ARCADIS Design & Consultancy for natural and built assets

Aboriginal Affairs and Northern Development Canada

LONG TERM MONITORING, 2015

PIN-D, Ross Point, Nunavut

January 20, 2016

LONG TERM MONITORING, 2015

PIN-D, Ross Point, Nunavut

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ACRONYMS AND ABBREVIATIONS

AANDC	Aboriginal Affairs and Northern Development Canada
AMSRP	Abandoned Military Site Remediation Protocol
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
DEW	Distant Early Warning
DLCC	DEW Line Clean-Up Criteria
DND	Department of National Defense
EC	Environment Canada
EHTO	Ekaluktutiak Hunters and Trappers Organization
ESG	Environmental Sciences Group
FCSAP	Federal Contaminated Sites Action Plan
FIGQG	Federal Interim Groundwater Quality Guidelines
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health and Safety Plan
INAC	Indian Affairs and Northern Development
LTM	Long Term Monitoring
NHWL	Non-Hazardous Waste Landfill
PCBs	Polychlorinated Biphenyls
PHCs	Petroleum Hydrocarbons
POL	Petroleum, Oil and Lubricants
QA/QC	Quality Assurance/Quality Control
RDL	Reportable Detection Limit
RPD	Relative Percent Difference

EXECUTIVE SUMMARY

Arcadis Canada Inc. (Arcadis) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to conduct long-term monitoring activities at the former Distant Early Warning (DEW) Line site PIN-D, Ross Point, Nunavut. This project was completed under AANDC Standing Offer Number 4600000861, Order number 4500335455.

PIN-D Ross Point was an Intermediate DEW Line site, located on the north shore of Johansen Bay, overlooking Coronation Gulf, approximately 500 metres from the coast. The site is situated on a mesa 150 metres above sea-level and was typical of Intermediate DEW Line sites. It consisted of a module train, warehouse, garage, Inuit house, petroleum/oil/lubricant (POL) tanks, and a Doppler antenna. In addition to the main site, a beach landing area was constructed along with gravel roads linking the various facilities. Two airstrips were constructed at the site. A remediation project was conducted at the site between 2011 and 2012, which involved the demolition and disposal of buildings, structures and other debris, as well as the clean-up of hazardous materials and contaminated soil. Construction of the Non-Hazardous Waste Landfill (NHWL) at PIN-D started in 2011 and was completed in August 2012.

The 2015 monitoring program was carried out at the site on July 22, 2015. The landfill monitoring program consisted of a visual inspection of the NHWL, active layer water monitoring and natural environment monitoring.

Based on systematic visual observations and measurements, supported with photographic documentation, Arcadis determined that the NHWL is in acceptable condition, is performing as designed, and is containing the enclosed waste. Minor features noted at the NHWL included three minor depressions, located in the southwest and northwest corners and on the surface along the east side, and two potholes, one of which was new in 2015. None of these features are considered to have any significant impact on the integrity or performance of the NHWL.

During remediation at the site (2011-2012), four monitoring wells were installed at the site to allow for active layer water monitoring. During the 2015 monitoring program, Arcadis collected groundwater samples from two of the wells; there was insufficient water in the remaining two wells for sample collection. There is inadequate historical or baseline data to compare the results to the baseline mean as recommended by AANDC's long-term monitoring guidance. Groundwater results from 2015 exhibited concentrations of total aluminum, copper, cadmium, iron, lead and zinc above the Federal Interim Groundwater Quality Guidelines (FIGQGs). Dissolved concentrations of these metals did not exceed the FIGQGs. When compared to the 2013 results (consisting of results from the two groundwater samples collected), no obvious trends were noted (i.e. parameter concentrations were not consistently higher or lower in 2015 when compared to 2013 results). At this time, these occasional exceedances of the FIGQGs are not an immediate concern; however metal concentrations in groundwater samples should continue to be monitored.

The access roads, airstrip, and Main Station Area were observed and found to be in good condition with little change from 2013. The East Beach Area was only observed visually from the air. No apparent changes were observed. Physical evidence, supported by interviews with persons with first-hand knowledge of the site and with members of the nearby community's Hunters and Trappers Organization

(in 2013), 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.

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to conduct long-term monitoring activities at the former Distant Early Warning (DEW) Line site PIN-D, Ross Point, Nunavut. This project was completed under AANDC Standing Offer Number 4600000861, Order number 4500335455.

This report describes the monitoring activities completed for AANDC at PIN-D and was prepared in accordance with the Arcadis proposal P-5802, dated July 3, 2015.

Throughout this report, the AANDC DEW Line site PIN-D will be referred to as “the site”.

1.1 Project Objectives

Long term monitoring of the PIN-D 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 2015 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-D site, as described in the PIN-D (Ross Point) Long-Term Monitoring (LTM) 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-D LTM Plan, dated April 15, 2011, 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 four 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 2015 monitoring program report.

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

- Review of the PIN-D LTM Plan, previous LTM reports for PIN-D and the *Abandoned Military Site Remediation Protocol* (AMSRP, INAC, 2009);
- Preparation of a health and safety plan;
- Preparation of a sampling plan for soil and groundwater;
- Collection of water level data and observation of monitoring well condition at the site;
- Collection of groundwater and soil samples;
- Visual inspection, measurement and photo documentation of the site;
- Interviews with local residents and officials to understand land use and wildlife trends; and
- Report preparation.

1.3 Report Format

The long-term monitoring report is structured as follows:

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

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

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

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

Section 5 – Non-Hazardous Waste Landfill: Describes the visual observations of the NHWL and presents the analytical results, from the 2015 monitoring event.

Section 6 – Surrounding Areas: Describes the physical conditions of the remainder of the study area.

Section 7 – Natural Environment: Describes the flora and fauna observed at the site.

Section 8 – Limitations

Section 9 – References

Section 10 – Closure

2 BACKGROUND INFORMATION

2.1 Site Description

PIN-D Ross Point was an Intermediate DEW Line site, located on the north shore of Johansen Bay, overlooking Coronation Gulf, approximately 500 metres from the coast (Figure 1, located at the end of the report). The nearest communities are Kugluktuk, approximately 185 kilometres to the southwest, and Cambridge Bay, approximately 250 kilometres to the east. The site is located at 68°35'48.74" N, 111°07'3.47" W. The Ross Point site was reserved by the Department of National Defence (DND) in 1956. The PIN-D Intermediate DEW Line Site was constructed in 1959 and deactivated in 1963.

The site is situated on a mesa 150 metres above sea-level and was typical of Intermediate DEW Line sites. It consisted of a module train, warehouse, garage, Inuit house, petroleum/oil/lubricant (POL) tanks, and a Doppler antenna. In addition to the main site, a beach landing area was constructed along with gravel roads linking the various facilities. Two airstrips were constructed at the site. The minor airstrip (~300 metres long) is closest to the station area and oriented northeast-southwest. The main airstrip (~500 metres long) has an approximate east-west orientation and closely approaches the minor airstrip at its eastern end.

The area is characterized by low mesas and hills composed of dolomite and glacial till. The station facilities were constructed on one of the mesas. A steep cliff extends along the southern edge of the station with gentler slopes leading out east and west. A gentle slope to the north leads towards the major airstrip and freshwater lake; access to these areas is provided by a road. The main landfill is located at the west end of the minor airstrip. A second small landfill is located at the top edge of a slope above a small lake at the northeast base of the mesa. There is very little soil at the upper site and, as such, little vegetation. During the investigation it was noted that the lower slopes and depressions previously undisturbed contained a fair amount of vegetation; mainly grasses, sedges, and willows. Very little vegetation growth was observed around disturbed surface areas. The wildlife typically found in this region includes polar bears, caribou, muskoxen, wolf, arctic fox, snowshoe hare, raven, osprey, shorebirds, seabirds, and waterfowl.

In 1985 some of the surface contaminants at PIN-D were cleaned up under a program conducted by DND, Environment Canada (EC), and AANDC. An investigation was conducted in 1994; at that time the module train and garage were still intact but had suffered damage from prolonged weathering. The warehouse had been dismantled down to the concrete base. The four POL tanks (two at the beach and two at the main station) had been removed but the station pumphouse was intact, although the pump had been removed. The pipeline connecting the beach and station tanks was mostly intact and marked with barrels. The refuelling pipeline at the beach was mostly removed but pieces remained.

A remediation project was conducted at the site between 2011 and 2012, which involved the demolition and disposal of buildings, structures and other debris, as well as the clean-up of hazardous materials and contaminated soil. Construction of the NHWL at PIN-D started in 2011 and was completed in August 2012.

The NHWL was designed to contain non-hazardous materials only. It was constructed on native ground 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 metre lifts of waste covered

by 0.15 metres of granular fill. Once all the layers were completed, a final cover consisting of a minimum of 1.0 metres of granular fill was used to cap the landfill.

The NHWL at PIN-D contains the following types of waste:

- Type A hydrocarbon impacted soil;
- Non-hazardous site debris, such as scrap metal and wood;
- Creosote timbers;
- Double-bagged asbestos; and
- Tier 1 contaminated soil (Lead concentration between 200 and 500 ppm and PCB concentrations between 1 and 5 ppm).

Waste of the types noted above from PIN-E Cape Peel were also disposed of in the PIN-D NHWL. These items were transported from PIN-E to PIN-D for disposal in mid-August 2012.

2.2 Baseline Soil and Groundwater Data

Remediation at PIN-D was contracted with PIN-E (Cape Peel) and all wastes from both sites were disposed of in the NHWL at PIN-D. During the site remediation (site clean-up) activities at PIN-D, AECOM Canada Ltd. (AECOM) collected baseline soil data to use for comparison during future monitoring events. In 2011, four monitoring wells (MW1 through MW4) were installed around the perimeter of the NHWL. Baseline groundwater data was not collected in 2011 due to the late season well installation.

Twelve (12) baseline soil samples were collected from the NHWL footprint prior to construction in 2011 and tested for select metals; benzene, toluene, ethylbenzene, xylenes (BTEX); petroleum hydrocarbons (PHCs) and PCBs. The results of the analytical testing showed no exceedances of the DEW Line Clean-up Criteria (DLCC) for Tier I and II in soils (AECOM, 2012). Table 6 (in Appendix B) depicts the baseline soil analytical data for PIN-D's NHWL footprint.

Environmental Sciences Group (ESG) of the Royal Military College of Canada (RMC) conducted a background geochemical assessment at PIN-D in 2009 (ESG, 2010). The background geochemical assessment was undertaken to establish the natural levels of inorganic elements in the surrounding environment at the site. As a result of ESG's statistical analysis, it was recommended that the DLCC be used for cadmium and lead as all samples reported non-detectable concentrations. In addition, using the logs of the data and then using the exponentiation of the results for arsenic, cobalt, chromium, nickel and zinc, it yielded extreme outlier values that were below the DLCCs. It is recommended that the DLCC also be used for these elements.

Background concentrations encountered during the geochemical assessment were elevated for copper. Using the logs of the data and then using the exponentiation of the results, it yielded mild outlier values of 80 ppm for Cass Fiord Formation (Cc) and 63 ppm for Neoproterozoic Nelson Head Formation (Nnh), and extreme outlier values of 254 ppm for unit Cc and 221 ppm for unit Nnh, which are above the DLCC. The highest copper concentration found during the ESG geochemical assessment was below both the DLCC and the calculated mild outlier level. It was recommended that the DLCC for copper be used as a

reference point and the higher of the two extreme outlier limits, 254 ppm, be used as a site specific control level (ESG, 2010).

Table 7 (in Appendix B) depicts the soil analytical data collected by ESG during their geochemical assessment at PIN-D, collected in 2009.

In general, the average concentrations of selected metals were higher across the entire site than at the NHWL footprint with the exception of arsenic and lead. Lead was reported as non-detectable for all samples collected by ESG in 2009; however, the average concentration for the samples collected at the NHWL was 11.2 mg/kg. Arsenic was reported at marginally higher concentrations at the NHWL (3.9 mg/kg) in comparison to site-wide levels (1.8 mg/kg). Zinc, conversely, reported non-detectable concentrations at the NHWL and an average concentration of 19.4 mg/kg site-wide. Table 1 compares the average concentrations in soil of selected metals collected site-wide and at the NHWL footprint.

Table 1: Average Soil Analytical Results - Site Wide vs. NHWL Footprint

Parameters	NHWL Footprint		Site Wide	
	Avg. Conc. (mg/kg)	Std. Dev.	Avg. Conc. (mg/kg)	Std. Dev.
As	3.9	2.9	1.8	0.7
Cd	ND	---	ND	
Cr	13	7.1	25	5.0
Co	2.3	0.8	6.4	1.3
Cu	7.1	1.9	16.7	9.5
Pb	11.2	3.2	ND	
Ni	8.3	3.2	8.0	2.7
Zn	ND	---	19.4	4.2

Std. Dev. = Standard Deviation

Data collected from Appendix B, Table B1 through B3 (AECOM, 2012) and Appendix B, Table B-1 (ESG, 2010).

2.3 Previous Monitoring Programs

The 2015 monitoring program at PIN-D was the second (Year 3) of a proposed eight that are scheduled over a 25 year period. To become familiar with the site, Arcadis reviewed the following reports pertaining to DEW Line sites:

- *Long Term Monitoring, 2013, PIN-D, Ross Point, Nunavut*, dated January 20, 2014 by Arcadis (formerly Franz Environmental Inc.);
- PIN-D (Ross Point) Long-Term Monitoring Plan, March 28, 2013, Aboriginal Affairs and Northern Development Canada.
- Abandoned Military Site Remediation Protocol, March 2009, Indian and Northern Affairs Canada, Contaminated Sites Program.

3 REGULATORY AND OTHER GUIDELINES

3.1 Guidelines Review

Arcadis reviewed the PIN-D, Ross Point, LTM Plan and the AMSRP for mention of specific guidelines to use for comparison purposes. Federal guidelines were used where site-specific criteria were absent and/or were less strict than federal standards.

3.2 Groundwater

3.2.1 Comparison to Background Concentrations

There are no groundwater guidelines provided in the PIN-D 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 2: Groundwater Assessment

Geochemical Assessment	Acceptable	Marginal	Significant	Unacceptable
Groundwater concentrations within average ± three standard deviations or within analytical variability	Performing as expected			
Increasing trend in contaminant data over two 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.

Note: This table is reproduced from AMSRP Chapter 11, Table 4.2

This is the second monitoring event for the LTM plan to be implemented within the first five years at PIN-D and only two groundwater samples from two separate wells had been collected during the first event (in 2013). Therefore, there is insufficient historical or baseline data to obtain significant means or standard

deviations for comparison to the analytical results obtained during the 2015 monitoring activities. A qualitative comparison will be made between samples collected in 2015 and the two groundwater samples collected in 2013.

3.2.2 Federal Interim Groundwater Quality Guidelines

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

The FIGQGs were not developed with the scientific rigour associated with the Canadian Environmental Quality Guidelines (CEQGs). Instead, EC 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 2 *Federal Interim Groundwater Quality Guidelines*, *Generic Guidelines for Residential/Parkland Land Uses”* Tier 1, Freshwater Life pathway for coarse grained soil (FIGQG Table 2 Tier 1) were referenced for comparison purposes.

4 INVESTIGATIVE METHODOLOGY

The monitoring program was carried out at the PIN-D DEW Line site on July 22, 2015 by field assessors Julie Dittburner and Alisha Williamson of Arcadis. Wildlife monitoring services were provided by a representative from the Ekaluktutiak Hunters and Trappers Organization (EHTO), in Cambridge Bay, NU. During the field investigation, weather conditions were overcast, slight wind and approximately 10 ^{o}C. The program consisted of the following:

- Completing a health and safety plan with field briefing;
- Visually observing, measuring and documenting through photographs the physical integrity of the landfill;
- Collecting groundwater samples from existing wells (if possible);
- Collecting soil samples (if necessary, as per the LTM 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 (SSHASP) was developed. The SSHASP identified and provided mitigative actions for potential physical and chemical hazards associated with the monitoring work. The SSHASP also contained a listing of emergency contact numbers and provided protocols to follow in the event of an emergency.

A copy of the SSHASP 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 SSHASP has been retained on file at Arcadis and at the AANDC Nunavut Regional Office.

4.2 Visual Inspection

The physical integrity of the NHWL and surrounding areas were assessed using systematic visual observations and empirical measurements to record evidence of erosion, ponding, frost action, settlement and lateral movement of the landfills. Definitions for completing the checklist are found in Table 3 (below). A visual monitoring checklist, presented in the PIN-D LTM Plan, was completed for the landfill and is found in Table 4 and Table 5 in Section 5.3. A photographic record was completed to document the condition of the structures and substantiate the visual observations (Appendix A).

Table 3: Preliminary Visual Inspection Report NHWL - Definitions

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

In previous years, a Trimble Pro XRT GPS unit was used 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 2015 site visit to capture all required information as outlined in the LTM Plan. However, in the field it was discovered that the battery pack provided with the unit could not hold its charge. It was charged the night prior to the site visit, but had no power at the time of the site visit (approximately 2:30 PM). Photos were taken based on Figure 2 from the 2013 LTM report (Franz Environmental Ltd., 2013). It should be noted that no new SSF file was created in 2015. The 2013 file remains the most current version. The 2013 Trimble files are included in the appended CD ROM to be used in future site investigations.

4.3 Wildlife Survey

Arcadis 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 (rough-legged hawk), 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 Arcadis have been compared to previously recorded observations.

As part of the investigation, Arcadis representatives contacted the EHTO in Cambridge Bay where land uses by humans and wildlife as well as changes over time were discussed. The manager of the EHTO was not able to provide much information in regards to the site area. In addition, Arcadis interviewed the wildlife monitor (Willie), who, however, had limited firsthand knowledge of the area.

4.4 Groundwater Sample Collection

Upon arrival at the PIN-D site, the Aracdis field assessors made an attempt to measure water levels at each of the wells. Using a water level tape, the field assessors found that all four of the monitoring wells contained groundwater; however one well (MW3) contained only 1.5 cm of water. No sample was collected from this well.

A peristaltic pump was used to purge the monitoring wells prior to sample collection. Wells were purged of three well volumes where recharge rates permitted (MW1 and MW2). At MW4, approximately 400 mL of water was pumped out, leaving the well dry. One hour later, the well only contained 5 cm of water; no sample was collected. A YSI 556 water quality meter was calibrated prior to arriving in the field and used to measure *in situ* field parameters including temperature, conductivity, dissolved oxygen, pH and oxidation-reduction potential. Groundwater samples were collected once stabilization of parameters was reached. Water samples submitted for dissolved metals analyses were field-filtered.

Samples from MW1 and MW2 were submitted for analysis of various parameters: total and dissolved metals, PCBs; PHCs; BTEX; suspended and dissolved solids; major ions; hardness; pH and conductivity. A duplicate sample was collected from MW2. The groundwater samples were collected in laboratory prepared sample bottles appropriate for the specified analyses and 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 C. Chain of custody forms are provided in Appendix B.

4.5 Soil Sample Collection

There were no indications of seepage or staining as part of the visual inspection; therefore, no soil samples were collected during the 2015 monitoring activities, as per the LTM Plan for the site.

4.6 Quality Assurance/Quality Control

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

4.6.1 Field

Groundwater samples were collected from monitoring wells and placed in appropriately sized and prepared laboratory containers. Sample numbers were clearly marked on the containers. The water

bottles were filled to capacity with minimum headspace and stored in coolers with ice to moderate temperature fluctuations during transport to the laboratory.

As a quality control measure, one groundwater blind field duplicate sample was collected and analyzed for identical parameters (total and dissolved metals, PCBs, PHCs, BTEX, suspended and dissolved solids, major ions, hardness, pH and conductivity).

The samples, accompanied by a Chain of Custody form, were shipped via Canadian North to Maxxam Analytics (Maxxam) in Yellowknife. There, the samples were re-packaged and shipped by Maxxam to the appropriate analytical laboratory in either Edmonton or Calgary. Copies of the Chain of Custody forms are provided in Appendix B.

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

4.6.2 Laboratory

The selected laboratory, Maxxam, is certified by the Canadian Association for Laboratory Accreditation, Inc. (CALA) and has an internal QA/QC protocol. The internal QA/QC protocol includes the analysis of matrix spikes, spike blanks and method blanks. The laboratory QA/QC documentation is provided with the analytical report and was reviewed by Arcadis as part of the QA/QC protocol.

4.7 Analytical Program

The groundwater samples were received by Maxxam in Edmonton and Calgary, Alberta for chemical analyses of the target compounds previously identified. The laboratory certificates of analysis and chain of custody forms are presented in Appendix B.

5 NON-HAZARDOUS WASTE LANDFILL

5.1 Area Summary

The NHWL is located along the access road between the Main Station Area and the minor airstrip, at an approximate elevation of 150 m asl. A site plan is available in Figure 2, at the end of this report. The monitoring of the landfill included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. The surface and the berms of the NHWL are generally graded flat. The slope of the landfill is towards the north, with a minor slope towards the east side.

Groundwater samples were collected from MW1 on the north side of the NHWL and from MW2 on the south side of the NHWL. Due to insufficient sample volumes (MW3 and MW4) groundwater samples at these locations could not be collected. Soil samples were deemed unnecessary by the Arcadis field assessors and the on-site AANDC representative. The visual inspection report, including supporting photos and drawings, 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 49, attached CD-ROM). Those portions of the record referenced in the body of this document are included in Appendix A. The complete photographic record, of full-resolution photographs, is provided in the attached CD-ROM.

5.3 Visual Inspection Checklist

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 groundwater monitoring wells can be seen in Figure 2, located following Section 9.0. The visual monitoring checklist provided in the PIN-D LTM Plan has been completed and pertinent information is summarized in Table 5 of this report. Table 4 presents the preliminary visual inspection results for the NHWL at PIN-B.

Table 4: Preliminary Visual Inspection Report NHWL

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

Settlement

Three minor depressions were observed in the area of the NHWL, similar to 2013. One small depression on the eastern side of the surface of the landfill was noted. Another small depression was noted at the southwest corner of the landfill at the toe of the berm (Photo 10, Appendix A). The final minor depression was observed at the northwest corner of the landfill at the toe of the berm (Photo 12, Appendix A). All of these features appeared to be the result of poor final grading. They are considered minor in scale (<1 m diameter and 0.1 m deep) and are not considered to affect landfill integrity.

One pothole was observed at the southeast corner of the toe of the landfill berm, as in 2013. This pothole appears to be a result of grading (Photo 2, Appendix A). A new pothole was observed in 2015, in the southwest corner of the landfill (Photo 11, Appendix A). It was approximately 0.75 m by 0.75 m, with an approximately depth of 0.10 m. It appears that this pothole was a result of a minor slump where the edge of the surface of the landfill and the slope meet.

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

No evidence of a burrowing animal was observed at the NHWL.

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. Very minor vegetation growth was observed at southeast corner of the landfill at the observed pothole (Photo 2, Appendix A). No vegetation growth was observed on the surface of the landfill.

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

No drainage pathways were observed during the NHWL inspection.

