APPENDIX I

Soil Sampling, Contaminated Soil Stockpile, Wabush Airport, Wabush, NL

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1.0 INTRODUCTION

Acting at the request of Public Works and Government Service Canada (PWGSC) on behalf of Transport Canada (TC), Stantec Consulting Ltd. (Stantec) has carried out soil sampling of the contaminated soil stockpile located at the Fire Training Area (FTA) at the Wabush Airport, Wabush, Newfoundland and Labrador (NL). The purpose of this sampling program was to monitor the concentrations of total petroleum hydrocarbons (TPH) in the soil stockpile and to mechanically turn (*i.e.,* mix) the soil stockpile to promote further natural attenuation of TPH in soil removed from the Combined Services Building (CSB) in 2005.

1.1 Site Description

The Wabush Airport is located 3.2 km from the Town of Wabush in Labrador. TC operates and maintains the Wabush Airport infrastructure. The airport was constructed in 1961 by Northern Airport Ltd. (a joint venture of Wabush Mines Limited and the Iron Ore Company of Canada) on previously undeveloped land. TC took over ownership and operation of the airport in 1973. The property was transferred to the Department of Transportation on May 13, 1978 from Wabush Iron Co. Ltd., The Steel Company of Canada Ltd. and Dominion Foundries and Steel Ltd.

The soil stockpile is located at the FTA site, which lies on the north side of the Wabush Airport (see Drawing No. 121412845-EE-02). The FTA is bordered by portions of the Wabush Airport to the north, south, east and west. Taxiway A is located to the east of the FTA and the CBS and Air Terminal Building (ATB) are located to the south. Undeveloped portions of the airport are present to the north and west of the site. The FTA site is enclosed within a chain link fence that surrounds the airport and access to the soil stockpile/FTA site is via a road north of the CSB. The site layout is shown on Drawing Nos. 121412845-EE-02 and -03.

The soil stockpile is located on a relatively level engineered knoll, approximately 7 m to 9 m above the surrounding land. Ground surfaces of the site consist predominantly of sand and grass cover with shrubs and trees. Stormwater is anticipated to drain by infiltration and/or overland flow. A north flowing stream is located east-northeast of the soil stockpile and FTA site, which flows towards Wabush Lake.

Based on an available topographic map and the observed site topography, regional surface drainage (anticipated shallow groundwater flow direction) appears to be to the east and northeast towards the Wabush Lake. Based on available surficial geology maps, the native surficial soils at the site likely consist of sand directly overlying bedrock.

1.2 Previous Site Investigations

Site Remediation and Confirmatory Soil Sampling – Jacques Whitford Ltd., 2005

In 2005, Jacques Whitford Ltd. carried out petroleum hydrocarbon impacted soil remediation and confirmatory soil sampling at the CSB site at the Wabush Airport, Wabush, NL. TC required that impacted soil be removed from the CSB site to an established remedial objective of 6,000 mg/kg. This remedial objective was established by TC in consideration with future land use. TC further required that the excavated soil be transported to the nearby FTA, stockpiled on a liner and covered for later treatment and/or disposal.

A total of 1,100 tonnes of petroleum hydrocarbon impacted soil was removed from the excavated area adjacent the CSB and temporarily stockpiled at an area located on the southwest corner of the FTA. An Enviro Liner 20 measuring 20 m x 20 m and with a thickness of 20 mil (0.5 mm) was used to line the bottom of the temporary containment cell. The edges of the enviro liner were folded back and a berm was constructed to a height of 0.45 m. The liner was stretched over the berm and the edge of the liner was covered with sand. The stockpile was covered with a plastic tarp with the edges of the tarp secured with sand from the site to prevent dislodging during the winter. Based on analytical data, additional remedial work was not required at the CSB site. Furthermore, Jacques Whitford Ltd. recommended that if the stockpiled soil is to be left at the site on a long term basis, the constructed stockpile must be maintained and additional sampling of the stockpile for TPH and benzene, toluene, ethylbenzene and xylenes (BTEX) be conducted on an annual basis. Prior to the soil being removed from the site and transported to another site (landfill or treatment facility) confirmatory sampling would be required.

Sampling of Contaminated Soil Stockpile – Jacques Whitford Ltd., 2006

Site sampling of the contaminated stockpile was carried out between September 11 and September 13, 2006 by an environmental technician from Jacques Whitford Ltd. The site investigation included ten (10) sampling locations (Top-1, Top-2, Corner-3, Corner-4, Corner-5, Corner-6, BS7, BS8, BS9 and BS10) and one (1) duplicate sample BS11. The samples were collected to depths between 0.8 m and 1.6 m.

Analytical results indicated that TPH concentrations in the soil samples ranged from 54 mg/kg at Top-1 to 1,500 mg/kg at Corner-3. The laboratory analytical results indicated that the products impacting soil samples primarily resembled the gasoline fraction and the fuel oil range. Eight (8) of the eleven (11) soil samples (Top-2, Corner-3, Corner-4, Corner-5, Corner-6, BS-7, BS-9 and BS-10) had TPH concentrations exceeding the Tier I RBSL for a commercial site with non-potable groundwater and coarse grained soil and gasoline impacts applicable at the time of the study (*i.e.*, 450 mg/kg). In addition, five (5) soil samples (Top-2, Corner-3, Corner-5, Corner-6 and BS-9) exceeded the Newfoundland and Labrador Department of Environment and Conservation (NLDEC) guidelines for disposal in a landfill (*i.e.*, 1,000 mg/kg). None of the detectable concentrations of BTEX parameters exceeded the applicable RBCA Tier I RBSL for a commercial site with non-potable groundwater and coarse grained soil.

Ex-Situ Remediation of Contaminated Soil Stockpile – Minaskuat - Jacques Whitford Ltd. Partnership, 2007

In June 2007, Minaskuat - Jacques Whitford Ltd. carried out *ex-situ* remediation on the contaminated soil stockpile located on the FTA site. The site investigation included: removing the tarp cover, partially dismantling and temporary relocating the upper half of the soil stockpile, aeration (*i.e.*, agitation) and addition of soil amendments to both halves of the soil stockpile, transferring contaminated soil in the temporary lay-down area back to the subject stockpile and placement of a new tarp cover.

Sampling of Contaminated Soil Stockpile at Wabush Airport – CBCL Ltd., 2009

In July 2009, CBCL Ltd. was retained by TC to conduct a soil sampling program at the contaminated soil stockpile. Four (4) soil samples were collected one (1) metre into the pile from each corner of the stockpile. Four (4) other samples were taken ten (10) metres from each corner, in the center of each side of the pile. Two (2) soil samples were taken on top of the pile equal distance from each side.

