/09/05	NC		%	20
			Total Thallium (Tl)	2014/09/05	NC		%	20
			Total Tin (Sn)	2014/09/05	NC		%	20
			Total Titanium (Ti)	2014/09/05	NC		%	20
			Total Uranium (U)	2014/09/05	1.6		%	20
			Total Vanadium (V)	2014/09/05	NC		%	20
			Total Zinc (Zn)	2014/09/05	NC		%	20
7625408	SRT	Matrix Spike	Total Barium (Ba)	2014/09/08		110	%	80 - 120
			Total Boron (B)	2014/09/08		111	%	80 - 120
			Total Calcium (Ca)	2014/09/08		NC	%	80 - 120
			Total Iron (Fe)	2014/09/08		NC	%	80 - 120
			Total Lithium (Li)	2014/09/08		110	%	80 - 120
			Total Magnesium (Mg)	2014/09/08		NC	%	80 - 120
			Total Manganese (Mn)	2014/09/08		111	%	80 - 120
			Total Phosphorus (P)	2014/09/08		104	%	80 - 120
			Total Potassium (K)	2014/09/08		105	%	80 - 120
			Total Silicon (Si)	2014/09/08		113	%	80 - 120
			Total Sodium (Na)	2014/09/08		NC	%	80 - 120
			Total Strontium (Sr)	2014/09/08		113	%	80 - 120
		Spiked Blank	Total Barium (Ba)	2014/09/08		104	%	80 - 120
			Total Boron (B)	2014/09/08		106	%	80 - 120
			Total Calcium (Ca)	2014/09/08		106	%	80 - 120
			Total Iron (Fe)	2014/09/08		109	%	80 - 120
			Total Lithium (Li)	2014/09/08		106	%	80 - 120
			Total Magnesium (Mg)	2014/09/08		99	%	80 - 120
			Total Manganese (Mn)	2014/09/08		105	%	80 - 120
			Total Phosphorus (P)	2014/09/08		99	%	80 - 120
			Total Potassium (K)	2014/09/08		99	%	80 - 120
			Total Silicon (Si)	2014/09/08		102	%	80 - 120
			Total Sodium (Na)	2014/09/08		103	%	80 - 120
			Total Strontium (Sr)	2014/09/08		107	%	80 - 120
		Method Blank	Total Barium (Ba)	2014/09/05	<0.010		mg/L	
			Total Boron (B)	2014/09/05	<0.020		mg/L	
			Total Calcium (Ca)	2014/09/05	<0.30		mg/L	
			Total Iron (Fe)	2014/09/05	<0.060		mg/L	
			Total Lithium (Li)	2014/09/05	<0.020		mg/L	
			Total Magnesium (Mg)	2014/09/05	<0.20		mg/L	
			Total Manganese (Mn)	2014/09/05	<0.0040		mg/L	
			Total Phosphorus (P)	2014/09/05	<0.10		mg/L	
			Total Potassium (K)	2014/09/05	<0.30		mg/L	
			Total Silicon (Si)	2014/09/05	<0.10		mg/L	
			Total Sodium (Na)	2014/09/05	<0.50		mg/L	
			Total Strontium (Sr)	2014/09/05	<0.020		mg/L	
			Total Sulphur (S)	2014/09/05	<0.20		mg/L	
		RPD	Total Barium (Ba)	2014/09/05	5.3		%	20

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB4F8676
P.O. #:
Site Location: 1697-1401:AANDC DEW LINE

Quality Assurance Report (Continued)

Maxxam Job Number: CB477292

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7625408	SRT	RPD	Total Boron (B)	2014/09/05	NC		%	20
			Total Calcium (Ca)	2014/09/05	6.4		%	20
			Total Iron (Fe)	2014/09/05	6.4		%	20
			Total Lithium (Li)	2014/09/05	NC		%	20
			Total Magnesium (Mg)	2014/09/05	5.9		%	20
			Total Manganese (Mn)	2014/09/05	6.6		%	20
			Total Phosphorus (P)	2014/09/05	NC		%	20
			Total Potassium (K)	2014/09/05	3.2		%	20
			Total Silicon (Si)	2014/09/05	5.2		%	20
			Total Sodium (Na)	2014/09/05	3.4		%	20
			Total Strontium (Sr)	2014/09/05	5.5		%	20
			Total Sulphur (S)	2014/09/05	2.7		%	20
7625670	SRT	Matrix Spike	Dissolved Barium (Ba)	2014/09/05		93	%	80 - 120
			Dissolved Boron (B)	2014/09/05		98	%	80 - 120
			Dissolved Calcium (Ca)	2014/09/05		NC	%	80 - 120
			Dissolved Iron (Fe)	2014/09/05		99	%	80 - 120
			Dissolved Lithium (Li)	2014/09/05		90	%	80 - 120
			Dissolved Magnesium (Mg)	2014/09/05		NC	%	80 - 120
			Dissolved Manganese (Mn)	2014/09/05		96	%	80 - 120
			Dissolved Phosphorus (P)	2014/09/05		100	%	80 - 120
			Dissolved Potassium (K)	2014/09/05		102	%	80 - 120
			Dissolved Silicon (Si)	2014/09/05		93	%	80 - 120
			Dissolved Sodium (Na)	2014/09/05		NC	%	80 - 120
			Dissolved Strontium (Sr)	2014/09/05		91	%	80 - 120
		Spiked Blank	Dissolved Barium (Ba)	2014/09/05		93	%	80 - 120
			Dissolved Boron (B)	2014/09/05		98	%	80 - 120
			Dissolved Calcium (Ca)	2014/09/05		106	%	80 - 120
			Dissolved Iron (Fe)	2014/09/05		100	%	80 - 120
			Dissolved Lithium (Li)	2014/09/05		91	%	80 - 120
			Dissolved Magnesium (Mg)	2014/09/05		103	%	80 - 120
			Dissolved Manganese (Mn)	2014/09/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2014/09/05		99	%	80 - 120
			Dissolved Potassium (K)	2014/09/05		103	%	80 - 120
			Dissolved Silicon (Si)	2014/09/05		96	%	80 - 120
			Dissolved Sodium (Na)	2014/09/05		95	%	80 - 120
			Dissolved Strontium (Sr)	2014/09/05		95	%	80 - 120
		Method Blank	Dissolved Barium (Ba)	2014/09/05	<0.010		mg/L	
			Dissolved Boron (B)	2014/09/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2014/09/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2014/09/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2014/09/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2014/09/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2014/09/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2014/09/05	<0.10		mg/L	
			Dissolved Potassium (K)	2014/09/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2014/09/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2014/09/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2014/09/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2014/09/05	<0.20		mg/L	
		RPD	Dissolved Barium (Ba)	2014/09/05	NC		%	20
			Dissolved Boron (B)	2014/09/05	NC		%	20
			Dissolved Calcium (Ca)	2014/09/05	1		%	20
			Dissolved Iron (Fe)	2014/09/05	NC		%	20
			Dissolved Lithium (Li)	2014/09/05	NC		%	20
			Dissolved Magnesium (Mg)	2014/09/05	1.3		%	20

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB4F8676
P.O. #:
Site Location: 1697-1401:AANDC DEW LINE

Quality Assurance Report (Continued)

Maxxam Job Number: CB477292

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7625670	SRT	RPD	Dissolved Manganese (Mn)	2014/09/05	0.6		%	20
			Dissolved Phosphorus (P)	2014/09/05	NC		%	20
			Dissolved Potassium (K)	2014/09/05	1.7		%	20
			Dissolved Silicon (Si)	2014/09/05	1.1		%	20
			Dissolved Sodium (Na)	2014/09/05	1.6		%	20
			Dissolved Strontium (Sr)	2014/09/05	1.4		%	20
			Dissolved Sulphur (S)	2014/09/05	1.8		%	20
7626033	HC7	Matrix Spike	Dissolved Aluminum (Al)	2014/09/05		107	%	80 - 120
			Dissolved Antimony (Sb)	2014/09/05		55 (1)	%	80 - 120
			Dissolved Arsenic (As)	2014/09/05		101	%	80 - 120
			Dissolved Beryllium (Be)	2014/09/05		101	%	80 - 120
			Dissolved Chromium (Cr)	2014/09/05		97	%	80 - 120
			Dissolved Cobalt (Co)	2014/09/05		92	%	80 - 120
			Dissolved Copper (Cu)	2014/09/05		94	%	80 - 120
			Dissolved Lead (Pb)	2014/09/05		90	%	80 - 120
			Dissolved Molybdenum (Mo)	2014/09/05		102	%	80 - 120
			Dissolved Nickel (Ni)	2014/09/05		89	%	80 - 120
			Dissolved Selenium (Se)	2014/09/05		93	%	80 - 120
			Dissolved Silver (Ag)	2014/09/05		95	%	80 - 120
			Dissolved Thallium (Tl)	2014/09/05		95	%	80 - 120
			Dissolved Tin (Sn)	2014/09/05		90	%	80 - 120
			Dissolved Titanium (Ti)	2014/09/05		98	%	80 - 120
			Dissolved Uranium (U)	2014/09/05		NC	%	80 - 120
			Dissolved Vanadium (V)	2014/09/05		103	%	80 - 120
			Dissolved Zinc (Zn)	2014/09/05		91	%	80 - 120
		Spiked Blank	Dissolved Aluminum (Al)	2014/09/05		125 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2014/09/05		109	%	80 - 120
			Dissolved Arsenic (As)	2014/09/05		111	%	80 - 120
			Dissolved Beryllium (Be)	2014/09/05		110	%	80 - 120
			Dissolved Chromium (Cr)	2014/09/05		110	%	80 - 120
			Dissolved Cobalt (Co)	2014/09/05		111	%	80 - 120
			Dissolved Copper (Cu)	2014/09/05		104	%	80 - 120
			Dissolved Lead (Pb)	2014/09/05		111	%	80 - 120
			Dissolved Molybdenum (Mo)	2014/09/05		109	%	80 - 120
			Dissolved Nickel (Ni)	2014/09/05		110	%	80 - 120
			Dissolved Selenium (Se)	2014/09/05		112	%	80 - 120
			Dissolved Silver (Ag)	2014/09/05		110	%	80 - 120
			Dissolved Thallium (Tl)	2014/09/05		110	%	80 - 120
			Dissolved Tin (Sn)	2014/09/05		105	%	80 - 120
			Dissolved Titanium (Ti)	2014/09/05		114	%	80 - 120
			Dissolved Uranium (U)	2014/09/05		105	%	80 - 120
			Dissolved Vanadium (V)	2014/09/05		113	%	80 - 120
			Dissolved Zinc (Zn)	2014/09/05		117	%	80 - 120
		Method Blank	Dissolved Aluminum (Al)	2014/09/05	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2014/09/05	<0.00060		mg/L	
			Dissolved Arsenic (As)	2014/09/05	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2014/09/05	<0.0010		mg/L	
			Dissolved Chromium (Cr)	2014/09/05	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2014/09/05	<0.00030		mg/L	
			Dissolved Copper (Cu)	2014/09/05	<0.00020		mg/L	
			Dissolved Lead (Pb)	2014/09/05	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2014/09/05	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2014/09/05	<0.00050		mg/L	
			Dissolved Selenium (Se)	2014/09/05	<0.00020		mg/L	
			Dissolved Silver (Ag)	2014/09/05	<0.00010		mg/L	

