FRANZ ENVIRONMENTAL INC.

◆ CONSULTING ◆ ENGINEERING ◆ TECHNOLOGIES ◆

Long Term Monitoring, 2013
PIN-B, Clifton Point, Nunavut

FINAL REPORT

Prepared for:

Aboriginal Affairs and Northern Development Canada
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EXECUTIVE SUMMARY

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to conduct year one long-term monitoring activities at the former Distant Early Warning (DEW) Line site PIN-B. This project was completed under AANDC Standing Offer Number 01-11-6001/5, Call-up Number 03, File Number 1632-11/01-11-6001/5.

The site is approximately 1.5 kilometres inland from the Amundsen Gulf on the mainland in the westernmost part of Nunavut, and once contained a five-module building train, a warehouse, a garage, a small house for Inuit staff, a petroleum, oil and lubricants storage facility with associated distribution system, and a felled radar tower. Site buildings were demolished and environmental impacts remediated in 2009-2010.

The 2013 monitoring program was carried out at the site on August 22, 2013. The landfill monitoring program consisted of a visual inspection of the Non-Hazardous Waste Landfill (NHWL), active layer water monitoring and natural environment monitoring.

Based on systematic visual observations and measurements, supported with photographic documentation, FRANZ determined that the NHWL is in acceptable condition, is performing as designed, and is containing the enclosed waste. Minor features noted at the NHWL during monitoring include a small animal burrow (likely arctic fox) on the slope of the north corner and two drainage pathways on the southwest and southeast sides. Neither of these features is considered to have any significant impact on the integrity or performance of the NHWL.

During remediation, four monitoring wells were installed at the site to allow for active layer water monitoring. During the 2013 monitoring program, FRANZ collected a groundwater sample from one of the wells; there was insufficient water in two wells for sample collection and one well was frozen. There was insufficient historical or baseline data to compare the results to the baseline mean as recommended by AANDC's long-term monitoring guidance. The groundwater results from 2013 exhibited concentrations of copper and zinc marginally above the FIGQGs. At this time, these concentrations are not an immediate concern; however should be evaluated during future sampling events.

The Lake, Beach, Mid- and Upper Station Areas were also observed and found to be in good condition. A small stain (< 1 m^2) was noted at Borrow Area 6 in the Lake Area. Physical evidence, supported by interviews with persons with firsthand knowledge of the site and with members of the nearby community's Hunters and Trappers Organization, indicate that wildlife continue to frequent this site but due to the distance to nearby communities, people do not.

This executive summary should be read in conjunction with the main report and is subject to the same limitations described in Section 8.0.

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1.0 INTRODUCTION

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to conduct long-term monitoring activities at the former DEW Line site PIN-B, Clifton Point, NU. This project was completed under AANDC Standing Offer Number 01-11-6001/5, Call-up Number 3, File Number 1632-11/01-11-6001/5.

This report describes the monitoring activities completed for AANDC at PIN-B and was prepared in accordance with the FRANZ proposal No. P-4612, dated June 13, 2013, the Call-up Details, dated July 8, 2013 and the Project Initiation Meeting Minutes, dated July 30, 2013.

Throughout this report the AANDC DEW Line site PIN-B will be referred to as "the site."

1.1 Project Objectives

Long term monitoring of the PIN-B site uses a three phased approach; with evaluation of further monitoring requirements to be completed after the completion of each phase. The objective of the 2013 long-term monitoring was to complete Year 3, the second of three planned monitoring events in Phase I of the monitoring program for the PIN-B site, as described in the PIN-B (Clifton Point) Long-Term Monitoring Plan (INAC, 2011). Monitoring included visual observations, chemical analyses (where warranted and possible) and interviews with members of the nearby community knowledgeable about local activities at the site to determine the condition of the natural environment and whether the site infrastructure is performing as designed.

1.2 Scope of Work

Consistent with the previous year's monitoring, the scope of work, as described in the PIN-B Long-Term Monitoring Plan, dated April 15, 2011 (the Plan), was as follows:

1. Visual Monitoring of the Non-Hazardous Waste Landfill (NHWL), including
    - Visually checking the physical integrity of the NHWL and looking for evidence of settlement, erosion, lateral movement, frost action, animal burrows, vegetation, staining, vegetation stress, seepage points, exposed debris, and the condition of wells;
    - Taking photographs to document the condition of the NHWL and substantiate the recorded observations.
2. Active Layer Water Monitoring, including
    - The collection of groundwater samples from the 4 monitoring wells installed around the NHWL. These samples were to be analysed and the results compared to those from background samples.

3. Soil Monitoring (as required)

    - Soil sampling was to be limited to locations where seepage or staining was identified as part of the visual inspection.

4. Natural Environment Monitoring, including

    - The collection of direct and indirect evidence of wildlife presence and activity;
    - Making observations regarding the revegetation of disturbed areas.

5. Preparation of a 2013 monitoring program report.

The following tasks were assessed as necessary to fulfill the scope:

a) Review of the PIN-B LTM Plan, previous LTM reports for PIN-B and the *Abandoned Military Site Remediation Protocol* (AMSRP, INAC, 2009);
b) Preparation of a health and safety plan;
c) Preparation of a sampling plan for soil and groundwater;
d) Collection of water level data and observation of monitoring well condition at the site;
e) Collection of groundwater and soil samples;
f) Visual inspection, measurement and photo documentation of the site;
g) Interviewing local residents and officials to understand land use and wildlife trends; and
h) Reporting.

