PROTECTING OUR ARCTIC ENVIRONMENT

Installation and Construction Details of Monitoring Wells

Hydrocarbon-Impacted Soil Landfarm Facility
1575 Federal Road.
City of Iqaluit, Nunavut

Water Licence Number – 1BR-NUN1217

Prepared for:

Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU
X0B 1J0

Prepared by:

Nunatta Environmental Services Inc.
P. O. Box 267
Iqaluit, Nunavut. X0A-0H0
Phone 1-867-979-1488
Fax 1-867-97-1478
Email Nunatta@northwestel.net

Dated: Dec 2017

Table of Contents

1.0 INTRODUCTION

Nunatta Environmental Services Inc. (Nunatta) owns and operates a Hydrocarbon-Impacted Soil Landfarm Facility within the City of Iqaluit, Nunavut.

The facility is located at 1575 Federal Road, Industrial Park, within the limits of the City of Iqaluit on Lot 1, Block 229.

The NWB License number for the Hydrocarbon-Impacted Soil Landfarm Facility is 1BR-NUN1217

This treatment facility is commonly referred to as the 'landfarm'. Nunatta's operations consist of accepting soils impacted with petroleum products at various concentrations at the landfarm's geosynthetic lined platform (Cells) and with addition of fertilizers, aeration, and moisture control, allow indigenous soil microorganisms to degrade petroleum products to braking them down into compounds such as water, carbon dioxide and hydrogen sulfide. Soils accepted at the landfarm are contaminated with diesel, gasoline and various automotive and construction/mining oils.
The site where the land farm is located is in the industrial part adjacent the old metal dump where all old equipment and cars and trucks were junked. Many rotting barrels of unknown products are still visible on adjacent properties around the landfarm and through out the dump site to the west of our fences. Records show the landfarm site was used as crushing grounds for any old waste barrels and storage of unclaimed products.

Conscious that the landfarm may adversely impact the environment should unlikely cell leaks or spills occur, groundwater monitoring wells were installed along the landfarm's perimeter. The landfarm terrain and surrounding areas are relatively flat, indicating that the hydro geological flows are most likely stagnant. The proximity of ponds, creeks and Koojessee inlet, to the landfarm are environmentally sensitive water bodies and must be protected from potential contamination inputs.

Monitoring wells are used to detect the potential movement of contaminated groundwater originated from the landfarm towards sensitive area and to detect potential contamination entering the landfarm's property from neighboring terrains.

Considering that Nunatta is handling substantial quantities of petroleum impacted soils and despite the fact that the treatment cells are lined with 30 mil High Density Poly Ethylene (HDPE) geomembrane, a potential for contamination entering subsoil and groundwater exists. To detect this potential contamination, Nunatta developed a groundwater monitoring system consisting in the installation of 6 groundwater wells located along the property's perimeter.

The groundwater monitoring wells were installed in September 2004 and were built rapidly to obtain water samples prior to freezing conditions. The depth to permafrost was determined to be approximately 8' deep at the end of September. The depth of the wells was therefore set to be 5'.

The location of the 6 monitoring wells is shown in Map #1. The groundwater wells consisted of a 2”diameter PVC pipe having a 5’ length placed vertically in the ground. The bottom 2’ of the pipe was perforated allowing groundwater entering the pipe. A geotextile sleeve to prevent soil particles from entering and blocking the pipe protects this 2’ perforated section. A four foot section was inserted into the ground whereas the remaining foot stayed above ground. With this layout any incoming or outgoing potential contamination will be detected.

The following is a detailed report from FRANZ outlining the operation and their findings.

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

February 24, 2009

Mr. Axel Have
Acting General Manager
Nunatta Environmental Services Ltd
P. O. Box 267
Iqaluit, Nunavut
X0A-0H0

Dear Mr. Have:

Re: 2008 Soil Testing and Groundwater Monitoring
Hydrocarbon-Impacted Soil Landfarm Facility
North 40 Industrial Park
City of Iqaluit, Nunavut

The following letter details the environmental testing work completed by Franz Environmental Inc. (FRANZ) at Nunatta Environmental Services Inc's (Nunatta) Hydrocarbon-Impacted Soil Landfarm Facility (Landfarm), North 40 Industrial Park, City of Iqaluit, NU (Figure 1). It is our understanding that the testing provided in this report will be used as part of the documentation supporting the annual reports filed with the Nunavut Water Board by Nunatta for water use and waste disposal activities.

FRANZ was retained by Nunatta to complete the following tasks:

- Install 4 new groundwater monitoring wells to replace older "dry" wells;
- Collect soil and groundwater samples from the new well locations for representative chemical analysis;
- Collect soil samples from Cell 3 Landfarm for representative chemical analysis; and
- Provide a factual report.

Investigative METHODOLOGY

An intrusive and sampling investigation was completed at the Landfarm from November 2 to November 6, 2008. Nunavut Construction, a Quebec construction company with a subsidiary in Iqaluit, was subcontracted to excavate pits for soil sampling, monitoring well installations and soil sampling of Cell 3. FRANZ personnel were responsible for the installation of the monitoring wells, and collection of groundwater and soil samples.

The monitoring well logs are provided in Appendix A. Photographs of the investigation are presented in Appendix B and copies of Paracel Laboratories Ltd results are presented in Appendix C.