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB4F8676
P.O. #:
Site Location: 1697-1401:AANDC DEW LINE

Quality Assurance Report (Continued)

Maxxam Job Number: CB477292

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7626033	HC7	Method Blank	Dissolved Thallium (Tl)	2014/09/05	<0.00020		mg/L	
			Dissolved Tin (Sn)	2014/09/05	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2014/09/05	<0.0010		mg/L	
			Dissolved Uranium (U)	2014/09/05	<0.00010		mg/L	
			Dissolved Vanadium (V)	2014/09/05	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2014/09/05	<0.0030		mg/L	
		RPD	Dissolved Aluminum (Al)	2014/09/05	NC		%	20
			Dissolved Antimony (Sb)	2014/09/05	NC		%	20
			Dissolved Arsenic (As)	2014/09/05	NC		%	20
			Dissolved Beryllium (Be)	2014/09/05	NC		%	20
			Dissolved Chromium (Cr)	2014/09/05	NC		%	20
			Dissolved Cobalt (Co)	2014/09/05	NC		%	20
			Dissolved Copper (Cu)	2014/09/05	NC		%	20
			Dissolved Lead (Pb)	2014/09/05	NC		%	20
			Dissolved Molybdenum (Mo)	2014/09/05	8.0		%	20
			Dissolved Nickel (Ni)	2014/09/05	3.1		%	20
			Dissolved Selenium (Se)	2014/09/05	2.9		%	20
			Dissolved Silver (Ag)	2014/09/05	NC		%	20
			Dissolved Thallium (Tl)	2014/09/05	NC		%	20
			Dissolved Tin (Sn)	2014/09/05	NC		%	20
			Dissolved Titanium (Ti)	2014/09/05	NC		%	20
			Dissolved Uranium (U)	2014/09/05	2.3		%	20
			Dissolved Vanadium (V)	2014/09/05	NC		%	20
			Dissolved Zinc (Zn)	2014/09/05	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Validation Signature Page

Maxxam Job #: B477292

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Peng Liang, Analyst II

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

APPENDIX F

QA/QC Discussion

In order to obtain the required minimum of 20% duplicate samples, as stipulated in Long-Term Monitoring Plan, one duplicate groundwater sample was collected at the site in 2014. Analytical results for submitted samples and the duplicate pair were compared to provide an indication of the precision of both the field sampling and laboratory analyzing methods. Results are presented along with chemical data in Appendix B, while the methodology is discussed in section 4.7.

All groundwater samples analyzed for PHCs, metals, PCBs and inorganics fell within limits of QA/QC acceptability with the exception of dissolved cobalt and dissolved zinc, which both reported unacceptable RPD values. These minor discrepancies are likely due to sediment entrainment in the water samples.

The internal laboratory quality control for analyses meets acceptability criteria. Therefore based on both laboratory and field QA/QC results, the data is reliable for its intended use. Laboratory QA/QC results are included in the laboratory certificates of analyses provided in Appendix D.

APPENDIX G

Field Notes

DEW Lines.

1697-1401 CAM-F Aug 24/14

9:00am: Drive out to airport

10:00am: wheels up to head to Hall Beach (Franz & Kenn Borek)

2:00pm (local time) arrived in Hall Beach

2:20pm – wheels up to CAM-F

2:50pm – arrive CAM-F – go to SSDF first
- did health & safety briefing

3:~~00~~pm: begin to install new data loggers – will download data tonight at hotel

At CAM-F-03-VT
- took old one out will reprogram new one to install now.

Manual Thermister Readings.

Annalog Channal	Thermister R (kOhms)	
1	15.851	channel / R
2	16.508	10 – 24.46
3	17.311	11 – 25.06
4	18.253	12 – 25.75
5	19.571	
6	20.67	
7	21.75	
8	22.66	
9	23.61	

Rite in the Rain

1697-1401 CAM-F Aug 24/14

- hooked up new one

Read Current config.	Configured to:
site #. 1	site: 1
Description: 08050018	CAM-F-03-VT
Sample Rate: 12 hr	23 hr
memory % full: 1%	0%
date when full: 27/12/2016	N/A
main 9V: 11.34	11.34
Aux 12V: 13.14	13.63
date: 24/08/2014	24/08/2014
time: 1:10pm	3:25pm

At CAMF-02-VT

- took old one out, new one installed and will program

Manual Thermister Readings

Channel	R(kOhms)	channel	R(kOhms)
1	~~10.165~~ 10.175	9 -	20.16
2	13.746	10 -	21.08
3	14.806	11 -	21.93
4	15.582	none	
5	16.393		
6	17.289		
7	18.111		
8	19.158		

→

1697-1401 CAM-F Aug 24/14

- new one hooked up.

Different Conf.	Configured to:
site #: 1	1
Description: 14000723	CAMF-02-VT
Sample rate: 12hr	23hr
memory % full: 1%	0%
date when full: 27-12-2016	N/A
Main 9V: 11.34V	11.34V
Aux 12V: 13.26V	13.63V
date: 24-08-2014	same
time: 1:35pm	3:39pm.

At CAMF-01-VT

- took old one out & will replace with new one.

Manual Thermistor Readings.

Channel	R(kOhms)		
1	11.343	8 -	19.506
2	14.371	9 -	20.49
3	15.378	10 -	21.48
4	16.249	11 -	22.31
5	16.957		
6	17.779		
7	18.591		

1697-1401 CAM-F Aug 24/14

Current Config:	Configure to:
Site #: 1	1
Description: 7080141	CAMF-01-VT
Sample rate: 12 hrs	23 hrs
memory full: 1%	0%
date when full: 27-12-2016	~~07-01-2041~~ N/A
main 9V: 11.34V	11.34V
Aux 12V: 12.17	12.53V
date: 24-08-2014	same
time: 1:55pm	4:00pm

At CAMF-04-VT
- took off old one - installed new one

Manual Thermister Readings.

Channel	R (K Ohms)	
1	15.876	9 - 23.53
2	16.484	10 - 24.45
3	17.233	11 - 25.78
4	18.122	12 - 25.15
5	19.299	
6	20.44	
7	21.47	
8	22.54	

1697-1401 CAM-F Aug 24/14

- ~~put~~ configure new one

Current Config.	Config to:
Site #: 1	1
Description: 13008014	CAMF-04-VT
Sample rate: 12 hrs	23 hr
Full: 1%	0%
Date when full: 27-12-2016	N/A
main 9V: 11.34V	11.34V
Aux 12V: 13.26V	13.50V
date: 24-08-2014	same
time: 2:10pm	4:13pm.

- Finished installing new dataloggers
- JD to use DGPS + KK to monitor wells

Well #	DTW	DTB
MW5	- frozen	1.835m
MW6	/ frozen	1.910m
MW4	1.115m	1.580m

- MW4 has water inside top of well (see photos)
- MW5 and MW6 frozen (see photos)

Rite in the Rain

1697-1401 CAMF Aug 24/14

MW0604

- began purging at 5:04 - using flow-thru cell YSI

Time	Temp°C	mS/cm	µS/cm	DO%	DO mg/L	pH	ORP	DTW(cm)
5:07	2.70	0.940	539	142.2	18.66	6.86	112.3	1.200
5:12	3.26	0.881	514	109.7	14.63	7.36	84.8	1.240
5:17	3.25	0.830	485	106.7	14.25	7.45	82.2	1.255
5:22	3.01	0.804	466	100.0	13.41	7.52	77.5	1.280
5:27	2.89	0.803	464	96.6	13.20	7.57	75.3	1.295

- purged ~ 2L
- began sampling at 5:30
- took DUP0601 here
  - water running out (recharge not sufficient) to collect full duplicate sample so took DUP of:
    - total metals
    - dissolved metals
    - VOCs
    - F2-F4
  - DUP sample has 7 containers
  - MW0604 sample has 11 containers (full sample)

1697-1401 CAMF Aug 24/14

- completed the visual assessment of SSDF & photo log.
- ~~no~~ two areas of seepage observed, soils were saturated but no staining observed - no running water
- no areas of ponded water observed
- no areas of staining observed.
- no soils collected.

→ Canada Goose & Caribou tracks & scat in abundance around SSDF

9:00pm: downloading data loggers.

CAMF-01-VT

Site no: 1
Description: CAMF-01VT
sample rate: 12 hrs
memory full: 32%
date when full: 20/01/2015
main 9V: 11.34V
aux 12V: 13.38V
date/time: 24/08/2014 7:51
current time 9:03

Rite in the Rain

1697-1401 CAM-F Aug 24/2014

CAMF-02VT

Site no.: 2
Description: CAMF-02VT
Sample rate: 12 hrs
Memory Full: 82%
Date full: 1/20/15
Battery main 9V: 11.34V
Battery aux 12V: 13.50V
Date: 8/24/14
Time: 8:32PM
Actual time: 7:26PM

CAMF-04VT

Site no.: 4
Description: CAMF-04VT
Sample rate: 12hrs
Memory full: 82%
Date Full: 1/20/15
Battery main 9V: 11.34V
Battery aux 12V: 13.50V
Datalogger date: 8/24/14
" time: 8:51PM
Actual time: 9:43 PM

1697-1401 CAM-F Aug 24, 2014

CAMF-03VT

Site no.: 0
Description: C@!F!!F
Sample rate: 4:00:04
Memory Full: 100%
Date when full: # 5/6/92
Battery main (9V): 11.34V
Battery aux (12V): 13.50V
Datalogger date: 5/10/92
" time: 5:01AM
Actual: 8/24/14 10:03PM

- went to data tab to download data from datalogger but would not download
- clearly error in programming of datalogger?
- bring back datalogger + try again in office

Rite in the Rain

1697-1401 CAM-F Aug 25, 2014

8.20 am: wheels up to CAM-F

8.45: down at CAM-F

Wildlife: Caribou, snow geese, Canada Geese, fox, arctic hare (sometimes) ptarmigans, lemmings, Sir Sics (Ground squirrels)

- Some kind Polar Bears travel through
- Sarcpa Lake - fish in here, Lake Trout

- People hunt in this area in winter - Caribou hunting grounds

Tracks - caribou, Canada Geese & moose & calf

Scott - lots of geese & some caribou

Simon seems to think there are less Caribou around now - more when he was younger - thinks just a lull right now due to less food for them - thinks they will come back

9:00: Health & Safety talk.

