Nanisivik Mine
Contaminated Soil Remediation
2013 Progress Report

Prepared for

CanZinco Ltd.

Prepared by

SRK Consulting (Canada) Inc.
1CB002.002
February 2014

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Executive Summary

This report provides a summary of contaminated soil remediation completed at the Nanisivik former bulk fuel storage facility in 2013.

Key remediation activities undertaken at the Site in 2013 included:

- Excavation of petroleum hydrocarbon (PHC) contaminated soil,
- Remediation confirmation soil sampling of the base and walls of the excavated areas,
- Processing of the PHC contaminated soil through a vibrating screen,
- Modifying a portion of the concrete pad (former concentrate storage shed pad) and using this for storage of oversize rocks and low-level contaminated soil, and
- Managing the treatment facility and biopile performance monitoring.

Excavation of the contaminated soil continued in 2013. All PHC contaminated soil excavated was processed through the vibrating screening plant. A small amount of PHC contaminated soil remains to be excavated in 2014.

Biopiles that had not previously been processed through the screener and that exhibited poor bioremediation performance at the start of the 2013 field season were removed from the treatment cells and screened also. The remaining biopiles established in 2011 and 2012 were relocated to a prepared area on the concrete pad.

New biopiles were created in the established treatment areas with the soil that had passed through the screener.

Analytical results indicate low levels of PHC contamination in the biopiles. Mechanical screening, nutrient amendment, moisture content management and soil aeration has successfully reduced PHC concentrations. The rate of PHC remediation achieved in 2013 is greater than the rate observed in 2011 and 2012.

Analytical results indicate that all stockpiles in the former secondary containment area and the north laydown yard meet the soil quality remediation objectives.

Notwithstanding the achievements made in 2013, completing the soil remediation work in accordance with the remediation approach and to the soil quality remediation objectives established in the Abandonment and Reclamation Plan will require several more years. Based on the experience gained through the 2012 and 2013 remediation seasons, current projections indicate that treatment of all remaining soil will require an additional two to three years. The projections also indicate that use of the in-situ treatment area will be required during the 2014 and 2015 field seasons.

SRK understands that the Department of National Defence is planning to construct a naval facility at the Nanisivik dock site and that these construction works are scheduled to commence in

August 2014. In an effort to eliminate the risk of conflict with the Department of National Defence's plans, an application to vary the remediation methodology was submitted to the Nunavut Water Board on November 13, 2013 by CanZinco Ltd. The remedial option proposed involves the transfer of the contaminated soil to the upper treatment area and capping the materials with clean soil. Simultaneously, studies are to be pursued to demonstrate that the residual low levels of soil contamination do not pose risks to human health or the environment. The alternative approach proposed would allow for the removal of contaminated soil within the footprint of the former bulk fuel storage facility in Q3 2014. The use of the pad for temporary storage would cease by July 31, 2014.

Should CanZinco Ltd.'s licence renewal application not be approved in time for the 2014 summer season, then the remediation shall continue as per the existing methodology applied since 2011.

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List of Abbreviations

CCME	Canadian Council of Ministers of the Environment
C :N :P	Carbon : Nitrogen: Phosphorous
DAP	Diammonium Phosphate
DFO	Department of Fisheries and Oceans
DND	Department of National Defence
F1	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C6 to C10
F2	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C11 to C16
F3	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C17 to C34
F4	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C35 to C50+
HCN	Hydrocarbonoclastes
LTA	lower treatment area
NWB	Nunavut Water Board
PAH	Polycyclic aromatic hydrocarbons
PHC	petroleum hydrocarbons
PID	photo-ionization detector
PQL	practical quantitation limit
QA/QC	quality assurance/ quality control
RPD	relative percent difference
SQRO	soil quality remediation objective
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
TPH	total petroleum hydrocarbons
UTA	upper treatment area

1 Introduction

The Nanisivik Mine produced lead and zinc mineral concentrates from 1976 to 2002. The mine infrastructure included a large tank farm providing year-around storage of diesel, gasoline and other fuels. Following mine closure, the facility was operated by a third party to supply fuel for commercial shipping and the Canadian Coast Guard. In February 2009 the Department of National Defence (DND) requested that the bulk fuel storage facility be decommissioned to allow for the construction of a naval facility. Decommissioning of the facility required remediation of petroleum hydrocarbon (PHC) contaminated soil known to be present within the facility's footprint.

The remediation work commenced in 2011 and is completed under an *Abandonment and Reclamation Plan, Fuel Tank Farm, Former Nanisivik Mine Site, Nunavut* (Jacques Whitford Stantec Limited [Stantec] 2010) approved by the Nunavut Water Board (NWB) on April 26, 2010. Remediation is carried out using landfarming methodologies in which nutrients are added to the soil to stimulate biological activity. The plan also established Soil Quality Remediation Objectives (SQROs) based on generic commercial land use federal guidelines.

This report provides a summary of soil remediation activities completed at the former Nanisivik bulk fuel storage facility (the Site) in 2013. The report has been prepared to fulfill reporting requirements specified in Schedule B, Part J, Item 13 of Water Licence No. 1AR-NAN0914, issued by the Nunavut Water Board (NWB).

2 Summary of Previous Remediation Activities

This section provides a brief introduction to soil remediation activities completed at the Site in 2011 and 2012. Principal reclamation and remediation work undertaken at the Site included: decommissioning and removal of the petroleum storage tanks and associated infrastructure; delineation of PHC contaminated soil; construction of soil treatment facilities; and excavation and treatment of PHC contaminated soil.

Decommissioning of the tanks was undertaken in May and June 2011. Prior to demolition, the tanks were placed in a gas free state, and waste liquids and sludge were collected and placed in drums. All scrap materials and PHC contaminated waste from the tank removal were shipped off-site for disposal in 2011. Further details are provided in the 2011 Annual Report (Nyrstar 2012).

Delineation of the PHC contaminated soil was conducted in 2011 to refine the estimated quantity of contaminated soil requiring treatment. Four areas of contamination were identified by field screening measurements and analytical laboratory results (Figure 1). Contamination extended to 2.45 m below ground level. As reported in the 2011 Annual Report, the quantities of soil requiring treatment were determined to be approximately 17,000 m^3 (Nyrstar 2012). This exceeded the 8,000 m^3 assumed in the Abandonment and Reclamation Plan (Stantec 2010).

Treatment facilities for PHC contaminated soil were constructed in 2011 and 2012. The facilities constructed are located in two areas referred to as the lower treatment area (LTA) and upper treatment area (UTA) (Figure 2). The treatment facilities comprise a series of sixteen cells in which 'biopiles' of PHC contaminated soil are managed. Further details on the treatment facility design and construction are provided in the *Construction Summary Report, Nanisivik Mine Site*

(WESA Inc. 2012). The report was submitted to the NWB November 29, 2012; in accordance with Part D Section 9 of Water Licence No. 1AR-NAN0914.

In 2011, PHC contaminated soil was excavated to remove liners under the tanks. The soil was placed in the treatment facilities or stockpiled above known areas of contamination. Eight cells were constructed in 2011. To provide supplementary treatment capacity, a temporary treatment facility was established within the footprint of the former fuel storage facility (the 'in-situ treatment area'). The contaminated soil in the treatment facilities were aerated mechanically every four days until winter closure. Further details are provided in the 2011 Annual Report (Nyrstar 2012).

In 2012, stockpiled PHC contaminated soil was relocated as additional treatment cells were constructed. Routine aeration of the soil continued. Nutrients were applied to the soil in the treatment facilities to encourage bioremediation of hydrocarbons. A vibrating screen to separate cobbles and boulders from the finer contaminated soil, and to improve aeration measures, was mobilized to site in August. Soil previously excavated and stockpiled within the footprint of the former fuel storage facility was screened. Further information on the 2012 remediation activities is provided in the *Nanisivik Mine Contaminated Soil Remediation 2012 Progress Report* (SRK Consulting (Canada) Inc. and WESA, a division of BlueMetric Environmental Inc. 2013 [SRK and WESA 2013]) submitted with the 2012 Annual Report (Nyrstar 2013a).

3 Soil Quality Remediation Objectives

Soil quality remediation objectives (SQRO) for the Site as specified in the Abandonment and Reclamation Plan (Stantec 2010) are listed in Table 3.1. The objectives were derived from generic commercial land use guidelines established in the Canadian Council of Ministers of the Environment (CCME) in *Canadian Environmental Quality Guidelines* (CCME, 1999) and *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CCME, 2008).

Table 3.1: SQROs for the Nanisivik former bulk fuel storage facility.

Parameter	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)
Benzene	110	360
Toluene	250	500
Ethylbenzene	300	600
Xylenes	350	700
PHC Fraction 1 (F1)	320	700
PHC Fraction 2 (F2)	260	1,000
PHC Fraction 3 (F3)	1,700	3,500
PHC Fraction 4 (F4)	3,300	10,000
PAH Anthracene	32	32
PAH Benzo(a)pyrene	72	72
PAH Fluoranthene	180	180

Source: (Stantec 2010)

The soil sampling plan to confirm the success of contaminated soil excavation was described in the NWB approved *Nanisivik Mine 2004 Reclamation and Closure Plan* (CanZinco Ltd. 2004),

and its appendix F, *Nanisivik Mine Reclamation and Closure Monitoring Plan* (Gartner Lee Limited 2004). The plan calls for the capture of at least 95% of soil containing contaminants in excess of the SQRO's in each remediation area and that no residual contaminant concentrations in soils exceed twice the SQRO's. Excavation remediation confirmation soil samples are collected in a consistent 25 m grid-based pattern.

The soil sampling plan to confirm biopile remediation was described in the 2012 Progress Report (SRK and WESA 2013). Biopile remediation confirmation soil samples are collected based on the volume of soil treated (per 250 m^3).

All remediation confirmation soil samples are analyzed at a laboratory accredited by the Canadian Association for Environmental Analytical Laboratories.

4 2013 Remediation Activities

4.1 Introduction

Key remediation activities undertaken at the Site in 2013 included:

- Excavating PHC contaminated soil,
- Remediation confirmation soil sampling of the base and walls of the excavated areas,
- Processing of the PHC contaminated soil through a vibrating screen,
- Modifying a portion of the concrete pad (former concentrate storage shed pad) and using this for storage of oversized rocks and low-level contaminated soil, and
- Managing the treatment facility and biopile performance monitoring.

The work plan for 2013 was overseen by SRK on behalf of CanZinco. SRK's project manager was at Site from June 15 to 21 and July 10 to 26 July. SRK retained an environmental assistant from Arctic Bay to monitor remediation progress from June to early September. WESA provided advice on nutrient amendment rates and a review of soil remediation performance in the treatment facilities. Group CMJ provided an environmental technician to support SRK in managing excavation activities. From June 14 to August 23, Group CMJ also provided supervision of the heavy equipment contractor, Arqvartuuq Services Ltd. of Arctic Bay.

4.2 Excavation and Soil Handling

4.2.1 Overview of Contaminated Areas

Preliminary boundaries of the areas to be remediated were identified by a series of test pits excavated within the footprint of the bulk fuel storage facility in 2011 and based on results from earlier remediation efforts adjacent to the facility. Field screening measurements and analytical laboratory results from samples indicated four areas of contamination (Figure 1):

1. Area 1. PHC F2 contaminated soil remained in the berm between the former pipe to the dock and the former truck loading terminal (SRK 2009). Results from test pits excavated in 2011

determined that the PHC F2 contamination extended across the area formerly occupied by the Tank 101 pad.

2. Area 2. The soil in the light fuels pad area was found to have isolated pockets of PHC F1 and F2 that exceeded the SQROs.
3. Area 3. The soil at the junction of the overlapping liners between the Tank 101 pad, the light fuels pad and the Tank 102 pad exceeded PHC F1 and F2 SQROs. Contamination in this area extended about 1 m further below ground level than observed in the other contaminated areas.
4. Area 4. PHC F2 contaminated soil was found in the southern corner of the secondary containment area.

4.2.2 Field Screening

Field screening of soil samples for the presence of PHC contamination was completed in accordance with CanZinco protocols. Field screening protocols were developed in alignment with the *Nanisivik Mine Reclamation and Closure Monitoring Plan* (Gartner Lee Limited 2004).

Soil from potentially PHC contaminated areas was tested on site using a bag-headspace method and a photo-ionization detector (PID) as described in the 2012 Progress Report (SRK and WESA 2013). The results of the PID measurements combined with the visual appearance of the soil and olfactory indications are then used on-site to guide further excavation and to monitor biopile performance.

The PID readings provide an indication of the PHC concentrations, however the method is susceptible to errors when the sample preparation environment cannot be controlled (i.e. when samples are not warmed at a constant temperature over a consistent length of time and when there is interference from PHC vapours emitted from equipment operating nearby in the sample preparation area). Confirmation that the SQROs are met requires laboratory analyses of samples.

4.2.3 Excavation

In 2013, the excavation of PHC contaminated soil in areas 1 and 3 commenced June 19 and continued until August 14. The excavation generally proceeded from the north berm of the former fuel storage facility towards the south and was accomplished in lifts as the ground thawed (Appendix A: Photos 1, 2 and 14). Excavation of Area 4 commenced June 17 with the removal of overlying soil not contaminated with PHC as determined during delineation sampling in 2011 (Appendix A: Photo 3). The excavation of PHC contaminated soil in Area 4 commenced July 13 and continued until August 8. Excavation of contaminated soil proceeded until field screening tests indicated that the remediation objectives had been met or as the stockpile of fine screened soil placed on Area 2 during 2013 restricted further excavation (Appendix A: Photo 4). The limits of the excavations are shown on Figure 3.