Test Pitting and Soil Sampling

A total of four (4) test pits completed as monitoring wells (MW08-1 to MW08-4) were advanced between November 3 and 4, 2008 to depths ranging from 2.8 to 3.4 m below ground surface (mbgs). The test pit/monitoring well locations are presented in Figures 2 and 3. Test pit/monitoring well logs are included in Appendix A

Test pits were excavated by using a track mounted excavator. Composite soil samples were collected from the side wall of each test pit. Soil stratigraphy was logged and photos taken before backfilling the test pits with excavated soil. The following represented a consistent level of effort for all test pits:

- Excavations from ground surface to a maximum depth of 3.4 mbgs (i.e., controlled by depth of permafrost);
- Field monitoring of combustible gas concentrations using an RKI Eagle Hydrocarbon surveyor was conducted for each test pit;
- Surface and subsurface materials were inspected, described and photographed;
- Representative samples were collected from each soil/fill horizon;
- Following sampling, test pits were backfilled to grade in the reverse order of excavation;
- General soil classification was completed on soil and fill and recorded to establish an understanding of soil and fill units and potential impacts; and
- Precautions were taken to prevent potential cross contamination, soil samples were taken with proper precautions during sampling, including using a fresh pair of nitrile gloves for each sample location.

All samples were stored immediately in doubled-up, zippered, plastic bags (for soil vapour analysis) and laboratory supplied sample jars (for laboratory analysis). Soil samples for laboratory analysis were stored with in laboratory supplied coolers equipped with ice packs from the time of collection until delivery to the laboratory. Test pit photos are presented in Appendix B.

Landfarm Soil Sampling

A total of three (3) surface test pits were advanced on November 4, 2008 to depths ranging from 0.5 to 0.9 m below ground surface (mbgs) in the Landfarm Cell-3. The surficial test pits were excavated by using a track mounted excavator, supplied and operated by Nunavut Construction. Composite soil samples were collected from each test pit. Soil stratigraphy was logged before backfilling the test pits with excavated soil. The test pit locations are presented in Figures 2 and 3.

All samples were stored immediately in doubled-up, zippered, plastic bags (for soil vapour analysis) and laboratory supplied sample jars (for laboratory analysis). Soil samples for laboratory analysis were stored with in laboratory supplied coolers equipped with ice packs from the time of collection until delivery to the laboratory.

Soil Vapour Screening

FRANZ field personnel screened all soil samples collected by measuring combustible vapour levels in the headspace of bagged samples. Field screening was conducted for each sample, using a consistent procedure as follows: a standard soil volume was placed into a polyethylene bags; the bagged samples were then allowed to equilibrate to ambient air temperatures for a consistent period of time until readings stabilized. After equilibration, a combustible gas indicator (CGI) probe was inserted into the bags and the maximum concentrations of combustible vapours were recorded. Visual and olfactory observations were also used in field screening of all soil samples.

An RKI Eagle CGI, Serial number E61010, Type 401 was used to screen vapours where petroleum hydrocarbon impacts were suspected. The CGI measures the concentration of combustible gas in parts per million (ppm) or as a percentage of the lower explosive limit (% LEL). The instrument has a methane sensor that can be turned on and off. The methane sensor was turned off for all measurements unless noted otherwise (i.e., measurements do not include methane concentrations). The CGI displays measurements in increments of 5 ppm. Concentrations equal to or less than 50 ppm (background) were considered to be an indication of the absence of petroleum hydrocarbon impacts. In all cases, olfactory and visual observations were reported together with CGI measurements.

A background, or ambient air reading was also recorded after the instrument was turned on and prior to measuring concentrations in a particular area of concern. The average background concentration of combustible gas averaged approximately 20 to 40 ppm.

Soil Chemical Analysis

Samples for potential hydrocarbon analysis were screened for soil vapour concentrations and reviewed for staining and visual impacts. In general, soil samples submitted for hydrocarbon analysis were based on the highest soil vapour concentrations, per test pit.

Soil samples for metals analyses were selected to determine the typical concentrations of these chemicals within the Landfarm area.

The samples that were submitted for laboratory analysis are summarized as follows:

Test Pits- Perimeter Monitoring Wells

- A total of three (3) representative soil samples were collected, and all of the samples were submitted for laboratory analysis of the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standards (CWS) for petroleum hydrocarbons F1-F4 parameters.
- Three (3) of these samples were also analysed for CCME metals, including mercury (Hg).

Test Pits- Landfarm Cell 3

- A total of three (3) representative soil samples were collected, and all of the samples were submitted for laboratory analysis of the CCME CWS for petroleum hydrocarbons F1-F4 parameters.
- Three (3) of these samples were also analysed for CCME metals, including mercury (Hg).

Monitoring Well Installation

Four (4) monitoring wells were installed in test pits to determine the absence or presence of dissolved contaminants. Monitoring well identifications and depths are presented below.

Monitoring Well Locations

Monitoring Well ID	Screen Depth (mbgs)	Water Levels (mbgs)
MW08-1	1.6 – 3.4	Dry
MW08-2	1.1 – 2.8	Dry
MW08-3	1.25 – 3.2	1.65
MW08-4	1.6 – 2.8	1.70

Monitoring installations were completed in accordance with the ASTM 5092-90 standards. The monitoring wells consisted of 31.78 mm (1.25 inch) I.D. diameter schedule 40, flush threaded, pre-washed and bagged PVC pipe with 1.52 m (PVC slot # 10) screens. The shallow wells were positioned to intercept the water table and to provide evidence of any phase-separated hydrocarbons. The wells were completed at the top of the permafrost within the active layer.