Analytical results indicated that TPH concentrations in the soil samples ranged from 190 mg/kg at SA-5 to 2,000 mg/kg at SA-1. Nine (9) of the ten (10) samples collected (SA-1, SA-2, SA-3, SA-4, SA-6, SA-7, SA-8, SA-9 and SA-10) exceeded the Tier I RBSL of 450 mg/kg applicable at the time of the study. In addition, five (5) of the ten (10) samples collected (SA-1, SA-2, SA3, SA-4 and SA-7) exceeded the NLDEC guideline for disposal in a landfill of 1,000 mg/kg. None of the detectable concentrations of BTEX parameters exceeded the applicable RBCA Tier I RBSL for a commercial site with non-potable groundwater and coarse grained soil.

In general, concentrations of TPH detected in soil samples decreased from the 2006 to 2009 sampling events.

Soil Sampling, Contaminated Soil Stockpile – Stantec Consulting Ltd., 2010

In October 2010, Stantec was retained by TC to conduct a soil sampling program at the contaminated soil stockpile. A total of eleven (11) soil samples (Top-1, Top-2, Corner-3, Corner-4, Corner-5, Corner-6, BS-7, BS-8, BS-9, BS-10 and Top-1-Dup) were collected from the contaminated soil stockpile during the site investigation.

TPH was detected in all eleven (11) soil samples collected, with concentrations ranging from 490 mg/kg in soil sample BS9 to 3,300 mg/kg Top-1. The laboratory analytical reports indicated that the products impacting the soil samples resembled the gasoline fraction and/or the weathered fuel oil fraction. All eleven (11) soil samples analysed had TPH concentrations that exceeded the Tier I RBSL for a commercial site with non-potable groundwater and coarse grained soil and gasoline impacts applicable at the time of the study (450 mg/kg). In addition, seven (7) of the soil samples (Top-1, Top-1-Dup, Top-2, Corner-4, Corner-5, BS7 and BS10) also exceeded the NLDEC guideline for disposal in a landfill (1,000 mg/kg).

Following the collection of soil samples on September 30, 2010, the entire soil stockpile was turned using an excavator and operator provided by Allard's Construction. Care was taken to compact the soil stockpile to its original compaction and shape and to ensure that the side slopes were properly maintained. During stockpile turning activities, a strong hydrocarbon odour was noted, particularly near the bottom of the soil stockpile. Following stockpile turning, the tarp was replaced and the tires were secured on top of the stockpile.

In general, the concentration of TPH in soil samples appeared to remain the same as in previous investigations, or slightly greater.

Based on the remaining petroleum hydrocarbon impacts in the soil stockpile, Stantec reviewed three (3) options for managing the contaminated soil stockpile, which included: 1) continue to monitor the petroleum hydrocarbon concentrations in the soil stockpile annually and turn the soil stockpile after each round of sampling; 2) contract a soil treatment company to provide on-site biotreatment of the remaining petroleum hydrocarbons in the soil stockpile; and 3) remove and transport the soil from the stockpile to an approved soil treatment facility. Based on analytical results and soil management advantages/limitations, Stantec recommended completing Option # 1 - continued monitoring and stockpile turning.

1.3 Scope of Work

The scope of work of the soil sampling program for the contaminated soil stockpile as per the project's Terms of Reference (TOR) are summarized as follows:

- Conduct a sampling program to sample and analyze petroleum hydrocarbon impacted soil from the stockpile as well as mechanically till/aerate the soil stockpile located at the FFA.
- Compare the laboratory analytical results to disposal criteria and/or the applicable guidelines for future land use at the site (*i.e.*, Atlantic RBCA and NLDEC disposal guidelines).
- Identify stockpile disposal options and/or provide recommendations for incorporation on the site.
- Submit a report detailing the findings of the soil sampling and stockpile turning program carried out on the FTA site.

2.0 REGULATORY FRAMEWORK

The Newfoundland and Labrador Department of Environment and Conservation (NLDEC) released soil and groundwater remediation guidelines on February 22, 2005 under Department Policy Document PPD05-01. These criteria are outlined in the *Guidance Document for the Management of Impacted Sites, Version 1.01* (September 2005). This guidance document is based on a tiered, risk-based approach to site management, and replaces the former Department Policy Document PPD-97-01 Cleanup of Contaminated Sites Criteria

(December 1997), which referenced provincial and Canadian Council of Ministers of the Environment (CCME) numerical guidelines for soil and groundwater quality based on specific land and groundwater uses. Protocols outlined in the NLDEC Department Policy Document PPD05-01 were fully implemented by the Province of Newfoundland and Labrador on May 16, 2005.

For petroleum hydrocarbons in soil the NLDEC guidance document recommends the current version of the Atlantic RBCA (Risk-Based Corrective Action) guidance (Version 3.0 User Guidance Document, July 2012).

Human Health Screening

The Atlantic RBCA guidance document contains risk-based screening levels (RBSLs) for evaluating human exposure to sites impacted with total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylenes (BTEX). These guidelines are contained in "Tier I RBSL Tables" that are based on default conditions for typical sites and exposure pathways and are classified by receptor characteristics, groundwater usage, and soil type. In addition, the TPH guidelines are dependent on the nature of the hydrocarbon type (*i.e.*, the guidelines vary for gasoline, fuel oil and lube oil).

If site concentrations exceed the Tier I RBSLs, the site may be remediated to the Tier I RBSLs or a Tier II human health risk assessment may be completed to determine more appropriate clean-up levels. A Tier II human health risk assessment may include comparison of the site concentrations to the Tier II Pathway-Specific Screening Level (PSSL) tables or development of Site-Specific Target Levels (SSTLs) using the Atlantic RBCA Toolkit Version 3.22. PSSLs are only appropriate for sites where the exposure pathways assumed in the Tier I RBSL tables are not complete (*e.g.*, if a property has no building on-site, there would be no potential for on-site indoor air exposure).

Users of the Tier I RBSLs or Tier II PSSLs are required to ensure that site conditions are compatible with the default site conditions used to generate the screening guidelines. If significant differences exist, the site should be evaluated using a site-specific risk assessment approach. The Site Assessment and Tier I/II checklist is presented in Appendix C. The Site Assessment and Tier I/II Checklist presented in Appendix C indicates that the human health Tier I RBSLs for gasoline at a commercial site with non-potable groundwater and coarse grained soil are applicable for the subject site. It should be noted that preliminary site assessments, subsurface investigations and remediation completed on the site prior to August 1, 2012 were compared to Version 2.0 of the Atlantic RBCA User Guidance Document.

Ecological Screening

The current version of the Atlantic RBCA guidance document (Version 3.0, July 2012) includes an Ecological Screening Protocol for Petroleum Impacted Sites in Atlantic Canada. While the RBSLs, the PSSLs and the Atlantic RBCA Toolkit assess risks to human health, the goal of the Ecological Screening Protocol is to assess potential risks to the environment (specifically ecological

receptors). While this protocol is not an ecological risk assessment, the protocol provides a decision making framework that will result in one of the following three (3) conclusions:

- The site does not pose a risk to ecological receptors/habitat and no further action is necessary related to the environment;
- The site should be remediated to Tier I ecological screening levels (ESLs); or,
- The site should undergo further assessment in terms of quantifying ecological risks at the site (*e.g.*, further delineation, quantitative ecological risk assessment, *etc.*).