4.2.4 Screening of Soil to Remove Oversize Particles

The excavated soil exhibiting PHC contamination was processed through a vibrating screening plant. The volume of soil requiring treatment was reduced by separating out cobbles and boulders

larger than 10 cm from the contaminated soil (Appendix A: Photos 5 and 6). The screening process also promoted the volatilization of PHC components.

In 2013, screening of the soil commenced June 16. Screening continued 5 days a week until July 17. Soil was screened continually between July 17 and August 19, at which time the screening plant was demobilized and prepared for sealift shipment on August 23. On average, 250 m^3 of soil was screened daily until August 8 when part of the screening deck became inoperable and production decreased by 50% thereafter.

The soil passing through the screener was stockpiled on Area 2 or placed in the UTA and LTA as space became available (see section 4.6). Based on survey results obtained by Underhill Geomatics Ltd.[1] on August 2, approximately 165 m^3 of fines were separated from the excavated soil daily (until August 8).

The coarse reject was processed with the screener a second time before being relocated. When dry, minimal soil adhered to the rocks rejected by the screener and this rock was relocated to the north laydown yard (Appendix A: Photo 7). When the material being screened was very wet, clumps of soil would remain adhered to the reject and this rock was moved to the concrete pad (the pad) where it was spread out to dry and the fine soil separated prior to the rock being relocated to the north laydown yard (Appendix A: Photo 8). Between 75 and 100 m^3 of coarse reject was separated from the excavated soil daily (until August 8).

4.2.5 Stockpile Management

As advised in the 2012 Progress Report (SRK and WESA 2013), storage areas for soil outside of the footprint of former fuel storage facility and the constructed treatment facilities were required to handle the large volume of soil undergoing treatment in 2013. The additional areas included:

- The north laydown yard, opposite the former secondary containment area (Appendix A: Photo 9); and
- A portion of the former concentrate storage shed concrete pad prepared to temporarily store soil in accordance with conditions agreed on with the surface lease holder, the Department of Fisheries and Oceans (DFO) (Appendix A: Photos 10, 11 and 12).

In 2013, soil was stockpiled based on PHC concentrations (Figure 3) as follows:

1. Stockpiles of screened fine soil in the former secondary containment area that, pending laboratory confirmation, meet the SQROs (Appendix A: Photo 13). The soil stockpiled in this area in 2012 was leveled off prior to the placement of additional material in 2013.
2. Stockpiles of unscreened soil in the north laydown yard that was removed from the excavation of Area 4 that, pending laboratory confirmation, meet the SQROs (Appendix A: Photos 7 and 9).
3. Stockpiles of rock rejected by the screener in the north laydown yard that, pending laboratory confirmation, meet the SQROs (Appendix A: Photos 7 and 9).

[1] Underhill Geomatics Ltd. surveyors were on site working for WorleyParsons Canada on behalf of the Department of National Defence.

4. Stockpiles of screened fine PHC contaminated soil in the in-situ treatment area (located on Area 2) (Appendix A: Photos 14, 15 and 16). The soil originated from the excavation of areas 1, 3 and 4 and from three biopiles in the UTA that showed poor performance results from the initial 2013 sampling event.

5. Stockpiles of coarse rock rejected by the screener with potentially PHC contaminated soil adhering to it on the pad (Appendix A: Photo 17).

6. Stockpiles of biopiles removed from thirteen cells in the UTA and LTA treatment facilities on the pad that, pending laboratory confirmation, have low levels of PHC contamination (i.e. less than two times the SQROs) (Appendix A: Photo 17).

4.3 Biopile Management

The UTA and LTA treatment facilities are comprise of a series of cells containing biopiles of PHC contaminated soil. The biopiles are constructed to a height of 1.5 m and each cell contains a biopile with a volume of approximately 220 m^3. In 2013 the biopiles were off-loaded from the cells and reloaded as indicated in Tables 4.1 and 4.2 below. All of the original biopiles in the treatment cells were either relocated to the pad in small piles (8 to 10 m^3) or screened and relocated onto Area 2 as described in Section 4.2.5.

The biopiles of PHC contaminated soil are treated through two principal mechanisms: volatilization and bioremediation. Volatilization occurs when the soil is aerated. In the bioremediation process, microorganisms are responsible for the degradation of the PHC in the soil. To enhance the microbial performance nutrients are added and moisture content managed.

4.3.1 Aeration

Gas transfer in the contaminated soil is important for two reasons: (i) the bioremediation process requires oxygen to occur, and (ii) gas transfer promotes volatilization of the PHC from the soil. To achieve the gas transfer, the contaminated soil in the UTA and LTA was turned and aerated as listed in Table 4.1.

The biopiles were typically aerated to a depth of 1.0 m using an excavator or backhoe. Each full bucket was lifted to the vertical extent of the bucket arm and then let to fall from elevation to achieve an air exchange (Appendix A: Photo 18). The bottom 0.3 to 0.5 m of the biopiles was not aerated or removed during off-loading in order to reduce the risk of damaging the liner.

Table 4.1: 2013 aeration schedule.

June								July								August						
S	M	T	W	T	F	S		S	M	T	W	T	F	S		S	M	T	W	T	F	S
						1			1	2	3	**4**	**5**	6						1	**2**	3
2	3	4	5	6	7	8		**7**	**8**	**9**	10	**11**	12	**13**		4	5	**6**	7	8	9	10
9	10	11	12	13	14	15		14	15	16	**17**	**18**	19	20		11	**12**	**13**	**14**	**15**	16	17
16	17	18	**19**	20	21	22		21	**22**	23	24	**25**	**26**	**27**		18	**19**	20	21	22	23	24
23	24	25	**26**	27	**28**	29		28	**29**	30	31					25	26	27	28	29	30	31
30																						

Note:

Days when biopiles were aerated

Days when biopiles in the cells were off-loaded and reloaded

4.3.2 Management of Moisture Content

Water is required for microbial respiration and therefore PHC remediation. Hydrocarbon-degrading microbes (hydrocarbonoclastes) need to come into contact with solubilised nutrients in order for PHC bioremediation to occur; this contact is largely governed by the soil moisture content. As recommended by WESA, the soil moisture of each biopile was managed by obtaining weekly readings from each biopile with a handheld soil moisture meter and additional water was added to the biopiles to maintain an average above 5%. Two m^3 per day of water was added to the biopiles August 9 to 11 (Appendix A: Photos 19 and 20). The water was obtained from Twin Lakes Creek.

4.3.3 Nutrient Amendment

The nutrients needed for accelerating bioremediation are added to the soil based on the level of total PHC concentration for the microbial cells to replicate and survive. As advised by WESA, in cold region soils, nitrogen and phosphorus are the nutrients that typically limit microbial degradation. Nitrogen and phosphorus were added to the constructed biopiles in the form of granular agricultural fertilizers Urea and diammonium phosphate (DAP). For every 125 m^3 of soil moved to the cells in 2013 25 kg Urea and 4.2 kg DAP were applied. The amount applied was recommended by WESA for soil with a total PHC concentration of 1030 ppm.

Table 4.2 shows the dates of biopile construction and nutrient amendment schedule. Second generation biopiles are identified with a suffix '-2' added to the name of the treatment area.

Table 4.2: Biopile construction and nutrient amendment schedule.

PHC Treatment Area	Date of Biopile Construction	Date of Nutrient Addition	Date of Biopile Unloading
In-situ treatment area on Area 2	17 August 2011	14 July 2012	17 June 2013
LTA-1	July 2011	14 July 2012 and 30 August 2012	12 August 2013
LTA-2	July 2011	14 July 2012 and 30 August 2012	12 August 2013
LTA-3	July 2011	14 July 2012 and 30 August 2012	12 August 2013
LTA-4	July 2011	14 July 2012 and30 August 2012	26 July 2013
LTA-5	24 August 2012	25 August 2012	13 August 2013
LTA-6	24 August 2012	25 August 2012	26 July 2013
UTA-1	21 August 2011	14 July 2012 and 21 August 2012	17 July 2013
UTA-2	21 August 2011	14 July 2012 and 21 August 2012	26 July 2013
UTA-3	21 August 2011	14 July 2012 and 21 August 2012	26 July 2013
UTA-4	21 August 2011	14 July 2012 and 21 August 2012	26 July 2013
UTA-5	16 July 2012	21 August 2012 and 25 August 2012	17 July 2013
UTA-6	18 July 2012	21 August 2012	17 July 2013
UTA-7	21 August 2012	21 August 2012	13 August 2013
UTA-8	20 August 2012	21 August 2012	13 August 2013
UTA-9	21 August 2012	25 August 2012	13 August 2013
UTA-10	24 August 2012	25 August 2012	29 July 2013
In-situ treatment area on Area 2	22 June to 19 August 2013	18 June 2013, 8 to 19 August 2013	
LTA-1-2	14 August 2013	14 August 2013	
LTA-2-2	14 August 2013	14 August 2013	
LTA-3-2	14 August 2013	14 August 2013	
LTA-4-2	27 July 2013	31 July 2013	
LTA-5-2	14 August 2013	14 August 2013	
LTA-6-2	27 July 2013	31 July 2013	
UTA-1-2	27 July 2013	31 July 2013	
UTA-2-2	27 July 2013	31 July 2013	
UTA-3-2	27 July 2013	31 July 2013	
UTA-4-2	27 July 2013	31 July 2013	
UTA-5-2	27 July 2013	31 July 2013	
UTA-6-2	27 July 2013	31 July 2013	
UTA-7-2	14 August 2013	14 August 2013	
UTA-8-2	14 August 2013	14 August 2013	
UTA-9-2	14 August 2013	14 August 2013	
UTA-10-2	29 July 2013	29 July 2013	

4.4 Chemical Analysis

Soil samples were collected and sent to Exova Canada Inc. in Ottawa or ALS Environmental in Vancouver, for chemical analysis. Samples to characterize the rock were submitted to the Iqaluit Analytical Services Unit. The sampling and analysis focused on:

- Background Soil Quality Monitoring
  - Characterization of the north laydown yard prior to being used to stockpile coarse reject and unscreened soil from the excavation areas previously determined to meet the SQROs.
  - Characterization of soil on the pad prior to and during use for the stockpile of low level PHC contaminated soil.
- Remediation Performance Monitoring
  - Characterization of screened fine soil stockpiled on Area 2 that was generated from the excavation of areas 1, 3 and 4 and from the original bioplies, UTA 1, 5 and 6.
  - Characterization of the biopiles in the treatment cells at the end of the 2013 season.
  - Characterization of the remaining original biopiles relocated to the pad.
- Remediation Confirmation Sampling
  - Characterization of soil along the base and walls of the excavated areas.
  - Characterization of soil stockpiled in the former secondary containment area and the north laydown yard.
  - Characterization of rock stockpiled in the north laydown yard.

4.5 QA/QC Sampling

The QA/QC sampling plan calls for one duplicate and three discrete samples from one of the composite sample areas are to be submitted for laboratory analysis for every ten composite samples collected. A single aliquot of soil from a specific point is a discrete QA/QC sample. All samples are to be provided unique sample identifiers.

One QA/QC sample set was collected from screened soil stockpiled in the former secondary containment area. One QA/QC sample set was collected from the soil adhering to the coarse reject stockpiled on the pad. Five QA/QC sample sets were collected from biopiles in the constructed treatment facilities.

Additional QA/QC samples were collected that did not follow the QA/QC sampling plan. Four duplicates and three discrete samples were analyzed from biopiles relocated from the UTA and LTA to the pad in 2013. The duplicate and discrete samples were obtained from multiple composite sample areas, rather than a single composite sample area. No QA/QC sample sets were collected from within the excavation limits. Also, four discrete samples were analyzed from each biopile in the UTA and LTA, but no duplicate samples were submitted for analysis.

5 Results

The sample locations are shown on figures 4 and 5 and the results are compared to the SQROs on tables 1 to 5 (back of report). The samples identified with the ending “F-C” represent composite floor samples and the samples identified with the ending “W-C” represent composite wall samples. Samples ending in “D” instead of “C” represent discrete grab samples. Samples collected from stockpiles do not contain the wall or floor identifiers.

5.1 Background Soil Quality Monitoring Results

Background soil quality samples were collected to allow for the mitigation of detectable impacts to the additional areas utilized for the stockpiling of materials in 2013. The results are provided below in Table 5.1 and Table 1. The sample locations are shown on Figure 4.

Two samples were collected from the base of the north laydown yard being used to stockpile unscreened soil and the coarse rejects. The results meet the SQROs for PHC F2 to F4.

Four samples were collected from the pad to establish baseline conditions. The results meet the SQROs for PHC F2 to F4 and lead and zinc.

Sample 13762-D was collected from soil removed from the cracks in the pad prior to the cracks being sealed. It was tested for cadmium, copper, lead and zinc. Zinc concentrations exceed the SQRO. Approximately 0.5 m^3 of soil and dust was removed from the cracks. It is stored in a lined wooden box on the pad.

Table 5.1: Baseline results.