Discussion

All physical observations suggest that the NHWL is performing as designed and is containing the enclosed waste. During future monitoring events all depression areas noted at the NHWL should be inspected for an increase in size and/or depth.

Table 5, on the following page, summarizes the results of the visual inspection.

Table 5: PIN-D, Ross Point, Visual Monitoring Checklist

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Toe of berm, southwest corner of the NHWL	1.0	0.25	0.2	<1%	Depression area as a result of final grading. Whole area is poorly graded	Feature appears mechanical. Does not affect the landfill integrity at this point	38
Settlement/Pothole	B	Toe of berm, southeast corner of the NHWL	1.0	1.0	0.1	<1%	Pothole, appears to be result of grading, minor vegetation growth	Feature appears mechanical. Does not affect the landfill integrity at this point	40
Settlement	C	On toe of berm at northwest corner of NHWL	1.5	0.75	0.1	<1%	Settlement area, minor, appears to be result of final grading	Feature appears mechanical. Does not affect the landfill integrity at this point	42
Settlement	D	On surface of NHWL along east side of landfill	2.5	1.75	0.15	<1%	Minor depression on surface of landfill, appears to be result of grading	Feature appears mechanical. Does not affect the landfill integrity at this point	43
Pothole	E	On surface of NHWL along south side of landfill	0.75	0.75	0.10	<1%	New feature	Feature appears to be a result of minor slumping. Does not affect the landfill integrity at this point	44

5.4 Analytical Results – Groundwater

5.4.1 Results

As described in Section 4.4, two groundwater samples, plus one duplicate, were submitted to Maxxam Analytics in Edmonton and Calgary, Alberta for analyses of PHCs, metals, PCBs and inorganic parameters. Analytical results are discussed below. There is insufficient historical or baseline data to obtain significant means and standard deviations for comparison, so results are compared quantitatively to the FIGQGs. A qualitative comparison is made to the limited 2013 results. Laboratory certificates of analyses for the 2015 groundwater samples are provided in Appendix B.

PHCs

Analytical results for PHCs are shown in Table B-3. Concentrations for all BTEX/PHC parameters were reported below laboratory detection limits. This is similar to the 2013 results.

There were no exceedances to be noted for FIGQGs. This is the same as the 2013 results.

Metals

Analytical results for dissolved and total metals in groundwater are shown in Table B-4 and B-5. Samples collected from MW1 and MW2 had low concentrations of several total and dissolved metals. The following exceedances of the FIGQGs were noted:

- Total aluminum concentrations in samples (sample and duplicate) collected from MW 2 exceeded the FIGQG concentration of 100 µg/L in 2015. Dissolved aluminum results did not exceed the FIGQG, indicating aluminum is likely associated with the sediment. Note that the concentration of total suspended solids (TSS) in samples collected from MW2 was 270 mg/L, whereas the sample collected from MW1 had a TSS concentration of 3 mg/L;
- Total cadmium concentrations in samples collected from MW2 (sample and duplicate) exceeded the FIGQG of 0.017 µg/L. The reportable detection limit (RDL) is 0.02 µg/L which also exceeds the FIGQG. Dissolved cadmium concentrations did not exceed the FIGQG, indicating cadmium is likely associated with the sediment;
- Total copper concentrations exceeded the FIGQG in all samples collected in 2015. Dissolved copper concentrations did not exceed the FIGQG, indicating copper is likely associated with the sediment;
- Total iron concentrations in the samples collected from MW2 (sample and duplicate) were higher than the FIGQG of 300 µg/L. Dissolved iron concentrations in these samples were not detected, indicating that iron is likely associated with the sediment;
- Total lead concentrations in the samples collected from MW2 (sample and duplicate) were higher than the FIGQG of 4 µg/L. Dissolved lead concentrations in these samples were not detected, indicating that lead is likely associated with the sediment;
- Total zinc concentrations in the samples collected from MW2 (sample and duplicate) were higher than the FIGQG of 10 µg/L. Dissolved zinc concentrations in these samples were not detected, indicating that zinc is likely associated with the sediment

The exceedances for total metals that are likely associated with the sediment in samples collected from MW2 (note higher TSS concentration in samples from MW2) are not an immediate concern. However they should continue to be evaluated during future sampling events.

Copper exceedances were noted in 2013: total copper concentrations in samples collected from MW2 and MW3 exceeded the FIGQG of 2 µg/L. Total copper concentrations in samples collected from MW2 were higher in 2015 than reported in 2013. Dissolved copper concentrations in samples collected from MW3 exceeded the FIGQG in 2013; no sample was collected from MW3 in 2015 but samples from MW1 and MW2 in 2015 did not exceed the FIGQG for copper.

When compared to the 2013 results (consisting of results from the one groundwater sample collected), no obvious trends were noted (i.e. parameter concentrations were not consistently higher or lower in 2015 when compared to 2013 results). At this time, these occasional exceedances of the FIGQGs are not an immediate concern; however metal concentrations in groundwater samples should continue to be monitored.

PCBs

Analytical results for PCBs in groundwater are shown in Table 11. Concentrations for all PCB parameters were reported below the laboratory detection limit. This is similar to the 2013 results. The FIGQGs do not specify guidelines for PCBs.

Inorganics

Laboratory analytical results for inorganics are shown in Table 12. Concentrations of hydroxide (OH^-), nitrite (NO_2^-) and dissolved nitrite (NO_2^-, calculated) were reported below the laboratory detection limit for all samples collected in 2015. Fluoride (F^-), orthophosphate (P), alkalinity (PP as CO_3) and carbonate (CO_3^-) were below detection limits in the sample collected from MW1. All other inorganic and calculated parameters reported concentrations above the laboratory detection limit but below the FIGQGs, where they exist.

5.4.2 Quality Assurance/Quality Control Results

A duplicate sample was collected from MW2. As a quality control check, a Relative Percent Difference (RPD) was calculated when analytical results from both samples were greater than five times the reportable detection limit (RDL). As per industry standards, the RPDs for parameters of duplicate groundwater samples should not exceed 80%. None of the RDLs calculated at MW2 exceeded this value (all RPDs were less than or equal to 22%) and the analytical results are considered acceptable.

6 SURROUNDING AREAS

Some of the outlying areas at the site were observed by foot and by aerial fly over during the site visit.

The access roads and airstrips appeared in good condition. Minor vegetation growth was observed on the airstrip and access roads. The main Station Area was void of any debris; however evidence of the remediation was prominent with equipment marks and graded areas. Three cement platforms remain that are likely the former foundations of the tower braces. The main Station Area is located on high table lands consisting of bedrock. Very little vegetation was observed at the Station Area as the area is lacking soils to support growth.

The East Beach Area was inspected by aerial fly over. No apparent changes from 2013 were observed. This area is at a much lower elevation then the Main Station. Here there is an increase of vegetation growth including mosses and grasses. Remnants of a derelict camp remain. A partially standing ply wood cabin, old camp equipment and caribou antlers were observed in 2013. The access road from this beach area connecting to the airstrip was observed in fair to good condition (Photo 15, Appendix A).

7 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-D 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
- Revegetation of disturbed areas versus previous years

Wildlife and Human Activity

According to observations by Kugluktuk community members, and a previous wildlife monitor (2013) O.J Bernhardt, this site is frequently used for hunting caribou and muskox. As far as Mr. Bernhardt is aware, these are the only animals hunted in the area. The area is not used for fishing. In Mr. Bernhardt's opinion as stated in 2013, the number of animals available for harvest has not changed in the past years. As far back as he can remember, the number of animals has remained consistent. During this investigation, Arcadis contacted the EHTO in Cambridge Bay where no additional information regarding wildlife in the Ross Point area was obtained.

During the site visit, the Arcadis field assessors observed evidence (e.g. scat, tracks, nesting areas, burrows or visual observation) of a number of animals. Caribou, arctic fox and muskox scat was observed. A rough-legged hawk was visually confirmed.

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 again observed on the south side of the NHWL, at the toe of landfill (Photo 2, Appendix A), in a similar location to 2013 observations. No vegetation growth was observed on the surface of the landfill.

8 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. Arcadis Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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

The conclusions presented represent the best judgment of the assessors based on current environmental standards and on the site conditions observed on July 22, 2015. Due to the nature of the investigation and the limited data available, the assessors cannot warrant against undiscovered environmental liabilities.

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

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

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

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

9 REFERENCES

Aboriginal Affairs and Northern Development Canada*, PIN-D Ross Point Long Term Monitoring Plan,* March 28, 2013.

AECOM Canada Ltd., PIN-D, Ross Point, Final Interim Construction Summary. April 2012.

Environmental Sciences Group, Royal Military College, Kingston, ON, Background Geochemical Assessment of PIN-D, Ross Point, Nunavut. January 2010.

Federal Interim Groundwater Quality Guidelines (FIGQG). 2013. *Table 1. Generic Guidelines for Residential/Parkland Land Uses Tier 1, Freshwater Life pathway for coarse-grained soil.*

Federal Interim Groundwater Quality Guidelines (FIGQG). 2013. *Table 2. Generic Guidelines for Residential/Parkland Land Uses Tier 1, Freshwater Life pathway for coarse-grained soil.*

Franz Environmental Inc., January 20, 2014. Long Term Monitoring, 2013, PIN-D, Ross Point, Nunavut.

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

TABLES

Tables 6 through 12

Table 6
Baseline Soil Analytical Data from NHWL Footprint
AANDC
PIN-D, Ross Point, Nunavut

Parameter (mg/kg)	11-0400	11-0401	11-0402	11-0403	11-0404	11-0405	11-0406	11-0407	11-0408	11-0409	11-0410	11-0411	Avg. Conc.	Std. Dev.
Depth (cm)	0-10	0-10	40-50	0-10	40-50	0-10	40-50	0-10	40-50	0-10	40-50	40-50		
As	3	3	3	3	3	1	2	2	12	3	6	6	3.9	2.9
Cd	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Cr	11	9	32	13	16	6	12	19	6	13	12	7	13.0	7.1
Co	ND	1	2	2	3	2	2	2	3	4	2	2	2.3	0.8
Cu	ND	ND	6	5	10	8	8	ND	5	8	ND	ND	7.1	1.9
Pb	14	15	12	9	11	4	8	10	14	13	14	10	11.2	3.2
Ni	7	5	16	8	11	5	7	11	7	9	8	5	8.3	3.2
Zn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Hg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
F1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
F1-BTEX	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
F2	ND	ND	ND	ND	62	ND	ND	ND	ND	30	42	61	48.8	15.5
F3	ND	ND	ND	ND	63	ND	ND	ND	ND	120	57	62	75.5	29.8
F4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---
Total PCBs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---	---

Table 7
ESG's Geochemical Assessment
Site-Wide Soil Analytical Data
AANDC
PIN-D, Ross Point, Nunavut

Sample ID	Terrain Unit	Depth (cm)	As (ppm)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Ni (ppm)	Pb (ppm)	Zn (ppm)
DCC Tier I	---	---	---	---	---	---	---	---	200	---
DCC Tier II	---	---	***30***	***5***	***50***	***250***	***100***	***100***	***500***	***500***
09-30960/61	Cc	20	2.1	ND	8.3	21	24	14	ND	24
09-30962	Cc	10	ND	ND	7.6	ND	27	11	ND	20
09-30963	Cc	10	ND	ND	ND	ND	14	6	ND	ND
09-30964	Cc	0	ND	ND	ND	22	34	11	ND	16
09-30965	Cc	0	ND	ND	ND	ND	12	ND	ND	ND
09-30966	Cc	30	ND	ND	7.3	21	26	12	ND	18
09-30967	Cc	10	1.5	ND	5.9	ND	30	8	ND	ND
09-30968	Cc	10	1.3	ND	ND	ND	6.5	7.7	ND	ND
09-30969	Cc	0	ND	ND	ND	ND	ND	ND	ND	ND
09-30970/71	Cc	20	ND	ND	ND	ND	20	ND	ND	ND
09-30972	Cc	10	ND	ND	5.3	ND	21	7.9	ND	ND
09-30973	Cc	10	1.3	ND	ND	ND	29	6.1	ND	ND
09-30974	Cc	10	1.4	ND	ND	ND	25	5.1	ND	19
09-30975	Cc	20	1.5	ND	5.2	ND	19	7.7	ND	ND
09-30976	Cc	20	1.2	ND	5.1	ND	17	8	ND	ND
09-30977	Cc	10	ND	ND	5.2	ND	5.9	5.8	ND	17
09-30978	Cc	10	2.3	ND	5.6	ND	18	7.5	ND	ND
09-30979	Cc	10	ND	ND	ND	ND	8.5	ND	ND	ND
09-30980/81	Cc	10	1.4	ND	ND	ND	14	ND	ND	ND
09-30982	Cc	10	ND	ND	ND	ND	10	5.1	ND	ND
09-30983	Cc	0	ND	ND	ND	ND	21	5.4	ND	ND
09-30984	Cc	10	2	ND	5.7	ND	49	10	ND	17
09-30985	Cc	10	ND	ND	ND	ND	6.2	ND	ND	ND
09-30986	Cc	20	ND	ND	ND	ND	8.4	5.3	ND	ND
09-30987	Cc	10	ND	ND	ND	ND	40	ND	ND	ND
09-30988	Cc	10	4	ND	5	ND	12	8	ND	ND
09-30989	Cc	0	2.4	ND	6.8	ND	24	11	ND	17
09-30990/91	Cc	10	ND	ND	ND	ND	5.6	ND	ND	ND
09-30992	Cc	20	1.1	ND	ND	ND	10	ND	ND	ND
09-30993	Cc	10	ND	ND	ND	ND	5.2	5.2	ND	ND
09-30994	Cc	0	ND	ND	ND	ND	16	7.6	ND	ND
09-30995	Cc	10	ND	ND	ND	ND	ND	ND	ND	ND
09-30996	Cc	0	1.1	ND	5.2	ND	26	7.9	ND	ND
09-30997	Cc	0	1.6	ND	5.3	ND	26	9.4	ND	ND
09-30998	Cc	0	ND	ND	ND	ND	12	5.6	ND	16
09-30999	Cc	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31000/01	Cc	0	2.9	ND	8.8	30	26	16	ND	30
09-31002	Cc	10	3.3	ND	ND	ND	16	6.4	ND	ND
09-31003	Cc	10	2.1	ND	5	ND	17	9	ND	ND
09-31004	Cc	10	1.4	ND	ND	ND	16	7.4	ND	ND
09-31005	Nnh	10	1.7	ND	ND	ND	7.3	6.5	ND	ND
09-31006	Nnh	10	1.6	ND	ND	ND	12	6	ND	ND
09-31007	Nnh	10	1.1	ND	ND	ND	15	5.7	ND	ND
09-31008	Nnh	20	ND	ND	ND	ND	5.5	ND	ND	ND

Table 7
ESG's Geochemical Assessment
Site-Wide Soil Analytical Data
AANDC
PIN-D, Ross Point, Nunavut

ARCADIS Design & Consultancy for natural and built assets

Sample ID	Terrain Unit	Depth (cm)	As (ppm)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Ni (ppm)	Pb (ppm)	Zn (ppm)
DCC Tier I	---	---	---	---	---	---	---	---	200	---
DCC Tier II	---	---	***30***	***5***	***50***	***250***	***100***	***100***	***500***	***500***
09-31009	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31010/11	Nnh	10	ND	ND	ND	ND	5.3	ND	ND	ND
09-31012	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31013	Nnh	10	1.7	ND	ND	ND	17	7.9	ND	ND
09-31014	Nnh	0	1.2	ND	ND	ND	ND	ND	ND	ND
09-31015	Nnh	0	2.1	ND	5.8	ND	15	8.6	ND	17
09-31016	Nnh	10	2.7	ND	ND	ND	13	7.1	ND	18
09-31017	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31018	Nnh	10	2.1	ND	7	ND	23	9.4	ND	17
09-31019	Nnh	10	1.4	ND	ND	ND	18	7.3	ND	ND
09-31020/21	Nnh	0	1.2	ND	ND	ND	10	6.2	ND	ND
09-31022	Nnh	10	1.3	ND	ND	ND	11	5.6	ND	ND
09-31023	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31024	Nnh	10	ND	ND	ND	ND	7.8	ND	ND	16
09-31025	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31026	Nnh	10	1.5	ND	ND	ND	18	7.1	ND	ND
09-31027	Nnh	0	ND	ND	ND	ND	6.2	ND	ND	ND
09-31028	Nnh	0	ND	ND	ND	ND	8.8	5.7	ND	18
09-31029	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31030/31	Nnh	20	ND	ND	ND	ND	10	ND	ND	ND
09-31032	Nnh	20	ND	ND	ND	ND	21	5	ND	ND
09-31033	Nnh	10	ND	ND	ND	ND	14	ND	ND	ND
09-31034	Nnh	0	ND	ND	ND	ND	9	5.5	ND	16
09-31035	Nnh	0	1.1	ND	ND	ND	15	ND	ND	16
09-31036	Nnh	0	ND	ND	ND	ND	6.4	5.1	ND	ND
09-31037	Cc	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31038	Cc	20	2.3	ND	7	24	17	13	ND	22
09-31039	Cc	10	3	ND	9.1	34	18	13	ND	ND
09-31040/41	Cc	0	ND	ND	ND	ND	17	6.2	ND	ND
09-31042	Cc	0	ND	ND	ND	ND	11	ND	ND	19
09-31043	Cc	10	ND	ND	5.8	ND	52	7.4	ND	ND
09-31044	Nnh	0	2.6	ND	6.3	ND	27	9.5	ND	28
09-31045	Nnh	0	1.8	ND	ND	ND	6.5	8.1	ND	ND
09-31046	Nnh	0	ND	ND	ND	ND	6.5	5.9	ND	ND
09-31047	Nnh	20	ND	ND	ND	ND	ND	ND	ND	ND
09-31048	Nnh	0	1.4	ND	9.3	27	16	16	ND	26
09-31049	Nnh	0	ND	ND	ND	ND	ND	5.5	ND	ND
09-31050/51	Nnh	0	ND	ND	ND	ND	ND	ND	ND	ND
09-31052	Nnh	0	2.3	ND	ND	ND	21	ND	ND	ND
09-31053	Nnh	10	1.3	ND	5.8	ND	25	8.9	ND	ND
09-31054	Nnh	20	ND	ND	ND	ND	9	ND	ND	ND
09-31055	Nnh	20	ND	ND	ND	ND	12	5.5	ND	ND
09-31056	Nnh	10	ND	ND	ND	ND	5.4	ND	ND	ND
09-31057	Nnh	10	ND	ND	ND	ND	ND	ND	ND	ND

Table 7
ESG's Geochemical Assessment
Site-Wide Soil Analytical Data
AANDC
PIN-D, Ross Point, Nunavut

Sample ID	Terrain Unit	Depth (cm)	As (ppm)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Ni (ppm)	Pb (ppm)	Zn (ppm)
DCC Tier I	---	---	---	---	---	---	---	---	200	---
DCC Tier II	---	---	***30***	***5***	***50***	***250***	***100***	***100***	***500***	***500***
09-31058	Nnh	10	2.9	ND	6.2	ND	23	9.5	ND	ND
09-31059	Nnh	10	1.2	ND	5.9	ND	19	10	ND	ND
Avg. Conc.	---	---	1.8	---	6.4	25.6	16.7	8.0	---	19.4
Std. Dev.	---	---	0.7	---	1.3	5.0	9.5	2.7	---	4.2

Table 8
Groundwater Chemical Concentrations - PHCs
AANDC Long Term Monitoring
PIN-D, Ross Point, Nunavut

PARAMETER	CCME FIGQGs[1]	RDL	MW1	MW2						MW3
			22/07/2015	21/08/2013	DUP 21/08/2013	RPD	22/07/2015	DUP 22/07/2015	RPD	21/08/2013
BTEX & F1 Hydrocarbons (µg/L)										
Benzene	140	0.40	<0.40	<0.40	<0.40	NA	<0.40	<0.40	NA	<0.40
Toluene	83	0.40	<0.40	<0.40	<0.40	NA	<0.40	<0.40	NA	<0.40
Ethylbenzene	11000	0.40	<0.40	<0.40	<0.40	NA	<0.40	<0.40	NA	<0.40
o-Xylene	NC	0.40	<0.40	<0.40	<0.40	NA	<0.40	<0.40	NA	<0.40
p+m-Xylene	NC	0.80	<0.80	<0.80	<0.80	NA	<0.80	<0.80	NA	<0.80
Total Xylenes	3900	0.80	<0.80	<0.80	<0.80	NA	<0.80	<0.80	NA	<0.80
F1 (C6-C10)	810	100	<100	<100	<100	NA	<100	<100	NA	<100
F1 (C6-C10) - BTEX	NC	100	<100	<100	<100	NA	<100	<100	NA	<100
F2-F4 Hydrocarbons (ug/L)										
F2 (C10-C16 Hydrocarbons)	1300	100	<100	<100	<100	NA	<100	<100	NA	<100
F3 (C16-C34 Hydrocarbons)	NC	200	-	<200	<200	NA	-	-	NA	<200
F4 (C34-C50 Hydrocarbons)	NC	200	-	<200	<200	NA	-	-	NA	<200
Reached Baseline at C50	NA	NA	-	Yes	Yes	NA	-	-	NA	Yes

Notes:

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

NA = Not Applicable

NC = No Criteria

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Table 9
Groundwater Chemical Concentrations - Total Metals
AANDC
PIN-D, Ross Point, Nunavut