2.0 BACKGROUND INFORMATION

2.1 Site Description

According to the PIN-B Long Term Monitoring Plan (INAC, 2011), the PIN-B Intermediate Distant Early Warning (DEW) Line Site was constructed in 1957 and closed and abandoned in 1963. The site comprised a five-module building train, a warehouse, a garage, a small house for Inuit staff, a petroleum, oil and lubricants (POL) storage facility with associated distribution system, and a felled radar tower. In addition to the main station facilities, a cargo handling area was constructed at the beach area. A second POL storage facility was located at this beach area (INAC, 2011).

Two airstrips were constructed at the site: the primary airstrip (approximately 1 km long), located south of the beach area, and a second airstrip northwest of the main strip with a length of 300 metres. Gravel roads were built linking the airstrip, the site's water supply lake and the beaching area with the main station area. A small construction camp was erected during the building of the site facilities but was demolished once construction was completed. The former camp of an Inuit family is located approximately 1.5 km south of the site (INAC, 2011).

A non-hazardous waste landfill (NHWL) was constructed at the site between 2009 and 2010. Final remediation activities were completed and the NHWL was closed on August 18, 2010. The NHWL was designed to contain non-hazardous materials only. It is situated approximately 1.5 km from the shore of Admundsen Gulf. It was constructed on native ground surface (elevation: 30 metres above mean sea level) with the organic matter stripped and consists of four perimeter berms constructed of granular material. The non-hazardous waste was placed in the landfill in layers consisting of 0.5 m lifts of waste covered by 0.15 m of granular fill. The layers were compacted and a final cover consisting of a minimum of 1.0 m of granular fill was used to cap the landfill (INAC, 2011). The NHWL at PIN-B contains the following types of waste:

- Soil impacted with petroleum hydrocarbon (PHC) fractions F3 and F4.
- Non-hazardous demolition debris, such as timbers, plywood, and sheet metal.
- Non-hazardous site debris, such as scrap metal and wood.
- Non-hazardous debris/soil excavated from landfills.
- Creosote timbers.
- Double-bagged asbestos.
- Tier 1 contaminated soil (Lead concentration between 200 and 500 ppm and polychlorinated biphenyl (PCB) concentrations between 1 and 5 ppm).

The site is not regularly inhabited and wells at the site would tend to freeze due to the presence of permafrost, therefore groundwater is not considered to be used for water supply purposes.

The area has been reported not to be used by hunters and fishermen from the nearby community of Kugluktuk, and is likely to be infrequently visited by persons from other communities in the region. A surface water sample collected from the Drinking Water Lake in 2007 suggests that some chronic inputs of inorganic elements may have occurred over time; however, contaminant levels were reported to be low and no significant impacts were identified.

2.2 Previous Monitoring Programs

The 2013 monitoring program at PIN-B was the second (Year 3) of a proposed eight that are scheduled over a 25 year period. To become familiar with the site, FRANZ reviewed the following reports pertaining to DEW Lines sites:

- *Long Term Monitoring, 2011, PIN-B, Clifton Point, Nunavut* dated January 17, 2012 by Franz Environmental Inc.;
- *PIN-B (Clifton Point) Long-Term Monitoring Plan* dated April 15, 2011 by Indian and Northern Affairs Canada.
- *Abandoned Military Site Remediation Protocol* dated March 2009 by Indian and Northern Affairs Canada, Contaminated Sites Program.

3.0 REGULATORY AND OTHER GUIDELINES

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

Table 3-1: Groundwater Analytical Assessment

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

This table is reproduced from AMSRP Chapter 11, Table 4.2 (INAC, 2009)

Since this is the second monitoring event for the long-term monitoring plan to be implemented within the first three years at PIN-B, FRANZ does not have sufficient historical or baseline data to obtain meaningful means or standard deviations for comparison to the analytical results obtained during the 2013 monitoring activities.

In May 2010, Environment Canada (EC) under Federal Contaminated Sites Action Plan (FCSAP) released the *Federal Interim Groundwater Quality Guidelines* (FIGQG) for Federal Contaminated Sites. The guidelines were released based on the observed need for federal custodians and others to apply appropriate groundwater guidelines at federal sites. Previously, a mixture of provincial standards, federal surface water guidelines, and drinking water quality

guidelines were applied to groundwater at federal sites. The FIGQGs remove the need for this patchwork of regulations, which were not consistently applied at federal sites. The FIGQGs were updated in November, 2012.

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

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

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

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

- Groundwater transport to surface water at least 10 m from the contamination and subsequent exposure of freshwater and marine life;
- Direct contact of soil organisms with contaminated groundwater;
- Use of groundwater for irrigation water;
- Use of groundwater for livestock watering;
- Groundwater transport to surface water at least 10 m from the contamination and subsequent ingestion by wildlife;
- Migration of contaminant vapours to indoor air and subsequent inhalation by humans; and
- Use of groundwater for human consumption (i.e., drinking water).

The generic guidelines are point estimates of a chemical concentration in groundwater associated with an approximate no- to low-effects level based on toxicological information about the chemical, along with a screening-level evaluation and environmental fate and transport and estimated intake rates, or exposure, by potential receptors. As a result, the Table 1 *Federal Interim Groundwater Quality Guidelines*, *Generic Guidelines for Residential/Parkland Land Uses* Tier 1 Lowest Guideline *Values* for coarse grained soil (FIGQG Table 1 Tier 1) were referenced for comparison purposes.