Groundwater Sampling and Chemical Analysis

A total of two (2) groundwater samples were collected (MW08-3 and MW08-4). The samples were collected from the monitoring wells using well-dedicated Watera tubing and foot valves. A total of three well volumes were purged from each well prior to sampling. Water samples were collected from each well and transferred into glass jars. Samples were collected using fresh disposable nitrile gloves for each sample.

All water samples were submitted for analysis for petroleum hydrocarbons (PHCs) fractions F1-F4, PAHs, metals and PCBs.

Regulatory Guidelines

Background

The Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CCME, 1999 and annual updates), including the *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CCME, 2001 and updates) were applied in the numerical comparison of laboratory data.

In Nunavut, environmental site assessments and site remediation projects are typically based on the use of federally developed generic guidelines. Risk assessment principles have been used extensively in developing federal generic clean-up criteria for contaminated sites. However, as the term “generic” implies, they are intended for broad applications and are usually over-protective to avoid underestimating potential risks associated with a wide range of site conditions and potential land uses.

The chemical data obtained during this Study were preferentially compared to established guidelines from the federal CCME. The federal guidelines are relevant since Nunavut has adopted the CCME approach.

The CCME "Canadian Environmental Quality Guidelines" (1999) publication compiled all previously released soil and groundwater criteria and guidelines into one publication. Updates have been issued for selected chemicals over the past several years. These guidelines for soil, sediment and water are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites. The guidelines are derived using toxicological data. There are four separate sets of guidelines for soil quality and five sets of guidelines for water quality. The guidelines are separated into groups for different types of land and water use.

Soil Guidelines

The soil analytical results were compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines and with the Canada-Wide Standards (CWS) for Petroleum Hydrocarbons (PHC) in soil. The criteria are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites. The guidelines are derived using toxicological data and aesthetic considerations.

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

- *Canadian Environmental Quality Guidelines* (CEQGs; CCME, 2007) for commercial land use.
- *Canada-Wide Standards for Petroleum Hydrocarbons* (CWS - PHC) in Soil (CCME, 2008a) - Tier 1 Levels also for commercial land use.

Groundwater

The federal CCME guidelines were derived based on potential impacts to humans and ecological receptors. However, the CCME guidelines also take into account potential risks to humans associated with the consumption of groundwater on the site. The CCME have not established an equivalent set of non-potable thresholds. For these reasons, Ontario criteria for groundwater were used in the chemical evaluation.

The following guidelines were adopted for the evaluation of groundwater.

Groundwater contaminant levels were compared to the Ontario Ministry of the Environment's Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (2004):

- Table 3 – Full Depth Generic Site Condition Standards in Non-Potable Ground Water Conditions (coarse soil)

These guidelines are protective of:

- Groundwater discharge to surface water bodies (protection of aquatic receptors).
- Vapour movement from groundwater to indoor air (protection of human health).
- Direct contact or dermal contact of chemicals of Concern (CoC).

PHYSICAL SITE CHARACTERISTICS

Topography and Drainage

The ground elevation at the site is approximately 30 m above sea level (masl). The site is located within a generally flat area (National Topographic Series map, Nunavut 25 N/15). The site has a gentle slope to the east towards a small drainage, which joins Carney Creek. Other small amounts of surface melt water also collects in a drainage ditch located to the west of the Landfarm property, between a quarry access roadway and the Landfarm property; however, water collected in this drainage ditch remains trapped and has poor to no circulation. Pooled water also collects to the west of the site in the low lying areas (approximately 20 to 25 masl) created by quarrying activities (See Figure 2).

Regional Bedrock Geology

The southern portion of Baffin Island consists of primarily Precambrian Canadian Shield crystalline rocks. The regional bedrock geology in the study area is part of the Churchill Structural province. The bedrock in the study area is from the Aphebian Era and consists of a variety of metamorphic rocks. Quartz-feldspar-gneissic rocks are the predominant facies in the area around Iqaluit (Härtling, 1988).

The structural geology follows the general northwest – southeast trend of the area. The northwest – southeast aligned fault system in southern Baffin Island were the result of the Upper Cretaceous and early Tertiary rifting associated with the spreading in the Baffin Bay and Davis Strait. The study area lies at the boundary between the Frobisher Bay graben and the Hall

Peninsula horst, and the cliff line and the bedrock outcrops follow the overall trend (Härtling, 1988).

Regional Surficial Soils

The major landforms developed along lines of weakness related to the Upper Cretaceous to Tertiary faulting and along pre-existing draining systems. During the Cenozoic, the area was affected by several glacial advances and retreats. Glacial ice streams flowed southeastward along the Sylvia Grinnell valley and surrounding areas. The landscape was developed during deglaciation when glacial, glaciofluvial and glaciomarine processes dominated (Mode and Jacobs, 1987). Following glacial retreat of the Frobisher Bay outlet glacier past the study area, the Sylvia Grinnell valley was covered by marine waters until approximately 2 – 3,000 years ago. The site became free of marine influence approximately 5,000 years ago. This time would be too short for substantial bedrock weathering, thus reducing the influence of the bedrock geochemistry on the overlying soils. Both areas would be subject to fluvial and colluvial processes. The predominant weathering process would be mechanical disintegration by differential thermal expansion and frost action (Härtling, 1988).

