2010 Monitoring Program
Solid Waste Management Facility Landfill
Roberts Bay, Nunavut

FINAL REPORT

Prepared for:

Indian and Northern Affairs Canada
Nunavut Regional Office
P.O. Box 2200
Iqaluit, Nunavut
X0A 0H0

Prepared by:

Franz Environmental Inc.
329 Churchill Avenue, Suite 200
Ottawa, Ontario
K1Z 5B8
Tel. (613) 721-0555
Fax: (613) 721-0029

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EXECUTIVE SUMMARY

Franz Environmental Inc. (FRANZ) was retained by Indian and Northern Affairs Canada (INAC) to conduct the first year of long-term monitoring activities at the abandoned silver mine site at Roberts Bay, Nunavut as prescribed by INAC's Roberts Bay and Ida Bay Long-Term Monitoring Plan. This project was completed under INAC standing offer number 01-09-6038, call-up number 02, file number 1632-11/01-09-6038.

The Roberts Bay abandoned mine site is located near Melville Sound, on the north coast of mainland Nunavut and southern side of the Northwest Passage, approximately 1 km north of Roberts Lake. The Roberts Bay site was an active silver mine in the early 1970s and was again the subject of exploration in the 1980s and 1990s. Remedial activities were conducted at the site between 2008 and 2010, including demolition of remaining site structures and disposal of non-hazardous waste and contaminated soils. To contain the soils and waste, a non-hazardous waste landfill was constructed over the former tailings pond. The landfill is known as the Solid Waste Management Facility landfill (SWMF).

FRANZ conducted the field activities for the first year of the Roberts Bay and Ida Bay Long-Term Monitoring Plan on August 28 and 29, 2010.

Physical observations suggest that the SWMF is performing as designed and continues to contain the enclosed waste. Although it is too early to properly assess landfill freezeback, temperature data collected from thermistor strings installed in the subsurface suggest that the facility is growing colder, as expected.

FRANZ also collected soil and surface water samples to assess the performance of the SWMF. All soil samples satisfied the appropriate guidelines for contaminants of potential concern at the site. Surface water samples collected in the vicinity of the SWMF landfill satisfied guidelines for most criteria; however, four surface water samples exceeded guidelines for arsenic, cadmium, cobalt, chromium, copper and lead. It is anticipated that these results are background contamination related to previous remedial work conducted at the site in 2009.

Based on observation and result of 2010 monitoring program it is recommended that:

1. Data logger on Thermistor String-B be replaced; and
2. Surface water data be used as a baseline for future monitoring conducted under the long-term monitoring plan.

This executive summary should be read in conjunction with the main report and is subject to the same limitations described in Section 7.0.

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1.0 INTRODUCTION

Franz Environmental Inc. (FRANZ) was retained by Indian and Northern Affairs Canada (INAC) to complete year one of the Roberts Bay mine long-term monitoring plan. This project was completed under INAC standing offer number 01-09-6038, call-up number 02, file number 1632-11/01-09-6038.

This report describes the monitoring activities completed in 2010 at the former silver mine Roberts Bay, Nunavut. It was prepared in accordance with the INAC Request for Proposal (RFP) dated April 14, 2010, the FRANZ Proposal No. P-3262, dated June 3, 2010, the Call-up Details, dated April 15, 2010 and the Project Initiating Meeting Minutes, dated July 6, 2010.

Throughout this report the abandoned silver mine site in Roberts Bay, Nunavut (Figure A-1, Appendix A) will be referred to as "the site".

1.1 Project Objectives

The overall objective of the first year of the Roberts Bay mine long-term monitoring plan was to determine whether the solid waste management facility (SWMF) landfill constructed at the site is performing as designed. To achieve this overall objective visual observation, surface water samples, test pitting and soil sampling activities were conducted at the site.

1.2 Scope of Work

The scope of work as described in the 2010 Roberts Bay and Ida Bay Long-Term Monitoring Plan (INAC, 2009) was as follows:

1. Visual Monitoring of the SWMF landfill, including:
    - Checking the physical integrity of the SWMF and observing any evidence of erosion, ponding, frost action, settlement and lateral movement and completing a Visual Monitoring Checklist.
    - Taking photographs to document the condition of the SWMF and substantiate the recorded observations.
2. Active Layer Water Monitoring of the SWMF, including:
    - Collection of samples from the designated downgradient surface water sampling points.
    - Examination and analyses 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 hydrocarbon (PHC) fractions F1 and F2, major ions, total dissolved solids (TDS) and total suspended solids (TSS).

3. Soil Monitoring in the area around the SWMF, including:
    - The collection of soil samples from the toe of the SWMF.
    - Analyses of the soil samples for inorganic elements (arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc), PCBs and total petroleum hydrocarbons (TPH).
4. Thermal Monitoring of the SWMF, including:
    - Collection of data from automatic data loggers attached to three thermistor strings with beads at selected intervals to provide ground temperature profiles at various locations within the SWMF.
5. Natural Environment Monitoring
6. Preparation of a report documenting the 2010 monitoring program.

To fulfill the scope of work as described above, FRANZ along with INAC, 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 surface water;
c) Excavation of test pits;
d) Collection of soil samples for chemical analysis;
e) Obtaining surface water samples for chemical analysis;
f) Inspection of thermistor installations and collection of data logger information;
g) Interpretation of analytical data;
h) Visual inspection and photo documentation of the site;
i) Observing and investigating land use and wildlife trends; and
j) Reporting.

The work plan for the 2010 field work was based on the following three documents: Roberts Bay and Ida Bay Long-Term Monitoring Plan (INAC, 2009), the Nunavut Water Board's Water Licence issued to INAC (NWB, 2008) and the SENES report on the remedial activities program (SENES, 2010).

1.3 Report Format

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

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

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

Chapter 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.

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

Chapters 5 – Summary of SWMF Conditions: Describes the physical characteristics and the chemical impacts and distribution above applicable regulatory guidelines of the SWMF.

Chapter 6 – Surrounding Areas and Natural Environment: Describes the physical conditions of the remainder of the study area, including flora and fauna.

Chapter 7 – Conclusions and Recommendations: Presents main findings and conclusions as well as recommendations for the next site visit.

Chapter 8 – Limitations

Chapter 9 – References

Chapter 10 – Closure

2.0 BACKGROUND INFORMATION

2.1 Site Description

Roberts Bay and Ida Bay are two abandoned silver mine sites located approximately 115 kilometres southwest of Cambridge Bay on the north coast of mainland Nunavut. The Roberts Bay site is located approximately 1 km north of Roberts Lake while the Ida Bay mine site is located adjacent to Melville Sound about 6 km north of the Roberts Bay site.

These two sites were explored between 1972 and 1975, operated from 1972 to 1975, and since then abandoned. Later, further explorations continued throughout the 1980s and 1990s.

A remediation project was conducted at the sites between 2008 and 2010. The remediation involved the demolition and disposal of buildings, structures and other debris, as well as the cleanup of hazardous materials. Contaminated soil was excavated and either shipped off site or placed in a secure soil disposal facility constructed at the Roberts Bay site. Although remedial activity at Ida Bay was not yet completed at the time of the site visit (August, 2010), no facility requiring monitoring will remain at Ida Bay and thus it is not a part of the monitoring program.

The Roberts Bay mine site had been in a state of abandonment for nearly 30 years. As recently as 2009 it contained residual infrastructure, a tailings pond, waste rock, abandoned equipment, non-hazardous wastes and debris (e.g. scrap metal, wood, mill equipment, appliances and burlap bags), hazardous wastes (e.g. petroleum products, batteries, propane tanks, assay lab reagents and some unknown chemicals) and petroleum and metals impacted soil.

The site also contained two mine openings (one adit and one vertical shaft) and a capped vent raise. The adit was surrounded by a chain-link fence meant to prevent accidental access, but the fence had deteriorated over time. The adit was fully flooded. The vertical shaft was located on the side of a basaltic ridge and was accessible by climbing the ridge. The shaft was open with partially caved-in walls. A fence surrounded 2/3 of the perimeter of the shaft, but allowed access to the shaft opening. There were stability problems around the collar, and the vent raise had been capped with concrete. As part of the remedial program, the adit and vertical shaft were fully sealed and the site regraded.

Geochemical assessment conducted on the waste rock and the tailings at the site suggested that these materials were potentially non-acid generating.

A Solid Waste Management Facility landfill (SWMF) was constructed during remediation in the summer of 2009. The only structure remaining at the Roberts Bay former mine, the SWMF is a

non-hazardous waste landfill built over the former tailings pond (refer to Figure A-2, Appendix A and Photos 1 to 3, Appendix F).

The SWMF 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 SWMF would reach a frozen state within a few years of construction, and the three thermistors and data loggers were installed along a transect of the facility to monitor the "freezeback" (i.e., the return to permafrost conditions typical of the area) of the contents and berms. The thickness of the cover material was calculated to prevent the thaw of the contaminated soil given current and predicted climate data.

The SWMF was designed to contain non-hazardous materials only. Due to the small amounts of metals and PCB-contaminated (Tier II) soils on site, no Tier II Secure Soil Disposal Facility was constructed during remediation. The SWMF was constructed over the former tailings pond, covered by a woven geotextile and then covered with 2 m of compacted waste rock which had been assessed as non-metal leaching and non-acid generating. The waste was placed in lifts and sequentially covered with granular fill. On the basis of survey work, a total of 109 m^3 of debris and 742 m^3 of debris and waste rock intermediate cover was placed into the SWMF. Once all the layers were completed a final cover of granular fill was used to cap the landfill. Shortly after the capping of the landfill in August, 2009, the final construction steps were completed, which included grading to promote drainage and installing three thermistor strings within the SWMF to monitor landfill freezeback.

During the 2010 monitoring program, the field assessors observed activity related to the Doris Mine development, mainly in the form of air traffic to and from the site.

2.2 Previous Monitoring Programs

Prior to the field program, FRANZ reviewed the following reports pertaining to the Roberts Bay abandoned mine site:

- Indian and Northern Affairs Canada. February 9, 2009. *Roberts Bay and Ida Bay Long-Term Monitoring Plan*.
- Nunavut Water Board (NWB)'s Water Licence, August 8, 2008. Licence No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.
- *2009 Inter-Seasonal Report for Roberts Bay and Ida Bay Mine Sites Site Remediation Program, Nunavut*. SENES Consultants Limited. February, 2010.

- Specification, Project No. 416829, Roberts Bay/Ida Bay, Section 31 70 02 Site Remediation
- Abandoned Military Site Remediation Protocol, December 2008, Indian and Northern Affairs Canada, Contaminated Sites Program.

2.3 Roberts Bay Long-Term Monitoring Plan

The 2010 monitoring program was the first event of a proposed eight monitoring events that are scheduled over a 25 year period. Information from the 2008 inter-seasonal report was incorporated into the 2010 sampling plan. It is envisaged that data collected in the future will be combined with the complete data set, as well as that from pre-landfill construction in 2008 and 2009, and analyzed.

Monitoring procedures adopted by INAC for this site are similar to those defined in the INAC Abandoned Military Site Remediation Protocol (AMSRP), with some modifications as applicable to mine sites.

3.0 REGULATORY GUIDELINES

3.1 Guideline Review

Where they were developed, criteria presented in the Nunavut Water Board (NWB)'s Water Licence (NWB, 2008) for both soil and surface water analytical results. These criteria were developed during a human health and ecological risk assessment which determined site specific remedial objectives prior to site remediation.

Soil analytical results were compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines, specifically the *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (CSQGs) and the *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CWS-PHC). These guidelines are applied to most federal contaminated sites. The guidelines are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites. They are derived using toxicological data and aesthetic considerations.

The CSQGs (CCME, 1999) are a subsection of the Canadian Environmental Quality Guidelines. The CSQGs are derived to approximate a no- to low- effect level (or threshold level) based only on scientific data, including toxicology, fate, and behaviour. The CSQGs are based on direct contact, ingestion, and inhalation toxicity data, and were developed to protect receptors exposed indirectly to contaminants of concern. Fact sheets are provided for 32 compounds. The benzene, toluene, ethylbenzene and xylenes fact sheets were used to obtain regulatory criteria for this report.

The CWS-PHC (CCME, 2008a) present criteria for petroleum hydrocarbons in soil. These numerical standards are based on the assessment and consistent management of risks posed to humans, plants, animals and environmental processes under four common land uses (agricultural, residential/parkland, commercial and industrial). Under Tier 1 of the CWS, specific numerical levels are presented for the four land uses, two soil textures (coarse and fine) and the four defined petroleum hydrocarbon fractions (F1 (nC_6-nC_{10}), F2 (nC_{10}-nC_{16}), F3 (nC_{16}-nC_{34}) and F4 (nC_{34}+)).

The CWS-PHC also include the option to generate Tier 2 levels where site-specific information indicates that site conditions exist that modify human or ecological exposure to PHC contamination. Such conditions may alter risks significantly relative to the generic conditions that were used to derive Tier 1 levels. A third tier in the CWS-PHC involves developing site-specific cleanup levels and management options using general and site-specific information in conducting a risk assessment.

The Roberts Bay abandoned mine site is a federal site and is therefore exempt from territorial regulation; however, the future disposition of the site may make it subject to territorial environmental guidelines. Because the Nunavut environmental guidelines are based on the work of the CCME, the federal and territorial guidelines often coincide.

The governing guideline for soil at contaminated sites in Nunavut is the *Environmental Guideline for Contaminated Site Remediation* (EGCSR), published by the Government of Nunavut in March, 2009. The criteria for Petroleum Hydrocarbons (PHC) in soil are found in Section 2.4, and are adapted from the CCME's CWS-PHC. The criteria for other compounds in soil are found in Table A-4 of Appendix 4 of the EGCSR, and are obtained from the CSQGs, published in the *Canadian Environmental Quality Guidelines* (CCME, 1999, updated 2007). The criteria are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites. Because the EGCSR is based on federal standards and has been updated recently, FRANZ does not expect that there are any discrepancies between the federal standards applied to the site and the Nunavut guidelines.

3.2 Soil

The soil standards or guidelines adopted for this evaluation are as follows:

- Nunavut Water Board's Water Licence, August 8, 2008. Licence No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada. Used where criteria exist.
- *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (CCME, 1999, with updates) for residential/parkland use, including fact sheets for benzene, toluene, ethylbenzene, and xylenes. Non-potable groundwater is stipulated and coarse-grained soil is assumed based on field observations during sample collection (generally sandy material).
- *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CCME, 2008a) - Tier 1 commercial land use, coarse-grained soil, non-potable groundwater.

As a preliminary and conservative determination of protection of human health and the environment at the site, Tier 1 levels of the CWS are applied to all analytical results where site specific values are not specified. The appropriate levels are presented with the laboratory analytical data in tables. The rationale for the selection of the appropriate criteria is discussed below.

BTEX Compounds

For the BTEX compounds specifically, the CSQGs were used to determine the appropriate pathway-specific guidelines. For benzene, for example, the 2004 update was used, with the following assumptions:

- Residential/Parkland land use
- Coarse-grained soils
- 10^{-5} acceptable incremental risk
- With applicable guidelines the most conservative of:
    - Soil dermal contact guideline
    - Soil ingestion guideline
    - Eco soil contact

The groundwater check (drinking water) pathway was excluded, as groundwater in the area of the Roberts Bay site is not used as a source of potable water. With its exclusion, the most conservative guideline for benzene applicable at the site is related to the protection of the pathway for the inhalation of indoor air (slab on grade), at 0.095 mg/kg; however, there are no buildings remaining on this site and therefore nothing to be affected by vapour intrusion. The most conservative remaining guideline is therefore the ecological soil contact guideline, at 31 mg/kg. A similar process was used to determine the most conservative applicable guideline value for toluene, ethylbenzene and xylenes.

Petroleum Hydrocarbons

For petroleum hydrocarbons, the CWS-PHC was used to determine the appropriate pathway-specific guidelines. Pathway-specific guidelines can be found in the CWS-PHC Technical Supplement (CCME, 2008c).

3.3 Surface Water

The surface water standards or guidelines adopted for this evaluation are as follows:

- Nunavut Water Board's Water Licence, August 8, 2008. Licence No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada. Used where criteria exist.
- *Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0* (CCME, 2007), Summary Table.
- *Water Management - Policies, Guidelines, Provincial Water Quality Objectives*, Table 2, (MOE, 1994).

Federal standards for surface water are provided by the CCME for several circumstances. Canadian water quality guidelines are intended to provide protection of freshwater and marine life from anthropogenic stressors such as chemical inputs or changes to physical conditions. In 2007, CCME also updated the surface water quality guidelines for the protection of aquatic life.

At the site, neither surface water nor groundwater is used for drinking water or agricultural uses. The landfill is not adjacent to a water body, although the CCME Freshwater Aquatic Life (FWAL) water quality guidelines were applied – where INAC criteria were absent – to the surface waters at the site since Roberts Lake, located near to site is a potential receptor where the aquatic life

or recreational water quality guidelines might be considered to apply. Ontario's *Provincial Water Quality Objectives* (PWQO) were adopted where both federal and site-specific criteria were absent. The goal of the PWQOs are "to ensure that the water quality is satisfactory for aquatic life and recreation and that water uses which require more stringent water quality be protected on a site specific basis. The PWQO's will protect aquatic life and recreation uses and policy direction is provided about how to deal with situations where water quality is better or worse than the Objectives" (MOE, 1994).

4.0 INVESTIGATIVE METHODOLOGY

The monitoring program was carried out at the Roberts Bay abandoned mine site on August 28 and 29, 2010. During the field investigations, weather conditions were mostly cloudy with temperatures ranging from approximately 4 to 10^{o} C. The monitoring program included the following tasks:

- Completing a health and safety plan;
- Visually observing and photographically documenting the physical integrity of the landfill;
- Reporting 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;
- Measuring headspace vapour concentrations in the soil samples and various physical parameters in the water samples; and
- Submission of soil and surface water 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 work required to complete the site monitoring program. Emergency provisions such as extra food and shelter were included given the site's remoteness. A wildlife monitor with a valid firearm licence was also hired to be present at the site for the duration of the field program. The HASP 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 INAC for their review and agreement before site activities began. Prior to conducting any work on-site, the HASP was distributed and discussed with all personnel involved in the monitoring program. A copy of the HASP has been retained on file at FRANZ.

4.2 Visual Inspections

The Solid Waste Management Facility landfill (SWMF) and surrounding areas were visually inspected to assess the landfill's physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. A visual monitoring checklist, using the format prescribed in the Roberts Bay and Ida Bay Long Term Monitoring Plan (INAC, 2009), was completed for the landfill (refer to Table 5-1, Section 5.3). Photographs were taken from the viewpoints indicated on Figure A-2, Appendix A and are presented in Appendix I. Future

photographs should be taken from the same viewpoints in subsequent years to maintain consistency and facilitate the assessment of any temporal changes.

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, some information was gathered though our wildlife monitor, a biologist and long-time resident of Yellowknife, knowledgeable of surrounding areas. Land use by both humans and wildlife were discussed.

A discussion of the recorded observations and information obtained is presented in Section 6.0 of this report.

4.4 Thermistor Monitoring

Three sets of thermistor strings were installed along a transect of the SWMF in the late summer of 2009. Thermistor installation records with details concerning the number of beads and bead depths were not available to FRANZ staff. Based on the data collected in August, 2010, it is presumed that the number of beads at Thermistors A, B and C is 9, 11 and 9, respectively. Assumptions regarding bead depth are discussed in detail in Section 5.4. Each string is connected to a Lakewood Systems UltraLogger data logger that is programmed to record values twice daily – at 0h00 and 12h00 – on a continual basis.

At the time of inspection thermistor strings A and C appeared to be functioning well, although the logger at thermistor B was malfunctioning on half of the analog channels. Thermistor data for the period from August 2009 to August 2010 were downloaded from each logger, using a laptop and portable power supply, and inspected on site to ensure completeness. Data logger battery voltages were noted and a visual inspection of the housing equipment was performed. Each logger was then restarted to begin collecting temperature information anew. Although the thermistor logger on String B requires replacement, the temperature sensing beads appear to be functioning correctly, as determined from a manual inspection.

The SWMF ground temperature record was examined and compiled and trends highlighted. A discussion, along with plots of temperature versus depth and time, is presented in section 5.4. The annual maintenance report, which also contains a basic description of the data logger systems, can be found in Table B-8, Appendix B. Raw data is provided in the attached CD-ROM.

4.5 Surface Water and Soil Sampling

The surface water and soil 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 *Roberts Bay and Ida Bay Long-Term Monitoring Plan* (INAC, 2009); and
- INAC *Abandoned Military Site Remediation Protocol*, Contaminated Sites Program (INAC, 2008).

4.5.1 Surface Water Sampling

Surface water was sampled at five predetermined locations: four near the SWMF and one distant, background reading. In-situ field measurements of water quality included temperature, conductivity, dissolved oxygen, pH and oxidation-reduction potential. Sampling took place when these parameters stabilized. In accordance with the policies at similar sites managed by INAC, water samples submitted for metals analyses were not field-filtered.

Sampling locations were selected based on sites named and described in the Nunavut Water Board (NWB)'s Water Licence (2008) – where surface water was present at such locations. One additional location to the east of the landfill was sampled and named ROB-8, as the surface water described at ROB-8 (stream flowing west to Roberts Bay) by the NWB was not present at the time of the site visit. An unnamed surface water source to the east of the landfill was instead sampled as ROB-8, deemed necessary based on site observations. A summary of the samples that were collected and submitted for laboratory analysis during the surface water sampling activities is provided in Table 4-1 below. Surface water sample logs are included in Appendix C.

Table 4-1: Summary of surface water sample collection near the SWMF.

SWMF Area	Sample	Description	Analytical Parameters
Downgradient	ROB-6	Surface water to southeast of landfill that may at times flow South to Roberts Lake	- total and dissolved metals - PCBs - petroleum hydrocarbon fractions F1-F4 and BTEX - inorganics (major ions, TDS, TSS, colour, pH, conductivity, hardness)
	ROB-7	Possible northern site drainage to west of landfill	
	DUP-1*	<same as ROB-&>	
	ROB-8	East of landfill (to detect possible leachate and runoff)	
	ROB-10	East of landfill (to detect possible leachate and runoff)	
Background	ROB-9	Roberts Lake (for background and control)	
	DUP-2*	<same as ROB-9>	

Note: * indicates a blind field duplicate of the sample listed directly above.

A Horiba U-22 water quality meter was calibrated and used to take field readings of pH, conductivity, turbidity, dissolved oxygen, temperature and oxidation-reduction potential; parameters were reasonably stable when readings were taken.

All samples were stored immediately in laboratory prepared sample bottles for future laboratory analysis. Water samples for laboratory analysis were stored in laboratory supplied coolers equipped with ice from the time of collection until delivery to the laboratory.

Additional details on the surface water sampling are presented in the surface water sample logs in Appendix C.

4.5.2 Test Pitting and Soil Sampling

Soil sampling was completed by manual test pitting. Seven test pits, identified as TP10-1, TP10-2, TP10-3, TP10-BK1, TP10-BK2, TP10-BK3 and TP10-BK4, were manually advanced in the vicinity of the SWMF. Three test pits (TP10-1, TP10-2 and TP10-3) were advanced at the locations specified in the ToR, at the downgradient toe of the SWMF landfill. Four additional test pits (TP10-BK1, TP10-BK2, TP10-BK3 and TP10-BK4) were advanced at a couple hundred metres off each corner of the SWMF for background chemistry information, as specified in the ToR and to supplement background information collected during the previous year's remedial work.

Test pitting was performed using a shovel, decontaminated with Alconox between sample collections. Refusal in the test pits generally occurred at 15 cm below ground surface, and so a composite soil sample was collected from the side wall of each test pit from ground surface to a

depth of 15 cm. Soil samples were collected from each test pit and placed into laboratory prepared jars for potential chemical analyses. Discrete soil samples and blind duplicates were collected as grab samples using disposable nitrile gloves for each sample. Fresh, sterile gloves were used at each sample location. A photoionization detector (PID) was available for use at the site to measure combustible gas concentrations in collected soil samples, although given that sampling locations were preselected and that no evidence of contamination was observed, PID readings were deemed unnecessary. Soil stratigraphy was logged and photos taken before backfilling the test pits with excavated soil.

A total of seven soil samples were collected and submitted for laboratory analyses for petroleum hydrocarbons (PHCs) fractions F1-F4 and benzene, toluene, ethylbenzene and xylenes (BTEX) as well as metals and polychlorinated biphenyls (PCBs). Two field duplicate samples (DUP-1 and DUP-2) were also submitted for analysis for QA/QC purposes. Professional judgment and visual observations were used to select the samples submitted for laboratory analyses. Samples submitted for laboratory analyses were stored in laboratory supplied coolers equipped with ice from the time of collection until delivery to the laboratory.

A summary of the samples that were collected and submitted for laboratory analyses during the test pitting activities is provided in Table 4-2 below.

Table 4-2: Summary of soil sample collection near the SWMF.

SWMF Area	Sample	Depth (mbgs)	Analytical Parameters
Downgradient	TP10-1	0 – 0.15	- metals - PCBs - PHC fractions F1-F4 and BTEX
	DUP-1*	0 – 0.15	
	TP10-2	0 – 0.15	
	DUP-2*	0 – 0.15	
	TP10-3	0 – 0.15	
Background	TP10-BK1	0 – 0.15	
	TP10-BK2	0 – 0.15	
	TP10-BK3	0 – 0.15	
	TP10-BK4	0 – 0.15	

Note: * indicates a blind field duplicate of the sample listed above.
mbgs = metres below ground surface.

Test pit locations for the SWMF area are indicated on Figure A-1 and on Figure A-2, Appendix A and additional details on the soil samples collected are presented in the test pit logs provided in Appendix C.

4.6 Quality Assurance and Quality Control

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

4.6.1 Field

Soil samples collected for potential laboratory analysis were placed in polyethylene bags and laboratory prepared 60 mL and 125 mL glass jars fitted with screw-tight Teflon-lined lids. Surface water samples were collected from all available surface water locations and placed in a variety of appropriately sized and prepared laboratory vessels. Sample numbers were clearly marked on the containers. The soil jars and water bottles were filled to capacity with minimum headspace and stored in coolers with cold packs to moderate temperature fluctuations during transport to the laboratory. To prevent cross contamination, samples were collected with fresh nitrile gloves. Where soil samples were impossible to obtain by hand, a stainless steel trowel or shovel was used and decontaminated between samples.

As a quality control measure, two soil and two surface water blind field duplicate samples were collected and analyzed for PHC fractions F1-F4, BTEX, metals and PCBs. The water samples were also analyzed for additional parameters, such as major ions, colour, pH, conductivity and total dissolved solids.

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 D.

As this is the first year of long-term monitoring activities at Roberts Bay, no previous analytical results exist to which these samples can be compared.

4.6.2 Laboratory

To assess the reliability of the laboratory data, duplicate samples were taken for at least every five samples collected by FRANZ. Two blind field duplicates were collected in the soil sampling program, and two blind field duplicates were collected in the surface water sampling program.

For soil duplicates, FRANZ personnel generated the duplicate samples by alternately placing approximately 50 percent of the sample volume into the primary sample container and then placing the same amount into the duplicate container. The field staff continued placing 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:

- Soil samples TP10-1 (primary) and DUP-1 (corresponding soil duplicate), and TP10-2 (primary) and DUP-2 (corresponding soil duplicate) were analyzed for PHC fractions F1-F4 and BTEX, PCBs and metals.
- Surface water samples ROB-7 (primary) and DUP-1 (corresponding water duplicate), and ROB-9 (primary) and DUP-2 (corresponding water duplicate) were analyzed for PHC fractions F1-F4, PCBs and metals (total and dissolved), major ions, hardness, conductivity, pH, TDS, TSS and colour.

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 sample and 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 E for a discussion on QA/QC results.

4.7 Laboratory Analytical Program

Soil and surface water samples were sent to Maxxam Analytics in Calgary, Alberta 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 analyses and chain of custody forms are presented in Appendix D.

5.0 SUMMARY OF SWMF CONDITIONS

5.1 Area Summary

The SWMF, composed of both a dry and a wet cell, is located to the west of the two former adits, built on the same location as the former mine tailings pond. Monitoring of the SWMF consisted in part of a visual inspection to assess its physical integrity, and by collecting evidence of erosion, ponding, frost action, settlement and lateral movement. Surface water and soil samples were also collected at locations up- and downgradient of the SWMF, including four background soil samples and one background surface water sample, all of which were collected over 200 metres beyond the landfill boundaries.

The SWMF soil and surface water sample locations and photographic viewpoints are shown on Figure A-1 and 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 SWMF (and other areas of the site) was completed as per the Terms of Reference. Copies of the photographs that are referenced in the body of this document are provided in Appendix F, where photograph captions provide the landfill viewpoint number (as seen on Figure A-2, Appendix A) where applicable. The complete photographic record, including full-sized photographs, is contained in the attached CD-ROM. Landfill viewpoint photos are presented in Appendix I.

5.3 Visual Inspection Report

The visual inspection of the SWMF and surrounding area was conducted on August 28 and 29, 2010. The visual monitoring checklist was completed using the format requested by INAC and is presented as Table 5-1 of this report. Field notes relating to the visual inspection are included in Appendix G.

Settlement

Extremely minor settlement was observed in a few locations on the top of the SWMF during the 2010 site inspection visit (refer to Figure A-2, Appendix A). These isolated areas are small (less than a few square metres) and shallow (less than 30 cm). There is no evidence of significant water infiltration. No ponding was observed on top of the landfill.

No ponding was observed at the in the immediate vicinity of the SWMF. Surface water exists, however, to the west (sampling point ROB-7) and east (sampling points ROB-6, ROB-8 and ROB-10) of the landfill (refer to Figure A-2, Appendix A).

Erosion

No evidence of erosion or preferred drainage channels was observed.

Small, localized amounts of fine-grained fill may have washed downward into the structure, forming the few small, scattered potholes described as settlement in the above section.

Frost Action

No evidence of heaving or cracking was observed on the top or on the berms of the SWMF. Additionally, no frost action was observed at any of the thermistor housing units.

Evidence of Burrowing Animals

Indications of burrowing animals (i.e. ground squirrels) were extremely prevalent in the non-regraded portions of the site. A newly created burrow was even observed on a regraded portion of the site, in Borrow Area 4 (refer to Photo 4, Appendix F).

Staining

There were no apparent signs of staining on the SWMF itself. One area, (< 1 m^2) of staining was noted to the east of the SWMF (refer to Photo 5, Appendix F) near surface water sample ROB-8, although it is unrelated to facility failure.

Seepage Points

There was no evidence of seepage at this site.

Debris

Two old, rusty barrels, with only a small portion exposed, were observed buried roughly 150 m southwest of the SWMF. An old, rusty, submerged barrel near the shore of Roberts Lake was also identified. No evidence suggested that additional sampling was necessary in either case. Other than at these two locations, there was no sign of exposed debris at the site.

Discussion

Based on the minimal or non-existent erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the SWMF, 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 5-1 below.

Table 5-1: Roberts Bay Abandoned Mine – Landfill Visual Inspection

Date:	August 28, 2010
Landfill:	Solid Waste Management Facility Landfill (SWMF)

1. Erosion	**Answer**
a) Is erosion occurring on the surface or berms of the landfill?	No
i) Are there preferred drainage channels?	No
ii) Is there sloughing of material?	No
b) What is the extent of the erosion? *(percentage of surface area)*	–
i) Is it localized or continuous?	–
c) Where is the erosion occurring? None visible.	
d) Explanation: No apparent signs of erosion.	

2. Settlement	**Answer**
a) Is there differential settlement occurring on the surface?	No
i) Are there low areas or depressions?	Yes
ii) Are voids forming?	No
b) What is the extent of the settlement? *(percentage of surface area)*	< 1%
i) Is it localized or continuous?	Localized
ii) How deep is it?	< 0.3 m
c) Where is the settlement occurring? Very small areas at a few locations on the landfill top (refer to Photo 6, Appendix F and to viewpoint numbers 27 to 32 on Figure A-2, Appendix A).	
d) Explanation: No obvious cause other than subsurface material; it is presumed that surface water infiltrates through the cobbly cover material, possibly carrying small amounts of fill that are fine-grained. No evidence, however, of surface ponding or infiltration. Settlement areas are small enough that it is possible that they are simply artefacts of the construction process.	

3. Frost Action	**Answer**
a) Is there frost action/damage to the landfill?	No
i) Is there exposed debris due to uplift?	No
ii) Is there tension cracking along the berms?	No
iii) Is there sorting of granular fill?	No
b) What is the extent of the frost action? *(percentage of surface area)*	–
i) Is it localized or continuous?	–
c) Where is the heaving/cracking occurring? None visible on any surface of the SWMF.	
d) Explanation: No apparent signs of frost action on any surface of the SWMF.	

4. Monitoring Instruments
a) What is the condition of the monitoring wells and thermistor strings? No monitoring wells present at this site. Thermistor housing units were in good condition. It was determined that the three sets of thermistor beads were operating correctly, but that one of the data loggers (on String-B) was malfunctioning. This logger should be replaced during the next site visit. Locks were replaced at each thermistor casing with Guard, 40 mm universal-key padlocks, No. 834 (key number 102). Thermistor batteries do not require replacing before 2012.
5. Others
Animal Burrows: despite the recent completion of remedial activities at this site, there is already at least one burrow (possible ground squirrel) on the regraded area (Borrow Area 4) to the east of the SWMF (refer to Photo 4, Appendix F). **Vegetation**: no significant regrowth on affected land since recent clean-up activities. **Staining**: no apparent signs, with the exception of a small patch (< 1 m^2) of a white substance (refer to Photo 5, Appendix F) with a grease-like tackiness lightly coating the gravel of the regraded area to the east of the SWMF, near the surface water sample ROB-8 (refer to Photo 7, Appendix F). **Vegetation stress**: nothing evident in areas surrounding the recent site clean-up activities. **Seepage points**: none observed. **Exposed debris**: a couple of slightly exposed rusty barrels to the southwest of the SWMF (within 200 m).
6. Sketch
See Figure A-2, Appendix A
7. General Comments
The physical condition of the SWMF is acceptable and appears to be performing as designed. A new data logger should be installed on thermistor String-B during the next site visit.

5.4 Thermal Monitoring Data

As generally described in the site remediation report (SENES, 2010), three thermistor strings, A, B and C were installed from the SWMF surface along a transect of the landfill. While thermistor bead installation records were not available, site remediation specifications document (INAC Project No. 416829) recommended that temperature sensing beads be placed at 500 mm intervals from thermistor bore bottoms to the landfill surface. Based on the elevations of the thermistor borehole bottoms, casing tops and the landfill surface provided by the SWMF construction drawings, it was assumed that thermistor beads were placed from the borehole

bottom to the top at the recommended 500 mm spacing. The top bead appears to coincide with the landfill surface in the case of Thermistor A, while it is the second to top bead in Thermistors B and C that appears to coincide with landfill surface with the top bead in these thermistors installed in the casing approximately 500 mm above the ground surface, providing atmospheric conditions.

The wide daily temperature fluctuations recorded on bead 1 of Thermistors B and C reflect what would be expected of air temperature readings, while bead 1 of Thermistor A and bead 2 of Thermistors B and C (all presumed to be installed at ground surface) indicate smaller daily temperature fluctuations, typical of beads installed at ground surface or beneath. A comparison of presumed air temperatures at bead 1 at Thermistor strings B and C with atmospheric conditions as measured at the nearby weather station in Kugluktuk suggests that these two beads are measuring surface atmospheric temperatures (all three readings within a few tenths of a degree Celsius of one another for several periods verified in August, 2010). Air temperatures in the nearby community of Cambridge Bay, however, were several degrees cooler for the times and dates verified, which could be due as much to spatial temperature variation as to casing effects, whereby solar radiation elevates temperatures within the thermistor casing. It is therefore difficult to be certain of bead depths without an installation log. The assumed bead depths are presented in Table B-9, Appendix B and graphed on Figures A-3 to A-5, Appendix A.

A complete memory transfer was successfully performed on each thermistor data logger. The position of the 0 ºC isotherm was calculated at each location from ground temperatures collected on August 28, 2010 (Table 5-2). Permafrost by definition is ground that is frozen for at least two years in a row, and so this data will be more valuable in the coming years when the maximum depth of the active layer – depth to the 0 ºC isotherm, or permafrost – can be compared between years to track the rate of landfill freezeback. Plots of depth versus temperature (at each thermistor bead) for a day at the end of each month over the previous year are presented on Figure A-3 through Figure A-6, Appendix A.

Table 5-2: Summary of SSDF Active Layer

Thermistor	**A**	**B**	**C**
Active layer depth (m) on Aug 28, 2010	2.4	N/A*	2.5

*insufficient data to calculate a depth.

Because of the malfunctioning data logger at Thermistor String B, only half of the temperature sensing bead channels recorded useful information. Unfortunately, not enough information was available to calculate a reasonable value for active layer depth at this location. Given the crucial

location of this thermistor, within the middle of the wet cell of the SWMF, it strongly recommended that the data logger at String B be replaced at the next available opportunity.

Based on data from a similar landfill at the CAM-F DEW line site, it is not expected that the depth to the active layer would have increased much, if at all, in the weeks following the last monitoring event on August 28, 2010, before decreasing again when the seasonal temperature drops. Although landfills generally require a few years to reach thermal equilibrium, this active layer depth of approximately 2.5 mbgs suggests that waste contained within the SWMF (≥ 3 mbgs) resides in the permafrost zone.