4.0 INVESTIGATIVE METHODOLOGY

The monitoring program was carried out at the PIN-B DEW Line site on August 22, 2013 by field assessors Julie Dittburner and Kim Krug of Franz Environmental Inc., accompanied by AANDC representative Allison Dunn. Wildlife monitoring services were provided by O.J. Bernhardt of Kugluktuk, NU. During the field investigations, weather conditions were overcast, with a light breeze and mild temperatures (5 - 10 ^{o}C). The program consisted of the following:

- Completing a health and safety plan with field briefing;
- Visually observing, measuring and photographically documenting the physical integrity of the landfill;
- Collection of groundwater samples from existing wells (if possible);
- Collection of soil samples (if necessary, as per the Plan); and
- Gathering information through first hand observation as well as through knowledgeable persons regarding local wildlife and human activity.

The field investigation procedures are described below.

4.1 Health and Safety Plan

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

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

4.2 Visual Inspections

The physical integrity of the NHWL and surrounding areas was assessed using systematic visual observations and empirical measurements to record evidence of erosion, ponding, frost action, settlement and lateral movement of the landfill. A visual monitoring checklist, presented in the PIN-B Long-Term Monitoring Plan, was completed for the landfill and is found in Table 5-1 through Table 5-3, Section 5. A photographic record was completed to document the condition of the structures and substantiate the visual observations (Appendix C).

Similar to 2011, the 2013 visual inspection was conducted with the aid of a Trimble Pro XRT GPS unit to locate features of note and to collect GIS information to be used in report preparation. A detailed data dictionary (Trimble file) was created prior to the site visit to capture all required information as outlined in the long-term monitoring plan. The SSF file from 2011

was updated with any changes to previous features and addition of any new features. The Trimble files are included in the appended CD ROM to be used in future site investigations.

4.3 Wildlife Survey

FRANZ made observations of the natural environment at the time of the site visit and recorded the observations in field notes. Observations included 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. Where possible, observations by FRANZ have been compared to previously recorded observations.

As part of the investigation, FRANZ representatives contacted the Kugluktuk Angoniatit Association of Hunters and Trappers. In addition, FRANZ interviewed our wildlife monitor (O.J. Bernhardt), whose family members were former site workers with firsthand knowledge. Land uses by humans and wildlife as well as changes in use over previous years by each were discussed.

4.4 Ground Water Sampling

Upon arrival at the PIN-B site, the FRANZ field assessors made an attempt to measure water levels at each of the wells. Using a water level tape, the field assessors found that three of the monitoring wells contained groundwater; the remaining well (MW4) was frozen.

A peristaltic pump was used to purge the monitoring wells prior to sample collection. Wells were purged of three well volumes except where poor recharge rates made it necessary to sample sooner. During purging, a YSI 556 water quality meter was calibrated and used to measure *in situ* field parameters including temperature, conductivity, dissolved oxygen, turbidity, pH and oxidation-reduction potential. Sampling took place when these parameters stabilized. Water samples submitted for dissolved metals analyses were field-filtered.

Two wells (MW1 and MW2) that did contain groundwater were confirmed to have insufficient volumes for groundwater sampling. After an initial purge of the standing water in the well, the wells did not recharge. No samples were collected from these locations.

Approximately 1075 mL of water was purged from MW3 prior to sampling. MW3 was submitted for various analytical parameters: total and dissolved metals, polychlorinated biphenyls (PCBs); petroleum hydrocarbons (PHCs); benzene, toluene, ethylbenzene and total xylenes (BTEX); suspended and dissolved solids; major ions; hardness; pH and conductivity. Due to limited sample volume, a duplicate sample was not collected. The groundwater sample was collected in laboratory prepared sample bottles appropriate for the specified analyses. The sample for laboratory analysis was stored in laboratory supplied coolers equipped with ice from the time of collection until delivery to the laboratory.

General well conditions were also recorded, and the wells were re-locked using keyed-alike padlocks. Additional details on the groundwater sampling are presented in the groundwater sample records provided in Appendix E. Chain of custody forms are provided in Appendix D.

4.5 Soil Sampling

There were no indications of seepage or significant staining as part of the visual inspection; therefore, no soil samples were collected during the 2013 monitoring activities, as per the 2011 Long-term Monitoring Plan for the site.

5.0 NON-HAZARDOUS WASTE LANDFILL

5.1 Area Summary

The NHWL is located at the Main Station Area, approximately 1.5 km southwest of the Beach Area, at an elevation of 30 metres above mean sea level (see Figure A-1, Appendix A). The monitoring of the landfill included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. A groundwater sample was collected from one (MW3) of the previously installed monitoring wells at the NHWL. Due to frozen well conditions (MW4) and insufficient sample volumes (MW1 and MW2) groundwater samples could not be collected from the remaining wells. Soil samples were deemed unnecessary by the FRANZ field assessors and on-site AANDC representative. The visual inspection report, including supporting photos and drawing, is presented in the following pages.

5.2 Photographic Record

The photographic record of the NHWL (and other areas of the site) has been completed as per the Terms of Reference (Photographs 1 to 59, attached CD-ROM). Those portions of the record referenced in the body of this document are included in Appendix C. The complete photographic record, of full-resolution photographs, is provided in the attached CD-ROM.

5.3 Visual Inspection Report

Monitoring consisted in part of visual observations of the NHWL to assess its physical integrity, by collecting evidence of erosion, ponding, frost action, settlement and lateral movement. A plan view of the NHWL indicating photographic viewpoints, salient observations and locations of ground water monitoring wells can be seen in Figure A-2, Appendix A. The visual monitoring checklist provided in the PIN-B Long-Term Monitoring Plan has been completed and pertinent information is summarized in Table 5-3 of this report. Table 5-1 and associated Table 5-2 present the preliminary visual inspection results for the NHWL at PIN-B.