1697-1401 CAM-F Aug 25/14

- KK monitoring wells & JD using DGPS

MW1

- lock missing & well cap missing
- DTW = / well frozen or dry
- DTB = 1.966m
- likely well is dry - could not get any use with water level meter
- cannot put lock on well b/c it has risen and will not close the whole way

MW3

DTW = 2.440m

DTB = 2.552m

MW2

- missing well cap
- DTW = 1.892m
- DTB = 2.030m

Rite in the Rain

1697-1401 CAM-F Aug 25/14

MW0602

- purged at 9:33AM (started)
- due to limited time + limited sample - began to sample after purging ~300mL
- ~~we will be~~ not enough volume to collect parameters.
- sampled BTEX vials, 1 500mL & metals bottles then went dry
  - will let recharge + come back.
- recharging but slow
- 11 again: collected ½ amber
  - will try to get whole sample.
- left recharg + kept coming back to sample
- sampled 10 bottles total
  - PHCs/BTEX, PCBs, metals
  - 1 bottle for general.
  - limited sample for general/TDS - no bottle

1697-1401 CAM-F Aug 25/14

MW0603 - 10:00am

- we will start to sample here.
- purged w 150mL out first
- will sample now due to limited volume in well + low
- water clear, no sediment.
- collected 3 vials + dissolved metals before going dry.

11:00am: still dry - not recharging much at all.

11:45am - well completely dry - no water at all.

12:15: still completely dry
- not going to recharge.
- total sampled 3 vials for BTEX 2 metal bottles total + dissolved

~~12:45~~ ~~Cont~~

1:15: back in Hall Beach.

1:35 - on route to Iqaluit

Rite in the Rain

1697-1101 CAM-F Aug 25/14

- NHWL appears in good condition.
no new features to add, no
erosion or new settlement areas.
- no cracks observed.
- dry all around.
- completed photo log
- ~~std~~ very little change to features
previously identified.
- observed other building areas -
no staining - cement pads appear
in good condition.

Rite in the Rain

Table 6-3: CAM-F Sarcpa Lake – NHWL Landfill Visual Inspection

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Top of NHWL, 24.6 m east from the northwest top ledge	12.9 m^2		0.02	<1%	Small depression	-minor, no change observed	47-48
Settlement	B	Top of NHWL, 15.4 m east from the northwest top ledge	32.3 m^2		0.1	<1%	Large Depression	-remains unchanged	49
Settlement	C	3.3 m west of the west corner of the NHWL	6.6 m^2		0.02	<1%	Slight low area	- remains unchanged	50
Settlement	D	10.8 m southwest of the south corner of the NHWL	16.3 m^2		0.25	<1%	Settlement	- remains unchanged	-
Settlement	E	25 m north of the north corner of the NHWL	20 m^2		0.25	<1%	Slight low area	Maximum depth	27

- almost appears mechanical

↳ minor depression, remains unchanged

- no additional features observed
- no erosion channels, cracking, additional depressions.
- overall in very good condition
- no seepage - dry, no stained areas.

Table 5-3: CAM-F Sarcpa Lake – SSDF Visual Inspection

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Near the road, 12 m east of northeast of MW604	20 m^2		0.02	<1%	Ponded water, increased in size in 2012	- dry in 2014	54
Settlement	B	Near the road, 14 m north of the SSDF northwest corner	28 m^2		0.1	<1%	Large Depression; No significant change (NSC)	- same, no change observed	55
Settlement	C	Along toe of the landfill, at the northwest corner of the SSDF	12	0.005	0.01	<1%	Minor cracking and a slightly low lying area; NSC 2012	- very minor - no change observed	56-57
Settlement	D	Along the northwest side of the landfill, 12 m south of the northwest corner of the SSDF	16	0.005	0.01	<1%	Minor settlement cracks; less evident/NSC 2012	- less evident - hard to see in 2014 - not really observed	58-59
Settlement	E	Along the side of the landfill , near toe of the SSDF along the west side, 31 m south of the northwest corner	16 m^2		0.12	<1%	Minor settlement and cracking, Pothole; NSC 2012	- remains unchanged	60-61
Settlement	F	Along the side of the landfill , near toe of the SSDF along the west side, 33 m north of the southwest corner	25	0.005	0.025	<1%	Minor settlement cracks; NSC 2012	- minor, don't see much cracking - no change	67
Settlement	G	Along the side of the landfill , near toe of the SSDF along the west side, 35 m north of the southwest corner	0.03 m^3			<1%	Two small settlement features – potholes; NSC 2012	- very minor, no change	70
Seepage	H	Along the side of the landfill in the southwest corner of the SSDF	16 m^2		N/A	<1%	Dark, saturated soil, not actively running; not observed in 2012	- NOT observed in 2014	71
Seepage	I	Toe of the landfill in the southwest corner of the SSDF	13.4 m^2		0.25	<1%	Seepage area. Two drainage courses, actively seeping with ponded water; NSC 2012	North ponded area	73-75
			41 m^2		0.25	<1%		South ponded area } dry in 2014	
			7	1	0.15	<1%		North channel	
			8.8	1	0.2	<1%		South channel	
Seepage	J	14 m southeast from the southwest corner of the SSDF near the toe	7.3	0.5	0.15	<1%	Active Seepage; not flowing in 2012	- Dry in 2014 - none observed	-
Settlement	K	9 m east from the southwest corner of the SSDF along side of landfill	13.6	0.005	0.01	<1%	Cracking; less evident in 2012	- less evident in 2014 - not really observed	76-77
Seepage	L	15 m east from the southwest corner of the SSDF along side of landfill	19.7 m^2		N/A	<1%	Dark saturated soil – long linear feature; Not observed in 2012	- NOT observed	17
Settlement	M	37 m east from the southwest corner of the SSDF along side of landfill	16.5	0.01	0.05	<1%	Very minor settlement cracking; not observed in 2012	- less evident not really observed	78
Seepage	N	28 m east from the southwest corner of the SSDF near the toe	9.6	0.05	N/A	<1%	Seepage face and associated drainage; NSC 2012	Seepage Face - saturated but not running - no staining	79-80
			40	0.4	0.3	<1%		Drainage channel → looks mechanical	
Settlement	O	24 m west from the southeast corner of the SSDF along side of landfill	12.5	0.005	0.01	<1%	Minor settlement cracking; NSC 2012	- not observed	81
Seepage	P	20 m west from the southeast corner of the SSDF along side of landfill	42.9 m^2		N/A	<1%	Dark saturated soil; not observed in 2012	- not observed in 2014	26

- dry this year, no ponding at all observed.
- Simon (B.M) says not much rain this year - very dry year

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Seepage	Q	11 m west from the southeast corner of the SSDF at the toe of the landfill	12	0.05	N/A	<1%	Seepage face, associated drainage and ponded water; NSC 2012	Seepage Face	82-84
			0.25	0.45	0.25	<1%		West channel	
			0.15	0.4	0.15	<1%		East channel	
			42 m^2		0.2	<1%		Ponded water	
Seepage	R	Southeast corner of the SSDF at toe	11.1	0.1	N/A	<1%	Seepage face and saturated soil area with ponded water; less evident in 2012	Seepage face	23
			32 m^2		N/A	<1%		Saturated soil area	
Vegetation	S	Southeast corner of the SSDF along the side slope	N/A			<1%	Area of vegetation; increased density of growth in 2012	Vegetation establishing on top of landfill and along eastern and southern slopes	85, 91-97,
Settlement	T	40 m north from the southeast corner of the SSDF along the side slope	7.8	0.01	0.01	<1%	Settlement cracks; less evident in 2012	South crack	86
			8.9	0.01	0.01			North crack	
Settlement	U	28 m south from the northeast corner of the SSDF along the side slope	10.1 m^2		0.2	<1%	Settlement/depressions; not observed in 2012	-not observed, very minor	87
Seepage	V	18 m south from the northeast corner of the SSDF along the side slope	29 m^2		N/A	<1%	Dark saturated soil with very sparse vegetation; NSC 2012	-not observed in 2014	36 and 38
Ponded Water	W	MW06-04	~55 m^2				Ponded/puddled water	Likely attributable to the heavy rains during the 2012 site visit	40, 90

- saturated soil, but not a running stream.
- no soil staining observed
- channel is dry + no ponded water

dry in 2014
- no seepage observed

- minor veg growth - similar to 2012

less evident, hard to tell if there

↳ Dry - no ponding observed.

Note: Measurements for relative location were taken from the landfill corner at the toe to the center of the feature of note.

APPENDIX H

Thermistor Data

Table H-1: Thermistor Annual Maintenance Report

Contractor name: Franz Environmental Inc.	**Inspection date:** August 24-25, 2014
Prepared by: Julie Dittburner	

Thermistor Information

Thermistor Number	CAMF 01-VT	CAMF 02-VT	CAMF 03-VT	CAMF 04-VT
Initial Install date	2007-09-21	2007-09-19	2007-09-16	2007-09-17
Location	CAM-F (SSDF)	CAM-F (SSDF)	CAM-F (SSDF)	CAM-F (SSDF)
Inclination	Vertical	Vertical	Vertical	Vertical
Cable length (m)	7.8	7.8	8.4	8.4
Cable length (m) above ground	3	3	1.5	1.5
No. of beads	11	11	12	12
Bead type	44007	44007	44007	44007
Coordinates (m)	N:7605524 E: 405936	N:7605544 E: 405886	N:7605574.5 E: 405956.9	N:7605594.1 E: 405906.5
Former data logger Serial no. (removed from site)	07060039	09010147	05070006	05070020
New data logger Serial no. (installed Aug. 24, 2014)	708141	14000723	08050018	13008014
Logger model	Lakewood Systems 16 channel RX Ultralogger			

Thermistor inspection

Thermistor Number	CAMF 01-VT	CAMF 02-VT	CAMF 03-VT	CAMF 04-VT
Casing	Good condition	Good condition	Good condition	Good condition
Cover	Good condition	Good condition	Good condition	Good condition
Data logger	Good condition	Good condition	Good condition	Good condition
Cable	Good condition	Good condition	Good condition	Good condition
Beads	Operational	Operational	Operational	Operational
Battery installation date	Aug. 24, 2014	Aug. 24, 2014	Aug. 24, 2014	Aug. 24, 2014
Main battery (V) On Aug 25/12	11.34	11.34	11.34	11.34
Aux battery (V) On Aug 25/12	12.53	13.63	13.63	13.50

Observations and proposed maintenance

- Two fresh desiccant cartridges should be installed in each datalogger at every site visit.
- Data logger 05070006 from CAMF 03-VT displayed an error message when attempting to download data. Data was not retrieved from this unit. A complete memory transfer (CMT) was completed and the CMT file sent to Lakewood Systems for analysis and possible data extraction. The physical data logger will also be sent to Lakewood Systems for maintenance and internal factory battery changes.
- Memory of each datalogger was 84% full. The newly installed data loggers were programed for one reading per day.