The active layer is expected to decrease in thickness over time as thermal equilibrium is approached. Landfill conditions, however, will be complicated by factors such as variation in average annual temperature and snow cover, where warmer winters and thicker and earlier snow cover will mean a slower freezeback.

In general, it can be concluded that the SWMF is getting colder, but it is difficult to draw more significant conclusions at this early stage. It can be said, at least, that the temperature values at all operational beads throughout the landfill were lower on August 28, 2010, than one year earlier, when data was first collected (August 31, 2009).

Thermistor details can be found in the annual maintenance monitoring report (Table B-8, Appendix B). Field notes relating to the thermistor inspection are included in Appendix G.

A manual verification of the data collected by the thermistors was performed in the field using equipment provided by the data logger manufacturer. Results indicate that all temperature sensing beads of the three thermistor strings are functioning well, despite the logger on String B malfunctioning. It was discovered that half of the data channels on the data logger at String B were not working correctly. A comparison of manually recorded temperatures indicated good agreement between the remaining beads and their automatically logged values. All thermistor beads were found to yield temperatures within the standard 0.2 ºC margin of error. The exception being the top bead at Thermistor C (which appears to be in good working order) where a 0.7 ºC discrepancy between logged and manually recorded values is most likely due to normal atmospheric fluctuation over the relatively lengthy test period (approximately 30 minutes). Details of the tests can be seen in Table B-9, Appendix B.

Additional thermistor inspection details, concerning field monitoring issues, field verification options, data cable pin-out and post-factory calibration, are included in Appendix H. Given the offsets for all thermistor beads were around 0.2 ºC (bead margin of error) or less, the values recorded by the data logger and by manual reading were not corrected using this information.

Conclusions drawn from data corrected by this small amount are unaffected. Nevertheless, the information (obtained from thermistor manufacturer, Lakewood Systems) is included here for convenience.

5.5 Analytical Results – Surface Water Samples

As described in section 4.5.1, a total of seven surface water samples (five samples plus two blind duplicates) were submitted to Maxxam Analytics in Calgary, Alberta for analyses of PHCs, metals, PCBs and inorganic parameters. Obtained analytical results are discussed below.

PHCs

Laboratory analytical results and selected federal guidelines, provincial standards and site-specific criteria for PHCs are shown in Table B-1. As shown in the table, concentrations were below laboratory detection limits and thus satisfy guidelines, standards and criteria applied to the site.

Metals

Laboratory analytical results and selected federal guidelines, provincial standards and site-specific criteria for dissolved and total metals are shown in Table B-2. As shown in Table B-2, a total of 21 exceedances (seven of which applied to the duplicate sample, DUP-1) were noted in samples ROB-6, ROB-7 and its duplicate pair, ROB-8 and ROB-10 for the following metals: As, Cd, Co, Cr, Cu and Pb. Given that each of these samples exceeded the selected criteria by less than one order of magnitude – many of which are very close to the criteria – and that the site was very recently remediated and that there are no apparent visible signs of physical failure at the SWMF landfill, it is likely that these low-level exceedances represent minor residual, post-remediation metals and are not connected with the integrity of the SWMF. These values should serve, however, as good benchmarks for future data to assess the ongoing performance of the landfill.

The background samples at ROB-9, collected from Roberts Lake, satisfied all applicable criteria.

PCBs

Laboratory analytical results and provincial criteria for PCBs are shown in Table B-3. Note that neither federal guidelines nor site-specific criteria exist for PCBs. As shown in the table, concentrations were below detection limits, although the detection limit was greater than the only guideline (the MOE PWQO) with criterion available for total PCBs.

Inorganics

Laboratory analytical results for inorganics are shown in Table B-4. No federal, provincial or site-specific criteria exist for the site as a whole. Data in this table were useful, however, in

calculating guideline criteria for other parameters (such as Cd, Cu, Pb and Ni) that are a function of certain inorganic parameters.

Laboratory certificates of analyses for the 2010 surface water samples are provided in Appendix D.

5.6 Analytical Results – Soil Samples

As described in section 4.5.2, a total of nine soil samples (seven samples plus two blind duplicates) were submitted to Maxxam Analytics in Calgary, Alberta for analyses of PHCs, metals and PCBs. Obtained analytical results are discussed below.

PHCs

Laboratory analytical results and selected federal guidelines, provincial standards and site-specific criteria for PHCs are shown in Table B-5. As shown in the table, concentrations were below laboratory reportable detection limits (RDLs) and thus satisfy numerical limits from all three sources applied to the site.

Metals

Laboratory analytical results and selected federal guidelines, provincial standards and site-specific criteria for metals are shown in Table B-6. As shown in the table, concentrations were nearly all below laboratory RDLs and all concentrations satisfied satisfy numerical limits from all three sources applied to the site.

PCBs

Laboratory analytical results and provincial standards for PCBs are shown in Table B-7. Note that neither provincial nor site-specific guidelines exist for PCBs. As shown in the table, concentrations were below RDLs, thus satisfying the single applicable standard.

Laboratory certificates of analyses for the 2010 soil samples are provided in Appendix D.

6.0 SURROUNDING AREAS AND NATURAL ENVIRONMENT

The rest of the Roberts Bay abandoned mine site was also inspected, including all the borrow areas, former adits and all regraded areas. The site was found to be very clean and in good order (see Photos 1 to 3, Appendix F). All areas of the former mine site appeared well restored. This was especially true of the former adit and shaft, which were so fully covered that their precise former locations were unidentifiable. The road from Roberts Lake, at the 2010 investigation team's landing point, to the SWMF was still in good condition, such that an all-terrain vehicle could have been used.

Long-Term Monitoring plans for other, similarly managed INAC 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 were either gathered directly, through personal observation while on site or indirectly, through our wildlife monitor, a scientist and long-time resident of the area, knowledgeable of local wildlife activities as well as members of the nearby community of Cambridge Bay.

Wildlife and Human Activity

From information gathered in Cambridge Bay, it seems that the site is used for hunting and fishing, although additional details were not well known. During the monitoring, the following signs of wildlife were observed on site between late morning and late afternoon on August 28 and August 29, 2010:

- Caribou tracks (near the surface water at ROB-8, east of the SWMF)
- Ground squirrels (ubiquitous at site)
- Ground squirrel burrow in newly regraded Borrow Area 4 (Photo 4)
- Pacific loons (two flew over site)
- Swans (a family of six, south of the site)
- Wolverine tracks (on Roberts Lake beach)
- Fish trap on creek flowing into Roberts Lake, immediately south of site (likely an environmental assessment device)
- Rabbit scat at Thermistor B
- Bald eagle (flew over site)

- Ptarmigan (eight near TP10-BK3)
- Caribou scat (near TP10-BK3)
- Bear tracks (near Roberts Lake beach)

Re-establishment of Vegetation

Major site remedial work, comprised of excavation and construction activities, was completed in the summer of 2009, approximately one year prior to the site monitoring visit. Thus it is not surprising that there was little sign of revegetation in August 2010. Given the regional setting of the Roberts Bay SWMF landfill and growth observed at other, similar sites in the Nunavut region, it is reasonable to assume that it will take some time for native vegetation to become re-established at the site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

All physical observations suggest that the SWMF is performing as designed and is containing the enclosed waste. Although it is too early to properly assess landfill freezeback, temperature data suggest that the facility is growing colder as expected.

Analytical results for soil samples submitted from seven test pits in the vicinity of the SWMF landfill satisfy selected guideline criteria for PHCs, metal, PCBs an inorganics. Surface water samples submitted from the vicinity of the SWMF landfill satisfied the selected guideline criteria for PHCs, PCBs an inorganics. Four surface water samples (ROB-6, ROB-7, ROB-8 and ROB-10) exceeded selected guideline criteria for As, Cd, Co, Cr, Cu and Pb. It is anticipated that these results are background contamination related to previous remedial work conducted at the site in 2009.

Based on observation and result of 2010 monitoring program it is recommended that:

1. Data logger on Thermistor String-B be replaced; and
2. Surface water data be used as a baseline for future monitoring conducted under the long-term monitoring plan.

8.0 LIMITATIONS

This report has been prepared exclusively for Indian and Northern Affairs Canada. Any other person or entity may not rely upon the report without the express written consent from Franz Environmental Inc. and Indian and Northern Affairs 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. Franz Environmental 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, Franz Environmental 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 28 and 29, 2010. 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, Franz Environmental 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), Franz Environmental Inc. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

9.0 REFERENCES

Canadian Council of Ministers of the Environment. 2007. *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.*

Canadian Council of Ministers of the Environment, 2007. *Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0*

Canadian Council of Ministers of the Environment. 2008a. *Canada-Wide Standards for Petroleum Hydrocarbons in Soil.*

Canadian Council of Ministers of the Environment. 2008b. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale Supporting Technical Document.*

Canadian Council of Ministers of the Environment. 2008c. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: User Guidance.*

Ministry of the Environment, Ontario, 1994. *Water Management - Policies, Guidelines, Provincial Water Quality Objectives.*

Indian and Northern Affairs Canada. December 2008. *Abandoned Military Site Remediation Protocol*, Contaminated Sites Program.

Indian and Northern Affairs Canada. February 9, 2009. *Roberts Bay and Ida Bay Long-Term Monitoring Plan*.

Nunavut Water Board (NWB)'s Water Licence, August 8, 2008. Licence No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.

SENES Consultants Limited. February, 2010. *2009 Inter-Seasonal Report for Roberts Bay and Ida Bay Mine Sites Site Remediation Program, Nunavut*.

Specification, Project No. 416829, Roberts Bay/Ida Bay, Section 31 70 02 Site Remediation. Indian and Northern Affairs Canada.

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.

10.0 CLOSURE

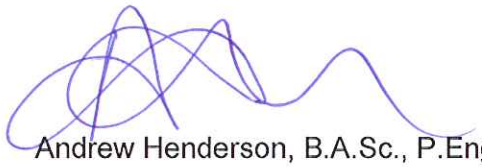
We trust that this information satisfies your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours truly,

Franz Environmental Inc.

Tina Ranger, Dipl. Tech.
Field Assessor

Matthew Cyr, M.Sc.
Field Assessor



Andrew Henderson, B.A.Sc., P.Eng.
Project Manager

Mike Grinnell, P.Eng.
Senior Environmental Engineer/Reviewer

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APPENDIX A

Figures

N

UTM NAD 83 Zone 13			
Station		**Easting**	**Northing**
Soil Sampling Point	TP10-BK1	435572	7563629
	TP10-BK2	435334	7563551
	TP10-BK3	435473	7564092
	TP10-BK4	435223	7563998
	TP10-1	435340	7563761
	TP10-2	435383	7563750
	TP10-3	435413	7563774
Surface water Sampling Point	ROB-6	N/A	N/A
	ROB-7	435310	7563745
	ROB-8	435445	7563933
	ROB-9	435440	7562728
	ROB-10	435403	7563765
Bench-marks	AMEC-CP-11 (#102)	435324	7563844
	AMEC-CP-11 (#105)	435479	7563709

TP10-BK3

TP10-BK4

TP10-BK2

TP10-BK1

TP10-1

TP10-2

TP10-3

ROB-6

ROB-7

ROB-8

ROB-10

BORROW AREA 1

BORROW AREA 2

BORROW AREA 4

BORROW AREA 5

A

B

C

Background Surface Water Sample "ROB-9" taken 763m south of this point

LEGEND

- 68.00 - Ground surface Contour
- Outcrop
- Waste Rock Area
- Pond/Surfacewater
- Excavation Limit (2009)
- Solid Waste Management Facility Landfill
- Thermistor
- Surfacewater Sample Location (FRANZ, 2010)
- Soil Sample Location (FRANZ, 2010)

Title: **SITE PLAN**

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: **2010 MONITORING PROGRAM, SWMF LANDFIL, ROBERTS BAY, NUNAVUT**

Date: October 2010

Updated: Nov. 10, 2010

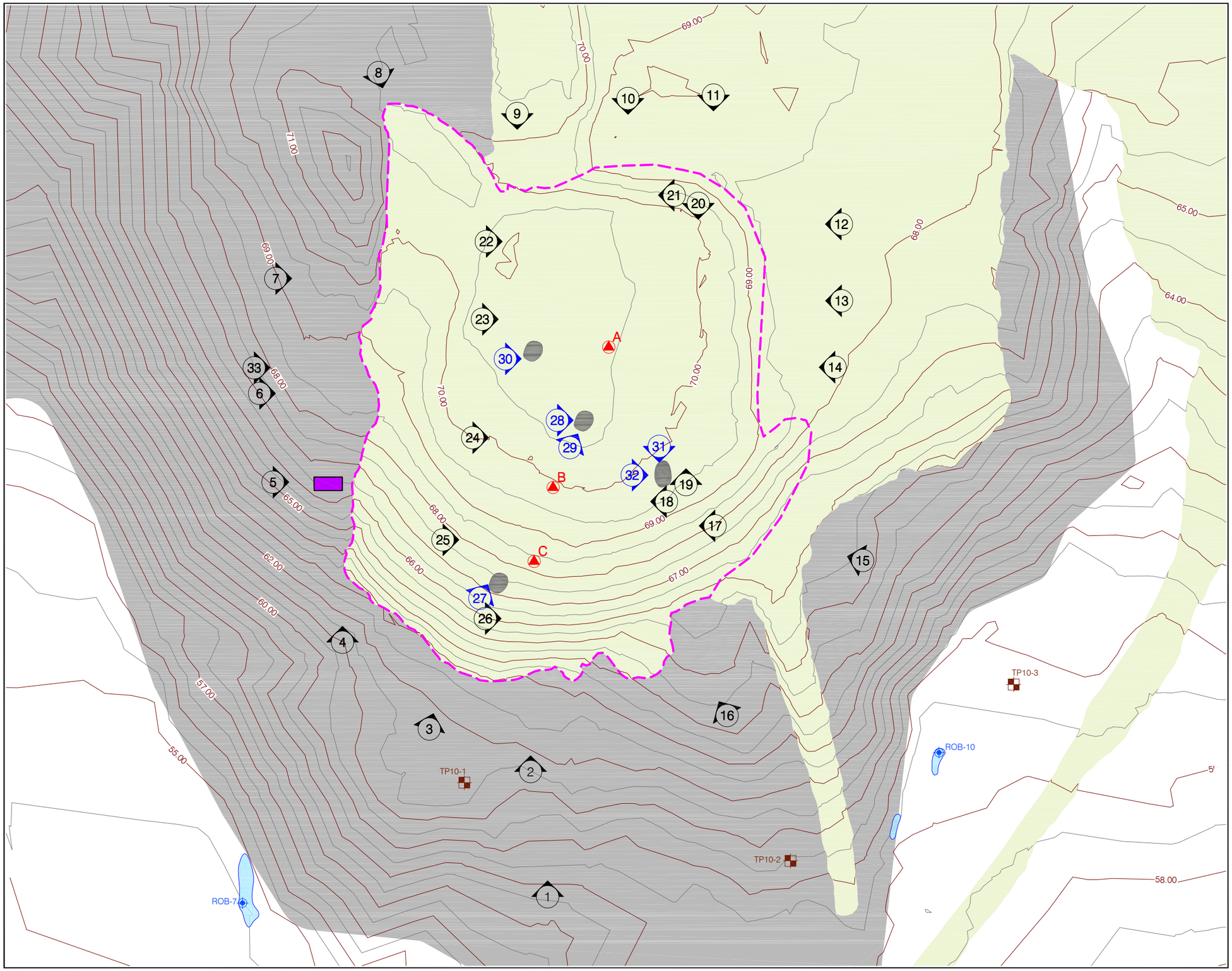
Client: **INDIAN AND NORTHERN AFFAIRS CANADA**

Scale 1:1500

20 10 0 20 40 60 metres

FIGURE A-1

1967-1001/XXX/MZ/Reberts_Bay_MineSite.dwg



N

LEGEND

- 68.00 — Ground surface Contour
- Outcrop
- Waste Rock Area
- Pond/Surface water
- Blast Hole (2 m deep)
- Solid Waste Management Facility Landfill
- Possible Settlement Area
- 1 — Picture Viewpoint Number
- 27 — Picture Viewpoint Number (Settlement Area)
- Thermistor
- Surfacewater Sample Location (FRANZ, 2010)
- Soil Sample Location (FRANZ, 2010)

REFERENCE:

1. PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PROJECT N° : 416829, SHEET 2 of 2
2. FIGURE BASED ON AMEC LAND SURVEYS LIMITED DRAWINGS: ROBERTS BAY AND IDA BAY MINE SITE REMEDIATION, SHEETS 1-4, SEPTEMBER 2005

NOTE:

1. SEE ATTACHED CD-ROM FOR VIEWPOINT PICTURES

Scale 1:500

10 7.5 5.0 2.5 0 metres 10 20

Title: **SOLID WASTE MANAGEMENT FACILITY LANDFILL**

Project: **2010 MONITORING PROGRAM, SWMF LANDFIL, ROBERTS BAY, NUNAVUT**

Client: **INDIAN AND NORTHERN AFFAIRS CANADA**

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Date: October 2010

Updated: Nov. 4, 2010

FIGURE A-2

1967-1001/xxx/MZ/Reberts_Bay_MineSite.dwg

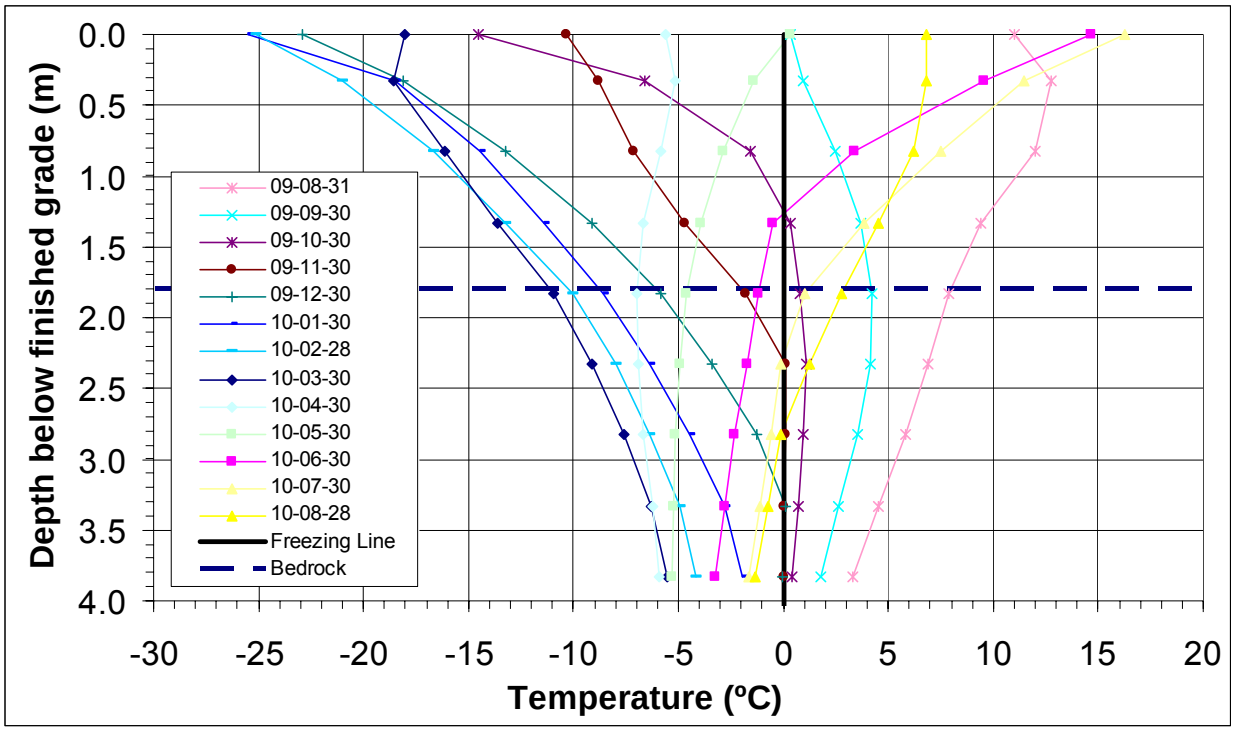


Figure A-3: Thermal monitoring data for thermistor String A (August 2009-August 2010).

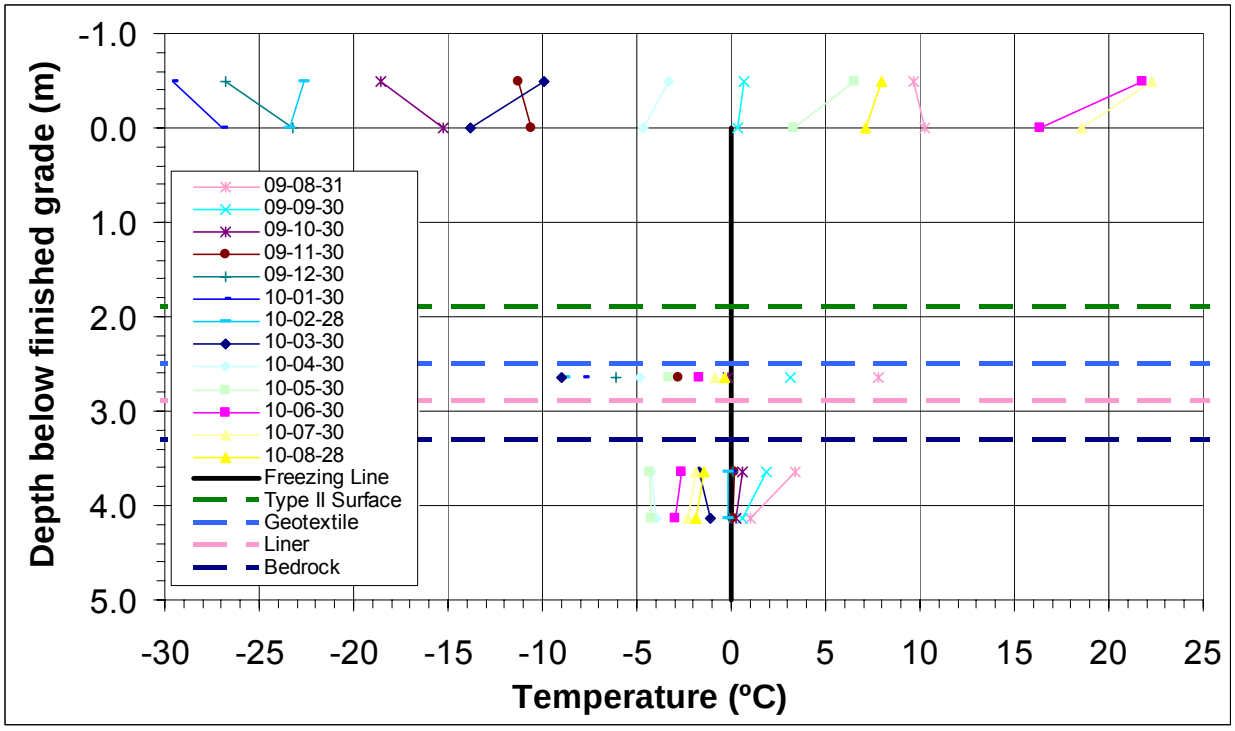


Figure A-4: Thermal monitoring data for thermistor String B (August 2009-August 2010).

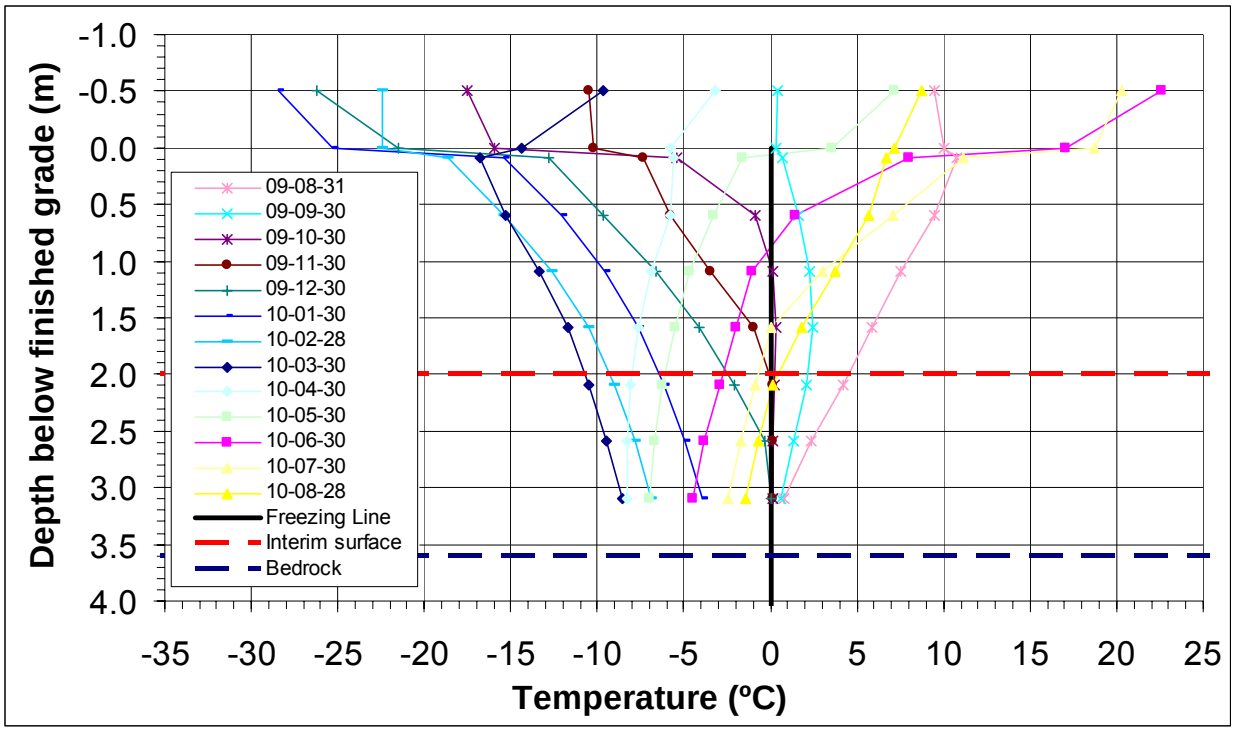


Figure A-5: Thermal monitoring data for thermistor String C (August 2000-August 2010).

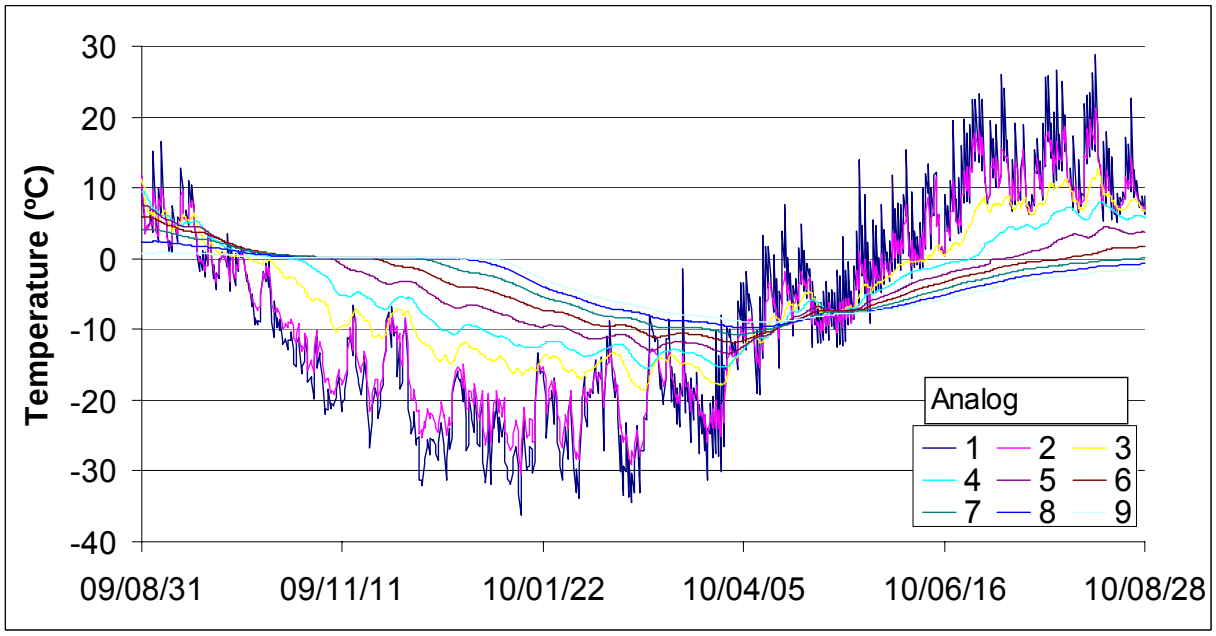


Figure A-6: Example of thermal monitoring data at the Solid Waste Management Facility (August 2009-August 2010) for Thermistor C.

APPENDIX B

Tables

Table B-1
Surface Water Chemical Concentrations - PHCs

PARAMETER	Surface Water Guidelines			RDL																
	Federal	Provincial	INAC Remediation Criteria[3]																	
Sample ID	CCME FWAL[1]	MOE PWQO[2]			ROB 6	ROB 7	DUP 1	Duplicate Evaluation				ROB 8	ROB 9	DUP 2	Duplicate Evaluation				ROB 10
Date					28/08/2010	28/08/2010	28/08/2010	Scenario*	RPD (%)	Value**	Acceptable	28/08/2010	28/08/2010	28/08/2010	Scenario*	RPD (%)	Value**	Acceptable	28/08/2010
BTEX & F1 Hydrocarbons (ug/L)																			
Benzene	370	**100**	370	0.4	<0.4	<0.4	<0.4	A	---	---	Y	<0.4	<0.4	<0.4	A	---	---	Y	<0.4
Toluene	2	**0.8**	2	0.4	<0.4	<0.4	<0.4	A	---	---	Y	<0.4	<0.4	<0.4	A	---	---	Y	<0.4
Ethylbenzene	90	**8**	90	0.4	<0.4	<0.4	<0.4	A	---	---	Y	<0.4	<0.4	<0.4	A	---	---	Y	<0.4
o-Xylene	NC	**40**	NC	0.4	<0.4	<0.4	<0.4	A	---	---	Y	<0.4	<0.4	<0.4	A	---	---	Y	<0.4
p+m-Xylene	NC	**32**	NC	0.8	<0.8	<0.8	<0.8	A	---	---	Y	<0.8	<0.8	<0.8	A	---	---	Y	<0.8
Total Xylenes	NC	**72**	180	0.8	<0.8	<0.8	<0.8	A	---	---	Y	<0.8	<0.8	<0.8	A	---	---	Y	<0.8
F1 (C6-C10)	NC	NC	NC	100	<100	<100	<100	A	---	---	Y	<100	<100	<100	A	---	---	Y	<100
F1 (C6-C10) - BTEX	NC	NC	NC	100	<100	<100	<100	A	---	---	Y	<100	<100	<100	A	---	---	Y	<100
F2-F4 Hydrocarbons (mg/L)																			
F2 (C10-C16 Hydrocarbons)	NC	NC	NC	0.1	<0.1	<0.1	<0.1	A	---	---	Y	<0.1	<0.1	<0.1	A	---	---	Y	<0.1
F3 (C16-C34 Hydrocarbons)	NC	NC	NC	0.1	<0.1	<0.1	<0.1	A	---	---	Y	<0.1	<0.1	<0.1	A	---	---	Y	<0.1
F4 (C34-C50 Hydrocarbons)	NC	NC	NC	0.1	<0.1	<0.1	<0.1	A	---	---	Y	<0.1	<0.1	<0.1	A	---	---	Y	<0.1
Reached Baseline at C50	NC	NC	NC		Yes	Yes	Yes	NC	NC	NC	NC	Yes	Yes	Yes	NC	NC	NC	NC	Yes

Notes:

1 = CCME (2007) Summary Table, Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0.

2 = MOE (1994) Ontario Ministry of the Environment and Energy, Water Management - Policies, Guidelines, Provincial Water Quality Objectives, Table 2. PWQOs.

3 = Table 1 (Appendix A), freshwater ciriteria, of the Nunavut Water Board (NWB)'s Water Licence, August 8, 2008. License No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.

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

** = Value displayed in corresponding unit.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for Roberts Bay SWMF landfill.

20 = Exceeds selected guideline.

Table B-2
Surface Water Chemical Concentrations - Metals

PARAMETER	Surface Water Guidelines			Lowest RDL																
	Federal	Provincial	INAC Remediation Criteria[3]																	
Sample ID	CCME FWAL[1]	MOE PWQO[2]			**ROB 6**	**ROB 7**	**DUP 1**	**Duplicate Evaluation**				**ROB 8**	**ROB 9**	**DUP 2**	**Duplicate Evaluation[‡]**				**ROB 10**
Date					28/08/2010	28/08/2010	28/08/2010	Scenario[†]	RPD (%)	Value (mg/L)	Acceptable	28/08/2010	28/08/2010	28/08/2010	Scenario	RPD (%)	Value (mg/L)	Acceptable	28/08/2010
Metals (mg/L - unless otherwise indicated)																			
Dissolved Mercury (Hg) (ug/L)	**0.026**	0.2**	**0.026**	0.002	0.002	<0.002	<0.002	A	---	---	Y	0.003	<0.002	<0.002	A	---	---	Y	<0.002
Dissolved Arsenic (As)	**0.005**	0.1	**0.005**	0.0002	0.0005	0.01	0.0097	C	3	---	Y	0.002	0.0002	<0.0002	B	---	0.000	Y	0.0016
Dissolved Cadmium (Cd) (ug/L)	**0.008 - 0.21***	0.2	**0.017**	0.005	0.012	0.008	0.013	D	---	0.005	Y	<0.03	0.005	<0.005	B	---	0.003	Y	0.052
Dissolved Chromium (Cr)[†]	**0.001**	**0.001**	**0.0089**	0.001	<0.001	<0.001	<0.001	A	---	---	Y	<0.005	<0.001	<0.001	A	---	---	Y	<0.001
Dissolved Cobalt (Co)	NC	**0.0009**	NC	0.0003	<0.0003	<0.0003	<0.0003	A	---	---	Y	<0.002	<0.0003	<0.0003	A	---	---	Y	0.0003
Dissolved Copper (Cu)	**0.002 - 0.004***	**0.005**	0.004	0.0002	0.0042	0.001	0.001	D	---	0.000	Y	<0.001	0.001	0.0009	D	---	0.000	Y	0.0027
Dissolved Lead (Pb)	**0.001 - 0.007***	0.005***	0.007	0.0002	<0.0002	<0.0002	<0.0002	A	---	---	Y	<0.001	<0.0002	<0.0002	A	---	---	Y	0.0008
Dissolved Nickel (Ni)	**0.025 - 0.15***	0.025	0.15	0.0005	0.0008	0.0047	0.0049	C	4	---	Y	<0.003	<0.0005	<0.0005	A	---	---	Y	0.0019
Dissolved Zinc (Zn)	**0.03**	**0.03**	0.03	0.003	0.005	<0.003	0.004	B	---	0.003	Y	<0.02	<0.003	<0.003	A	---	---	Y	0.01
Total Mercury (Hg) (ug/L)	**0.026**	0.2**	0.026	0.002	0.008	0.003	0.007	D	---	0.004	N	0.009	0.007	0.004	D	---	0.003	N	0.006
Total Arsenic (As)	**0.005**	0.1	0.005	0.0002	0.0023	0.05	0.043	C	15	---	Y	0.005	0.0003	0.0007	D	---	0.000	N	0.0022
Total Cadmium (Cd) (ug/L)	**0.008 - 0.21***	0.2	0.017	0.005	0.079	0.087	0.065	C	29	---	N	0.05	<0.005	<0.005	A	---	---	Y	0.048
Total Chromium (Cr)[†]	**0.001**	**0.001**	0.0089	0.001	0.003	<0.001	<0.001	A	---	---	Y	<0.005	<0.001	<0.001	A	---	---	Y	<0.001
Total Cobalt (Co)	NC	**0.0009**	NC	0.0003	0.0047	0.0041	0.0033	C	22	---	N	<0.002	<0.0003	<0.0003	A	---	---	Y	0.0005
Total Copper (Cu)	**0.002 - 0.004***	**0.005**	0.004	0.0002	0.022	0.0048	0.0038	C	23	---	N	0.002	0.002	0.0017	C	16	---	Y	0.0051
Total Lead (Pb)	**0.001 - 0.007***	**0.005*** **	0.007	0.0002	0.0092	0.014	0.0087	C	47	---	N	<0.001	<0.0002	<0.0002	A	---	---	Y	0.0048
Total Nickel (Ni)	**0.025 - 0.15***	**0.025**	0.15	0.0005	0.0045	0.01	0.0095	C	5	---	Y	<0.003	0.0008	0.0007	D	---	0.000	Y	0.0032
Total Zinc (Zn)	**0.03**	**0.03**	0.03	0.003	0.017	0.021	0.015	D	---	0.006	N	<0.02	<0.003	<0.003	A	---	---	Y	0.014

Notes:

Dissolved value assumed same as total value.

1 = CCME (2007) Summary Table, Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0.

2 = MOE (1994) Ontario Ministry of the Environment and Energy, Water Management - Policies, Guidelines, Provincial Water Quality Objectives, Table 2. PWQOs.

3 = Table 1 (Appendix A), freshwater cirriteria, of the Nunavut Water Board (NWB)'s Water Licence, August 8, 2008. License No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.

* = Indicates that criterion is a function of hardness and varies per sample (for Cd, the following equation was used: 10^{0.86log[hardness] - 3.2})

** = in a filtered water sample

*** = Indicates that the most stringent value was used as quality criterion where compound objective is a function alkalinity.