Sample #	DATE	General Location	Lead mg/kg	Zinc mg/kg	F2 mg/kg	F3 mg/kg	F4 mg/kg
North Laydown Yard							
13675-F-C	14-07-2013	Below stockpiles	-	-	<10	120	30
13676-F-C	14-07-2013	Below stockpiles	-	-	<10	30	<20
Pad							
13300-W-C	28-06-2013	North end of sump	-	-	<30	894	<50
13302-W-C	28-06-2013	North access ramp	141	2370	<30	<50	<50
13303-W-C	28-06-2013	East of north access ramp	-	-	<30	<50	<50
13307-W-C	28-06-2013	Former south access ramp	155	727			
13762-D	15-07-2013	Fines recovered from cracks	23300	177000	-	-	-

Table 5.2 lists sample results obtained to monitor potential impacts on soil from the use of the pad. The sample locations are shown on Figure 5. Samples 14193-D to 14196-D were collected from soil excavated to create a sump at the north end of the pad and sample 14413-F-C was collected from sediment that had accumulated on the sump liner. Sample 14195-D exceeds the PHC F2 SQRO. The results for the remaining monitoring samples meet the SQROs for PHC F2 to F4.

Table 5.2: Monitoring results.

Sample #	DATE	General Location	F2 mg/kg	F3 mg/kg	F4 mg/kg
14193-D	31-07-2013	Soil stockpiled to create sump in 2013	<10	80	<20
14194-D	31-07-2013	Soil stockpiled to create sump in 2013	<10	<20	<20
14195-D	31-07-2013	Soil stockpiled to create sump in 2013 (in a location where the backhoe leaked hydraulic fluid)	310	70	<20
14196-D	31-07-2013	Soil stockpiled to create sump in 2013	<10	<20	<20
14413-F-C	20-08-2013	Soil collected within lined sump in 2013	<10	70	<20

5.2 Remediation Performance Monitoring Results

5.2.1 Characterization of Soil Passing Through the Vibrating Screen

The maximum concentration of PHC F2 from the soil that passed through the screener in 2013 is 1,100 ppm. Analytical results (Table 2) show that the PHC contaminated soil has F2 concentrations ranging from 230 to 1,110 ppm, with an average concentration of 590 ppm F2.

5.2.2 Nutrient Amendment

The nutrient content of the soil was measured as Total Kjeldahl Nitrogen (TKN) and Total Phosphorus (TP). TKN is the sum of organic nitrogen, ammonia (NH_3), and ammonium (NH_4^+) in the chemical analysis of soil.

Analyzed samples indicate that nitrogen and phosphorous levels were within the required levels in all biopiles. The results of the TKN and TP analyses are presented in a memo prepared by WESA (Appendix B: Biopile Remediation Performance Monitoring Memo).

5.2.3 Microbial Colony

Microorganisms that target PHC, hydrocarbonoclastes (HCN), were measured in biopiles in the UTA and LTA and in the screened fine soil stockpiles on Area 2. The sample results demonstrated that the populations of hydrocarbon degrading bacteria are thriving. The results of the HCN analyses are discussed further in Appendix B.

5.2.4 Moisture Content

The moisture content of the soil in the biopiles was measured in the field and analytically.

Moisture content was monitored in the field at the start of the field season and then weekly before and after soil aeration. The average soil moisture content was 10% throughout June, July and August. At the end of July the moisture content dropped to 8% following a week without rain and water was purposely added to the biopiles to increase the moisture content on August 6 to 12.

The average soil moisture content of the biopiles as determined by laboratory analysis was 5.5% in June, 6.9% in July and 8.9% in August. The laboratory results of moisture analyses are presented in tables 1 thru 5. Moisture content is discussed further in Appendix B.

5.2.5 Characterization of Biopiles

Analytical results from 2012 showed that all soil samples from the original biopiles in the treatment cells met the SQROs for PHC F1, F3 and F4. Concentrations of PHC F2 continued to exceed the SQRO but demonstrated clear evidence of remediation progress (i.e. declining concentrations). Results from 2013 to characterize the biopiles are provided in Tables 3 and 4. Results for biopiles removed from the treatment cells and stockpiled on the pad are provided in Table 2, along with results for biopiles removed from UTA-1, 5 and 6 and stockpiled on Area 2.

Biopiles currently in the UTA and LTA had PHC F2 concentrations ranging from 130 to 610 ppm at the end of the field season. The biopile in UTA-10 meets the SQROs. Soil relocated from the treatment cells to the concrete pad had PHC F2 concentrations ranging from 140 to 420 ppm. The biopiles that were screened and stockpiled on Area 2 had PHC F2 concentrations ranging from 320 to 370 ppm. Further discussion of biopile performance is included in Appendix B.

5.3 Remediation Confirmation Results

5.3.1 Characterization of Excavation Limits

Results for seventeen soil samples analyzed for PHC F2 to F4 are summarized in Table 5 and illustrated on Figure 5. Sample identifiers ending in “F-C” represent composite floor samples and sample identifiers ending in “W-C” represent wall composite samples.

All soil samples collected from Area 1 returned results that met the SQROs. The sampling of the floor of Area 1 was combined with the floor of Area 3. Two of the three wall samples collected in Area 3 exceed the SQRO for PHC F2. Of the eight confirmatory samples collected for Area 4, one wall sample exceeds the SQRO of PHC F2. Area 2 currently contains stockpiles of nutrient amended screened soil and no excavation confirmation samples were collected. Table 5.3 below indicates the areas where samples were collected and the type of sample collected.

Table 5.3: Sample summary.

Area	Floor Composite (“F-C”)	Wall Composite (“W-C”)	Total
Area 1	4	2	6
Area 2	-	-	-
Area 3	-	3	3
Area 4	4	4	8
Total	**8**	**9**	**17**

5.3.2 Characterization of Stockpiled Soil

Results for two composite, three discrete and one blind duplicate samples collected to characterize screened soil stockpiled in the former secondary containment area are summarized in Table 2.

Two composite samples from soil excavated from Area 4 and relocated to the north laydown yard are also summarized in Table 2. The soil in the north laydown yard is unscreened. The confirmatory soil samples indicated that stockpiled soil in the former secondary containment area and in the north laydown yard meets the SQROs.

The total volume of screened soil relocated to the secondary containment area in 2012 and 2013 is approximately 1,500 m^3. The volume of unscreened soil stockpiled in the north laydown yard is estimated to be 300 m^3.

5.3.3 Characterization of Screened Oversize Rock

Analytical results for the five swab samples collected from the oversized rocks are summarized in Table 2. All five swab samples were reported to have PHC F2 to F4 concentrations below the analytical detection limit of 100 µg.

One composite, seven discrete and one duplicate samples were collected from the fine soil adhering to the coarse reject relocated to the pad area. As shown on Table 2, eight of the nine samples exceed the PHC F2 SQRO.

The total volume of screened oversize rock is approximately 4,000 m^3.

5.4 Quality Assurance and Control

Quality assurance and control (QA/QC) measures associated with the collection and analysis of the soil samples included the comparison of field screening results with laboratory data and laboratory analysis of blind duplicates and discrete QA/QC samples.

Field screening results were compared to laboratory data as presented in Tables 1, 2, 3 and 4. The comparisons show that the field screening limit of 30 ppm used to indicate that the PHC F2 SQRO has been met was too high. In 2013, field screening results of 25 ppm or less met the PHC F2 SQRO and results of 40 ppm or more typically exceeded the PHC F2 SQRO. The results suggest that the addition of nutrients in 2012 has decreased the field screening limit at which PHC F2 concentrations will meet the SQRO in the biopiles.

The complete listing of laboratory QA/QC samples and their relative percent difference (RPD) are shown in Table 6. QA/QC sample identifiers ending in “Q” represent blind field duplicate samples. These monitor a combination of the precision of the laboratory analyses, sample preparation errors, sample collection errors and genuine short scale variations in soil geochemistry. QA/QC sample identifiers ending in “D” represent discrete samples which monitor the homogeneity of composite sample areas. Results that are either below the detection limit for one or both sample pairs, or below the Practical Quantitation Limit (“PQL”) have RPD’s identified as not applicable.

Eleven sample pairs have blind field duplicate analyses for PHC. Each sample pair has PHC F3 and F4 results below the PQL. RPD’s are less than 50% for PHC F2 for each sample pair. This data demonstrate an improvement overall in the homogeneity of PHC at the site when compared to QA/QC results in previous years.

Eight nine (89) composite and discrete sample pairs were analysed for petroleum hydrocarbons. Every sample pair has PHC F3 and F4 results below the PQL and one of these have results that are below the PQL for all parameters. Eleven sample pairs were collected from unscreened soil. RPD limits are greater than 50% for fraction F2 in five of the eleven sample pairs. Seventy eight sample pairs were collected from screened materials. RPD limits are greater than 50% for fraction F2 in six of the seventy eight sample pairs. These data suggest the heterogeneity of PHC in the unscreened soil and demonstrate the homogeneity achieved by processing the soil through the vibrating screener, which is to be expected.

6 Discussion

6.1 Field Screening

The PID field screening results were generally low when compared with laboratory analytical results based on the historical correlation of PID measurements and analytical results dating back to 2002. 2012 recommendations (SRK 2013) were adhered to in 2013. The lack of a temperature controlled sample preparation area and the presence of additional nutrients in the soil being tested appears to have resulted in a change to the PID level at which the SQROs for PHC can be assumed to be met.

6.2 Volume of Contaminated Soil

Test pitting was undertaken in 2011 to delineate the PHC contaminated soil and refine the estimated quantity of contaminated soil requiring treatment. As reported in the 2011 Annual Report, the quantity of soil requiring treatment was estimated to be 17,000 m^3 based on the results of the delineation assessment (Nyrstar 2012). The volume of impacted soil exceeded the 8,000 m^3 assumed in the Abandonment and Reclamation Plan (Stantec 2010).

In 2012, 2,450 m^3 of soil meeting the soil quality remediation objectives (SQRO) were removed from the in-situ treatment area. In 2013, 30 to 40% (4,000 m^3) of the material excavated was rejected by the screener as gravel and boulders exhibiting no PHC contamination. One biopile (220 m^3) in the UTA also meets the SQROs. The estimated volume of soil requiring further treatment at the end of the 2013 season is listed in Table 6.1.

Table 6.1: Estimated volume of soil requiring treatment.

Location of PHC contaminated soil	2013 Volume
Below ground within area of former tanks	500 m^3
Stockpile within tank farm footprint [a]	5,000 m^3
Stockpiled on Pad	1,500 m^3
Upper Treatment Area	2,000 m^3
Lower Treatment Area	1,300 m^3
Total Volume of Soil Requiring Treatment	**10,300 m^3**

Note

[a] Volume based on an August 2, 2013 survey by Underhill Geomatics Ltd. for WorleyParsons Canada and scaled up to account for additional material added between August 2 and August 19, 2013.

Approximately 220 m^3 of PHC contaminated soil is now being treated in each treatment cell. In contrast, the Abandonment and Reclamation Plan (Stantec 2010) had assumed that 400 to 500 m^3 would be treated in each cell. The as-built soil volume in each cell is attributed to the shallower depth of the biopiles (1.5 m verses 2+ m) as recommended by WESA to effectively remediate the soil.

The screened stockpile of soil in the in-situ treatment area on Area 2 is currently too large of a pile to safely aerate in-situ. Results from 2011 and 2012 have shown that the in-situ treatment area is capable of treating approximately 2,500 m^3. Contaminated soil known to underlay the stockpile cannot be excavated until the soil in the in-situ treatment area is removed.

6.3 PHC Concentrations

Confirmatory samples collected from Area 1 in August 2013 met the SQROs for PHC. Residual PHC contamination remains to be excavated. It is estimated that 450 m^3 remains to be excavated along the wall between Area 3 and at Area 2. An additional 50 m^3 remains in the northern corner of Area 4. The stockpile of PHC contaminated soil on Area 2 restricted access to these materials in 2013.

Current concentrations of PHC F2 remaining to be excavated and in various stockpiles and biopiles are listed below.

Table 6.2: Concentrations of PHC F2 requiring treatment.

PHC F2 Concentrations	Average mg/kg	Minimum mg/kg	Maximum mg/kg
Below ground, remaining to be excavated	2,350	<10	6,450
Stockpile within tank farm footprint	590	230	1,100
Stockpiled on Pad	370	140	440
Upper and Lower Treatment Area biopiles	400	130	610

The zinc levels in the sample retrieved from soil removed from cracks on the pad suggest that residual concentrate that was stored on the pad during mine operations is present in the cracks.

6.4 Remediation Rate

Analysis of the biopiles in the treatment cells indicates that PHC concentrations for F2 reduced from an average of 930 ppm following the application of nutrients in August 2012, to 300 ppm in August 2013.

Excavating and screening the PHC contaminated soil in 2013 reduced F2 concentrations from an in-situ average of 2,350 to an ex-situ average of 590 ppm.

The rate of PHC remediation observed in 2013 is greater than the rate observed in 2011 and 2012. In Appendix B, WESA attributes this improvement in the biopiles to lower initial PHC concentrations, mechanical screening of material prior to loading, existence of established microbial colonies, early application of nutrient and improved soil moisture management. In

addition, improved equipment maintenance in 2013 reduced the incidents of hydraulic leaks and fuel spills at site.

The Abandonment and Reclamation Plan (Stantec 2010) assumed that the biopiles would meet the SQROs following one season of bioremediation and aeration in the treatment cells. The improvement seen in 2013 suggests that this may be achievable in the future.

Notwithstanding these improvements, completing the soil remediation work in accordance with the remediation approach and to the SQROs established in the Abandonment and Reclamation Plan will require several more years. Based on the experience gathered through the 2012 and 2013 remediation, current projections indicate that landfarming of contaminated soil will need to continue throughout 2014, 2015 and 2016. The projections also indicate that use of the in-situ treatment area will be required during the 2014 and 2015 field seasons.