PARAMETER	CCME FIGQGs[1]	RDL	MW1 22/07/2015	MW2 21/08/2013	MW2 22/07/2015	MW2 DUP 22/07/2015	RPD (%)	MW3 21/08/2013	MW3 DUP 21/08/2013	RPD (%)
Metals (µg/L)										
Total Aluminum (Al)	100*	3/0.5	11	33	4000	3500	13	21	20	7
Total Antimony (Sb)	2000	0.6/0.02	<0.6	0.027	<0.6	<0.6	NA	0.081	0.079	NA
Total Arsenic (As)	5	0.2/0.02	0.26	0.19	3.4	3.1	9	0.13	0.11	16
Total Barium (Ba)	500	10/0.02	15	39	65	62	5	31	31	2
Total Beryllium (Be)	5.3	1/0.01	<1	<0.010	<1	<1	NA	<0.010	<0.010	NA
Total Bismuth (Bi)	NA	5/0.005	<5	<0.0050	<5	<5	NA	<0.0050	0.0050	NA
Total Boron (B)	5000	20/50	<20	<50	<20	<20	NA	<50	<50	NA
Total Cadmium (Cd)	0.017	0.02/0.005	<0.020	0.0080	0.074	0.061	NA	0.012	0.0090	NA
Total Calcium (Ca)	NA	300/50	40000	23000	19000	18000	5	68900	62400	10
Total Chromium (Cr)	8.9	1/0.1	<1	1.5	3.1	2.7	NA	<0.10	0.15	NA
Total Cobalt (Co)	NA	0.3/0.005	<0.3	0.36	2.7	2.5	8	0.19	0.20	NA
Total Copper (Cu)	2*	0.2/0.05	3.2	7.3	15	12	22	3.1	3.1	1
Total Iron (Fe)	300	60/1	<60	41	7100	6500	9	23	19	18
Total Lead (Pb)	4*	0.20/0.005	0.26	0.13	9.8	8.7	12	0.10	0.095	6
Total Lithium (Li)	NA	20/0.5	<20	1.7	<20	<20	NA	1.4	1.6	NA
Total Magnesium (Mg)	NA	200/50	21000	41100	20000	20000	0	49200	49600	1
Total Manganese (Mn)	NA	4/0.05	<4	63	140	130	7	26	27	3
Total Molybdenum (Mo)	73	0.2/0.05	0.52	1.7	1.7	1.6	6	0.79	0.84	6
Total Nickel (Ni)	110*	0.5/0.02	1.5	6.0	4.5	4.0	12	1.9	2.0	4
Total Potassium (K)	NA	300/50	600	1540	2600	2500	4	1320	1340	2
Total Selenium (Se)	1	0.2/0.04	<0.2	0.23	0.38	0.37	NA	0.36	0.33	9
Total Silicon (Si)	NA	100	780	823	11000	10000	10	1170	1040	12
Total Silver (Ag)	0.1	0.1/0.005	<0.1	<0.0050	<0.1	<0.1	NA	<0.0050	<0.0050	NA
Total Sodium (Na)	NA	500/50	2800	8180	16000	16000	NA	8090	8210	1
Total Strontium (Sr)	NA	20/0.05	<20	55	37	36	NA	60	59	2
Total Sulphur (S)	NA	200/3000	2700	40200	3100	3100	0	70400	70200	0
Total Thallium (Tl)	0.8	0.2/0.002	<0.20	0.014	0.23	0.22	NA	0.033	0.033	0
Total Tin (Sn)	NA	1/0.2	<1	<0.20	1.1	1.1	NA	<0.20	<0.20	NA
Total Titanium (Ti)	100	1/0.5	<1	1.2	92	89	3	<0.50	<0.50	NA
Total Uranium (U)	15	0.1/0.002	0.74	4.1	2.3	2.1	9	6.9	6.8	2
Total Vanadium (V)	NA	1/0.2	<1	0.23	7.8	6.9	12	<0.20	0.20	NA
Total Zinc (Zn)	10	3/0.1	9.1	0.64	50	42	17	0.95	0.81	16
Total Zirconium (Zr)	NA	3/0.1	<3	<0.10	<3	3.5	NA	<0.10	<0.10	NA

Notes:

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

* = Value from Canadian Environmental Water Quality Guidelines, Water Quality Guidelines for the Protection of Freshwater Aquatic Life, with no groundwater factor applied (i.e. value is conservative)

NA = Not Applicable

NC = No Criteria

RPD = Relative Percent Difference

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table 10
Groundwater Chemical Concentrations - Total Metals
AANDC
PIN-D, Ross Point, Nunavut

PARAMETER	CCME FIGQGs[1]	RDL	MW1 22/07/2015	MW2 21/08/2013	MW2 22/07/2015	MW2 DUP 22/07/2015	RPD (%)	MW3 21/08/2013	MW3 DUP2 21/08/2013	RPD (%)
Metals (µg/L)										
Dissolved Aluminum (Al)	100*	0.5/3	4.3	28	7.3	7.4	NA	17	21	18
Dissolved Antimony (Sb)	2000	0.02/0.6	<0.6	0.025	<0.6	<0.6	NA	0.086	0.095	NA
Dissolved Arsenic (As)	5	0.02/0.2	<0.2	0.15	0.31	0.27	NA	0.13	0.13	3
Dissolved Barium (Ba)	500	0.02/10	15	38	12	12	NA	31	31	0
Dissolved Beryllium (Be)	5.3	0.01/1	<1	<0.010	<1	<1	NA	<0.010	<0.010	NA
Dissolved Bismuth (Bi)	NA	0.005/5	<5	<0.0050	<5	<5	NA	<0.0050	0.0130	NA
Dissolved Boron (B)	5000	50/20	<20	<50	<20	<20	NA	<50	<50	NA
Dissolved Cadmium (Cd)	0.017	0.005/0.02	<0.020	0.013	<0.020	<0.020	NA	0.013	0.012	NA
Dissolved Calcium (Ca)	NA	50/300	40000	27100	17000	17000	0	68500	67500	1
Dissolved Chromium (Cr)	8.9	0.1/1	<1	<0.10	<1	<1	NA	<0.10	<0.10	NA
Dissolved Cobalt (Co)	NA	0.005/0.3	<0.3	0.37	<0.3	<0.3	NA	0.22	0.24	10
Dissolved Copper (Cu)	2*	0.05/0.2	1.5	2.0	1.3	0.95	NA	2.6	2.9	10
Dissolved Iron (Fe)	300	1/60	<60	1.6	<60	<60	NA	3.7	3.3	NA
Dissolved Lead (Pb)	4*	0.005/0.20	<0.2	0.020	<0.2	<0.2	NA	0.014	0.033	NA
Dissolved Lithium (Li)	NA	0.5/20	<20	1.5	<20	<20	NA	1.7	1.5	NA
Dissolved Magnesium (Mg)	NA	50/200	21000	44100	20000	20000	0	50300	53300	6
Dissolved Manganese (Mn)	NA	0.05/4	<4	61	6.8	6.6	NA	27	29	6
Dissolved Molybdenum (Mo)	73	0.05/0.20	0.46	1.9	0.85	0.81	NA	0.77	0.89	15
Dissolved Nickel (Ni)	110*	0.02/0.50	1.0	3.5	<0.5	<0.5	NA	1.9	2.2	14
Dissolved Potassium (K)	NA	50/300	590	1540	980	940	NA	1310	1360	4
Dissolved Selenium (Se)	1	0.04/0.20	<0.2	0.24	<0.2	<0.2	NA	0.34	0.33	3
Dissolved Silicon (Si)	NA	100	770	898	640	640	0	1140	1110	3
Dissolved Silver (Ag)	0.1	0.005/0.10	<0.1	<0.0050	<0.1	<0.1	NA	<0.0050	<0.0050	NA
Dissolved Sodium (Na)	NA	50/500	2600	8700	9100	9200	1	8250	8640	5
Dissolved Strontium (Sr)	NA	0.05/20	<20	54	28	28	NA	57	58	2
Dissolved Sulphur (S)	NA	3000/200	2700	4250	2700	2700	0	68200	74300	9
Dissolved Thallium (Tl)	0.8	0.002/0.20	<0.20	0.013	<0.2	<0.2	NA	0.033	0.034	3
Dissolved Tin (Sn)	NA	0.2/1	<1	<0.20	<1	<1	NA	<0.20	<0.20	NA
Dissolved Titanium (Ti)	100	0.5/1	<1	<0.50	<1	<1	NA	<0.50	<0.50	NA
Dissolved Uranium (U)	15	0.002/0.1	0.65	4.4	0.63	0.59	7	7.1	7.1	1
Dissolved Vanadium (V)	NA	0.2/1	<1	0.21	<1	<1	NA	0.23	0.22	NA
Dissolved Zinc (Zn)	10	0.1/3	8.0	2.7	<3	<3	NA	2.1	2.3	9
Dissolved Zirconium (Zr)	NA	0.1/3	<3	<0.10	<3	<3	NA	0.12	0.10	NA

Notes:

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

* = Value from Canadian Environmental Water Quality Guidelines, Water Quality Guidelines for the Protection of Freshwater Aquatic Life, with no groundwater factor applied (i.e. value is conservative)

NA = Not Applicable

NC = No Criteria

RPD = Relative Percent Difference

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table 11
Groundwater Chemical Concentrations - PCBs
AANDC
PIN-D, Ross Point, Nunavut

PARAMETER	CCME FIGQGs[1]	RDL	MW1 22/07/2015	MW2 22/08/2013	MW2 22/07/2015	MW2 DUP 22/07/2015	RPD	MW3 22/08/2013	MW3 DUP 22/08/2013	RPD
PCBs (ug/L)										
Aroclor 1016	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1221	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1232	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1242	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1248	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1254	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1260	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1262	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Aroclor 1268	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA
Total Aroclors	NC	0.050	<0.050	<0.050	<0.050	<0.050	NA	<0.050	<0.050	NA

Notes:

1 = Table 1: Federal Interim Groundwater Quality Guidelines, Generic Guidelines for Residential/Parkland Land Use (µg/L), Tier 1, Lowest Guideline for coarse grained soils.
NA = Not Applicable
NC = No Criteria
RDL = Reportable Detection Limit
RPD = Relative Percent Difference

Table 12
Groundwater Chemical Concentrations - Inorganic Parameters
AANDC
PIN-D, Ross Point, Nunavut

PARAMETER		CCME FIGQGs[1]	RDL	MW1	MW2	MW2	MW2		MW3	MW3	
				22/07/2015	21/08/2013	22/07/2015	DUP 22/07/2015	RPD	21/08/2013	DUP 21/08/2013	RPD
Inorganics	**Units**										
True Colour	PtCo	NC	2	6.8	3.6	4.9	39	NA	3.8	2.7	NA
Conductivity	uS/cm	NC	1.0	370	520	270	270	0	730	730	0
Total Dissolved Solids	mg/L	NC	10	190	NA	150	140	7	500	490	2
Fluoride (F-)	mg/L	0.12	0.050	<0.050	0.061	0.066	0.064	NA	<0.050	<0.050	NA
Orthophosphate (P)	mg/L	NC	0.0030	<0.0030	0.0030	0.014	0.013	NA	<0.0030	0.0032	NA
pH	pH	6.5-9	NA	7.8	8.01	8.7	8.7	0	7.99	7.92	1
Total Suspended Solids	mg/L	NC	0.4/1.0	2.7	NA	270	300	11	0.5	0.46	NA
Alkalinity (PP as $CaCO_3$)	mg/L	NC	0.50	<0.50	<0.50	3.6	3.9	8	<0.50	<0.50	NA
Alkalinity (Total as $CaCO_3$)	mg/L	NC	0.50	170	110	130	130	0	160	160	0
Bicarbonate (HCO_3)	mg/L	NC	0.50	200	130	150	140	7	190	190	0
Carbonate (CO_3)	mg/L	NC	0.50	<0.50	<0.50	4.3	4.7	9	<0.50	<0.50	NA
Hydroxide (OH)	mg/L	NC	0.50	<0.50	<0.50	<0.50	<0.50	NA	<0.50	<0.50	NA
Dissolved Sulphate (SO_4)	mg/L	100	1.0	8.6	130	12	12	0	190	200	5
Dissolved Chloride (Cl)	mg/L	120	1.0	5.7	22	7.1	7.2	1	18	19	5
Nitrite (N)	mg/L	0.06	0.003/0.010	<0.010	<0.0030	<0.010	<0.010	NA	<0.0030	0.0050	NA
Nitrate (N)	mg/L	13	0.003/0.010	1.6	0.31	0.38	0.39	3	1.0	1.0	0
Calculated Parameters											
Hardness (CaCO3)	mg/L	NC	0.50	190	260	120	120	0	370	390	5
Ion Balance	NA	NC	0.010	1.0	1.0	0.96	0.97	1	1.0	1.0	0
Dissolved Nitrate (NO3)	mg/L	NC	0.013/0.044	7.2	1.4	1.7	1.7	0	4.6	4.6	0
Nitrate plus Nitrite (N)	mg/L	NC	0.003/0.020	1.6	0.31	0.38	0.39	3	1.0	1.0	0
Dissolved Nitrite (NO2)	mg/L	NC	0.0099/0.033	<0.033	<0.0099	<0.033	<0.033	NA	<0.0099	0.016	NA
Total Dissolved Solids	mg/L	NC	10	190	300	150	140	7	430	450	5

Notes:

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

NA = Not Applicable
NC = No Criteria
RDL= Reportable Detection Limit
RPD = Relative Percent Difference
200 Exceeds selected guideline.

FIGURES

Legend

Title: Site Location

ARCADIS

Project: PIN-D 1697-1501

Date: October 2015

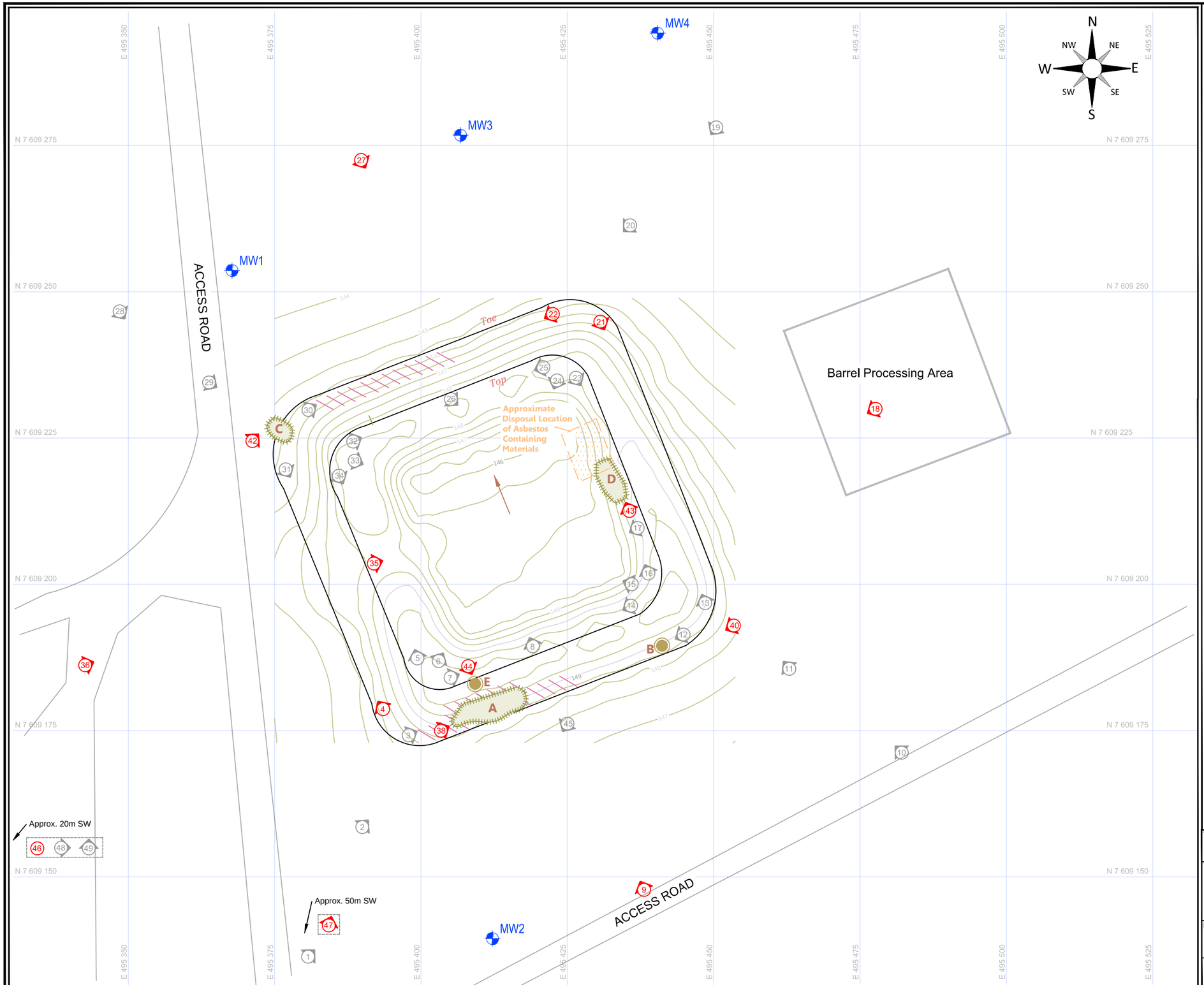
Client: Aboriginal Affairs and Northern Development Canada

Metres
49999.9996 0 49999.9996 99999.9992
1:4999999.961

Figure 1

last saved by:dlogan on 18-Nov-15

Z:\Projects\2015\1697-1501 AANDC DEW Lines\Individual Sites\PIN-D\Figures\1-CAD\PIN-D 2015 Monitoring.dwg(layout)



Legend

- MW — Monitoring Well Locations
- 25 — Picture Viewpoint Number
- 8 — Viewpoint Photograph Included in Appendix A
- A — Settlement or Depression
- Pothole
- A — Feature Reference Letter
- Slope Direction
- Poorly graded areas - large marks left by grader

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

Title: Non-Hazardous Waste Landfill	
ARCADIS	Project: PIN-D 1697-1501
Date: October 2015	Client: Aboriginal Affairs and Northern Development Canada
Metres 7.5 0 7.5 15 1:650	Figure 2

last saved by:dlogan on 18-Nov-15

Z:\Projects\2015\1697-1501 AANDC DEW Lines\Individual Sites\PIN-D\Figures\1-CAD\PIN-D 2015 Monitoring.dwg(layout)

APPENDIX A

Site Photographs

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 1

Date:
July 22, 2015

Description:
South side of the NHWL
Location:
Viewpoint 9 (Figure 2)
Direction Taken:
N

Photo: 2

Date:
July 22, 2015

Description:
Along SE berm of the NHWL. Settlement/pothole (Feature B) visible in foreground.
Location:
Viewpoint 40 (Figure 2)
Direction Taken:
SW

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 3

Date:
July 22, 2015

Description:
East side of the NHWL
Location:
Viewpoint 18 (Figure 2)
Direction Taken:
W

Photo: 4

Date:
July 22, 2015

Description:
.
Location:
Viewpoint 21 (Figure 2)
Direction Taken:
SE

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 5

Date*:*
July 22, 2015

Description:
North side of the NHWL.
Location:
Viewpoint 27 (Figure 2)
Direction Taken:
S

Photo: 6

Date:
July 22, 2015

Description:
Along northwest berm of the NHWL.
Location:
Viewpoint 22 (Figure 2)
Direction Taken:
E

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 7

Date*:*
July 22, 2015

Description:
West side of the NHWL.
Location:
Viewpoint 36 (Figure 2)
Direction Taken:
E

Photo: 8

Date:
July 22, 2015

Description:
Along the southwest berm of the NHWL.
Location:
Viewpoint 4 (Figure 2)
Direction Taken:
NW

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 9

Date*:*
July 22, 2015

Description:
View of grading on surface of NHWL.

Location:
Viewpoint 35 (Figure 2)

Direction Taken:
E

Photo: 10

Date:
July 22, 2015

Description:
View of depression on southwest corner of NHWL (Feature A). Also poorly graded.

Location:
Viewpoint 38 (Figure 2)

Direction Taken:
E

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 11

Date:
July 22, 2015

Description:
View of new pothole at southwest corner of the NHWL (Feature E), minor vegetation growth is evident.

Location:
Viewpoint 44 (Figure 2)

Direction Taken:
S

Photo: 12

Date:
July 22, 2015

Description:
View of depression on northwest corner of NHWL (Feature C).

Location:
Viewpoint 42 (Figure 2)

Direction Taken:
SE

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 13

Date:
July 22, 2015

Description:
View of muskox scat.
Location:
Viewpoint 46 (Figure 2)
Direction Taken:
N/A

Photo: 14

Date:
July 22, 2015

Description:
Settlement (Feature D) in foreground, along NE side on top of NHWL.
Location:
Viewpoint 43 (Figure 2)
Direction Taken:
NW

Project Photographs

Long Term Monitoring, 2015
PIN-D, Ross Point, Nunavut

Photo: 15

Date*:*
July 22, 2015

Description:
View of access road, south of the NHWL.

Location:
Viewpoint 47 (Figure 2)

Direction Taken:
N

Photo Summary

Picture viewpoint numbers of the NHWL (as depicted in Figure 2) cross-referenced with picture numbers on attached CD-ROM. Bolded viewpoint and pictures are those that appear in the partial photographic record presented above.