† = Indicates that the more stringent of the two objective values (0.0089 and 0.001 mg/L for Cr III and Cr VI, respectively) was used.

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

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for Roberts Bay SWMF landfill.

20 = Exceeds selected guideline.

Table B-3
Surface Water Chemical Concentrations - PCBs

PARAMETER	Surface Water Guidelines		RDL															
	Federal	Provincial																
Sample ID	CCME FWAL[1]	MOE PWQO[2]		ROB 6	ROB 7	DUP 1	Duplicate Evaluation				ROB 8	ROB 9	DUP 2	Duplicate Evaluation				ROB 10
Date				28/08/2010	28/08/2010	28/08/2010	Scenario†	RPD (%)	Value (mg/L)	Acceptable	28/08/2010	28/08/2010	28/08/2010	Scenario†	RPD (%)	Value (mg/L)	Acceptable	28/08/2010
PCBs (mg/L)																		
Aroclor 1016	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1221	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1232	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1242	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1248	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1254	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1260	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1262	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Aroclor 1268	NC	NC	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050
Total PCB	NC	**0.000001**	0.00005	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050	<0.00050	<0.00050	A	---	---	Y	<0.00050

Notes:

1= CCME (2007) Summary Table, Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0.

2 = MOE (1994) Ontario Ministry of the Environment and Energy, Water Management - Policies, Guidelines, Provincial Water Quality Objectives, Table 2. PWQOs.

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

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for Roberts Bay SWMF landfill.

20 = Exceeds selected guideline.

Table B-4
Surface Water Chemical Concentrations - Inorganics

PARAMETER		Surface Water Guidelines		Lowest RDL															
		Federal	Provincial																
Sample ID		CCME FWAL[1]	MOE PWQO[2]		ROB 6	ROB 7	DUP 1	Duplicate Evaluation				ROB 8	ROB 9	DUP 2	Duplicate Evaluation				ROB 10
Date					28/08/2010	28/08/2010	28/08/2010	Scenario†	RPD (%)	Value**	Acceptable	28/08/2010	28/08/2010	28/08/2010	Scenario†	RPD (%)	Value**	Acceptable	28/08/2010
Inorganics	**Units**																		
Hardness (CaCO3)	mg/L	NC	NC	0.5	34	20	20	C	0	---	Y	871	40.3	40.1	C	0	---	Y	582
True Colour	PtCo units	NC	NC	2	34	20	20	C	0	---	Y	59	11	10	D	---	1.000	Y	15
Conductivity	uS/cm	NC	NC	1	1500	950	950	C	0	---	Y	4000	250	250	C	0	---	Y	1900
pH	---	NC	NC	0	7.66	7.60	7.62	C	0	---	Y	7.84	7.45	7.45	C	0	---	Y	7.62
Total Dissolved Solids	mg/L	NC	NC	10	1500	970	980	C	1	---	Y	3400	180	190	C	5	---	Y	1700
Total Suspended Solids	mg/L	NC	NC	1	420	80	160	C	67	---	N	11	11	8	C	32	---	N	57
Dissolved Fluoride (F)	mg/L	NC	NC	0.05	0.06	0.06	0.06	D	---	0.000	Y	0.14	0.07	0.07	D	---	0.000	Y	0.05
Dissolved Sulphate (SO_4)	mg/L	NC	NC	1	150	120	130	C	8	---	Y	230	5	5	D	---	0.000	Y	170
Dissolved Chloride (Cl)	mg/L	NC	NC	1	280	90	90	C	0	---	Y	1000	58	56	C	4	---	Y	380
Orthophosphate (P)	mg/L	NC	NC	0.003	<0.003	<0.003	<0.003	A	---	---	Y	0.004	0.004	0.006	D	---	0.002	Y	<0.003
Nitrite (N)	mg/L	NC	NC	0.003	<0.003	<0.003	<0.003	A	---	---	Y	<0.003	<0.003	<0.003	A	---	---	Y	<0.003
Nitrate (N)	mg/L	NC	NC	0.003	1.4	<0.003	<0.003	A	---	---	Y	<0.003	<0.003	<0.003	A	---	---	Y	3.6
Nitrate + Nitrite	mg/L	NC	NC	0.003	1.4	<0.003	<0.003	A	---	---	Y	<0.003	<0.003	<0.003	A	---	---	Y	3.6

Notes:

1 = CCME (2007) Summary Table, Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0.

2 = MOE (1994) Ontario Ministry of the Environment and Energy, Water Management - Policies, Guidelines, Provincial Water Quality Objectives, Table 2. PWQOs .

a = Nunavut Water Board (NWB)'s Water Licence criteria for effluent discharged from the SDMF (for Station ROB-4 only).

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

** = Value displayed in corresponding unit.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for Roberts Bay SWMF landfill.

20 = Exceeds selected guideline.

Table B-5
Soil Chemical Concentrations - PHCs

PARAMETER	Federal		INAC Remediation Criteria[3]	RDL																
Sample ID					TP10-1	DUP-1	Duplicate Evaluation*				TP10-2	DUP-2	Duplicate Evaluation*				TP10-3	TP10-BK1	TP10-BK2	TP10-BK3	TP10-BK4
Date	CCME [1] Residential/ Parkland	CWS for PHC in Soil (<1.5m)[2]			28/08/2010	28/08/2010	Scenario	RPD (%)	Value (ug/g)	Acceptable	28/08/2010	28/08/2010	Scenario	RPD (%)	Value (ug/g)	Acceptable	28/08/2010	28/08/2010	28/08/2010	28/08/2010	28/08/2010
Depth (m)					0 to 0.15	0 to 0.15					0 to 0.15	0 to 0.15					0 to 0.15	0 to 0.15	0 to 0.15	0 to 0.1	0 to 0.15
BTEX & F1 Hydrocarbons (ug/g)																					
Benzene	31	NC	**0.0095**	0.0050	<0.0050	<0.0050	A	---	---	Y	<0.0050	<0.0050	A	---	---	Y	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Toluene	75	NC	**0.37**	0.020	<0.020	<0.020	A	---	---	Y	<0.020	<0.020	A	---	---	Y	<0.020	<0.020	<0.020	<0.020	<0.020
Ethylbenzene	55	NC	**0.082**	0.010	<0.010	<0.010	A	---	---	Y	<0.010	<0.010	A	---	---	Y	<0.010	<0.010	<0.010	<0.010	<0.010
Total Xylenes	95	NC	**11**	0.040	<0.040	<0.040	A	---	---	Y	<0.040	<0.040	A	---	---	Y	<0.040	<0.040	<0.040	<0.040	<0.040
p+m-Xylene	NC	NC	NC	0.040	<0.040	<0.040	A	---	---	Y	<0.040	<0.040	A	---	---	Y	<0.040	<0.040	<0.040	<0.040	<0.040
o-Xylene	NC	NC	NC	0.020	<0.020	<0.020	A	---	---	Y	<0.020	<0.020	A	---	---	Y	<0.020	<0.020	<0.020	<0.020	<0.020
F1 (C6-C10) - BTEX	NC	**30 (210)**	130	12	<12	<12	A	---	---	Y	<12	<12	A	---	---	Y	<12	<12	<12	<12	<12
F1 (C6-C10)	NC	NC	NC	12	<12	<12	A	---	---	Y	<12	<12	A	---	---	Y	<12	<12	<12	<12	<12
F2-F4 Hydrocarbons (ug/g)																					
F2 (C10-C16 Hydrocarbons)	NC	**150 (150)**	**150**	10	<10	<10	A	---	---	Y	<10	<10	A	---	---	Y	<10	<10	<10	<10	<10
F3 (C16-C34 Hydrocarbons)	NC	**300 (300)**	400	10	<10	<10	A	---	---	Y	<10	<10	A	---	---	Y	<10	19	<10	<10	<10
F4 (C34-C50 Hydrocarbons)	NC	**2800 (2800)**	**2800**	10	<10	<10	A	---	---	Y	<10	<10	A	---	---	Y	<10	<10	<10	<10	<10
Reached Baseline at C50	N/A	N/A	N/A	N/A	Yes	Yes	NC	NC	NC	NC	Yes	Yes	NC	NC	NC	NC	Yes	Yes	Yes	Yes	Yes

Notes:

1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 2. Canadian Soil Quality Guidelines, Residential / Parkland Use, coarse-grained soils.

2 = CCME (2008) Canadian-Wide Standards for Petroleum Hydrocarbons in Soil - Table 1, Tier 1 levels for PHCs, Residential / Parkland Use in coarse-grained surface soils. (Brackets) Protection of Eco Soil Contact from Table 1 - Technical Supplement.

3 = Table 2 (Appendix A) of the Nunavut Water Board (NWB)'s Water Licence, August 8, 2008. License No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.

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

N/A = Not applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for Roberts Bay SWMF landfill.

20 = Exceeds selected guideline.

Table B-6
Soil Chemical Concentrations - Metals

PARAMETER	Federal																			
Sample ID	**CCME[1] Residential/ Parkland**	**CCME[2] Human Health Ingestion (H) / Eco Soil Contact (E)**	**INAC Remediation Criteria[3]**	**RDL**	**TP10-1**	**DUP-1**	**Duplicate Evaluation***				**TP10-2**	**DUP-2**	**Duplicate Evaluation***				**TP10-3**	**TP10-BK1**	**TP10-BK2**	**TP10-BK3**	**TP10-BK4**
Date					28/08/2010	28/08/2010	Scenario	RPD (%)	Value (ug/g)	Acceptable	28/08/2010	28/08/2010	Scenario	RPD (%)	Value (ug/g)	Acceptable	28/08/2010	28/08/2010	28/08/2010	28/08/2010	28/08/2010
Depth (m)					0 to 0.15	0 to 0.15					0 to 0.15	0 to 0.15					0 to 0.15	0 to 0.15	0 to 0.15	0 to 0.15	0 to 0.15
Metals (ug/g)																					
Arsenic (As)	**12**	**12H 17E**	105	1	<1	1	B	---	0.500	Y	<1	4	B	---	3.500	N	<1	<1	<1	2	<1
Cadmium (Cd)	**10**	NC	**10**	0.1	<0.1	<0.1	A	---	---	Y	<0.1	<0.1	A	---	---	Y	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (Cr)	**64**	**220H 64E**	**64**	1	<1	25	B	---	24.500	N	6	19	C	104	---	N	2	<1	<1	16	10
Cobalt (Co)	**50****	NC	**50**	1	<1	9	B	---	8.500	N	3	11	D	---	8.000	N	1	<1	<1	7	4
Copper (Cu)	**63**	**1100H 63E**	176	5	<5	29	B	---	26.500	N	<5	24	B	---	21.500	N	<5	<5	<5	40	<5
Lead (Pb)	**140**	**140H 300E**	**140**	1	<1	5	B	---	4.500	N	6	27	C	127	---	N	1	<1	<1	6	3
Nickel (Ni)	**50****	**50E**	**50**	1	2	15	D	---	13.000	N	7	19	C	92	---	N	2	<1	<1	13	7
Zinc (Zn)	**200**	**200E**	2000	10	<10	37	B	---	32.000	N	22	69	D	---	47.000	N	<10	<10	<10	35	21
Mercury (Hg)	**6.6**	**6.6H 12E**	**6.6**	0.05	0.07	<0.05	B	---	0.045	Y	0.07	<0.05	B	---	0.045	Y	0.06	0.06	0.06	0.06	<0.05
Physical Properties																					
Moisture (%)	NC	NC	NC	0.2	9.4	9.1	C	3	---	Y	9.1	3.8	C	82	---	N	9.3	18	7.4	12	8.3

Notes:

1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1. Canadian Soil Quality Guidelines, Residential / Parkland Use, coarse-grained soils.

2 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 2. Human health soil ingestion and Eco Soil Contact.

3 = Table 2 (Appendix A) of the Nunavut Water Board (NWB) S Water Licence, August 8, 2008. License No. 1BR-KUB0813 issued to Indian and Northern Affairs Canada

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

** = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 2. Interim remediation criteria for soil that have not yet been replaced by canadian soil quality guidelines.

N/A = Not applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for Roberts Bay SWMF landfill.

20 = Exceeds selected guideline.

Table B-7
Soil Chemical Concentrations - PCBs

PARAMETER		RDL																
Sample ID	Federal		TP10-1	DUP-1	Duplicate Evaluation*				TP10-2	DUP-2	Duplicate Evaluation*				TP10-3	TP10-BK1	TP10-BK2	TP10-BK3	TP10-BK4
Date	CCME[1]		28/08/2010	28/08/2010	Scenario	RPD (%)	Value (ug/g)	Acceptable	28/08/2010	28/08/2010	Scenario	RPD (%)	Value (ug/g)	Acceptable	28/08/2010	28/08/2010	28/08/2010	28/08/2010	28/08/2010
Depth (m)	Residential/ Parkland		0 to 0.15	0 to 0.15					0 to 0.15	0 to 0.15					0 to 0.15	0 to 0.15	0 to 0.15	0 to 0.15	0 to 0.15
Polychlorinated Biphenyls (ug/g)																			
Aroclor 1016	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1221	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1232	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1242	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1248	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1254	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1260	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1262	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Aroclor 1268	NC	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01
Total Aroclor	1.3	0.01	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	A	---	---	Y	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:

1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1. Canadian Soil Quality Guidelines, Residential / Parkland Use, coarse-grained soils.

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

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-8: Thermistor Annual Maintenance Report

Contractor name: Franz Environmental Inc.	**Inspection date:** 2010-08-28
Prepared by: Matthew D. Cyr	

Thermistor Information

Thermistor Number	String-A site 1	String-B site 2	String-C site 3
Install date	2009	2009	2009
Location	Roberts Bay (SWMF)	Roberts Bay (SWMF)	Roberts Bay (SWMF)
Inclination	Vertical	Vertical	Vertical
Cable length (m)	N/A	N/A	N/A
Cable length (m) above ground	2.5	3.3	3.1
No. of beads*	9	11	9
Bead type	44007	44007	44007
Coordinates (m)	N:7563819 E: 435359	N:7563800 E: 435351	N:7563790 E: 435349
Elevation: casing top (masl)	71.80	71.29	69.53
Elevation: bottom bore (masl)	66.67	65.76	65.11
Serial no.	07060503	07060501	07060500
Logger model	Lakewood Systems Ultralogger (RX-16, Revision JC)		

*determined indirectly from thermistor logger data.

Thermistor inspection

Thermistor Number	String-A site 1	String-B site 2	String-C site 3
Casing	Good condition	Good condition	Good condition
Cover	Good condition	Good condition	Good condition
Data logger	Good condition	Faulty on channels 3-7 & 9	Good condition
Cable	Good condition	Good condition	Good condition
Beads	Operational	Operational*	Operational
Battery installation date	N/A	N/A	N/A
Battery change date (recommended)	2012	2012	2012
Main battery (V)	11.34	11.34	11.34
Aux battery (V)	13.50	13.50	13.26

*based on reasonable resistance values obtained manually on Aug 28, 2010.

Observations and proposed maintenance

- New locks were installed on all three thermistor casings: Guard, 40 mm universal-key padlocks, No. 834 (key number 102).

- Lakewood recommends replacing logger batteries every three years (although they may last up to five years, at voltages as low as 10 V). It is presumed that batteries were installed around the time of installation (summer 2009) and it is on this basis that battery replacement be performed in 2012, the third year of the Roberts Bay long-term monitoring program.

- A Lakewood resistance meter and switchbox were employed to compare manual (taken directly from thermistor beads) and logged readings. It was determined that the beads were functioning correctly, but that the data logger on

String-B was malfunctioning. This logger requires replacement during the next site visit.

- Additional diagnostic and repair equipment may also be brought to the site (e.g. multimeter, soldering kit, shrink wrap, etc) although repairing the thermistor sting or beads is typically not feasible without complete replacement of the thermistor in order to maintain calibration. However, current technical problems seem to be only with the data logger.

Table B-9: Manual Thermistor Readings and Presumed Bead Elevations

Analog Channel		Elevation (masl)	Depth (mbgs)	Thermistor R (Ohms)	Temperature (ºC)		
					Manual	Logged	Difference
String-A	1	70.5	0	11495	7.0316	7.1444	0.1
	2	70.17	0.33	11703	6.6666	6.7468	0.1
	3	69.67	0.83	11967	6.2138	6.2022	0.0
	4	69.17	1.33	13089	4.4070	4.5103	0.1
	5	68.67	1.83	14247	2.7164	2.7967	0.1
	6	68.17	2.33	15409	1.1683	1.2109	0.0
	7	67.67	2.83	16483	-0.1502	-0.1205	0.0
	8	67.17	3.33	16922	-0.6616	-0.6898	0.0
	9	66.67	3.83	17514	-1.3283	-1.2691	0.1
				maximum	--	--	***0.1***
String-B	1	70.76	-0.5	10438	9.0091	9.2513	0.2
	2	70.26	0	10913	8.0938	7.9761	0.1
	3	69.76	0.14	11666	6.7310	3.4518	3.3
	4	69.26	0.64	12117	5.9614	3.4518	2.5
	5	68.76	1.14	13150	4.3138	3.4718	0.8
	6	68.26	1.64	14432	2.4606	3.4518	1.0
	7	67.76	2.14	15899	0.5544	3.4718	2.9
	8	67.26	2.64	16648	-0.3442	-0.2728	0.1
	9	66.76	3.14	17230	-1.0117	3.5692	4.6
	10	66.26	3.64	17622	-1.4472	-1.4688	0.0
	11	65.76	4.14	17989	-1.8452	-1.846	0.0
				maximum	--	--	***4.6***
String-C	1	69.11	-0.5	10438	9.0091	9.7439	0.7
	2	68.61	0	10815	8.2789	8.3903	0.1
	3	68.11	0.09	11777	6.5385	6.6668	0.1
	4	67.61	0.59	12358	5.5633	5.673	0.1
	5	67.11	1.09	13577	3.6748	3.7565	0.1
	6	66.61	1.59	14989	1.7123	1.7942	0.1
	7	66.11	2.09	16325	0.0376	0.1	0.1
	8	65.61	2.59	17026	-0.7806	-0.7382	0.0
	9	65.11	3.09	17642	-1.4691	-1.4483	0.0
				maximum	--	--	***0.7***

Green: established elevation of landfill surface (from as-built drawings).
Grey: established elevation of borehole bottom (from as-built drawings).
Red: large values represent corrupted data logger channels.
Yellow: large value likely due to surface air temperature fluctuations over measurement period.

APPENDIX C

Surface Water Sample and Test Pit Logs

Test Pit Sampling Log

TP10-1 - Dup1

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
		N68° 10.806'	TR
Project Name: Roberts Bay	(Y) / N	W 106° 33.539'	Weather: Overcast 1°C
Work Area: Toe of			
Sector:			
DEPTH (m) 0.15			

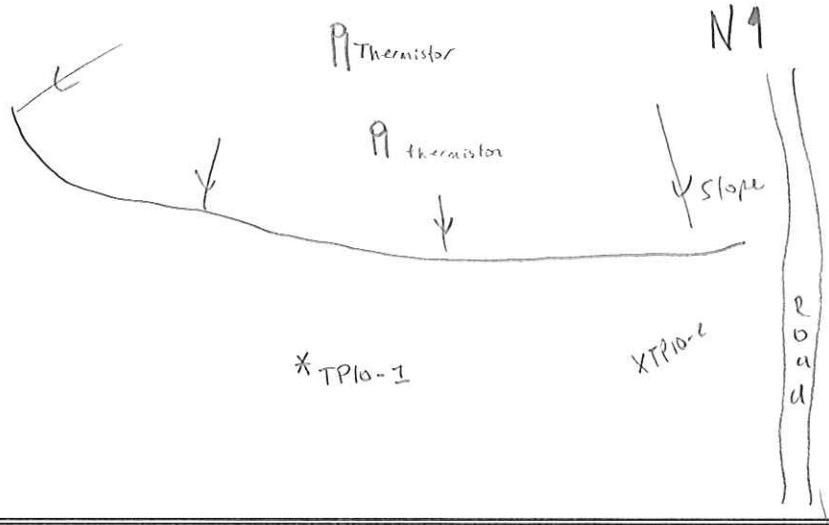
TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0 - 0.03	Peat, organic, brown, moss, leaves, dry	TP10-1	na	3 x 120mL 1 bag
0.03 -	Clayey silt, fine, brown, roots, dry, no HC odour	Dup1	na	3 120mL 1 bag

PCB PHC metals " "

Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:



Test Pit Sampling Log

TP10-2 & Dup2

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
		N 68° 10.801'	TR
Project Name: Roberts Bay	(Y) / N	W 106° 33.976'	Weather: Overcast 7°C
Work Area:			
Sector:			
DEPTH (m)			

TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0.-0.03	Peat, organic, leaves, roots, moss, brown, dry			6 x 120 mL
0.03-0.15	Sand and gravel, coarse to med, dark brown dry			2 x 1 bag
Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:

See TP10-1 pg Sketch

Franz Environmental Inc.
Project:

___ of ___

Test Pit Sampling Log

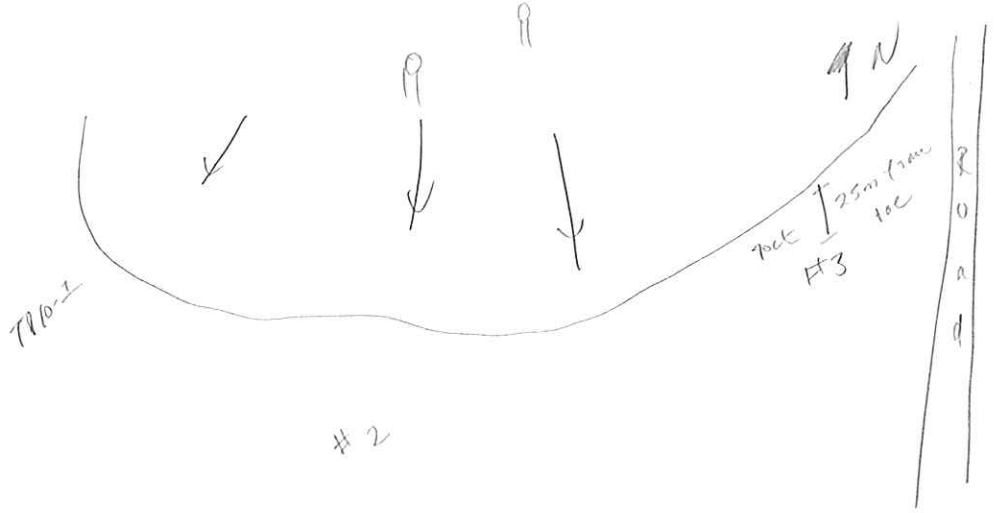
TP10-3

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
		N68° 10. 814'	TR
Project Name: Roberts Bay	(Y) / N	W106° 33. 434'	Weather: Overcast
Work Area:			
Sector:			
DEPTH (m)			

TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0 - 0.15	Sand, some roots, beige, fine to med, dry no hc odour			3x 120mL 1 bag
Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:



Franz Environmental Inc.
Project:

___ of ___

Test Pit Sampling Log

TP10-BK1

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
		N68° 10' 738"	TR
Project Name: Roberts Bay	(Y) N	W106° 33' 198"	Weather: Overcast 7°C
Work Area: Background to south of landfill			
Sector:			
DEPTH (m) 0.15			

TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0 - 0.02	Organic, grass, brown, roots,	TP10BK1	na	3 X 120mL
0.02 - 0.15	Clayey sand, med to fine, light grey, ~~loose~~ moist, no hc odour			PCB PHC 1 bag noted
Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:

Franz Environmental Inc.
Project:

___ of ___

Test Pit Sampling Log

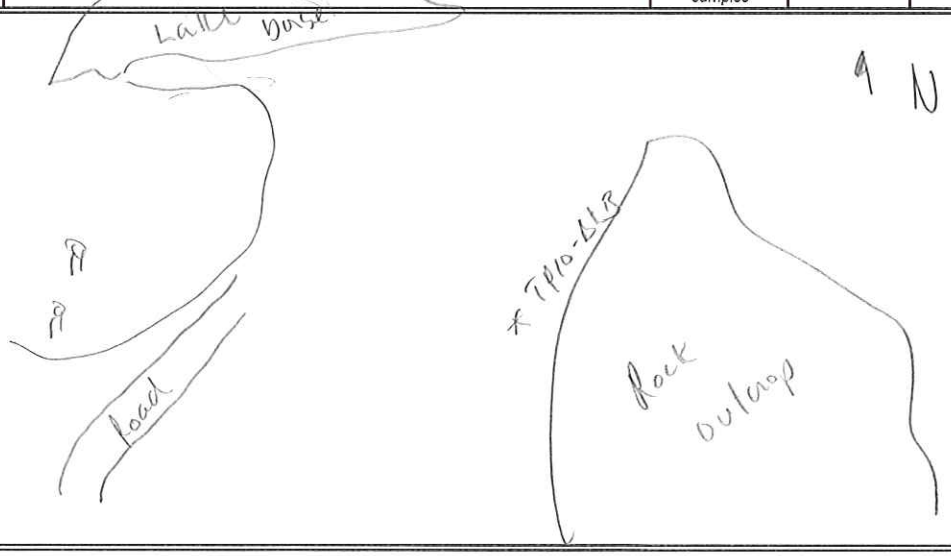
TP10-Bt3

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
Project Name: Roberts Bay	(Y) N	N 68° 10.986' W 106° 33.358'	TR
			Weather: Overcast
Work Area:			
Sector:			
DEPTH (m) 0.15			

TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0-0.15	Clayey sand, roots, dark brown, fine to med, some pebbles, dry	TP10-Bt3	na	3 x 120mL 1 bag
Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:



Franz Environmental Inc.
Project:

___ of ___

Test Pit Sampling Log

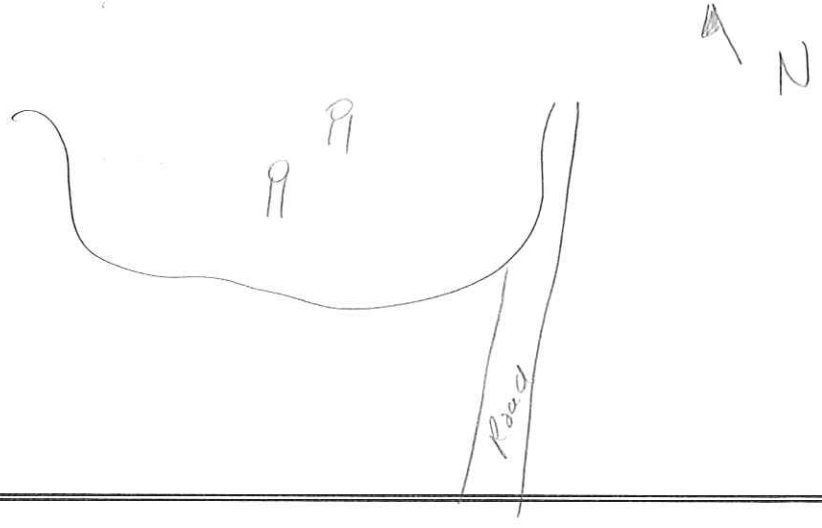
TP10-BK2

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
		N68° 10' 698"	TR
Project Name: Roberts Bay	Ⓨ/ N	W106° 33' 539"	Weather: Overcast
Work Area:			
Sector:			
DEPTH (m)			

TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0-0.15	Sand, clayey sand, fine to med, light brown / grey, moist	TP10-BK2	na	3x 120 mL 1 bag
Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:



Franz Environmental Inc.
Project:

___ of ___

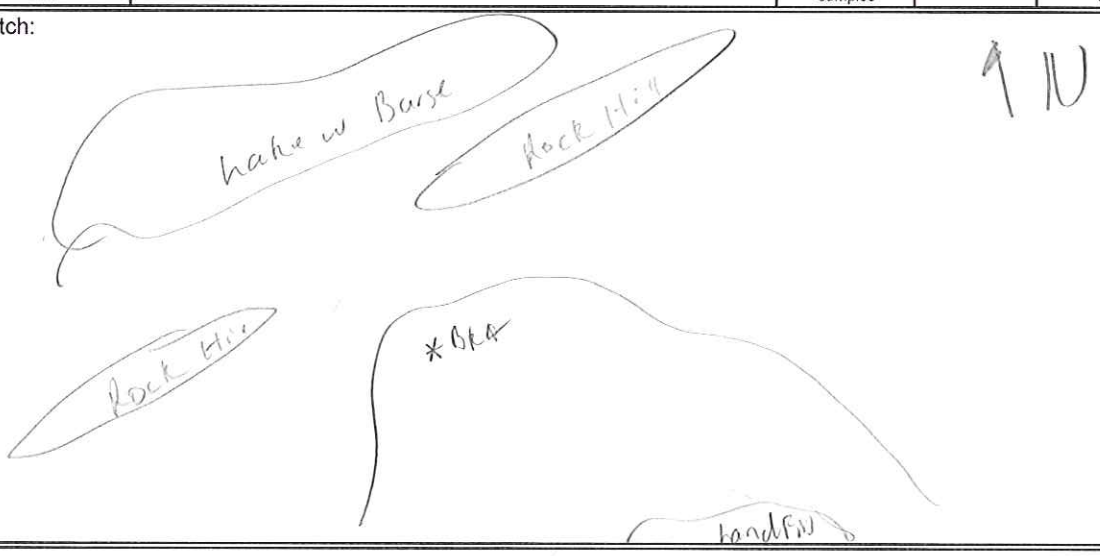
Test Pit Sampling Log TP10-BK4

Project #: 1697-1001	Photos	Easting/Northing	Personnel:
		N 68° 10.938'	TR
Project Name: Robert's Bay	Y / N	W 106° 33.717'	Weather: Overcast
Work Area:			
Sector:			
DEPTH (m) 0.10			

TEST PIT IDENTIFICATION:

DEPTH (m)	Stratigraphic Description	Sample I.D.	Organic Vapours	Analysis
0 - 0.10	Sand and gravel, fine to coarse, loose, dry		NR	3 x 120mL bag
Indicate depth of each major stratigraphic unit	Colour, grain size, major constituent, minor constituents, organics, staining, moisture content (dry, damp, moist, wet), odour	Indicate depth and range of samples	Measurements in PPM	Indicate analysis completed on each sample

Sketch:



Project #: 1697-1001
Project Name: Robert's Bay

Surface Water Log

ROB-10

Franz Personnel: TR
Weather: Sunny

Sample Information

Name of Area:			Sector:
Date of Sampling:	Day: 29	Month: 08	Year: 2010
Sample ID:			
Coordinates of Sample Location	GPS unit: 68° 10.969'		WP #:
	Easting: 106° 33.478		Northing:
Sampling Equipment:	YSI		
Photo:	(Yes)		No

Measured Data

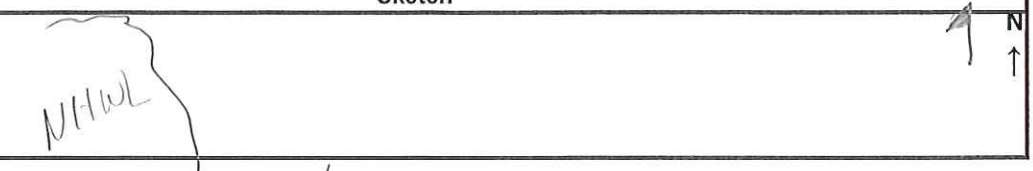
Sample Depth (m): 0.03

Field Chemistry			Sample Analysis	Y/N
Name and # unit:	Readings *			
pH:	1	7.60	PHC	✓ F1 F4
	2	7.59		
	3	7.47		
	4	7.45		
	5		PCB Total	✓
	6			
Temperature (°C):	1	8.65		
	2	8.69		
	3	8.67		
	4		VOC	
	5			
	6			
Conductivity (mS/cm):	1	1.374		
	2	1.374		
	3	1.374	PAH	
	4			
	5			
	6			
DO:	1	131.9		
	2	109.2	Hardness	Metals Group ✓
	3	105.7		
	4			
	5			
	6			
ORP:	1	234.5	Other	
	2	238.2		
	3	238.5		
	4			
	5			
	6			
Turbidity:	1			
	2			
	3			
	4			
	5			
	6			

Comments/ Notes:

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

Sketch



Project #: 1697-100c
Project Name: Roberts Bay

Surface Water Log

ROB8

Franz Personnel: TR
Weather: Overcast

Sample Information

Name of Area:			Sector:	
Date of Sampling:	Day: 28	Month: 08	Year: 2010	
Sample ID:				
Coordinates of Sample Location	GPS unit: 68° 10.900"		WP #: Garmin	
	Easting: W 106° 33.393'		Northing:	
Sampling Equipment:	YSI			
Photo:	(Yes)		No	

Measured Data

Sample Depth (m): 0.05

Field Chemistry			Sample Analysis	(Y)/N
Name and # unit:	Readings *			
pH:	1	7.74	PHC	3 x 40mL FI-FP 2 x 125mL
	2	7.71		
	3	7.70		
	4			
	5			
	6			
Temperature (°C):	1	9.38	PCB Total	✓ 2 x 500mL
	2	9.37		
	3	9.38		
	4			
	5			
	6			
Conductivity (mS/cm):	1	2.901	VOC	
	2	2.900		
	3	2.900		
	4			
	5			
	6			
DO:	1	15.34	PAH	
	2	15.33		
	3	15.35		
	4			
	5			
	6			
ORP:	1	231.1	Hardness	
	2	231.1		
	3	231.1		
	4			
	5			
	6			
Turbidity:	1		Other	Metals 2 x plastic
	2			
	3			
	4			
	5			
	6			

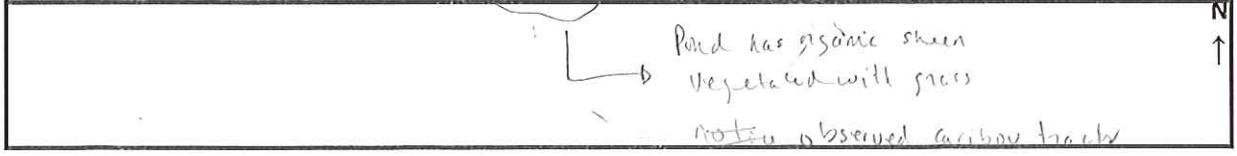
Comments/ Notes:

N Hwy Rock outcrop

X N

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

Sketch



Project #:
Project Name:

Surface Water Log

ROB 7 and Dup 1

TK
Franz Personnel:
Weather: Overcast

Sample Information

Name of Area: West of NHWL			Sector:
Date of Sampling:	Day: 28	Month: 08	Year: 2010
Sample ID:			
Coordinates of Sample Location	GPS unit:		WP #:
	Easting: N68° 10.797'		Northing:
Sampling Equipment:	W106° 33.581'		
Photo:	(Yes)		No

Measured Data

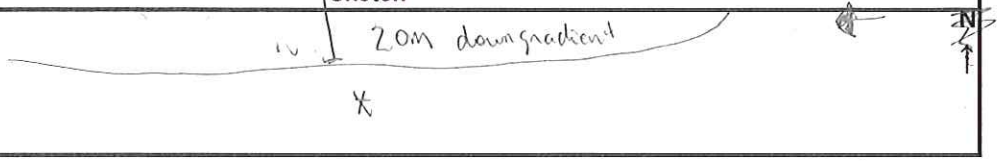
Sample Depth (m):			Sample Analysis	Y/N
Field Chemistry				
Name and # unit:	Readings *			
pH:	1	7.49	PHC	F1, F4
	2	7.29		
	3	7.22		
	4	7.24		
	5		PCB Total	yes
	6			
Temperature (°C):	1	9.76		
	2	9.74		
	3	9.74		
	4	9.74	VOC	
	5			
	6			
Conductivity (mS/cm):	1	0.095		
	2	0.065		
	3	0.092	PAH	
	4	0.098		
	5			
	6			
DO:	1	155.1		
	2	132.1		
	3	121.0	Hardness	
	4	114.6		
	5			
	6			
ORP:	1	211.6		
	2	209.5		
	3	208.9		
	4	208.5		Metals
	5		Other	
	6			
Turbidity:	1			
	2			
	3			
	4			
	5			
	6			

Comments/ Notes:

NHWL

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

Sketch



Franz Environmental Inc.

Project #: 1697-1001
Project Name: Robert's Bay

Surface Water Log

RoB 9- Dup2

Franz Personnel: TR
Weather: Overcast

Sample Information

Name of Area:			Sector:
Date of Sampling:	Day: 29	Month: 08	Year: 2010
Sample ID:			
Coordinates of Sample Location	GPS unit: N68°10.252"		WP #:
	Easting: W106°33.357"		Northing:
Sampling Equipment:	YSI		
Photo:	(Yes)		No

Measured Data

Sample Depth (m):		

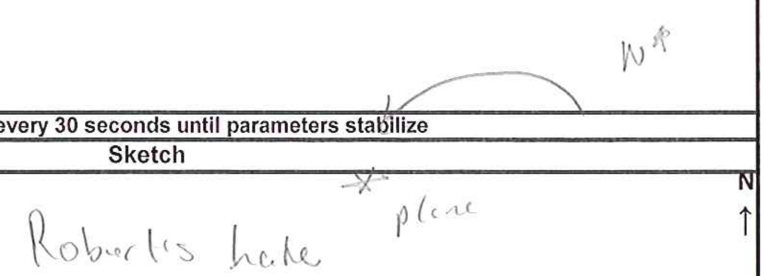
Field Chemistry		
Name and # unit:	Readings *	
pH:	1	8.41
	2	8.40
	3	8.40
	4	8.36
	5	
	6	
Temperature (°C):	1	11.35
	2	11.36
	3	11.43
	4	11.45
	5	
	6	
Conductivity (mS/cm):	1	0.190
	2	0.190
	3	0.191
	4	
	5	
	6	
DO:	1	177
	2	167.1
	3	165.4
	4	150.5
	5	
	6	
ORP:	1	193.7
	2	194.1
	3	194.4
	4	195.3
	5	
	6	
Turbidity:	1	
	2	
	3	
	4	
	5	
	6	

Sample Analysis	Y/N
PHC	F1-F4 ✓ Rylac
PCB Total	✓
VOC	
PAH	
Hardness	
Other	Metals +.