The foreseen timelines described above are likely to present conflicts with proposed re-development plans for the dock site, namely the DND's construction of a refueling facility. Based on CanZinco's understanding of the DND's plans, construction in the in-site treatment area is to commence by 2015. An application to vary the remediation methodology was submitted to the NWB on November 13, 2013 (Nyrstar 2013b) in an effort to eliminate the risk of conflict with the DND's plans. For this application, Herrema provided CanZinco with an options analysis for the PHC contaminated soils remaining (Herrema 2013).

7 Recommendations

7.1 Alternative Remediation Approach

In order to facilitate the redevelopment of the site within the timelines proposed by the DND an alternative approach to the remediation is required. The remedial option (Herrema 2013) involves the transfer of the contaminated soil to the UTA and capping the materials with clean soil. Simultaneously, studies are to be pursued to demonstrate that the residual low levels of soil contamination do not pose risks to human health or the environment.

7.2 Field Screening

It is recommended that the PID continues to be utilized to monitor soil excavation and PHC attenuation in the field. Should temperatures in the sample preparation area resemble those historically achieved inside of heated buildings, it is recommended that a suit of six samples collected from nutrient amended soils with PID readings ranging between 20 and 120 ppm be submitted for analytical analysis to evaluate the correlation between PID field screening measurements and laboratory results.

7.3 Excavation

It is recommended that the residual contamination be excavated. Portions of the stockpile on Area 2 must be removed to allow for the excavation of the remaining PHC contaminated soil.

During excavation activities spill response measures for leaks from the heavy equipment are to involve relocating the impacted soil to a single designated treatment cell in the UTA-9 or UTA-10.

7.4 Stockpile Management

No further management of stockpiled material that meet the SQROs is recommended.

The 0.5 m^3 of zinc concentrate contaminated soil stored on the pad should be packaged in a container suitable for shipping off-site and disposed of at an approved facility.

The stockpile of rock on the pad should be sifted so as to dislodge the remaining fine soil during a period of dry weather conditions and the rock relocated to the north laydown yard. The fine soil remaining on the pad should be spread thinly and moved about to facilitate aeration until the SQROs are met. Should the fine soil not meet the existing SQROs by July 31 the soil is to be relocated to a treatment area or stockpile unless approval is obtained from the lease holder to continue using the pad.

7.4.1 Alternative Remediation Approach Approved

Upon approval of the alternative remediation method, the soil stockpiled on Area 2 should be relocated to the UTA (excluding UTA-9 and UTA-10). The soil will need to be removed in layers as the thaw progresses through the stockpile. Soil samples are to be routinely submitted for PHC analysis as the soil is relocated to the UTA as described in section 7.6.2. The stockpiled soil has been amended with nutrients and no additional nutrients need to be applied to this soil, unless PHC F2 concentrations above the maximum level documented in 2013 (1,100 mg/kg) are detected.

7.4.2 Continuation of Current Remediation Approach

Should approval of the alternative remediation methodology not be received before the start of the 2014 field season, it is recommended that the soil stockpiled on Area 2 be spread as thinly as possible across the whole of Area 2 and aerated every four days. Samples are to be collected to monitor bioremediation performance routinely as described in section 7.6.3.

7.5 Biopile Management

The biopile in UTA-10 meets the SQROs specified in the Abandonment and Reclamation Plan (Stantec 2010). It is recommended that this cell be off-loaded at the start of the 2014 field season.

7.5.1 Alternative Remediation Approach Approved

Upon approval of the alternative remediation methodology, it is recommended that biopile confirmatory samples be collected from UTA-9-2 and LTA-1-2 thru LTA-6-2 at the start of the 2014 field season. Biopiles that meet the SQROs should be off-loaded and the remediated soil reserved for use at the UTA. It is recommended that the select biopiles be managed with the same aeration schedule as undertaken in 2012 and 2013; once every four days during periods of limited precipitation until mid-July. A second set of biopile confirmatory samples are then to be collected and biopiles that do not meet the SQROs are to be relocated to the UTA. No aeration of biopiles in UTA-1 thru UTA-8 is recommended. Samples to characterize the soil should be collected prior to the placement of additional soil in this area.

7.5.2 Continuation of Current Remediation Approach

Should approval of the alternative remediation methodology not be received before the start of the 2014 field season, it is recommended that the biopiles with low levels of PHC contamination (i.e., less than two times the SQROs) be relocated to the pad (except UTA-10-2 which currently meets the SQROs).[2] All biopiles relocated to the pad should be spread as thin as possible within the prepared area and the soil should be moved every four days. In mid-July samples should be submitted for analytical testing to assess the PHC levels.

An application to DFO to continue to utilize the pad for soil with low levels of PHC contamination beyond July 31, 2014 is recommended should approval of the alternative remediation methodology not be received. A one year extension should be requested, at a minimum.

Should approval of the alternative remediation methodology not be received, the treatment cells are to be reloaded with material from the stockpile on Area 2 and PHC contaminated soil excavated in 2014 and the biopiles aerated once every four days during periods of limited precipitation and temperatures above 0 C^{o} until the biopiles meet the SQROs. Nutrients are to be applied to soil excavated in 2014 to promote microbial activity. Soil moisture content is to be monitored in the field and if it gets below 5% and no precipitation is forecast supplementary water is to be applied.

7.6 Confirmation Sampling

7.6.1 Excavation Limits

Further excavation is to be undertaken in areas where the laboratory analytical results do not meet the SQROs and additional confirmatory samples are to be taken upon completion of the excavation. One QA/QC sample set is to be collected for every ten composite samples.

7.6.2 Stockpiles

Confirmatory sample procedures involve one composite sample per 250 m^3 of material stockpiled to be submitted for laboratory analysis. For every ten composite samples collected, one duplicate and three discrete samples are to be submitted. The QA/QC samples are to be obtained from a single stockpile.

7.6.3 Biopiles

The recommended sampling plan calls for one composite sample per 250 m^3 of material to be submitted for laboratory analysis. For every ten composite samples, one duplicate and three discrete samples are to be sent for analysis as part of the QA/QC plan.

Biopiles are not to be off-loaded without confirmation that the soil meets the SQROs unless the soil is destined for remediation elsewhere.

7.6.4 Oversized Rocks

No further measures are recommended for the stockpile in the north laydown yard.

[2] As of August 2013 fourteen of the sixteen biopiles in the treatment cells had PHC concentrations less than two times the SQROs.

8 Conclusions

Key conclusions from the 2013 soil remediation activities are as follows:

- Soil removed from the in-situ treatment area and stockpiled in the former secondary containment area is remediated in accordance with the SQROs.
- Soil removed from the excavation of Area 4 and stockpiled in the north laydown yard meets the existing SQROs.
- Oversized rocks separated out with the screening plant and stockpiled in the north laydown yard show no indication of PHC contamination.
- Processing of soil through the screening plant has reduced PHC concentrations. The soil screened in 2013 has low levels of PHC contamination (i.e. less than two times the SQROs).
- Nutrient amendment and soil aeration has successfully reduced PHC concentrations. The biopiles in the UTA and LTA and those relocated to the pad have low levels of PHC contamination.
- The soil removed from the cracks during preparation of the pad for temporary storage was contaminated with zinc.
- PHC contamination remains to be excavated within the footprint of the former bulk fuel storage facility. Final confirmatory samples are to be collected from the excavation limits.
- Soil nutrient concentrations are considered to be sufficient for ongoing bioremediation. No additional nutrient amendment applications are anticipated for the established biopiles.

The volume of PHC contaminated soil being treated is more than anticipated and the rate of remediation achieved initially (in 2011 and 2012) less in the Abandonment and Reclamation Plan (Stantec 2010). It is uncertain if the targeted completion date, Q3 2015, can be achieved. SRK understands that the DND is planning to construct a naval facility at the Nanisivik dock site and that these construction works are scheduled to commence in August 2014. In an effort to eliminate the risk of conflict with the DND's plans an application to vary the remediation methodology was submitted to the NWB on November 13, 2013 by CanZinco. The remedial option proposed involves the transfer of the contaminated soil to the upper treatment area and capping the materials with clean soil. Simultaneously, studies are to be pursued to demonstrate that the residual low levels of soil contamination do not pose risks to human health or the environment. The alternative approach proposed would allow for the removal of contaminated soil within the footprint of the former bulk fuel storage facility in Q3 2014. The use of the pad for temporary storage would cease by July 31, 2014.

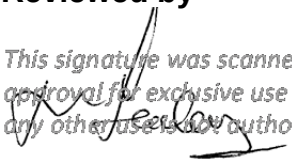
Should approval of the alternative remediation methodology not be received, the soil remediation work will continue in accordance with the remediation approach and to the SQROs established in the Abandonment and Reclamation Plan. The management of the biopiles in the UTA, LTA, on the pad and in the in-situ treatment area will include routine aeration and moisture content control. Use of the in-situ treatment area and possibly the pad will be required.

This report, Nanisivik Mine, Contaminated Soil Remediation 2013 Progress Report, was prepared by:

Prepared by

Arlene Laudrum, PGeo, FGC
Principal Consultant

Reviewed by



Peter Healey, PEng
Project Reviewer

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Figures

Legend

Extent of Contaminated Soil July 2011

Notes:
1. Coordinate system is NAD83, UTM Zone 16

0 12.5 25 50 75 100 Meters

srk consulting

nyrstar

Original Areas of Contaminated Soil

Job No: 1CB002.002

Filename: 1CB002.002_soil_remed_fig_1.0_orig_contam_extent

Nanisivik Mine
Contaminated Soil Remediation
2013 Progess Report

Date:	Approved:	Figure:
November 2013	A.L.	1

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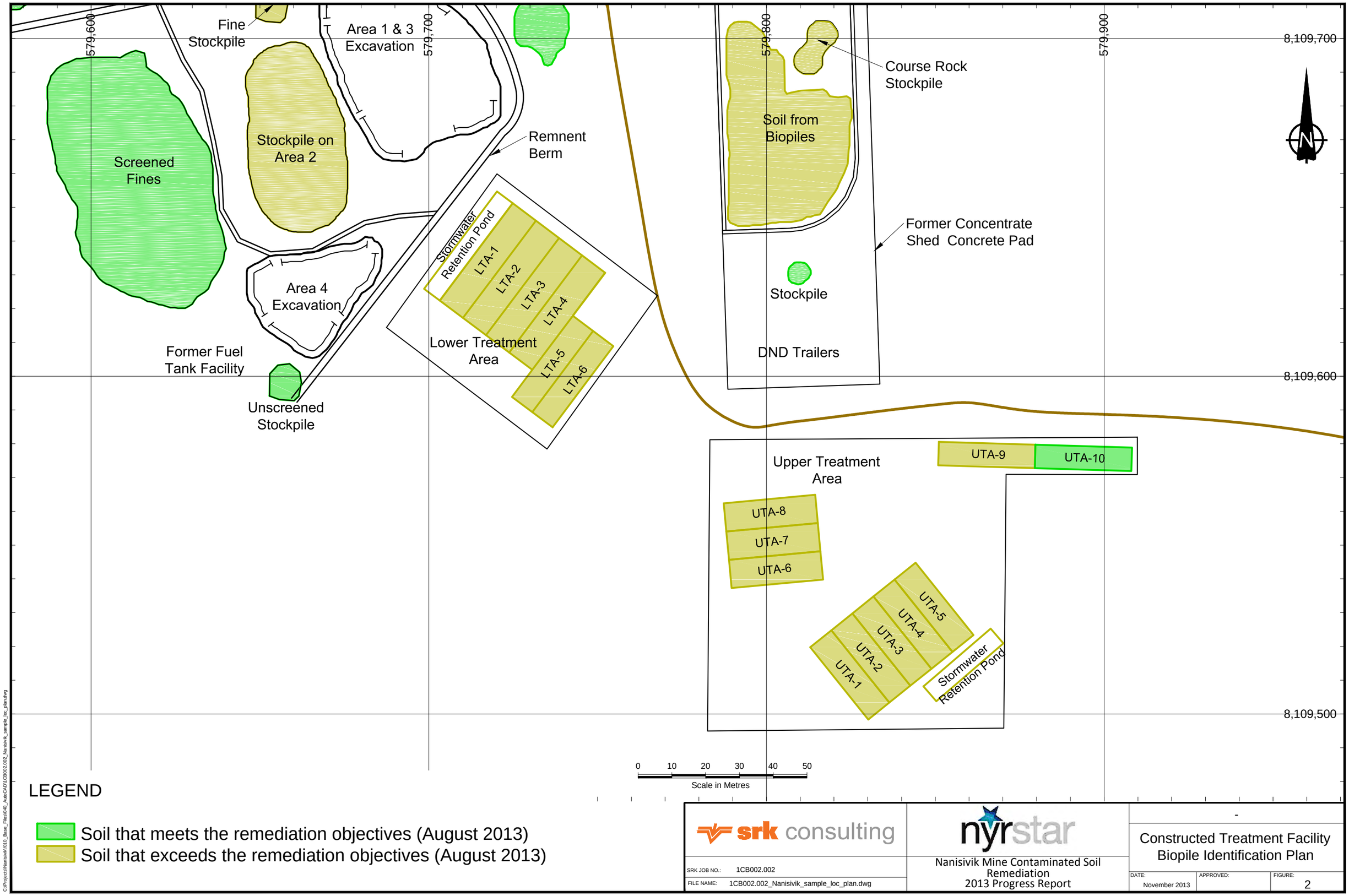