Table 13: Summary of Photos

Viewpoint #	Picture #	Viewpoint #	Picture #
1	1	25	25
2	2	26	26
3	3	**27**	**27**
4	**4**	28	28
5	5	29	29
6	6	30	30
7	7	31	31
8	8	32	32
9	**9**	33	33
10	10	34	34
11	11	**35**	**35**
12	12	**36**	**36**
13	13	37	Not taken
14	14	**38**	**38**
15	15	39	Not taken
16	16	**40**	**40**
17	17	41	Not taken
18	**18**	**42**	**42**
19	19	**43**	**43**
20	20	**44**	**44**
21	**21**	45	45
22	**22**	**46**	**46**
23	23	47	**47**
24	24	48	48
---	---	49	49

APPENDIX B

Laboratory Reports and Chain of Custody Forms

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 1697-1501;PIN-D
Your C.O.C. #: 471125-01-01

Attention:STEPHANIE JOYCE

ARCADIS Canada
329 CHURCHILL AVE NORTH
SUITE 2000
OTTAWA, ON
CANADA K1Z 5B8

Report Date: 2015/08/05
Report #: R2009939
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B563731
Received: 2015/07/27, 10:50

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	3	N/A	2015/07/29	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	3	N/A	2015/07/31	AB SOP-00039	CCME CWS/EPA 8260C m
Cadmium - low level CCME - Dissolved	2	N/A	2015/07/31	AB WI-00065	Auto Calc
Cadmium - low level CCME - Dissolved	1	N/A	2015/08/04	AB WI-00065	Auto Calc
Cadmium - low level CCME (Total)	3	2015/07/29	2015/07/30	AB WI-00065	Auto Calc
Chloride by Automated Colourimetry	3	N/A	2015/07/31	AB SOP-00020	SM 22 4500-Cl G m
True Colour	3	N/A	2015/07/29	EENVSOP-00065	SM 22 2120 C m
Conductivity @25C	3	N/A	2015/07/30	AB SOP-00005	SM 22 2510 B m
Fluoride	3	N/A	2015/07/31	AB SOP-00005	SM 22 4500-F C m
CCME Hydrocarbons in Water (F2; C10-C16)	3	2015/07/30	2015/07/30	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2015/07/30	AB WI-00065	Auto Calc
Hardness	2	N/A	2015/07/31	AB WI-00065	Auto Calc
Elements by ICP - Dissolved	3	N/A	2015/07/30	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP - Total	3	2015/07/30	2015/07/30	AB SOP-00014 / AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	3	N/A	2015/07/30	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS - Total	3	2015/07/30	2015/07/30	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS - Dissolved (Ext List) (1)	3	N/A	2015/08/04	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS - Total (Ext List) (1)	3	2015/08/01	2015/08/04	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	3	N/A	2015/07/31	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2015/07/30	AB WI-00065	Auto Calc
Sum of cations, anions	2	N/A	2015/07/31	AB WI-00065	Auto Calc
Nitrate and Nitrite	3	N/A	2015/07/31	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	3	N/A	2015/07/31	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	3	N/A	2015/07/30	AB SOP-00023	SM 22 4110 B m
Polychlorinated Biphenyls (1)	3	2015/07/30	2015/08/03	CAL SOP-00149	EPA 8082A R1 m
pH @25°C (Alkalinity titrator)	3	N/A	2015/07/29	AB SOP-00005	SM 22 4500 H+ B m

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Your Project #: 1697-1501;PIN-D
Your C.O.C. #: 471125-01-01

Attention:STEPHANIE JOYCE

ARCADIS Canada
329 CHURCHILL AVE NORTH
SUITE 2000
OTTAWA, ON
CANADA K1Z 5B8

Report Date: 2015/08/05
Report #: R2009939
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B563731
Received: 2015/07/27, 10:50

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Orthophosphate by Konelab	3	N/A	2015/07/31	AB SOP-00025	SM 22 4500-P A,B,F m
Sulphate by Automated Colourimetry	3	N/A	2015/07/31	AB SOP-00018	SM 22 4500-SO4 E m
Total Dissolved Solids (Filt. Residue)	3	2015/07/29	2015/07/30	AB SOP-00065	SM 22 2540 C m
Total Dissolved Solids (Calculated)	3	N/A	2015/07/31	AB WI-00065	Auto Calc
Total Suspended Solids (NFR)	3	2015/07/29	2015/07/30	AB SOP-00061	SM 22 2540 D m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Calgary Environmental

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Sherlyne Sim, B.Eng, Project Manager
Email: SSim@maxxam.ca
Phone# (780)577-7113
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B563731
Report Date: 2015/08/05

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		MT1666	MT1667	MT1668		
Sampling Date		2015/07/22 16:30	2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01	471125-01-01	471125-01-01		
	Units	MW1	MW2	DUP	RDL	QC Batch
Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	0.10	7984948
Volatiles						
Benzene	ug/L	<0.40	<0.40	<0.40	0.40	7985630
Toluene	ug/L	<0.40	<0.40	<0.40	0.40	7985630
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	0.40	7985630
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	0.80	7985630
o-Xylene	ug/L	<0.40	<0.40	<0.40	0.40	7985630
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	0.80	7985630
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	100	7985630
F1 (C6-C10)	ug/L	<100	<100	<100	100	7985630
Surrogate Recovery (%)						
1,4-Difluorobenzene (sur.)	%	103	103	104	N/A	7985630
4-Bromofluorobenzene (sur.)	%	96	94	95	N/A	7985630
D4-1,2-Dichloroethane (sur.)	%	94	91	91	N/A	7985630
O-TERPHENYL (sur.)	%	97	100	97	N/A	7984948

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B563731
Report Date: 2015/08/05

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		MT1666	MT1667	MT1668		
Sampling Date		2015/07/22 16:30	2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01	471125-01-01	471125-01-01		
	Units	MW1	MW2	DUP	RDL	QC Batch
Calculated Parameters						
Anion Sum	meq/L	3.8	3.0	3.0	N/A	7983567
Cation Sum	meq/L	3.9	2.9	2.9	N/A	7983567
Hardness (CaCO3)	mg/L	190	120	120	0.50	7983562
Ion Balance	N/A	1.0	0.96	0.97	0.010	7983565
Dissolved Nitrate (NO3)	mg/L	7.2	1.7	1.7	0.044	7983571
Nitrate plus Nitrite (N)	mg/L	1.6	0.38	0.39	0.020	7983573
Dissolved Nitrite (NO2)	mg/L	<0.033	<0.033	<0.033	0.033	7983571
Total Dissolved Solids	mg/L	190	150	140	10	7983576
Misc. Inorganics						
Conductivity	uS/cm	370	270	270	1.0	7985532
pH	pH	7.79	8.69	8.70	N/A	7984655
Low Level Elements						
Dissolved Cadmium (Cd)	ug/L	<0.020	<0.020	<0.020	0.020	7983556
Anions						
Alkalinity (PP as CaCO3)	mg/L	<0.50	3.6	3.9	0.50	7984656
Alkalinity (Total as CaCO3)	mg/L	170	130	130	0.50	7984656
Bicarbonate (HCO3)	mg/L	200	150	140	0.50	7984656
Carbonate (CO3)	mg/L	<0.50	4.3	4.7	0.50	7984656
Hydroxide (OH)	mg/L	<0.50	<0.50	<0.50	0.50	7984656
Dissolved Sulphate (SO4)	mg/L	8.6	12	12	1.0	7986488
Dissolved Chloride (Cl)	mg/L	5.7	7.1	7.2	1.0	7986479
Nutrients						
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	<0.010	0.010	7984681
Dissolved Nitrate (N)	mg/L	1.6	0.38	0.39	0.010	7984681
Elements						
Dissolved Aluminum (Al)	mg/L	0.0043	0.0073	0.0074	0.0030	7985700
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	0.00060	7985700
Dissolved Arsenic (As)	mg/L	<0.00020	0.00031	0.00027	0.00020	7985700
Dissolved Barium (Ba)	mg/L	0.015	0.012	0.012	0.010	7985984
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	7985700
Dissolved Boron (B)	mg/L	<0.020	<0.020	<0.020	0.020	7985984
Dissolved Calcium (Ca)	mg/L	40	17	17	0.30	7985984
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	7985700
Dissolved Cobalt (Co)	mg/L	<0.00030	<0.00030	<0.00030	0.00030	7985700
Dissolved Copper (Cu)	mg/L	0.0015	0.0013	0.00095	0.00020	7985700

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B563731
Report Date: 2015/08/05

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		MT1666	MT1667	MT1668		
Sampling Date		2015/07/22 16:30	2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01	471125-01-01	471125-01-01		
	Units	MW1	MW2	DUP	RDL	QC Batch
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	<0.060	0.060	7985984
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	0.00020	7985700
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	<0.020	0.020	7985984
Dissolved Magnesium (Mg)	mg/L	21	20	20	0.20	7985984
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0068	0.0066	0.0040	7985984
Dissolved Molybdenum (Mo)	mg/L	0.00046	0.00085	0.00081	0.00020	7985700
Dissolved Nickel (Ni)	mg/L	0.0010	<0.00050	<0.00050	0.00050	7985700
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	0.10	7985984
Dissolved Potassium (K)	mg/L	0.59	0.98	0.94	0.30	7985984
Dissolved Selenium (Se)	mg/L	<0.00020	<0.00020	<0.00020	0.00020	7985700
Dissolved Silicon (Si)	mg/L	0.77	0.64	0.64	0.10	7985984
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	0.00010	7985700
Dissolved Sodium (Na)	mg/L	2.6	9.1	9.2	0.50	7985984
Dissolved Strontium (Sr)	mg/L	<0.020	0.028	0.028	0.020	7985984
Dissolved Sulphur (S)	mg/L	2.7	2.7	2.7	0.20	7985984
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	0.00020	7985700
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	7985700
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	7985700
Dissolved Uranium (U)	mg/L	0.00065	0.00063	0.00059	0.00010	7985700
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	7985700
Dissolved Zinc (Zn)	mg/L	0.0080	<0.0030	<0.0030	0.0030	7985700
RDL = Reportable Detection Limit						

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Maxxam Job #: B563731
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ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		MT1666	MT1667	MT1668		
Sampling Date		2015/07/22 16:30	2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01	471125-01-01	471125-01-01		
	Units	MW1	MW2	DUP	RDL	QC Batch
Low Level Elements						
Total Cadmium (Cd)	ug/L	<0.020	0.074	0.061	0.020	7983557
Elements						
Total Aluminum (Al)	mg/L	0.011	4.0	3.5	0.0030	7985512
Total Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	0.00060	7985512
Total Arsenic (As)	mg/L	0.00026	0.0034	0.0031	0.00020	7985512
Total Barium (Ba)	mg/L	0.015	0.065	0.062	0.010	7985519
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	0.0010	7985512
Total Boron (B)	mg/L	<0.020	<0.020	<0.020	0.020	7985519
Total Calcium (Ca)	mg/L	40	19	18	0.30	7985519
Total Chromium (Cr)	mg/L	<0.0010	0.0031	0.0027	0.0010	7985512
Total Cobalt (Co)	mg/L	<0.00030	0.0027	0.0025	0.00030	7985512
Total Copper (Cu)	mg/L	0.0032	0.015	0.012	0.00020	7985512
Total Iron (Fe)	mg/L	<0.060	7.1	6.5	0.060	7985519
Total Lead (Pb)	mg/L	0.00026	0.0098	0.0087	0.00020	7985512
Total Lithium (Li)	mg/L	<0.020	<0.020	<0.020	0.020	7985519
Total Magnesium (Mg)	mg/L	21	20	20	0.20	7985519
Total Manganese (Mn)	mg/L	<0.0040	0.14	0.13	0.0040	7985519
Total Molybdenum (Mo)	mg/L	0.00052	0.0017	0.0016	0.00020	7985512
Total Nickel (Ni)	mg/L	0.0015	0.0045	0.0040	0.00050	7985512
Total Phosphorus (P)	mg/L	<0.10	0.19	0.17	0.10	7985519
Total Potassium (K)	mg/L	0.60	2.6	2.5	0.30	7985519
Total Selenium (Se)	mg/L	<0.00020	0.00038	0.00037	0.00020	7985512
Total Silicon (Si)	mg/L	0.78	11	10	0.10	7985519
Total Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	0.00010	7985512
Total Sodium (Na)	mg/L	2.8	16	16	0.50	7985519
Total Strontium (Sr)	mg/L	<0.020	0.037	0.036	0.020	7985519
Total Sulphur (S)	mg/L	2.7	3.1	3.1	0.20	7985519
Total Thallium (Tl)	mg/L	<0.00020	0.00023	0.00022	0.00020	7985512
Total Tin (Sn)	mg/L	<0.0010	0.0011	0.0011	0.0010	7985512
Total Titanium (Ti)	mg/L	<0.0010	0.092	0.089	0.0010	7985512
Total Uranium (U)	mg/L	0.00074	0.0023	0.0021	0.00010	7985512
Total Vanadium (V)	mg/L	<0.0010	0.0078	0.0069	0.0010	7985512
Total Zinc (Zn)	mg/L	0.0091	0.050	0.042	0.0030	7985512
RDL = Reportable Detection Limit						

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Maxxam Job #: B563731
Report Date: 2015/08/05

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		MT1666		MT1667	MT1668		
Sampling Date		2015/07/22 16:30		2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01		471125-01-01	471125-01-01		
	Units	MW1	RDL	MW2	DUP	RDL	QC Batch
Misc. Inorganics							
Total Dissolved Solids	mg/L	180	10	220	170	10	7984004
Total Suspended Solids	mg/L	2.7	1.0	270 (1)	300 (1)	1.5	7984059
Anions							
Dissolved Fluoride (F)	mg/L	<0.050	0.050	0.066	0.064	0.050	7987732
Nutrients							
Orthophosphate (P)	mg/L	<0.0030	0.0030	0.014	0.013	0.0030	7987497
Physical Properties							
True Colour	PtCo units	6.8	2.0	4.9	39	2.0	7984590

RDL = Reportable Detection Limit
(1) Detection limit raised based on sample volume used for analysis.

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ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		MT1666	MT1667	MT1668		
Sampling Date		2015/07/22 16:30	2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01	471125-01-01	471125-01-01		
	Units	MW1	MW2	DUP	RDL	QC Batch
Polychlorinated Biphenyls						
Aroclor 1016	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1221	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1232	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1242	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1248	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1254	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1260	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1262	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Aroclor 1268	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Total Aroclors	mg/L	<0.000050	<0.000050	<0.000050	0.000050	7985983
Surrogate Recovery (%)						
NONACHLOROBIPHENYL (sur.)	%	93	94	114	N/A	7985983

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B563731
Report Date: 2015/08/05

ARCADIS Canada
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Sampler Initials: AW, JD

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		MT1666	MT1667	MT1668		
Sampling Date		2015/07/22 16:30	2015/07/22 17:30	2015/07/22 17:30		
COC Number		471125-01-01	471125-01-01	471125-01-01		
	Units	MW1	MW2	DUP	RDL	QC Batch
Elements						
Dissolved Bismuth (Bi)	mg/L	<0.0050	<0.0050	<0.0050	0.0050	7989692
Total Bismuth (Bi)	mg/L	<0.0050	<0.0050	<0.0050	0.0050	7988465
Dissolved Zirconium (Zr)	mg/L	<0.0030	<0.0030	<0.0030	0.0030	7989692
Total Zirconium (Zr)	mg/L	<0.0030 (1)	<0.0030	0.0035	0.0030	7988465

RDL = Reportable Detection Limit

(1) Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

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Maxxam Job #: B563731
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ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

GENERAL COMMENTS

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

Package 1	3.0°C
Package 2	4.0°C

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER) Comments

Sample MT1666-05 Polychlorinated Biphenyls: Sample extracted past method-specified hold time.
Sample MT1667-05 Polychlorinated Biphenyls: Sample extracted past method-specified hold time.
Sample MT1668-05 Polychlorinated Biphenyls: Sample extracted past method-specified hold time.

Results relate only to the items tested.

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Maxxam Job #: B563731
Report Date: 2015/08/05

QUALITY ASSURANCE REPORT

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
7984948	O-TERPHENYL (sur.)	2015/07/29	98	50 - 130	94	50 - 130	91	%		
7985630	1,4-Difluorobenzene (sur.)	2015/07/31	96	70 - 130	95	70 - 130	102	%		
7985630	4-Bromofluorobenzene (sur.)	2015/07/31	91	70 - 130	92	70 - 130	96	%		
7985630	D4-1,2-Dichloroethane (sur.)	2015/07/31	88	70 - 130	91	70 - 130	89	%		
7985983	NONACHLOROBIPHENYL (sur.)	2015/07/31			98	30 - 130	94	%		
7984004	Total Dissolved Solids	2015/07/30	100	80 - 120	103	80 - 120	<10	mg/L	6.7	20
7984059	Total Suspended Solids	2015/07/30	90	80 - 120	102	80 - 120	<1.0	mg/L	8.0	20
7984590	True Colour	2015/07/29			98	80 - 120	<2.0	PtCo units	0	20
7984655	pH	2015/07/29			100	97 - 103			0.54	N/A
7984656	Alkalinity (PP as CaCO3)	2015/07/29					<0.50	mg/L	NC	20
7984656	Alkalinity (Total as CaCO3)	2015/07/29			97	80 - 120	<0.50	mg/L	1.0	20
7984656	Bicarbonate (HCO3)	2015/07/29					<0.50	mg/L	1.0	20
7984656	Carbonate (CO3)	2015/07/29					<0.50	mg/L	NC	20
7984656	Hydroxide (OH)	2015/07/29					<0.50	mg/L	NC	20
7984681	Dissolved Nitrate (N)	2015/07/30	106	80 - 120	100	80 - 120	<0.010	mg/L	0.18	20
7984681	Dissolved Nitrite (N)	2015/07/30	107	80 - 120	99	80 - 120	<0.010	mg/L	0.44	20
7984948	F2 (C10-C16 Hydrocarbons)	2015/07/30	NC	50 - 130	91	70 - 130	<0.10	mg/L	3.1 (1)	40
7985512	Total Aluminum (Al)	2015/07/30	90	80 - 120	99	80 - 120	<0.0030	mg/L	NC	20
7985512	Total Antimony (Sb)	2015/07/30	105	80 - 120	102	80 - 120	<0.00060	mg/L	NC	20
7985512	Total Arsenic (As)	2015/07/30	108	80 - 120	108	80 - 120	<0.00020	mg/L	NC	20
7985512	Total Beryllium (Be)	2015/07/30	105	80 - 120	109	80 - 120	<0.0010	mg/L	NC	20
7985512	Total Chromium (Cr)	2015/07/30	109	80 - 120	112	80 - 120	<0.0010	mg/L	NC	20
7985512	Total Cobalt (Co)	2015/07/30	105	80 - 120	110	80 - 120	<0.00030	mg/L	NC	20
7985512	Total Copper (Cu)	2015/07/30	102	80 - 120	112	80 - 120	<0.00020	mg/L	4.9	20
7985512	Total Lead (Pb)	2015/07/30	100	80 - 120	106	80 - 120	<0.00020	mg/L	NC	20
7985512	Total Molybdenum (Mo)	2015/07/30	112	80 - 120	108	80 - 120	<0.00020	mg/L	1.0	20
7985512	Total Nickel (Ni)	2015/07/30	105	80 - 120	111	80 - 120	<0.00050	mg/L	3.4	20
7985512	Total Selenium (Se)	2015/07/30	103	80 - 120	102	80 - 120	<0.00020	mg/L	NC	20
7985512	Total Silver (Ag)	2015/07/30	100	80 - 120	104	80 - 120	<0.00010	mg/L	NC	20
7985512	Total Thallium (Tl)	2015/07/30	100	80 - 120	104	80 - 120	<0.00020	mg/L	NC	20
7985512	Total Tin (Sn)	2015/07/30	105	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20

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Maxxam Job #: B563731
Report Date: 2015/08/05

QUALITY ASSURANCE REPORT(CONT'D)

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
7985512	Total Titanium (Ti)	2015/07/30	106	80 - 120	108	80 - 120	<0.0010	mg/L	NC	20
7985512	Total Uranium (U)	2015/07/30	108	80 - 120	110	80 - 120	<0.00010	mg/L	0.53	20
7985512	Total Vanadium (V)	2015/07/30	112	80 - 120	113	80 - 120	<0.0010	mg/L	NC	20
7985512	Total Zinc (Zn)	2015/07/30	100	80 - 120	105	80 - 120	<0.0030	mg/L	NC	20
7985519	Total Barium (Ba)	2015/07/30	100	80 - 120	102	80 - 120	<0.010	mg/L	NC	20
7985519	Total Boron (B)	2015/07/30	108	80 - 120	108	80 - 120	<0.020	mg/L	NC	20
7985519	Total Calcium (Ca)	2015/07/30	NC	80 - 120	97	80 - 120	<0.30	mg/L	0.81	20
7985519	Total Iron (Fe)	2015/07/30	95	80 - 120	92	80 - 120	<0.060	mg/L	NC	20
7985519	Total Lithium (Li)	2015/07/30	97	80 - 120	98	80 - 120	<0.020	mg/L	NC	20
7985519	Total Magnesium (Mg)	2015/07/30	NC	80 - 120	103	80 - 120	<0.20	mg/L	1.3	20
7985519	Total Manganese (Mn)	2015/07/30	98	80 - 120	97	80 - 120	<0.0040	mg/L	NC	20
7985519	Total Phosphorus (P)	2015/07/30	91	80 - 120	93	80 - 120	<0.10	mg/L	NC	20
7985519	Total Potassium (K)	2015/07/30	102	80 - 120	103	80 - 120	<0.30	mg/L	NC	20
7985519	Total Silicon (Si)	2015/07/30	97	80 - 120	98	80 - 120	<0.10	mg/L	0.38	20
7985519	Total Sodium (Na)	2015/07/30	105	80 - 120	104	80 - 120	<0.50	mg/L	0.17	20
7985519	Total Strontium (Sr)	2015/07/30	95	80 - 120	95	80 - 120	<0.020	mg/L	NC	20
7985519	Total Sulphur (S)	2015/07/30			97	80 - 120	<0.20	mg/L	0.27	20
7985532	Conductivity	2015/07/30			99	90 - 110	<1.0	uS/cm	0.46	20
7985630	Benzene	2015/07/31	92	70 - 130	90	70 - 130	<0.40	ug/L	NC	40
7985630	Ethylbenzene	2015/07/31	97	70 - 130	94	70 - 130	<0.40	ug/L	NC	40
7985630	F1 (C6-C10) - BTEX	2015/07/31					<100	ug/L	NC	40
7985630	F1 (C6-C10)	2015/07/31	125	70 - 130	124	70 - 130	<100	ug/L	NC	40
7985630	m & p-Xylene	2015/07/31	96	70 - 130	92	70 - 130	<0.80	ug/L	NC	40
7985630	o-Xylene	2015/07/31	93	70 - 130	91	70 - 130	<0.40	ug/L	NC	40
7985630	Toluene	2015/07/31	89	70 - 130	88	70 - 130	<0.40	ug/L	NC	40
7985630	Xylenes (Total)	2015/07/31					<0.80	ug/L	NC	40
7985700	Dissolved Aluminum (Al)	2015/07/30	89	80 - 120	97	80 - 120	<0.0030	mg/L	NC	20
7985700	Dissolved Antimony (Sb)	2015/07/30	100	80 - 120	102	80 - 120	<0.00060	mg/L	NC	20
7985700	Dissolved Arsenic (As)	2015/07/30	97	80 - 120	101	80 - 120	<0.00020	mg/L	NC	20
7985700	Dissolved Beryllium (Be)	2015/07/30	94	80 - 120	97	80 - 120	<0.0010	mg/L	NC	20
7985700	Dissolved Chromium (Cr)	2015/07/30	91	80 - 120	98	80 - 120	<0.0010	mg/L	NC	20

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QUALITY ASSURANCE REPORT(CONT'D)

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
7985700	Dissolved Cobalt (Co)	2015/07/30	90	80 - 120	99	80 - 120	<0.00030	mg/L	NC	20
7985700	Dissolved Copper (Cu)	2015/07/30	87	80 - 120	98	80 - 120	<0.00020	mg/L	12	20
7985700	Dissolved Lead (Pb)	2015/07/30	91	80 - 120	99	80 - 120	<0.00020	mg/L	NC	20
7985700	Dissolved Molybdenum (Mo)	2015/07/30	98	80 - 120	100	80 - 120	<0.00020	mg/L	NC	20
7985700	Dissolved Nickel (Ni)	2015/07/30	89	80 - 120	99	80 - 120	<0.00050	mg/L	3.1	20
7985700	Dissolved Selenium (Se)	2015/07/30	95	80 - 120	99	80 - 120	<0.00020	mg/L	NC	20
7985700	Dissolved Silver (Ag)	2015/07/30	92	80 - 120	99	80 - 120	<0.00010	mg/L	NC	20
7985700	Dissolved Thallium (Tl)	2015/07/30	89	80 - 120	97	80 - 120	<0.00020	mg/L	NC	20
7985700	Dissolved Tin (Sn)	2015/07/30	97	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20
7985700	Dissolved Titanium (Ti)	2015/07/30	93	80 - 120	99	80 - 120	<0.0010	mg/L	NC	20
7985700	Dissolved Uranium (U)	2015/07/30	94	80 - 120	99	80 - 120	<0.00010	mg/L	2.7	20
7985700	Dissolved Vanadium (V)	2015/07/30	96	80 - 120	102	80 - 120	<0.0010	mg/L	NC	20
7985700	Dissolved Zinc (Zn)	2015/07/30	NC	80 - 120	104	80 - 120	<0.0030	mg/L	1.6	20
7985983	Aroclor 1016	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1221	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1232	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1242	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1248	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1254	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1260	2015/07/31			71	30 - 130	<0.000050	mg/L		
7985983	Aroclor 1262	2015/07/31					<0.000050	mg/L		
7985983	Aroclor 1268	2015/07/31					<0.000050	mg/L		
7985983	Total Aroclors	2015/07/31					<0.000050	mg/L		
7985984	Dissolved Barium (Ba)	2015/07/30	100	80 - 120	95	80 - 120	<0.010	mg/L	NC	20
7985984	Dissolved Boron (B)	2015/07/30	105	80 - 120	102	80 - 120	<0.020	mg/L	NC	20
7985984	Dissolved Calcium (Ca)	2015/07/30	97	80 - 120	97	80 - 120	<0.30	mg/L	0.18	20
7985984	Dissolved Iron (Fe)	2015/07/30	99	80 - 120	96	80 - 120	<0.060	mg/L	NC	20
7985984	Dissolved Lithium (Li)	2015/07/30	92	80 - 120	90	80 - 120	<0.020	mg/L	NC	20
7985984	Dissolved Magnesium (Mg)	2015/07/30	105	80 - 120	103	80 - 120	<0.20	mg/L	0.29	20
7985984	Dissolved Manganese (Mn)	2015/07/30	98	80 - 120	95	80 - 120	<0.0040	mg/L	NC	20
7985984	Dissolved Phosphorus (P)	2015/07/30	99	80 - 120	97	80 - 120	<0.10	mg/L	NC	20

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Maxxam Job #: B563731
Report Date: 2015/08/05

QUALITY ASSURANCE REPORT(CONT'D)

ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
7985984	Dissolved Potassium (K)	2015/07/30	101	80 - 120	99	80 - 120	<0.30	mg/L	NC	20
7985984	Dissolved Silicon (Si)	2015/07/30	102	80 - 120	99	80 - 120	<0.10	mg/L	0.75	20
7985984	Dissolved Sodium (Na)	2015/07/30	98	80 - 120	95	80 - 120	<0.50	mg/L	0.75	20
7985984	Dissolved Strontium (Sr)	2015/07/30	95	80 - 120	94	80 - 120	<0.020	mg/L	NC	20
7985984	Dissolved Sulphur (S)	2015/07/30			99	80 - 120	<0.20	mg/L	1.8	20
7986479	Dissolved Chloride (Cl)	2015/07/31	115	80 - 120	102	80 - 120	<1.0	mg/L	NC	20
7986488	Dissolved Sulphate (SO4)	2015/07/31	NC	80 - 120	105	80 - 120	<1.0	mg/L	3.2	20
7987497	Orthophosphate (P)	2015/07/31	98	80 - 120	100	80 - 120	<0.0030	mg/L	NC	20
7987732	Dissolved Fluoride (F)	2015/07/31	104	80 - 120	99	80 - 120	<0.050	mg/L	NC	20
7988465	Total Bismuth (Bi)	2015/08/04	101	80 - 120	99	80 - 120	<0.0050	mg/L	NC	20
7988465	Total Zirconium (Zr)	2015/08/04	10 (2)	80 - 120	104	80 - 120	<0.0030	mg/L	NC	20
7989692	Dissolved Bismuth (Bi)	2015/08/04	69 (2)	80 - 120	103	80 - 120	<0.0050	mg/L	NC	20
7989692	Dissolved Zirconium (Zr)	2015/08/04	104	80 - 120	99	80 - 120	<0.0030	mg/L	NC	20

N/A = Not Applicable

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

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

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

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

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

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

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

(1) Detection limits raised due to dilution to bring analyte within the calibrated range.Detection limit raised based on sample volume used for analysis.