Comments/ Notes:

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

Sketch



Franz Environmental Inc.

Project #: 1697-1001
Project Name: Robert's Bay

Surface Water Log

Franz Personnel: TR
Weather: overcast

ROB6

Sample Information

Name of Area:		Sector:	
Date of Sampling:	Day: 28	Month: 08	Year: 10
Sample ID:			
Coordinates of Sample Location	GPS unit:	WP #:	
	Easting:	Northing:	
Sampling Equipment:			
Photo:	(Yes)	No	

Measured Data

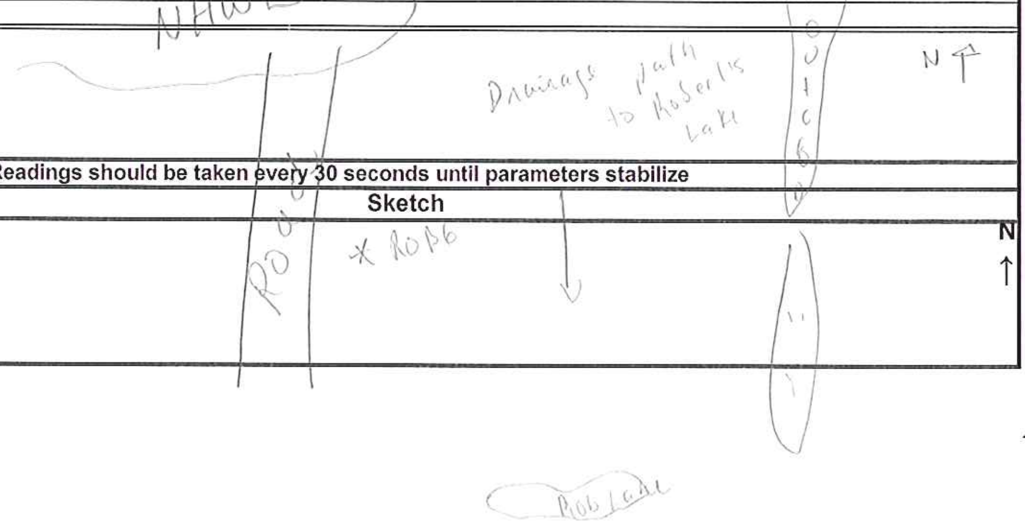
Sample Depth (m):		
Field Chemistry		
Name and # unit:	**Readings ***	
pH:	1	7.85
	2	7.81
	3	7.78
	4	7.76
	5	
	6	
Temperature (◦C):	1	7.15
	2	7.15
	3	7.10
	4	7.14
	5	
	6	
Conductivity (mS/cm):	1	1.082
	2	1.082
	3	1.082
	4	1.082
	5	
	6	
DO:	1	614.5
	2	305.5
	3	236.9
	4	
	5	
	6	
ORP:	1	202.5
	2	204.5
	3	205.5
	4	
	5	
	6	
Turbidity:	1	
	2	
	3	
	4	
	5	
	6	

Sample Analysis	Y/N
PHC	
PCB Total	
VOC	
PAH	
Hardness	
Other	

Comments/ Notes:

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

Sketch



Franz Environmental Inc.

APPENDIX D

Laboratory Reports and Chain of Custody Forms

Your Project #: 1697-1001
Site: ROBERT'S BAY
Your C.O.C. #: A019581

Attention: TINA RANGER
FRANZ ENVIRONMENTAL INC.
329 CHURCHILL AVE NORTH
SUITE 2000
OTTAWA, ON
CANADA K1Z5B8

Report Date: 2010/09/10
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B078493
Received: 2010/08/30, 12:40

Sample Matrix: Soil
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Boron (Hot Water Soluble)	4	2010/09/04	2010/09/04	AB SOP-00042	EPA 200.7
Boron (Hot Water Soluble)	4	2010/09/07	2010/09/07	AB SOP-00042	EPA 200.7
Boron (Hot Water Soluble)	1	2010/09/08	2010/09/08	AB SOP-00042	EPA 200.7
BTEX/F1 by HS GC/MS (MeOH extract)	4	2010/08/31	2010/09/03	CAL SOP-00190	EPA 8260C/CCME
BTEX/F1 by HS GC/MS (MeOH extract)	4	2010/08/31	2010/09/04	CAL SOP-00190	EPA 8260C/CCME
BTEX/F1 by HS GC/MS (MeOH extract)	1	2010/08/31	2010/09/05	CAL SOP-00190	EPA 8260C/CCME
Hexavalent Chromium	8	2010/09/01	2010/09/01	CAL SOP-00056	SM 3500-Cr B
Hexavalent Chromium	1	2010/09/07	2010/09/07	CAL SOP-00056	SM 3500-Cr B
CCME Hydrocarbons (F2-F4 in soil)	6	2010/08/31	2010/09/03	CAL SOP-00086 AB WI-00016	CCME PHC-CWS
CCME Hydrocarbons (F2-F4 in soil)	2	2010/08/31	2010/09/07	CAL SOP-00086 AB WI-00016	CCME PHC-CWS
CCME Hydrocarbons (F2-F4 in soil)	1	2010/09/02	2010/09/04	CAL SOP-00086 AB WI-00016	CCME PHC-CWS
Elements by ICPMS - Soils	8	2010/09/02	2010/09/05	AB SOP-00043	EPA 200.8
Elements by ICPMS - Soils	1	2010/09/05	2010/09/05	AB SOP-00043	EPA 200.8
Moisture	8	N/A	2010/09/01	CAL SOP-00023	McKeague MSSMA 2.411
Moisture	1	N/A	2010/09/03	CAL SOP-00023	McKeague MSSMA 2.411
Polychlorinated Biphenyls	8	2010/08/31	2010/09/02	CAL SOP-00149	EPA 3550B, EPA 8082A
Polychlorinated Biphenyls	1	2010/08/31	2010/09/07	CAL SOP-00149	EPA 3550B, EPA 8082A

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

Encryption Key

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

LISA MCMANES, Sample Reception Supervisor
Email: lisa.mcmanes@maxxamanalytics.com
Phone# (403) 291-3077

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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.

Total cover pages: 1

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

AT1 BTEX AND F1-F4 IN SOIL (SOIL)

Maxxam ID		W60488	W60492	W60493	W60494		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019581	A019581	A019581	A019581		
	Units	**TP10-1 @ 0-0.15M**	**TP10-2 @ 0-0.15M**	**TP10-3 @ 0-0.15M**	**TP10- BK1 @ 0-0.15M**	**RDL**	**QC Batch**
Physical Properties							
Moisture	%	15	5.4	9.6	14	0.3	4227454
Ext. Pet. Hydrocarbon							
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	<10	10	4229474
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	<10	<10	19	10	4229474
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	<10	<10	10	4229474
Reached Baseline at C50	mg/kg	YES	YES	YES	YES		4229474
Surrogate Recovery (%)							
O-TERPHENYL (sur.)	%	98	97	99	100		4229474
Volatiles							
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	4234651
Toluene	mg/kg	<0.020	<0.020	<0.020	<0.020	0.020	4234651
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4234651
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	0.040	4234651
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	0.040	4234651
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	0.020	4234651
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	<12	12	4234651
(C6-C10)	mg/kg	<12	<12	<12	<12	12	4234651
Surrogate Recovery (%)							
4-BROMOFLUOROBENZENE (sur.)	%	116	103	104	102		4234651
D10-ETHYLBENZENE (sur.)	%	82	97	97	97		4234651
D4-1,2-DICHLOROETHANE (sur.)	%	116	111	110	112		4234651
D8-TOLUENE (sur.)	%	91	108	107	107		4234651

RDL = Reportable Detection Limit

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

AT1 BTEX AND F1-F4 IN SOIL (SOIL)

Maxxam ID		W60495	W60496	W60497	W60500		W60507		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28		2010/08/28		
COC#		A019581	A019581	A019581	A019581		A019581		
	Units	**TP10-BK2 @ 0-0.15M**	**TP10-BK3 @ 0-0.15M**	**DUP-1 @ 0-0.15M**	**DUP-2 @ 0-0.15M**	**QC Batch**	**TP10 - BK4**	**RDL**	**QC Batch**
Physical Properties									
Moisture	%	6.8	13	15	6.4	4227454	4.8	0.3	4233517
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	<10	4229474	<10	10	4233247
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	<10	<10	<10	4229474	<10	10	4233247
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	<10	<10	4229474	<10	10	4233247
Reached Baseline at C50	mg/kg	YES	YES	YES	YES	4229474	YES		4233247
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	102	99	102	101	4229474	88		4233247
Volatiles									
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	4234651	<0.0050	0.0050	4237050
Toluene	mg/kg	<0.020	<0.020	<0.020	<0.020	4234651	<0.020	0.020	4237050
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	4234651	<0.010	0.010	4237050
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	4234651	<0.040	0.040	4237050
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	4234651	<0.040	0.040	4237050
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	4234651	<0.020	0.020	4237050
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	<12	4234651	<12	12	4237050
(C6-C10)	mg/kg	<12	<12	<12	<12	4234651	<12	12	4237050
Surrogate Recovery (%)									
4-BROMOFLUOROBENZENE (sur.)	%	117	104	103	104	4234651	111		4237050
D10-ETHYLBENZENE (sur.)	%	81	96	96	96	4234651	111		4237050
D4-1,2-DICHLOROETHANE (sur.)	%	116	111	113	113	4234651	98		4237050
D8-TOLUENE (sur.)	%	90	106	106	106	4234651	93		4237050

RDL = Reportable Detection Limit

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

REGULATED METALS (CCME/AT1)

Maxxam ID		W60488	W60492		W60493		W60494		W60495		
Sampling Date		2010/08/28	2010/08/28		2010/08/28		2010/08/28		2010/08/28		
COC#		A019581	A019581		A019581		A019581		A019581		
	Units	**TP10-1 @ 0-0.15M**	**TP10-2 @ 0-0.15M**	**RDL**	**TP10-3 @ 0-0.15M**	**RDL**	**TP10- BK1 @ 0-0.15M**	**QC Batch**	**TP10-BK2 @ 0-0.15M**	**RDL**	**QC Batch**
Elements											
Soluble (Hot water) Boron (B)	mg/kg	<0.1	<0.1	0.1	<0.1	0.1	<0.1	4237176	<0.1	0.1	4240896
Hex. Chromium (Cr 6+)	mg/kg	<0.75(1)	<0.75(2)	0.75	<0.15	0.15	<0.75(2)	4226314	<0.75(2)	0.75	4226314
Total Antimony (Sb)	mg/kg	<1	<1	1	<1	1	<1	4233725	<1	1	4233725
Total Arsenic (As)	mg/kg	<1	<1	1	<1	1	<1	4233725	<1	1	4233725
Total Barium (Ba)	mg/kg	<10	31	10	14	10	<10	4233725	<10	10	4233725
Total Beryllium (Be)	mg/kg	<0.4	<0.4	0.4	<0.4	0.4	<0.4	4233725	<0.4	0.4	4233725
Total Cadmium (Cd)	mg/kg	<0.1	<0.1	0.1	<0.1	0.1	<0.1	4233725	<0.1	0.1	4233725
Total Chromium (Cr)	mg/kg	<1	6	1	2	1	<1	4233725	<1	1	4233725
Total Cobalt (Co)	mg/kg	<1	3	1	1	1	<1	4233725	<1	1	4233725
Total Copper (Cu)	mg/kg	<5	<5	5	<5	5	<5	4233725	<5	5	4233725
Total Lead (Pb)	mg/kg	<1	6	1	1	1	<1	4233725	<1	1	4233725
Total Mercury (Hg)	mg/kg	0.07	0.07	0.05	0.06	0.05	0.06	4233725	0.06	0.05	4233725
Total Molybdenum (Mo)	mg/kg	<0.4	<0.4	0.4	<0.4	0.4	<0.4	4233725	<0.4	0.4	4233725
Total Nickel (Ni)	mg/kg	2	7	1	2	1	<1	4233725	<1	1	4233725
Total Selenium (Se)	mg/kg	<0.5	<0.5	0.5	<0.5	0.5	<0.5	4233725	<0.5	0.5	4233725
Total Silver (Ag)	mg/kg	<1	<1	1	<1	1	<1	4233725	<1	1	4233725
Total Thallium (Tl)	mg/kg	<0.3	<0.3	0.3	<0.3	0.3	<0.3	4233725	<0.3	0.3	4233725
Total Tin (Sn)	mg/kg	<1	<1	1	<1	1	<1	4233725	<1	1	4233725
Total Uranium (U)	mg/kg	<1	<1	1	<1	1	<1	4233725	<1	1	4233725
Total Vanadium (V)	mg/kg	<1	7	1	2	1	<1	4233725	<1	1	4233725
Total Zinc (Zn)	mg/kg	<10	22	10	<10	10	<10	4233725	<10	10	4233725

RDL = Reportable Detection Limit
(1) - Detection limits raised due to matrix interference.
(2) - Detection limits raised due to matrix interference

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

REGULATED METALS (CCME/AT1)

Maxxam ID		W60496	W60497		W60500			W60507		
Sampling Date		2010/08/28	2010/08/28		2010/08/28			2010/08/28		
COC#		A019581	A019581		A019581			A019581		
	Units	**TP10-BK3 @ 0-0.15M**	**DUP-1 @ 0-0.15M**	**RDL**	**DUP-2 @ 0-0.15M**	**RDL**	**QC Batch**	**TP10 - BK4**	**RDL**	**QC Batch**
Elements										
Soluble (Hot water) Boron (B)	mg/kg	0.2	0.2	0.1	<0.1	0.1	4240896	<0.1	0.1	4243204
Hex. Chromium (Cr 6+)	mg/kg	<0.75(1)	<0.75(1)	0.75	<0.30(1)	0.30	4226314	<0.15	0.15	4240798
Total Antimony (Sb)	mg/kg	<1	<1	1	<1	1	4233725	<1	1	4237582
Total Arsenic (As)	mg/kg	2	1	1	4	1	4233725	<1	1	4237582
Total Barium (Ba)	mg/kg	41	71	10	160	10	4233725	24	10	4237582
Total Beryllium (Be)	mg/kg	<0.4	<0.4	0.4	<0.4	0.4	4233725	<0.4	0.4	4237582
Total Cadmium (Cd)	mg/kg	<0.1	<0.1	0.1	<0.1	0.1	4233725	<0.1	0.1	4237582
Total Chromium (Cr)	mg/kg	16	25	1	19	1	4233725	10	1	4237582
Total Cobalt (Co)	mg/kg	7	9	1	11	1	4233725	4	1	4237582
Total Copper (Cu)	mg/kg	40	29	5	24	5	4233725	<5	5	4237582
Total Lead (Pb)	mg/kg	6	5	1	27	1	4233725	3	1	4237582
Total Mercury (Hg)	mg/kg	0.06	<0.05	0.05	<0.05	0.05	4233725	<0.05	0.05	4237582
Total Molybdenum (Mo)	mg/kg	<0.4	<0.4	0.4	<0.4	0.4	4233725	<0.4	0.4	4237582
Total Nickel (Ni)	mg/kg	13	15	1	19	1	4233725	7	1	4237582
Total Selenium (Se)	mg/kg	<0.5	<0.5	0.5	<0.5	0.5	4233725	<0.5	0.5	4237582
Total Silver (Ag)	mg/kg	<1	<1	1	<1	1	4233725	<1	1	4237582
Total Thallium (Tl)	mg/kg	<0.3	<0.3	0.3	<0.3	0.3	4233725	<0.3	0.3	4237582
Total Tin (Sn)	mg/kg	<1	<1	1	<1	1	4233725	<1	1	4237582
Total Uranium (U)	mg/kg	2	<1	1	<1	1	4233725	<1	1	4237582
Total Vanadium (V)	mg/kg	29	43	1	62	1	4233725	34	1	4237582
Total Zinc (Zn)	mg/kg	35	37	10	69	10	4233725	21	10	4237582

RDL = Reportable Detection Limit
(1) - Detection limits raised due to matrix interference

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

POLYCHLORINATED BIPHENYLS BY GC-ECD (SOIL)

Maxxam ID		W60488	W60492	W60493	W60494		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019581	A019581	A019581	A019581		
	Units	**TP10-1 @ 0-0.15M**	**TP10-2 @ 0-0.15M**	**TP10-3 @ 0-0.15M**	**TP10- BK1 @ 0-0.15M**	**RDL**	**QC Batch**
Polychlorinated Biphenyls							
Aroclor 1016	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1221	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1232	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1242	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1248	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1254	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1260	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1262	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Aroclor 1268	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Total Aroclors	mg/kg	<0.010	<0.010	<0.010	<0.010	0.010	4230338
Surrogate Recovery (%)							
NONACHLOROBIPHENYL (sur.)	%	63	72	75	76		4230338

Maxxam ID		W60495	W60496	W60497	W60500		W60507		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28		2010/08/28		
COC#		A019581	A019581	A019581	A019581		A019581		
	Units	**TP10-BK2 @ 0-0.15M**	**TP10-BK3 @ 0-0.15M**	**DUP-1 @ 0-0.15M**	**DUP-2 @ 0-0.15M**	**QC Batch**	**TP10 - BK4**	**RDL**	**QC Batch**
Polychlorinated Biphenyls									
Aroclor 1016	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1221	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1232	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1242	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1248	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1254	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1260	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1262	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Aroclor 1268	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Total Aroclors	mg/kg	<0.010	<0.010	<0.010	<0.010	4230338	<0.010	0.010	4233986
Surrogate Recovery (%)									
NONACHLOROBIPHENYL (sur.)	%	65	67	78	78	4230338	80		4233986

RDL = Reportable Detection Limit

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

Package 1	4.0°C

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

REGULATED METALS (CCME/AT1) Comments

Sample W60492-01 Boron (Hot Water Soluble): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

QUALITY ASSURANCE REPORT

			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
4226314	Hex. Chromium (Cr 6+)	2010/09/01	92	75 - 125	92	90 - 110	<0.15	mg/kg	NC	35		
4227454	Moisture	2010/09/01							11.0	20		
4229474	O-TERPHENYL (sur.)	2010/09/07	95	50 - 130	88	50 - 130	90	%				
4229474	F2 (C10-C16 Hydrocarbons)	2010/09/07	NC	50 - 130	92	80 - 120	<10	mg/kg	49.7	50		
4229474	F3 (C16-C34 Hydrocarbons)	2010/09/07	NC	50 - 130	89	80 - 120	<10	mg/kg	36.0	50		
4229474	F4 (C34-C50 Hydrocarbons)	2010/09/07	90	50 - 130	86	80 - 120	<10	mg/kg	18.8	50		
4230338	NONACHLOROBIPHENYL (sur.)	2010/09/02	59	30 - 130	81	30 - 130	64	%				
4230338	Aroclor 1260	2010/09/02	77	30 - 130	94	30 - 130	<0.010	mg/kg	NC	50		
4230338	Aroclor 1016	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1221	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1232	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1242	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1248	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1254	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1262	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Aroclor 1268	2010/09/02					<0.010	mg/kg	NC	50		
4230338	Total Aroclors	2010/09/02					<0.010	mg/kg	NC	50		
4233247	O-TERPHENYL (sur.)	2010/09/03	85	50 - 130	81	50 - 130	82	%				
4233247	F2 (C10-C16 Hydrocarbons)	2010/09/04	90	50 - 130	88	80 - 120	<10	mg/kg	NC	50		
4233247	F3 (C16-C34 Hydrocarbons)	2010/09/04	92	50 - 130	90	80 - 120	<10	mg/kg	NC	50		
4233247	F4 (C34-C50 Hydrocarbons)	2010/09/04	89	50 - 130	88	80 - 120	<10	mg/kg	NC	50		
4233517	Moisture	2010/09/03							6.8	20		
4233725	Total Antimony (Sb)	2010/09/03	114	75 - 125	108	75 - 125	<1	mg/kg	NC	35		
4233725	Total Arsenic (As)	2010/09/03	98	75 - 125	96	75 - 125	<1	mg/kg	NC	35	90	50 - 150
4233725	Total Barium (Ba)	2010/09/03	NC	75 - 125	100	75 - 125	<10	mg/kg	12.4	35	109	69 - 131
4233725	Total Beryllium (Be)	2010/09/03	124	75 - 125	113	75 - 125	<0.4	mg/kg	NC	35		
4233725	Total Cadmium (Cd)	2010/09/03	99	75 - 125	101	75 - 125	<0.1	mg/kg	NC	35		
4233725	Total Chromium (Cr)	2010/09/03	113	75 - 125	100	75 - 125	<1	mg/kg	NC	35	101	41 - 159
4233725	Total Cobalt (Co)	2010/09/03	114	75 - 125	107	75 - 125	<1	mg/kg	NC	35	97	75 - 125
4233725	Total Copper (Cu)	2010/09/03	97	75 - 125	101	75 - 125	<5	mg/kg	NC	35	84	72 - 127
4233725	Total Lead (Pb)	2010/09/03	92	75 - 125	98	75 - 125	<1	mg/kg	NC	35	95	54 - 146
4233725	Total Molybdenum (Mo)	2010/09/03	117	75 - 125	101	75 - 125	<0.4	mg/kg	NC	35		
4233725	Total Nickel (Ni)	2010/09/03	101	75 - 125	99	75 - 125	<1	mg/kg	14.0	35	97	61 - 139
4233725	Total Selenium (Se)	2010/09/03	87	75 - 125	95	75 - 125	<0.5	mg/kg	NC	35		
4233725	Total Silver (Ag)	2010/09/03	88	75 - 125	92	75 - 125	<1	mg/kg	NC	35		
4233725	Total Thallium (Tl)	2010/09/03	92	75 - 125	96	75 - 125	<0.3	mg/kg	NC	35		
4233725	Total Tin (Sn)	2010/09/03	104	75 - 125	100	75 - 125	<1	mg/kg	NC	35		
4233725	Total Uranium (U)	2010/09/03	100	75 - 125	90	75 - 125	<1	mg/kg	NC	35		
4233725	Total Vanadium (V)	2010/09/03	117	75 - 125	102	75 - 125	<1	mg/kg	NC	35	109	50 - 150
4233725	Total Zinc (Zn)	2010/09/03	NC	75 - 125	99	75 - 125	<10	mg/kg	NC	35	75	72 - 128

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

QUALITY ASSURANCE REPORT

			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
4233725	Total Mercury (Hg)	2010/09/03			101	80 - 120	<0.05	mg/kg	NC	35	77	75 - 125
4233986	NONACHLOROBIPHENYL (sur.)	2010/09/07	99	30 - 130	71	30 - 130	76	%				
4233986	Aroclor 1260	2010/09/07	NC	30 - 130	87	30 - 130	<0.010	mg/kg	NC	50		
4233986	Aroclor 1016	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1221	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1232	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1242	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1248	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1254	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1262	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Aroclor 1268	2010/09/07					<0.010	mg/kg	NC	50		
4233986	Total Aroclors	2010/09/07					<0.010	mg/kg	NC	50		
4234651	4-BROMOFLUOROBENZENE (sur.)	2010/09/03	112	60 - 140	110	60 - 140	104	%				
4234651	D10-ETHYLBENZENE (sur.)	2010/09/03	91	30 - 130	91	30 - 130	96	%				
4234651	D4-1,2-DICHLOROETHANE (sur.)	2010/09/03	120	60 - 140	119	60 - 140	109	%				
4234651	D8-TOLUENE (sur.)	2010/09/03	101	60 - 140	101	60 - 140	106	%				
4234651	Benzene	2010/09/04	117	60 - 140	125	60 - 140	<0.0050	mg/kg	NC	50		
4234651	Toluene	2010/09/04	108	60 - 140	116	60 - 140	<0.020	mg/kg	NC	50		
4234651	Ethylbenzene	2010/09/04	104	60 - 140	112	60 - 140	<0.010	mg/kg	NC	50		
4234651	m & p-Xylene	2010/09/04	104	60 - 140	112	60 - 140	<0.040	mg/kg	NC	50		
4234651	o-Xylene	2010/09/04	101	60 - 140	109	60 - 140	<0.020	mg/kg	NC	50		
4234651	(C6-C10)	2010/09/04	77	60 - 140	90	60 - 140	<12	mg/kg	NC	50		
4234651	Xylenes (Total)	2010/09/04					<0.040	mg/kg	NC	50		
4234651	F1 (C6-C10) - BTEX	2010/09/04					<12	mg/kg	NC	50		
4237050	4-BROMOFLUOROBENZENE (sur.)	2010/09/05	106	60 - 140	116	60 - 140	100	%				
4237050	D10-ETHYLBENZENE (sur.)	2010/09/05	81	30 - 130	121	30 - 130	80	%				
4237050	D4-1,2-DICHLOROETHANE (sur.)	2010/09/05	91	60 - 140	100	60 - 140	83	%				
4237050	D8-TOLUENE (sur.)	2010/09/05	104	60 - 140	93	60 - 140	100	%				
4237050	Benzene	2010/09/05	110	60 - 140	119	60 - 140	<0.0050	mg/kg	NC	50		
4237050	Toluene	2010/09/05	115	60 - 140	124	60 - 140	<0.020	mg/kg	NC	50		
4237050	Ethylbenzene	2010/09/05	121	60 - 140	133	60 - 140	<0.010	mg/kg	NC	50		
4237050	m & p-Xylene	2010/09/05	139	60 - 140	139	60 - 140	<0.040	mg/kg	NC	50		
4237050	o-Xylene	2010/09/05	126	60 - 140	138	60 - 140	<0.020	mg/kg	NC	50		
4237050	(C6-C10)	2010/09/05	74	60 - 140	76	60 - 140	<12	mg/kg	NC	50		
4237050	Xylenes (Total)	2010/09/05					<0.040	mg/kg	NC	50		
4237050	F1 (C6-C10) - BTEX	2010/09/05					<12	mg/kg	NC	50		
4237176	Soluble (Hot water) Boron (B)	2010/09/04	107	75 - 125	108	80 - 120	<0.1	mg/kg	NC	35		
4237582	Total Antimony (Sb)	2010/09/05	89	75 - 125	102	75 - 125	<1	mg/kg	NC	35		
4237582	Total Arsenic (As)	2010/09/05	NC	75 - 125	94	81 - 103	<1	mg/kg	2.8	35	93	50 - 150
4237582	Total Barium (Ba)	2010/09/05	NC	75 - 125	97	75 - 125	<10	mg/kg	7.9	35	109	69 - 131

Maxxam Job #: B078493
Report Date: 2010/09/10

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: TR

QUALITY ASSURANCE REPORT

			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
4237582	Total Beryllium (Be)	2010/09/05	108	75 - 125	102	75 - 116	<0.4	mg/kg	NC	35		
4237582	Total Cadmium (Cd)	2010/09/05	89	75 - 125	94	75 - 125	<0.1	mg/kg	NC	35		
4237582	Total Chromium (Cr)	2010/09/05	NC	75 - 125	103	75 - 125	<1	mg/kg	1.0	35	93	41 - 159
4237582	Total Cobalt (Co)	2010/09/05	97	75 - 125	103	75 - 125	<1	mg/kg	1.1	35	94	75 - 125
4237582	Total Copper (Cu)	2010/09/05	91	75 - 125	99	75 - 125	<5	mg/kg	NC	35	84	72 - 127
4237582	Total Lead (Pb)	2010/09/05	108	75 - 125	104	85 - 112	<1	mg/kg	5.0	35	97	54 - 146
4237582	Total Mercury (Hg)	2010/09/05	90	75 - 125	99	75 - 125	<0.05	mg/kg	NC	35	103	75 - 125
4237582	Total Molybdenum (Mo)	2010/09/05	99	75 - 125	102	75 - 125	<0.4	mg/kg	NC	35		
4237582	Total Nickel (Ni)	2010/09/05	94	75 - 125	102	75 - 125	<1	mg/kg	2.2	35	97	61 - 139
4237582	Total Selenium (Se)	2010/09/05	78	75 - 125	86	75 - 125	<0.5	mg/kg	NC	35		
4237582	Total Silver (Ag)	2010/09/05	99	75 - 125	103	75 - 125	<1	mg/kg	NC	35		
4237582	Total Thallium (Tl)	2010/09/05	80	75 - 125	102	75 - 125	<0.3	mg/kg	NC	35		
4237582	Total Tin (Sn)	2010/09/05	91	75 - 125	96	75 - 125	<1	mg/kg	NC	35		
4237582	Total Uranium (U)	2010/09/05	112	75 - 125	99	75 - 125	<1	mg/kg	NC	35		
4237582	Total Vanadium (V)	2010/09/05	NC	75 - 125	100	75 - 125	<1	mg/kg	5.9	35	98	50 - 150
4237582	Total Zinc (Zn)	2010/09/05	NC	75 - 125	102	75 - 125	<10	mg/kg	0.2	35	80	72 - 128
4240798	Hex. Chromium (Cr 6+)	2010/09/07	97	75 - 125	97	90 - 110	<0.15	mg/kg	NC	35		
4240896	Soluble (Hot water) Boron (B)	2010/09/07	107	75 - 125	104	80 - 120	<0.1	mg/kg	16.2	35		
4243204	Soluble (Hot water) Boron (B)	2010/09/08	93	75 - 125	103	80 - 120	<0.1	mg/kg	NC	35		

N/A = Not Applicable
RPD = Relative Percent Difference
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 blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
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 not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B078493

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

JENNIFER LO, Senior Analyst, Organics Department

ORLA JORGENSEN, Organics Supervisor

RON VENZI, Scientific Specialist

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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.

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody A019581

Page: 1 of 1

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☑	Report Distribution (E-Mail):	REGULATORY GUIDELINES:
Company:	Franz Environmental		tranger@franzenvironmental.com	☐ AT1
Contact:	Tina Ranger		meyr@franzenvironmental.com	☑ CCME
Address:	329 Churchill Ave, Ottawa			☐ Regulated Drinking Water
	Prov: ON PC: K1Z 5B8	Prov: PC:		☐ Other:
Contact #s:	Ph: 613-721-0555 Cell: 819-360-2402	Ph: Cell:		

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	1697-1001
Project # / Name:	Robert's Bay
Site Location:	
Quote #:	
Sampled By:	Tina Ranger

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	PCBs	WATER: ☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	TP10-1	0-0.15m	Soil	28/08/10	X		X				X											4
2	TP10-2				X		X				X											4
3	TP10-3				X		X				X											4
4	TP10-Bk1				X		X				X											4
5	TP10-Bk2				X		X				X											4
6	TP10-Bk3				X		X				X											4
7	Dup1				X		X				X											4
8	Dup2				X		X				X											4
9																				ARRIVED AT DEPOT:		
10																				AUG 30 2010		
11																				TEMP: 9/4/4/1		
12																						F/P

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print): Tina Ranger	Date (YY/MM/DD): 29/08/10	Time (24:00):
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Special Instructions:	# of Jars Used & Not Submitted	

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: CB078493
	RECEIVED AUG 31 2010		Custody Seal / Temperature / Ice
Lab Comments:			

Lisa McManes

From: Tina Ranger [tranger@franzenvironmental.com]
Sent: Wednesday, September 01, 2010 1:10 PM
To: Calgary Customer Service
Cc: 'Matthew Cyr'
Subject: RE: Job Confirmation Report [B078493] - Project 1697-1001 , Site Location: ROBERT'S BAY

I understand that no sample for TP10-BK4 was included in the CoC, but can we please proceed with analysis for this sample. Same analysis as all others.

Thank-you,

Tina

-----Original Message-----
From: customerservicecalgary@maxxamanalytics.com
[mailto:customerservicecalgary@maxxamanalytics.com]
Sent: Wednesday, September 01, 2010 1:25 PM
To: tranger@franzenvironmental.com; mcyr@franzenvironmental.com
Subject: Job Confirmation Report [B078493] - Project 1697-1001 , Site Location: ROBERT'S BAY
Importance: High

CONFIRMATION-RECEPTION OF SAMPLES FOR ANALYSIS

Hi,

Please see attached confirmation report for extra sample received, TP10-BK4.
Let me know if you would like analysis on this sample.

Thanks,

Lisa.

MAXXAM ANALYTICS
4000 19st N.E
Calgary, Alberta T2E 6P8
http://www.maxxamanalytics.com

1

Your Project #: 1697-1001
Site: ROBERT'S BAY
Your C.O.C. #: A019580

Attention: TINA RANGER
FRANZ ENVIRONMENTAL INC.
329 CHURCHILL AVE NORTH
SUITE 2000
OTTAWA, ON
CANADA K1Z5B8

Report Date: 2010/09/08

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B078600
Received: 2010/08/30, 12:40

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 in Water by HS GC/MS	7	N/A	2010/09/02	CAL SOP-00190	EPA 8260 C / CCME
Cadmium - low level CCME - Dissolved	7	N/A	2010/09/07	CAL SOP-00191	EPA SW-846 6020A
Cadmium - low level CCME (Total)	7	2010/08/31	2010/09/07	CAL SOP-00191	EPA SW-846 6020A
Chloride by Automated Colourimetry	7	N/A	2010/09/01	AB SOP-00020	EPA 325.2
True Colour	7	N/A	2010/09/01	CAL SOP-00049	SM 2120 C
Conductivity	7	N/A	2010/09/01	AB SOP-00005	SM 2510-B
Fluoride	7	N/A	2010/09/01	AB SOP-00005	SM 4500-F C
CCME Hydrocarbons (F2-F4 in water)	7	2010/09/01	2010/09/03	CAL SOP-00086 AB WI-00017	EPA3510C/CCME PHCCWS
Hardness	7	N/A	2010/09/07	CAL WI-00053	AEMM, Method 423
Mercury - Low Level (Dissolved)	7	2010/09/02	2010/09/02	CAL SOP-00007	EPA 1631
Mercury - Low Level (Total)	7	2010/09/03	2010/09/03	CAL SOP-00007	EPA 1631
Elements by ICP - Dissolved	7	N/A	2010/09/02	AB SOP-00042	EPA 200.7
Elements by ICP - Total	7	2010/09/02	2010/09/02	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	7	N/A	2010/09/03	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	7	2010/09/02	2010/09/03	AB SOP-00043	EPA 200.8
Nitrate and Nitrite	7	N/A	2010/09/04		CAL SOP-00060
Nitrate + Nitrite-N (calculated)	7	N/A	2010/09/04	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	7	N/A	2010/09/02	AB SOP-00023	SM 4110-B
Polychlorinated Biphenyls	7	2010/09/02	2010/09/03	CAL SOP-00149	EPA 3510C, EPA 8082A
pH	7	N/A	2010/09/01	AB SOP-00005	SM 4500-H B
Orthophosphate by Konelab	7	N/A	2010/09/02	CAL SOP-00064	SM 4500 P-F
Sulphate by Automated Colourimetry	7	N/A	2010/09/01	AB SOP-00018	EPA 375.4
Total Dissolved Solids (Filt. Residue)	7	2010/09/01	2010/09/02	CAL SOP-00074	SM 2540-C
Total Suspended Solids (NFR)	7	2010/09/01	2010/09/01	CAL SOP-00075	SM 2540-D

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

../2

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

Encryption Key

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

LISA MCMANES, Sample Reception Supervisor
Email: lisa.mcmanes@maxxamanalytics.com
Phone# (403) 291-3077

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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.