Table H-2: Manual Thermistor Readings

Analog Channel		Thermistor R (Ohms)	Temperature (ºC)		
			Manual	Logged	Difference
VT01	1	11343	7.3031	5.9101	1.4
	2	14371	2.5445	2.168	0.4
	3	15378	1.2079	1.2084	0.0
	4	16249	0.1287	0.1278	0.0
	5	16957	-0.7018	-0.7407	0.0
	6	17779	-1.6185	-1.579	0.0
	7	18591	-2.4787	-2.475	0.0
	8	19506	-3.3989	-3.4727	0.1
	9	20490	-4.3361	-4.3811	0.0
	10	21480	-5.2295	-5.3104	0.1
	11	22310	-5.9438	-6.0676	0.1
		maximum	--	--	***1.4***
VT02	1	10775	8.3550	6.5044	1.9
	2	13746	3.4281	2.6741	0.8
	3	14806	1.9546	1.887	0.1
	4	15582	0.9491	0.8254	0.1
	5	16393	-0.0434	-0.2068	0.2
	6	17289	-1.0779	-1.1643	0.1
	7	18111	-1.9754	-2.1291	0.2
	8	19158	-3.0547	-3.2119	0.2
	9	20160	-4.0275	-4.1755	0.1
	10	21080	-4.8742	-5.0757	0.2
	11	21930	-5.6205	-5.8681	0.2
		maximum	--	--	***1.9***
VT03	1	15851	0.6136	0	0.6
	2	16508	-0.1797	0	0.2
	3	17311	-1.1026	0	1.1
	4	18253	-2.1259	0	2.1
	5	19571	-3.4624	0	3.5
	6	20670	-4.5021	0	4.5
	7	21750	-5.4652	0	5.5
	8	22660	-6.2361	0	6.2
	9	23610	-7.0049	0	7.0
	10	24460	-7.6640	0	7.7
	11	25060	-8.1140	0	8.1
	12	25750	-8.6169	0	8.6
		maximum	--	--	***8.6***
VT04	1	15876	0.5827	0.6285	0.0
	2	16484	-0.1514	-0.1408	0.0
	3	17233	-1.0150	-1.0162	0.0
	4	18122	-1.9871	-1.9437	0.0
	5	19299	-3.1950	-3.191	0.0
	6	20440	-4.2897	-4.2967	0.0
	7	21470	-5.2207	-5.273	0.1
	8	22540	-6.1365	-6.2135	0.1
	9	23530	-6.9415	-7.0684	0.1
	10	24450	-7.6564	-7.7961	0.1
	11	25780	-8.6384	-8.8933	0.3
	12	25150	-8.1805	-8.4261	0.2
		maximum	--	--	***0.3***

Note: Data logger 05070006 from CAMF 03-VT displayed an error message when attempting to download data. Data was not retrieved from this unit.