(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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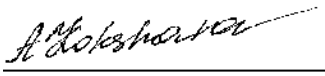
Maxxam Job #: B563731
Report Date: 2015/08/05

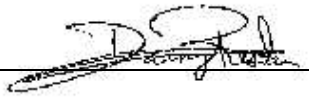
ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Sampler Initials: AW, JD

VALIDATION SIGNATURE PAGE

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



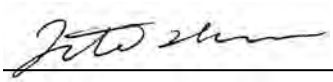
Anna Koksharova, M.Sc., Senior Analyst



Daniel Reslan, Chem. Tech., Water Lab Supervisor

Kale Edwards, Senior Analyst

Luba Shymushovska, Organics – Senior Analyst



Lili Zhou, Senior analyst, Inorganic department.

Sandy Yuan, M.Sc., Scientific Specialist

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.

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9331 - 48th Street, Edmonton, Alberta Canada T6B 2R4 Tel:(780) 577-7100 Toll-Free:800-563-6266 Fax:(780) 450-4187 www.maxxam.ca

AP07/1132 (2)

Chain Of Custody Record

Page 1 of 1

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#3269 ARCADIS Canada	Company Name	ARCADIS Canada Inc.	Quotation #		Maxxam Job #	Bottle Order #:
Contact Name	JULIE DITTBURNER	Contact Name	Stephanie Joyce	P.O. #		B563731	471125
Address	329 CHURCHILL AVE NORTH SUITE 2000 OTTAWA ON K1Z 5B8	Address	329 Churchill Ave North Ottawa, ON K1Z 5B9	Project #	~~PIN-D~~ 1697-1501	Chain Of Custody Record	Project Manager
Phone	(613) 721-0555 Fax: (613) 721-0029	Phone	613-721-0555 Fax: 613-721-0029	Project Name	PIN-D	C#471125-01-01	Sherlyne Sim
Email	jdittburner@franzenvironmental.com, Stephanie.Joyce	Email	stephanie.joyce@arcadis.com	Site #			
				Sampled By	AW + JD		

Regulatory Criteria: CCME + FIGQGS

Special Instructions

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10°C) from time of sampling until delivery to maxxam

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

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

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Analysis Requested: AT1 BTEX and F1-F2	Regulated Metals (CCME/AT1) - Total, Bismuth, Zirconium	Regulated Metals (CCME/AT1) - Dissolved, Bismuth, Zirconium	Hardness	TDS, TSS	Polychlorinated Biphenyls	Major Ions (SO4, NO2-NO3, F, Cl, PO4, Alkalinity), Conductivity, pH, Colour			# of Bottles	Comments
1		MW1	July 22, 2015	4:30	GW	N	Y	X	X	X	X	X	X	X			10	
2		MW2	↓	5:30	GW	N	Y	X	X	X	X	X	X	X			10	-sediment in sample
3		DUP	↓	5:30	GW	N	Y	X	X	X	X	X	X	X			10	-sediment in sample
4					GW													
5					GW													
6					GW													
7					GW													
8					GW													
9																		
10																		

RECEIVED IN YELLOWKNIFE
By: Michelle Gould 10:50
2015-07-27
3.3.3
Temp: 4 1 3 1 5

* * RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Lab Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
J. Dittburner	15/07/25	10:00	Jenna Walter	20150728	0923		☐	4.6 4.3 6	☑ ~~Yes~~ ☐ No
								ice present both	

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

White: Maxxam Yellow: Client

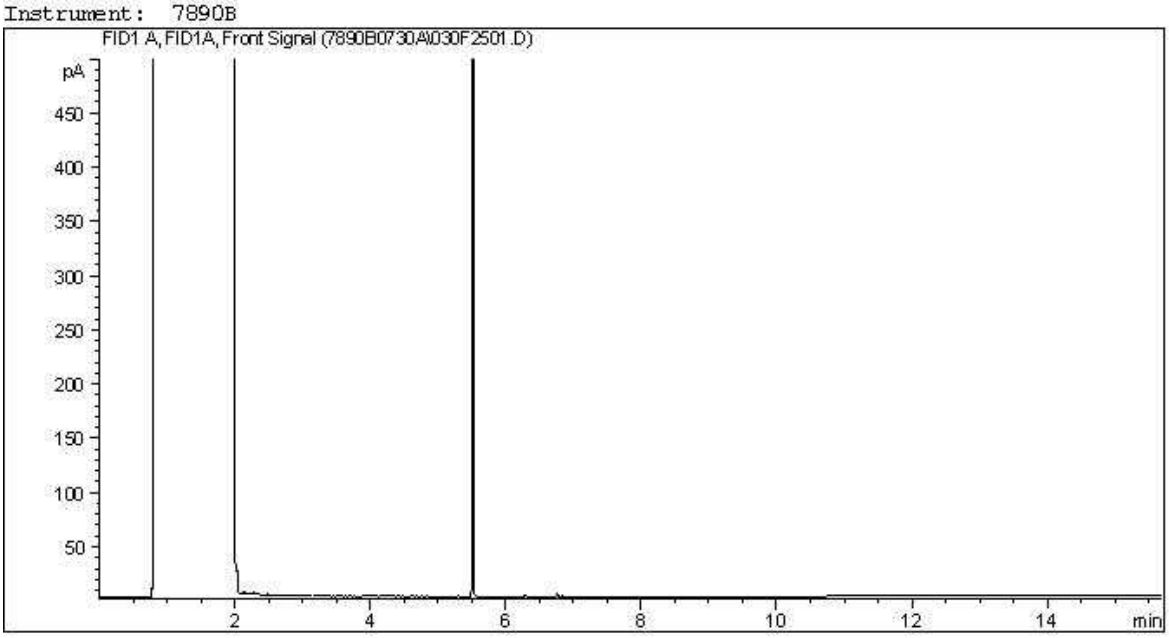
Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam Job #: B563731
Report Date: 2015/08/05
Maxxam Sample: MT1666

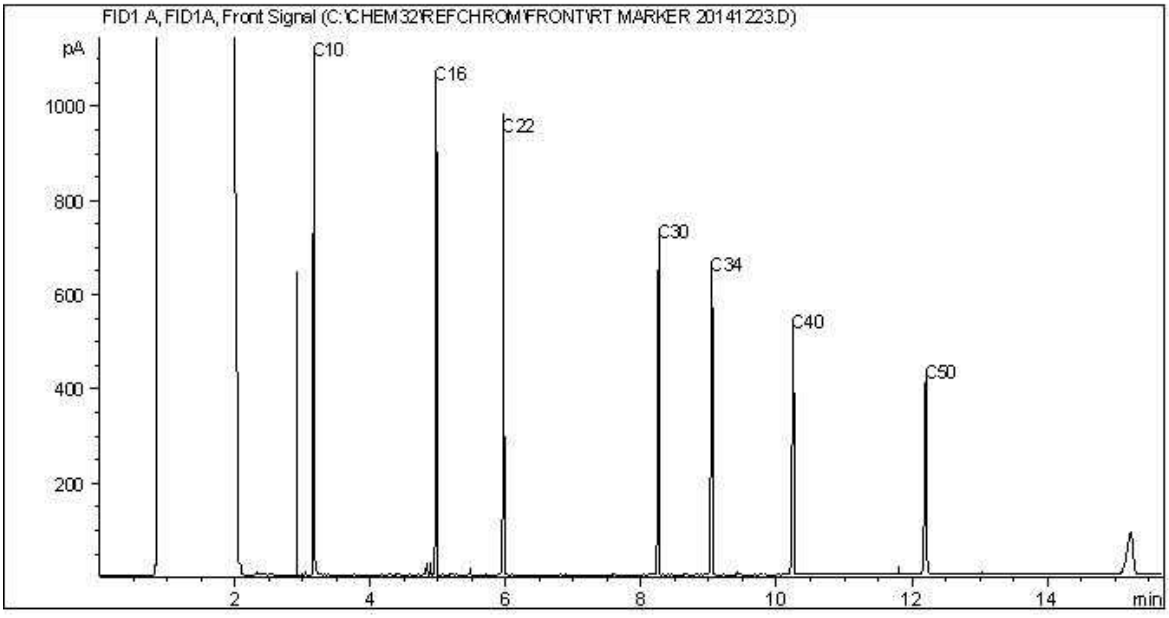
ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Client ID: MW1

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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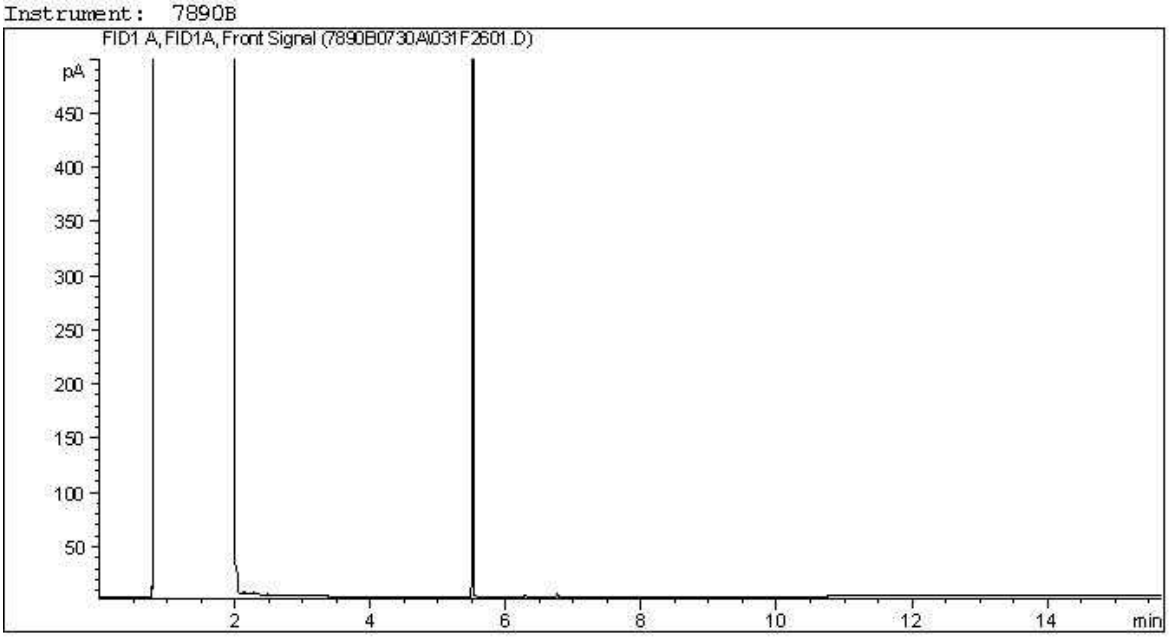
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B563731
Report Date: 2015/08/05
Maxxam Sample: MT1667

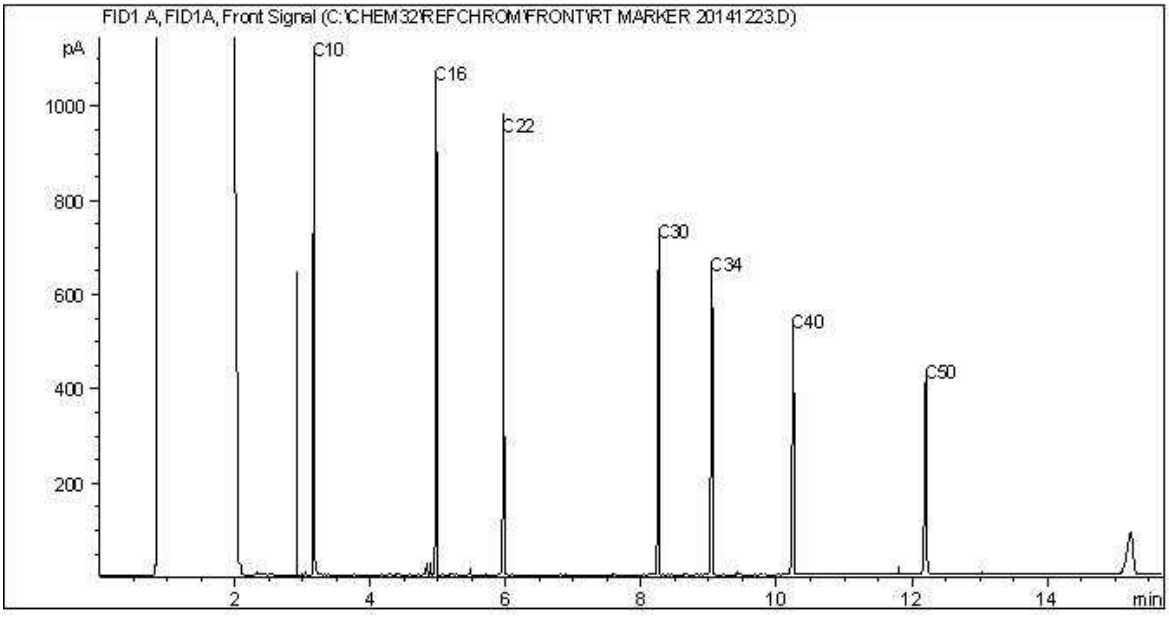
ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Client ID: MW2

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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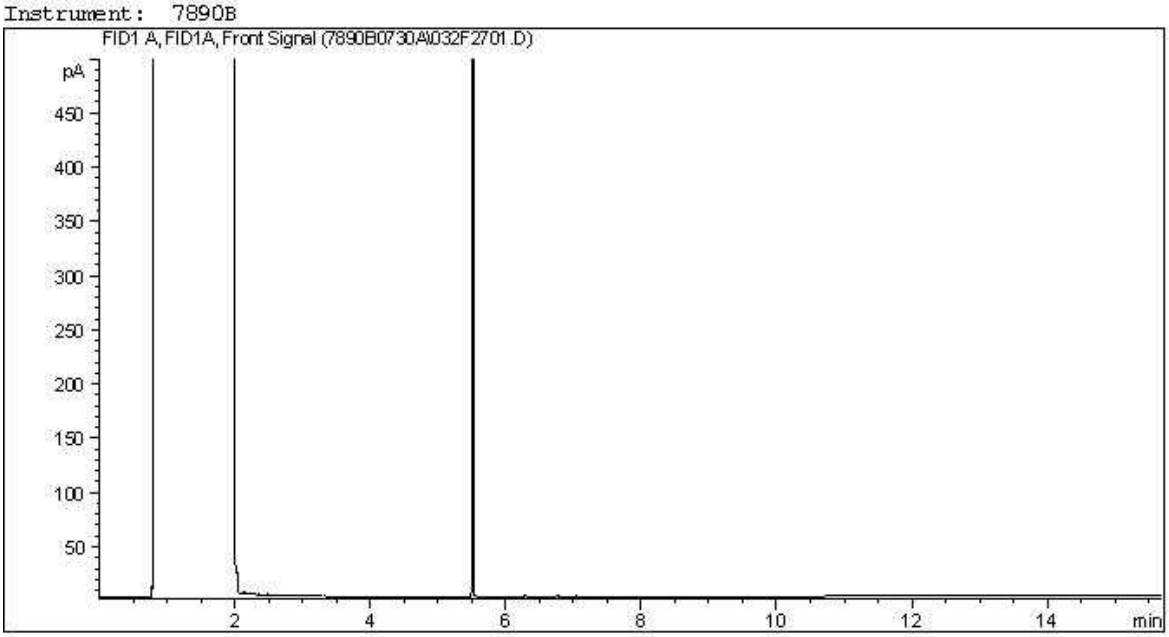
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B563731
Report Date: 2015/08/05
Maxxam Sample: MT1668

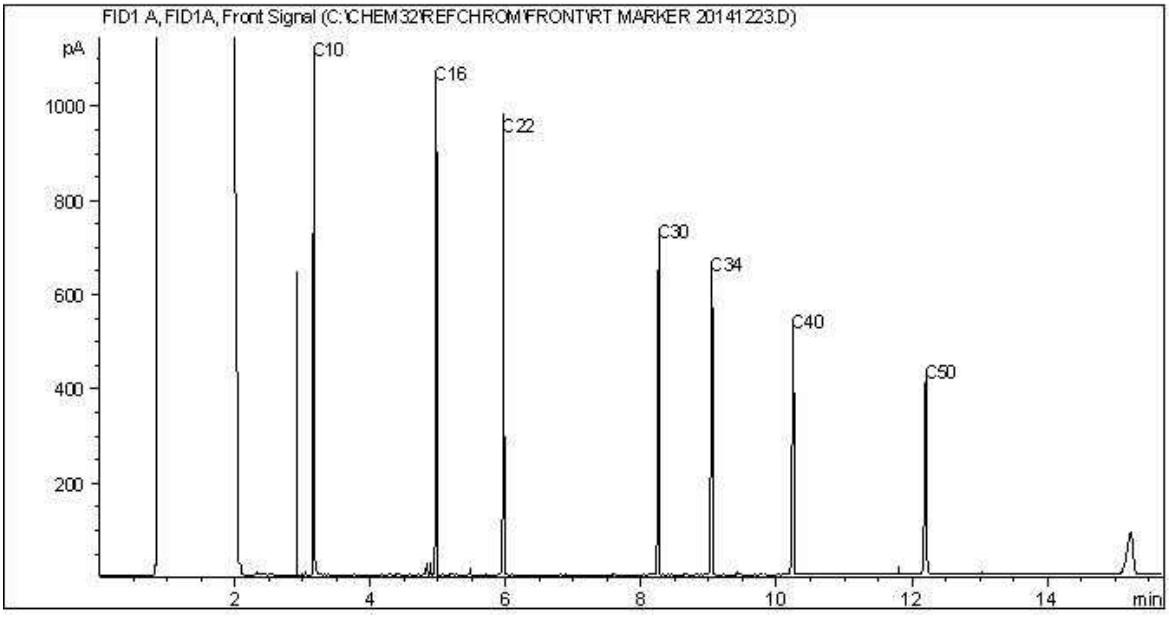
ARCADIS Canada
Client Project #: 1697-1501;PIN-D
Client ID: DUP

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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

APPENDIX C

Field Notes

PIN-D

1697-1501 AANDC DEWLINES July 22/15

1:00pm - meeting at Adlair Hangar to take off for PIN-D Ross Point
- AANDC (Lilianne Aresnault)
- ARCADIS (J. Dittburner + A. Williamson)
- Pilots - 2
- B.M - Willie Nashook
- depart Cambridge Bay @ 1.15pm

Purpose: conduct LTM at NTWL at PIN-D
- inspect landfill, natural environment monitoring and groundwater sampling.
Julie - will conduct NTWL assessment and photo log.
Alisha - GW monitoring

2:30pm - arrive onsite
- conduct health + safety talk
- pilots parked at south end of runway so had to walk up to site
- they moved it the closer after

- Alisha to start sampling - 3 wells have water - will try sampling all of them
- 1 well Dry.

Rite in the Rain

1697-1501 PIN-D AANDC DEWLINES July 22/15

- battery of DGPS is dead - not sure why as it was charged overnight - the plane does not have a plug in to charge it
- will have to do photolog by following the map as best as can.
- Susie will begin this @ 4:00pm
  - ↳ photo log & integrity check completed

GW Sampling

MW1 - had good recharge - full suite of sample collected

MW2 - good recharge - full suite of samples collected plus a duplicate

MW3 - 1.5 cm of water in well - No sample collected

MW4 - 15cm of water - pumped out approx 400mL water until went dry - went back 1hr later & still only 5cm water in well, - no enough recharge to sample - No sample collected

1697-1501 : PIN-D AANDC DEWLINES

July 22/15

Wild life sightings:

Ruff-Legged Hawk - sighting - nest nearby

Muskox - skat + ~~carcass~~ remains

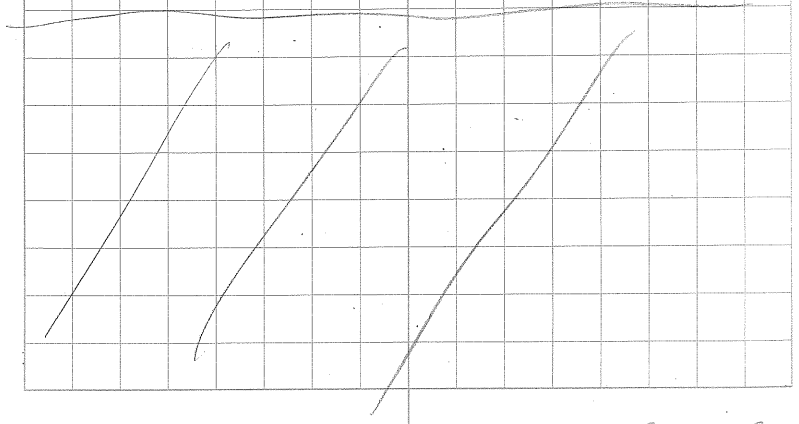
Caribou - skat

Arctic Fox - skat.