Total cover pages: 2

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

AT1 BTEX AND F1-F4 IN WATER (WATER)

Maxxam ID		W60921	W61076	W61079	W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580	A019580	A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**ROB 8**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Extractable Hydrocarbons										
F2 (C10-C16 Hydrocarbons)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	4225648
F3 (C16-C34 Hydrocarbons)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	4225648
F4 (C34-C50 Hydrocarbons)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	4225648
Reached Baseline at C50	mg/L	YES	YES	YES	YES	YES	YES	YES		4225648
Surrogate Recovery (%)										
O-TERPHENYL (sur.)	%	79	102	76	87	79	78	86		4225648
Volatiles										
Benzene	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	4225661
Toluene	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	4225661
Ethylbenzene	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	4225661
o-Xylene	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	4225661
m & p-Xylene	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	0.8	4225661
Xylenes (Total)	ug/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	0.8	4225661
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	<100	<100	<100	100	4225661
(C6-C10)	ug/L	<100	<100	<100	<100	<100	<100	<100	100	4225661
Surrogate Recovery (%)										
4-BROMOFLUOROBENZENE (sur.)	%	96	96	97	97	96	98	96		4225661
D4-1,2-DICHLOROETHANE (sur.)	%	109	108	103	108	109	108	106		4225661
D8-TOLUENE (sur.)	%	101	101	97	101	101	99	100		4225661

HARDNESS (WATER)

Maxxam ID		W60921	W61076	W61079	W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580	A019580	A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**ROB 8**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Calculated Parameters										
Hardness (CaCO3)	mg/L	590	415	871	40.3	582	424	40.1	0.5	4222701

RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

NITRATE, NITRITE, NITRATE PLUS NITRITE-N (WATER)

Maxxam ID		W60921	W61076	W61079	W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580	A019580	A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**ROB 8**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Calculated Parameters										
Nitrate plus Nitrite (N)	mg/L	1.4	<0.003	<0.003	<0.003	3.6	<0.003	<0.003	0.003	4222713
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	4232047
Dissolved Nitrate (N)	mg/L	1.4	<0.003	<0.003	<0.003	3.6	<0.003	<0.003	0.003	4232047

RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		W60921	W61076		W61079		W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28		2010/08/28		2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580		A019580		A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**RDL**	**ROB 8**	**RDL**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Low Level Elements												
Dissolved Cadmium (Cd)	ug/L	0.012	0.008	0.005	<0.03	0.03	0.005	0.052	0.013	<0.005	0.005	4223191
Elements												
Dissolved Aluminum (Al)	mg/L	0.007	0.003	0.001	0.020	0.005	0.018	0.002	0.002	0.016	0.001	4231959
Dissolved Antimony (Sb)	mg/L	0.0002	0.0025(1)	0.0002	<0.001	0.001	<0.0002	0.0023(1)	0.0025	<0.0002	0.0002	4231959
Dissolved Arsenic (As)	mg/L	0.0005	0.010	0.0002	0.002	0.001	0.0002	0.0016	0.0097	<0.0002	0.0002	4231959
Dissolved Barium (Ba)	mg/L	0.16(1)	0.10	0.01	0.13	0.01	<0.01	0.13	0.11(1)	<0.01	0.01	4230966
Dissolved Beryllium (Be)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231959
Dissolved Boron (B)	mg/L	<0.02	<0.02	0.02	0.03	0.02	<0.02	0.06	0.03	<0.02	0.02	4230966
Dissolved Calcium (Ca)	mg/L	140(2)	130	0.3	190	0.3	5.9(2)	150(2)	130	5.9	0.3	4230966
Dissolved Chromium (Cr)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231959
Dissolved Cobalt (Co)	mg/L	<0.0003	<0.0003	0.0003	<0.002	0.002	<0.0003	0.0003	<0.0003	<0.0003	0.0003	4231959
Dissolved Copper (Cu)	mg/L	0.0042	0.0010	0.0002	<0.001	0.001	0.0010	0.0027	0.0010	0.0009	0.0002	4231959
Dissolved Iron (Fe)	mg/L	7.9(3)	3.9(2)	0.06	0.44(1)	0.06	0.12(2)	0.36	<0.06	0.08	0.06	4230966
Dissolved Lead (Pb)	mg/L	<0.0002	<0.0002	0.0002	<0.001	0.001	<0.0002	0.0008	<0.0002	<0.0002	0.0002	4231959
Dissolved Lithium (Li)	mg/L	<0.02	<0.02	0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	0.02	4230966
Dissolved Magnesium (Mg)	mg/L	61(2)	22	0.2	95	0.2	6.2(2)	52(2)	23	6.2	0.2	4230966
Dissolved Manganese (Mn)	mg/L	0.89(3)	0.007	0.004	0.24(1)	0.004	0.009(2)	0.017(2)	0.006	0.007(2)	0.004	4230966
Dissolved Molybdenum (Mo)	mg/L	0.0013	0.0008	0.0002	0.001(2)	0.001	<0.0002	0.0045(3)	0.0010(2)	<0.0002	0.0002	4231959
Dissolved Nickel (Ni)	mg/L	0.0008	0.0047	0.0005	<0.003	0.003	<0.0005	0.0019	0.0049	<0.0005	0.0005	4231959
Dissolved Phosphorus (P)	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1(2)	<0.1	<0.1	0.1	4230966
Dissolved Potassium (K)	mg/L	5.7(2)	3.3	0.3	8.0	0.3	1.9	6.2	4.0	1.9	0.3	4230966
Dissolved Selenium (Se)	mg/L	0.0005	<0.0002	0.0002	<0.001	0.001	<0.0002	0.0009(2)	<0.0002	<0.0002	0.0002	4231959
Dissolved Silicon (Si)	mg/L	3.6	3.2	0.1	2.5	0.1	0.6	2.3	3.4	0.6	0.1	4230966
Dissolved Silver (Ag)	mg/L	<0.0001	<0.0001	0.0001	<0.0005	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	4231959
Dissolved Sodium (Na)	mg/L	79(2)	35	0.5	470	0.5	31	170(2)	37	30	0.5	4230966
Dissolved Strontium (Sr)	mg/L	0.28(2)	0.18	0.02	0.86	0.02	0.04	0.28(2)	0.18	0.04	0.02	4230966
Dissolved Sulphur (S)	mg/L	44	38	0.2	83	0.2	1.5	52(2)	39	1.5	0.2	4230966
Dissolved Thallium (Tl)	mg/L	<0.0002	<0.0002	0.0002	<0.001	0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	4231959
Dissolved Tin (Sn)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231959
Dissolved Titanium (Ti)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231959
Dissolved Uranium (U)	mg/L	0.0048	0.0011(1)	0.0001	0.0014(2)	0.0005	<0.0001	0.0044	0.0011	<0.0001	0.0001	4231959
Dissolved Vanadium (V)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231959

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

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		W60921	W61076		W61079		W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28		2010/08/28		2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580		A019580		A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**RDL**	**ROB 8**	**RDL**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	0.005	<0.003	0.003	<0.02	0.02	<0.003	0.010	0.004	<0.003	0.003	4231959

RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		W60921	W61076		W61079		W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28		2010/08/28		2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580		A019580		A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**RDL**	**ROB 8**	**RDL**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Low Level Elements												
Total Cadmium (Cd)	ug/L	0.079	0.087	0.005	0.05	0.03	<0.005	0.048	0.065	<0.005	0.005	4223192
Elements												
Total Aluminum (Al)	mg/L	0.52	0.12	0.001	0.047	0.005	0.097	0.15	0.11	0.067	0.001	4231944
Total Antimony (Sb)	mg/L	0.0003	0.0024	0.0002	<0.001	0.001	<0.0002	0.0022	0.0025	<0.0002	0.0002	4231944
Total Arsenic (As)	mg/L	0.0023	0.050	0.0002	0.005	0.001	0.0003	0.0022	0.043	0.0007	0.0002	4231944
Total Barium (Ba)	mg/L	0.14	0.10	0.01	0.13	0.01	<0.01	0.13	0.10	<0.01	0.01	4230964
Total Beryllium (Be)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231944
Total Boron (B)	mg/L	<0.02	<0.02	0.02	0.04	0.02	0.03	0.06	0.03	<0.02	0.02	4230964
Total Calcium (Ca)	mg/L	130	130	0.3	190	0.3	5.8	140	140	5.9	0.3	4230964
Total Chromium (Cr)	mg/L	0.003	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231944
Total Cobalt (Co)	mg/L	0.0047	0.0041	0.0003	<0.002	0.002	<0.0003	0.0005	0.0033	<0.0003	0.0003	4231944
Total Copper (Cu)	mg/L	0.022	0.0048	0.0002	0.002	0.001	0.0020	0.0051	0.0038	0.0017	0.0002	4231944
Total Iron (Fe)	mg/L	5.0	3.8	0.06	0.38	0.06	0.12	0.39	2.7	0.09	0.06	4230964
Total Lead (Pb)	mg/L	0.0092	0.014	0.0002	<0.001	0.001	<0.0002	0.0048	0.0087	<0.0002	0.0002	4231944
Total Lithium (Li)	mg/L	<0.02	<0.02	0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	0.02	4230964
Total Magnesium (Mg)	mg/L	60	22	0.2	95	0.2	6.1	50	23	6.2	0.2	4230964
Total Manganese (Mn)	mg/L	0.48	0.54	0.004	0.20	0.004	0.006	0.011	0.46	0.005	0.004	4230964
Total Molybdenum (Mo)	mg/L	0.0015	0.0008	0.0002	<0.001	0.001	0.0003	0.0016	0.0008	0.0003	0.0002	4231944
Total Nickel (Ni)	mg/L	0.0045	0.010	0.0005	<0.003	0.003	0.0008	0.0032	0.0095	0.0007	0.0005	4231944
Total Phosphorus (P)	mg/L	0.2	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	4230964
Total Potassium (K)	mg/L	5.6	3.5	0.3	8.1	0.3	1.9	6.2	4.4	2.0	0.3	4230964
Total Selenium (Se)	mg/L	0.0005	<0.0002	0.0002	<0.001	0.001	<0.0002	0.0006	<0.0002	<0.0002	0.0002	4231944
Total Silicon (Si)	mg/L	4.2	3.2	0.1	2.5	0.1	0.7	2.3	3.4	0.7	0.1	4230964
Total Silver (Ag)	mg/L	<0.0001	<0.0001	0.0001	<0.0005	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	4231944
Total Sodium (Na)	mg/L	77	35	0.5	480	0.5	31	160	38	32	0.5	4230964
Total Strontium (Sr)	mg/L	0.26	0.18	0.02	0.86	0.02	0.04	0.27	0.19	0.04	0.02	4230964
Total Sulphur (S)	mg/L	44	38	0.2	84	0.2	1.5	51	40	1.5	0.2	4230964
Total Thallium (Tl)	mg/L	<0.0002	<0.0002	0.0002	<0.001	0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	4231944
Total Tin (Sn)	mg/L	<0.001	<0.001	0.001	<0.005	0.005	<0.001	<0.001	<0.001	<0.001	0.001	4231944
Total Titanium (Ti)	mg/L	0.015	0.002	0.001	<0.005	0.005	0.003	0.006	0.003	0.001	0.001	4231944
Total Uranium (U)	mg/L	0.0057	0.0010	0.0001	0.0010	0.0005	<0.0001	0.0057	0.0011	<0.0001	0.0001	4231944
Total Vanadium (V)	mg/L	0.005	0.001	0.001	<0.005	0.005	<0.001	0.001	<0.001	<0.001	0.001	4231944
Total Zinc (Zn)	mg/L	0.017	0.021	0.003	<0.02	0.02	<0.003	0.014	0.015	<0.003	0.003	4231944

RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		W60921		W61076		
Sampling Date		2010/08/28		2010/08/28		
COC#		A019580		A019580		
	Units	**ROB 6**	**RDL**	**ROB 7**	**RDL**	**QC Batch**
Calculated Parameters						
Dissolved Nitrate (NO3)	mg/L	6.3	0.01	<0.01	0.01	4222711
Dissolved Nitrite (NO2)	mg/L	<0.01	0.01	<0.01	0.01	4222711
Misc. Inorganics						
Conductivity	uS/cm	1500	1	950	1	4226257
pH	N/A	7.66	N/A	7.60	N/A	4226111
Total Dissolved Solids	mg/L	1500	10	970	10	4225852
Total Suspended Solids	mg/L	420	1	80	1	4225835
Anions						
Dissolved Fluoride (F)	mg/L	0.06	0.05	0.06	0.05	4226235
Dissolved Sulphate (SO4)	mg/L	150	1	120	1	4226729
Dissolved Chloride (Cl)	mg/L	280(1)	2	90	1	4226650
Nutrients						
Orthophosphate (P)	mg/L	<0.003	0.003	<0.003	0.003	4230180
Physical Properties						
True Colour	PtCo units	34	2	20	2	4225870

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		W61079		W61081		W61084		W61086		
Sampling Date		2010/08/28		2010/08/28		2010/08/28		2010/08/28		
COC#		A019580		A019580		A019580		A019580		
	Units	**ROB 8**	**RDL**	**ROB 9**	**RDL**	**ROB 10**	**RDL**	**DUP 1**	**RDL**	**QC Batch**
Calculated Parameters										
Dissolved Nitrate (NO3)	mg/L	<0.01	0.01	<0.01	0.01	16	0.01	<0.01	0.01	4222711
Dissolved Nitrite (NO2)	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	4222711
Misc. Inorganics										
Conductivity	uS/cm	4000	1	250	1	1900	1	950	1	4226257
pH	N/A	7.84	N/A	7.45	N/A	7.62	N/A	7.62	N/A	4226111
Total Dissolved Solids	mg/L	3400	10	180	10	1700	10	980	10	4225852
Total Suspended Solids	mg/L	11	1	11	1	57	1	160	1	4225835
Anions										
Dissolved Fluoride (F)	mg/L	0.14	0.05	0.07	0.05	0.05	0.05	0.06	0.05	4226235
Dissolved Sulphate (SO4)	mg/L	230(1)	2	5	1	170	1	130	1	4226729
Dissolved Chloride (Cl)	mg/L	1000(1)	10	58	1	380(1)	5	90	1	4226650
Nutrients										
Orthophosphate (P)	mg/L	0.004	0.003	0.004	0.003	<0.003	0.003	<0.003	0.003	4230180
Physical Properties										
True Colour	PtCo units	59	2	11	2	15	2	20	2	4225870

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		W61088		
Sampling Date		2010/08/28		
COC#		A019580		
	Units	**DUP 2**	**RDL**	**QC Batch**
Calculated Parameters				
Dissolved Nitrate (NO3)	mg/L	<0.01	0.01	4222711
Dissolved Nitrite (NO2)	mg/L	<0.01	0.01	4222711
Misc. Inorganics				
Conductivity	uS/cm	250	1	4226257
pH	N/A	7.45	N/A	4226111
Total Dissolved Solids	mg/L	190	10	4225852
Total Suspended Solids	mg/L	8	1	4225835
Anions				
Dissolved Fluoride (F)	mg/L	0.07	0.05	4226235
Dissolved Sulphate (SO4)	mg/L	5	1	4226729
Dissolved Chloride (Cl)	mg/L	56	1	4226650
Nutrients				
Orthophosphate (P)	mg/L	0.006	0.003	4230180
Physical Properties				
True Colour	PtCo units	10	2	4225870

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		W60921		W61076		W61079		
Sampling Date		2010/08/28		2010/08/28		2010/08/28		
COC#		A019580		A019580		A019580		
	Units	**ROB 6**	**RDL**	**ROB 7**	**RDL**	**ROB 8**	**RDL**	**QC Batch**
Polychlorinated Biphenyls								
Aroclor 1016	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1221	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1232	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1242	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1248	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1254	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1260	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1262	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1268	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Total Aroclors	mg/L	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Surrogate Recovery (%)								
NONACHLOROBIPHENYL (sur.)	%	58		53		45		4229319

Maxxam ID		W61081	W61084		W61086		W61088		
Sampling Date		2010/08/28	2010/08/28		2010/08/28		2010/08/28		
COC#		A019580	A019580		A019580		A019580		
	Units	**ROB 9**	**ROB 10**	**RDL**	**DUP 1**	**RDL**	**DUP 2**	**RDL**	**QC Batch**
Polychlorinated Biphenyls									
Aroclor 1016	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1221	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1232	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1242	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1248	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1254	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1260	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1262	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Aroclor 1268	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Total Aroclors	mg/L	<0.000050	<0.000050	0.000050	<0.00050	0.00050	<0.000050	0.000050	4229319
Surrogate Recovery (%)									
NONACHLOROBIPHENYL (sur.)	%	62	58		57		54		4229319

RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		W60921	W61076	W61079	W61081	W61084	W61086	W61088		
Sampling Date		2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28	2010/08/28		
COC#		A019580	A019580	A019580	A019580	A019580	A019580	A019580		
	Units	**ROB 6**	**ROB 7**	**ROB 8**	**ROB 9**	**ROB 10**	**DUP 1**	**DUP 2**	**RDL**	**QC Batch**
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.002	4229573
Total Mercury (Hg)	ug/L	0.008	0.003	0.009	0.007	0.006	0.007	0.004	0.002	4233333

RDL = Reportable Detection Limit

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
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Site Reference: ROBERT'S BAY
Sampler Initials: RT

Package 1	5.7°C

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

REGULATED METALS (CCME/AT1) - DISSOLVED Comments

Sample W61079-01 Elements by ICPMS - Dissolved: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

REGULATED METALS (CCME/AT1) - TOTAL Comments

Sample W61079-01 Elements by ICPMS - Total: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER) Comments

Sample W61076-02 Polychlorinated Biphenyls: Detection limits raised due to matrix interference

Sample W61086-02 Polychlorinated Biphenyls: Detection limits raised due to matrix interference

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
4225648	F2 (C10-C16 Hydrocarbons)	2010/09/03	95	70 - 130	92	70 - 130	<0.1	mg/L	NC	40
4225648	F3 (C16-C34 Hydrocarbons)	2010/09/03	98	70 - 130	88	70 - 130	<0.1	mg/L	NC	40
4225648	F4 (C34-C50 Hydrocarbons)	2010/09/03	85	70 - 130	82	70 - 130	<0.1	mg/L	NC	40
4225648	O-TERPHENYL (sur.)	2010/09/02	85	70 - 130	97	70 - 130	99	%		
4225661	4-BROMOFLUOROBENZENE (sur.)	2010/09/02	107	70 - 130	105	70 - 130	97	%		
4225661	D4-1,2-DICHLOROETHANE (sur.)	2010/09/02	110	70 - 130	108	70 - 130	107	%		
4225661	D8-TOLUENE (sur.)	2010/09/02	100	70 - 130	101	70 - 130	102	%		
4225661	Benzene	2010/09/02	108	70 - 130	108	70 - 130	<0.4	ug/L	NC	40
4225661	Toluene	2010/09/02	108	70 - 130	104	70 - 130	<0.4	ug/L	NC	40
4225661	Ethylbenzene	2010/09/02	116	70 - 130	106	70 - 130	<0.4	ug/L	NC	40
4225661	o-Xylene	2010/09/02	115	70 - 130	111	70 - 130	<0.4	ug/L	NC	40
4225661	m & p-Xylene	2010/09/02	118	70 - 130	107	70 - 130	<0.8	ug/L	NC	40
4225661	(C6-C10)	2010/09/02			86	70 - 130	<100	ug/L	NC	40
4225661	Xylenes (Total)	2010/09/02					<0.8	ug/L	NC	40
4225661	F1 (C6-C10) - BTEX	2010/09/02					<100	ug/L	NC	40
4225835	Total Suspended Solids	2010/09/01			99	81 - 105	<1	mg/L	0	20
4225852	Total Dissolved Solids	2010/09/02			92	80 - 113	<10	mg/L	0.2	20
4225870	True Colour	2010/09/01			97	90 - 110	<2	PtCo units	NC	20
4226111	pH	2010/09/01			98	97 - 102			0.06	5
4226235	Dissolved Fluoride (F)	2010/09/01	93	80 - 120	94	93 - 111	<0.05	mg/L	NC	20
4226257	Conductivity	2010/09/01			101	93 - 106	<1	uS/cm	1.4	20
4226650	Dissolved Chloride (Cl)	2010/09/01	NC	80 - 120	102	92 - 113	<1	mg/L	0.06	20
4226729	Dissolved Sulphate (SO4)	2010/09/01	NC	80 - 120	102	91 - 116	<1	mg/L	0.3	20
4229319	NONACHLOROBIPHENYL (sur.)	2010/09/03			74	30 - 130	66	%		
4229319	Aroclor 1260	2010/09/03			109	30 - 130	<0.000050	mg/L		
4229319	Aroclor 1016	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1221	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1232	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1242	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1248	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1254	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1262	2010/09/03					<0.000050	mg/L		
4229319	Aroclor 1268	2010/09/03					<0.000050	mg/L		
4229319	Total Aroclors	2010/09/03					<0.000050	mg/L		
4229573	Dissolved Mercury (Hg)	2010/09/02	107	80 - 120	106	80 - 120	<0.002	ug/L	NC	20
4230180	Orthophosphate (P)	2010/09/02	94	80 - 120	102	88 - 104	<0.003	mg/L	NC	20
4230964	Total Barium (Ba)	2010/09/02	90	80 - 120	95	80 - 120	<0.01	mg/L	0.02	20
4230964	Total Boron (B)	2010/09/02	NC	80 - 120	108	80 - 120	<0.02	mg/L	0.7	20
4230964	Total Calcium (Ca)	2010/09/02	NC	80 - 120	103	80 - 120	<0.3	mg/L	2.4	20
4230964	Total Iron (Fe)	2010/09/02	NC	80 - 120	106	80 - 120	<0.06	mg/L	2.8	20

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
4230964	Total Lithium (Li)	2010/09/02	96	80 - 120	94	80 - 120	<0.02	mg/L	NC	20
4230964	Total Magnesium (Mg)	2010/09/02	NC	80 - 120	102	80 - 120	<0.2	mg/L	4.5	20
4230964	Total Manganese (Mn)	2010/09/02	91	80 - 120	99	80 - 120	<0.004	mg/L	1.1	20
4230964	Total Phosphorus (P)	2010/09/03	104	80 - 120	101	80 - 120	<0.1	mg/L		
4230964	Total Potassium (K)	2010/09/02	100	80 - 120	98	80 - 120	<0.3	mg/L	4.0	20
4230964	Total Silicon (Si)	2010/09/02	91	80 - 120	116	80 - 120	<0.1	mg/L	0.5	20
4230964	Total Sodium (Na)	2010/09/02	NC	80 - 120	97	80 - 120	<0.5	mg/L	2.8	20
4230964	Total Strontium (Sr)	2010/09/02	NC	80 - 120	97	80 - 120	<0.02	mg/L	0.4	20
4230964	Total Sulphur (S)	2010/09/02					<0.2	mg/L	4.1	20
4230966	Dissolved Barium (Ba)	2010/09/02	82	80 - 120	95	80 - 110	<0.01	mg/L		
4230966	Dissolved Boron (B)	2010/09/02	91	80 - 120	100	84 - 117	<0.02	mg/L		
4230966	Dissolved Calcium (Ca)	2010/09/02	NC	80 - 120	105	88 - 115	<0.3	mg/L	3.4	20
4230966	Dissolved Iron (Fe)	2010/09/02	89	80 - 120	102	81 - 111	<0.06	mg/L	0.05	20
4230966	Dissolved Lithium (Li)	2010/09/02	90	80 - 120	96	82 - 117	<0.02	mg/L		
4230966	Dissolved Magnesium (Mg)	2010/09/02	NC	80 - 120	103	80 - 120	<0.2	mg/L	1.3	20
4230966	Dissolved Manganese (Mn)	2010/09/02	NC	80 - 120	100	85 - 110	<0.004	mg/L	1.5	20
4230966	Dissolved Phosphorus (P)	2010/09/02	106	80 - 120	104	87 - 116	0.1, RDL=0.1	mg/L		
4230966	Dissolved Potassium (K)	2010/09/02	95	80 - 120	102	85 - 117	<0.3	mg/L	0.9	20
4230966	Dissolved Silicon (Si)	2010/09/02	93	80 - 120	99	80 - 120	<0.1	mg/L		
4230966	Dissolved Sodium (Na)	2010/09/02	NC	80 - 120	98	84 - 118	<0.5	mg/L	3.0	20
4230966	Dissolved Strontium (Sr)	2010/09/02	NC	80 - 120	98	83 - 113	<0.02	mg/L		
4230966	Dissolved Sulphur (S)	2010/09/02					<0.2	mg/L		
4231944	Total Aluminum (Al)	2010/09/03	NC	80 - 120	80	80 - 120	<0.001	mg/L	13.7	20
4231944	Total Antimony (Sb)	2010/09/03	NC	80 - 120	98	80 - 120	<0.0002	mg/L	NC	20
4231944	Total Arsenic (As)	2010/09/03	105	80 - 120	83	80 - 107	<0.0002	mg/L	NC	20
4231944	Total Beryllium (Be)	2010/09/03	107	80 - 120	105	80 - 120	<0.001	mg/L	NC	20
4231944	Total Chromium (Cr)	2010/09/03	101	80 - 120	97	80 - 120	<0.001	mg/L	NC	20
4231944	Total Cobalt (Co)	2010/09/03	107	80 - 120	97	80 - 120	<0.0003	mg/L	NC	20
4231944	Total Copper (Cu)	2010/09/03	101	80 - 120	95	80 - 120	<0.0002	mg/L	NC	20
4231944	Total Lead (Pb)	2010/09/03	114	80 - 120	100	80 - 115	<0.0002	mg/L	NC	20
4231944	Total Molybdenum (Mo)	2010/09/03	NC	80 - 120	101	80 - 120	<0.0002	mg/L	6.5	20
4231944	Total Nickel (Ni)	2010/09/03	NC	80 - 120	98	80 - 120	0.0006, RDL=0.0005	mg/L	9.0	20
4231944	Total Selenium (Se)	2010/09/03	106	80 - 120	105	80 - 120	<0.0002	mg/L	0.4	20
4231944	Total Silver (Ag)	2010/09/03	112	80 - 120	102	80 - 120	<0.0001	mg/L	NC	20
4231944	Total Thallium (Tl)	2010/09/03	114	80 - 120	94	80 - 120	<0.0002	mg/L	NC	20
4231944	Total Tin (Sn)	2010/09/03	119	80 - 120	97	80 - 120	<0.001	mg/L	NC	20
4231944	Total Titanium (Ti)	2010/09/03	NC	80 - 120	96	80 - 120	<0.001	mg/L	NC	20
4231944	Total Uranium (U)	2010/09/03	114	80 - 120	101	80 - 120	<0.0001	mg/L	3.3	20
4231944	Total Vanadium (V)	2010/09/03	114	80 - 120	100	80 - 120	<0.001	mg/L	NC	20
4231944	Total Zinc (Zn)	2010/09/03	92	75 - 125	82	75 - 125	0.005, RDL=0.003	mg/L	NC	20

Maxxam Job #: B078600
Report Date: 2010/09/08

FRANZ ENVIRONMENTAL INC.
Client Project #: 1697-1001
Site Reference: ROBERT'S BAY
Sampler Initials: RT

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
4231959	Dissolved Aluminum (Al)	2010/09/03	NC	80 - 120	90	80 - 120	<0.001	mg/L		
4231959	Dissolved Antimony (Sb)	2010/09/03	119	80 - 120	107	80 - 120	<0.0002	mg/L		
4231959	Dissolved Arsenic (As)	2010/09/03	110	80 - 120	99	83 - 104	<0.0002	mg/L		
4231959	Dissolved Beryllium (Be)	2010/09/03	84	80 - 120	92	80 - 120	<0.001	mg/L		
4231959	Dissolved Chromium (Cr)	2010/09/03	106	80 - 120	102	80 - 115	<0.001	mg/L	NC	20
4231959	Dissolved Cobalt (Co)	2010/09/03	108	80 - 120	104	80 - 120	<0.0003	mg/L	NC	20
4231959	Dissolved Copper (Cu)	2010/09/03	103	80 - 120	103	80 - 116	<0.0002	mg/L	0.5	20
4231959	Dissolved Lead (Pb)	2010/09/03	103	80 - 120	107	80 - 116	<0.0002	mg/L	NC	20
4231959	Dissolved Molybdenum (Mo)	2010/09/03	117	80 - 120	105	80 - 118	<0.0002	mg/L		
4231959	Dissolved Nickel (Ni)	2010/09/03	101	80 - 120	101	80 - 116	<0.0005	mg/L	NC	20
4231959	Dissolved Thallium (Tl)	2010/09/03	107	80 - 120	107	80 - 116	<0.0002	mg/L		
4231959	Dissolved Tin (Sn)	2010/09/03	96	80 - 120	101	80 - 120	<0.001	mg/L		
4231959	Dissolved Titanium (Ti)	2010/09/03	102	80 - 120	95	80 - 115	<0.001	mg/L		
4231959	Dissolved Vanadium (V)	2010/09/03	110	80 - 120	101	80 - 120	<0.001	mg/L		
4231959	Dissolved Selenium (Se)	2010/09/03			100	80 - 117	<0.0002	mg/L		
4231959	Dissolved Silver (Ag)	2010/09/03			94	80 - 119	<0.0001	mg/L		
4231959	Dissolved Uranium (U)	2010/09/03			111	80 - 120	<0.0001	mg/L		
4231959	Dissolved Zinc (Zn)	2010/09/03			104	80 - 120	<0.003	mg/L		
4232047	Dissolved Nitrite (N)	2010/09/02	93	80 - 120	94	80 - 120	<0.003	mg/L	NC	20
4232047	Dissolved Nitrate (N)	2010/09/02	97	80 - 120	94	82 - 116	<0.003	mg/L	0.6	20
4233333	Total Mercury (Hg)	2010/09/03	NC	80 - 120	99	80 - 120	<0.002	ug/L	6.4	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
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 to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
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 not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

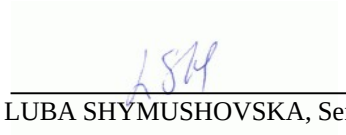
Maxxam Job #: B078600

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

RON VENZI, Scientific Specialist

WILFRED WAN, Analyst II, Organic Department

ORLA JORGENSEN, Organics Supervisor



LUBA SHYMUSHOVSKA, Senior Analyst, Organic Department

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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.

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody A019580

Page: 1 of 1

	Invoice To: C/O Report Address ☑	Report To: Same as Invoice ☐	Report Distribution (E-Mail):	REGULATORY GUIDELINES:
Company:	Franc Environmental	// Same as invoice //	tranger@francenvironmental.com	☐ AT1
Contact:	Tina Ranger		MCyr@francenvironmental.com	☑ CCME
Address:	329 Churchill Ave, Ottawa			☐ Regulated Drinking Water
	Prov: Ontario PC: K1Z5B8	Prov: PC:		☐ Other:
Contact #s:	Ph: 613-721-0555 Cell: 819-360-2462	Ph: Cell:		

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	na
Project # / Name:	1697-1001
Site Location:	Roberts Bay
Quote #:	na
Sampled By:	Tina Ranger

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☑BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☐Routine Water ☐Turb ☐F	☐TOC ☐DOC	Regulated Metals (CCME / AT1) Total ✓	Dissolved ✓	Mercury	☐Total ☐Dissolved	Other Analysis: PCBs	pH	Major Ions	Hardness	Conductivity	TDS	TSS	Colour	HOLD - Do not Analyze	# of Containers Submitted
1	ROB6	na	GW	28/08/10							X				X	X			X	X	X	X	X	X	X	X	9
2	ROB7										X				X	X			X	X	X	X	X	X	X	X	9
3	ROB8										X				X	X			X	X	X	X	X	X	X	X	9
4	ROB9										X				X	X			X	X	X	X	X	X	X	X	9
5	ROB10										X				X	X			X	X	X	X	X	X	X	X	9
6	Dup-1										X				X	X			X	X	X	X	X	X	X	X	9
7	Dup-2										X				X	X			X	X	X	X	X	X	X	X	9
8											X				X	X			X	X	X	X	X	X	X	X	9
9																											
10																											
11																											
12																											

ARRIVED AT DEPOT:
AUG 31 2010
TEMP: 10/4/3/
12:40

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
TINA RANGER	29/08/10	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Please analyze: pH, conductivity, major ions, hardness TDS + TSS and colour for all samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: CB078600
	RECEIVED AUG 31 2010		Custody Seal / Temperature / Ice
Lab Comments:			

APPENDIX E

QA/QC Discussion

In order to obtain the required minimum of 20% duplicate samples, as stipulated in Long-Term Monitoring Plan, two duplicate soil samples and two duplicate surface water samples were collected at the site in 2010. Obtained analytical results for submitted samples and their duplicate pairs 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 4.6.

All surface water samples for PHCs and PCBs fell within limits of acceptability. The following inorganics did not meet the criteria: total suspended solids. Several metals did not meet criteria: dissolved Cd, total As, Hg, Cd, Co, Cu, Pb, and Zn. Dissolved cadmium, total zinc and total mercury exceeded the acceptable range for "Case D" samples as outlined in Table 4-3. This means that the concentration of the compound in one or more of the samples was less than five times the detection limit. Duplicate samples in this range often exhibit similar concentrations, but the very low concentrations concerned cause minor differences in concentration to be magnified into a discrepancy between the parent and duplicate samples. Relative percent differences for parent and duplicate samples for total cadmium, total cobalt, total copper and total lead were calculated in the traditional manner of absolute difference over average of concentrations (i.e., "Case C"). While the relative percent differences for these duplicates were out of the acceptable range defined by Zeiner, most were less than 30%, with only total lead being above at 47%.

All soil samples for PHCs and PCBs fell within the limits of acceptability as outlined in Table 4-3. Metals (Cr, Co, Cu, Pb, Ni and Zn) and physical parameters samples were more problematic with several parameters outside the limits of acceptability, with "Case C" calculations all over 90%, and calculated relative percent difference for lead at 127%.

The above-mentioned parameters that did not meet the acceptable criteria were present in relatively small concentrations for the most part. Despite the unacceptable percent difference between (RPD) values, the absolute difference in most cases was relatively small. In many cases the absolute difference was on the same order of magnitude as the reportable detection limit. And while RPD results may be unacceptable, the conclusions that would be drawn from using either the primary or duplicate sample chemical results would be the same. In every case, whether for water or soil sample, there was agreement between sampling results as to whether samples exceeded or did not exceed the standards.

The discrepancies between soil samples and their duplicates also highlight the difficulty in obtaining true duplicates due to soil heterogeneity, the small amounts of soil available for sampling in one location and the nature of scattered debris. While every effort was made in the field to obtain good-quality duplicates, other sampling requirements (especially for volatile

components) prohibit any additional soil handling or mixing than that outlined in the field procedures section above.

Lab quality assurance and quality control was reviewed by Franz and is summarized in Table E-1, below.

Table E-1: Laboratory Quality Analysis

Quality Control Method	Soil	Groundwater
Blank	PCBs, metals, PHCs and BTEX were not present in the laboratory blank at detectable levels, which is acceptable. Surrogate recovery was within the acceptable range.	PCBs, metals, PHCs and BTEX were not present in the laboratory blank at detectable levels, which is acceptable. Surrogate recovery was within the acceptable range.
Relative Percent Difference	No RPDs were calculated as a result of undetectable concentrations in parent and duplicate sample for PCBs. RPDs for PHCs and BTEX were all within the acceptable range, although one RPD for PHC F2 was within 0.3% of the upper limit of 50%. RPDs for metals were as high as 16.2% (limit of acceptability is 50%).	No RPDs were calculated as a result of undetectable concentrations in parent and duplicate sample for BTEX/PHCs. RPDs for metals, PCBs and other physical parameters were all within acceptable limits.
Matrix Spike	Percent recoveries for matrix spikes for were within acceptable range.	Percent recoveries for matrix spikes for were within acceptable range.
Spiked Blank	Percent recoveries for matrix spikes for were within acceptable range	Percent recoveries for matrix spikes for were within acceptable range

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 F

Site Photographs

Photo 1. Roberts Bay site showing the SWMF, Borrow Areas 2 and 4 and regraded areas. Direction photo taken: SW (picture # P8290787).

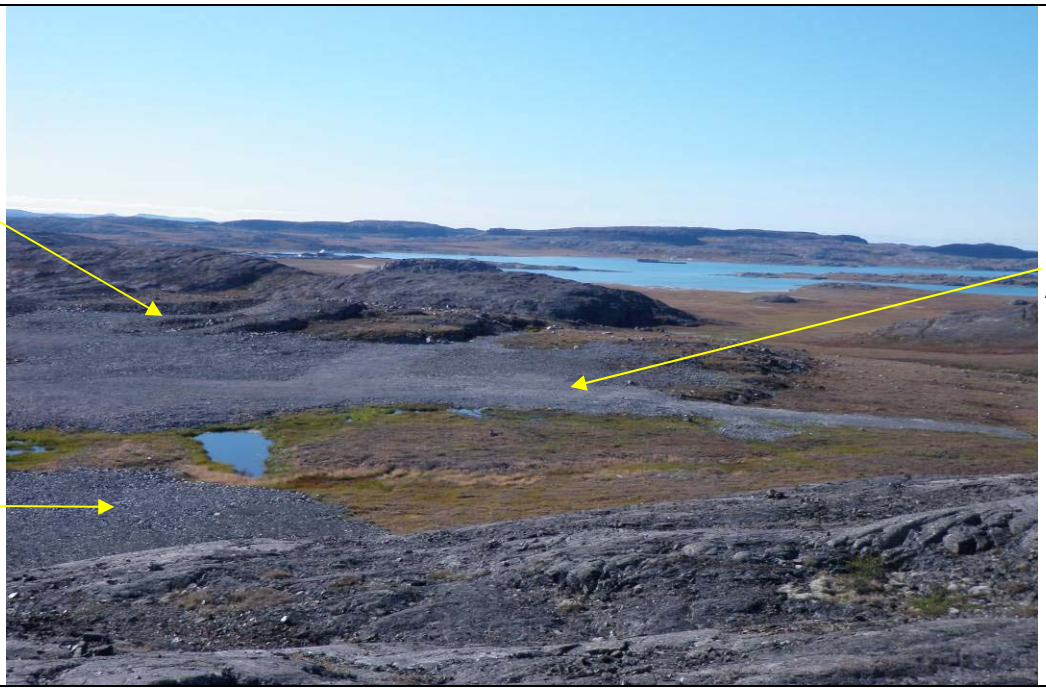


Photo 2. Roberts Bay site showing Borrow Areas 1, 4 and 5 regraded areas. Direction photo taken: W (picture # P8290788).