Chart H-1: Thermal Profiles at 01-VT for 2012

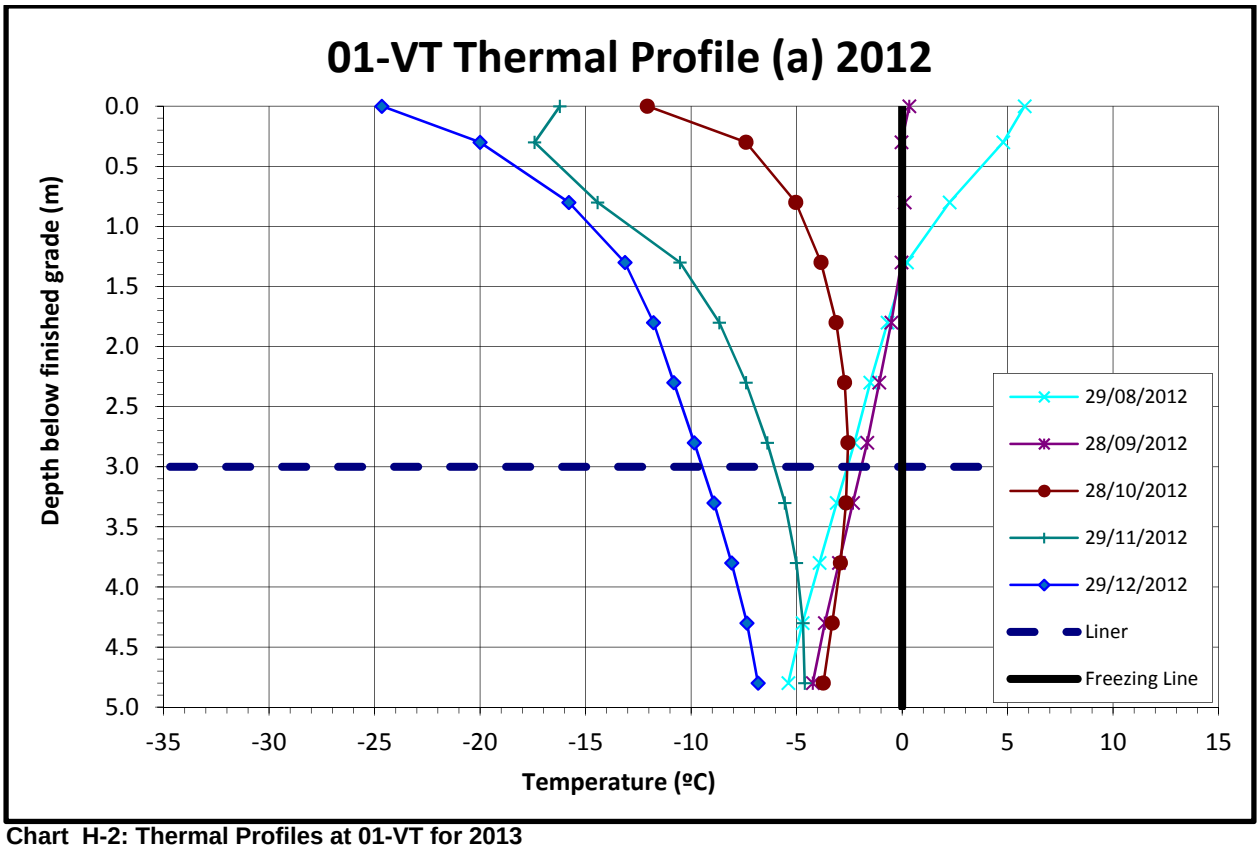


Chart H-2: Thermal Profiles at 01-VT for 2013

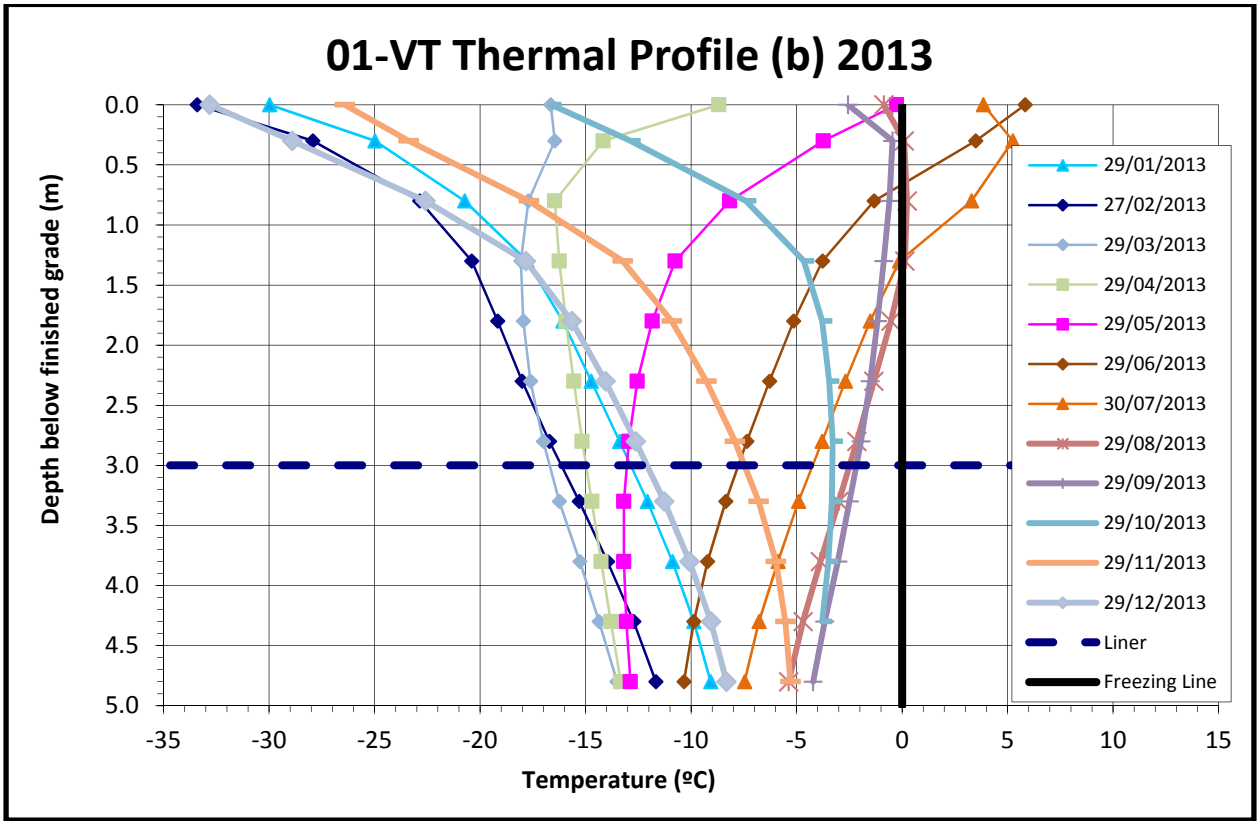


Chart H-3: Thermal Profiles at 01-VT for 2014

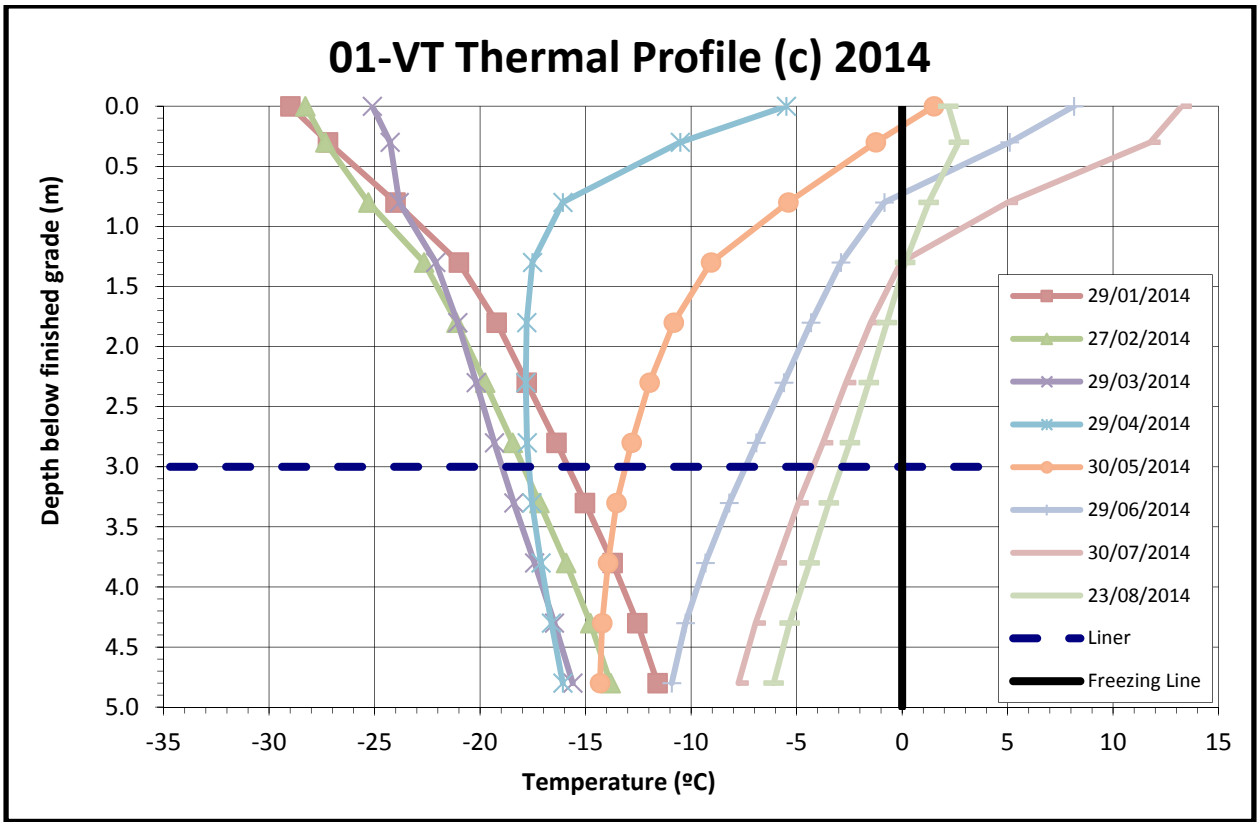


Chart H-4: Thermal Profiles at 01-VT for 2012-2014

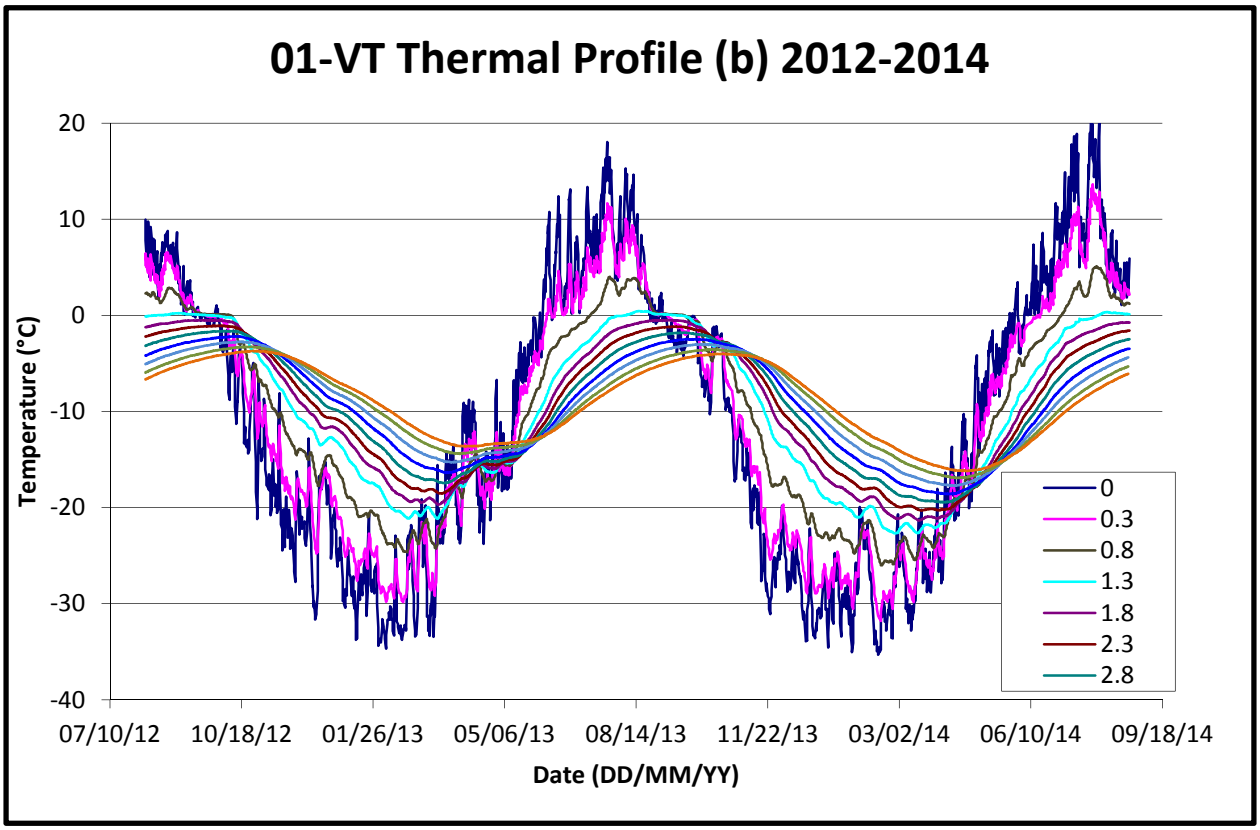