The three (3) parts of the ecological screening protocol are:

- Part I: Identification of petroleum hydrocarbon hazards in site media or site-influenced media;
- Part II: Identification of habitat and ecological receptors on or near a site; and,
- Part III: Identification of exposure pathways by which ecological receptors could come into contact with site petroleum hydrocarbons.

Landfill facilities in NL typically do not accept soil with concentrations of chemical parameters in exceedance of the CCME Guidelines Canadian Soil Quality Guidelines (CSQGs) for an industrial site for BTEX and 1,000 mg/kg for TPH. As such, soil samples collected from the stockpile were compared to the NLDEC guidelines for disposal in a landfill and the generic CCME CSQGs for an industrial site in the event that soil is removed off-site for disposal. Soil acceptance is however ultimately at the discretion of the landfill operator. The latest update of the CCME CSQGs was obtained on-line at http://cegg-rcge.ccme.ca/. Contaminated soil with TPH concentrations greater than 1,000 mg/kg require disposal at a licensed soil treatment facility.

3.0 DESCRIPTION OF SITE WORK

3.1 Tarp Removal

On October 21, 2013 Stantec personnel were on site to remove the tarp that covers the contaminated soil stockpile. Several rips and tears were present on the tarp when Stantec personnel arrived on-site. With the aid of a labourer from Big Land Solutions of Wabush, NL and an excavator operator from Dexter Mining Inc. of Wabush, NL, the tires used to secure the tarp were removed and the tarp was pulled off the soil stockpile and laid to the west of the pile during sampling activities. Care was taken to avoid further ripping/tearing the tarp during removal.

Based on a visual inspection of the soil stockpile, the berm surrounding the stockpile has weathered and decreased in size over time. The likely cause is suspected to be the result of

wind and snow cover in addition to previous soil turning events (see photographs 1, 2, 5, and 6 in Appendix B).

3.2 Soil Sampling

Soil sampling of the contaminated stockpile was carried out on October 21, 2013. Soil samples were collected from eleven (11) locations (*i.e.*, SS1 to SS8, and SS10 to SS12). In addition, one (1) field duplicate sample of SS8 (labeled SS9) was collected. The sample locations were selected by TC in 2006 and are shown on Drawing No. 121412845-EE-03 provided in Appendix A.

Soil samples were collected from each sample location within the stockpile using a hand driven split-spoon apparatus. Each split-spoon was driven to a depth of approximately 1.4 m to 1.6 m with the aid of a track mounted excavator provide by Dexter Mining Inc. Soil samples were visually examined in the field for any evidence of petroleum hydrocarbon impacts. The samples were placed in clean glass jars with aluminum foil under the lids of duplicate samples. Head space soil vapour concentrations were measured in the sample jars using a MiniRAE 2000 photoionization detector (PID). Based on the measured soil vapor concentrations and field observations, select soil samples were placed on ice in sample coolers and sent directly to Maxxam Analytics in St. John's, NL for analysis of BTEX and TPH by the Atlantic PIRI protocol. Analytical results of the soil samples collected during this investigation are presented in Table D.1, Appendix D.

3.3 Stockpile Turning

Following the collection of soil samples, on October 22, 2013 the entire soil stockpile was turned using an excavator and operator provided by Dexter Mining Inc. Care was taken to compact the soil stockpile to its initial compaction and shape and to ensure that the side slopes were properly maintained.

During stockpile turning activities, a moderate to strong hydrocarbon odour was noted, particularly near the bottom of the soil stockpile. Following completion of the stockpile turning, the tarp was replaced and the tires were secured on top of the stockpile (see photograph 9 in Appendix B).

4.0 ANALYTICAL RESULTS

Petroleum hydrocarbon analysis was conducted on eleven (11) soil samples (SS1 to SS11) collected from the contaminated soil stockpile during the site investigation, and one (1) laboratory duplicate sample (SS5 Lab-Dup). All eleven (11) soil samples were submitted to Maxxam Analytics in St. John's, NL for analysis of petroleum hydrocarbons (*i.e.*, TPH and BTEX) by the Atlantic PIRI protocol. The locations of soil samples are shown on Drawing No. 121412845-EE-03 in Appendix A. Results of the laboratory analysis for petroleum hydrocarbons in soil collected during this investigation as well as previous investigations are summarized in Tables D.1 and D.2 in

Appendix D, respectively. The Maxxam Analytics Laboratory certificates for the current investigation are provided in Appendix E.

Concentrations of modified TPH were detected in all eleven (11) soil samples at concentrations ranging from 73 mg/kg in SS11 to 1,900 mg/kg in SS6. The laboratory analytical results indicated that the products impacting soil samples SS1 to SS6, and SS8 to SS10 resembled the fuel oil fraction, while soil samples SS7 and SS11 resembled the fuel oil fraction with no resemblance to petroleum products in the lube oil range. The detected modified TPH concentrations in five (5) soil samples (SS1 to SS3, SS5, and SS6) exceeded the Tier I RBSL for gasoline on a commercial site with non-potable groundwater and coarse grained soil (870 mg/kg). Additionally, four (4) of the soil samples (SS1, SS3, SS5 and SS6) exceeded the NLDEC guideline for disposal in a landfill (1,000 mg/kg).

As per the Atlantic PIRI Ecological Screening Protocol, the concentrations of F1, F2, and F3 petroleum hydrocarbon fractions in soil were compared to the Atlantic PIRI Table 1a, Tier I Soil ESLs for Plant and Invertebrates in Direct Soil Contact (*i.e.*, <1.5 mbgs). The detected concentrations of F1 fraction (C_6-C_{10}) in soil samples SS1 to SS6, and SS9 (field duplicate of SS8) exceeded the ESL for a commercial site with coarse grained soil (320 mg/kg). The detected concentrations of F2 fraction (C_{10}-C_{16}) in soil samples SS1 to SS6, SS8 and SS9 (field duplicate of SS8) exceeded the ESL for a commercial site with coarse grained soil (260 mg/kg). Concentrations of F3 fraction (C_{16}-C_{32}) were not detected in exceedance of the ESL for a commercial site with coarse grained soil (1,700 mg/kg) in any of the soil samples analysed.