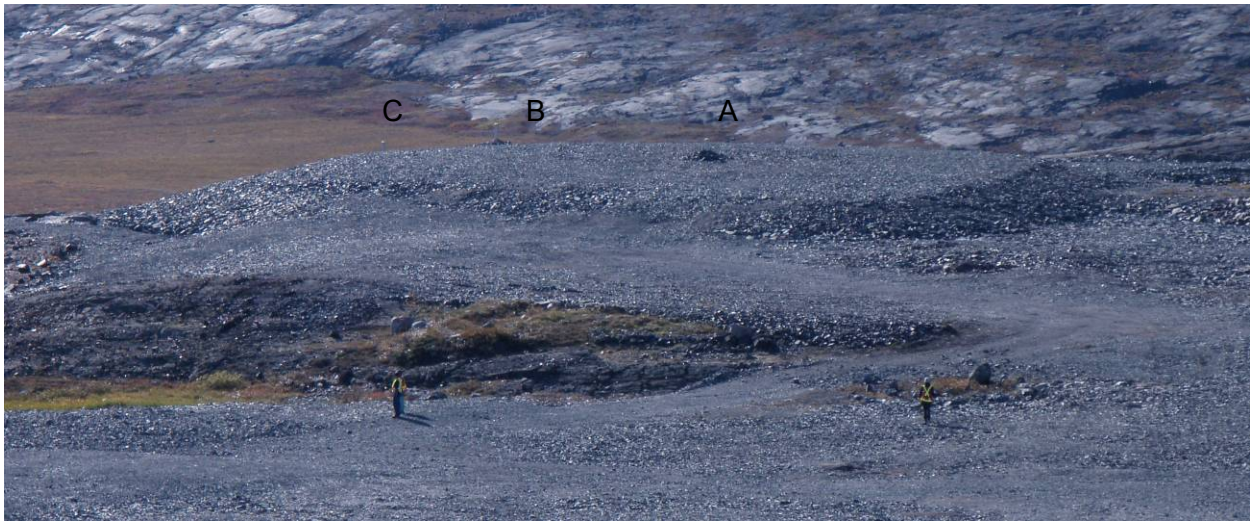


Photo 3. SWMF showing casings for thermistor strings A, B & C. Direction photo taken: SW (picture # P8290789).

Photo 4. Ground squirrel burrow on Borrow Area 4. Direction of photo taken: SE (picture # P8280791).

Photo 5. Stain on regraded area to the east of the SWMF (picture # P8280732).

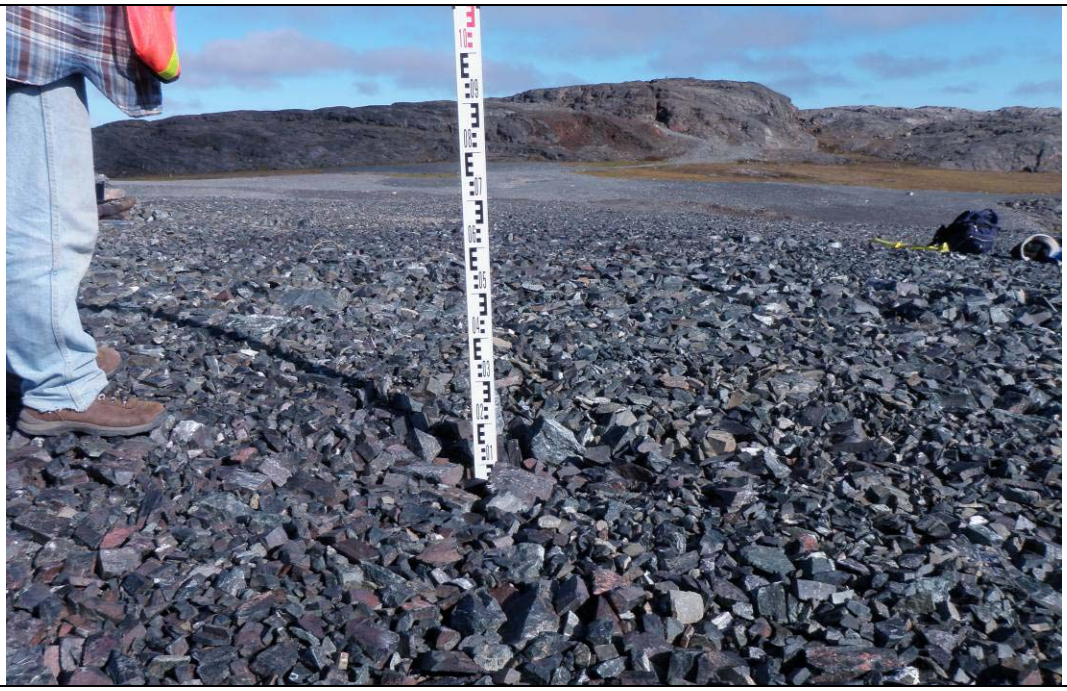


Photo 6. Area of possible settlement and washing out of fines area on top of the SWMF. Picture viewpoint number 28 (Figure A-2, Appendix A). Direction photo taken: E (picture # P8290766).

Photo 7. ROB-8 surface water sampling point (front, left) showing additional surface water body beyond (centre). Stain (Photo 5) to immediate left of camera. Direction photo taken: SE (picture # P8280731).

Photo 8. ROB-7 surface water sampling point with SWMF thermistor casings in the distant background. Surface water slightly obscured by grasses and reeds. Direction photo taken: E (picture # P8280721).

Photo 9. Former adit #2. Direction photo taken: E (picture # P8280792).

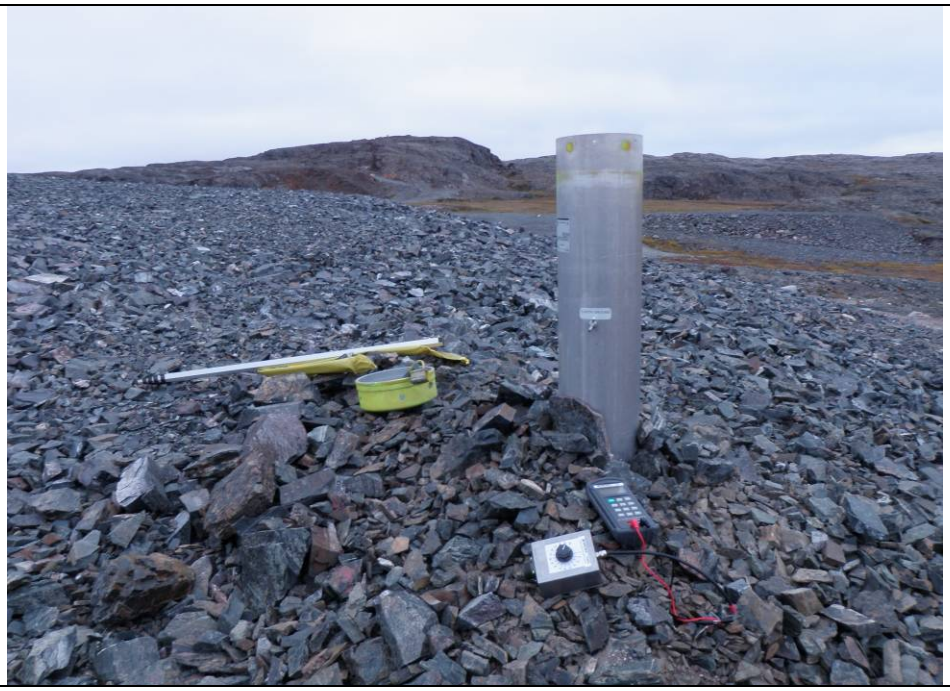


Photo 10. Thermistor String C casing with ohmmeter and diagnostic tools in foreground (ohmmeter and data logger analog channel switchbox). Direction photo taken: E (picture # P8280718).

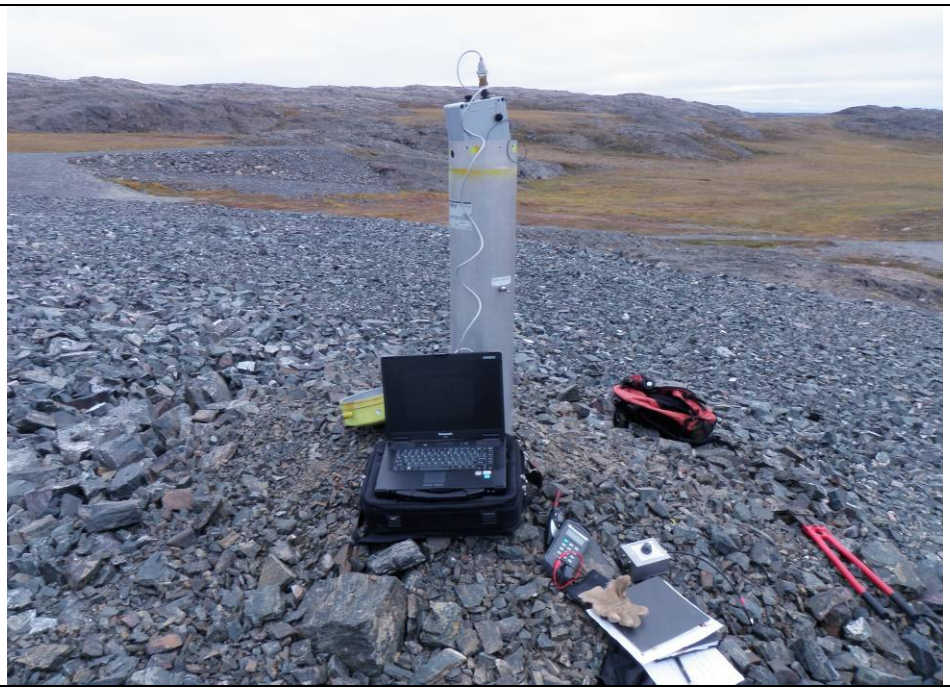


Photo 11. Thermistor String B casing (picture # P8280715).

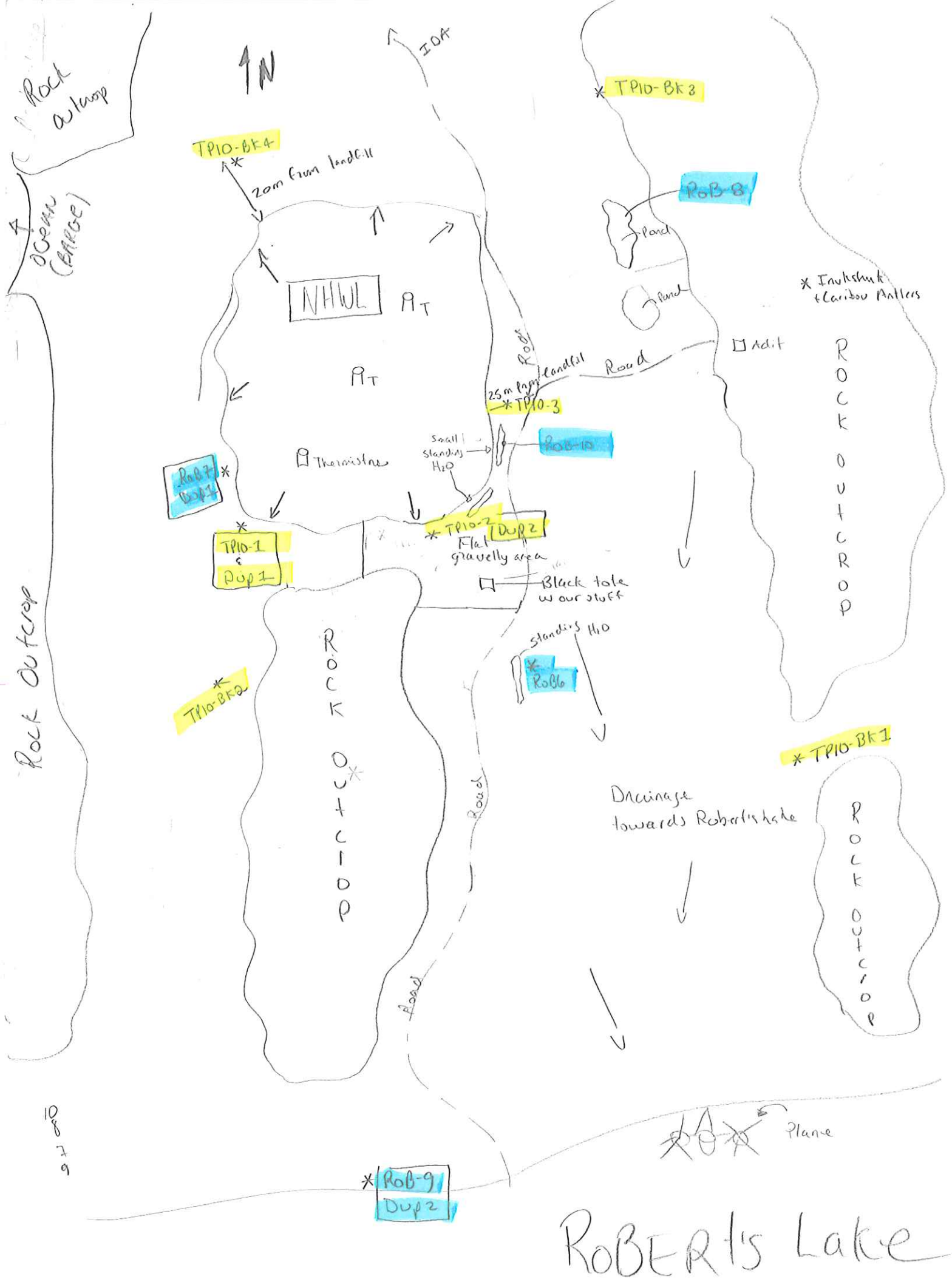
Photo 12. Thermistor String A casing (picture # P8280719).

Table F-1. Picture viewpoint numbers of the NHWL (as depicted in Figure A-2, Appendix A) cross-referenced with picture numbers on attached CD-ROM.

Viewpoint #	Picture #	Viewpoint #	Picture #
1	P8290739	18	P8290764
2	P8290740	19	P8290765
3	P8290752	20	P8290757
4	P8290741	21	P8290756
5	P8290742	22	P8290758
6	P8290753	23	P8290759
7	P8290754	24	P8290760
8	P8290744	25	P8290761
9	P8290745	26	P8290762
10	P8290755	27	P8290769
11	P8290746	28	P8290766
12	P8290747	29	P8290767
13	P8290748	30	P8290768
14	P8290749	31	P8290770
15	P8290750	32	P8290771
16	P8290751	33	P8290743
17	P8290763		

APPENDIX G

Field Notes


Rock outcrop
N
IOA
TP10-BK4
20m from landfill
Ocean (barge)
TP10-BK3
RoB-8
Pond
Pond
Inuktshuk + Caribou Antlers
NHWL
A_T
A_T
Road
Road
Adit
ROCK OUTCROP
25m from landfill
TP10-3
Thermistor
Small standing H_2O
RoB-10
RoB7
Dup1
TP10-1
& Dup 1
TP10-2
Dup2
Flat gravelly area
Black tote w our stuff
standing H_2O
RoB6
TP10-BK2
ROCK OUTCROP
Road
Road
Rock Outcrop
TP10-BK1
Drainage towards Robertslake
ROCK OUTCROP
Plane
RoB-9
Dup2
Roberts Lake

Roberts Bay and Ida Bay
VISUAL MONITORING CHECKLIST

Date:	28/08/10
Landfill:	NHWL Roberts Bay

Visually assess the landfill for the following items & provide a photograph record

1. Erosion	Answer
a) Is erosion occurring on the surface or berms of the landfill?	
i) Are there preferred drainage channels?	NO
ii) Is there sloughing of material?	
b) What is the extent of the erosion? *(percentage of surface area)*	
i) Is it localized or continuous?	
c) Where is the erosion occurring? *(i.e. along the toe, on the surface, through the berms)*	
d) Explanation: *(i.e. evidence of significant surface water run-off, poor material)*	

2. Settlement	Answer
a) Is there differential settlement occurring on the surface?	No
i) Are there low areas or depressions?	Yes (few & small)
ii) Are voids forming?	No
b) What is the extent of the settlement? *(percentage of surface area)*	< 1%
i) Is it localized or continuous?	local.
ii) How deep is it?	< 30 cm
c) Where is the settlement occurring? *(i.e. near berms, near the centre of the facility)* as indicated on fig (marked with ◇?)	
d) Explanation: *(i.e. evidence of significant surface infiltration, water ponding, snow drifting)*	

3. Frost Action	Answer
a) Is there frost action/damage to the landfill?	
i) Is there exposed debris due to uplift?	NO
ii) Is there tension cracking along the berms?	
iii) Is there sorting of granular fill?	
b) What is the extent of the frost action? *(percentage of surface area)*	
i) Is it localized or continuous?	
c) Where is the heaving/cracking occurring? *(i.e. along the toe, on the surface, through the berms)*	
d) Explanation: *(i.e. poor material, poor compaction, high water/silt content in cover material)*	

4. Monitoring Instruments

a) What is the condition of the monitoring wells and thermistor strings *(if applicable)*?

good

5. Others - Confirm presence or absence, extent and description of the following

Animal Burrows: already one burrow (possibly ground squirrel) on regraded area to east of landfill

Vegetation: no significant regrowth since recent clean-up activities on affected land

Staining: none

Vegetation Stress: nothing evident in areas surrounding the recent clean-up activities

Seepage Points: none

Exposed Debris: a couple of slightly exposed barrels slightly to SW of landfill

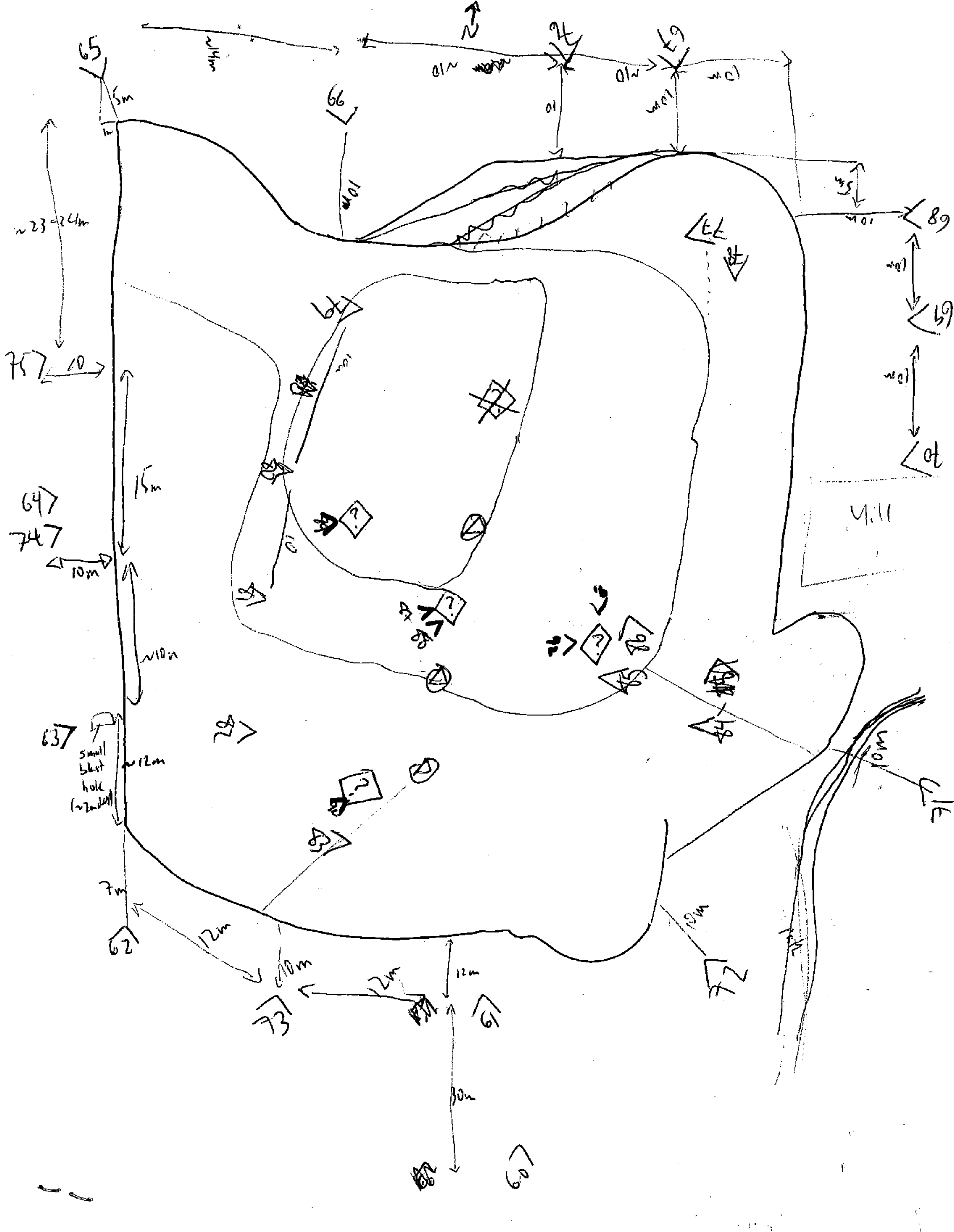
Other observed features:

6. Sketch

See over

"◇?" indicates areas of mild concern, photographed as indicated (possible settlement, though likely insignificant... discuss in final rpt)

7. General Comments


65
5m
66
10m
N
~23-24m
75
10
64
74
10m
15m
~10m
63
small
blast
hole
~12m
7m
62
12m
10m
73
12m
61
30m
60
72
8m

APPENDIX H

Thermistor Details

From monitoring experience at INAC DEW Line and abandoned mine sites, Franz Environmental Inc. suggests the following steps be considered to collect better-quality temperature data with increased efficiency from the thermistor data loggers installed to monitor landfill freezeback.

1. Before the long-term monitoring field program commences, the following information should be confirmed if not recorded in the thermistor installation report: bead type, bead depths, bead offset or calibration data, appropriate temperature conversion file (e.g. 16temp.sff for bead type 44007 if using Lakewood Systems hardware and Prolog software). Without this baseline data, field temperature readings will not be interpretable.

2. A list of provisions and checks for thermistor maintenance should be provided, particularly given that most sites are visited only once per year. The list will increase the chances of rectifying or preventing problems with thermistors in the field, minimizing the chances of leaving malfunctioning loggers in the field to collect a year of bad data – or to collect no data at all. The list of provisions and checks should include (but not be limited to) the following items:
    a. A spare data logger. Consultants should be prepared to change data loggers on site if field observations indicate that the logger in place is not functioning. The logger replaced at the SSDF thermistor 02VT during the 2010 CAM-F monitoring program and sent to Lakewood Systems for repair should now be available to INAC.
    b. A spare set of data logger batteries. Consultants should be prepared to change data logger batteries (a 9V and a 12V lithium) if voltages are low or data logger not functioning (see also note 5 below). One set of batteries, left over from the 2010 CAM-F monitoring program, should be available to INAC.
    c. Consideration for shipment of dangerous goods. Lithium batteries are considered a dangerous good and therefore require special packaging and additional time to be transported to sites.
    d. Desiccant cartridges. Bring spare desiccant cartridges to all sites with thermistors, and open all data logger units to verify if cartridges require replacement (based on colour). Also look for evidence of moisture within the thermistor housing unit and on cable pins, as moisture can cause serious logger malfunction.
    e. Manual data verification. Temperature data should be verified manually in the field each year, for each thermistor string, which means bringing data logger software (with appropriate resistance-temperature conversion file obtained from the manufacturer) and a manual temperature conversion file (.xls), also obtained from the manufacturer. If there is a significant difference (i.e., > 0.2 C, perhaps giving small leeway to top bead and possible rapid temperature change over short time periods), the spare logger should be swapped in and again values compared. An

effort should be made, however, to attempt to minimize the time between manual and logged temperature readings. If issues persist, the beads themselves may not be in good condition (though there is no immediate field option to fix this problem).

f. Manual verification equipment. A switchbox (to isolate and probe individual analog data channels on data loggers) and accurate ohmmeter is required to perform a manual verification of thermistor data loggers and temperature sensing beads. In the event that these are unavailable, manual verification is still possible, if slightly more difficult and less precise. Small alligator clips and a diagram of the data logger cable pin-out (attached later in this appendix) will be required to replace the switchbox (note pin "M" is common). In the absence of a Lakewood-provided, or other sensitive ohmmeter, a low quality multimeter can be used if calibrated, either before or immediately after field measurements. The internal resistors of the Lakewood Systems data loggers may be used for this purpose (contact Lakewood or see attached sheet later in this appendix for some common resistances found in the RX-16 data logger).

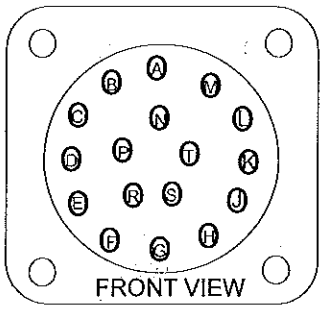
g. Adjust data logger clocks. If consistent temperature comparisons are to be made year to year, time should be verified and corrected to the appropriate local time as some data logger clocks appear to drift significantly over the period of a single year.

3. Whether future installations of thermistor strings include surface (air) temperature beads or not, weather data from the nearest weather stations should be considered in analyses. Although temperature data is likely to be the most reliable and useful, snowfall and wind speed data, landfill aggregate type and moisture content could also be shown to impact landfill freezeback.

4. Reports and data from other permafrost sites with landfill thermistors would be extremely useful in helping to analyse landfill temperature trends.

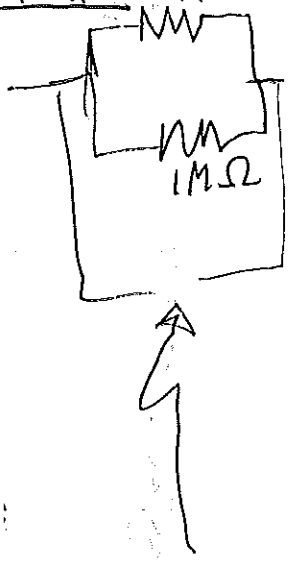
5. A note on battery voltages: The battery voltage levels are particularly meaningful when rechargeable batteries are used. With lithium batteries, as is the case at Roberts Bay, the discharge curve is extremely flat until total failure, when voltage levels drop off abruptly. Because voltage readings are not a good predictor of failure, lithium batteries should generally be replaced based on their date stickers.

RX-16 CONNECTOR PINOUT AND WIRING



PIN#	ALG#	COLOR
PIN A	ALG 1	Black
PIN B	ALG 2	Purple
PIN C	ALG 3	White
PIN D	ALG 4	Grey
PIN E	ALG 5	Red
PIN F	ALG 6	Brown
PIN G	ALG 7	White/Green
PIN H	ALG 8	Blue
PIN J	ALG 9	Green
PIN K	ALG 10	Yellow
PIN L	ALG 11	White/Blue
PIN N	ALG 12	Orange
PIN P	ALG 13	White/Yellow
PIN R	ALG 14	White/Black
PIN S	ALG 15	White/Brown (Bat V)
PIN T	ALG 16	P1 Green
PIN M	REF	Black (18 Guage)

Data logger (thermistor) - verification



- open logger
- red module across top
- analog 1 (A1) + GND
  - meas Ω across : should be 9998Ω ± few ohms (record val)
  - calibrate V-meter afterwards (from ___ to ___)
- jumper A1 & A2 & should get ~5K ± few ohms (for that Ω range)

pin-out for thermistor strip : maybe labelled inside box

(*) leads : L

A-T : pins 1-16 A-H = 1-8 N = 12
J = 9 P-T = 13-16
K-L = 10-11

* Pin "M" is common
* no pin "I", "O",

LAKEWOOD SYSTEMS LTD.
Remote Data Recording Products

CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh01

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.2013	0.2013	0.0000	-0.0208	-0.0208
0.2013	0.2013	0.0000	-0.0208	-0.0208
0.2418	0.2418	0.0000	0.0197	0.0197
0.2418	0.2418	0.0000	0.0197	0.0197
0.2013	0.2013	0.0000	-0.0208	-0.0208
0.2013	0.2013	0.0000	-0.0208	-0.0208
0.2241	0.2241	0.0000	0.0020	0.0020
0.2241	0.2241	0.0000	0.0020	0.0020
0.2418	0.2418	0.0000	0.0197	0.0197
0.2418	0.2418	0.0000	0.0197	0.0197

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh01

SERIAL # A
LOGGER # 07060503

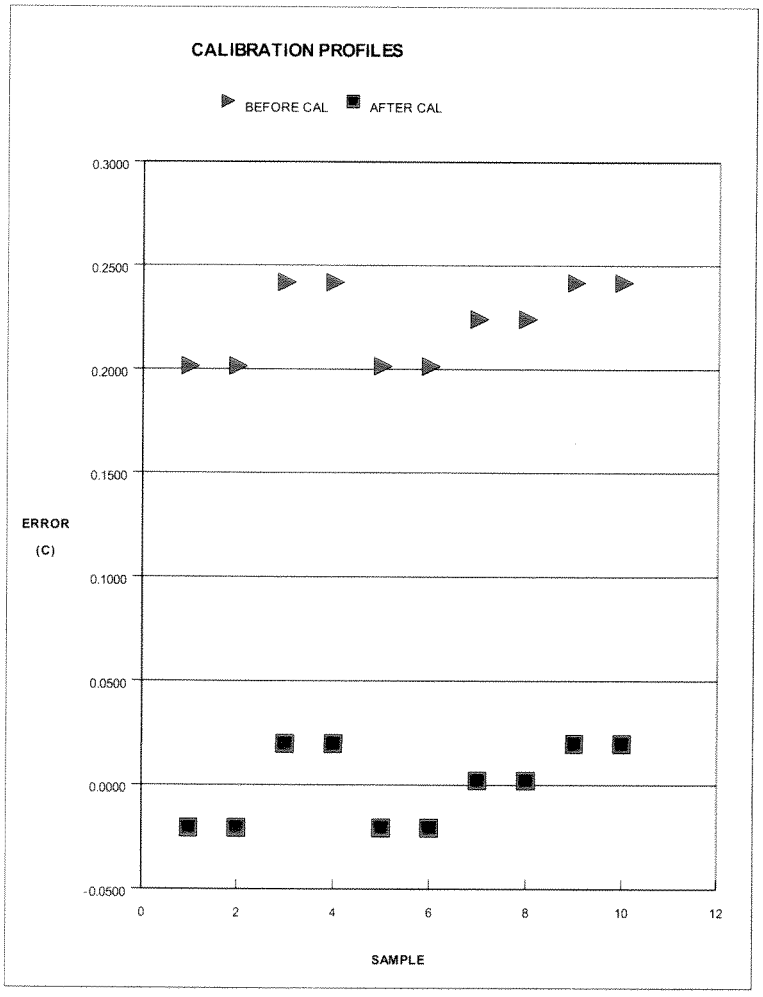
UNITS C

OFFSET (C): -0.2220

C0	448.156423
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



lakewood.com
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Phone: (780) 462-9110 Fax:(780) 450-3867

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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh02

BEFORE CAL ERROR C	BEFORE CAL VALUE C	ACTUAL C	AFTER CAL VALUE C	AFTER CAL ERROR C
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1633	0.1633	0.0000	0.0230	0.0230

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh02

SERIAL # A
LOGGER # 07060503

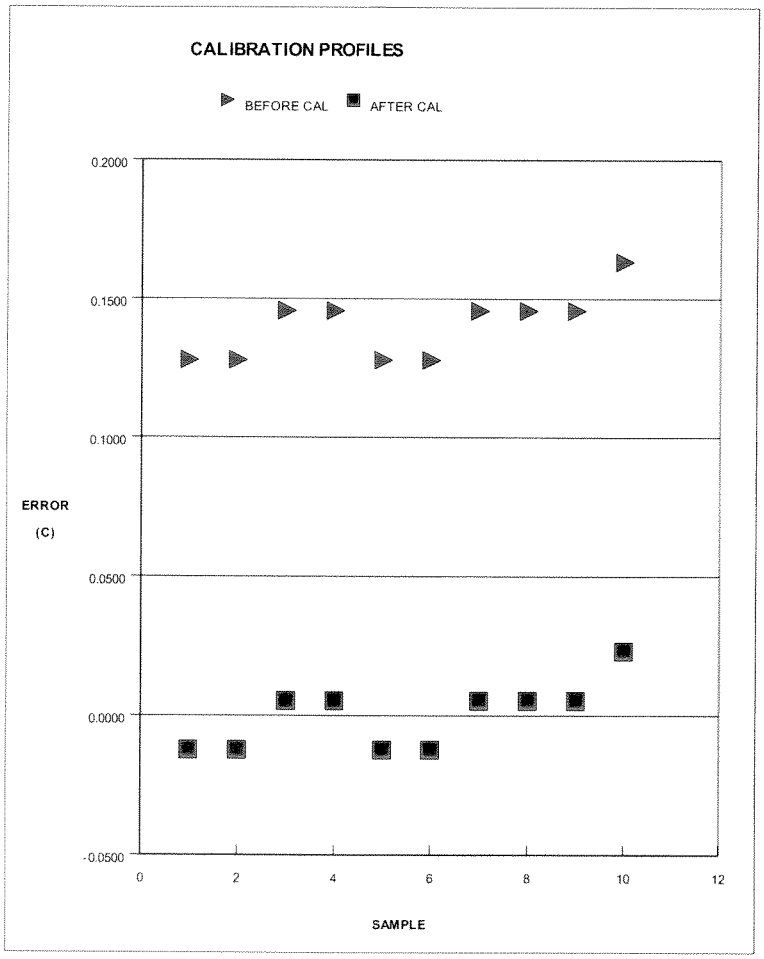
UNITS C

OFFSET (C): -0.1403

C0	448.238194
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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Remote Data Recording Products

CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh03

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
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0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh03

SERIAL # A
LOGGER # 07060503

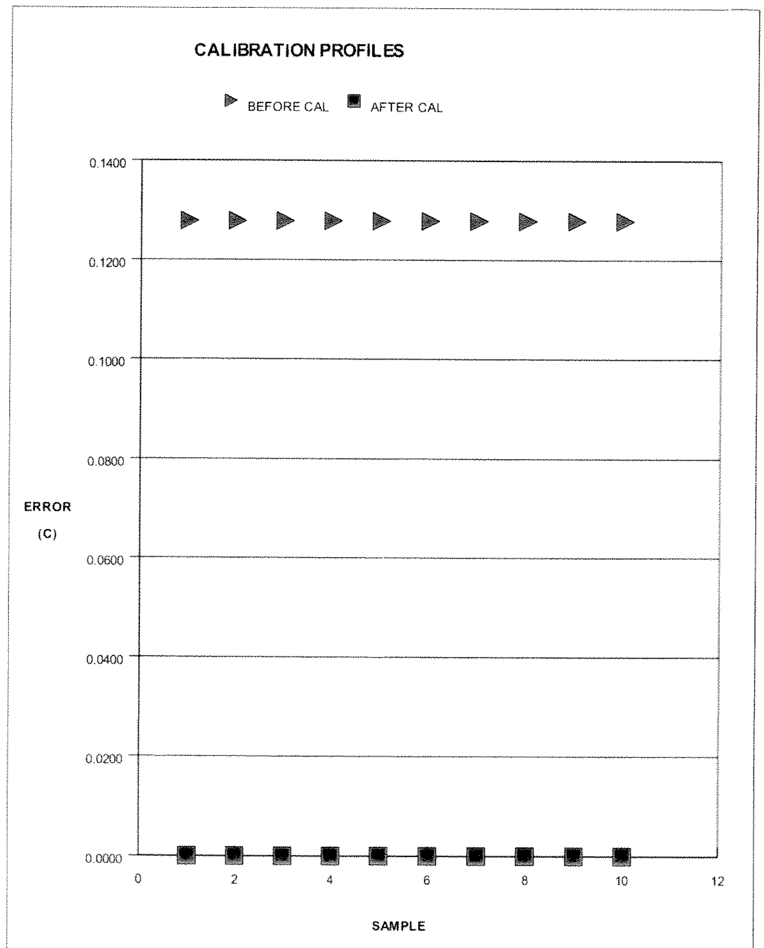
UNITS C

OFFSET (C): -0.1278

C0	448.250603
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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LAKEWOOD SYSTEMS LTD.
Remote Data Recording Products

CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh04

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
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0.1000	0.1000	0.0000	-0.0137	-0.0137
0.1278	0.1278	0.0000	0.0142	0.0142
0.1177	0.1177	0.0000	0.0041	0.0041
0.1000	0.1000	0.0000	-0.0137	-0.0137
0.1000	0.1000	0.0000	-0.0137	-0.0137
0.1177	0.1177	0.0000	0.0041	0.0041
0.1278	0.1278	0.0000	0.0142	0.0142
0.1177	0.1177	0.0000	0.0041	0.0041
0.1278	0.1278	0.0000	0.0142	0.0142