Chart H-5: Thermal Profiles at 02-VT for 2012

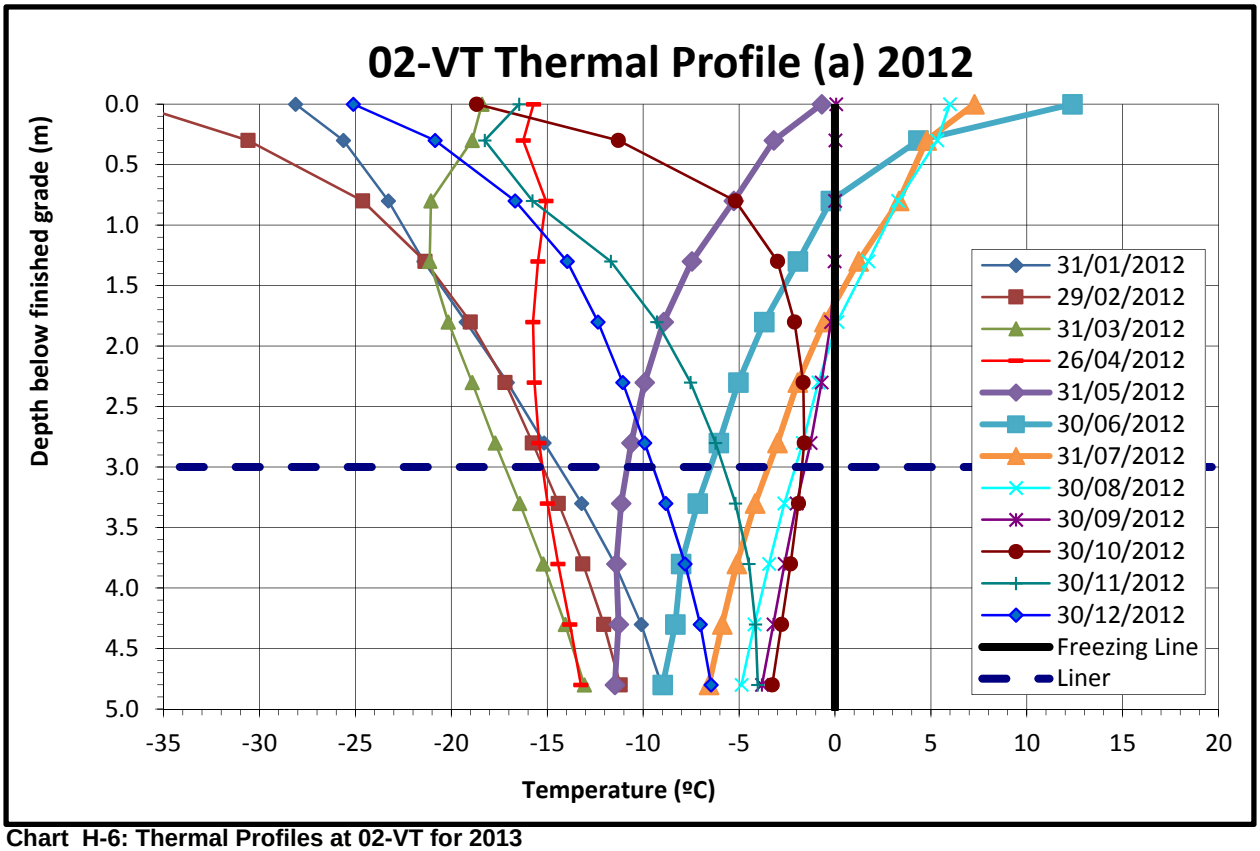


Chart H-6: Thermal Profiles at 02-VT for 2013

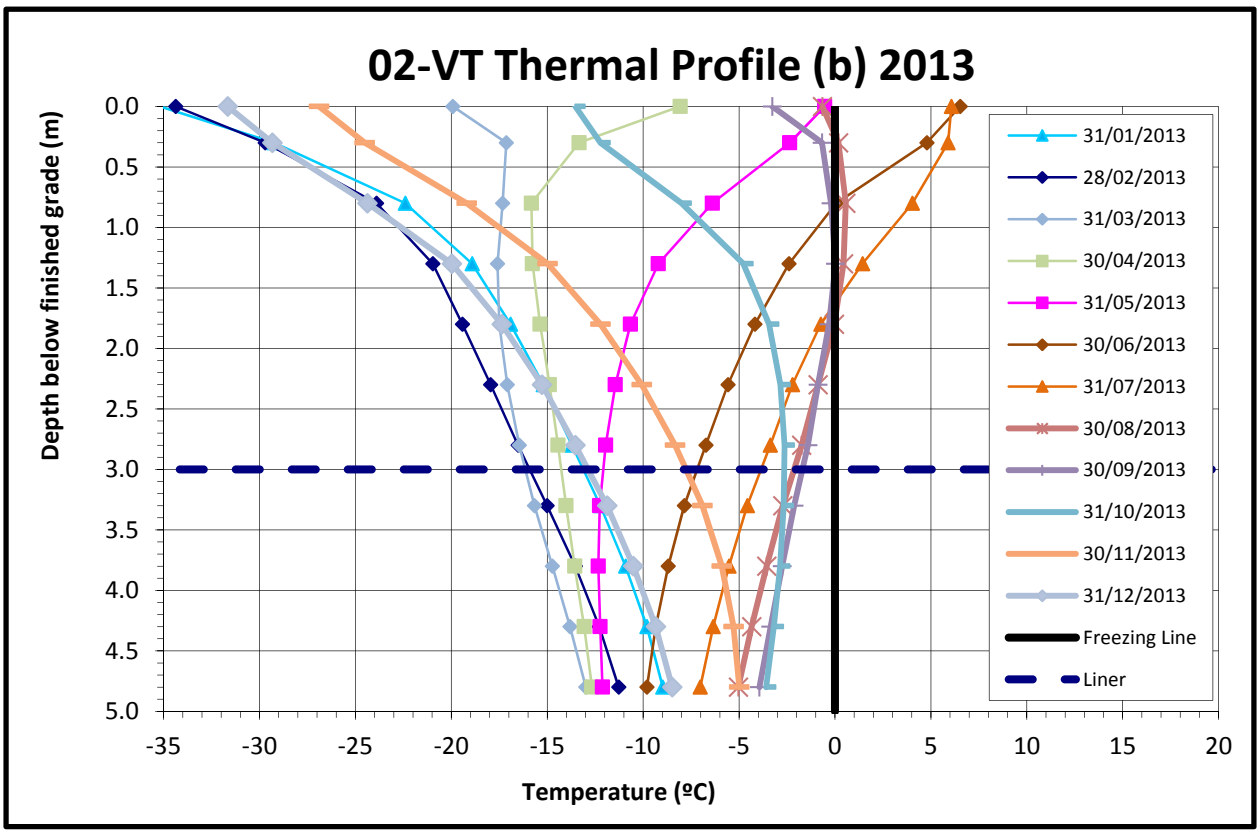


Chart H-7: Thermal Profiles at 02-VT for 2014

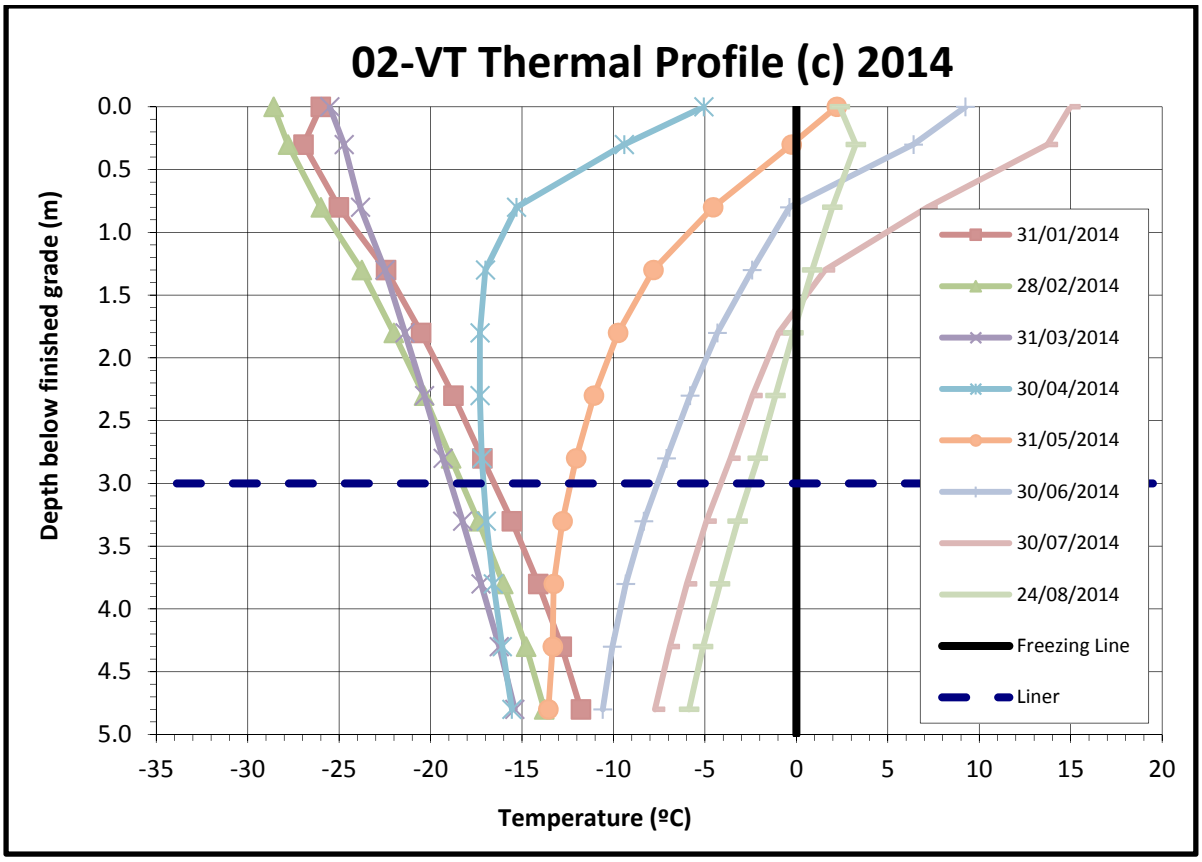


Chart H-8: Thermal Profiles at 02-VT for 2012-2013