Soil Stratigraphy

The soil conditions encountered in each perimeter test pit are presented in the test pit logs in Appendix A. The test pits ranged in depth from 2.8 to 3.4 mbgs. Permafrost was encountered in all test pits. The frost lines associated with the 2008 freeze up are also noted in the test pit/monitoring well logs in Appendix A.

The soils in all test pits consisted of a thin layer of gravel mixed with topsoil approximately 0.05 to 0.1 m in thickness; followed by silty sand till, boulders and cobbles, grey to brown in colour, and dry down to an average depth of 1.8 mbgs.

MW08-1 and MW08-2 also exhibited an additional stratigraphic layer, differing only slightly from that above. This additional layer consisted of silty sand till, boulders and angular cobbles, brown to grey in colour, moist to wet, and loose. This lower layer ranged from an average depth of 1.8 mbgs to permafrost. Based on field observations, all soils encountered on site are classified as course grained (See Photo 1 in Appendix B).

MW08-3 was the only test pit to exhibit trace hydrocarbon odours during sample collection.

Hydrogeology

Permafrost, soil and overburden materials, with the exception of taliks (localized areas of discontinuous permafrost) within the tidal zone and surrounding larger/deeper bodies, behave as an impervious aquitard (Freeze and Cherry, 1979). As a result of the frozen pore water in the soil and overburden, very little groundwater movement is expected deeper than the active layer at the site. The active layer is defined as: The top layer of soil which thaws during the summer months and re-freezes during autumn/winter. The active layer thickness is dependent on such factors as slope angles and aspect, drainage, rock or soil type, depth of snow cover, vegetation cover, and local ground moisture conditions. Thawing of the active layer may occur daily or only in the summer.

Values of hydraulic conductivity for the overburden material are dependent on the frozen state of the pore water (frozen or liquid). Under “normal” thaw conditions, the active layer in the overburden material (consisting of silt, sand, gravel, and boulders) would have a hydraulic conductivity ranging from approximately 10^{-5} to 10^{-3} cm/s. Under frozen winter conditions (seasonally from approximately November to May/June), the active layer would be frozen and, thus become a non-operable pathway.

Groundwater in the active layer was encountered at the site during the test pitting program, which took place during thaw conditions. Groundwater levels were measured 1.7 mbgs, with average depth of the water table was approximately from 1.7 mbgs.

Based on the groundwater elevations measured by FRANZ (2008), the groundwater flow direction is determined to be broadly south-southwest towards the main ponds located to the west.

CHEMICAL Results

The chemical data was compared to the appropriate guidelines for soil (CCME Commercial/Industrial) and groundwater (non-potable) established by both federal and provincial authorities as indicated in Section 2 and referenced as the Environmental Quality Guidelines (EQG). For this study, commercial guidelines for soil were used for comparison purposes.

Federal and provincial guidelines are numerical limits or statements which can be used for comparison with measured contaminant levels at a site in order to determine whether further investigation or actions are required. It should be noted, however, that the definition of impact does not necessarily imply that there will be significant risks to human health and the environment. Natural attenuation mechanisms such as biodegradation and adsorption, exposure pathways, frequency of exposure and distances to potential receptors must be considered to determine specific risks and potential impacts.

Chemical results compared to commercial guidelines are presented in the attached Tables 1 through 5 (Tables Section) and in Figure 4 (Figures Section).

4.1 Soil and Groundwater Testing

General Field Observations (Staining/Vapours)

There was no indication of free product or hydrocarbon odours in the test pits, with the exception of a faint hydrocarbon odour in MW08-3. The maximum hydrocarbon vapour headspace reading in the soil samples collected from test pits was 50 ppm (MW08-3), and the lowest was 20 ppm (MW08-1).

1.1.1 Soil Chemistry

Perimeter Test Pits/Monitoring Wells

Four (4) test pits were excavated surrounding the Landfarm on each corner (MW08-1 through MW08-4) (Figures 2 and 3). Three (3) soil samples were selected for analysis of PHCs (F1 to F4) and metals (MW08-1, MW08-3, and MW08-4). No exceedances of the selected EQG were detected in any of the perimeter soil samples analysed. Analytical results are displayed in Figure 4 and in Tables 1 and 2.

Cell 3 – Soil Sampling

Three (3) soil samples were collected from shallow test pits located across Cell-3 (Cell3-08-1, Cell3-08-2, and Cell3-08-3) (Figure 2 and 3). All three samples were analysed for PHCs and metals. Exceedances of PHC F2 were detected in all three soil samples above the selected EQG. One soil sample (Cell3-08-2) also exhibited concentrations of Selenium elevated above the selected EQG. Analytical Results are displayed in Figure 4 and Tables 1 and 2.

1.1.2 Groundwater Chemistry

Two groundwater samples were collected from MW08-3 and MW08-4 dowgradient of the Landfarm. The two samples were analysed for PHCs, PAHs, metals, and PCBs. Both MW08-3 and MW08-4 exhibited chemical concentrations below the selected EQG in all analyses tested. Analytical results are displayed in Tables 3 through 5.