Table 5-1: Preliminary Visual Inspection Report Non-Hazardous Waste Landfill

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

Table 5-2: Preliminary Visual Inspection Report Non-Hazardous Waste Landfill - Definitions

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

Settlement

Two minor depressions were observed in the area of the NHWL. One small depression on the surface of the landfill at the southeast corner was noted. This depression appeared to be the result of final grading. Another small depression was noted on the northeast side berm of the landfill where this appeared to be the result of settlement. Both features are considered minor in scale (<1 m diameter and 0.1 m deep).

Erosion

No indication of erosion was observed in the area of the NHWL.

Frost Action

No indication of frost action was observed in the area of the NHWL.

Evidence of Burrowing Animals

Evidence of a burrowing animal was observed in one location on the slope of north corner of the NHWL. It appeared as though an animal has dug a small burrow and deposited the soil to one side, exposing larger cobbles (Photo 45, Appendix C). The extent of the animal burrow has increased slightly since 2011 to approximately 0.5 to 1.0 m inwards. Sik sik tracks were observed leading into the burrow. The integrity of the NWHL has not been impacted by the burrow.

Re-establishment of Vegetation

Based on the regional setting of this landfill, full re-establishment of vegetation will likely not occur within the timeframe of the first phase of long term monitoring. Minor vegetation growth was observed at southeast side berm and toe of the landfill (Photo 51, Appendix C).

Staining

No staining was observed in the area of the NHWL.

Seepage Points

Seepage was not observed during the NHWL inspection.

Debris

Exposed debris was not observed.

Drainage Pathways

Two drainage pathways were noted during the NHWL inspections that have remained unchanged since 2011. One was observed on the southeast side of the landfill and one on the southwest side. Both drainage pathways appeared to be natural features of the topography in

the area (Photo 46 and Photo 47, Appendix C). Erosion does not appear to be taking place in these drainage pathways, therefore the physical integrity of the NHWL has not been impacted.

Discussion

All physical observations suggest that the NHWL is performing as designed and is containing the enclosed waste. Care should be taken during future monitoring events to observe the condition of animal burrow (Feature A) at the north corner of the NHWL for increase size and depth and the potential of exposure of landfill debris.

Table 5-3 below summarizes the results of the visual inspection.

Table 5-3: PIN-B – Clifton Point – Visual Monitoring Checklist

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Animal Burrow	A	On slope of north corner of the NHWL	1.0	0.25	0.2	<1%	Animal burrowed exposing larger cobbles	Does not affect the landfill integrity at this point	45
Drainage Pathway	B	On southwest side of NHWL, draining in a SW direction towards MW2	25	0.5	0.1	<1%	Minor drainage pathway originating from NHWL, running towards SW	Feature appears natural. Does not affect the landfill integrity at this point	46
Drainage Pathway	C	On southeast side of NHWL, draining in a SE to SW direction towards MW3	24	0.6	0.25	<1%	Drainage pathway originating from the base of the SE side of the NHWL	Feature appears natural. Does not affect the landfill integrity at this point	47
Settlement	D	On surface of NHWL at southeast corner	2	0.75	0.1	<1%	Minor depression on surface of landfill, appears to be result of grading	New feature identified in 2013. Feature appears mechanical. Does not affect the landfill integrity at this point	21
Settlement	E	On slope of northeast corner of NHWL	1	1	0.1	<1%	Minor depression on berm of landfill, appears to be slight settlement	New feature identified in 2013. Does not affect the landfill integrity at this point	5

5.4 Analytical Results – Groundwater

As described in section 4.4, one groundwater sample was submitted to Maxxam Analytics in Calgary, Alberta for analyses of PHCs, metals, PCBs and inorganic parameters. Analytical results are discussed below. FRANZ does not have sufficient historical or baseline data to obtain the mean and standard deviations for comparison to the analytical results as suggested in the AMSRP guidance.

PHCs

Analytical results for PHCs are shown in Table B-1; Appendix B. Concentrations for all BTEX/PHC parameters were reported below the laboratory detection limit.

Metals

Analytical results for dissolved and total metals in groundwater are shown in Table B-2; Appendix B. Water sampled from MW3 had concentrations of total and dissolved for multiple parameters above the laboratory detection limits. The following parameters reported non-detect concentrations for both total and dissolved metals: beryllium, bismuth, boron, silver, tin and titanium. Cadmium also reported non-detect concentrations for dissolved metals. In addition, copper and zinc reported concentrations that are marginally above the FIGQGs. At this time, these concentrations are not an immediate concern; however should be evaluated during future sampling events.

PCBs

Analytical results for PCBs in groundwater are shown in Table B-3; Appendix B. Concentrations for all PCB parameters were reported below the laboratory detection limit.

Inorganics

Laboratory analytical results for inorganics are shown in Table B-4; Appendix B. Concentrations of alkalinity (PP as CO3), carbonate (CO3) and hydroxide (OH) were reported below the laboratory detection limit. All other inorganics and calculated parameters reported concentrations above the laboratory detection limit.

Laboratory certificates of analyses for the 2013 groundwater samples are provided in Appendix D.

6.0 SURROUNDING AREAS

Station Area

This area lies adjacent to NHWL, and is the site of the former PIN-B Main Station (Figure A-1, Appendix A). Prior to remediation, this area consisted of a five-module building train, a warehouse, a garage, an Inuit staff house, and a POL storage facility, a felled radar tower, a PCB temporary storage area, and an outdoor wash house. In addition, three borrow source areas (borrow area 1A, 1B, and 4) were identified. Currently, two concrete pads are present in the area (Photo 49, Appendix C). The area has been completely graded and appeared in good condition. No changes were noted since 2011. No anomalies were observed.