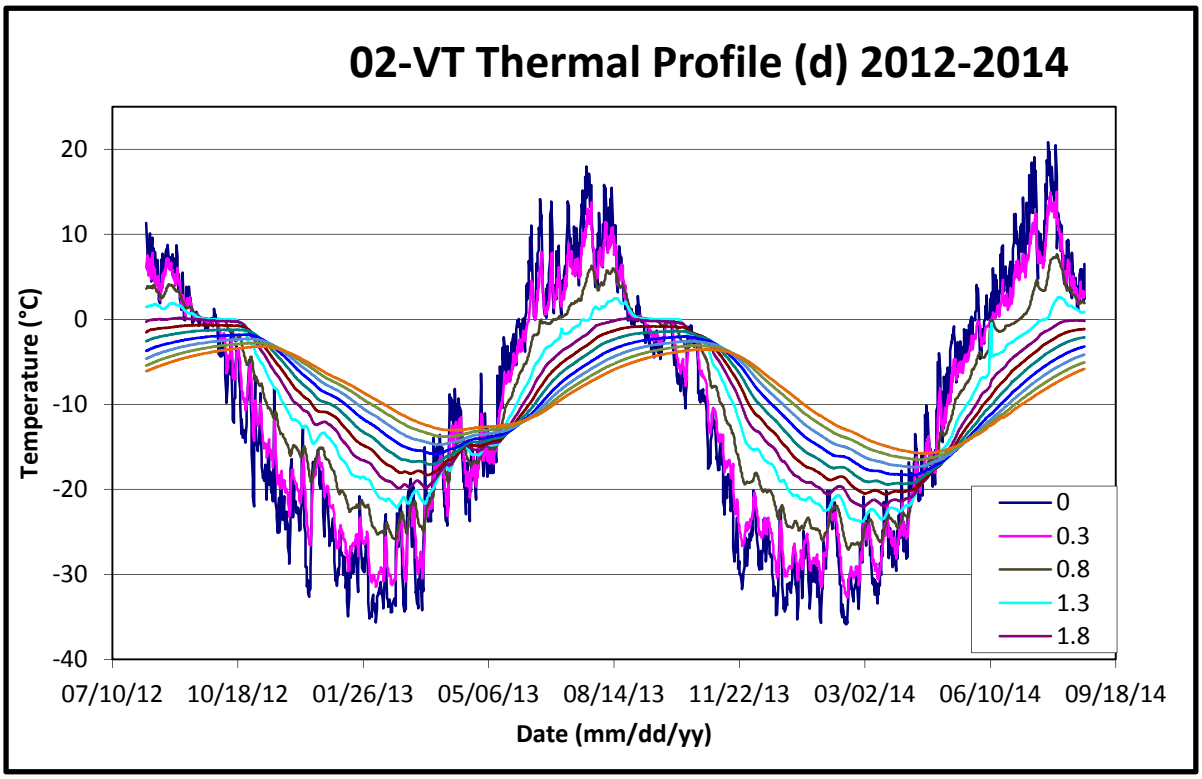


Chart H-9: Thermal Profiles at 04-VT for 2012

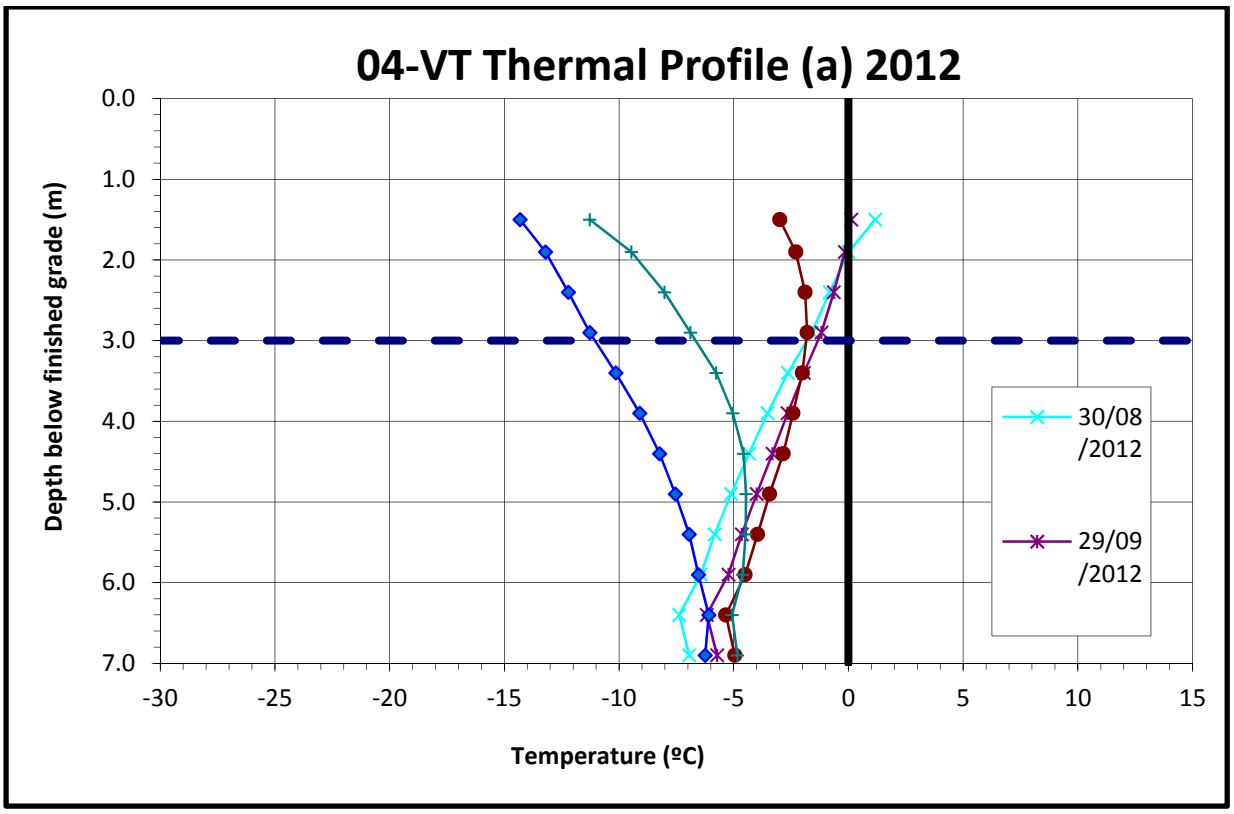


Chart H-10: Thermal Profiles at 04-VT for 2013

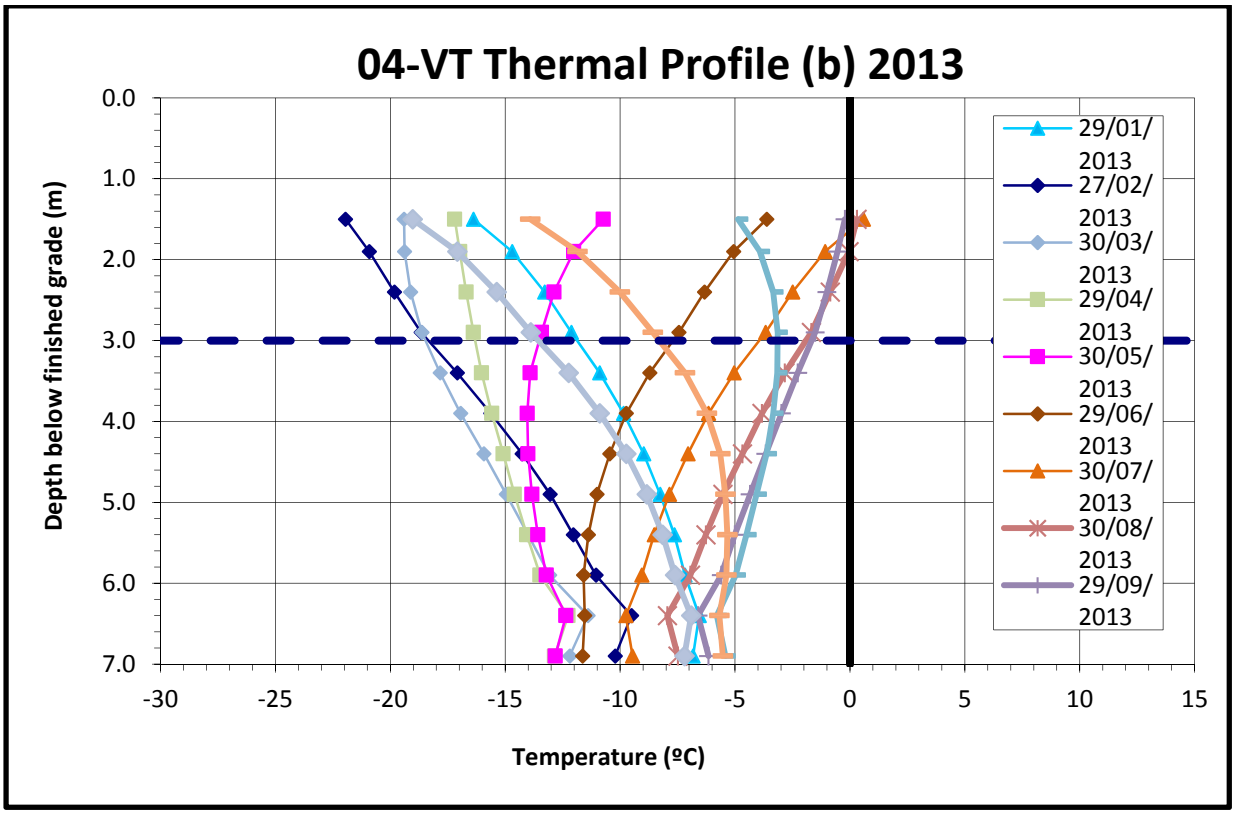


Chart H-11: Thermal Profiles at 04-VT for 2014

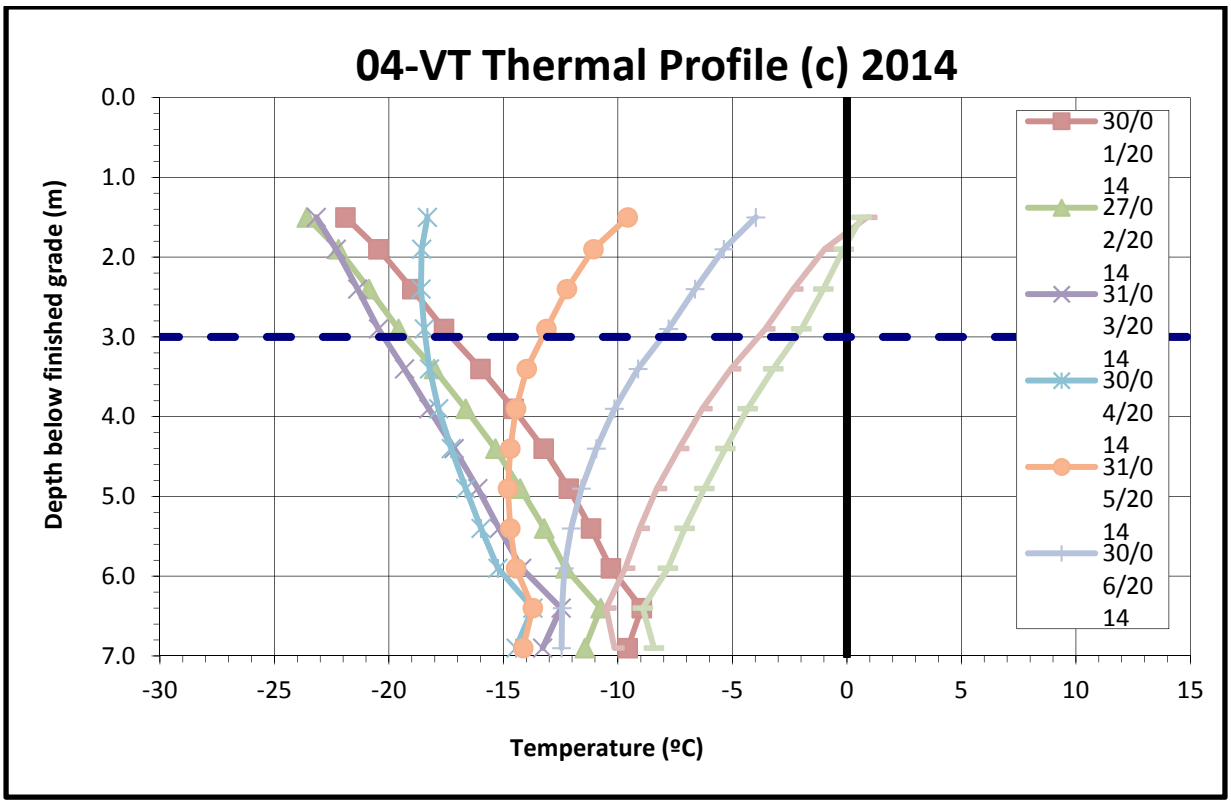
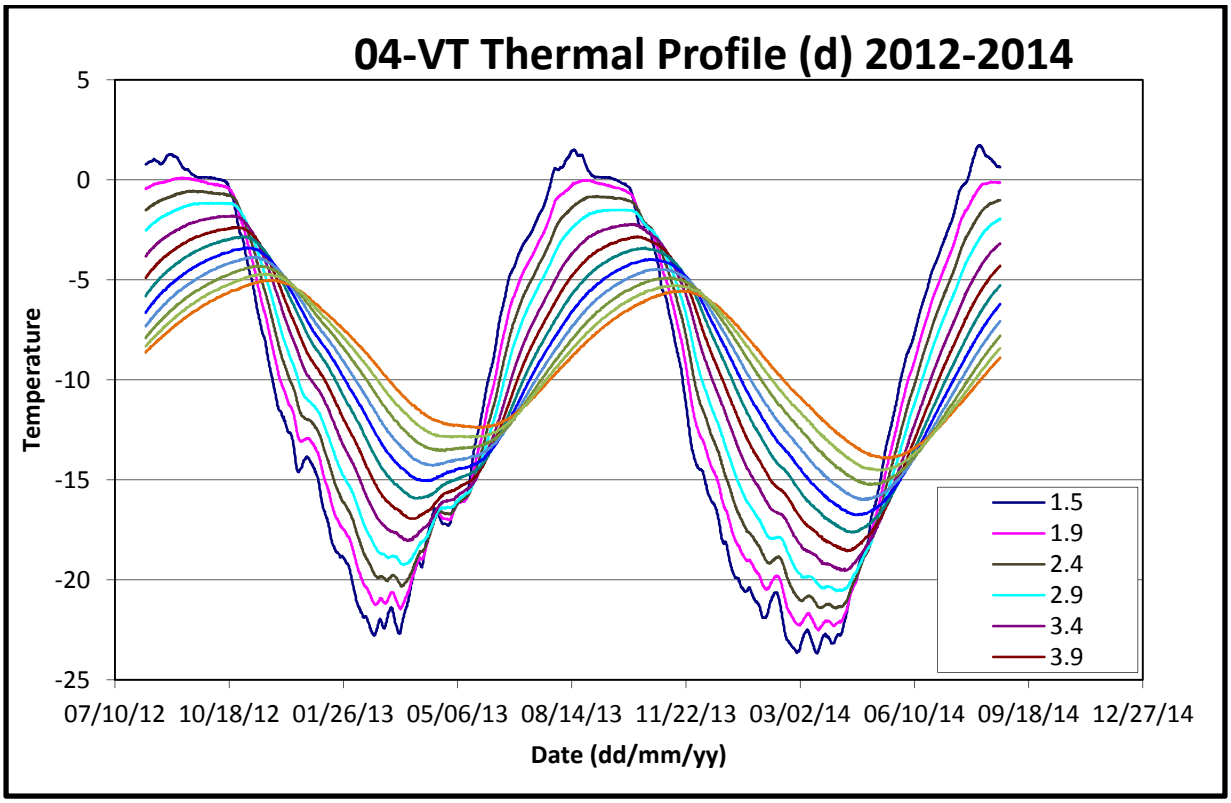