LEGEND

- Soil that meets the remediation objectives (August 2013)
- Soil that exceeds the remediation objectives (August 2013)

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SRK JOB NO.: 1CB002.002

FILE NAME: 1CB002.002_Nanisivik_sample_loc_plan.dwg

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Nanisivik Mine Contaminated Soil Remediation
2013 Progress Report

-

Constructed Treatment Facility
Biopile Identification Plan

DATE:	APPROVED:	FIGURE:
November 2013		2

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579600
579800
580000
8109800
8109600
STRATHCONA SOUND
TWIN LAKES CREEK
Lunch Room
Office
Seacan
Soil Cover
Former Concentrate Shed Concrete Pad
Lined Sump
Former Fuel Tank Facility
Unscreened Stockpile
Course Rock Stockpile
Rubble Pile
Fine Stockpile
Area 1 & 3 Excavation
Screened Fines
Stockpile on Area 2
Remnent Berm
Area 4 Excavation
Former Fuel Tank Facility
Unscreened Stockpile
Lower Treatment Area
Course Rock Stockpile
Soil from Biopiles
Former Concentrate Shed Concrete Pad
Stockpile
DND Trailers
Upper Treatment Area

LEGEND

- Soil that meets the remediation objectives
- Soil that exceeds the remediation objectives
- Berms

0 50 100
Scale in Metres

NOTES

Coordinate System: UTM NAD 1983 Zone 16

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SRK JOB NO.: 1CB02.02

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Nanisivik Mine Contaminated Soil Remediation
2013 Progress Report

-

General Site Arrangement

DATE:	APPROVED:	FIGURE:
November 2013		3

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579,600
579,700
579,800
579,900
8,109,700
8,109,600
North Laydown Yard
13675-F-C
13676-F-C
Former Bulk Fuel Storage Facility
Remnant Berm
Former Secondary Containment Area
TWIN LAKES CREEK
13300-W-C
13302-W-C
13303-W-C
Lined Sump
Lined Wooden Box 13672-D
Area Prepared for Temporary Storage of Soil
Former Concentrate Shed Concrete Pad
13307-W-C
N

LEGEND

- Discrete Sample (Sample <CL)
- Composite Sample (Sample <CL)
- Discrete Sample (Sample >CL)
- Composite Sample (Sample >CL)
- Berm
- Sample Grid

14428-W-D
<Sample ID><Location><Type>

Location
F Floor of Excavation
W Wall of Excavation

Type
D Discrete
C Composite

0 10 20 30 40 50
Scale in Metres

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Nanisivik Mine Contaminated Soil Remediation
2013 Progress Report

-

Background Soil Quality Characterization Samples

DATE: November 2013
APPROVED:
FIGURE: 4

579,600
579,700
579,800
579,900
8,109,700
8,109,600

Unscreened Stockpile
14252-D
14255-D
14677-C
14678-C
14253-D
14256-D
14254-D
Course Rock Stockpile

Former Fuel Tank Facility
NAME
Remnant Berm
Remnant Berm
Remnant Berm

14412-D
13958-C
14411-D
Fines Stockpile
14417-W-C
14421-W-C
14414-F-C
14416-F-C

Area 1 & 3 Excavation
14408-D
14199-D
Screened Fines Stockpile
13673-D
13672-D
14198-D
13674-D
14409-D
14410-D
14420-W-C
14415-F-C
14430-F-C
14418-W-C
14419-W-C

13023-C
Screened Fines
13013-D
13024-C
13011-D
13012-D

14429-W-C
14425-F-C
14422-F-C
14426-W-C
14428-W-C
14424-F-C
Area 4 Excavation
14423-F-C
14427-W-C
Unscreened Stockpile

Lower Treatment Area

Soil Cover
14195-D
14196-D
14194-D
14193-D
14413-C
Lined Sump
Course Rock Stockpile
14191-D
14327-C
14190-D
14310-D
Soil from Biopiles
14326-C
14325-C
14301-D
14305-D
14324-C
14323-C
Stockpile
DND Trailers

Former Concentrate Shed Concrete Pad

Upper Treatment Area

TWIN LAKES CREEK

N

0 10 20 30 40 50
Scale in Metres

LEGEND

- Discrete Sample (Sample <CL)
- Composite Sample (Sample <CL)
- Discrete Sample (Sample >CL)
- Composite Sample (Sample >CL)
- Berm
- Sample Grid

14428-W-D
<Sample ID><Location><Type>

Location
F Floor of Excavation
W Wall of Excavation

Type
D Discrete
C Composite

srk consulting

SRK JOB NO.: 1CB002.002
FILE NAME: 1CB002.002_Nanisivik_sample_loc_plan.dwg

nyrstar

Nanisivik Mine Contaminated Soil Remediation
2013 Progress Report

-

Excavation and Stockpile Characterization Samples

DATE: November 2013
APPROVED:
FIGURE: 5

C:\Projects\Nanisivik\010_Base_Files\040_AutoCAD\1CB002.002_Nanisivik_sample_loc_plan.dwg

Tables

Table 1: Background Soil Quality Monitoring Results

Location:			North Laydown		Pad					
Sample ID:			13675-F-C	13676-F-C	13300-W-C	13302-W-C	13303-W-C	13307-W-C	13762-D	14193-D
Sample Date:			7/14/2013	7/14/2013	6/28/2013	6/28/2013	6/28/2013	6/28/2013	7/15/2013	7/31/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0-0.1	0-0.1	0.1-0.15
Field Screen (ppm)[d]:			10	25	10	0	0	-	-	30
Moisture			5.6	5.8	6.2	2.95	7.76	-	-	4.8
Accutest File #			1315067	1315067	L1332796	L1332796	L1332796	L1332796	L1332796	1316852
Parameter	**Units**	**SQRO**	**Analytical Results**							
Extractable Hydrocarbons[a]										
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700								
F2 (C10-C16) surface[b,c]	µg/g	260	<10	<10	<30	<30	<30	-	-	<10
F2 (C10-C16) subsoil[b,c]	µg/g	1000								
F3 (C10-C16) surface[b,c]	µg/g	1700	120	30	894	<50	<50	-	-	80
F3 (C16-C34) subsoil[b,c]	µg/g	3500								
F4 (C34-C50) surface[b,c]	µg/g	3300	30	<20	<50	<50	<50	-	-	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000								
Metals[e]										
Cadmium	ug/g	2800	-	-	-	-	-	-	409	-
Copper	ug/g	5900	-	-	-	-	-	-	280	-
Lead	ug/g	4500	-	-	-	141	-	155	23300	-
Zinc	ug/g	44000	-	-	-	2370	-	727	**177000**	-

Bold *Concentration greater than or equal to the soil quality remediation objective.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

e) The site-specific SQROs for the dock area at the former Nanisivik Mine Site are based on the approved Human Health and Ecological Risk Assessment, Nunavut Mine, Nunavut, Jacques Whitford Environmental Limited, October 2003.

Table 1: Background Soil Quality Monitoring Results

Location:			Pad			
Sample ID:			14194-D	14195-D	14196-D	14413-F-C
Sample Date:			7/31/2013	7/31/2013	7/31/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			25	40	50	-
Moisture			4	9.8	7	39.5
Accutest File #			1316852	1316852	1316852	1318567
Parameter	**Units**	**SQRO**	**Analytical Results**			
Extractable Hydrocarbons[a]						
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700				
F2 (C10-C16) surface[b,c]	µg/g	260	<10	**310**	<10	<10
F2 (C10-C16) subsoil[b,c]	µg/g	1000				
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	70	<20	70
F3 (C16-C34) subsoil[b,c]	µg/g	3500				
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000				
Metals[e]						
Cadmium	ug/g	2800	-	-	-	-
Copper	ug/g	5900	-	-	-	-
Lead	ug/g	4500	-	-	-	-
Zinc	ug/g	44000	-	-	-	-

Bold *Concentration greater than or equal to the soil quality remediation objective.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

e) The site-specific SQROs for the dock area at the former Nanisivik Mine Site are based on the approved Human Health and Ecological Risk Assessment, Nunavut Mine, Nunavut, Jacques Whitford Environmental Limited, October 2003.

Table 2: Stockpile Characterization Soil Samples

Location:			Screened Fines Stockpiled on Area 2 from excavation of Areas 1, 3 and 4							
Sample ID:			13672-D	13673-D	13674-D	14198-D	14199-D	14408-D	14409-D	14410-D
Sample Date:			7/13/2013	7/13/2013	7/13/2013	7/31/2013	7/31/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			60	45	90	>500	>500	-	-	-
Moisture			7.8	7.2	5.8	6.3	8	8.8	7.6	8.4
Accutest File #			1315067	1315067	1315067	1316852	1316852	1318567	1318567	1318567
Parameter	**Units**	**SQRO**	**Analytical Results**							
Extractable Hydrocarbons[a]										
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700								
F2 (C10-C16) surface[b,c]	µg/g	260	**780**	**1110**	**960**	**410**	**930**	**600**	230	240
F2 (C10-C16) subsoil[b,c]	µg/g	1000								
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	80	70	30	40	20	<20	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500								
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000								

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 2: Stockpile Characterization Soil Samples

Location:			Biopiles removed from Treatment Cells and Stockpiled on Pad								
			UTA9	LTA4	LTA2	UTA9	Composites from various biopiles				
Sample ID:			14261-Q	14301-D	14305-D	14310-D	14323-C	14324-C	14325-C	14326-C	14327-C
Sample Date:			duplicate of	8/19/2013	8/19/2013	8/19/2013	8/19/2013	8/19/2013	8/19/2013	8/19/2013	8/19/2013
Sample Depth (m):			14310-D	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			25	80	25	25	50	40	30	30	40
Moisture			6.3	5.9	7.1	8.1	7	6.4	7	7.6	7.5
Accutest File #			1318573	1318573	1318573	1318573	1318573	1318573	1318573	1318573	1318573
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	230	140	250	240	**360**	**310**	**350**	**420**	**280**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	40	20	50	<20	90	30	90	80	60
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 2: Stockpile Characterization Soil Samples

Location:			Screened Fines Stockpiled on Area 2 from UTA 1, 5 and 6			Stockpile Screened Fines in Former Secondary Containment Area relocated from Area 2 at start of season					
Sample ID:			13958-C	14411-D	14412-D	13011-D	13012-D	13013-D	13023-C	13024-C	13025-Q
Sample Date:			7/24/2013	8/20/2013	8/20/2013	6/17/2013	6/17/2013	6/17/2013	6/18/2013	6/18/2013	duplicate of
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	13024-C
Field Screen (ppm)[d]:			125	-	-	10	5	15		-	-
Moisture			6.2	6.1	5.7	6.1	5.4	5.7	5.9	6.1	5.2
Accutest File #			1316853	1318567	1318567	1312655	1312655	1312655	1312655	1312655	1312655
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	**540**	**370**	**320**	90	100	120	100	120	110
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	80	50	50	20	20	30	20	20	20
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 2: Stockpile Characterization Soil Samples

Location:			Unscreened Stockpile in North Laydown from surface of Area 4		Screened Oversized Rock Stockpiled in North Laydown Rock Swab Results				
Sample ID:			13677-C	13678-C	14252-D	14253-D	14254-D	14255-D	14256-D
Sample Date:			7/14/2013	7/14/2013	8/9/2013	8/9/2013	8/9/2013	8/9/2013	8/9/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0	0	0	0	0
Field Screen (ppm)[d]:			10	0	-	-	-	-	-
Moisture			6.8	6.5	-	-	-	-	-
Accutest File #			1315067	1315067	128[e]	128[e]	128[e]	128[e]	128[e]
Parameter	**Units**	**SQRO**	**Analytical Results**						
Extractable Hydrocarbons[a]									
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700							
F2 (C10-C16) surface[b,c]	µg/g	260	10	<10	<100	<100	<100	<100	<100
F2 (C10-C16) subsoil[b,c]	µg/g	1000							
F3 (C10-C16) surface[b,c]	µg/g	1700	30	<20	<100	<100	<100	<100	<100
F3 (C16-C34) subsoil[b,c]	µg/g	3500							
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<100	<100	<100	<100	<100
F4 (C34-C50) subsoil[b,c]	µg/g	10000							

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

e) Laboratory results for Swab samples provided by Iqaluit Analytical Services Unit.