Willie - the I.H. - is not that familiar with the area & hunting practices for which mammals

6:30 - all of us off site & going back to Cambridge Bay.

7:15 - arrive in Cambridge Bay - reorganize stuff & head back to hotel



Rite in the Rain

GROUND WATER MONITORING FORM (Low Flow Sampling Technique)

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WELL ID: MW1
PROJECT NUMBER/NAME: 1697-1501
SITE ADDRESS: Pin D
ARCADIS FIELD PERSONNEL: A. Williamson
WEATHER CONDITIONS: Partly Cloudy
DATE (YYYY/MM/DD): 2015/07/22
START TIME: 4:15 pm sampling
FLOW RATE:
INTAKE DEPTH:

(A) Depth to Bottom of Well: 2.482
(B) Depth to Water: 2.139
(A-B) Metres of Water in Well:
Casing Diameter: 1.5 inches
(C) Water Vol/metre of Water in Well (0.051 m ID casing = 2.0 L/m
(D) Volume of Water in Well: (A-B) X C
Estimate Purge Vol (3 X Well Vol [D])
Purging Method: Low flow

TIME	(0.1) W.L (mbtoc)	(0.1) pH (pH Units)	(3%) Conductivity (mS/cm)	(10%) Turbidity (NTU)	(10%) D.O. (mg/L)	(3%) Temperature (°C)	(10%) Salinity (%)	(10%) T.D.S. (g/L)	(10 mV) ORP (mV)		Comments
4:15 0:00		6.97	0.256		13.44	4.29			144.3		
4:20 5:00		7.53	0.199		11.21	2.68			167.4		
4:25 10:00		7.58	0.196		11.01	2.49			175.3	✓	
4:30 15:00		7.67	0.195		11.01	2.37			178.6		

INSTURMENT USED: YSI Multimeter (Flow Cell)
ODOUR: Yes / (No) (circle) Type:
SHEEN: Yes / (No) (circle)
TURBIDITY: (Clear) | | | | | | | | | Very Turbid

Comments:
- Stabilized
- recharged at steady rate

PAGE: 1 OF 1

- Sampled for full suite
- 10 bottles each
- PAHs / PHCs / BCBs / metals (total / dissolved) & nutrients

GROUND WATER MONITORING FORM (Low Flow Sampling Technique)

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WELL ID: MW3
PROJECT NUMBER/NAME: 1697-1501
SITE ADDRESS: PIN-D
ARCADIS FIELD PERSONNEL: A. Williamson
WEATHER CONDITIONS:
DATE (YYYY/MM/DD): July 22/2015
START TIME:
FLOW RATE:
INTAKE DEPTH:

(A) Depth to Bottom of Well: 1.940
(B) Depth to Water: 1.9~~6~~2
(A-B) Metres of Water in Well: 0.0018 m
Casing Diameter: 1.5 inches
(C) Water Vol/metre of Water in Well (0.051 m ID casing = 2.0 L/m
(D) Volume of Water in Well: (A-B) X C
Estimate Purge Vol (3 X Well Vol [D])
Purging Method: Low flow

Pretty Dry. Notable to Sample

TIME	(0.1) W.L. (mbtoc)	(0.1) pH (pH Units)	(3%) Conductivity (mS/cm)	(10%) Turbidity (NTU)	(10%) D.O. (mg/L)	(3%) Temperature (°C)	(10%) Salinity (%)	(10%) T.D.S. (g/L)	(10 mV) ORP (mV)		Comments
INSUFFICIENT WATER											

INSTURMENT USED:
ODOUR: Yes / No (circle) Type:
SHEEN: Yes / No (circle)
TURBIDITY: Clear | | | | | | | | | | Very Turbid

Comments:

GROUND WATER MONITORING FORM (Low Flow Sampling Technique)

ARCADIS
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WELL ID: MW4
PROJECT NUMBER/NAME: 1697-1501 DEWLINES
SITE ADDRESS: PIN-D
ARCADIS FIELD PERSONNEL: A. Williamson
WEATHER CONDITIONS:
DATE (YYYY/MM/DD): July 27 /2015
START TIME:
FLOW RATE:
INTAKE DEPTH:

(A) Depth to Bottom of Well: 1.335
(B) Depth to Water: 1.507
(A-B) Metres of Water in Well: 0.015 ~
Casing Diameter: 1.5
(C) Water Vol/metre of Water in Well (0.051 m ID casing = 2.0 L/m
(D) Volume of Water in Well: (A-B) X C
Estimate Purge Vol (3 X Well Vol [D])
Purging Method:

TIME	(0.1) W.L. (mbtoc)	(0.1) pH (pH Units)	(3%) Conductivity (mS/cm)	(10%) Turbidity (NTU)	(10%) D.O. (mg/L)	(3%) Temperature (°C)	(10%) Salinity (%)	(10%) T.D.S. (g/L)	(10 mV) ORP (mV)		Comments
4:50 (0:00)		8.42	0.280		15.24	3.48			220.4		
INSUFFICIENT WATER											

INSTURMENT USED:
ODOUR: Yes / No (circle) Type:
SHEEN: Yes / No (circle)
TURBIDITY: Clear | | | | | | | | | | Very Turbid

Comments:

PAGE# 1 OF 1

GROUND WATER MONITORING FORM (Low Flow Sampling Technique)

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WELL ID:	MW2 & DUP1	(A) Depth to Bottom of Well	2.370
PROJECT NUMBER/NAME:	1697-1501	(B) Depth to Water	2.185
SITE ADDRESS:	PIN-D	(A-B) Metres of Water in Well	~0.20m
ARCADIS FIELD PERSONNEL:	A. Williamson	Casing Diameter:	1.5 inch
WEATHER CONDITIONS:	Overcast	(C) Water Vol/metre of Water in Well (0.051 m ID casing = 2.0 L/m	
DATE (YYYY/MM/DD):	July 22/2015	(D) Volume of Water in Well: (A-B) X C	
START TIME:		Estimate Purge Vol (3 X Well Vol [D])	
FLOW RATE:		Purging Method:	
INTAKE DEPTH:			

TIME	(0.1) W.L (mbtoc)	(0.1) pH (pH Units)	(3%) Conductivity (mS/cm)	(10%) Turbidity (NTU)	(10%) D.O. (mg/L)	(3%) Temperature (°C)	(10%) Salinity (%)	(10%) T.D.S. (g/L)	(10 mV) ORP (mV)		Comments
5:10 (0:00)		9.93	0.255		19.01	3.95			215.5		
5:15 (5:00)		9.77	0.201		10.30	2.91			226.0		
5:20 (10:00)		9.24	0.295		11.53	1.58			240.7		
5:25 (15:00)		8.91	0.260		11.97	2.37			255.9		
5:30 (20:00)		8.89	0.255		11.77	2.42			266.3		

INSTURMENT USED: Peristaltic

ODOUR: Yes / No (circle) Type:

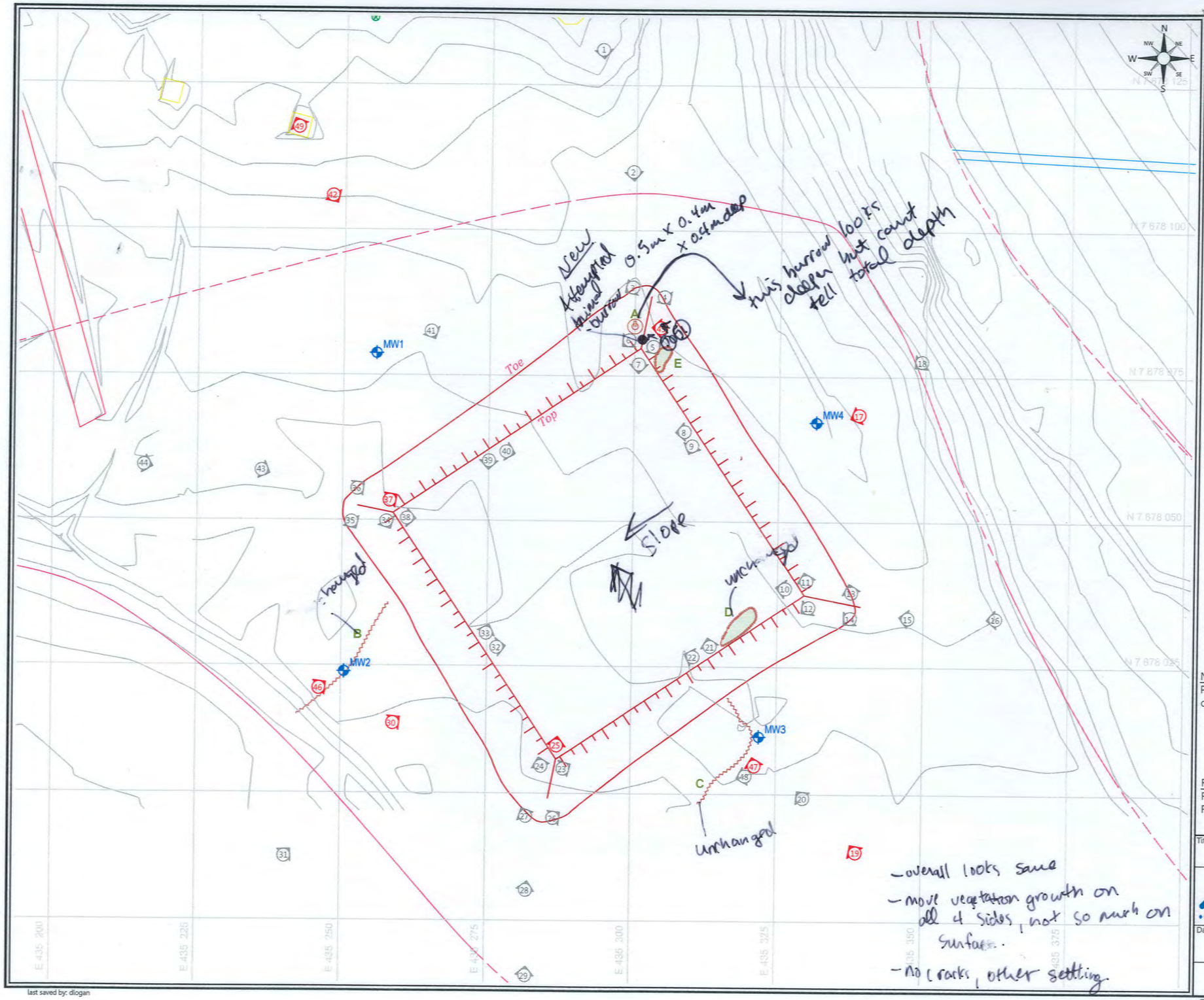
SHEEN: Yes / No (circle)

TURBIDITY: Clear | | | | | | | | Very Turbid

Comments:
- Sampled both full suite
- 10 bottles for both

PHCs / PAHs / PCBs / metals total / dissolved, nutrients & general.

PAGE # 1 OF 1



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

Z:\Projects\2013\1697-1301 AANDC Dewlines\Individual Sites\PIN-B\Figures\CAD\PIN-B-2013_monitoring.dwg (layout)

Table 5-3: PIN-D – Ross Point – Visual Monitoring Checklist

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Toe of berm, southwest corner of the NHWL	1.0	0.25	0.2	<1%	Depression area as a result of final grading. Whole are is poorly graded	Feature appears mechanical. Does not affect the landfill integrity at this point	38/39
Settlement/Pothole	B	Toe of berm, southeast corner of the NHWL	1.0	1.0	0.1	<1%	Pothole, appears to be result of grading, minor vegetation growth	Feature appears mechanical. Does not affect the landfill integrity at this point	40/41
Settlement	C	On toe of berm at northwest corner of NHWL	1.5	0.75	0.1	<1%	Settlement area, minor, appears to be result of final grading	Feature appears mechanical. Does not affect the landfill integrity at this point	42
Settlement	D	On surface of NHWL along east side of landfill	2.5	1.75	0.15	<1%	Minor depression on surface of landfill, appears to be result of grading	Feature appears mechanical. Does not affect the landfill integrity at this point	43
NEW - Pothole	E	On surface of NHWL along south side of landfill	0.75	0.75	0.10	<1%	NEW Feature	Happens like a sm	44

APPENDIX D

Health and Safety Plan

ARCADIS
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Imagine the result

Aboriginal Affairs and Northern Development Canada

Health and Safety Plan

Collection of Monitoring Data for DEW Line Site: PIN-D Clifton Point

July 10, 2015

ARCADIS

~~DRAFT~~

Signature 1 Julie Dittburner
Environmental Technician

~~DRAFT~~

Signature 2 Alisha Williamson
Environmental Technician

~~DRAFT~~

Signature 3 Stephanie Joyce
Project Manager

Health and Safety Plan

Collection of Monitoring Data for DEW Line Site: PIN-D, Ross Point

Prepared for:
Aboriginal Affairs and Northern Development Canada

Prepared by:
ARCADIS Canada Inc.
329 Churchill Ave. N Suite 200
Ottawa, ON K1Z 5B8

Tel 613.721.0555
Fax 613.721.0029

Our Ref.:
1697-1501

Date:
July 10, 2015

Tables

Appendices

1.0 PURPOSE

The purpose of this Site Specific Health and Safety Plan (HASP) prepared by ARCADIS Canada Inc. (ARCADIS) is to specify the detailed measures to be taken to protect both site workers and the public during the work to be carried out at PIN-D. The site specific HASP also assigns responsibilities; establishes personnel protection standards and mandatory safety practices and procedures with respect to environmental aspects of the site related activities; and provides for contingencies that may arise during on-site activities.

The provisions of this plan are mandatory for all sub-contractors engaged in conducting the work activities. As necessary, when new information regarding a potential hazard emerges and this new information suggests that further safeguards would be prudent, amendments to this Plan will be issued pertaining to specific precautions to be taken for specific locations or operations or regarding specific hazards. Unless any of these Amendments specify otherwise, all provisions of this plan shall remain in effect for the duration of project work at the Site.

This plan has been developed in accordance with accepted worker health and safety practices and applicable territorial and federal Occupational Health and Safety regulations. This HASP represents the minimum Health and Safety precautionary requirements and guidelines to be expected. All sub-contractors working on-site will agree to, and abide by, the requirements of this site specific HASP as a condition of working on this Project. A copy of the site specific HASP shall be kept on-site at all times for the duration of on-site activities. Anticipated personnel to whom this HASP becomes applicable are:

- 2 ARCADIS staff members;
- 1 Bear Monitor;
- 1 AANDC representative; and
- 2 Dornier 228 Pilots.

2.0 AUTHORITY

This site specific HASP is provided by ARCADIS to cover environmental activities at PIN-D, the Site. This Plan is intended to supplement, not replace, applicable acts and regulations regarding worker health and safety.

The ARCADIS Site Health and Safety Officer (SHSO) or his/her representative will be responsible for implementing the site specific HASP for the duration of work being conducted at the Site. Ms. Julie Dittburner or her designate shall function as the SHSO and will be responsible for the health and safety of those on the site. Ms. Dittburner is appropriately trained for the position. The SHSO has the authority to stop work and to authorize the resumption of work based on health and safety considerations, as specified in this plan. Any health and safety issues or concerns will be communicated directly to the on-site representative of AANDC, to the ARCADIS Project Manager and to the appropriate authority at AANDC.

Prior to commencement of the work, every sub-contractor working at the Site will provide a copy of their HASP to ARCADIS for their records and maintain a copy at the site. This is a mandatory requirement to work on the site.

Personnel involved in health and safety related communications will include:

Table 1: Emergency Contact Information

Contact	Person or Agency	Phone Number
Hospital	Kitikmeot Regional Health Centre (Cambridge Bay)	867-983-4500
Police	RCMP, Cambridge Bay	867-983-1111
Fire Department	Fire Emergency Calls	867-983-2222 (Cam Bay)
Spill Report Line	GN Department of Environment	867-920-8130
Consulting Engineers	ARCADIS Canada Inc. Suite 200, 329 Churchill Avenue N	(613) 721-0555
Drug and Alcohol Testing (Nationwide)	Driver Check Inc.	1-800-463-4310
ARCADIS Canada Inc.	Chris Ludwig	613-721-0555 (O) 613-222-8192 (cell)

Contact	Person or Agency	Phone Number
	Stephanie Joyce	613-721-0555 (O) 613-986-8398 (cell)
	Andrew Henderson	613-721-0555 (O) 613-286-7760 (cell)
Aircraft Charter Company	Adlair Aviation	867-873-5161

home: 613-~~986~~ 236-8398

The ARCADIS SHSO may choose to conduct a safety site audit as and when site operations demand. During the audit, if health and safety related deficiencies are found, suitable written corrective actions will be recommended. It is binding on the part of the subcontractors to abide and implement the recommended corrective actions within the specified time limits. The ARCADIS SHSO will reserve the authority to inspect the implementation of corrective and/or mitigative actions.

3.0 HEALTH AND SAFETY REGULATIONS

Before activities at the Site commence, sub-contractor(s) Health and Safety representative(s) must review this HASP and indicate that they understand, and all workers engaged at the Site will demonstrate ongoing compliance of the plan by signing the Daily Health and Safety Meeting Form(s) (**Appendix B**). While carrying out work at the site, it is the responsibility of the Prime sub-contractor to ensure the health and safety of its employees and sub-contractors engaged by it. It is the duty of all workers employed at the site to report unsafe working conditions to the SHSO. To comply with the health and safety requirements outlined in this plan, ARCADIS will ensure/provide that:

- At least one on-site personnel is trained in first aid and level C CPR. First-aid and additional ARCADIS personnel certification is provided in **Appendix A**.
- On-site personnel are equipped with appropriate Canadian Standards Association (CSA) approved personal protective equipment as deemed necessary by the SHSO (personal protective equipment requirements at the Site are discussed in Section 7.0 of this HASP).
- On-site personnel will attend daily health and safety tailgate meetings led by the ARCADIS SHSO. Daily Health and Safety Meetings will be conducted at the beginning of each work day for the review of health and safety issues and site conditions. Health and Safety Meeting forms are provided in **Appendix B**.
- Equipment and materials used in the project meet applicable safety standards.
- A health and safety incident/accident reporting system will be in place to prevent reoccurrence of incidents/accidents through staff education.
- An appropriate area shall be designated as the onsite First-Aid Station. It shall be selected so that it is in close proximity to the work area but remain a safe distance from major activities and potential hazards. The First Aid Station shall be clearly identified and will contain: the First Aid Kit, copy of this HASP, an appropriate supply of water for washing/decontamination, and any other objects deemed necessary by the SHSO and/or ARCADIS Project Manager.

4.0 SITE AND WORK PROGRAM DESCRIPTION

4.1 Site Location and Description

PIN-D Ross Point Fjord was an Intermediate Distant Early Warning (DEW) Line site; a remediation project was conducted at the site between 2011 and 2012. The remediation involved the demolition and disposal of buildings, structures and other debris, as well as the clean up of hazardous materials and contaminated soil. PIN-D Ross Point is located on the north shore of Johansen Bay, overlooking Coronation Gulf, approximately 500 metres from the coast. The nearest communities are Kugluktuk, located approximately 185 kilometres to the Southwest, and Cambridge Bay, located approximately 250 kilometres to the East. The GPS Coordinates of the site are 68°35'48.74"N - 111°07'3.47"W. The Ross Point site was reserved by the Department of National Defence in 1956 and the PIN-D Intermediate Distant Early Warning (DEW) Line Site was constructed in 1959, and subsequently deactivated in 1963.

The site is situated on a mesa 150 metres above sea-level and was typical of all Intermediate sites and consisted of a module train, warehouse, garage, Inuit house, Petroleum/Oil/Lubricant (POL) tanks, and a Doppler antenna. In addition to the main site a beach landing area was constructed along with gravel roads linking the various facilities. Two airstrips were constructed at the site. The minor airstrip (~300 metres long) is closest to the station area and oriented northeast-southwest. The main airstrip (~500 metres long) has an approximate east-west orientation and closely approaches the minor airstrip at its eastern end.

In 1985 some of the surface contaminants at PIN-D were cleaned up under a program conducted by DND, EC, and AANDC. During the 1994 investigation the module train and garage were still intact, however they had suffered damage from prolonged weathering. The Warehouse had been dismantled down to the concrete base. The four POL tanks (two at the beach and two at the main station) had been removed but the station pumphouse was intact, although the pump had been removed. The pipeline connecting the beach and station tanks was mostly intact and marked with barrels. The refuelling pipeline at the beach was mostly removed but pieces remain.

The area is characterized by low mesas and hills composed of dolomite and glacial till. The station facilities were constructed on one of the mesas. A steep cliff extends along the southern edge of the station with gentler slopes leading out east and west. A gentle

slope to the north leads towards the major airstrip and freshwater lake; access to these areas is provided by a road. The main landfill is located at the west end of the minor airstrip. A second small landfill is located at the top edge of a slope above a small lake at the northeast base of the mesa. There is very little soil at the upper site as such little vegetation. During the investigation it was noted that the lower slopes and depressions contained a fair amount of vegetation; mainly grasses, sedges, and willows. The wildlife typically found in this region includes polar bears, caribou, muskoxen, wolf, arctic fox, snowshoe hare, raven, osprey, shorebirds, seabirds, and waterfowl.

The monitoring program for the PIN-D Ross Point site includes the natural environment as well as the Non-Hazardous Waste Landfill (NHWL); the only structure remaining on-site after the completion of remediation.

4.2 Description of Work Program

This will be the third long term monitoring event for the Site (year 5 of the LTMP), the work program to be carried out consists of the following:

- Mobilize the monitoring team, departmental representatives, wildlife monitor and field equipment via wheeled Dornier 228 aircraft;
- Visual monitoring of the general site conditions including borrow areas, excavation areas, regrades etc.;
- Natural environmental monitoring as detailed in the Abandoned Military Site Remediation Protocol (AMSRP);
- Visual monitoring of the physical integrity of the NHWL looking for evidence of erosion, ponding, frost action, settlement, and lateral movement.
- Visual monitoring (including photographs) of the NHWL;
- Purging of water and collection of groundwater (permafrost active layer) samples from the monitoring wells around the NHWL;
- Collection of soil samples in areas of seepage and staining identified during the visual monitoring, if required; and
- Submission of samples to a CALA-accredited laboratory for analysis of metals, petroleum hydrocarbons, polychlorinated biphenyls, major ions, hardness, total dissolved and suspended solids, pH, and conductivity;
- Demobilize the monitoring team, departmental representatives, wildlife monitor and field equipment and collected samples via wheeled Dornier 228 aircraft.