Benzene was detected in four (4) of the eleven (11) soil samples analysed with concentrations ranging from 0.026 mg/kg in sample SS1 to 0.56 mg/kg in sample SS6. Toluene was detected in six (6) of the eleven (11) soil samples analysed with concentrations ranging from 0.092 mg/kg in sample SS5 to 19 mg/kg in sample SS6. Ethylbenzene was detected in eight (8) of the soil samples analysed with concentrations ranging from 0.18 mg/kg in sample SS4 to 18 mg/kg in sample SS6. Xylenes were detected in nine (9) soil samples analysed with concentrations ranging from 0.56 mg/kg in sample SS10 to 120 mg/kg in sample SS6. With the exception xylenes detected in soil sample SS6 (120 mg/kg), none of the detected concentrations of BTEX parameters exceeded the RBCA Tier I RBSLs for a commercial site with non-potable groundwater and coarse grained soil (2.5 mg/kg, 10,000 mg/kg, 10,000 mg/kg, and 110 mg/kg, respectively). Soil samples SS3 and SS6 exceeded the CCME CSQG for benzene (0.03 mg/kg). Soil sample SS6 exceeded the CCME CSQG for toluene (0.37 mg/kg). Soil samples SS1 to SS6, SS8 and SS9 (field dup of SS8) exceeded the CCME CSQG for ethylbenzene (0.082 mg/kg); while soil samples SS1 to SS3, SS5, SS6, SS8 and SS9 (field dup of SS8) exceeded the CCME CSQG for xylenes (11 mg/kg).

5.0 ECOLOGICAL SCREENING

In accordance with the Atlantic RBCA requirements, the Ecological Screening Protocol summary table has been completed and is included in Appendix C. Two (2) types of ecological habitat

(aquatic habitat in north flowing stream and forested areas) were identified within 200 m of the site (see Table 5.1).

Table 5.1 Ecological Screening Level Applicability within 200 m of the Site

Pathway	Are ESLs Applicable?	Rationale
Protection of Plants and Soil Invertebrates; Direct Soil Contact (Table 1a)*	Yes	Ecological habitat was identified within 200 m of the site.
Protection of Wildlife (mammals and birds) and Livestock; Soil and Food Ingestion (Table 1b)*	No	No agricultural areas were identified within 200 m of the site.
Plant and Invertebrate Direct Contact with Shallow Groundwater (Table 2)*	N/A	Ecological habitat was identified within 200 m of the site. However, groundwater was not evaluated as part of the soil stockpile sampling program.
Protection of Freshwater and Marine Aquatic Life from groundwater and surface water impacts (Table 3a and Table 3b)*	N/A	Freshwater aquatic life may be present within 200 m of the site. However, groundwater and surface water were not evaluated as part of the soil stockpile sampling program.
Protection of Freshwater and Marine Aquatic Life from sediment impacts (Table 4)*	N/A	Sediment is present within 200 m of the site. However, sediment was not evaluated as part of the soil stockpile sampling program.
Protection of Aquatic Life from Soil Leaching to Groundwater Pathway (CWS)	Yes	Aquatic life may be present within 200 m of the site.
*Table references based on *Atlantic RBCA Version 3 User Guidance (Appendix 2)*.		

Petroleum hydrocarbon impacted soil was detected in exceedance of the Tier I ESLs in soil samples SS1 to SS6, SS8 and SS9 (field dup of SS8) collected from the contaminated soil stockpile. However, contaminated soil is stockpiled in a temporary containment cell that is covered year round. As such, it is reasonable to conclude that site hydrocarbons in stockpiled soil with concentrations exceeding applicable ESLs will not come into contact with terrestrial plants, invertebrates, mammalian, avian or herpetile receptors in a suitable habitat. Therefore, further assessment or remediation for the protection of ecological receptors is not deemed necessary at this time.

6.0 DISCUSSION AND CONCLUSIONS

Stantec has carried out sampling of the contaminated soil stockpile located on the FTA site at the Wabush Airport, Wabush, NL. Five (5) soil samples analysed had TPH concentrations exceeding the Tier I RBSL for a commercial site with non-potable groundwater and coarse grained soil and gasoline impacts (870 mg/kg). Four (4) of the eleven (11) soil samples analysed also had TPH concentrations exceeding the NLDEC guideline for disposal of contaminated soil in

a landfill (1,000 mg/kg). Additionally, BTEX parameters detected in eight (8) of the eleven (11) soil samples analysed exceed the CCME CSQGs applicable for disposal of contaminated soil in a landfill.

The results of the 2013 soil sampling program indicate that the concentrations of TPH in soil have not yet reached a level that would be accepted at the local landfill. However, the concentration of TPH in soil samples has deceased compared to previous investigations, indicating that mechanical aeration has marginally aided with the natural attenuation of TPH in soil removed from the CSB and stockpiled on the FTA site.

7.0 SOIL MANAGEMENT OPTIONS

Based on the remaining petroleum hydrocarbon impacts in the soil stockpile, Stantec presents the following options for management of the contaminated soil stockpile:

1. Continue to monitor petroleum hydrocarbon concentrations in the soil stockpile annually and turn the soil stockpile after each round of sampling.

2. Develop a biotreatment program to determine requirements for soil augmentation (*i.e.*, specific nutrients, irrigation and aeration) to enhance the *ex-situ* natural attenuation of TPH in the soil stockpile.

3. Incorporate contaminated stockpile soil into future land development.

4. Remove and transport the soil from the stockpile to an approved soil treatment facility.

Each of these options is discussed in detail in Table 7.1.

Table 7.1 Soil Management Options

Management Option No.	Description	General Advantages/Limitations	Estimated Time Required (years)	Estimated Cost ($ per tonne)
1	**Continued Monitoring & Soil Turning** This would include a continuation of the current program. The soil stockpile would be sampled annually in nine (9) sample locations. Soil samples would be collected from each sample location within the stockpile using a hand driven split-spoon apparatus over continuous 0.6 m intervals, to a maximum depth of 1.6 m. To obtain average petroleum hydrocarbon concentrations within each horizon of the stockpile, soil samples from the same depths would be combined to form composite samples. Three (3) composite samples from the 0.0 m to 0.6 m horizon, three (3) composite samples from the 0.6 m to 1.2 m horizon and three (3) composite samples from the 1.2 m to 1.6 m horizon would be submitted to a laboratory for analysis of TPH/BTEX. Based on the analytical results, the upper layers could potentially be removed and disposed of in a local landfill (providing approval from the local landfill operator and NLDEC are obtained). Following sampling activities, the soil stockpile would be turned using an excavator. The concentrations of petroleum hydrocarbons would be monitored until the concentrations meet the NLDEC guidelines for disposal in a landfill. Following approval from the local landfill and NLDEC, soil would be removed from the site and disposed of at the local landfill. Based on analytical data collected as part of the current investigation, it is estimated that the time to achieve the NLDEC guideline could be up to 3 years or more.	**Advantages**: • Easy to implement; soil turning has already been completed at the site in 2010 and 2013. • Soil would not have to be removed from the site or transported for treatment. • No permitting required with this option. • Minimal amount of site disruption during sampling/turning. • Lower cost option than off-site treatment. **Disadvantages:** • Time required is greater than the other options. • On-going liability associated with having contaminated soil on-site for another 3 + years. • Weather restrictions - best to complete soil turning during summer months/early fall when soil is not frozen and tarp can be removed easily.	**3**	**51[a]**