Table 2: Stockpile Characterization Soil Samples

Location:			Fines in Screened Oversized Rock Stockpiled on Pad from excavation of Areas 1, 3 and 4								
Sample ID:			13301-D	13995-D	13996-D	13998-D	13999-D	14020-C	14021-Q	14190-D	14191-D
Sample Date:			6/27/2013	7/24/2013	7/24/2013	7/24/2013	7/24/2013	7/24/2013	duplicate of	7/31/2013	7/31/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	14020-C	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			25	30	40	65	35	-	40	70	200
Moisture			5.4	4.4	4.1	4.3	5.9	4.7	5.2	6.1	5.3
Accutest File #			L1332796[f]	1316853	1316853	1316853	1316853	1316853	1316853	1316852	1316852
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	149	**380**	**300**	**610**	**550**	**530**	**470**	**280**	**440**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	81	70	70	80	80	100	70	60	60
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<50	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

f) Laboratory results for sample 13301-D provdied by ALS Environmental

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			LTA-1				LTA-2			LTA-3	
Sample ID:			13033-C	13755-C	14089-Q	14158-C	13153-C	13756-C	14159-C	13154-C	13739-D
Sample Date:			6/19/2013	7/15/2013	duplicate of	7/30/2013	6/19/2013	7/15/2013	7/30/2013	6/19/2013	7/15/2013
Sample Depth (m):			0.0-0.8	0.1-0.15	14158-C	0.1-0.15	0.0-0.9	0.1-0.15	0.1-0.15	0.0-0.85	0.1-0.15
Field Screen (ppm)[d]:			-	115		50	-	10	130	-	75
Moisture			7.7	12.1	5.8	6.1	9.5	8.8	6.4	7.8	6.7
Accutest File #			1312655	1315067	1316853	1316853	1312655	1315067	1316853	1312655	1315067
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	**660**	**780**	**540**	**550**	**380**	**710**	**610**	**790**	**760**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	130	90	120	110	50	70	80	100	80
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			LTA-3					LTA-4			
Sample ID:			13741-D	13742-D	13757-C	13758-Q	14160-C	13039-D	13040-D	13041-D	13155-C
Sample Date:			7/15/2013	7/15/2013	7/15/2013	duplicate of	7/30/2013	6/19/2013	6/19/2013	6/19/2013	6/19/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	13757-C	0.1-0.15	0.0-0.75	0.0-0.9	0.0-0.9	0.0-0.9
Field Screen (ppm)[d]:			110	25	70	-	140	15	20	80	-
Moisture			8.1	8	7.3	7.7	7.2	6.5	7.1	7.6	6.2
Accutest File #			1315067	1315067	1315067	1315067	1316853	1312655	1312655	1312655	1312655
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	100	**380**	**710**	**540**	**650**	160	**340**	**1040**	**480**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	40	50	80	60	90	30	40	100	50
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			LTA-4		LTA-5			LTA-6		UTA-1	
Sample ID:			13158-Q	13759-C	13156-C	13760-C	14162-C	13157-C	13761-C	13159-C	13691-C
Sample Date:			duplicate of	7/15/2013	6/19/2013	7/15/2013	7/30/2013	6/19/2013	7/15/2013	6/19/2013	7/14/2013
Sample Depth (m):			13155-C	0.1-0.15	0.0-0.8	0.1-0.15	0.1-0.15	0.0-0.85	0.1-0.15	0.0-0.7	0.1-0.15
Field Screen (ppm)[d]:			-	50	-	80	80	-	78	-	30
Moisture			7.2	7	11.2	8.3	7.3	8.7	7.8	6.6	8.3
Accutest File #			1312655	1315067	1312655	1315067	1316853	1312655	1315067	1312655	1315067
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	**420**	**300**	**690**	**710**	**750**	**520**	**510**	**1020**	**520**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	40	40	60	60	80	20	40	130	70
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			UTA-2		UTA-3						
Sample ID:			13160-C	13692-C	13059-D	13060-D	13062-D	13161-C	13162-Q	13687-D	13689-D
Sample Date:			6/19/2013	7/14/2013	6/19/2013	6/19/2013	6/19/2013	6/23/2013	duplicate of	7/14/2013	7/14/2013
Sample Depth (m):			0.0-0.6	0.1-0.15	0.0-0.6	0.0-0.7	0.0-0.5	0.0-0.6	13161-C	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	15	5	10	5	-	-	25	30
Moisture			7.3	8.3	7.7	8.2	7	6.7	7.7	8.8	9.2
Accutest File #			1312655	1315067	1312655	1312655	1312655	1312655	1312655	1315067	1315067
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	**740**	**560**	**590**	**730**	**960**	**440**	**550**	**420**	**620**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	100	100	90	70	100	50	80	60	80
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			UTA-3			UTA-4		UTA-5		UTA-6	
Sample ID:			13690-D	13693-C	13694-Q	13163-C	13723-C	13164-C	13724-C	13165-C	13725-C
Sample Date:			7/14/2013	7/14/2013	duplicate of	6/19/2013	7/14/2013	6/19/2013	7/14/2013	6/19/2013	7/14/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	13690-D	0.0-0.7	0.0-0.15	0.0-0.65	0.1-0.15	0.0-0.85	0.1-0.15
Field Screen (ppm)[d]:			50	50	50	-	10	-	135	-	45
Moisture			7.9	8.7	7.6	6.1	8	7.3	8.8	7.7	6.6
Accutest File #			1315067	1315067	1315067	1312655	1315067	1312655	1315067	1312655	1315067
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	**1220**	**550**	**860**	**640**	**410**	**1650**	**1050**	**1180**	**620**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	120	70	110	70	60	110	90	110	70
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			UTA-7			UTA-8					
Sample ID:			13166-C	13726-C	14153-C	13167-C	13711-D	13712-D	13714-D	13727-C	13728-Q
Sample Date:			6/19/2013	7/14/2013	7/30/2013	6/19/2013	7/14/2013	7/14/2013	7/14/2013	7/14/2013	duplicate of
Sample Depth (m):			0.0-0.9	0.1-0.15	0.1-0.15	0.0-0.85	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	13727-C
Field Screen (ppm)[d]:			-	75	90	-	45	30	45	65	65
Moisture			8.4	8.7	7.2	9.6	8.3	8.3	6	7.9	7.4
Accutest File #			1312655	1315067	1316853	1312655	1315067	1315067	1315067	1315067	1315067
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	**560**	**700**	**590**	**690**	**720**	**500**	**650**	**710**	**570**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	40	50	60	40	50	40	80	60	40
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 3: Biopile Characterization Soil Samples - Original Biobiles

Location:			UTA-8		UTA-9			UTA-10	
Sample ID:			14088-C	14154-Q	13168-C	13729-C	14155-C	13169-C	13730-C
Sample Date:			7/30/2013	duplicate of	6/19/2013	7/14/2013	7/30/2013	6/19/2013	7/14/2013
Sample Depth (m):			0.1-0.15	14088-C	0.0-0.8	0.1-0.15	0.1-0.15	0.0-0.75	0.1-0.15
Field Screen (ppm)[d]:			125	125	-	65	175	-	60
Moisture			5.8	5.8	6.6	7.5	5.2	7.5	8.2
Accutest File #			1316853	1316852	1312655	1315067	1316853	1312655	1315067
Parameter	**Units**	**SQRO**	**Analytical Results**						
Extractable Hydrocarbons[a]									
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700							
F2 (C10-C16) surface[b,c]	µg/g	260	**370**	**410**	**640**	**610**	**470**	**660**	**470**
F2 (C10-C16) subsoil[b,c]	µg/g	1000							
F3 (C10-C16) surface[b,c]	µg/g	1700	50	<20	40	60	60	40	30
F3 (C16-C34) subsoil[b,c]	µg/g	3500							
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000							

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			LTA-1-2					LTA-2-2				
Sample ID:			14328-D	14329-D	14330-D	14331-D	14352-C	14332-D	14333-D	14334-D	14335-D	14353-C
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	-	-	-	-	-	-	-
Moisture			10	9.3	9.2	7.6	8.6	9.5	9.9	9.2	10	9.2
Accutest File #			1318556	1318556	1318556	1318556	1318557	1318556	1318556	1318556	1318556	1318557
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**470**	**410**	**400**	**410**	**440**	**430**	**500**	**460**	**410**	**440**
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	30	<20	<20	<20	<20	<20	20	30	30	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			LTA-3-2					LTA-4-2				
Sample ID:			14336-D	14337-D	14338-D	14339-D	14354-C	14161-C	14340-D	14341-D	14342-D	14343-D
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	-	-	125	-	-	-	-
Moisture			9.8	9.5	9.3	9.9	10.2	6.8	8.6	9.7	8.9	9.4
Accutest File #			1318556	1318556	1318556	1318556	1318557	1316852	1318556	1318556	1318556	1318556
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**320**	**390**	**360**	**430**	**420**	**730**	170	250	240	240
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	<20	<20	<20	<20	60	<20	<20	<20	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

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"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			LTA-4-2	LTA5-2					LTA-6-2			
Sample ID:			14355-C	14344-D	14345-D	14346-D	14347-D	14356-C	14163-C	14348-D	14349-D	14350-D
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	-	-	-	80	-	-	-
Moisture			9.4	9.2	9.4	9.4	17.6	8.5	5.7	9.2	9.6	9.4
Accutest File #			1318557	1318556	1318556	1318556	1318556	1318557	1316852	1318557	1318557	1318557
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**280**	**320**	**440**	**350**	**500**	**340**	**380**	220	**310**	**310**
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	<20	<20	30	30	<20	40	<20	<20	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			LTA-6-2		UTA-1-2						UTA-2-2	
Sample ID:			14351-D	14357-C	14147-C	14358-D	14359-D	14360-D	14361-D	14398-C	14087-C	14148-C
Sample Date:			8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	7/30/2013	Duplicate o
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	14087
Field Screen (ppm)[d]:			-	-	175	-	-	-	-	-	225	225
Moisture			7.3	8.4	6.7	9	8.4	9.7	9.6	8.8	6	4.8
Accutest File #			1318557	1318557	1316852	1318557	1318557	1318557	1318557	1318565	1316852	1316852
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**370**	**320**	**810**	**400**	**330**	**400**	**430**	**400**	**970**	**1000**
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	<20	80	20	<20	<20	40	<20	80	70
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			UTA-2-2					UTA-3-2				
Sample ID:			14362-D	14363-D	14364-D	14365-D	14399-C	14149-C	14366-D	14367-D	14368-D	14369-D
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	-	-	225	-	-	-	-
Moisture			9.6	10.4	9.9	5.5	7.2	5.7	9.5	9.8	8.6	7
Accutest File #			1318557	1318557	1318557	1318557	1318565	1316852	1318557	1318557	1318560	1318560
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**390**	**480**	**420**	**590**	**460**	**310**	**530**	**760**	**900**	**500**
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	30	40	420	50	30	20	30	50	80	30
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			UTA-3-2	UTA-4-2						UTA-5-2		
Sample ID:			14400-C	14150-C	14370-D	14371-D	14372-D	14373-D	14401-C	14151-C	14374-D	14375-D
Sample Date:			8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.0-0.15	0.0-0.15	0.0-0.15	0.0-0.15	0.0-0.15	0.0-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	210	-	-	-	-	-	210	-	-
Moisture			10	6.9	9.2	9.6	8.3	8.5	8.6	6.4	8.4	9.7
Accutest File #			1318565	1316852	1318560	1318560	1318560	1318560	1318565	1316852	1318560	1318560
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**610**	**840**	**690**	**370**	**470**	**440**	**380**	**720**	**510**	**360**
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	40	60	80	40	30	50	20	60	<20	70
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			UTA-5-2			UTA-6-2						UTA-7-2
Sample ID:			14376-D	14377-D	14402-C	14152-C	14378-D	14379-D	14380-D	14381-D	14403-C	14382-D
Sample Date:			8/20/2013	8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	210	-	-	-	-	-	-
Moisture			9.3	8.1	10.5	5.8	8.7	9.2	9.8	7.7	9.1	8.6
Accutest File #			1318560	1318560	1318565	1316852	1318560	1318560	1318560	1318560	1318565	1318560
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**740**	**600**	**610**	**690**	**460**	**310**	**340**	**370**	**430**	**470**
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	40	110	40	<20	40	30	<20	60	<20	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			UTA-7-2				UTA-8-2					UTA-9-2
Sample ID:			14383-D	14384-D	14385-D	14404-C	14386-D	14387-D	14388-D	14389-D	14405-C	14390-D
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	-	-	-	-	-	-	-
Moisture			7	7.6	8.7	7.8	8.5	9.2	9.5	9.9	8.8	9.4
Accutest File #			1318560	1318560	1318560	1318565	1318560	1318560	1318565	1318565	1318565	1318565
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**530**	**390**	**380**	**370**	**490**	**580**	**420**	**450**	**420**	250
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	40	60	<20	40	70	<20	40	<20	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 4: Remediation Progress Soil Samples - 2013 Biopiles

Location:			UTA-9-2				UTA-10-2					
Sample ID:			14391-D	14392-D	14393-D	14406-C	14157-C	14394-D	14395-D	14396-D	14397-D	14407-C
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	7/30/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm)[d]:			-	-	-	-	80	-	-	-	-	-
Moisture			8.4	8.1	9.2	9	6.1	8.9	9.2	8.6	8.9	7.9
Accutest File #			1318565	1318565	1318565	1318565	1316853	1318565	1318565	1318565	1318565	1318565
Parameter	**Units**	**SQRO**	**Analytical Results**									
Extractable Hydrocarbons[a]												
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700										
F2 (C10-C16) surface[b,c]	µg/g	260	**550**	**420**	**540**	**340**	**470**	**280**	230	220	130	160
F2 (C10-C16) subsoil[b,c]	µg/g	1000										
F3 (C10-C16) surface[b,c]	µg/g	1700	30	40	20	<20	40	<20	<20	<20	40	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500										
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000										

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 5: Remediation Confirmation Soil Samples