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh04

SERIAL # A
LOGGER # 07060503

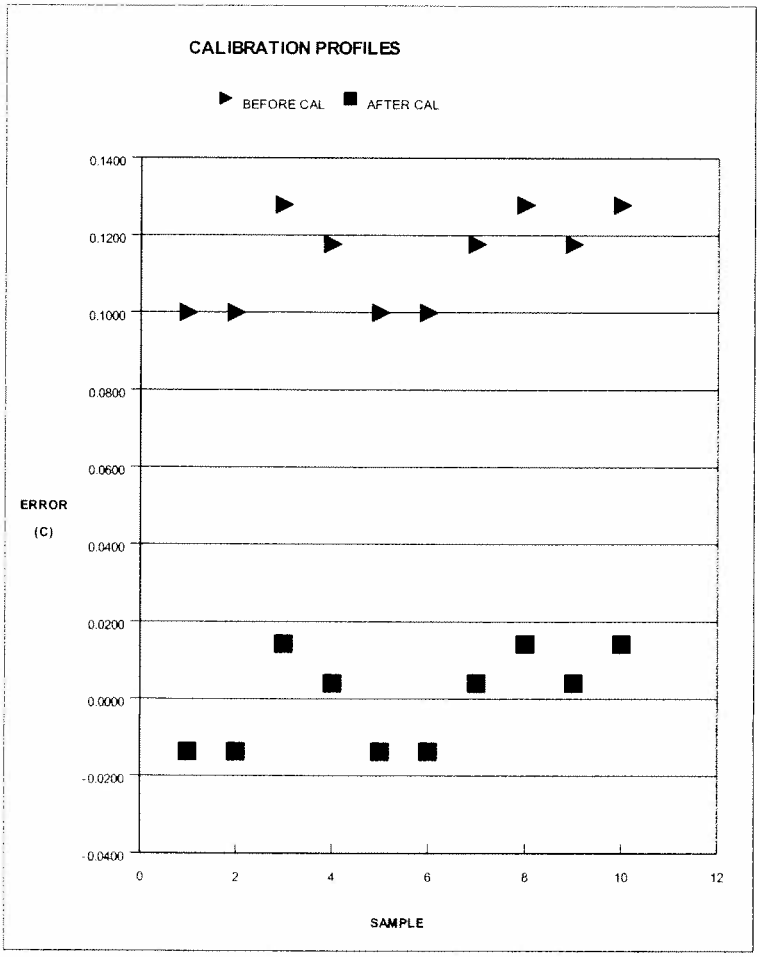
UNITS C

OFFSET (C): -0.1137

C0	448.264786
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh05

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1456	0.1456	0.0000	-0.0165	-0.0165
0.1633	0.1633	0.0000	0.0013	0.0013
0.1633	0.1633	0.0000	0.0013	0.0013
0.1633	0.1633	0.0000	0.0013	0.0013
0.1456	0.1456	0.0000	-0.0165	-0.0165
0.1456	0.1456	0.0000	-0.0165	-0.0165
0.1633	0.1633	0.0000	0.0013	0.0013
0.1836	0.1836	0.0000	0.0215	0.0215
0.1633	0.1633	0.0000	0.0013	0.0013
0.1836	0.1836	0.0000	0.0215	0.0215

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh05

SERIAL # A
LOGGER # 07060503

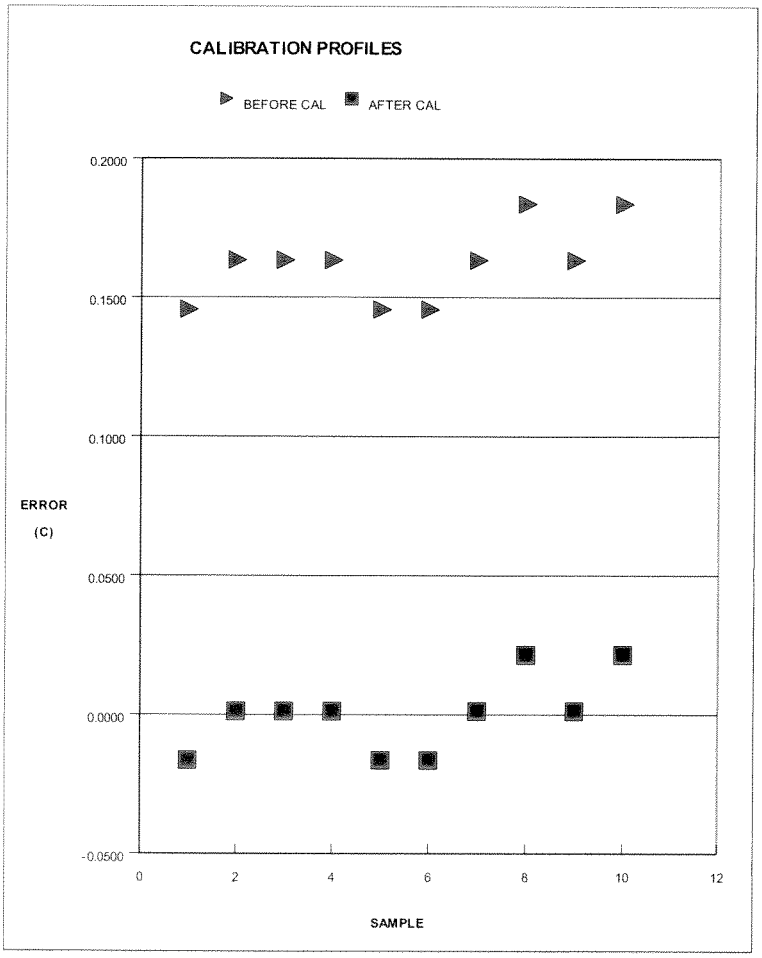
UNITS C

OFFSET (C): -0.1620

C0	448.216418
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh06

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
0.2013	0.2013	0.0000	-0.0154	-0.0154
0.2013	0.2013	0.0000	-0.0154	-0.0154
0.2241	0.2241	0.0000	0.0073	0.0073
0.2241	0.2241	0.0000	0.0073	0.0073
0.2013	0.2013	0.0000	-0.0154	-0.0154
0.2013	0.2013	0.0000	-0.0154	-0.0154
0.2241	0.2241	0.0000	0.0073	0.0073
0.2241	0.2241	0.0000	0.0073	0.0073
0.2418	0.2418	0.0000	0.0251	0.0251
0.2241	0.2241	0.0000	0.0073	0.0073

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh06

SERIAL # A
LOGGER # 7060503

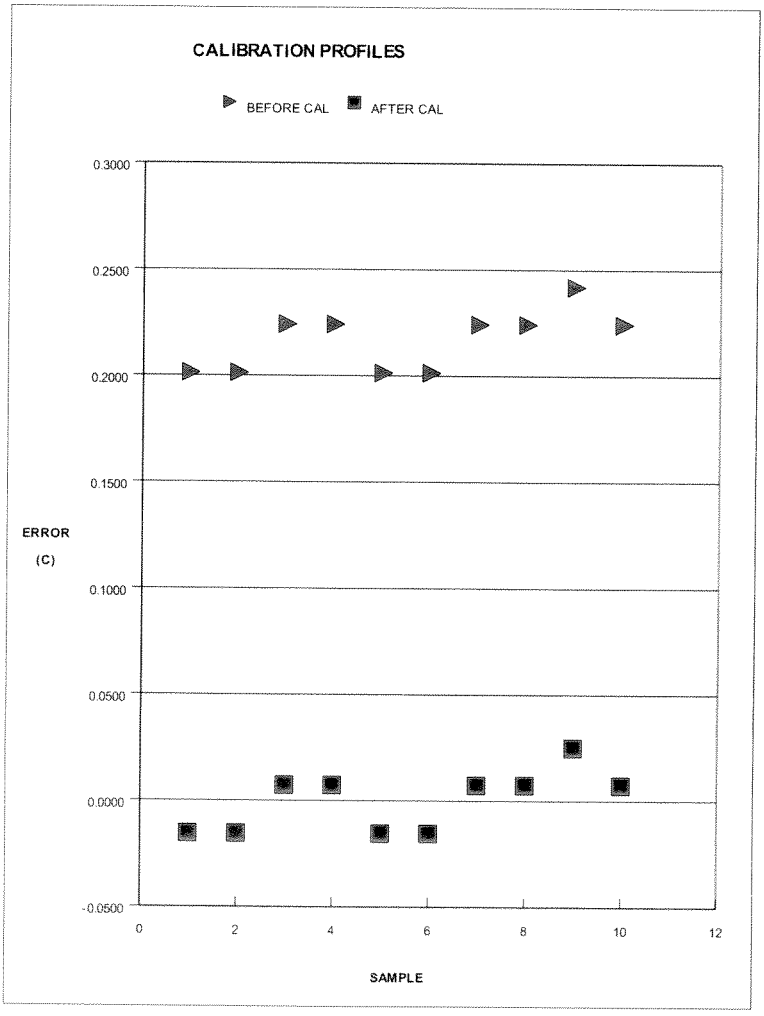
UNITS C

OFFSET (C): -0.2167

C0	448.161738
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh07

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh07

SERIAL # A
LOGGER # 07060503

UNITS C

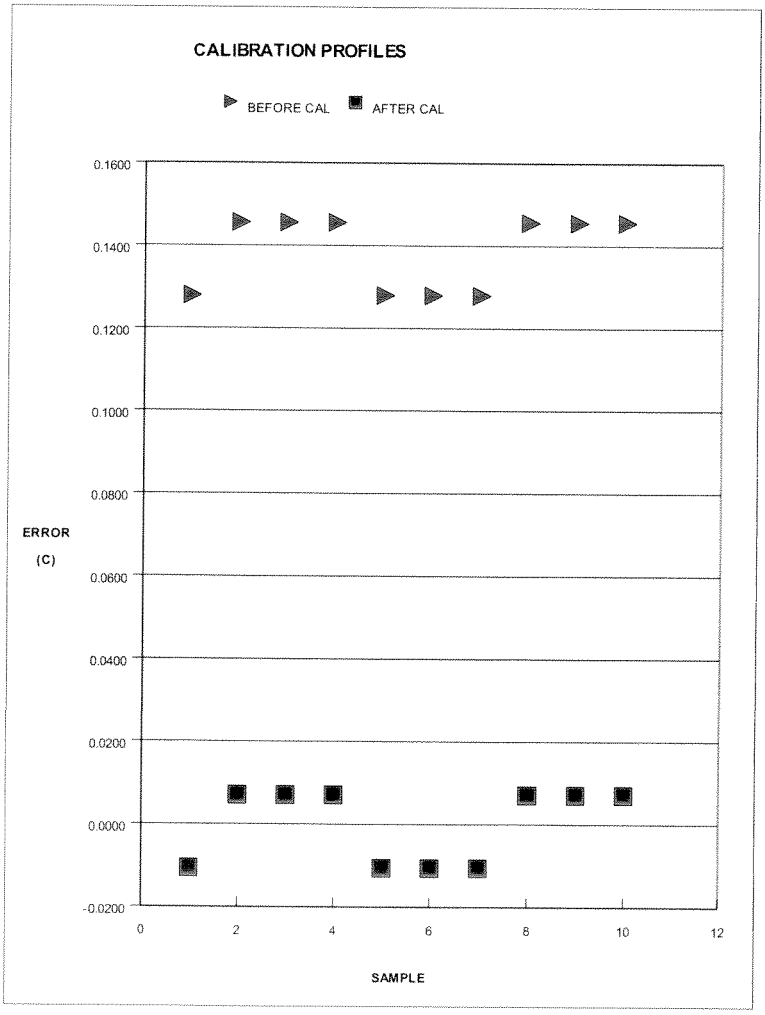
OFFSET (C): -0.1385

C0	448.239967
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094

Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh08

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.0797	0.0797	0.0000	-0.0236	-0.0236
0.1000	0.1000	0.0000	-0.0033	-0.0033
0.1000	0.1000	0.0000	-0.0033	-0.0033
0.1177	0.1177	0.0000	0.0144	0.0144
0.1000	0.1000	0.0000	-0.0033	-0.0033
0.1000	0.1000	0.0000	-0.0033	-0.0033
0.1000	0.1000	0.0000	-0.0033	-0.0033
0.1177	0.1177	0.0000	0.0144	0.0144
0.1177	0.1177	0.0000	0.0144	0.0144
0.1000	0.1000	0.0000	-0.0033	-0.0033

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh08

SERIAL # A
LOGGER # 07060503

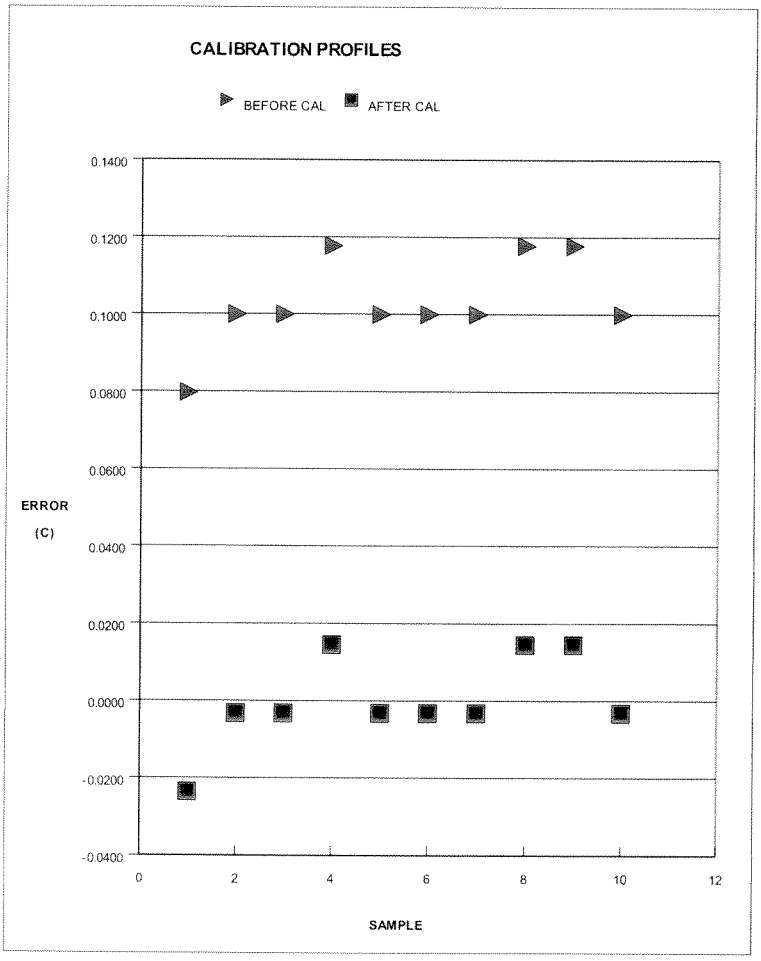
UNITS C

OFFSET (C): -0.1033

C0	448.275170
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703A-STRING-ACh09

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1278	0.1278	0.0000	0.0081	0.0081
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1278	0.1278	0.0000	0.0081	0.0081
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1177	0.1177	0.0000	-0.0020	-0.0020
0.1177	0.1177	0.0000	-0.0020	-0.0020

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-ACh09

SERIAL # A
LOGGER # 07060503

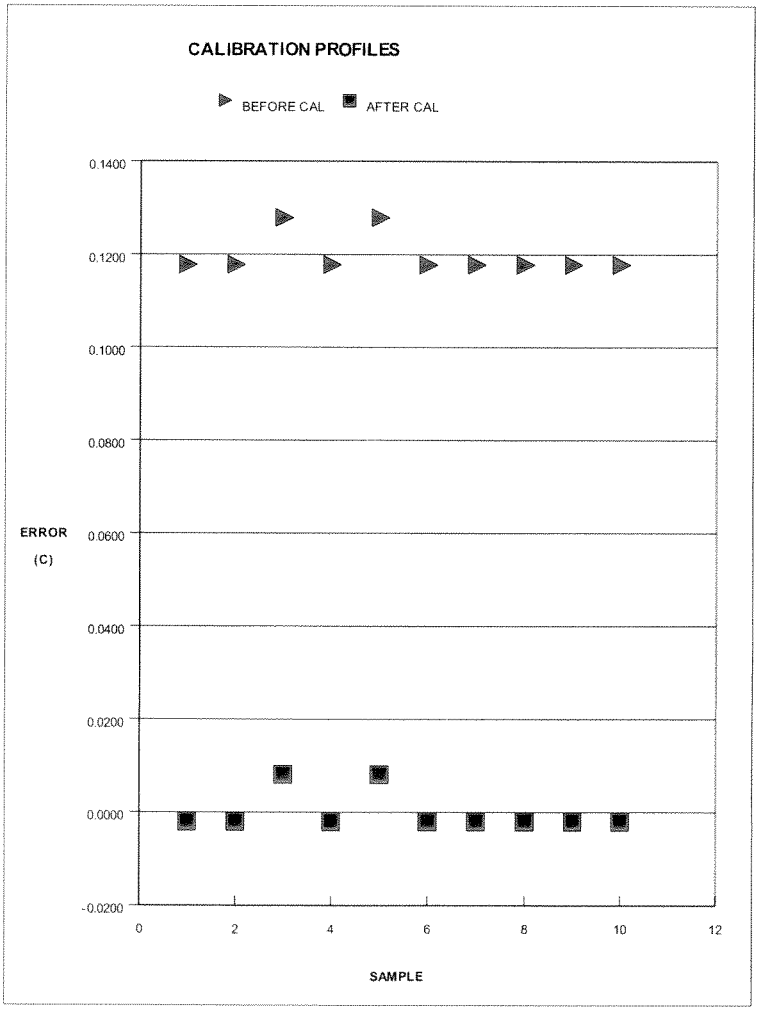
UNITS C

OFFSET (C): -0.1197

C0	448.258707
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh01

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1278	0.1278	0.0000	-0.0124	-0.0124
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053
0.1456	0.1456	0.0000	0.0053	0.0053

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh01

SERIAL # B
LOGGER # 07060501

UNITS C

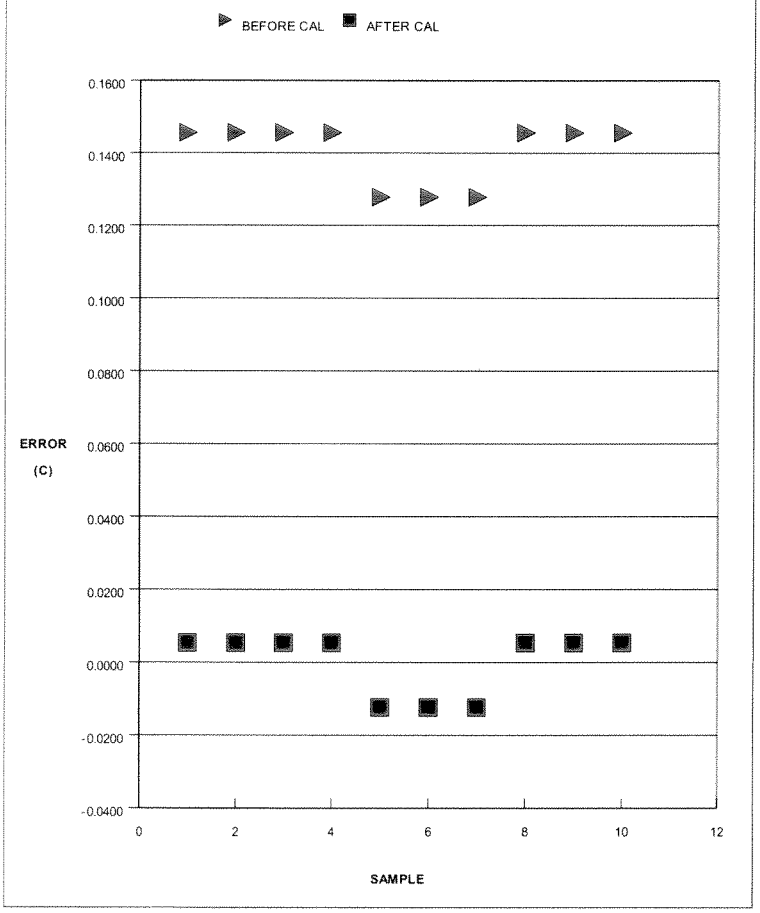
OFFSET (C): -0.1403

C0	448.238194
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021

CALIBRATION PROFILES



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh02

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1456	0.1456	0.0000	-0.0127	-0.0127
0.1456	0.1456	0.0000	-0.0127	-0.0127
0.1633	0.1633	0.0000	0.0051	0.0051
0.1456	0.1456	0.0000	-0.0127	-0.0127
0.1633	0.1633	0.0000	0.0051	0.0051
0.1633	0.1633	0.0000	0.0051	0.0051
0.1456	0.1456	0.0000	-0.0127	-0.0127
0.1836	0.1836	0.0000	0.0253	0.0253
0.1633	0.1633	0.0000	0.0051	0.0051
0.1633	0.1633	0.0000	0.0051	0.0051

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh02

SERIAL # B
LOGGER # 07060501

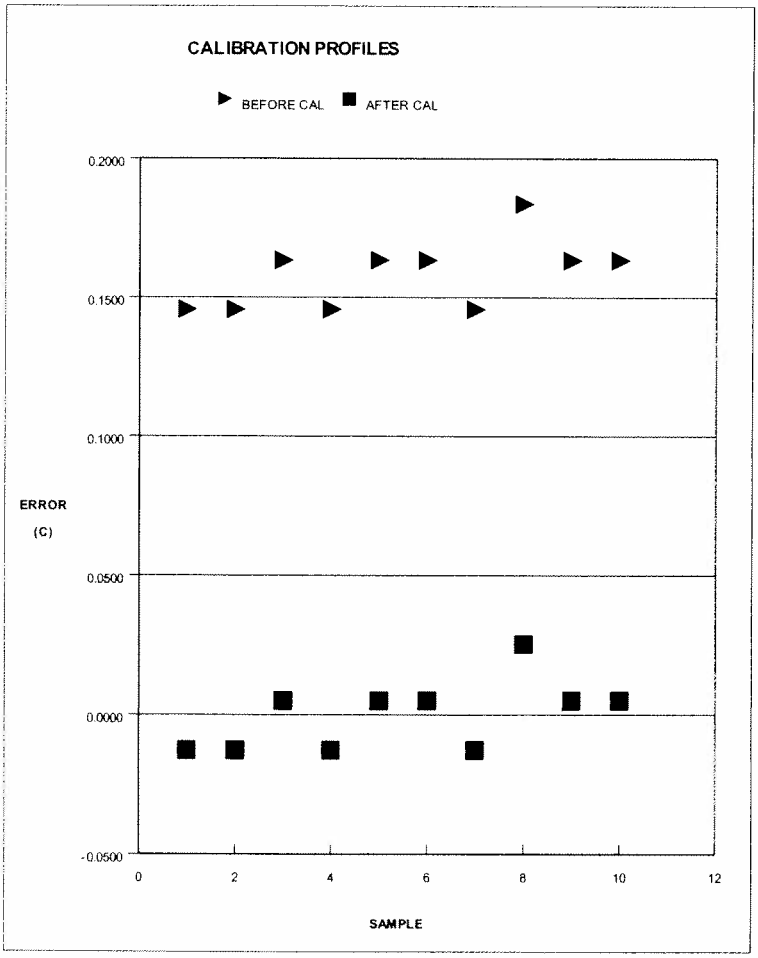
UNITS C

OFFSET (C): -0.1582

C0	448.220216
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh03

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
0.1456	0.1456	0.0000	0.0035	0.0035
0.1456	0.1456	0.0000	0.0035	0.0035
0.1633	0.1633	0.0000	0.0213	0.0213
0.1456	0.1456	0.0000	0.0035	0.0035
0.1278	0.1278	0.0000	-0.0142	-0.0142
0.1278	0.1278	0.0000	-0.0142	-0.0142
0.1278	0.1278	0.0000	-0.0142	-0.0142
0.1633	0.1633	0.0000	0.0213	0.0213
0.1278	0.1278	0.0000	-0.0142	-0.0142
0.1456	0.1456	0.0000	0.0035	0.0035

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh03

SERIAL # B
LOGGER # 07060501

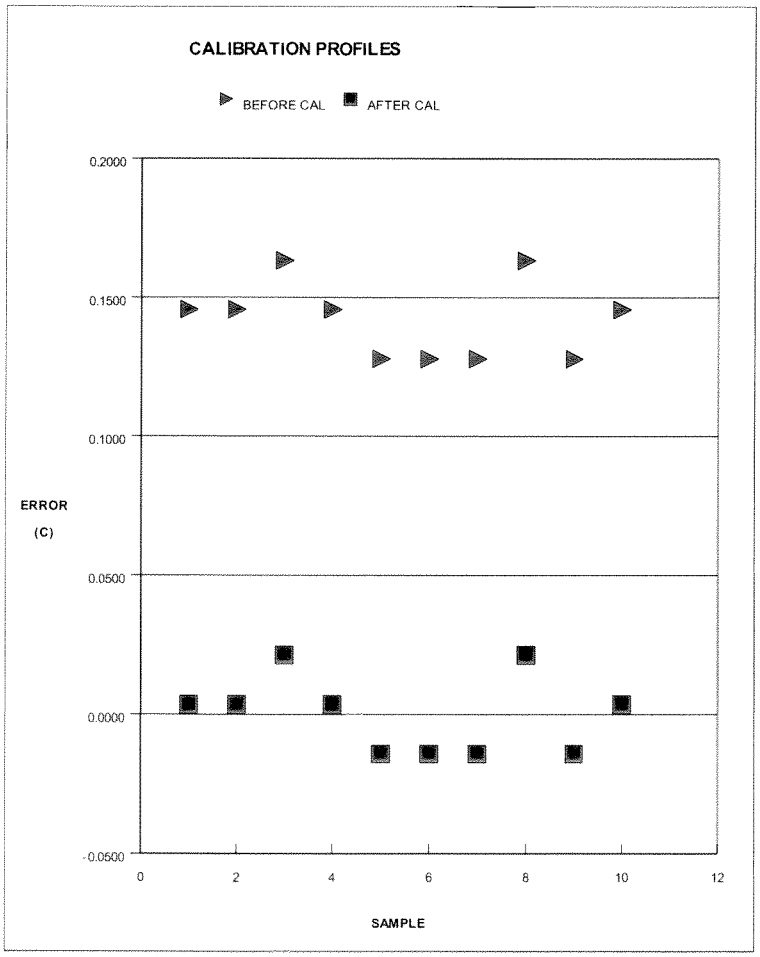
UNITS C

OFFSET (C): -0.1420

C0	448.236422
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh04

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1456	0.1456	0.0000	0.0124	0.0124
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1633	0.1633	0.0000	0.0301	0.0301
0.1278	0.1278	0.0000	-0.0053	-0.0053
0.1278	0.1278	0.0000	-0.0053	-0.0053

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh04

SERIAL # B
LOGGER # 07060501

UNITS C

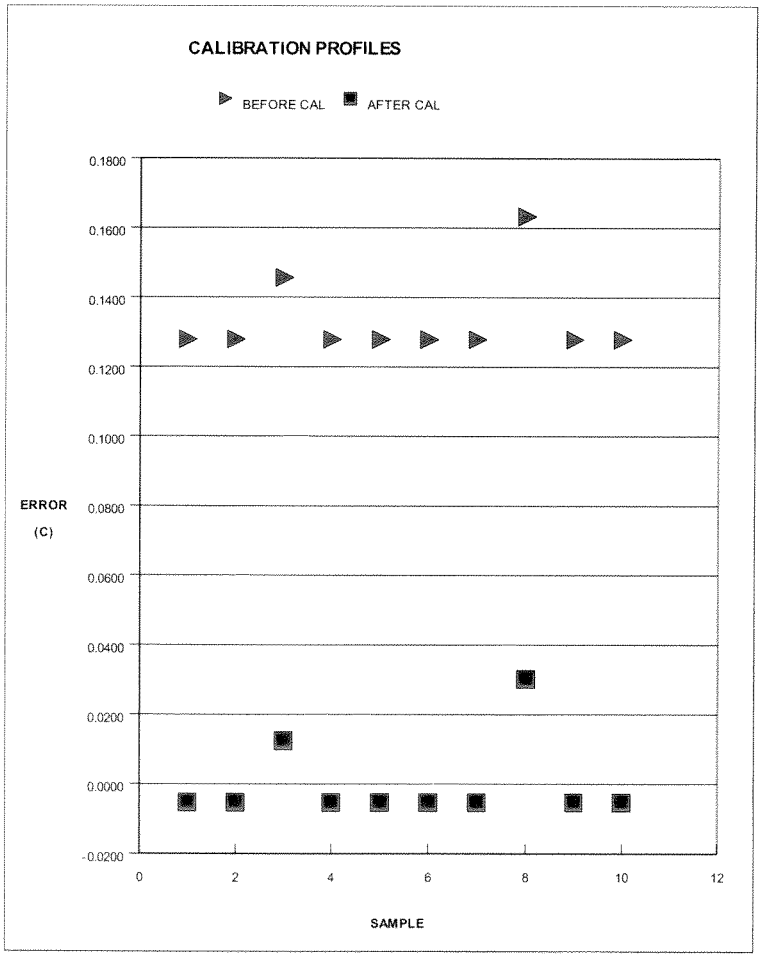
OFFSET (C): -0.1332

C0	448.245285
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021

CALIBRATION PROFILES



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh05

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh05

SERIAL # B
LOGGER # 07060501

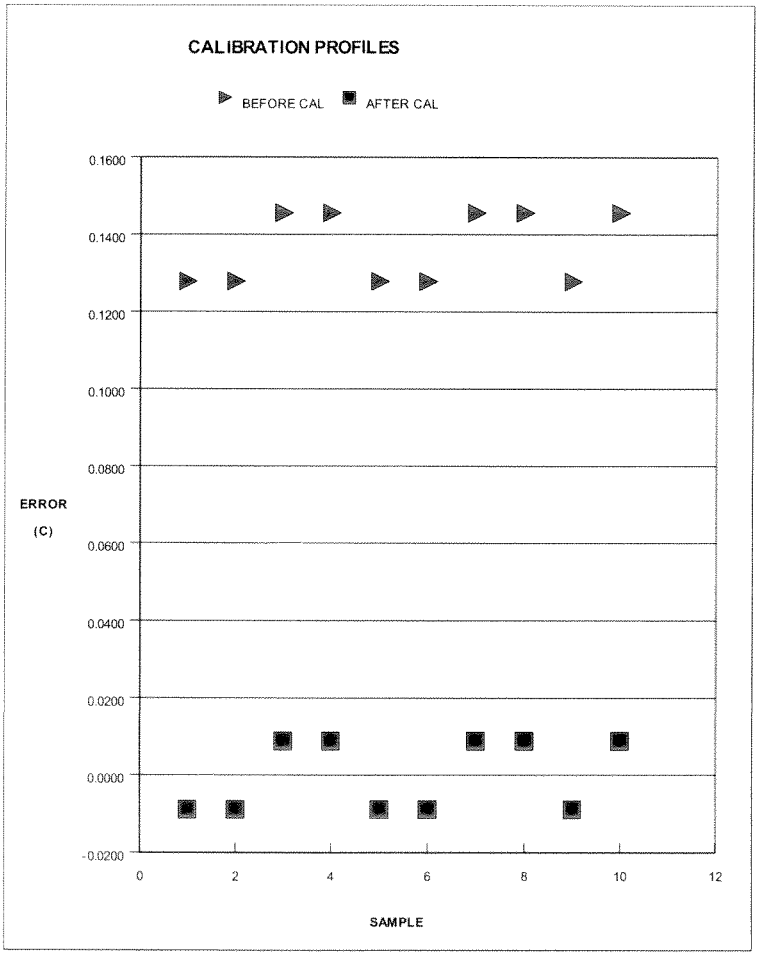
UNITS C

OFFSET (C): -0.1367

C0	448.241740
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh06

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	0.0071	0.0071
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	0.0071	0.0071
0.1278	0.1278	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	0.0071	0.0071

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh06

SERIAL # B
LOGGER # 7060501

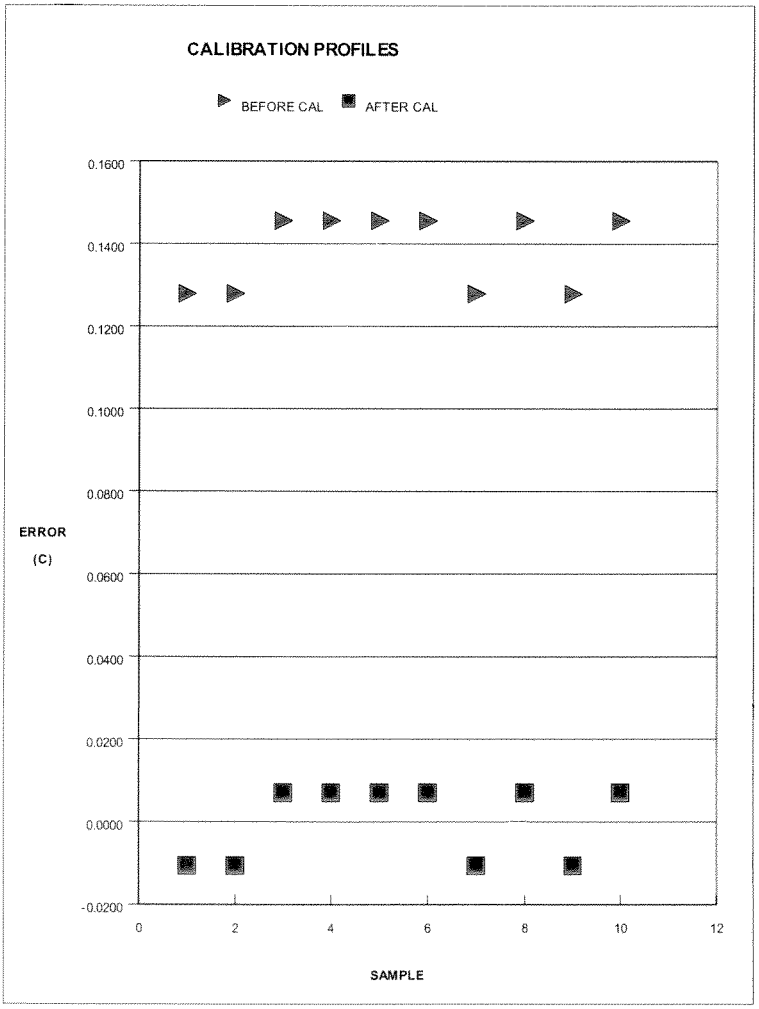
UNITS C

OFFSET (C): -0.1385

C0	448.239967
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh07

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1633	0.1633	0.0000	0.0266	0.0266
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh07

SERIAL # B
LOGGER # 07060501

UNITS C

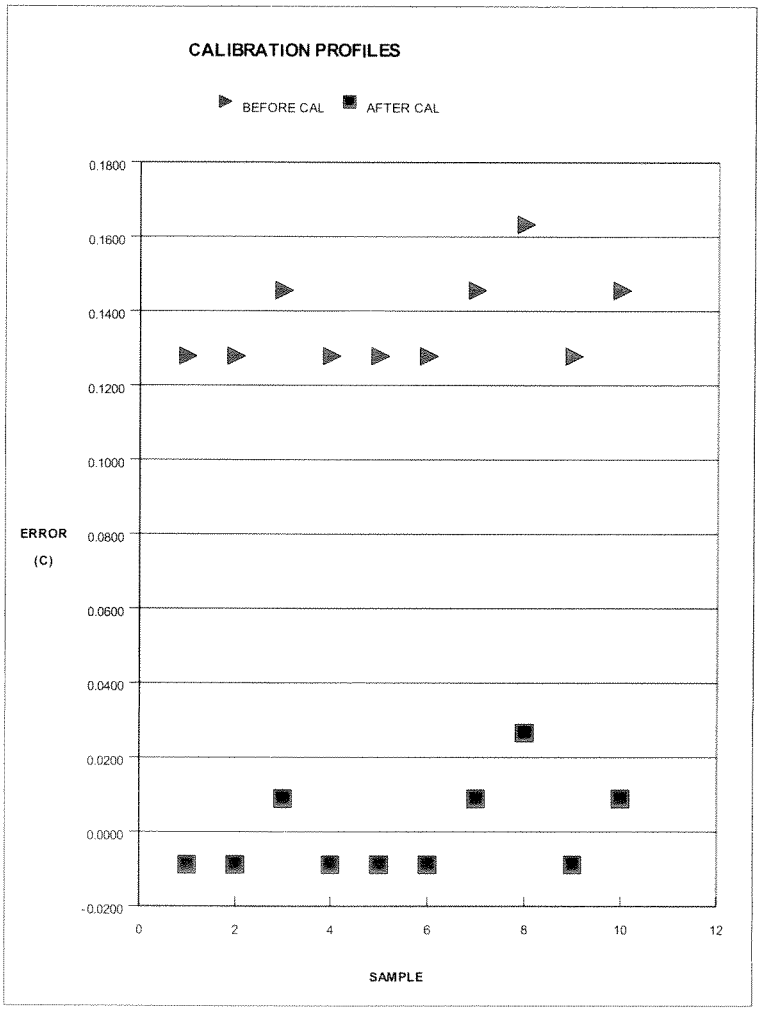
OFFSET (C): -0.1367

C0	448.241740
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094

Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh08

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1633	0.1633	0.0000	0.0266	0.0266
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh08