CLOSURE

The findings and conclusions documented in this report have been developed in a manner consistent with the level of care normally exercised by members of the environmental science and engineering profession. This document has been prepared for the exclusive use by Nunatta Environmental Services Inc and Incorporates a summary of the best available information at the time of writing.

The statement of conditions of the site is limited to the sampling locations and frequency, and field results noted herein. No warranty, express or implied, exists for the condition of groundwater between these sampling points or sessions. However, reasonable science and engineering judgment has been applied to any and all field measurements, observations and sampling procedures conducted by Franz Environmental Inc.

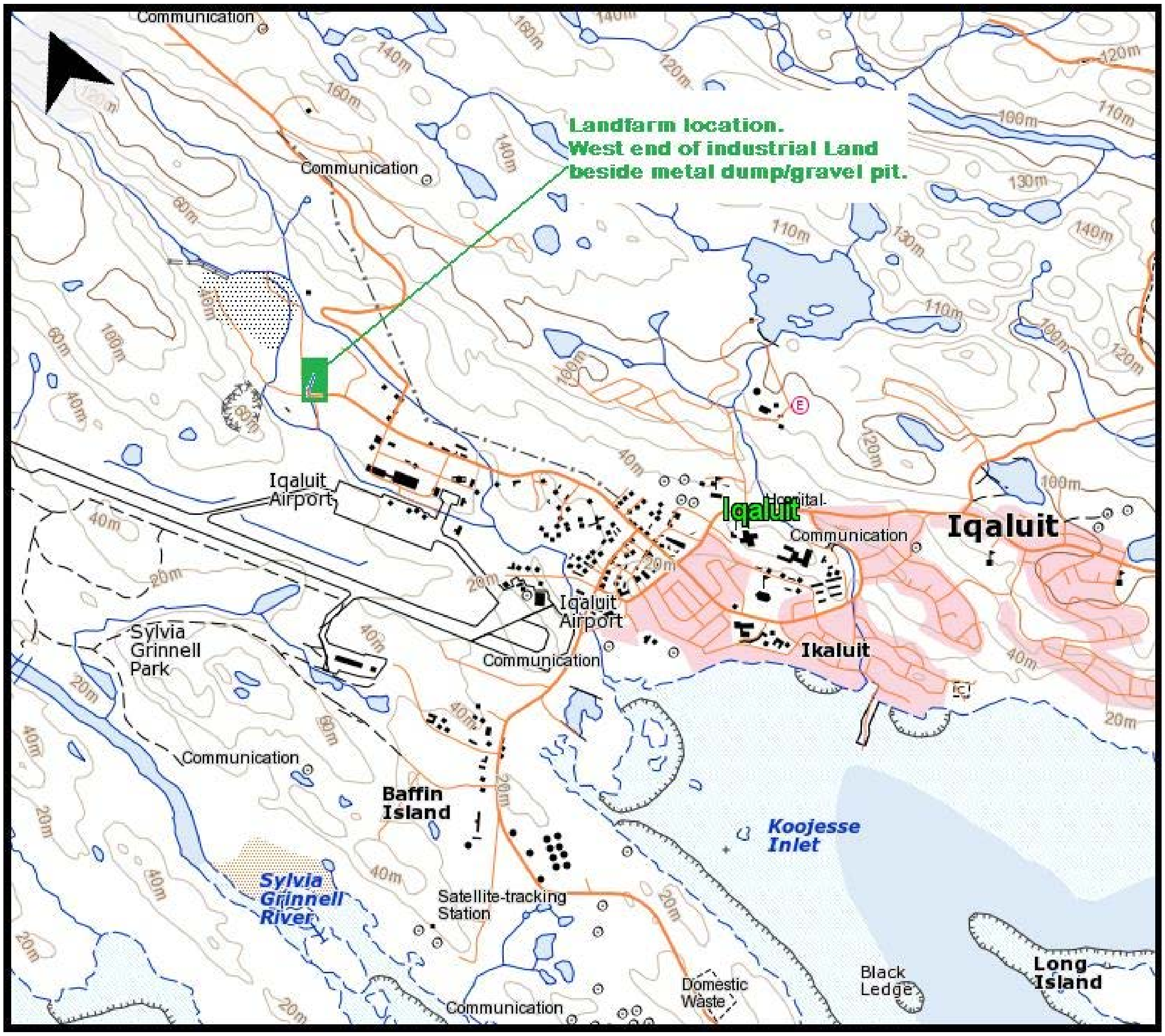
We trust that the above is satisfactory for your purposes at this time. If you have any questions please feel free to contact the undersigned at your convenience.

Yours truly,
Franz Environmental Inc.

Steve Livingstone, M.Sc., P. Geo.