Management Option No.	Description	General Advantages/Limitations	Estimated Time Required (years)	Estimated Cost ($ per tonne)
2	**<u>On-site Treatment</u>** This would include developing a biotreatment program to determine requirements for soil augmentation (*i.e.*, specific nutrients, irrigation and aeration). Treatment of the soil on-site could take one (1) or more years to complete. The appropriate permits would be required with this option. Once the soil was below NLDEC guidelines (with approval from the local landfill and NLDEC), soil could be removed from the site and disposed of at the local landfill. This option could be achieved by TC initiating the biotreatment program with: a) A select consultant who would manage the program; or, b) A licensed soil treatment company who would be responsible for treating and disposing the soil, as well as accepting liability for the soil.	**Advantages:** • Easy to implement. • Soil would not have to be removed and transported for treatment. • Time to complete should be less than soil turning/monitoring option. • Lower cost option compared to off-site treatment. **Disadvantages:** • Moderate amount of site disruption during treatment period. • Appropriate permits and approvals would be required with this option. • Continued liability during treatment (exception – if TC hire licensed soil treatment company). • Weather restrictions – petroleum hydrocarbon degradation likely to only occur over a period of 4 to 6 months per year.	**1**	**a) 50[b]** **or** **b) 75[c]**

Management Option No.	Description	General Advantages/Limitations	Estimated Time Required (years)	Estimated Cost ($ per tonne)
3	**Incorporate into Future Land Development** This option would involve incorporating contaminated soil within the stockpile into the proposed helipad and/or hanger expansion at the FTA site. Five (5) soil samples analysed had TPH concentrations exceeding the Tier I RBSL for a commercial site with non-potable groundwater and coarse grained soil with gasoline impacts (870 mg/kg) and nine (9) soil samples analysed had TPH concentrations exceeding the Tier I ESLs for a commercial site with coarse grained soil. Based on these exceedances, the following restrictions would apply: • A building could not be located within 30 m of the contaminated soil. • Areas of contaminated soil would have to be capped with a layer such as asphalt, concrete or clay to limit potential exposure pathways. Prior to incorporating contaminated soil into the future land use design, further consideration in terms of a human health and ecological risk assessment (HHERA) or site specific Remedial Action Plan (RAP) is suggested and applicable federal agencies (*i.e.*, Health Canada (HC), Environment Canada (EC) and/or Fisheries and Oceans Canada (DFO)) would have to be consulted. A HHERA is currently being completed for the FTA site, which does not include the contaminated soil stockpile results. It should be noted that the results of the HHERA report could impact the ability to incorporate soil into future land use/development.	**Advantages:** • Soil would not have to be removed from the site or transported for treatment. • Time to complete should be less than 1 year. • Lowest cost option. **Disadvantages:** • Moderate amount of site disruption during site development. • Appropriate permits and approvals would be required with this option. • Continued liability throughout the life of the site. • If site conditions or land uses change, this management option may need to be revisited to ensure that there are no risks to potential receptors on the site.	**<1**	**20[d]**

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Management Option No.	Description	General Advantages/Limitations	Estimated Time Required (years)	Estimated Cost ($ per tonne)
4	**Soil Disposal at Treatment Facility** This option would involve removing the soil from the FTA and transporting it to the nearest approved soil treatment facility, located in Happy Valley-Goose Bay. This option would remove the liability and would not require any permitting or permissions from local/provincial/federal regulatory authorities.	**Advantages:** • Liability is eliminated when the soil is removed. • This option requires the least amount of time to implement. • No permitting/special permissions required. **Disadvantages:** • Technology is not available locally therefore transport is more costly. • Relatively high site disruption for the period of transport; however, short term.	**<1**	**150**

a = The cost has been calculated assuming 3 years of additional sampling/soil turning at the site. The cost does not include any transport or tipping fees at a local landfill.
b = The cost has been calculated assuming 1 year of bioremediation/soil turning at the site and two (2) sampling events. The cost does not include any fees associated with altering or modifying the existing containment cell or any transport/tipping fees at a local landfill.
c = Assumes 1 year guarantee.
d = Assumes no soil is transported to local landfill and/or soil treatment facility.
Cost provided are estimates only.

8.0 RECOMMENDATIONS

The results of the 2013 soil sampling program indicate that the concentrations of TPH in soil have deceased compared to previous investigations; however, have not yet reached a level that would be accepted at the local landfill.

Based on a review of analytical data and the management options presented in Table 7.1, Stantec recommends enhancing the *ex-situ* natural attenuation of TPH in the contaminated soil stockpile. In 2014 it is suggested to complete option # 2 – On-site Treatment at the contaminated soil stockpile. As such, TC would have to initiate the biotreatment program with a) a select consultant who would manage the program; or, b) a licensed soil treatment company who would be responsible for treating and disposing the soil. Additionally, based on a visual inspection of the contaminated soil stockpile, the berm surrounding the stockpile has weathered and decreased in size over time and various tears are present on the tarp cover; therefore, berm maintenance and tarp replacement is recommended for both management options #1 and #2.

9.0 CLOSURE

This report is for the exclusive use of Public Works and Government Services Canada and Transport Canada and no other party shall have any right to rely on any service provided by Stantec Consulting Ltd. without prior written consent from Public Works and Government Services Canada and Transport Canada and Stantec Consulting Ltd.

All parties are subject to the same limit of liability as agreed to in the Stantec Consulting Ltd. Standard Terms and Conditions. Any use which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

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

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgement of Stantec Consulting Ltd. based on the data obtained during the assessment. Due to the nature of assessment and the limited data available, Stantec Consulting Ltd. cannot warrant against undiscovered environmental liabilities. Conclusions and recommendations presented in this report should not be construed as legal advice.

CLOSURE
January 31, 2014

The conclusions presented in this report represent the best technical judgement of Stantec Consulting Ltd. based on the data obtained from the work. The conclusions are based on the site conditions encountered by Stantec Consulting Ltd. at the time the work was performed at the specific testing and/or sampling locations, and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the Sites reflecting natural, construction and other activities. In addition, analysis has been carried out for a limited number of chemical parameters, and it should not be inferred that other chemical species are not present.

Should additional information become available which differs significantly from our understanding of conditions presented in this report, we request that this information be brought to our attention so that we may reassess the conclusions provided herein. This report was prepared by Jacqueline Gillis, B.Sc., B.Eng., and reviewed by Jim Slade, P.Eng., P.Geo.