Beach Area

To the north of the NHWL lies the Beach Area (Figure A-1, Appendix A), in which three distinct dump areas were previously identified, as well as the main 1 km long airstrip. Just south of the airstrip is the site of the former petroleum hydrocarbon contaminated soil treatment area and a small abandoned airstrip, both of which have been re-graded. Three former borrow source areas (borrow area 3, 6 and 7) were also identified at the Beach Area. These re-graded areas appear to be in good condition, with only one minor anomaly: a minor erosion channel, attributed to a natural drainage pathway, was observed on the south side of the active airstrip; it does not have any significant negative impact to the re-graded area. Bird and animal tracks, as well as a falcon nest, were noted in this area (Photo 54, Appendix C). No changes were observed in 2013.

Station Dump Area

To the northwest of the NHWL, along the west side of the access road, lies the Station West Dump (Figure A-1, Appendix A). This area contained a small amount of site debris, a treatment lagoon, and a small surface water body (lake). A small stain (area < 1 m^2) along the access road with a slight PHC-like odour was observed in 2011. This was likely left by the re-grading machinery; it does not appear connected to the failure or malfunctioning of any former on-site facility. This stained area was not observed during the 2013 site visit. Effort should be made to revisit the Station Dump Area and stained area during the 2015 monitoring year.

Construction Camp Area

The Construction Camp Area is located just to the north of the NHWL between the Beach Area and the NHWL (Figure A-1, Appendix A). This camp was set up and used during the construction of the Station at the site. This area consisted of the camp and associated tents and buildings, two small dump areas and a barrel stockpile and washing area. This area appeared in good condition and no anomalies were observed.

Access Road

The recently constructed road, used to access the Main Station area and NHWL from the airstrip (Beach Area), appeared to be in good condition. An additional trail/partial access road was also observed in good condition connecting the airstrip to the Main Station Area.

Surface Water Bodies

Four freshwater surface water bodies are present at the PIN-B site. The largest of these, located just northwest of the active airstrip, was used as the freshwater supply lake during the active years of the DEW Line site. Impacts to the freshwater surface water bodies were not observed at PIN-B in 2013.

7.0 NATURAL ENVIRONMENT

Information regarding the natural environment was gathered directly, through observation, and indirectly, through consultation with knowledgeable local persons in order to better understand the presence and temporal change of wildlife. The PIN-B Long-Term Monitoring Plan recommends monitoring the following parameters:

- 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; and
- Revegetation of disturbed areas versus previous years.

Wildlife and Human Activity

According to observations by a member of the PIN-B remediation workforce present on-site over a nine week period in 2010, some wildlife species that frequent the site include caribou, snow geese, Canada geese, grizzly bears, ground squirrels, and various birds. Evidence of human activities at the site was present but limited, and much was historical. Due to the large distance between the site and the nearest communities, it is not believed to be frequently visited or used by people. Limited human use of the PIN-B site was reported by the Kugluktuk Hunters and Trappers Organization, which responded that they and the local conservation office did not recall people from Kugluktuk using the site to hunt or fish recently. O.J. Bernhardt believes that the area is infrequently used for hunting of caribou and muskox. In his opinion, and with talk with other hunters, the number of animals available for harvest has not changed in recent years.

During the site visit, the FRANZ field assessors observed evidence (e.g. scat, tracks, nesting areas, burrows or visual observation) that sik sik, caribou, snowy owl, lemming, loons, grizzly bear, and bunting birds have frequented the area. During the 2011 site visit ravens, Canada geese, caribou, wolverine, black bears and ducks were identified on the site. A large raptor nest, presumed to be falcons, was observed at the Beach Area (Photo 54, Appendix C).

Re-establishment of Vegetation

Based on the regional setting of this site re-establishment of vegetation is not likely in the near future. Minor growth was observed on southeast side of the NHWL, on the berm and toe of landfill, during the 2013 monitoring activity (Photo 51, Appendix C).

8.0 LIMITATIONS

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

Any use, which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. 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 22, 2013. 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

Franz Environmental Inc., January 17, 2012. *Long Term Monitoring, 2011, PIN-B, Clifton Point, Nunavut.*

Indian and Northern Affairs Canada. April 15, 2011. *PIN-B (Clifton Point) Long-Term Monitoring Plan* (PIN-B LTMP, 2011).

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

10.0 CLOSURE

We trust that this information is satisfactory for 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.

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Distribution: Addressee (2 hardcopies, 1 electronic)
FRANZ (1 hard copy, 1 electronic)