Vice President

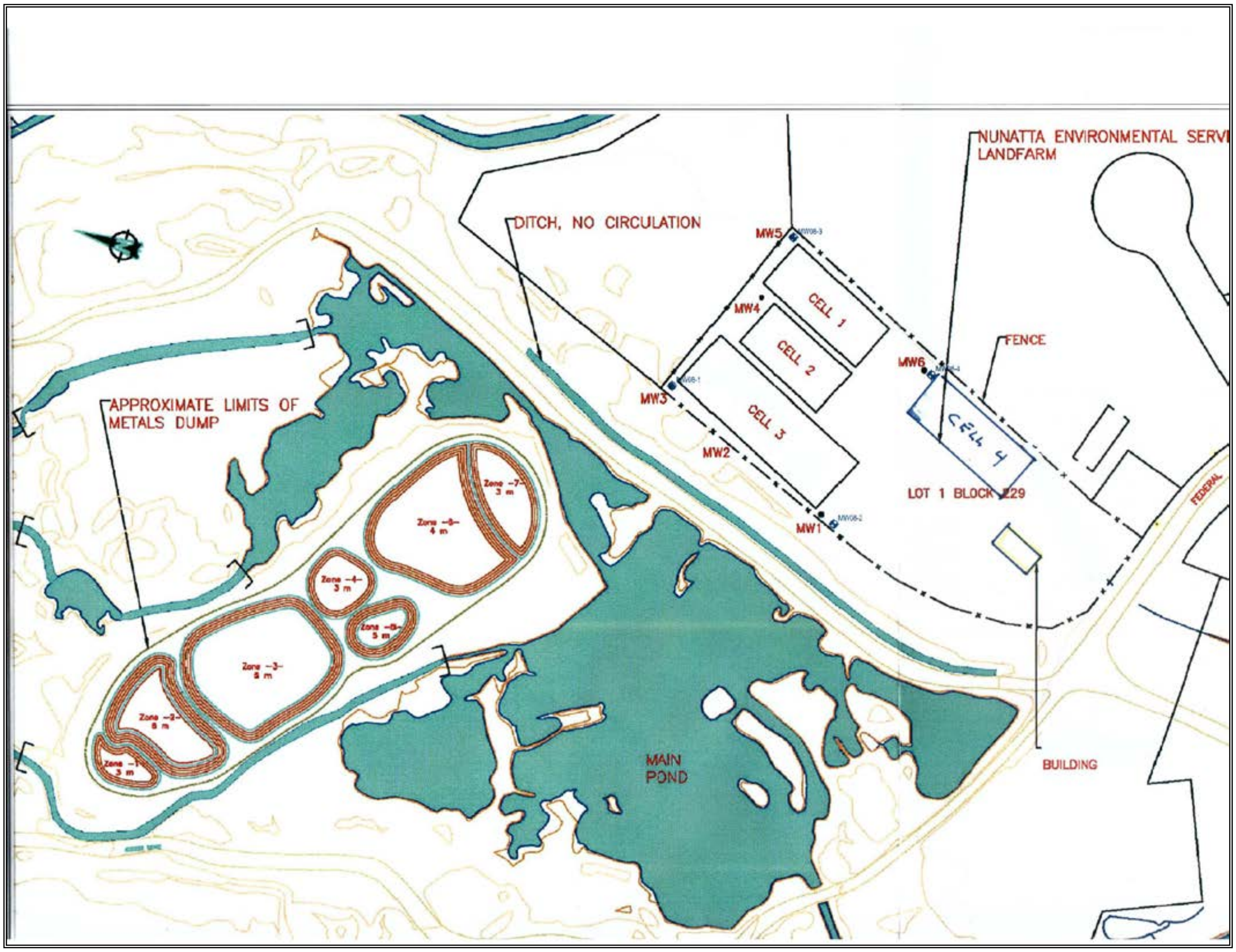
3.0 Landfarm location in Iqaluit



Landfarm monitoring wells Locations

2004 well numbers and location in red MW

2008 well numbers and locations in Blue MW08



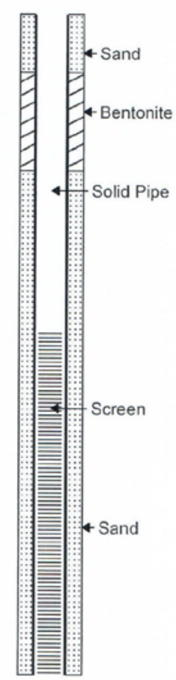
4.0 Monitoring Well/test pit Logs

Franz Environmental Inc.
CONSULTING ♦ ENGINEERS ♦ TECHNOLOGIES ♦

Monitoring Well Log: MW08-01

Project: Annual Report	*Project No: 1517-0801*
Client: Nunatta Environmental Inc	*Logged By: SL*
Location: Iqaluit, Nunavut	*Checked By: SL*

SUBSURFACE PROFILE			SAMPLE		
Depth (m)	Symbol	Description	Sample Type	Vapours (PPM)	Well Description
0 ft / 0 m		Ground Surface			
		Gravel - Topsoil			
		Silty Sand Till, boulders and cobbles, grey to brown, dry, no odours, no staining.	GB-1	20	Sand
					Bentonite
3 ft / 1 m		Frost Line			Solid Pipe
			GB-2	NA	
7 ft / 2 m		Brown to grey, loose, angular cobbles.			Screen
		Wet to moist			Sand
11 ft		End of Test Pit - Permafrost			



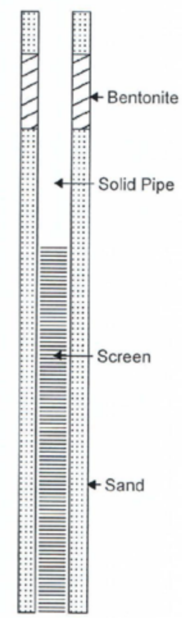
Excavation Company: TPNG	Depth of Test Pit:
Excavation Method: Backhoe	Location: Nunatta Environmental Inc Landfarm
Installation Date:	