Respectfully submitted,

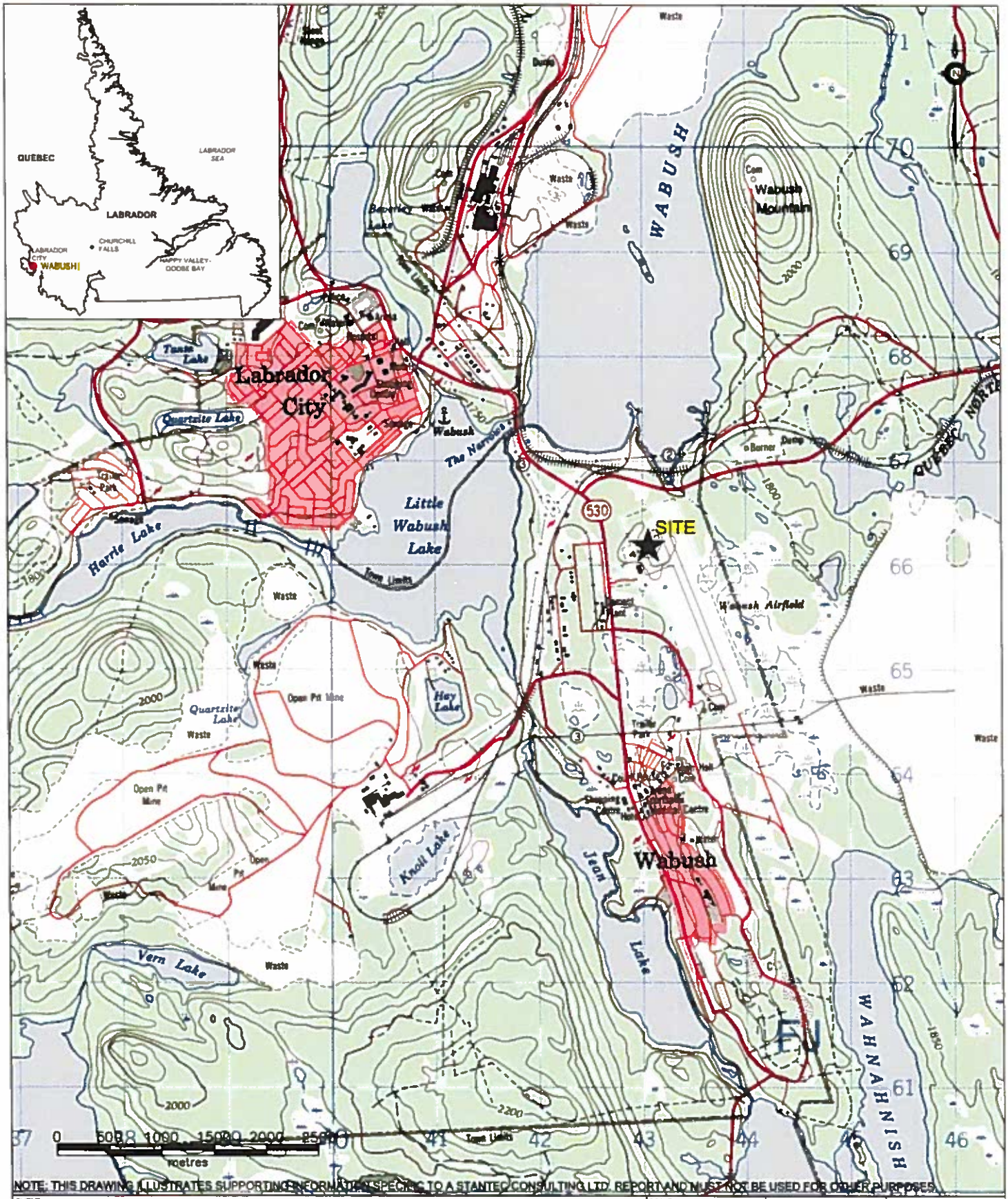
STANTEC CONSULTING LTD.

Jacqueline Gillis, B.Sc., B.Eng., EIT
Environmental Engineer in Training

Jim Slade, P.Eng., P.Geo.
Senior Environmental Engineer

APPENDIX A

Drawings



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT: Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

PROJECT TITLE: SOIL SAMPLING, CONTAMINATED SOIL STOCKPILE
WABUSH AIRPORT, WABUSH, NL

DRAWING TITLE: SITE LOCATION MAP

SCALE	DATE	REV No
1:50,000	NOV. 27, 2013	0
DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: J.G.
DRAWING No: 121412845-EE-01	CAD FILE: 121412845-EE-01.DWG	

Stantec

27NOV13 9:00AM

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

PROJECT TITLE

SOIL SAMPLING, CONTAMINATED SOIL STOCKPILE
WABUSH AIRPORT, WABUSH, NL

DRAWING TITLE

SITE LOCATION PLAN

SCALE	DATE	REV No.
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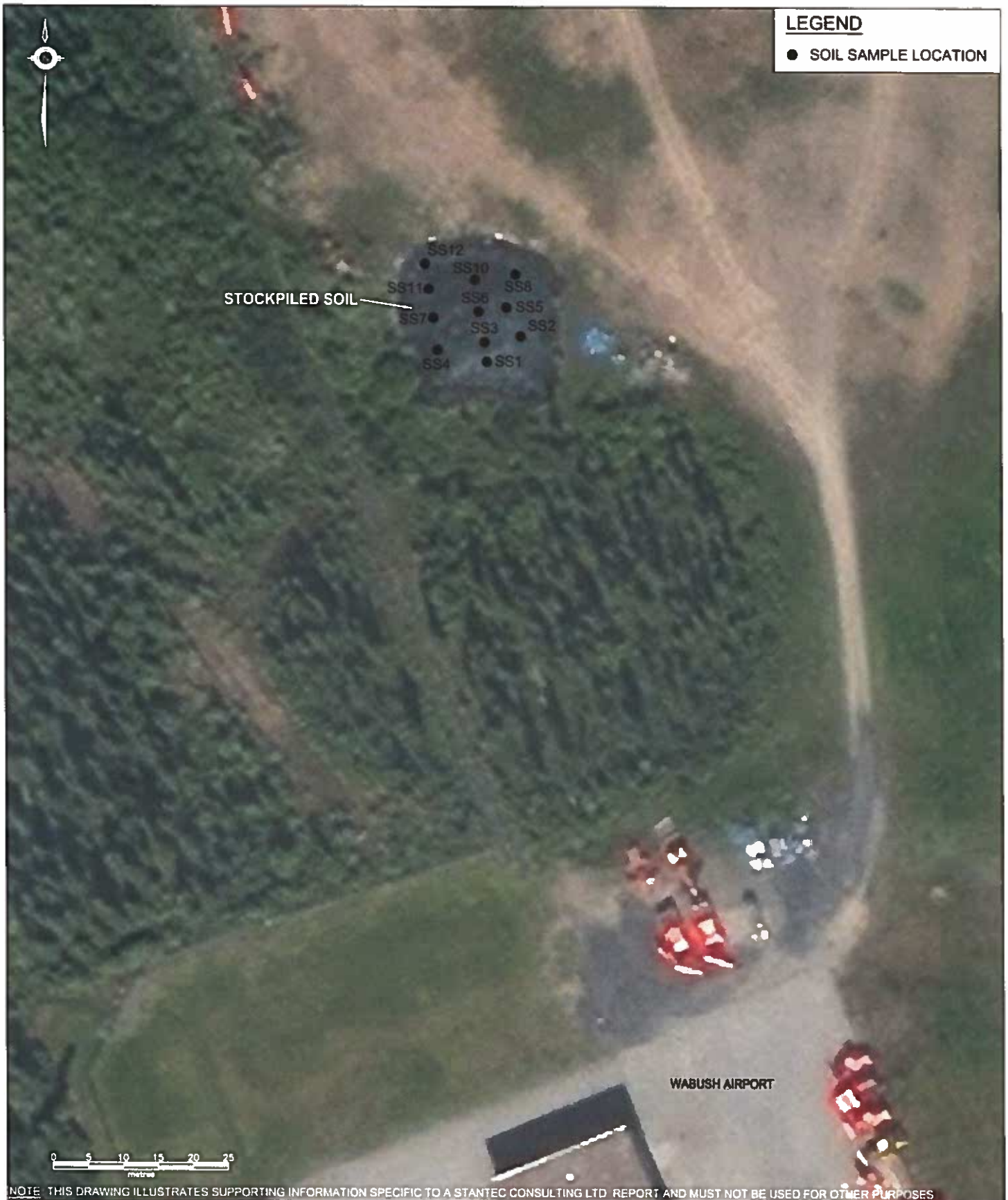
DRAWN BY	EDITED BY	CHECKED BY
N.M.	-	J. G.
DRAWING No.	CAD FILE	
121412845-EE-02	121412845-EE-02.DWG	