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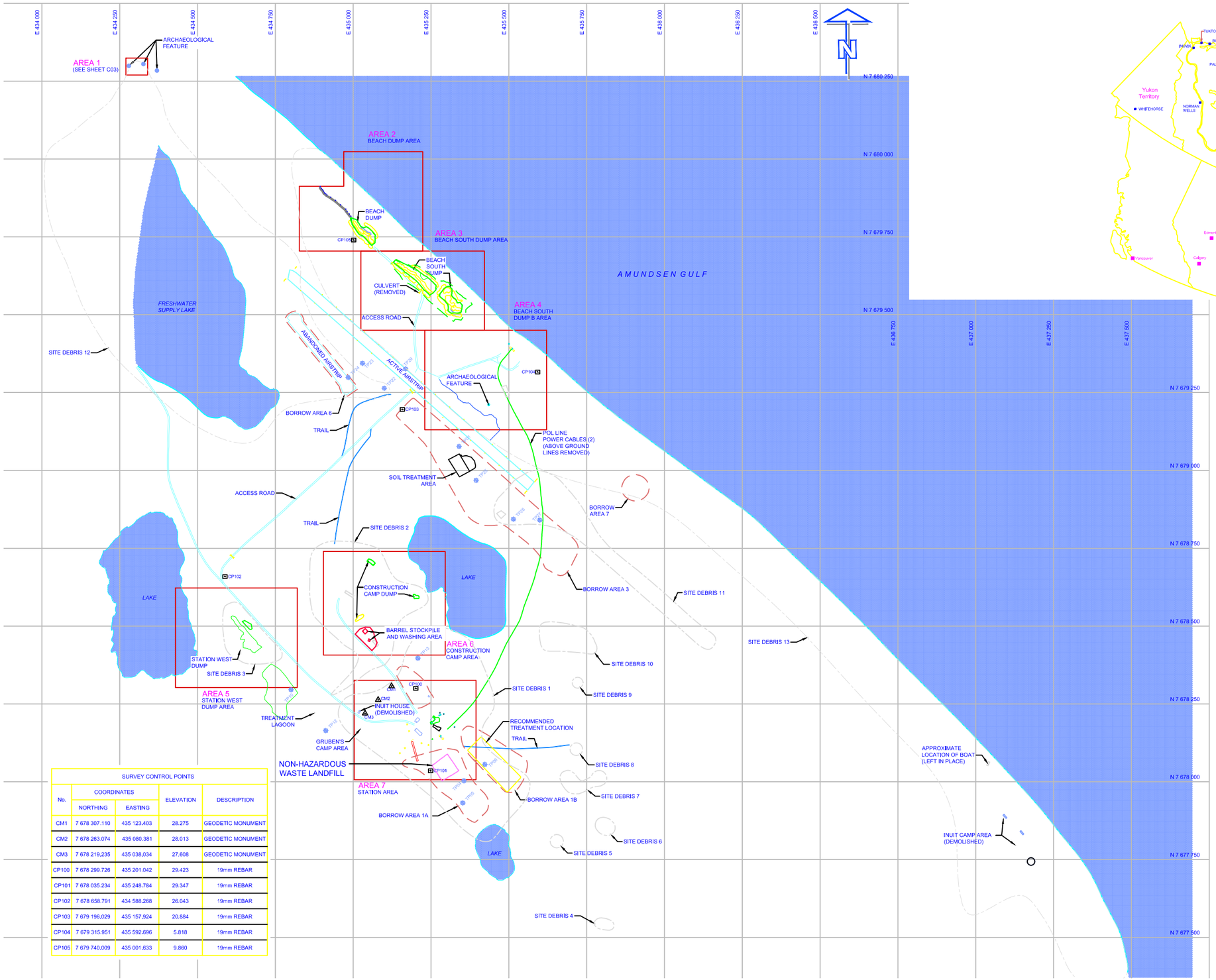
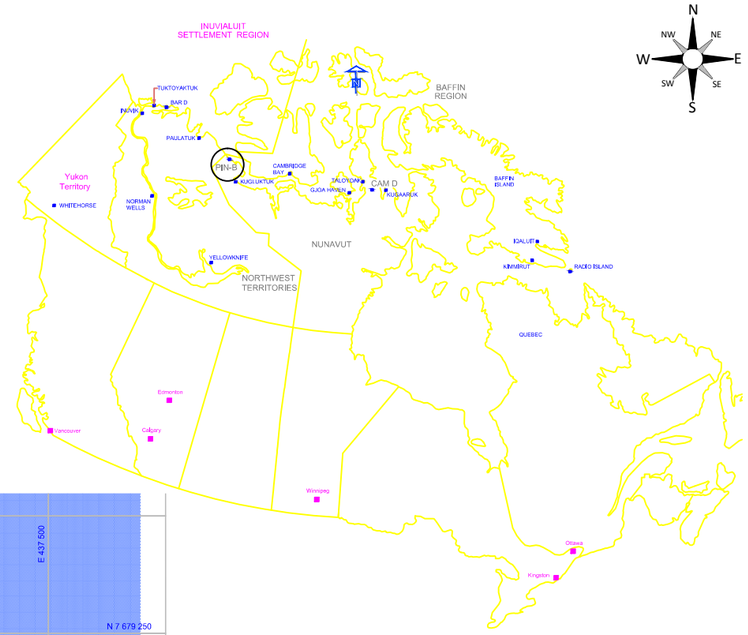
APPENDIX A

Figures



SURVEY CONTROL POINTS				
No.	COORDINATES		ELEVATION	DESCRIPTION
	NORTHING	EASTING		
CM1	7 678 307.110	435 123.403	28.275	GEODETIC MONUMENT
CM2	7 678 263.074	435 080.381	28.013	GEODETIC MONUMENT
CM3	7 678 219.235	435 038.034	27.608	GEODETIC MONUMENT
CP100	7 678 299.726	435 201.042	29.423	19mm REBAR
CP101	7 678 035.234	435 248.784	29.347	19mm REBAR
CP102	7 678 658.791	434 588.268	26.043	19mm REBAR
CP103	7 679 196.029	435 157.924	20.884	19mm REBAR
CP104	7 679 315.951	435 592.696	5.818	19mm REBAR
CP105	7 679 740.009	435 001.633	9.860	19mm REBAR



LEGEND:

- APPROXIMATE EXTENT OF BORROW AREA
- APPROXIMATE EXTENT OF SHORELINE
- ACCESS ROAD
- TRAIL
- EXTENT OF SITE DEBRIS AREAS
- CULVERT
- BODY OF WATER
- TP01 TESTPIT LOCATIONS
- CM1 SURVEY CONTROL MONUMENT
- CP100 SURVEY CONTROL POINTS

Reference:
Figure adopted from SENES Consultants drawing C02, dated February 2011

Title: Overall Site Plan

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: PIN-B Clifton Point 1697-1301