Franz Environmental Inc.
CONSULTING ♦ ENGINEERS ♦ TECHNOLOGIES ♦

Monitoring Well Log: MW08-02

Project: Annual Report | *Project No: 1517-0801*
Client: Nunatta Environmental Inc | *Logged By: SL*
Location: Iqaluit, Nunavut | *Checked By: SL*

SUBSURFACE PROFILE			SAMPLE		
Depth (m)	Symbol	Description	Sample Type	Vapours (PPM)	Well Description
0 ft / 0 m		Ground Surface			
		Gravel - Topsoil			
1 ft		Silty sand till, boulders and cobbles, grey to brown, dry, no odours or staining	GB-1	25	
4 ft		Frost Line			
5–6 ft		Brown to grey, loose	GB-2	35	
8–9 ft		Moist to wet			
10 ft / 3 m		End of Test Pit - Permafrost			



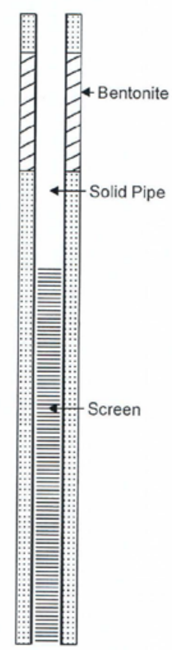
Excavation Company: TPNG | Depth of Test Pit: 3.0
Excavation Method: Backhoe | Location: Nunatta Environmental Inc Landfarm
Installation Date: November 3, 2008

Franz Environmental Inc.
CONSULTING ♦ ENGINEERS ♦ TECHNOLOGIES ♦

Monitoring Well Log: MW08-03

Project: Annual Report	*Project No: 1517-0801*
Client: Nunatta Environmental Inc	*Logged By: SL*
Location: Iqaluit, Nunavut	*Checked By: SL*

SUBSURFACE PROFILE			SAMPLE		
Depth (m)	Symbol	Description	Sample Type	Vapours (PPM)	Well Description
0 ft / 0 m		Ground Surface			
0		Gravel -Topsoil			
1 ft		Silty sand till, boulders and cobbles, grey to brown, no odours, no staining	GB-1	35	
8 ft		Wet Trace odours	GB-2	50	
11 ft		End of Test Pit - Permafrost			



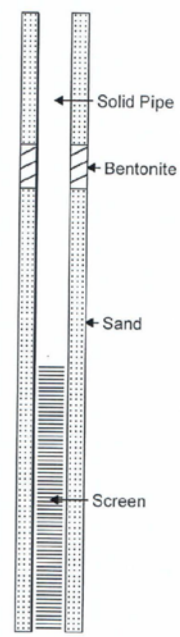
Excavation Company: TPNG	Depth of Test Pit: 3.25
Excavation Method: Backhoe	Location: Nunatta Environmental Inc Landfarm
Installation Date: November 4, 2008	

Franz Environmental Inc.
CONSULTING ♦ ENGINEERS ♦ TECHNOLOGIES ♦

Monitoring Well Log: MW08-04

Project: *Annual Report* | ***Project No:*** *1517-0801*
Client: *Nunatta Environmental Inc* | ***Logged By:*** *SL*
Location: *Iqaluit, Nunavut* | ***Checked By:*** *SL*

SUBSURFACE PROFILE			SAMPLE		
Depth (m)	Symbol	Description	Sample Type	Vapours (PPM)	Well Description
0 ft / 0 m		Ground Surface			
		Grravel - Topsoil			
1 ft		Silty sand till, some boulders and cobbles, grey to brown, no odours, no staining.		30	
3 ft / 1 m		Frost line			
7 ft / 2 m		Wet Significant water		45	
9 ft		End of Test Pit - Permafrost			
10 ft / 3 m					



Excavation Company: TPNG
Excavation Method: Backhoe
Installation Date: November 3, 2008
Depth of Test Pit: 2.8
Location: Nunatta Environmental Inc Landfarm

5.0 Monitoring Well/Test Pit Diagrams

FRANZ ENVIRONMENTAL INC.
• CONSULTING • ENGINEERING • TECHNOLOGIES •

PHOTOGRAPHIC LOG

Nunatta Environmental Services Land Treatment Facility	
Photo ID: 1	
Date: November 4, 2008	
Direction: N	
Description: Showing soil type	

Nunatta Environmental Services Land Treatment Facility	
Photo ID: 2	
Date: November 4, 2008	
Direction: N	
Description: Showing landfarm and fence	