Location:			Excavation Limits of Area 1						Excavation Limits of Area 3		
Sample ID:			14414-F-C	14415-F-C	14416-F-C	14417-W-C	14418-W-C	14430-F-C	14419-W-C	14420-W-C	14421-W-C
Sample Date:			8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/20/2013	8/22/2013	8/20/2013	8/20/2013	8/20/2013
Sample Depth (m):			0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Field Screen (ppm)[d]:			-	-	-	-	-	-	-	-	-
Moisture			9.7	5.1	7.8	6.3	5.7	6	8.1	4.5	5.5
Accutest File #			1318568	1318568	1318568	1318568	1318568	1318568	1318568	1318568	1318568[e]
Parameter	**Units**	**SQRO**	**Analytical Results**								
Extractable Hydrocarbons[a]											
F1 (C6-C10) surface[b,c]	µg/g	320	-	-	-	-	-	-	-	-	**480**
F1 (C6-C10) subsoil[b,c]	µg/g	700									
F2 (C10-C16) surface[b,c]	µg/g	260	10	<10	20	100	<10	70	**370**	80	**6450**
F2 (C10-C16) subsoil[b,c]	µg/g	1000									
F3 (C10-C16) surface[b,c]	µg/g	1700	<20	<20	<20	<20	<20	<20	<20	<20	150
F3 (C16-C34) subsoil[b,c]	µg/g	3500									
F4 (C34-C50) surface[b,c]	µg/g	3300	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000									

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

e) Analysis for F1 requested after receipt of F2-F4 results. Results reported on Accutest File #1319729

Table 5: Remediation Confirmation Soil Samples

Location:			Excavation Limits of Area 4							
Sample ID:			14422-F-C	14423-F-C	14424-F-C	14425-F-C	14426-W-C	14427-W-C	14428-W-C	14429-W-C
Sample Date:			8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013
Sample Depth (m):			1.6	1.6	1.6	1.6	1.3	1.3	1.3	1.3
Field Screen (ppm)[d]:			-	-	-	-	-	-	-	-
Moisture			8.2	10.6	27	9.5	5.6	6.7	7	5.9
Accutest File #			1318569	1318569	1318569	1318569	1318569	1318569	1318569	1318569
Parameter	**Units**	**SQRO**	**Analytical Results**							
Extractable Hydrocarbons[a]										
F1 (C6-C10) surface[b,c]	µg/g	320					-	-	-	-
F1 (C6-C10) subsoil[b,c]	µg/g	700	-	-	-	-				
F2 (C10-C16) surface[b,c]	µg/g	260					20	240	**620**	<10
F2 (C10-C16) subsoil[b,c]	µg/g	1000	50	160	290	120				
F3 (C10-C16) surface[b,c]	µg/g	1700					<20	<20	60	<20
F3 (C16-C34) subsoil[b,c]	µg/g	3500	40	140	<20	<20				
F4 (C34-C50) surface[b,c]	µg/g	3300					<20	<20	<20	<20
F4 (C34-C50) subsoil[b,c]	µg/g	10000	<20	<20	<20	<20				

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Petroleum Hydrocarbon Canada-Wide Standards (PHC CWS). The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

b) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

c) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

d) Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				Stockpile in former secondary containment				LTA-5				UTA-3			
Screened or Unscreened:				Screened				Screened				Unscreened			
Sample Parent:				**13024-C**				**13155-C**				**13161-C**			
Sample ID:				13024-C	13024-C	13024-C	13024-C	13155-C	13155-C	13155-C	13155-C	13161-C	13161-C	13161-C	13161-C
Duplicate ID:				13011-D	13012-D	13013-D	13025-Q	13039-D	13040-D	13041-D	13158-Q	13059-D	13060-D	13062-D	13162-Q
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	120	120	120	120	480	480	480	480	440	440	440	440
Duplicate Result	ug/g	20	100	90	100	120	110	160	340	1040	420	590	730	960	550
RpD	**%**			*na*	18%	0%	9%	**100%**	34%	**74%**	13%	29%	**50%**	**74%**	22%
PHC Fraction 3															
Sample Result	ug/g	20	100	20	20	20	20	50	50	50	50	50	50	50	50
Duplicate Result	ug/g	20	100	20	20	30	20	30	40	100	40	90	70	100	80
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				UTA-3				UTA-8				LTA-3			
Screened or Unscreened:				Unscreened				Screened				Unscreened			
Sample Parent:				13693-C			13690-D	13727-C				13757-C			
Sample ID:				13693-C	13693-C	13693-C	13690-D	13727-C	13727-C	13727-C	13727-C	13757-C	13757-C	13757-C	13757-C
Duplicate ID:				13687-D	13689-D	13690-D	13694-Q	13711-D	13712-D	13714-D	13728-Q	13739-D	13741-D	13742-D	13758-Q
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	550	550	550	1220	710	710	710	710	710	710	710	710
Duplicate Result	ug/g	20	100	420	620	1220	860	720	500	650	570	760	100	380	540
RpD	**%**			27%	12%	**76%**	35%	1%	35%	9%	22%	7%	**151%**	**61%**	27%
PHC Fraction 3															
Sample Result	ug/g	20	100	70	70	70	120	60	60	60	60	80	80	80	80
Duplicate Result	ug/g	20	100	60	80	120	110	50	40	80	40	80	40	50	60
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				Soil adhereing to oversized rock on pad					Soil removed from treatment cells on pad						
Screened or Unscreened:				Screened					Various						
Sample Parent:				**14020-C**					**14148-C**	**14154-C**	**14158-C**	**14310-D**	**14323-C**	**14324-C**	**14325-C**
Sample ID:				14020-C	14020-C	14020-C	14020-C	14020-C	14148-C	14154-C	14158-C	14310-D	14323-C	14324-C	14325-C
Duplicate ID:				13995-D	13996-D	13998-D	13999-D	14021-Q	14148DUP-D	14154DUP-D	14158DUP-D	14310DUP-D	14301-D	14305-D	14310-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	530	530	530	530	530	1000	410	550	240	360	310	350
Duplicate Result	ug/g	20	100	380	300	610	550	470	970	370	540	230	140	250	240
RpD	**%**			33%	**55%**	14%	4%	12%	3%	10%	2%	4%	**88%**	21%	37%
PHC Fraction 3															
Sample Result	ug/g	20	100	100	100	100	100	100	70	<20	120	<20	90	30	90
Duplicate Result	ug/g	20	100	70	70	80	80	70	80	50	90	40	20	50	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				LTA-1-2				LTA-2-2				LTA-3-2			
Screened or Unscreened:				Screened				Screened				Screened			
Sample Parent:				**14352-C**				**14353-C**				**14354-C**			
Sample ID:				14352-C	14352-C	14352-C	14352-C	14353-C	14353-C	14353-C	14353-C	14354-C	14354-C	14354-C	14354-C
Duplicate ID:				14328-D	14329-D	14330-D	14331-D	14332-D	14333-D	14334-D	14335-D	14336-D	14337-D	14338-D	14339-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	440	440	440	440	440	440	440	440	420	420	420	420
Duplicate Result	ug/g	20	100	470	410	400	410	430	500	460	410	320	390	360	430
RpD	**%**			7%	7%	10%	7%	2%	13%	4%	7%	27%	7%	15%	2%
PHC Fraction 3															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	30	<20	<20	<20	<20	20	30	30	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				LTA-4-2				LTA-5-2				LTA-6-2			
Screened or Unscreened:				Screened				Screened				Screened			
Sample Parent:				**14355-C**				**14356-C**				**14357-C**			
Sample ID:				14355-C	14355-C	14355-C	14355-C	14356-C	14356-C	14356-C	14356-C	14357-C	14357-C	14357-C	14357-C
Duplicate ID:				14340-D	14341-D	14342-D	14343-D	14344-D	14345-D	14346-D	14347-D	14348-D	14349-D	14350-D	14351-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	280	280	280	280	340	340	340	340	320	320	320	320
Duplicate Result	ug/g	20	100	170	250	240	240	320	440	350	500	220	310	310	370
RpD	**%**			49%	11%	15%	15%	6%	26%	3%	38%	37%	3%	3%	14%
PHC Fraction 3															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	30	30	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				UTA-1-2				UTA-2-2				UTA-3-2			
Screened or Unscreened:				Screened				Screened				Screened			
Sample Parent:				**14398-C**				**14399-C**				**14400-C**			
Sample ID:				14398-C	14398-C	14398-C	14398-C	14399-C	14399-C	14399-C	14399-C	14400-C	14400-C	14400-C	14400-C
Duplicate ID:				14358-D	14359-D	14360-D	14361-D	14362-D	14363-D	14364-D	14365-D	14366-D	14367-D	14368-D	14369-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	400	400	400	400	460	460	460	460	610	610	610	610
Duplicate Result	ug/g	20	100	400	330	400	430	390	480	420	590	530	760	900	500
RpD	**%**			0%	19%	0%	7%	16%	4%	9%	25%	14%	22%	38%	20%
PHC Fraction 3															
Sample Result	ug/g	20	100	<20	<20	<20	<20	30	30	30	30	40	40	40	40
Duplicate Result	ug/g	20	100	20	<20	<20	40	30	40	420	50	30	50	80	30
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				UTA-4-2				UTA-5-2				UTA-6-2			
Screened or Unscreened:				Screened				Screened				Screened			
Sample Parent:				14401-C				14402-C				14403-C			
Sample ID:				14401-C	14401-C	14401-C	14401-C	14402-C	14402-C	14402-C	14402-C	14403-C	14403-C	14403-C	14403-C
Duplicate ID:				14370-D	14371-D	14372-D	14373-D	14374-D	14375-D	14376-D	14377-D	14378-D	14379-D	14380-D	14381-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	380	380	380	380	610	610	610	610	430	430	430	430
Duplicate Result	ug/g	20	100	690	370	470	440	510	360	740	600	460	310	340	370
RpD	**%**			**58%**	3%	21%	15%	18%	**52%**	19%	2%	7%	32%	23%	15%
PHC Fraction 3															
Sample Result	ug/g	20	100	20	20	20	20	40	40	40	40	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	80	40	30	50	<20	70	40	110	40	30	<20	60
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				UTA-7-2				UTA-8-2				UTA-9-2			
Screened or Unscreened:				Screened				Screened				Screened			
Sample Parent:				**14404-C**				**14405-C**				**14406-C**			
Sample ID:				14404-C	14404-C	14404-C	14404-C	14405-C	14405-C	14405-C	14405-C	14406-C	14406-C	14406-C	14406-C
Duplicate ID:				14382-D	14383-D	14384-D	14385-D	14386-D	14387-D	14388-D	14389-D	14390-D	14391-D	14392-D	14393-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**											
PHC Fraction 2															
Sample Result	ug/g	20	100	370	370	370	370	420	420	420	420	340	340	340	340
Duplicate Result	ug/g	20	100	470	530	390	380	490	580	420	450	250	550	420	540
RpD	**%**			24%	36%	5%	3%	15%	32%	0%	7%	31%	47%	21%	45%
PHC Fraction 3															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	40	60	40	70	<20	40	<20	30	40	20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
PHC Fraction 4															
Sample Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				UTA-10-2			
Screened or Unscreened:				Screened			
Sample Parent:				**14407-C**			
Sample ID:				14407-C	14407-C	14407-C	14407-C
Duplicate ID:				14394-D	14395-D	14396-D	14397-D
Parameter	**Units**	**MRL**	**PQL**	**Analytical Results**			
PHC Fraction 2							
Sample Result	ug/g	20	100	160	160	160	160
Duplicate Result	ug/g	20	100	280	230	220	130
RpD	**%**			**55%**	36%	32%	21%
PHC Fraction 3							
Sample Result	ug/g	20	100	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	40
RpD	**%**			*na*	*na*	*na*	*na*
PHC Fraction 4							
Sample Result	ug/g	20	100	<20	<20	<20	<20
Duplicate Result	ug/g	20	100	<20	<20	<20	<20
RpD	**%**			*na*	*na*	*na*	*na*

Bold *RpD Value is greater than or equal to 50% and the concentrations of both samples are greater than the PQL.*

Notes:

na RpD value is not applicable because one or both results are less than the PQL.

*RpD Relative Percent Difference = (Difference/Average)*100.*

*PQL Practical Quantitation Limit = 5 * Method Reporting Limit (MRL).*

MRL Method Reporting Limit of analysis.

Appendix A: Photographic Record

Photo 1: Excavation of Area 1 commenced in the north berm.

Photo 2: Excavation of Area 1, looking south.

Photo 3: Excavation of Area 4 proceeded with the removal of an overlying layer of non PHC contaminated soil. Frozen ground restricted the risk of excavating into the underlying contaminated soil.

Photo 4: Samples were collected along the walls and at the base of the excavation at Area 4.

Photo 5: Rock rejected by vibrating screener.

Photo 6: Soil passing through the vibrating screener.

Photo 7: Rock relocated to the north laydown yard surrounding unscreened stockpile of soil removed from Area 4.

Photo 8: Rock relocated to prepared area of pad for drying in July.

Photo 9: North laydown yard.

Photo 10: Preparation of the concrete pad for temporary storage of PHC contaminated soil. Soil was removed from the cracks.

Photo 11: Preparation of the concrete pad for temporary storage of PHC contaminated soil. Cracks were sealed and a sump established

Photo 12: Preparation of the concrete pad for temporary storage of PHC contaminated soil. Berms were placed to divert surface water from the prepared area.