Date: November 2013

Client: Aboriginal Affairs and Northern Development Canada

1:12,500

Figure A-1

last saved by: dlogan

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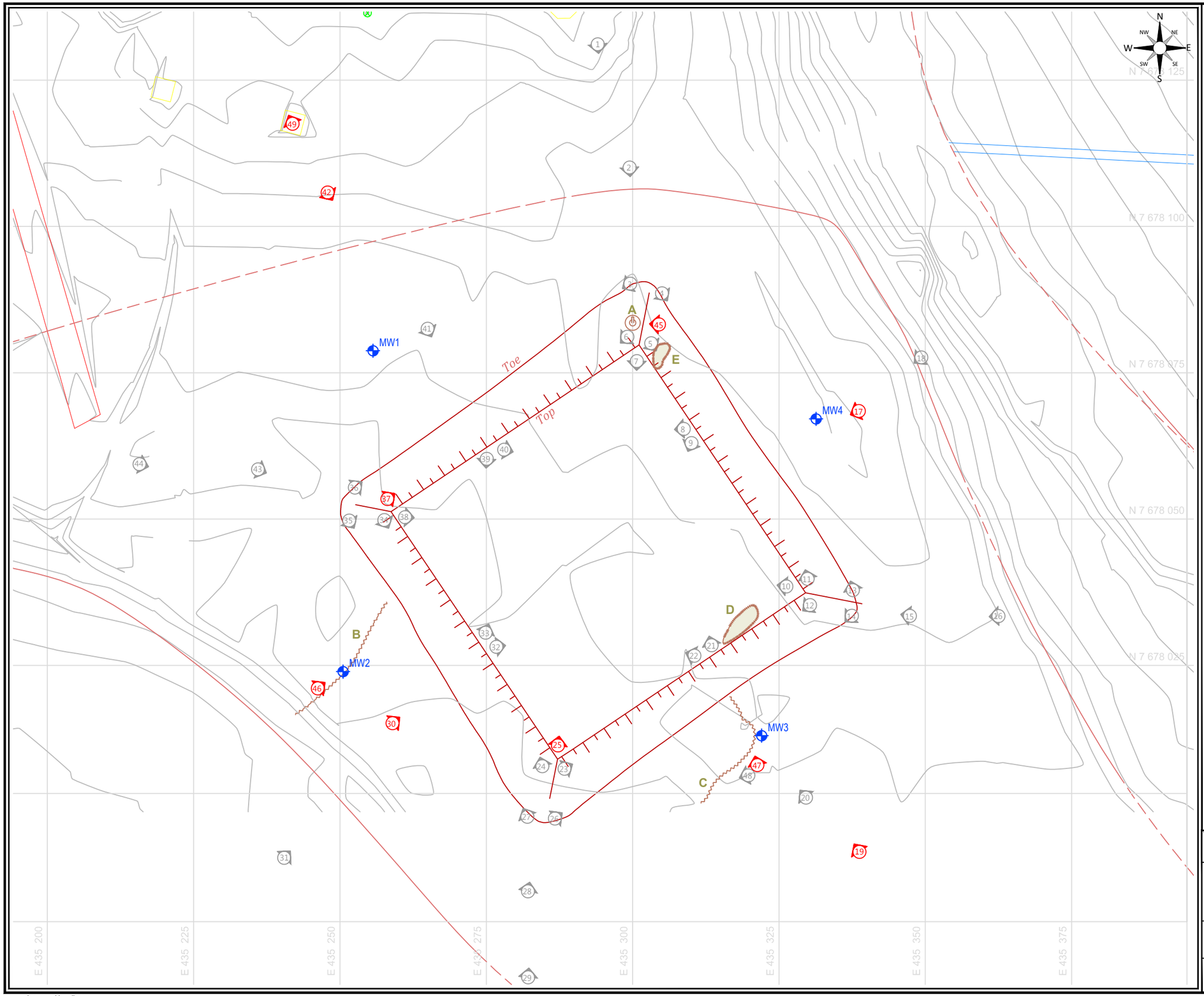

Legend

- MW — Monitoring Well Locations
- 25 — Picture Viewpoint Number
- 25 — Veiwpoint Photograph Included in Appendix B
- Erosion/Drainage
- Animal Burrow
- A — Feature Letter
- Settlement/Depression

Note:
Picture numbers refer to photograph names as they appear on the attached cd-rom.

Reference:
Figure adopted from SENES Consultants drawing C08, dated February 2011

Title: Non-hazardous Waste Landfill

FRANZ ENVIRONMENTAL INC.
CONSULTING ENGINEERING TECHNOLOGIES

Project: PIN-B Clifton Point 1697-1301

Date: October 2013

Client: Aboriginal Affairs and Northern Development Canada

1:650

Figure A-2

last saved by: dlogan

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APPENDIX B

Tables

Table B-1
Ground Water Chemical Concentrations - PHCs

PARAMETER / Sample ID / Date	CCME FIGQGs[1]	RDL	MW3-B
			22/08/2013
BTEX & F1 Hydrocarbons (ug/L)			
Benzene	140	0.40	<0.40
Toluene	83	0.40	<0.40
Ethylbenzene	1100	0.40	<0.40
o-Xylene	NC	0.40	<0.40
p+m-Xylene	NC	0.80	<0.80
Total Xylenes	3900	0.80	<0.80
F1 (C6-C10)	810	100	<100
F1 (C6-C10) - BTEX	NC	100	<100
F2-F4 Hydrocarbons (ug/L)			
F2 (C10-C16 Hydrocarbons)	1300	100	<100
F3 (C16-C34 Hydrocarbons)	NC	200	<200
F4 (C34-C50 Hydrocarbons)	NC	200	<200
Reached Baseline at C50	NA	NA	Yes