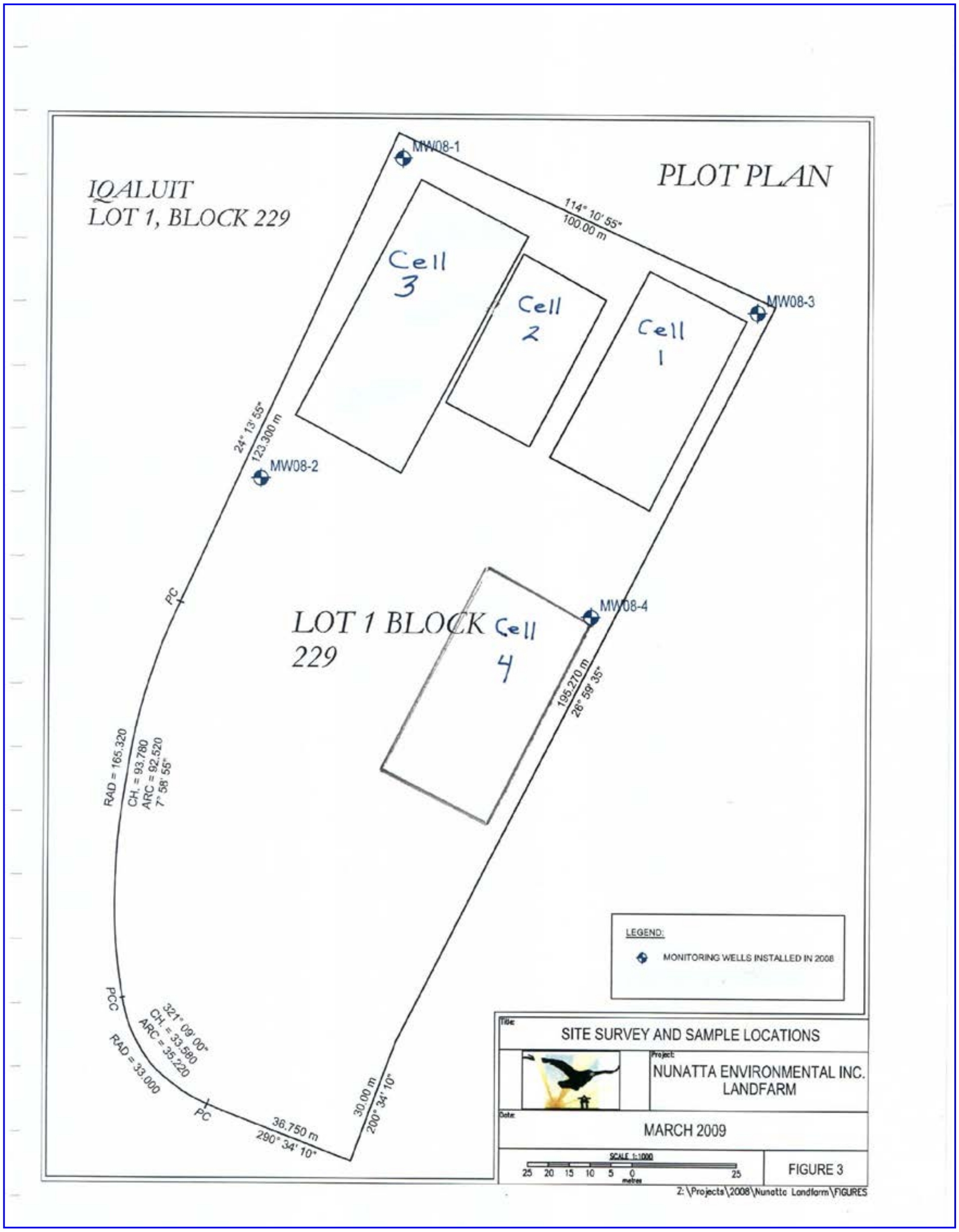
FRANZ ENVIRONMENTAL INC.
• CONSULTING • ENGINEERING • TECHNOLOGIES •

PHOTOGRAPHIC LOG

Nunatta Environmental Services **Land Treatment Facility**	
Photo ID: 3	
Date: November 4, 2008	
Direction: NA	
Description: Showing stratigraphy and groundwater	

Nunatta Environmental Services **Land Treatment Facility**	
Photo ID: 4	
Date: November 4, 2008	
Direction: NA	
Description: Showing stratigraphy	

6.0 Monitoring Well Locations installed by Franz 2008



7.0 2012 Ground Water Monitoring Well installations

In 2009 Nunatta constructed a forth containment cell. To make this possible Monitoring well number MW08-04 was decommissioned and has been replaced with two (2) new wells. The location is to be close to the north east corner where the previous well was positioned it was commissioned at MW12-1 and a second well constructed in the south east corner of cell #4 referred to as MW12-2. This additional coverage will ensure complete coverage on the south eastern side of the cell.

Future - Groundwater Sampling Program: Components and Frequency

The contaminated soils placed in the landfarm for treatment contain petroleum hydrocarbon products. Heavy metals may be present in low concentrations and testing each year check this component. All water is to be analyzed as per the Canadian Council of Ministers of the Environment (CCME) criteria

Considering that the ground is totally frozen 8 months per year and that the active zone thaws to 4 feet only 2 months per year, it is proposed that groundwater monitoring wells be sampled on a yearly basis, anytime from mid July to the end of August but in years when cold weather continues through out the summer often water does not thaw and no samples are collected

Reporting

Nunatta environmental Services will write a groundwater quality status report on a yearly basis, and will be available for review. The report will include analytical results from the sampling campaign and recommendations depending on the findings.

Evolution of the ground water monitoring plan

In the event that the landfarm was to increase or decrease in size over time, the groundwater monitoring plan would directly be affected. In such cases, the plan would be amended to reflect all changes and presented to NWB for approval.