The following sections discuss the hazards which are expected to be encountered during the execution of the work program along with activities and/or safeguards to be implemented for their mitigation.

4.3 General Safety Precautions

The following general safety precautions are applicable to all work tasks:

- Eating, chewing gum or tobacco, and smoking are prohibited in contaminated or potentially contaminated areas, or where there is a possibility for the transfer of contamination.
- Contact with potentially contaminated substances should be avoided. Puddles, pools, mud, etc., should not be walked through. Kneeling, leaning, or sitting on equipment or the ground should be avoided, whenever possible. Monitoring equipment should not be placed on a potentially contaminated surface, such as the ground.
- Spillage of contaminated/hazardous liquids should be prevented, to the extent possible. In the event that spillage occurs, the liquid should be contained, if possible.
- Splashing of contaminated materials should be prevented.
- Field crew members should use all their senses to alert themselves to potentially dangerous situations (i.e. presence of strong, irritating, or nauseating odours).
- Field crew members should be familiar with the physical characteristics of investigations, including:
  - Wind direction in relation to the ground zero area
  - Accessibility to Associates, equipment, and vehicles
  - Communications
  - Hot zones (areas of known or suspected contamination)
  - Site access
  - Nearest water sources
  - Routes and procedures to be used during emergencies
- A minimum number of personnel and equipment should be in the contaminated area, but only to the extent consistent with workforce requirements of safe site operations.
- All wastes generated during ARCADIS or subcontractor activities at the site must be disposed of as directed by the Project Manager.

4.3.1 Buddy System

Where deemed hazardous by the ARCADIS SHSO, workers will conduct all site activities with a buddy who is able to:

- Provide his or her partner with assistance;
- Observe his or her partner for signs of chemical or heat exposure;
- Check the integrity of his or her partner's protective clothing periodically;
- Notify the site supervisor if emergency help is needed;
- Prearrange hand signals or other emergency communication signals such as:
  - Hand gripping throat: out of air, can't breathe;
  - Gripping partners wrist or placing both hands around waist: leave area immediately, no debate;
  - Hands on top of head: need assistance;
  - Thumbs up: okay, I'm alright, I understand;
  - Thumbs down: no, negative.

4.4 On-Site Communications

Communications during the fieldwork is as follows:

- Satellite phone, activated 24/7 to contact Kugluktuk (closest community), Cambridge Bay, Yellowknife, Ottawa, or other external locations during emergencies and for routine updates of field progress;
- Verbal communications between workers using 2-way radios;
- Use of a rifle or bear banger to get immediate attention of all staff.

Rally/muster point in case of an emergency will be established once on-site and will remain for the duration of the field program unless otherwise decided by the SHSO.

4.5 Physical Hazards and Mitigation Procedures

The following sections provide potential physical hazards encountered during the execution of tasks included in the work program. Procedures for the mitigation of hazards are also discussed as part of this HASP. Further, the identified hazard(s) and mitigation procedures will be discussed with all personnel working on site prior to working in the area of the hazard(s).

Generally encountered hazards during field operations include but are not limited to:

- Slips, trips and falls;
- Traffic related incidents;
- Partially buried debris, exposed at the surface, which might be unseen;
- Heavy lifting, bending, shovelling, (general manual labour) hazards;
- Poor housekeeping practices;
- Cuts, scrapes, and bruises from hand tool usage or handling of soils/rock;
- Underground/overhead utility strikes;
- Heat stress/cold stress (harsh weather, including snow etc. – See Section 4.8);
- Bears and other wildlife (See Section 4.9); and
- Entering/exiting charter planes/working near propellers.

The following measures are considered mandatory to ensure that the above hazards are mitigated to the greatest extent possible:

- Daily Health and Safety meetings – be aware of specific known physical hazards;
- Ongoing last minute risk assessment will be conducted by site workers.
- a Job Safety Analysis shall be completed for required specific work tasks and shall be reviewed prior to the execution of the task (**Appendix C**);
- Personal Protective Equipment (PPE) as prescribed by the HASP and SHSO;
- All underground utilities will be clearly marked and delineated prior to any subsurface disturbances;
- Overhead utilities will be identified and strategies for their avoidance will be decided upon prior to execution of the work program;
- Labour intensive tasks shall be carried out at an appropriate pace, and using appropriate lifting/bending techniques;
- Potentially hazardous debris shall be removed from work areas or flagged at the soonest possible opportunity; and
- Work areas will be kept clean and clear of obstructions to the extent possible.

4.6 Chemical Hazards and Mitigation Procedures

Potentially hazardous chemical constituents are present at the site in contaminated soil and groundwater). Contaminants of concern include: Petroleum Hydrocarbons (PHCs), Polychlorinated biphenyls (PCBs), and metals. All work involving the handling of contaminated/hazardous material requires the following mitigation procedures:

- PPE must be worn as prescribed for the handling of potentially contaminated materials.
- Normal hygiene practices such as washing hands and face before eating, drinking, smoking, chewing gum or tobacco, or other hand-to-face activity, or before leaving the project site shall be employed.
- Avoid skin contact with or accidental ingestion of soil or water.
- Field staff should use all their senses to alert themselves to potentially dangerous situations (i.e., presence of strong, irritating, or nauseating odours). Respirators may be prescribed by the SHSO at any time throughout the execution of the work program.
- All recovered contaminated/hazardous materials shall be contained appropriately in a manner preventing potential releases to the environment.

4.7 Monitoring

Based on the nature of the site activities that will be performed and the type of (suspected) contamination present in the area, monitoring of chemical concentrations in air or for combustible gases is not required as part of this HASP.

Should operations commence which disturb or expose any substance to create a potential airborne hazard or if airborne contamination is suspected as a result of observed site conditions; work at the Site shall cease until a sufficient air monitoring program is in place and appropriate protective measures are implemented to mitigate identified risks.

4.8 Harsh Weather Conditions

Harsh weather conditions can arrive at the Site anytime, therefore each member of the team must abide by the following:

- To deal with low and sub zero temperature every staff member must bring warm clothes, backup clothes, waterproof breathable outerwear, waterproof boots, hats, gloves, rain vests; learn how to use a kerosene heater; and learn how set up wall tents;
- To deal with strong winds, have adequate clothing and shelter, avoid working near steep slopes or water bodies until winds have calmed down, and cancel return charter until landing conditions are improved;

- To deal with fog, only work near camp where field workers can always be under direct sight of the bear monitor and stop work if fog is too dense; and
- To deal with rain and freezing rain, have adequate clothing and shelter and remember keeping dry remains the most important point.

Occasional delays may occur due to adverse weather conditions. It is of primary importance to work under safe conditions even if it causes delays. The Team Leader/SHSO decides when to stop work. Staff will stay in their tents during adverse weather conditions. Regular safety rounds are undertaken every hour around the camp installations by the Team Leader/SHSO.

4.9 Wildlife Safety

Wildlife safety and monitoring is continuous during the entire fieldwork period. One Inuit staff member or sub-contractor having a strong knowledge of wildlife, and the use of rifles to scare or kill bears will be assigned as the Bear Monitor. The role of a Bear Monitor is as follows, but not limited to:

- Conduct a visual inspection of gun and fire a test shot to ensure gun is in working order;
- Check for wildlife, such as bears, approaching the work site;
- Protect wildlife by preventing it from approaching the workers by using bear bangers (bears will be temporarily scared of a banger);
- Ensure that all garbage and food waste are picked up and properly packaged after meals (all workers at the site should assist with maintaining a clean camp);
- Have all field workers under direct view at all times;
- Walk around perimeter of the work place or hills to look for wildlife approaching the site, inform staff if wildlife are approaching, and inform field workers of the measures being taken to address the approaching wildlife; and
- Conduct any other measures necessary to protect the health and safety of staff and contractors from wildlife, especially bears.

Before any fieldwork begins on this project, all ARCADIS staff and subcontractor staff are to have reviewed documentation related to Grizzly and Polar Bear Safety. Listed below are resources where some documentation is located.

- Parks Canada Polar Bear Safety and other wildlife can be found at: http://www.pc.gc.ca/eng/pn-np/nu/quttinirpaaq/activ/activ3/e.aspx
- Parks Canada – If you Encounter a Bear: http://www.pc.gc.ca/eng/docs/pc/guide/nature/nature03.aspx
- Hinterland's Who's Who – Grizzly Bear Fact Sheet found at: http://www.hww.ca/en/wildlife/mammals/grizzly-bear.html?referrer=https://www.google.ca/
- Hinterland's Who's Who – Polar Bear Fact Sheet found at: http://www.hww.ca/en/wildlife/mammals/polar-bear.html

A couple of general comments regarding bear behaviour include:

- Do not try to run away from a bear. They can outrun a human. Seeing an animal fleeing from them arouses their instincts to chase. They think you are prey. Always back away slowly from a bear.
- Do not stare at them directly. Direct eye contact, to them, is a sign of aggression.
- If a bear stalks you and then attacks, or attacks at camp while you are sleeping do not play dead – fight back.

5 TASK SPECIFIC JOB SAFETY ANALYSES

Activities which involve potentially higher risks require a documented risk management procedure referred to as a Job Safety Analysis (JSA). A JSA consists of a step by step analysis of the task to be carried out, the hazards which may be encountered, and the techniques or controls to be implemented in order to prevent an incident or near-miss from occurring. JSAs are to be completed prior to the undertaking of the activity for which it is written and reviewed and discussed by all persons involved in the task. Since site, weather, equipment, and/or crew conditions may vary from day to day; the JSA must be reviewed and revised as per any changes during the daily safety meeting. Activities included in the scope of work which will require the completion of a JSA include, but are not necessarily limited to:

- Water sampling
- Soil sampling
- Geotechnical assessment

Three partially completed and one blank JSA forms, to be completed prior to any of the aforementioned activities or when deemed necessary by the SHSO, are provided in **Appendix C**.

6 PLANNED JOB OBSERVATIONS

The safe working procedures and the effectiveness of the JSA are judged by completing a Planned Job Observation (PJO). In a PJO, a worker or supervisor stands back from the work and observes it in progress to assess whether the work is being completed safely and according to the JSA. The PJO will identify potentially unsafe work/conditions and possible gaps in the safety measures prescribed in the JSA. Once the observer has completed the PJO checklist and recorded his/her findings, potentially unsafe work/conditions are analyzed to determine causal factors and implement mitigative actions as necessary. A discussion is subsequently carried out between the work crew to address the PJO findings and if necessary, to update the JSA.

The completion of at least one PJO is required for each JSA over the course of a work program. Additional PJOs may be required for long-term projects.

Blank PJO forms are provided in **Appendix D**.

7 PERSONAL PROTECTIVE EQUIPMENT

PPE that will protect personnel and visitors from the hazards and potential hazards likely to be encountered during site work will be prescribed by the ARCADIS SHSO and used by all personnel working at or visiting the Site. PPE selection is based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

7.1 Level of Protection

PPE required to be worn at the site is dependent upon the task(s) being performed. The SHSO/project manager has the authority to regulate additional PPE requirements should he/she deem it necessary. Based on the task(s) being carried out at the Site, the following PPE levels are required:

Table 2: PPE Requirements

TASK	Description	Required Protection
Water Sampling	*Sampling water using peristaltic pump from pre-installed monitoring wells*	• *Hard hat* • *Visi-Vest* • *Safety Boots* • *Safety Glasses* • *Work Gloves (handling tools)* • *Nitrile Gloves (handling water/soils)*
Soil Sampling	*Sampling soil from hand-excavations*	• *Hard hat* • *Visi-Vest* • *Safety Boots* • *Safety Glasses* • *Work Gloves (handling tools)* • *Nitrile Gloves (handling water/soils)*
Geotechnical Assessment	*Visual and photographic inspection of landfill areas*	• *Hard hat* • *Visi-Vest* • *Safety Boots* • *Safety Glasses* • *Work Gloves (handling tools)* • *Nitrile Gloves (handling water/soils)*

8 HAZARD, INCIDENT AND NEAR MISS REPORTING

If an incident which may result in an accident or an accident occurs, the SHSO or his/her representative and the affected party or parties will complete an incident/accident report. The affected parties will review the report and determine together, as a team, appropriate mitigation to prevent the reoccurrence of the incident/accident in the future. The incident/accident, regardless of severity, will be reported immediately to the client representative and ARCADIS Project Manager. Near-Miss occurrences and hazard identifications will also be recorded and reported for the prevention of future hazardous situations. Forms for the reporting of near misses, hazard identification, and incidents are attached in **Appendix E**.

9 EMERGENCY RESPONSE PLAN

This section describes contingencies and emergency planning procedures to be implemented at the Site. This Emergency Response Plan is compatible with local emergency management plans.

9.1 Emergency Contacts

A listing of emergency contacts, including the local police, fire department, ambulance, poison control centre, spill reporting department, client and project manager is provided in **Appendix F**. Copies of this listing will be posted in close proximity to all work areas across the site.

9.2 Pre-Emergency Planning

An emergency evacuation route to the nearest hospital is provided in **Appendix F**. If necessary, this route will be reviewed and revised by the SHSO to ensure that the route is adequate and consistent with prevailing conditions.

9.3 Roles and Lines of Authority

The SHSO has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measures to ensure the safety of site personnel (and the public), such as evacuation of personnel and adjacent residents from the site area. The site supervisor must also ensure that corrective measures have been implemented, appropriate authorities have been notified, and follow-up reports have been completed.

9.4 Emergency Recognition

Personnel should be familiar with techniques of hazard recognition from pre-assignment and site-specific briefings. In an emergency, personnel should proceed to the closest exit with their buddies and mobilize to a safe distance area identified prior to the start of work. Personnel should remain at that area until it is deemed safe by an authorized person (e.g. SHSO) to enter the area.

9.5 Emergency Medical Treatment Procedures

In the event that any person becomes ill or injured, first aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must be reported immediately to the SHSO and the Project Manager.

The SHSO, Ms. Julie Dittburner has experience working in remote wilderness environments and has received first aid and Level C CPR training (refer to Appendix A).

9.6 Fire or Explosion

In the unlikely event that such a hazard be identified, the property owner, Project Manager and proper authorities shall be contacted immediately. Following, an incident investigation and report will be carried out and its findings documented for future hazard identification.

9.7 Spills or Leaks

In the unlikely event that such a hazard be identified, the property owner, Project Manager and proper authorities, including the Government of Nunavut Department of Environment 24-hr Spill Line shall be contacted immediately. Following, an incident investigation and report will be carried out and its findings documented for future hazard identification.

ARCADIS

Appendix A

First Aid Certifications

CERTIFICATE of ACHIEVEMENT

This is to certify that

Julie Dittburner

has completed the course

POST 2015 - BBS - Orientation and Test

February 12, 2015

POST Final Quiz Grade: 100.00 %

cFoD8fwVIM

CANADIAN RED CROSS

Name: Julie Ditthurner

Is Recertified In

STANDARD FIRST AID CPR/AED Level ☐A ☑C ☐HCP

This card is invalid if more than one level of CPR is checked.

May 3rd 2014
Date of Issue

W100212.0
Instructor I.D.#

May 3rd 2017
Expiry Date

Alison Postma
Instructor

YOU MAY RECERTIFY SOONER IF REQUIRED FOR EMPLOYMENT

CANADIAN RED CROSS

Alisha Williamson
Name

Is Certified In

STANDARD FIRST AID CPR/AED Level ☐ A ☑ C ☐ HCP

This card is invalid if more than one level of CPR is checked.

July 4/2013 — Date of Issue

30156709 — Instructor I.D.#

July 4/2016 — Expiry Date

Instructor

YOU MAY RECERTIFY SOONER IF REQUIRED FOR EMPLOYMENT

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Appendix B

Health and Safety Meeting Form

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Health and Safety Meeting Form

Daily Safety meeting

☐ **KICK-OFF MEETING** ☐ **DAILY RENEWAL**

LOCATION OF WORK: _____

DESCRIPTION OF WORK: _____

DATE OF ISSUE: _____ TIME: _____

PRIME CONTRACTOR: _____

WEATHER: Temp:_____ Weather:_____Wind Direction:_____

IDENTIFICATION OF HAZARDS ON SITE

☐ Weather ☐ Water
☐ Wildlife
☐ Hazardous material on site (e.g. H_2S,PCB's, NORMs)
☐ Specify:
☐ Other:

HAZARDOUS WORK IDENTIFICATION (a JSA is required by the crew prior to commencing work to address any of these hazards)

☐ Excavation (includes test pits) ☐ Materials Sampling
☐ Groundwater Monitoring Sampling
☐ Helicopter/Charter Plane
☐ Other:

CRITICAL PROCEDURES (Where work involves any of the following hazards, applicable critical procedures must be incorporated into the JSA)

☐ Work at heights above 1.5 m (5 ft- includes excavations)
☐ Entry into excavations > 1.2 m (4 ft) deep
☐ Other:

	YES	N/A
1. Supervisor in attendance for duration of work outlined above.	____	____
2. Health and Safety Plan briefing has occurred before the start of the work and included a review of all sections of the attached Health and Safety Plan.	____	____
3. Work area has been inspected for potential hazards and risks have been mitigated/controlled.	____	____
4. Appropriate personal protective equipment is on site and worn by workers and visitors (e.g. glove policy).	____	____
5. Work area is defined and appropriate signs/barricades are in place to ensure other traffic or people kept out of area, where applicable.	____	____
6. Appropriate fire extinguisher(s) available in work area.	____	____
7. Did any incident or near miss occur that should be reported and discussed before work starts.	____	____
8. All required JSA'S (including critical procedures) signed by work crew and site supervisor	____	____
Operations/Associate acknowledges and can safety accommodate work being done on site.	___	___

Site Operation/Associate

SIGNATURE:_____

Date: _____

ARCADIS
Infrastructure · Water · Environment · Buildings

Health and Safety Meeting Form
Daily Safety meeting

I have read this document and agree to abide by the requirements of this Plan for staff and contractors as a condition of working at this site for this project.

Print name	*Company*	*Signature*
Julie Dittburner	ARCADIS	
Alisha Williams	Arcadis	
Joshua Eggers	Summit	
Tilman Freis	Summit	
Lilianne Arsenault	AANDC	
[illegible]	Bear Monitor	

STOP AND THINK TESTING RESULTS (minimimum1/day/10 workers/supervisor)

Worker's employer:	**Craft or Trade:**	**Test Results** (pass or fail vs 4 test areas: scope of work, hazards, mitigation, attitude)	**Completed By** Print and Sign:

FOR DAILY RENEWAL ONLY

Are there any new conditions on site not covered in the kick-off meeting?

☐ YES ☐ NO

If yes, describe

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Appendix C

Job Safety Analysis Forms
(JSAs)

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JOB SAFETY ANALYSIS (JSA) FORM

Site/Project:		
Name of Contractor/Subcontractor:	Date:	Weather:
Task/Activity:		

Check applicable anticipated or potential hazards:

- ☐ Demolition
- ☐ Underground tank removal/disposal/high vapours
- ☐ Excavation
- ☐ Activities in or near traffic areas
- ☐ Concrete cutting / coring
- ☐ Mobile heavy equipment activity (excavators, dump trucks, vacuum and hydrovac trucks)
- ☐ Pile driving / Shoring
- ☐ Work affecting integrity of critical controls
- ☐ Welding, cutting, grinding
- ☐ Hydroblasting / sandblasting
- ☐ Radiography / X-ray testing
- ☐ Pressure testing
- ☐ Other: _____

(Includes clearing brush/trees, reactive chemical handling, working in proximity to deep water, etc.)

Ensure that all hazards identified are addressed in JSA below

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*

Where necessary, insert additional pages to complete JSA

Personal Protective Equipment: *(Minimum requirement: safety boots / hard hat / visi-vest / safety glasses / gloves fit for use)*

Additional PPE:

- ☐ Eye Protection (specify)
- ☐ Hearing Protection
- ☐ Fall Protection
- ☐ Rubber footwear and gloves if in damp area
- ☐ Portable Gas Monitor
- ☐ Other (e.g. fire retardant coveralls, breathing apparatus, etc.)

Outside Authorities: *(Any authorities who need to be advised including site operator)*

Names of person(s) Carrying out work : _____ Signed: _____ Date: _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

JSA Approved By (Site Supervisor): _____ Signed: _____ Date: _____

Note: For tasks/activities that extend beyond a single day, use attached DAILY RENEWAL form for review of JSA with current crew and weather

JOB SAFETY ANALYSIS (JSA) - DAILY RENEWAL

(For JSA activities that extend beyond one day)

Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		

JOB SAFETY ANALYSIS (JSA) FORM

Site/Project: PIN-D		
Name of Contractor/Subcontractor:	Date:	Weather:
Task/Activity: Geotechnical Assessment		

Check applicable anticipated or potential hazards:

- ☐ Demolition
- ☐ Underground tank removal/disposal/high vapours
- ☐ Excavation
- ☐ Activities in or near traffic areas
- ☐ Concrete cutting / coring
- ☐ Mobile heavy equipment activity (excavators, dump trucks, vacuum and hydrovac trucks)
- ☐ Pile driving / Shoring
- ☐ Work affecting integrity of critical controls
- ☐ Welding, cutting, grinding
- ☐ Hydroblasting / sandblasting
- ☐ Radiography / X-ray testing
- ☐ Pressure testing
- ☐ Other: _____

(Includes clearing brush/trees, reactive chemical handling, working in proximity to deep water, etc.)

Ensure that all hazards identified are addressed in JSA below

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*
STEP 1 Driving/Mobilization to Site Airplane Charter	- Injury loading and exiting/entering aircraft	- Proper lifting and loading techniques - Use 2 workers for heavy equipment - Follow airplane safety briefing

STEP 2 Site conditions Health/safety meeting General Housekeeping Requirements	- Slips, trips and falls - Ankle sprains - Weather	- Observe conditions of terrain and inspect areas for potential slip, trip, fall hazards - Visi-vests, hold meeting in safe area - Steel-toed boots with laces tied - Removal/flag potential tripping hazards - Eye, head and hand protection - Keep clean and organized work area at all times - Dedicate area for storage of surplus materials and keep them stockpiled nicely - Complete site walkthrough prior to departing from site - Appropriate clothing for weather conditions
STEP 3 Job setup Equipment unloading	- Back strain, cuts, scrapes, sprains - Equipment falling/tipping - Pinch points - Slips, trips and falls	- Use 2 workers for lifting heavy objects - Use proper lifting techniques (with knees, not back) - Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Ensure all workers are qualified/trained to work with equipment. - Work area inspection, plan entry and exit routes - Barricade work areas via cones, signs, etc. - Avoid areas marked as trip hazards
STEP 4 Assessment – walk around and DGPS	- Back/muscle strains - Cuts, scrapes, abrasions - Slips, trips and falls - Walking on slope	- Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Communication between workers - Proper selection/use of tools - Proper body positioning and ergonomics - Avoid areas marked as trip hazards

STEP 5 Loading equipment Job Completion Drive/Mobilization home	- Review step 3 - Danger to public from poor site condition	- Review Step 3 - Clean all debris from Site at completion of work - Complete site walkthrough prior to departing from site

Personal Protective Equipment: *(Minimum requirement: safety shoes / hard hat / visi-vest / safety glasses / gloves fit for use)*

Additional PPE:

- ☐ Eye Protection (specify)
- ☐ Hearing Protection
- ☐ Fall Protection
- ☐ Rubber footwear and gloves if in damp area
- ☐ Portable Gas Monitor
- ☐ Other (e.g. fire retardant coveralls, breathing apparatus, etc.)