Stantec

28NOV13 12:00PM



NOTE THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD REPORT AND MUST NOT BE USED FOR OTHER PURPOSES

CLIENT: Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

PROJECT TITLE: SOIL SAMPLING, CONTAMINATED SOIL STOCKPILE
WABUSH AIRPORT, WABUSH, NL

DRAWING TITLE: SAMPLE LOCATION PLAN

SCALE	DATE	REV No
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DRAWN BY: N.M.	EDITED BY: -	CHECKED BY: J. G.
DRAWING No: 121412845-EE-03	CAD FILE: 121412845-EE-03.DWG	

Stantec

20JAN14 10:00AM

APPENDIX B

Site Photographs

Photo 1. Contaminated Soil Stockpile prior to sampling and turning, looking southwest.

Photo 2. Contaminated Soil Stockpile prior to sampling and turning, looking west.

Photo 3. Tear along seam of covering tarp.

Photo 4. Small tears in covering tarp.

Photo 5. Berm, looking west – slightly weathered with reduced height.

Photo 6. Weathered ripped area of berm.

Photo 7. Various marked sample locations prior to sampling Contaminated Soil Stockpile.

Photo 8. Turning Contaminated Soil Stockpile, looking west.

Photo 9. Turning Contaminated Soil Stockpile, looking north.

Photo 10. Contaminated Soil Stockpile following sampling and turning, looking southwest.

APPENDIX C

Site Assessment and Tier I/II Table Checklist and Ecological Screening Protocol for Petroleum Impacted Sites

SITE ASSESSMENT & TIER I/II TABLE CHECKLIST

Site Location:	Wabush Airport, Wabush, NL
Site Professional:	Jim Slade, P.Eng., P.Geo.
Date:	January 31, 2014

METHOD USED	
Tier I RBSL	✓
Tier II PSSL	
Tier II SSTL	

Minimum Site Assessment Requirements		
Issue	**Yes Or No***	**Comment**
PID, owner, location identified	Yes	
Current and anticipated future land use identified	Yes	
Review of underground services as conduits	Yes	
Historical review completed	No	Report only addresses impacts associated with the current site work.
Local groundwater use identified	Yes	
Adjacent land uses and receptors identified	Yes	
Ecological screening completed	Yes	
Soil and groundwater samples from all source areas obtained	N/A	Groundwater was not evaluated as part of the soil stockpile sampling program.
Soil and groundwater impacts delineated to Tier I RBSLs for potential receptor (adjacent property receptor may be lower Tier I RBSLs)	N/A	Contaminated soil is stockpiled in a temporary containment cell that is covered year round.
Groundwater flow direction and gradient established	Yes	Assumed based on local topography.
Combination of surface and sub-surface soil samples analyzed	N/A	Contaminated soil is stockpiled in a temporary containment cell that is covered year round.
Free product observations made in soil and groundwater	Yes	No visual evidence of free product in on soil during site work.
Low lab detection level for benzene in soil if potable water area	N/A	
Grain size and organic carbon analysis completed on soil	No	Used most stringent soil type for RBSL.
TPH fractionation done on soil and water if calculating Tier II SSTL	N/A	Used Tier I RBSLs.
Scale site plan showing all relevant site features	Yes	
Receptor building characteristics obtained (storeys, floor condition, ceiling height, *etc*.)	N/A	No Buildings on the site.
Mandatory Conditions		
Issue	**Yes or No***	**Comment**
Non-aqueous phase liquids not present in groundwater	N/A	Groundwater was not evaluated as part of the soil stockpile sampling program.
Potable water free of objectionable taste and odour	N/A	Groundwater not used as a source of drinking water.
Soils do not contain liquid and/or free petroleum product	Yes	No free product observed on soil.
Residual hydrocarbons do not create objectionable odours or explosive conditions in indoor or outdoor air	Yes	Contaminated soil is stockpiled in a temporary containment cell that is covered year round.
Surface soil not stained	N/A	Contaminated soil is stockpiled in a temporary containment cell that is covered year round.
No dirt basement floors, sumps with dirt bottoms, *etc*.	N/A	No Buildings on the site.
Confirmed that correct TPH type selected in RBSL or PSSL Table	Yes	
Confirmed that correct soil type selected in RBSL or PSSL Table	Yes	Used most stringent.
Defaults Site Characteristics and Exposure Scenarios		
Issue	**Yes Or No***	**Comment**
Depth to groundwater approximately 3.0 metres	No	Based on historical site investigations, groundwater is approximately 10 mbgs (in the central portion of the FTA site).
Impacted soil thickness is less than 3.0 metres	Yes	
Default foundation crack fraction is appropriate	N/A	No Buildings on the site.
Default foundation thickness is appropriate	N/A	No Buildings on the site.
Two floors exist if using a residential scenario	N/A	No Buildings on the site.
Hydrocarbon impacts above RBSL or PSSL Table soil values are not within 0.3 m of foundation walls or floor slab	N/A	No Buildings on the site.

Defaults Site Characteristics and Exposure Scenarios		
Issue	**Yes Or No***	**Comment**
Confirmed that RBSL or PSSL Table criteria is correct for adjacent property receptors (*i.e.*, use residential at property line if adjacent property is residential)	Yes	
Where exposure pathways have been eliminated at Tier II, detailed explanation provided in report explain why pathways are not relevant	N/A	
Where PSSLs tables are used based on elimination or control of a pathway that could be reopened by changes in site use, this condition is specified as a limitation in the report	N/A	
Where Tier II SSTLs have been calculated by changing default values, the report includes the parameter changed, the default value, the site-specific value used, and the rationale and/or detailed written justification	N/A	

* If no, indicate in comment section if and where in report the issue is addressed.
Consult the Best Management Practices (Appendix 2) for additional details.