Notes:

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

NA = Not Applicable
NC = No Criteria
RDL= Reportable Detection Limit

Table B-2
Ground Water Chemical Concentrations - Metals

PARAMETER / Sample ID / Date	CCME FIGQGs[1]	RDL	MW3-B	
			22/08/2013	
Metals (µg/L)			**Total**	**Dissolved**
Total Aluminum (Al)	100	0.50	26	22
Total Antimony (Sb)	2000	0.020	0.080	0.085
Total Arsenic (As)	5	0.020	0.19	0.23
Total Barium (Ba)	500	0.020	63	61
Total Beryllium (Be)	5.3	0.010	<0.010	<0.010
Total Bismuth (Bi)	NA	0.0050	<0.0050	<0.0050
Total Boron (B)	5000	50	<50	<50
Total Cadmium (Cd)	0.017	0.0050	0.0090	0.013
Total Calcium (Ca)	NA	50	37700	40300
Total Chromium (Cr)	8.9	0.10	0.11	<0.10
Total Cobalt (Co)	NA	0.0050	0.045	0.11
Total Copper (Cu)	2	0.050	4.3	4.7
Total Iron (Fe)	300	1.0	14	3.4
Total Lead (Pb)	2	0.0050	0.050	0.025
Total Lithium (Li)	NA	0.50	1.7	1.6
Total Magnesium (Mg)	NA	50	24800	26700
Total Manganese (Mn)	NA	0.050	4.7	4.6
Total Molybdenum (Mo)	73	0.050	1.4	1.5
Total Nickel (Ni)	83	0.020	1.6	1.9
Total Potassium (K)	NA	50	2110	2240
Total Selenium (Se)	1	0.040	0.44	0.48
Total Silicon (Si)	NA	100	1200	1300
Total Silver (Ag)	0.1	0.0050	<0.0050	<0.0050
Total Sodium (Na)	NA	50	40200	43200
Total Strontium (Sr)	NA	0.050	70	69
Total Sulphur (S)	NA	3000	16500	17300
Total Thallium (Tl)	0.8	0.0020	0.0090	0.010
Total Tin (Sn)	NA	0.20	<0.20	<0.20
Total Titanium (Ti)	100	0.50	<0.50	<0.50
Total Uranium (U)	15	0.0020	1.4	1.5
Total Vanadium (V)	NA	0.20	0.21	0.34
Total Zinc (Zn)	10	0.10	16	19
Total Zirconium (Zr)	NA	0.10	0.26	0.33

Notes:

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

NA = Not Applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-3
Ground Water Chemical Concentrations - PCBs

PARAMETER / Sample ID / Date	CCME FIGQGs[1]	RDL	MW3-B
Sample ID			
Date			22/08/2013
PCBs (ug/L)			
Aroclor 1016	NC	0.050	<0.050
Aroclor 1221	NC	0.050	<0.050
Aroclor 1232	NC	0.050	<0.050
Aroclor 1242	NC	0.050	<0.050
Aroclor 1248	NC	0.050	<0.050
Aroclor 1254	NC	0.050	<0.050
Aroclor 1260	NC	0.050	<0.050
Aroclor 1262	NC	0.050	<0.050
Aroclor 1268	NC	0.050	<0.050
Total Aroclors	NC	0.050	<0.050

Notes:

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

NC = No Criteria

RDL= Reportable Detection Limit

Table B-4
Ground Water Chemical Concentrations - Inorganics

PARAMETER		CCME FIGQGs[1]	RDL	MW3-B
Sample ID				
Date				09/08/2013
Inorganics				
True Colour	PtCo	NC	20	5.0
Conductivity	uS/cm	NC	1.0	630
Total Dissolved Solids	mg/L	NC	10	410
Fluoride (F-)	mg/L	0.12	0.050	0.077
Orthophosphate (P)	mg/L	NC	0.003	0.0041
pH	pH	6.5-9	NA	8.01
Total Suspended Solids	mg/L	NC	0.40	2.9
Alkalinity (PP as CaCO3)	mg/L	NC	0.50	<0.50
Alkalinity (Total as CaCO3)	mg/L	NC	0.50	120
Bicarbonate (HCO3)	mg/L	NC	0.50	150
Carbonate (CO3)	mg/L	NC	0.50	<0.50
Hydroxide (OH)	mg/L	NC	0.50	<0.50
Dissolved Sulphate (SO4)	mg/L	NC	1.0	47
Dissolved Chloride (Cl)	mg/L	120	1.0	71
Nitrite (N)	mg/L	0.060	0.003	0.016
Nitrate (N)	mg/L	13.0	0.003	8.2
Calculated Parameters				
Hardness (CaCO3)	mg/L	NC	0.50	210
Ion Balance	NA	NC	0.010	1.0
Dissolved Nitrate (NO3)	mg/L	NC	0.013	36
Nitrate plus Nitrite (N)	mg/L	NC	0.0030	8.2
Dissolved Nitrite (NO2)	mg/L	NC	0.0099	0.053
Total Dissolved Solids	mg/L	NC	10	340

Notes:

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

NA = Not Applicable

NC = No Criteria

RDL= Reportable Detection Limit

APPENDIX C

Site Photographs

Northwest side of the NHWL. Monitoring Well 1 in foreground on right hand side. Viewpoint 42 (Figure A-2; Appendix A). Photograph reference 42 (CD-ROM). Direction photo taken: SE

Southwest side of the NHWL. Monitoring Well 2 in foreground on left hand side (arrow). Viewpoint 30 (Figure A-2; Appendix A). Photograph reference 30 (CD-ROM). Direction photo taken: NE