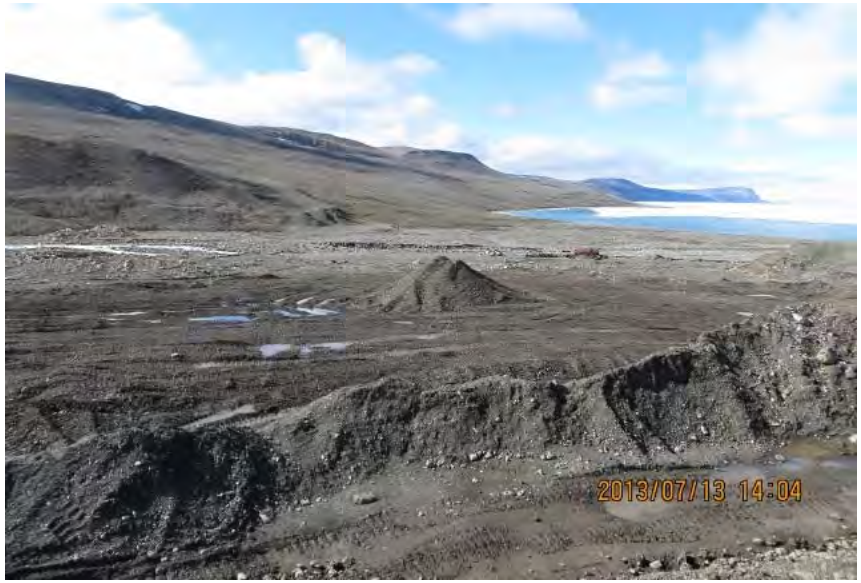

Photo 13: Stockpile of screened fine soil in former secondary containment area. Soil stockpiled here in 2012 was levelled off.

Photo 14: Stockpiles of screened fine PHC contaminated soil on right and excavation and screening plant in Area 1 on left.

Photo 15: Stockpile of screened fine PHC contaminated soil on right and biopiles being removed from the lower treatment area on left.

Photo 16: Part of the stockpile of screened fine PHC contaminated soil being relocated to the upper and lower treatment area.

Photo 17: Biopiles from the upper and lower treatment area are relocated to the prepared area of the pad. The remaining stockpile of rock is in front of the truck.

Photo 18: Aeration of a biopile in the upper treatment area.

Photo 19: Moisture monitoring the biopiles.

Photo 20: Apply water to the biopiles during an extended dry spell.

Appendix B: Biopile Remediation Performance Monitoring Memo

WESA™

a BluMetric™ company

MEMORANDUM

DATE: November 14, 2013
TO: Arlene Laudrum, SRK
FROM: Jos van Straaten and Wayne Ingham,
WESA, a division of BluMetric Environmental Inc.
WESA FILE #: YB9977-13-00
RE: Nanisivik 2013 Bioremediation Performance Monitoring

As per your request, WESA, a division of BluMetric Environmental Inc. has prepared the following memo; presenting an assessment of the bioremediation performance indicators measured in 2013 at the Nanisivik former tank farm facility. This assessment is based on analytical data and summary of field activities received from SRK. It is understood that samples were collected by SRK and their representatives during the 2013 field program.

Monitored bioremediation performance indicators include: petroleum hydrocarbon (PHC) concentrations (fractions F2, F3, and F4), moisture contents, nutrient concentrations (TKN & TP), and numbers of hydrocarbon degrading bacteria in sampled soils.

BIOPILES CONSTRUCTED IN 2011 & 2012

It is understood that the original 8 biopiles constructed in 2011 and the 8 biopiles constructed in 2012 were offloaded during the 2013 field season. Soil samples collected from these biopiles in June and July 2013 identify an average reduction in total petroleum hydrocarbon (TPH) concentration of 35% compared with the 2012 end of season results, although the rate of remediation has slowed somewhat when compared to reductions reported for the 2012 field season. With the exception of UTA-5, sampled soils from all other biopiles reported TPH concentrations less than 1000 mg/kg before being offloaded. All biopiles reported PHC F2 concentrations greater than the cleanup criteria of 260 mg/kg. Figure 1 illustrates the trend over time.

Biopiles that were constructed in August 2012 with screened fines generally show the greatest reductions in TPH concentrations from end of 2012 field season to their final reading in 2013.

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Soil moisture contents were generally higher in the reported 2013 results when compared to the 2012 end of season results. This may be partially attributed to closer monitoring of soil moisture content in the field and application of supplementary water during extended periods of dry weather. The modified soil sampling procedure in 2013 may also influence the reported difference in the soil moisture content.

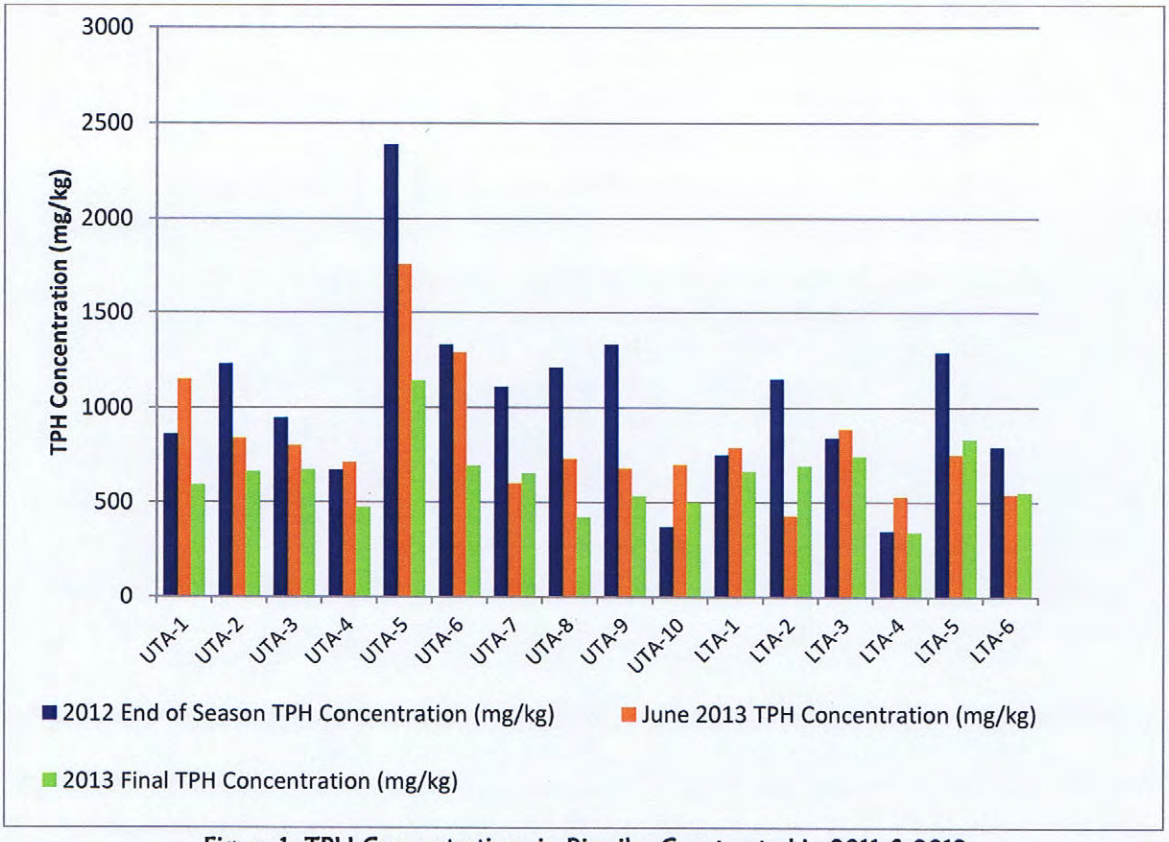

Figure 1: TPH Concentrations in Biopiles Constructed in 2011 & 2012

Nitrogen and phosphorus concentrations show reductions from 2012 (post nutrient amendment) to June 2013; expected to be the result of bacteria metabolization and reproduction. Soil nutrient concentrations reported in 2013 are considered to be sufficient for ongoing bioremediation processes.

Hydrocarbonoclastes numbers are more than one order of magnitude higher than the reported results from 2011 and 2012 field seasons; with values greater than 10 million (10^7) cfu/g; confirming that the populations of hydrocarbon degrading bacteria are thriving.

New Biopiles Constructed in 2013

It is understood that 16 new biopiles were constructed in 2013 (reloading the treatment cells which were offloaded) with screened fines and nutrient amendments applied to each biopile within 4 days after their construction.

Analytical results from soils sampled at the end of the 2013 field season show an average 35% reduction in TPH concentrations when compared to the analyses from the initial samples collected upon biopiles construction. The following graph (Figure 2) illustrates the trend in decreasing TPH concentrations.

Soil moisture contents were reported to be higher in the final samples compared to the initial samples collected in 2013. Again, this may be attributed to closer monitoring of soil moisture content in the field and application of supplementary water during extended periods of dry weather to maintain soil moisture concentrations above 5%. It is understood that 2,000 litres of water was applied per day to all 16 biopiles (approximately 125 L/biopile/d) over the course of one week in August.

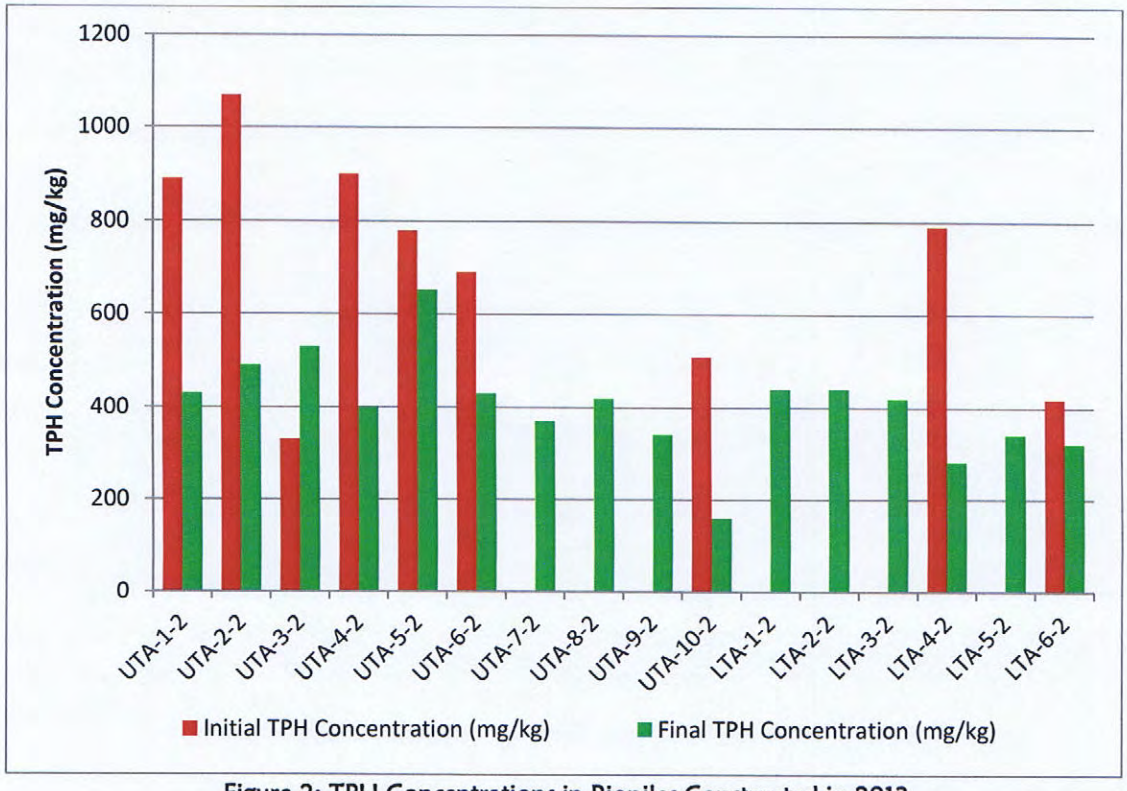

Figure 2: TPH Concentrations in Biopiles Constructed in 2013

Soil nutrient concentrations reported in 2013 are considered to be sufficient for ongoing bioremediation processes. In fact, nutrient amendments applied to the new biopiles at time of their construction are on average twice the design C:N:P ratio. Note that excessive nutrient application may negatively impact the soil bacteria.

All end of season reported Hydrocarbonoclastes values are greater than 48 million ($4.8x10^7$) cfu/g; confirming that the populations of hydrocarbon degrading bacteria are thriving.

Conclusions & Recommendations

Based on our assessment of the bioremediation performance indicators measured in 2013 at the Nanisivik former tank farm facility, the following conclusions and recommendations can be made:

- The rate of PHC bioremediation observed in new biopiles constructed in 2013 is greater than the rate observed in the original biopiles constructed in 2011 and 2012; likely attributed to the lower initial PHC concentrations, mechanical screening of the material prior to loading, existence of established microbial colonies, early application of nutrients and improved soil moisture management.
- Nutrient amendments applied in 2013 have shown positive results in promoting microbial activity necessary for bioremediation of the hydrocarbon contaminants. No additional nutrient amendment applications are anticipated in 2014 for the established biopiles.
- Ongoing laboratory analyses of soil PHC concentrations are required to monitor the remediation progress and confirm when the soil quality meets the established clean up criteria. Three sampling events are proposed: once each in early June, mid-July, and end of August 2014. Soils yet to be remediated should also be analysed for BTEX, PHC fraction F1, pH, TKN, TP and Hydrocarbonoclastes.
- It is recommended that during the 2014 field season the biopiles continue to be aerated once every four days, as practicable.
- Continue with weekly field measurements of soil moisture content in 2014. In the event that soil moisture content is measured to be below 5% and no precipitation is forecast, the site supervisor is to coordinate and oversee the addition of supplementary water to the biopiles.

CLOSING

The conclusions presented in this report represent our professional opinion and are based upon the work described in this memo and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

WESA makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

This report has been prepared for SRK. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from WESA in writing. WESA accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.