SERIAL # B
LOGGER # 07060501

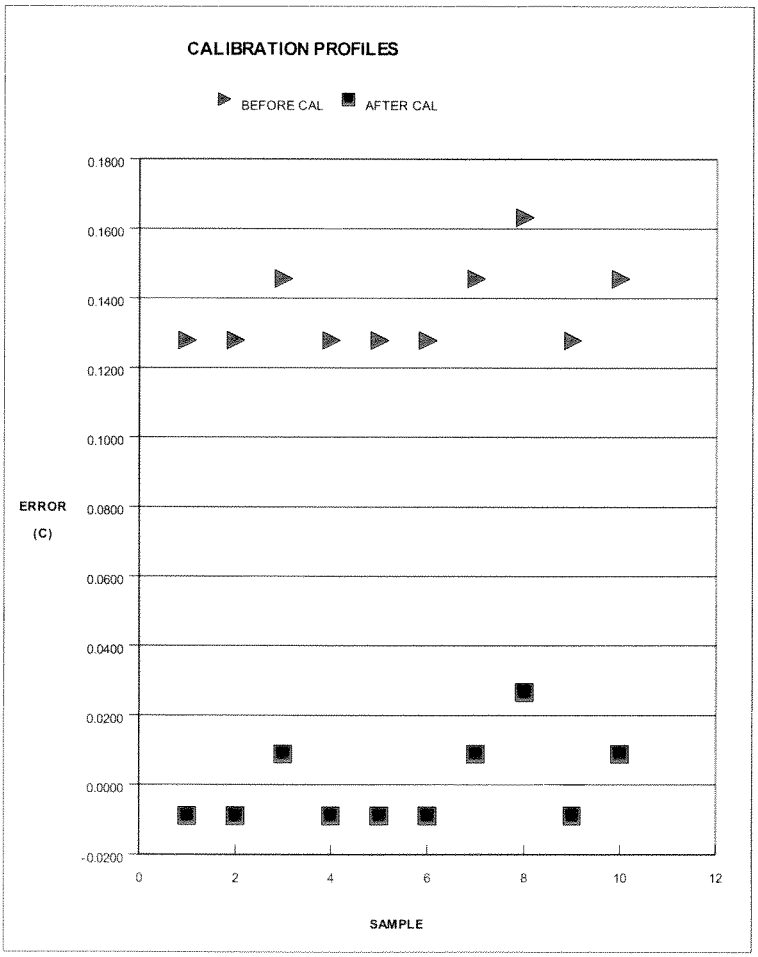
UNITS C

OFFSET (C): -0.1367

C0	448.241740
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh09

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
0.2797	0.2797	0.0000	-0.0061	-0.0061
0.2797	0.2797	0.0000	-0.0061	-0.0061
0.2898	0.2898	0.0000	0.0040	0.0040
0.2797	0.2797	0.0000	-0.0061	-0.0061
0.2797	0.2797	0.0000	-0.0061	-0.0061
0.2898	0.2898	0.0000	0.0040	0.0040
0.2898	0.2898	0.0000	0.0040	0.0040
0.2898	0.2898	0.0000	0.0040	0.0040
0.2898	0.2898	0.0000	0.0040	0.0040
0.2898	0.2898	0.0000	0.0040	0.0040

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh09

SERIAL # B
LOGGER # 07060501

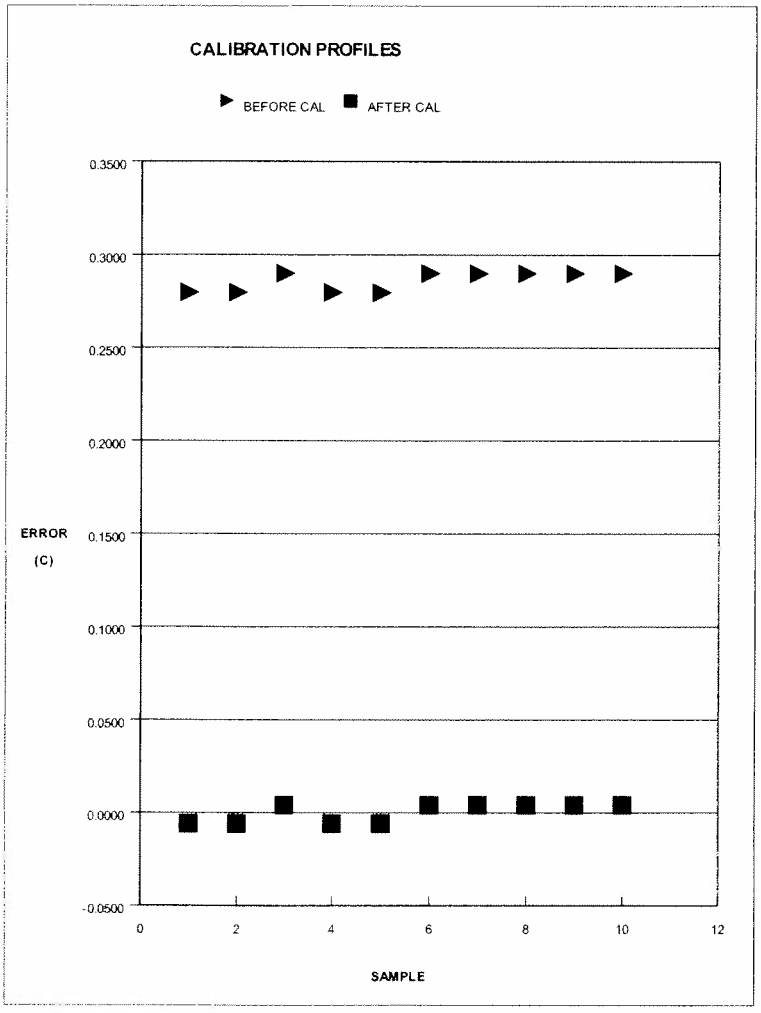
UNITS C

OFFSET (C): -0.2858

C0	448.092653
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703B-STRING-BCh10

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1633	0.1633	0.0000	0.0160	0.0160
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh10

SERIAL # 0
LOGGER # 07060501

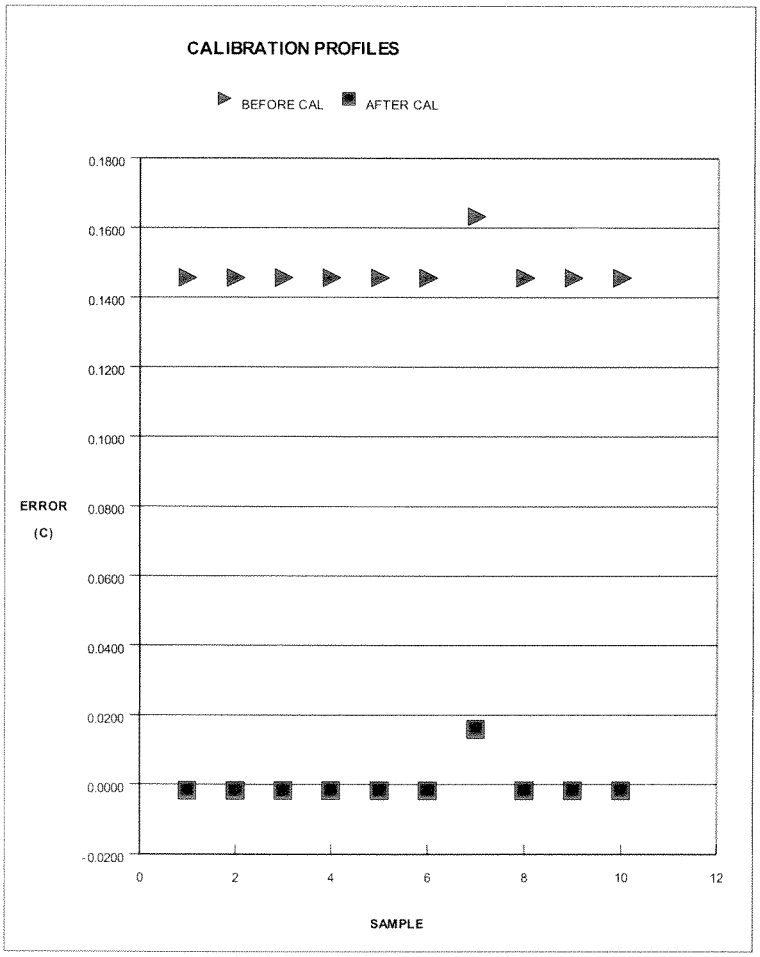
UNITS C

OFFSET (C): -0.1473

C0	448.231104
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. # JH090703B-STRING-BCh11

BEFORE CAL ERROR C	BEFORE CAL VALUE C	ACTUAL C	AFTER CAL VALUE C	AFTER CAL ERROR C
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1456	0.1456	0.0000	-0.0018	-0.0018
0.1633	0.1633	0.0000	0.0160	0.0160

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-BCh11

SERIAL # B
LOGGER # 07060501

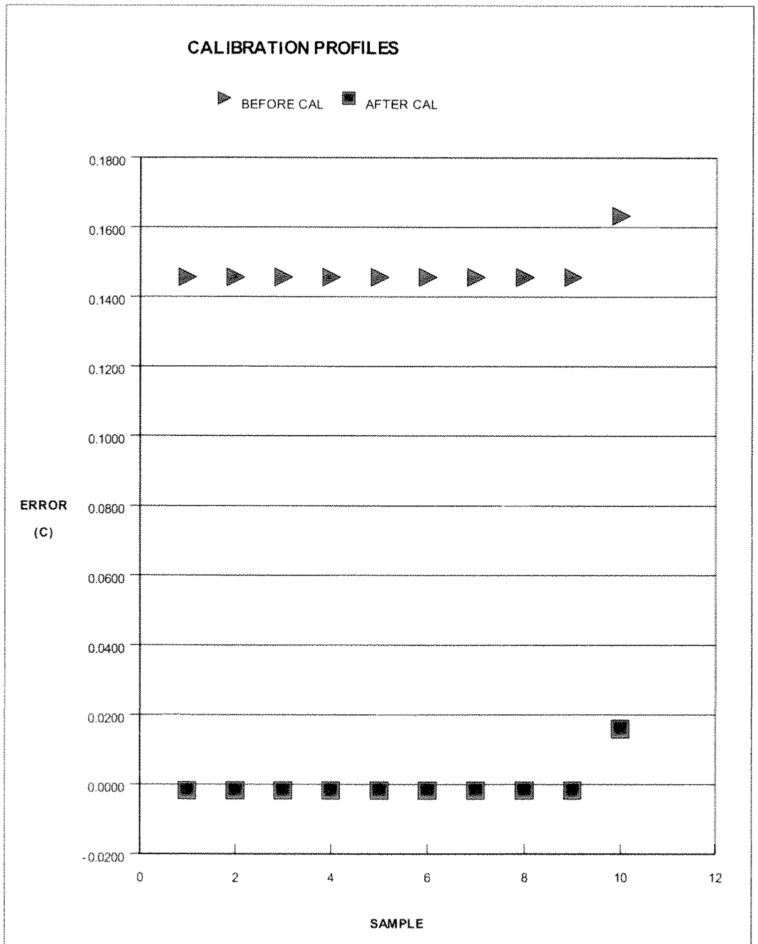
UNITS C

OFFSET (C): -0.1473

C0	448.231104
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. # JH090703C-STRING-CCh01

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh01

SERIAL # C
LOGGER # 07060500

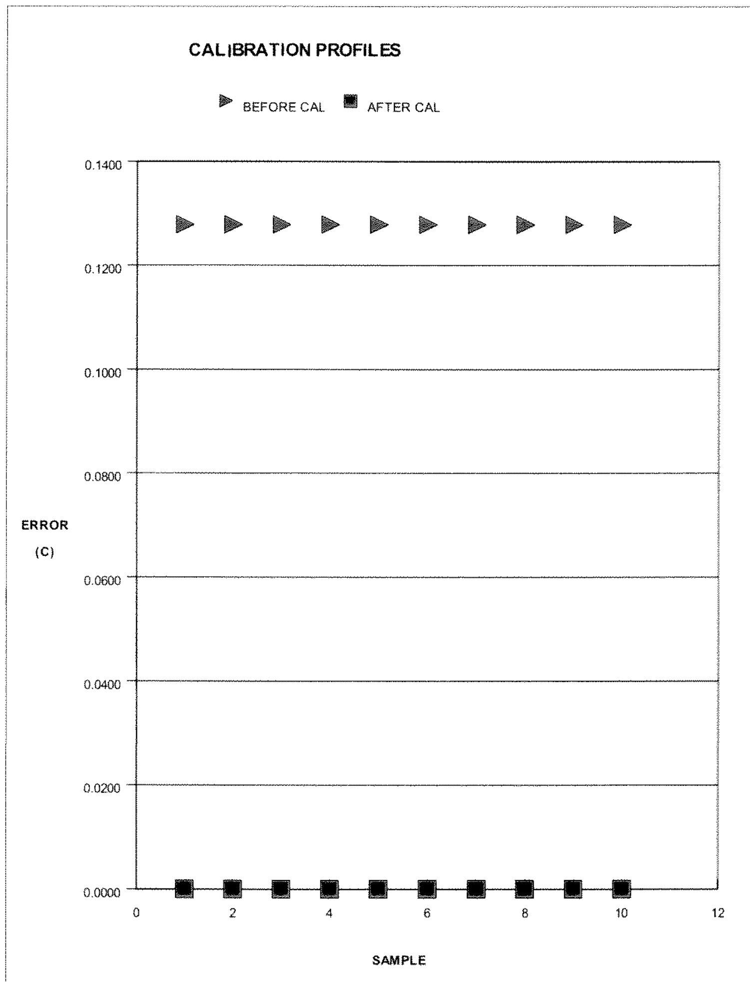
UNITS C

OFFSET (C): -0.1278

C0	448.250603
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh02

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1633	0.1633	0.0000	0.0089	0.0089
0.1633	0.1633	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	-0.0089	-0.0089
0.1633	0.1633	0.0000	0.0089	0.0089
0.1633	0.1633	0.0000	0.0089	0.0089
0.1633	0.1633	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	-0.0089	-0.0089

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh02

SERIAL # C
LOGGER # 07060500

UNITS C

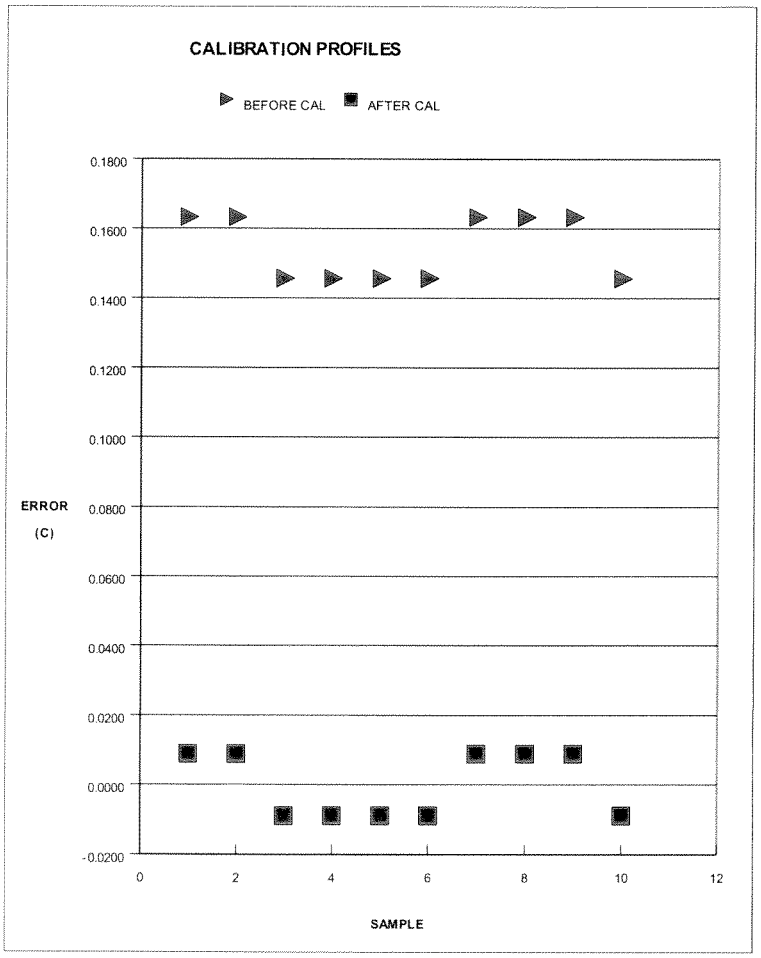
OFFSET (C): -0.1544

C0	448.224014
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094

Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. # JH090703C-STRING-CCh03

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000
0.1633	0.1633	0.0000	0.0000	0.0000

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh03

SERIAL # C
LOGGER # 07060500

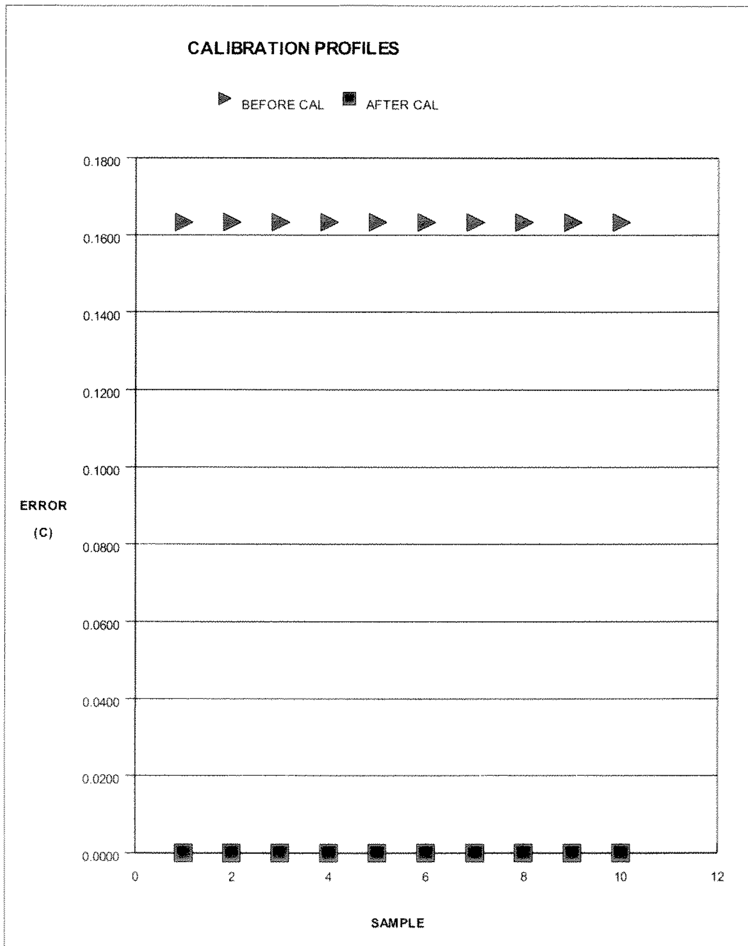
UNITS C

OFFSET (C): -0.1633

C0	448.215152
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh04

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
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0.1456	0.1456	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	-0.0106	-0.0106
0.1456	0.1456	0.0000	-0.0106	-0.0106
0.1633	0.1633	0.0000	0.0071	0.0071
0.1633	0.1633	0.0000	0.0071	0.0071
0.1633	0.1633	0.0000	0.0071	0.0071
0.1456	0.1456	0.0000	-0.0106	-0.0106
0.1633	0.1633	0.0000	0.0071	0.0071
0.1633	0.1633	0.0000	0.0071	0.0071
0.1633	0.1633	0.0000	0.0071	0.0071

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh04

SERIAL # C
LOGGER # 07060500

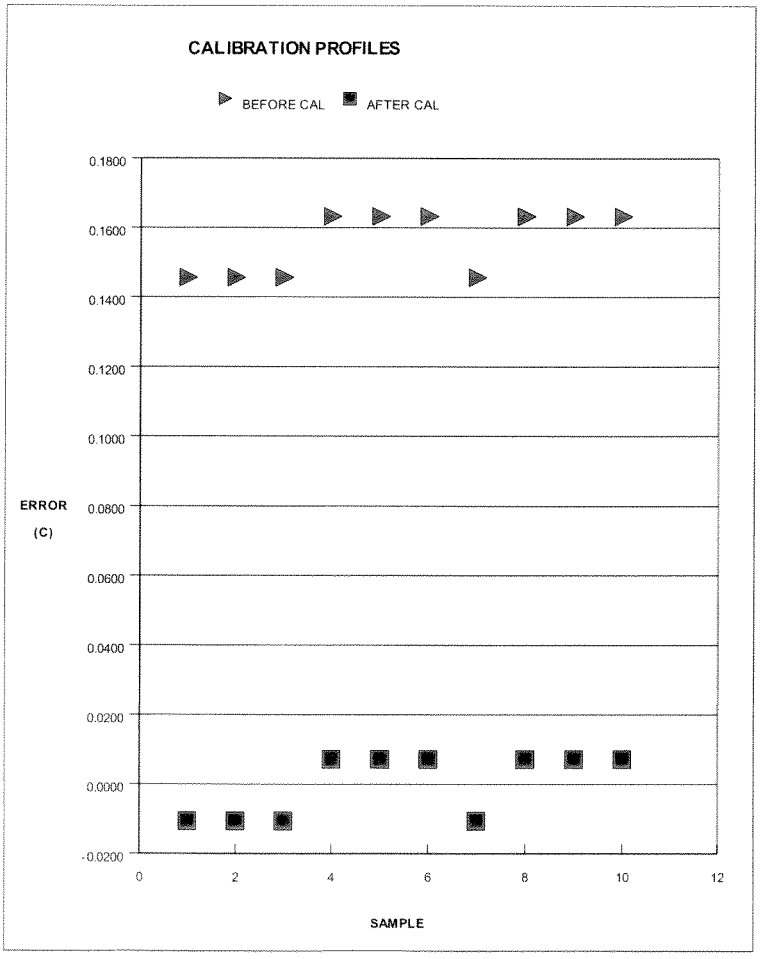
UNITS C

OFFSET (C): -0.1562

C0	448.222242
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh05

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
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0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1456	0.1456	0.0000	0.0089	0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089
0.1278	0.1278	0.0000	-0.0089	-0.0089

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh05

SERIAL # C
LOGGER # 07060500

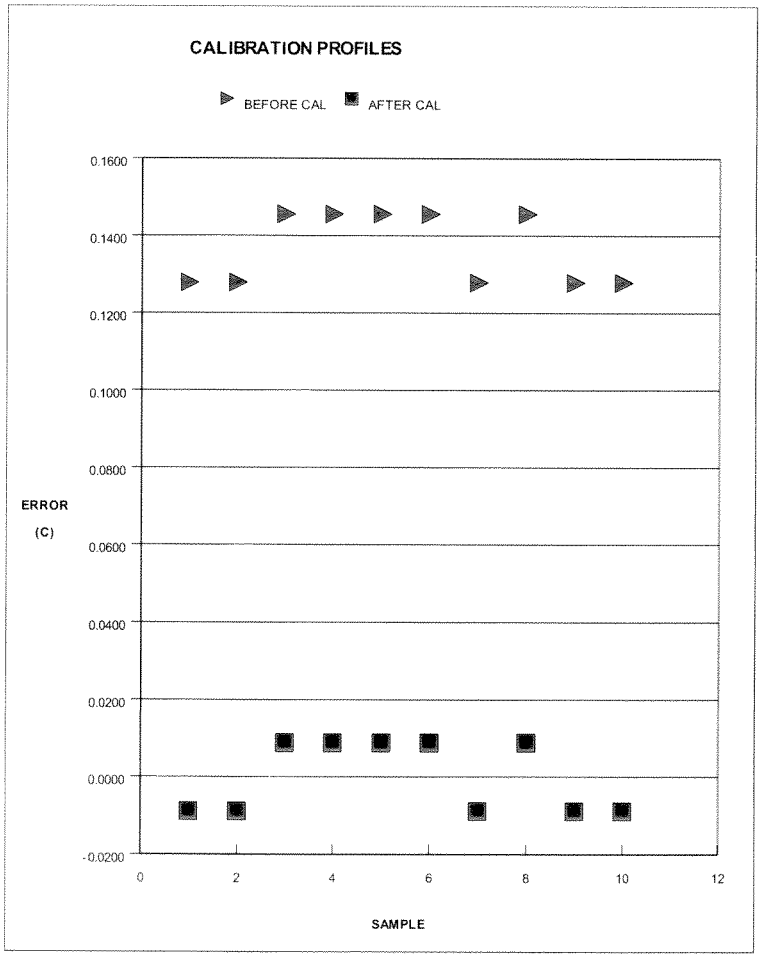
UNITS C

OFFSET (C): -0.1367

C0	448.241740
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh06

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018
0.1836	0.1836	0.0000	-0.0159	-0.0159
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018
0.2013	0.2013	0.0000	0.0018	0.0018

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh06

SERIAL # C
LOGGER # 7060500

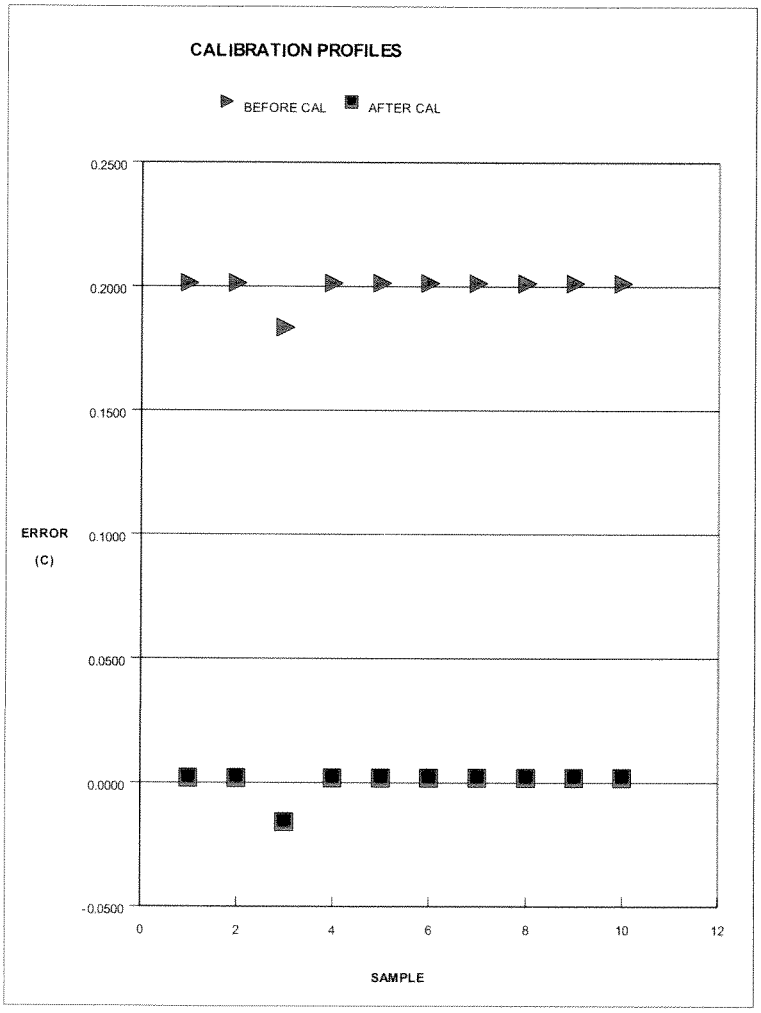
UNITS C

OFFSET (C): -0.1995

C0	448.178950
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh07

BEFORE CAL		ACTUAL	AFTER CAL	
ERROR	VALUE		VALUE	ERROR
C	C	C	C	C
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018
0.1456	0.1456	0.0000	-0.0160	-0.0160
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018
0.1633	0.1633	0.0000	0.0018	0.0018

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh07

SERIAL # C
LOGGER # 07060500

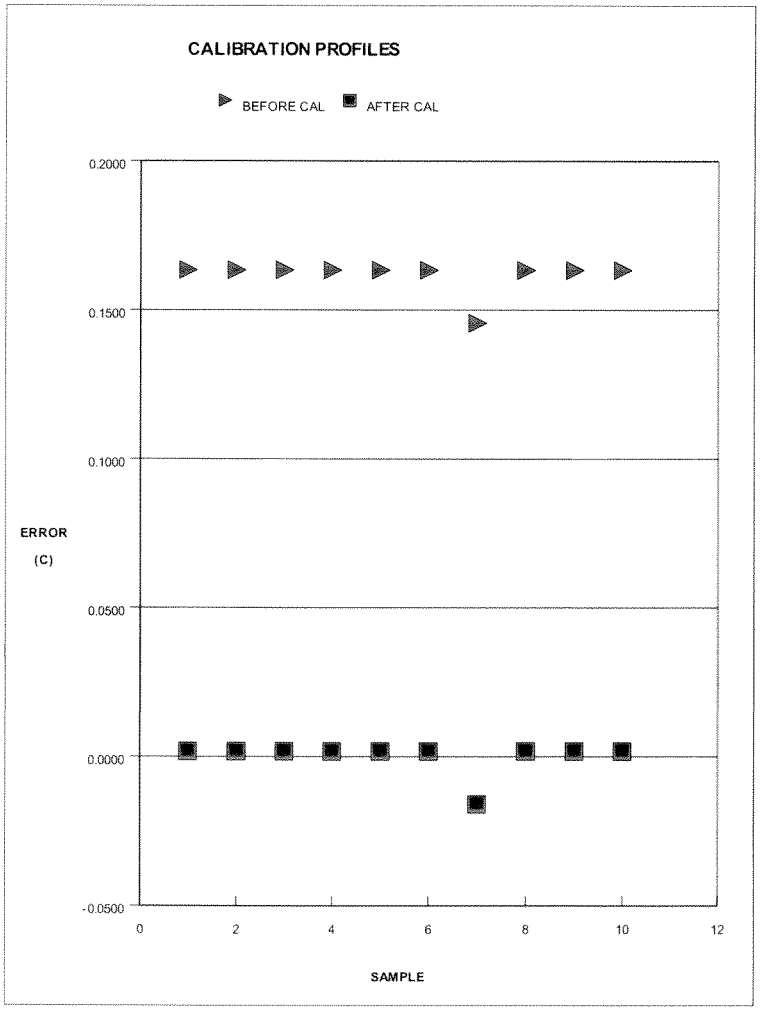
UNITS C

OFFSET (C): -0.1615

C0	448.216924
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh08

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh08

SERIAL # 0
LOGGER # 07060500

UNITS C

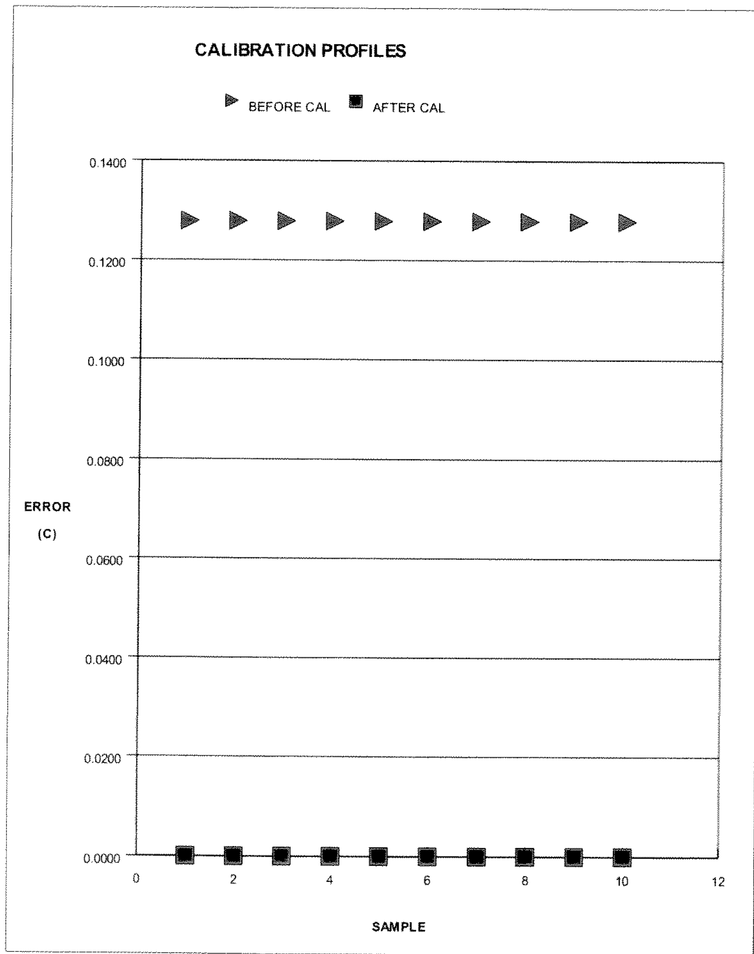
OFFSET (C): -0.1278

C0	448.250603
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

ORDER # 9005021

BEFORE CAL ERROR C	BEFORE CAL VALUE C	ACTUAL C	AFTER CAL VALUE C	AFTER CAL ERROR C
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000
0.1278	0.1278	0.0000	0.0000	0.0000



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CALIBRATION CERTIFICATE

CALIBRATION DATA

REF. #JH090703C-STRING-CCh09

BEFORE CAL			AFTER CAL	
ERROR	VALUE	ACTUAL	VALUE	ERROR
C	C	C	C	C
0.1456	0.1456	0.0000	-0.0053	-0.0053
0.1456	0.1456	0.0000	-0.0053	-0.0053
0.1456	0.1456	0.0000	-0.0053	-0.0053
0.1456	0.1456	0.0000	-0.0053	-0.0053
0.1633	0.1633	0.0000	0.0124	0.0124
0.1456	0.1456	0.0000	-0.0053	-0.0053
0.1633	0.1633	0.0000	0.0124	0.0124
0.1456	0.1456	0.0000	-0.0053	-0.0053
0.1633	0.1633	0.0000	0.0124	0.0124
0.1456	0.1456	0.0000	-0.0053	-0.0053

DATE: 03/JUL/09
CUSTOMER: Rice
SENSOR: STRING-CCh09

SERIAL # C
LOGGER # 07060500

UNITS C

OFFSET (C): -0.1509

C0	448.227559
C1	-95.859120
C2	8.361954
C3	-0.434098
C4	0.011183
C5	-0.000094
Old C0	448.378449
Old C1	-95.859120
Old C2	8.361954
Old C3	-0.434098
Old C4	0.011183
Old C5	-0.000094

BY: JH

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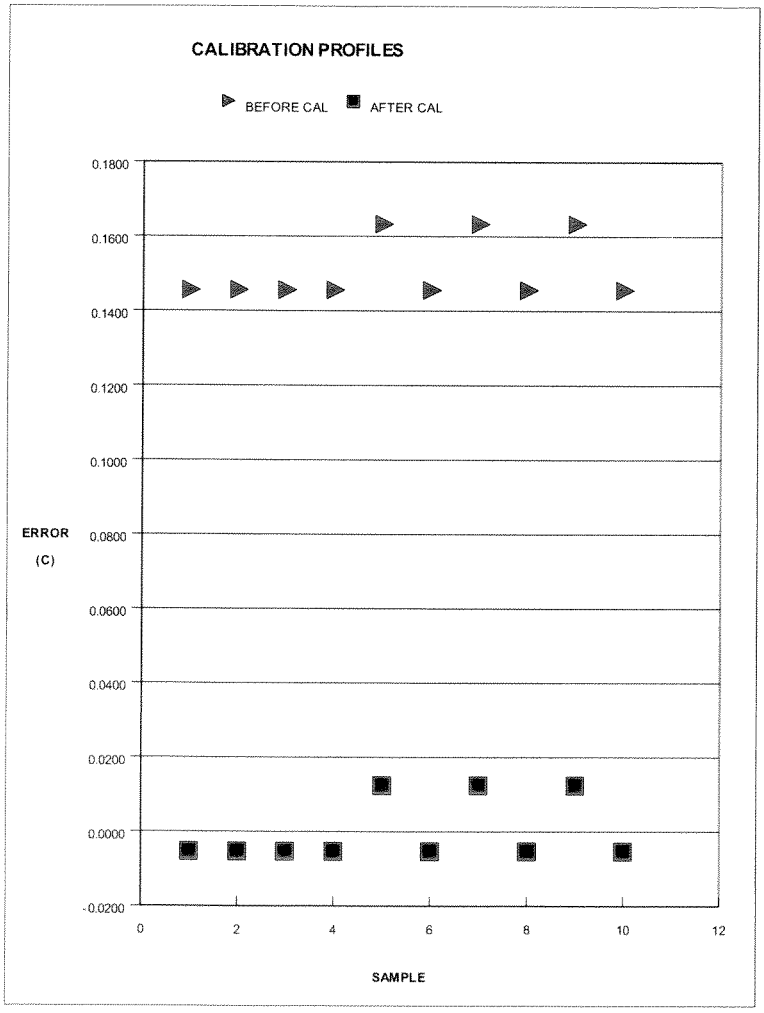
CALIBRATION PROFILES



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APPENDIX I

Solid Waste Management Facility Viewpoint Photo Collection


Photo 1


Photo 2


Photo 3


Photo 4


Photo 5


Photo 6

Note: see Figure A-2, Appendix A for location and orientation of photos


Photo 7


Photo 8


Photo 9


Photo 10


Photo 11


Photo 12

Note: see Figure A-2, Appendix A for location and orientation of photos

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Note: see Figure A-2, Appendix A for location and orientation of photos


Photo 19


Photo 20


Photo 21


Photo 22


Photo 23


Photo 24

Note: see Figure A-2, Appendix A for location and orientation of photos


Photo 25


Photo 26


Photo 27

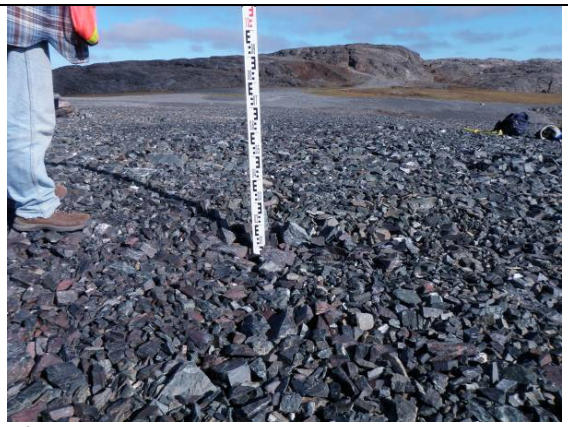
Photo 28


Photo 29


Photo 30

Note: see Figure A-2, Appendix A for location and orientation of photos

Photo 31

Photo 32

Photo 33

Note: see Figure A-2, Appendix A for location and orientation of photos