Chart H-12: Thermal Profiles at 04-VT for 2012-2014



APPENDIX I

Datalogger Email Correspondence

Dittburner, Julie (FRANZ)

From: Henderson, Andrew (FRANZ)
Sent: February-19-15 11:18 AM
To: Fletcher, Ryan (FRANZ)
Cc: Dittburner, Julie (FRANZ)
Subject: FW: Update - shipping dataloggers - received-dh
Attachments: VT-03DataRecoveryForFranz2014Feb18

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Ryan,

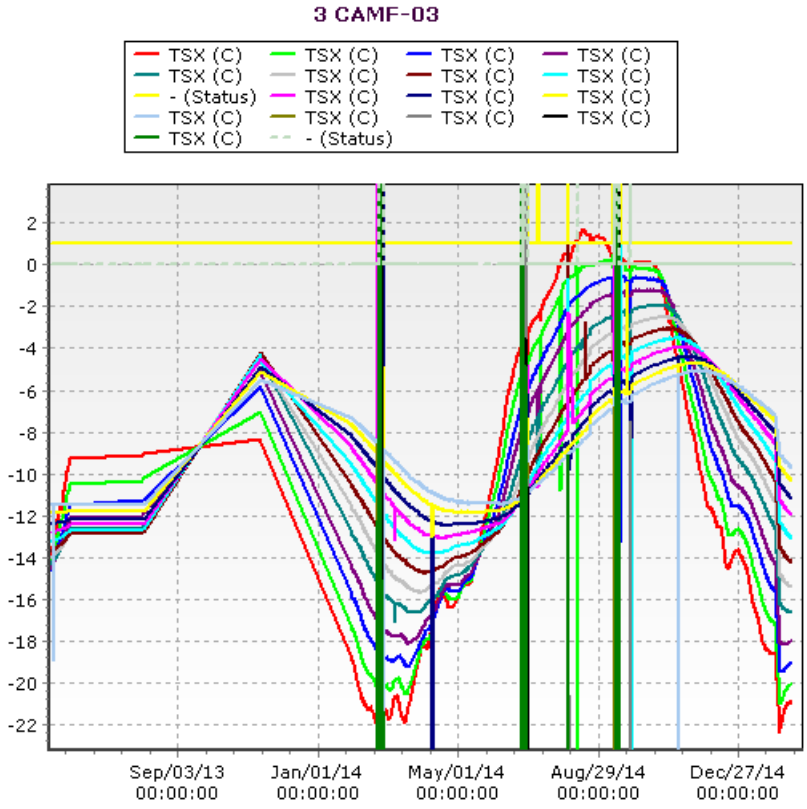
We got this back from Lakewood – let's talk when you get back…

Andrew

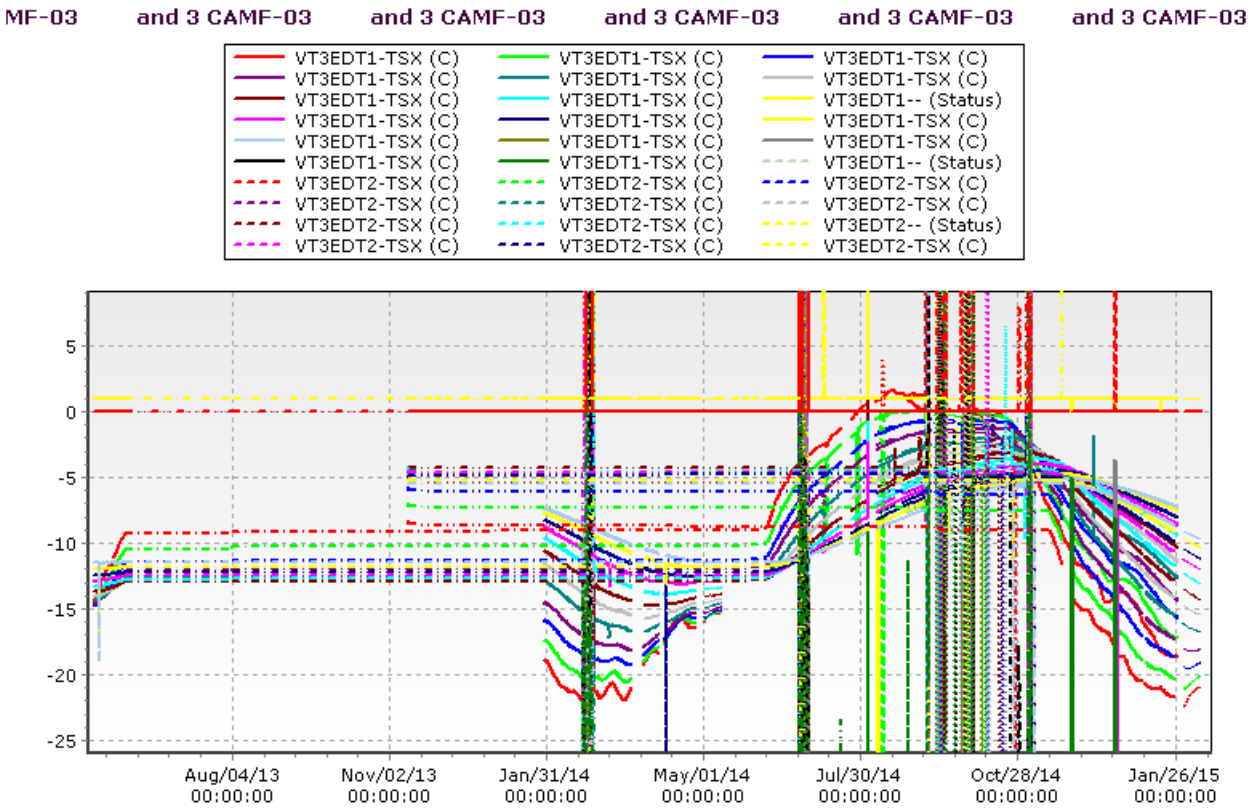
From: James Hlibka [mailto:james@lakewood.com]
Sent: February-18-15 4:37 PM
To: Don Hlibka; Henderson, Andrew (FRANZ)
Cc: boris@lakewood.com
Subject: Re: Update - shipping dataloggers - received-dh

Hi Andrew,

I was able to recover some data from the memory of VT-03. There are 18 chunks of data in the complete memory transfer that look like they could be temperature data. Here is what a graph of all the recovered data looks like ignoring conflicts in the the files to create VT3AllFilesMerged.prn:



And here is all of the data allowing overlaps:



I have attached the recovered data to this e-mail. It is possible that the dates in the files are wrong. It could just be the year or the whole clock could be out. The files are in sequence from the start to the end of the memory.

Let me know what you think and if you have any questions,
James

--
ph.: (780) 462-9110 x 222
fax: (780) 450-3867
web: lakewood.com

On 2/10/2015 12:43 PM, Don Hlibka wrote:

> Hi Andrew,
>
> We received the loggers today.
>
> We'll check them out and send you a service quote.
>
> ***Regards Don Hlibka***
>
> ***Bus.ph. 780-462-9110 ext. 221***
> ***Bus.fax 780-450-3867***
> ***Cell ph. 780-699-6189 (off while driving)***
>
> ***e-mail don@lakewood.com***
> *home page* http://www.lakewood.com/

From: Henderson, Andrew (FRANZ) [mailto:ahenderson@franzenvironmental.com]
Sent: Monday, February 09, 2015 1:53 PM

To: Don Hlibka; 'James Hlibka'
Subject: RE: Update - shipping dataloggers

Great! Thanks.

From: Don Hlibka [mailto:don@lakewood.com]
Sent: February-09-15 3:52 PM
To: 'James Hlibka'
Cc: Henderson, Andrew (FRANZ)
Subject: FW: Update - shipping dataloggers

Hi James,

Could you check if you have done this VT03 data recovery in the past.

Hi Andrew,

We will take a look at the units for you when they come in and give you an estimate on the repairs.

Regards Don Hlibka

Bus.ph. 780-462-9110 ext. 221
Bus.fax 780-450-3867
Cell ph. 780-699-6189 (off while driving)

e-mail don@lakewood.com
home page http://www.lakewood.com/

From: Henderson, Andrew (FRANZ) [mailto:ahenderson@franzenvironmental.com]
Sent: Monday, February 09, 2015 12:42 PM
To: Don Hlibka (don@lakewood.com)
Cc: Dittburner, Julie (FRANZ)
Subject: Update - shipping dataloggers

Hi Don,

As we discussed a few weeks ago, we are sending four dataloggers back to you for coin cell battery replacement and general refurbishment. If any of them require a major overhaul, though, can you please let me know in advance of the work? They are coming with Purolator, tracking number 330365055681. Your reference number for the file is DH150115.

My colleague Ryan also emailed Lakewood a few months ago about some corrupt data that we pulled off one of the dataloggers. He didn't hear back, so I thought we would try again – can someone have a look at the attached CMT file and see what we can get out of it? According to Ryan, It went through the process fine and then gave an error message right at the end just before it finishes.

Thanks again for this,

Andrew