Outside Authorities: *(Any authorities who need to be advised including site operator)*

Names of person(s) Carrying out work : _____ Signed: _____ Date: _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

JSA Approved By (Site Supervisor): _____ Signed: _____ Date: _____

JOB SAFETY ANALYSIS (JSA) - DAILY RENEWAL

(For JSA activities that extend beyond one day)

Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		

JOB SAFETY ANALYSIS (JSA) FORM

Site/Project: PIN-D		
Name of Contractor/Subcontractor:	Date:	Weather:
Task/Activity: Monitoring Well Development and Groundwater Sampling (Waterra w/ Foot Valve and Bailer)		

Check applicable anticipated or potential hazards:

- ☐ Demolition
- ☐ Underground tank removal/disposal/high vapours
- ☐ Excavation
- ☐ Activities in or near traffic areas
- ☐ Concrete cutting / coring
- ☐ Mobile heavy equipment activity (excavators, dump trucks, vacuum and hydrovac trucks)
- ☐ Pile driving / Shoring
- ☐ Work affecting integrity of critical controls
- ☐ Welding, cutting, grinding
- ☐ Hydroblasting / sandblasting
- ☐ Radiography / X-ray testing
- ☐ Pressure testing
- ☐ Other: _____

(Includes clearing brush/trees, reactive chemical handling, working in proximity to deep water, etc.)

Ensure that all hazards identified are addressed in JSA below

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*
STEP 1 Driving/Mobilization to Site Airplane Charter	- Injury loading and exiting/entering aircraft	- Proper lifting and loading techniques - Use 2 workers for heavy equipment - Follow airplane safety briefing

STEP 2 Site conditions Health/safety meeting General Housekeeping Requirements	- Slips, trips and falls - Ankle sprains - Weather	- Observe conditions of terrain and inspect areas for potential slip, trip, fall hazards - Visi-vests, hold meeting in safe area - Steel-toed boots with laces tied - Removal/flag potential tripping hazards - Eye, head and hand protection - Keep clean and organized work area at all times - Dedicate area for storage of surplus materials and keep them stockpiled nicely - Complete site walkthrough prior to departing from site - Appropriate clothing for weather conditions
STEP 3 Job setup Equipment unloading	- Back strain, cuts, scrapes, sprains - Equipment falling/tipping - Pinch points	- Use 2 workers for lifting heavy objects - Use proper lifting techniques (with knees, not back) - Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Ensure all workers are qualified/trained to work with equipment. - Work area inspection, plan entry and exit routes - Barricade work areas via cones, signs, etc.
STEP 4 Well Monitoring and Development	- Back/muscle strains - Cuts, scrapes, abrasions - Contact w/ contaminants - Contact w/ decon supplies - Line of Fire - Release of contaminated purge water	- Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Nitrile gloves when in contact w/ contaminated water - Communication between workers - Proper selection/use of tools - MSDS, eye wash and first aid station available on site. - Proper body positioning and ergonomics - Appropriate storage of purge water

STEP 5 Groundwater Sample collection	- Back/muscle strains - Cuts, scrapes, abrasions - Contact w/ contaminants - Contact w/ decon supplies - Line of Fire - Release of contaminated purge water - Glass sample bottles - Contact w/ sample preservatives	- Ensure all workers are outfitted with the required PPE boots, gloves, visi-vest, glasses) - Nitrile gloves when in contact w/ contaminated water - Communication between workers - Proper selection/use of tools - MSDS, eye wash and first aid station available on site. - Proper body positioning and ergonomics - Appropriate storage of purge water - Check for breakages, handle carefully
STEP 6 Relocate to new monitoring well and repeat	- Review steps 3 - 5	- Review steps 3 - 5
STEP 7 Pack Samples Loading equipment Job Completion Drive/Mobilization home	- Review step 3 - Danger to public from poor site condition	- Review Step 3 - Clean all debris from Site at completion of work - Complete site walkthrough prior to departing from site

Personal Protective Equipment: *(Minimum requirement: safety shoes / hard hat / visi-vest / safety glasses / gloves fit for use)*

Additional PPE:

- ☐ Eye Protection (specify)
- ☐ Hearing Protection
- ☐ Fall Protection
- ☐ Rubber footwear and gloves if in damp area
- ☐ Portable Gas Monitor
- ☐ Other (e.g. fire retardant coveralls, breathing apparatus, etc.)

Outside Authorities: *(Any authorities who need to be advised including site operator)*

Names of person(s) Carrying out work : _____ Signed: _____ Date: _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

JSA Approved By (Site Supervisor): _____ Signed: _____ Date: _____

JOB SAFETY ANALYSIS (JSA) - DAILY RENEWAL

(For JSA activities that extend beyond one day)

Date:	Weather:	
<u>Identified changes to risk and additional controls</u> (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
<u>Identified changes to risk and additional controls</u> (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
<u>Identified changes to risk and additional controls</u> (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
<u>Identified changes to risk and additional controls</u> (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		

JOB SAFETY ANALYSIS (JSA) FORM

Site/Project: PIN-D		
Name of Contractor/Subcontractor:	Date:	Weather:
Task/Activity: Soil Sampling – manual excavations		

Check applicable anticipated or potential hazards:

- ☐ Demolition
- ☐ Underground tank removal/disposal/high vapours
- ☐ Excavation
- ☐ Activities in or near traffic areas
- ☐ Concrete cutting / coring
- ☐ Mobile heavy equipment activity (excavators, dump trucks, vacuum and hydrovac trucks)
- ☐ Pile driving / Shoring
- ☐ Work affecting integrity of critical controls
- ☐ Welding, cutting, grinding
- ☐ Hydroblasting / sandblasting
- ☐ Radiography / X-ray testing
- ☐ Pressure testing
- ☐ Other: _____

(Includes clearing brush/trees, reactive chemical handling, working in proximity to deep water, etc.)

Ensure that all hazards identified are addressed in JSA below

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*
STEP 1 Driving/Mobilization to Site Airplane Charter	- Injury loading and exiting/entering aircraft	- Proper lifting and loading techniques - Use 2 workers for heavy equipment - Follow airplane safety briefing

STEP 2 Site conditions Health/safety meeting General Housekeeping Requirements	- Slips, trips and falls - Ankle sprains - Weather	- Observe conditions of terrain and inspect areas for potential slip, trip, fall hazards - Visi-vests, hold meeting in safe area - Steel-toed boots with laces tied - Removal/flag potential tripping hazards - Eye, head and hand protection - Keep clean and organized work area at all times - Dedicate area for storage of surplus materials and keep them stockpiled nicely - Complete site walkthrough prior to departing from site - Appropriate clothing for weather conditions
STEP 3 Job setup Equipment unloading	- Back strain, cuts, scrapes, sprains - Equipment falling/tipping - Pinch points - Slips, trips and falls	- Use 2 workers for lifting heavy objects - Use proper lifting techniques (with knees, not back) - Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Ensure all workers are qualified/trained to work with equipment. - Work area inspection, plan entry and exit routes - Barricade work areas via cones, signs, etc. - Avoid areas marked as trip hazards
STEP 4 Soil Sampling – excavation (by hand using a spade or pick)	- Back/muscle strains - Cuts, scrapes, abrasions - Contact w/ contaminants - Contact w/ decon supplies - Line of Fire - Slips, trips and falls	- Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Nitrile gloves when in contact w/ contaminated water/soil - Communication between workers - Proper selection/use of tools - MSDS, and first aid station available on site. - Proper body positioning and ergonomics - Avoid areas marked as trip hazards

STEP 5 Sample collection	- Back/muscle strains - Cuts, scrapes, abrasions - Contact w/ contaminants - Contact w/ decon supplies - Line of Fire - Glass sample bottles - Contact w/ sample preservatives	- Ensure all workers are outfitted with the required PPE (boots, gloves, visi-vest, glasses) - Nitrile gloves when in contact w/ contaminated water/soil - Communication between workers - Proper selection/use of tools - MSDS, and first aid station available on site. - Proper body positioning and ergonomics - Check for breakages, handle carefully
STEP 6 Relocate to new sample location and repeat	- Review steps 3 - 5	- Review steps 3 - 5
STEP 7 Pack Samples Loading equipment Job Completion Drive/Mobilization home	- Review step 3 - Danger to public from poor site condition	- Review Step 3 - Clean all debris from Site at completion of work - Complete site walkthrough prior to departing from site

Personal Protective Equipment: *(Minimum requirement: safety shoes / hard hat / visi-vest / safety glasses / gloves fit for use)*

Additional PPE:

- ☐ Eye Protection (specify)
- ☐ Hearing Protection
- ☐ Fall Protection
- ☐ Rubber footwear and gloves if in damp area
- ☐ Portable Gas Monitor
- ☐ Other (e.g. fire retardant coveralls, breathing apparatus, etc.)

Outside Authorities: *(Any authorities who need to be advised including site operator)*

Names of person(s) Carrying out work : _____ Signed: _____ Date: _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

JSA Approved By (Site Supervisor): _____ Signed: _____ Date: _____

JOB SAFETY ANALYSIS (JSA) - DAILY RENEWAL

(For JSA activities that extend beyond one day)

Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		

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JOB SAFETY ANALYSIS (JSA) FORM

Site/Project: PIN-D		
Name of Contractor/Subcontractor:	Date:	Weather:
Task/Activity: Wildlife Monitoring		

Check applicable anticipated or potential hazards:

- ☐ Demolition
- ☐ Underground tank removal/disposal/high vapours
- ☐ Excavation
- ☐ Activities in or near traffic areas
- ☐ Concrete cutting / coring
- ☐ Mobile heavy equipment activity (excavators, dump trucks, vacuum and hydrovac trucks)
- ☐ Pile driving / Shoring
- ☐ Work affecting integrity of critical controls
- ☐ Welding, cutting, grinding
- ☐ Hydroblasting / sandblasting
- ☐ Radiography / X-ray testing
- ☐ Pressure testing
- ☐ Other: _____

(Includes clearing brush/trees, reactive chemical handling, working in proximity to deep water, etc.)

Ensure that all hazards identified are addressed in JSA below

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*
STEP 1 Mobilization to Site Airplane Charter	- Injury loading and exiting/entering aircraft - Damage to gun due to improper storage	- Proper lifting and loading techniques - Use 2 workers for heavy equipment - Follow airplane safety briefing - Store weapon as directed and in location indicated by pilots

Sequence of Basic Job Steps *(Order in which the work will be carried out and brief details of how tasks will be performed)*	**Potential Hazards** *(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)*	**Safety Controls to Reduce or Eliminate Hazard** *(Describe the precautions that will be taken)*
STEP 2 Site conditions	- Slips, trips and falls - Ankle sprains - Weather	- Observe conditions of terrain and inspect areas for potential slip, trip, fall hazards - Appropriate clothing for weather conditions
STEP 3 Job setup Test fire	- Weapon test fire hits something	- Conduct test fire in appropriate location, away from people and air craft - Safety weapon after test fire
STEP 4 Wildlife Monitoring	- Back/muscle strains - Cuts, scrapes, abrasions - Slips, trips and falls - Contact with wild animal	- Avoid areas marked as trip hazards -

Where necessary, insert additional pages to complete JSA

Personal Protective Equipment: *(Minimum requirement: safety shoes / hard hat / visi-vest / safety glasses / gloves fit for use)*

Additional PPE:

- ☐ Eye Protection (specify)
- ☐ Hearing Protection
- ☐ Fall Protection
- ☐ Rubber footwear and gloves if in damp area
- ☐ Portable Gas Monitor
- ☐ Other (e.g. fire retardant coveralls, breathing apparatus, etc.)

Outside Authorities: *(Any authorities who need to be advised including site operator)*

Names of person(s) Carrying out work : _____ Signed: _____ Date: _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

JSA Approved By (Site Supervisor): _____ Signed: _____ Date: _____

Note: For tasks/activities that extend beyond a single day, use attached DAILY RENEWAL form for review of JSA with current crew and weather.

JOB SAFETY ANALYSIS (JSA) - DAILY RENEWAL

(For JSA activities that extend beyond one day)

Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		
Date:	Weather:	
Identified changes to risk and additional controls (e.g.: new crew member, impact on others, inclement weather, etc.):		
Site Supervisor (Print & Sign):		
Participant name(s):		

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Appendix D

Planned Job Observation Forms
(PJOs)

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PLANNED JOB OBSERVATION (PJO) FORM

Location/Project Name:

Observer Name: Date: Time:

Observer Title: Observer Company:

Task Description

□ Soil Sampling	□ Activities in/near Traffic Area
□ Groundwater Sampling	□ Test Pitting w/ Soil Sampling
□ UST Removal	□ Excavation
□ Well Repairs/Maintenance	□ Mobile Heavy Equipment
□ SVP Sampling	□ SVP Installation
□ Other (Specify):	

Critical Procedures

When work involves any of the following hazards, critical procedures must be incorporated into the JSA:

- □ working at heights greater than 1.5 m or 5 feet (includes excavations)
- □ confined-space entry (includes tank cleaning)
- □ electrical or mechanical conditions (live, isolation, lock out or tag out)
- □ subsurface clearance (before drilling, wellbore activity or excavation)
- □ entry into excavations greater than 1.2 m or 4 feet deep
- □ hot work in potentially explosive atmospheres
- □ lifting with heavy equipment (e.g., cranes and boom trucks)

Observed Task and Relevant Background Information

(What objective basis was used for observation? An example is a JSA.)

Positive Comments

Participant Information

Session conducted by: Date: Time:

Supervisor name: Observee:

(of person being observed) (optional)

	Description	Correct	NA	Questionable Behavior Noted/Comments
Personal Protective Equipment				
1	Hearing Protection			
2	Head Protection			
3	Eye Protection			
4	Hand Protection			
5	Foot Protection			
6	Respiratory Protection			
7	Fall Protection			
8	Reflective Clothing			
9	Other (specify)			
Body Use and Positioning				
10	Correct lifting, pushing, pulling technique			
11	Hands/body clear of line of fire			
12	Using 3-point contact for mount/dismount			
13	Other (specify)			
Work Environment				
14	Work/walking surface clear of obstruction			
15	Housekeeping			
16	Barricades, cones, signage, security			
17	Safety shutdown devices secured			
18	Sample/waste materials properly stored			
19	Other (specify)			
Operating Procedures				
20	LMRA and job-planning			
21	Compliance to specified permits			
22	JSA compliance			
23	Hazard identification			
24	Communication with other site personnel			
25	Subsurface clearance			
26	Other (specify)			
Tools and Equipment				

27	Hand-tool selection, condition, usage			
28	Power-tool selection, condition, usage			
29	Heavy equip. selection, condition, usage			
30	Other (specify)			
Total Correct:		Percent Correct (approx.):		

Root Cause Analysis and Solutions

Address questionable items noted during job observation.

Root Causes	
☐ Personal Factors	☐ 1 - Lack of skill or knowledge. ☐ 2 - Doing the job according to procedures or acceptable practices takes more time or effort. ☐ 3 - Shortcutting procedures or acceptable practice is positively reinforced or tolerated ☐ 4 - In the past, no incident occurred.
☐ Job Factors	☐ 5 - Lack of or inadequate procedures. ☐ 6 - Inadequate communication of expectations regarding procedures or acceptable practices. ☐ 7 - Inadequate tools or equipment.
☐ External Factors	☐ 8 - External factors (specify):

Questionable Observations

Questionable Observation Number	Root Cause Number	Solution	Person Responsible	Agreed Due Date (yy/mm/dd)	Date Completed (yy/mm/dd)

Verification and Validation

Were solutions implemented?

Were solutions effective?

Describe the thought process leading to the chosen root cause(s):

PJO Authorization

Reviewed by: _____

(Position) (Name)

_____

(Date) (Time)

Approved by: _____

(Position) (Name)

_____

(Date) (Time)

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Appendix E

Incident, Near Miss and Hazard Identification Report Forms

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Incident Report/Near Miss

ARCADIS Site Supervisor:		Contractor representative:	
Incident location:	Street: City: Province:		
Incident date:		Incident time:	

Incident type:

Injury to contractor/employee	☐	Property/equipment damage	☐	Discharge exceeding legal limits	☐
Injury to third party	☐	Contractor property/equipment damage	☐	Government inspection report/order	☐
Motor vehicle accident	☐	Third party property/equipment damage	☐	Near miss - unsafe act	☐
Product spill/leak	☐	Line strike	☐	Near miss - unsafe condition	☐

Incident description (include media coverage and government involvement):

Factors contributing to incident and incident severity:

Emergency assistance obtained (police, ambulance, fire)

Police	☐	Ambulance	☐	Fire	☐

Safety incidents

People involved (injured party, witnesses)

Name	Employer (if contractor employee)	Involvement

Nature of injury (type, body part)	
Treatment given	
Current condition	

Spills and leaks

Product	Quantity discharged
	Quantity contained
	Quantity recovered

Notifications:				
Ministry of the Environment	☐	TSSA (Ontario)	☐	Other
Municipality	☐	Workers' Compensation	☐	Other

Follow-up required:

Action	Responsibility/Timeframe	Completed by

Report prepared by:	
Date:	Time:
ARCADIS Project manager	

Copy to project file and to Safety Representative for incident system entry and filing.

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Appendix F

Emergency Contacts, Procedures and Route to Nearest Hospital

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EMERGENCY CONTACT LIST

ARCADIS Job Number:	AANDC Dewline Site Monitoring 1697-1501
Field Start Date:	July 22/23, 2015
Project Address:	Ross Point, PIN-D

Contact	Person or Agency	Phone Number
Hospital	Kitikmeot Regional Health Centre (Cambridge Bay)	867-983-4500
Police	RCMP, Cambridge Bay	867-983-1111
Fire Department	Fire Emergency Calls	867-983-2222 (Cam Bay)
Spill Report Line	GN Department of Environment	867-920-8130
Consulting Engineers	ARCADIS Canada Inc. Suite 200, 329 Churchill Avenue N	(613) 721-0555
Drug and Alcohol Testing (Nationwide)	Driver Check Inc.	1-800-463-4310
ARCADIS Canada Inc.	Chris Ludwig	613-721-0555 (O) 613-222-8192 (cell)
	Stephanie Joyce	613-721-0555 (O) 613-986-8398 (cell)
	Andrew Henderson	613-721-0555 (O) 613-286-7760 (cell)
Aircraft Charter Company	Adlair Aviation	867-873-5161

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EMERGENCY CONTACT PLAN

WHAT TO DO IN THE EVENT OF AN INCIDENT ON-SITE

In the case of any incident involving injury, illness or property damage:

1. **Stop work as soon as safely possible**
   a. Meet at safe area (designated at kick-off meeting), and account for all site personnel.
   b. Perform a scene survey
   c. Take control of the scene, restrict access to the area affected by the incident, and determine what happened.
   d. Assess hazards, and make the scene safe.
   e. Determine if the incident has caused an illness, injury, or property damage.

2. **Perform a primary survey (Airway-Breathing-Circulation), if any casualties have been identified**
   a. Assess casualties for life-threatening injuries or illnesses, and begin first-aid procedures.
   b. Direct non-injured bystanders to send for medical/emergency help; assist with first aid and securing the scene.
   c. Provide ongoing casualty care until medical help arrives.

3. **In the case where non-life threatening injury or property damage has occurred, contact the Site project manager (PM) or appropriate management personnel as soon as possible**
   a. Direction will be given as to the appropriate steps to take to manage the incident, to prevent further property damage or injury, and for the eventual resumption of work.
   b. ARCADIS PM will contact the client PM, and provide notification that an incident has occurred, and what steps are being taken post-incident.
   c. On-site injuries or workplace related illnesses of ARCADIS personnel need to be reported to WorkCare. Call 1-888-449-7787.

4. If a critical incident (i.e. fatality), call local Ministry of Labour (MOL) office (1-800-268-8013 – to obtain number to the local office) or appropriate Provincial/Territorial Regulatory Agency for region where work is being performed.

   Within four (4) days must notify MOL in writing the details of the accident. Check local requirements before work begins, if not working in Ontario.

5. Driver Check must be contacted for Drug/Alcohol Testing if a recordable incident involving either direct employees or sub-contractors has occurred. Recordable incidents are identified as one of the following:

a. Critical injury[1];
b. Actual/potential medical assistance (provided by a legally-qualified medical practitioner or registered nurse);
c. Lost time incident (unable to perform work duties the next day after incident); and
d. Environmental and down gradient incidents (spills/leaks, fire/explosion, potential adverse publicity, vehicle accident, damage to property).

The contact numbers for Driver Check are on the Emergency Contact Sheet. Driver Check must be contacted within 4 hours of incident occurring, and a mobile testing unit can be dispatched to the Site.

6. Report the accident to the Workplace Safety and Insurance Board (WSIB - Ontario) within three (3) days if the employee loses time from work or requires medical treatment (i.e. visits a medical professional). If work is being performed out-of-province, report to appropriate Provincial/Territorial Regulatory Agency for region where work is being performed. If the incident requires first aid only, reporting is not required.

   Ontario-specific: Form 6 should be filled out by the worker and Form 7 should be filled out by the employer (forms on website www.wsib.ca). Report to WSIB within 10 days if there is any significant change (i.e. back to work, change to illness etc.). **Appropriate provincial/territorial requirements must be adhered to for the region in which work is being performed**

7. Investigate the incident, and document investigation on the Incident Report Form (found in the Site Specific Health and Safety Plan - **Appendix G**), which will be sent to the PM within 24 hours of incident occurrence. Implement solutions, and forward a copy of paperwork to the Corporate Health and Safety Coordinator (CHSC).

8. The incident investigation will be reviewed with site personnel at the next daily safety meeting, once work on site is permitted to safely resume.

[1] Defined under appropriate Provincial/Territorial legislation for the region where the work is being performed.

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Route from Cambridge Bay Airport to Kitikmeot Regional Health Centre

Google

Drive 3.8 km, 9 min

Directions from **Cambridge Bay Airport** to **13A Omingmak St.**

Cambridge Bay Airport

Cambridge Bay, NU X0B 0C0

1. Head **southeast** on **Gravel Pit Rd** toward **Airport Rd**

700 m

2. Slight **left** onto **Airport Rd**

2.0 km

3. Continue onto **Mitik St**

900 m

4. Turn **left** onto **Kamotik Rd**

130 m

5. Turn **right**

   Destination will be on the left

74 m

13A Omingmak St.

Cambridge Bay, NU X0B 0C0

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

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