SUMMARY TABLE B.1 - RESULTS OF ECOLOGICAL SCREENING PROTOCOL FOR PETROLEUM IMPACTED SITES

Instructions to Practitioners: This table is intended to summarize the results of the Ecological Screening Protocol and must be completed in consultation with guidance provided in the protocol. Users should include this completed table in their Environmental Assessment or Closure Report. Details and explanations are to be provided in the body of the Report.

Ecological Screening Component	Yes or No	Report name and location of details and explanations
Part I - Identification of petroleum hydrocarbons in media		
1. Do site characterization data indicate the presence of PHC in site surface soil (depth < 1.5 m) above the appropriate screening levels in Tables 1a and 1b?	No	Petroleum hydrocarbon impacted soil was detected in exceedance of the Tier I ESLs in soil sample SS1 to SS6 and SS8 and SS9; however, contaminated soil is stockpiled in a temporary containment cell that is covered year round. As such, it is reasonable to conclude that site hydrocarbons in stockpiled soil with concentrations exceeding ESLs will not come into contact with terrestrial plants, invertebrates, mammalian, avian or herpetile receptors in a suitable habitat.
2. Do site characterization data indicate the presence of PHC in shallow site groundwater (depth < 3.0 m) above appropriate ecological screening levels that were derived for the protection of terrestrial plants and soil invertebrates in contact with site groundwater in Table 2?	N/A	Ecological habitat was identified within 200 m of the site. However, groundwater was not evaluated as part of the soil stockpile sampling program.
3. Do existing site characterization data indicate the presence of PHC in site groundwater above appropriate ecological screening levels derived for the protection of aquatic receptors in Table 3a/3b?	N/A	Freshwater aquatic life may be present within 200 m of the site. However, groundwater was not evaluated as part of the soil stockpile sampling program.

4. Do site characterization data indicate the presence of PHC in site surface water above the appropriate screening levels in Table 3?	N/A	Freshwater aquatic life may be present within 200 m of the site. However, surface water was not evaluated as part of the soil stockpile sampling program.
5. Does site characterization indicate the presence of PHC in on-site or adjacent sediments above the appropriate screening levels in Table 4?	N/A	Sediment is present within 200 m of the site. However, sediment was not evaluated as part of the soil stockpile sampling program.

Ecological Screening Component		Yes or No	Report name and location of details and explanations
IF ALL ANSWERS IN PART I ARE"NO" THEN NO FURTHER ACTION IS REQUIRED			
Part II - Identification of habitat and ecological receptors			
1.	Are the following habitat types or conditions present on the site or proximate to site within a minimum of 200 metres? • wetland habitats • aquatic habitats • forested habitats • grassland habitats • provincial/national parks or ecological reserves • known rare, threatened or endangered species • other known critical or sensitive habitat • other local or regional receptor or habitat concerns	-	
2a.	Are there visible indications of stressed vegetation on the site?	-	
2b.	Is there evidence that the site vegetation community differs from what would be expected?	-	
2c.	Are there indications that the site soil cannot support a soil invertebrate community?	-	
3.	Is there evidence that terrestrial plants in the habitats above are likely to be in root contact with site groundwater above screening levels?	-	
4.	Would wildlife receptors be expected to forage on or near the contaminated areas of the site?	-	

Ecological Screening Component	Yes or No	Report name and location of details and explanations
Part III - Identification of exposure pathways for ecological receptors		
1a. Is it reasonable to conclude that site hydrocarbons in surface soil with concentrations exceeding applicable screening levels, will come into contact with terrestrial plants and invertebrates in a suitable habitat?	-	
1b. Is it reasonable to conclude that site hydrocarbons in surface soil with concentrations exceeding applicable screening levels, will come into contact with mammalian, avian or herptile terrestrial receptors within an agricultural land use in a suitable habitat?	-	
2. Is it reasonable to conclude that dissolved hydrocarbons in site groundwater with concentrations exceeding applicable screening levels will come into contact with plants or soil invertebrates in a suitable habitat?	-	
3. Is it reasonable to conclude that dissolved hydrocarbons in site groundwater with concentrations exceeding applicable screening levels will come into contact with aquatic receptors or aquatic receptor habitat?	-	
4. Is it reasonable to conclude that site petroleum hydrocarbon contamination could impact aquatic receptors or aquatic habitat in surface water bodies via the following: a. surface runoff (*e.g.*, erosion, windblown contaminants) b. groundwater flow c. preferential overland flow pathways (*e.g.* drainage ditch, slope, swale) d. preferential subsurface flow pathways (*e.g.* culvert, trench, sewer line, pipelines, swales) such that aqueous media concentrations would potentially exceed surface water and/or sediment quality screening levels?	-	
5. Are there site specific conditions present, which were not considered in any section above that should require further ecological assessment?	-	
IF ALL ANSWERS IN PART III ARE"NO" THEN NO FURTHER ACTION IS REQUIRED		

APPENDIX D

Analytical Results Summary Tables

Table D.1 Results of Laboratory Analyses for Petroleum Hydrocarbons in Soil
Soil Sampling, Contaminated Stockpile
Wabush Airport, Wabush, NL
Stantec Project No. 121412845

Sample ID	Sampling Date	Sample Depth (m)	BTEX Parameters (mg/kg)				Total Petroleum Hydrocarbons (mg/kg)					Resemblance
			Benzene	Toluene	Ethyl-benzene	Xylenes	F1 (C_6-C_{10})	F2 (C_{10}-C_{16})	F3 (C_{16}-C_{32})	Returned to baseline?[5]	Modified TPH[6]	
SS1	21-Oct-13	1.4 - 1.6	0.026	nd	**3.1**	**23**	670	*780*	169	Yes	**1,600**	FO
SS2	21-Oct-13	1.4 - 1.6	0.027	0.10	**2.3**	**38**	450	*380*	84	Yes	**910**	FO
SS3	21-Oct-13	1.4 - 1.6	**0.41**	0.23	**8.5**	**52**	860	*820*	175	Yes	**1,800**	FO
SS4	21-Oct-13	1.4 - 1.6	nd	nd	**0.18**	2.2	340	360	146	No	850	FO
SS5	21-Oct-13	1.4 - 1.6	nd	0.092	**3.9**	**47**	880	*760*	110	Yes	**1,700**	FO
SS5 Lab-Dup	21-Oct-13	1.4 - 1.6	nd	0.11	**4.8**	**61**	*1,100*	*770*	134	Yes	-	-
SS6	21-Oct-13	1.4 - 1.6	**0.56**	**19**	**18**	**120**	*1,100*	*670*	140	Yes	**1,900**	FO
SS7	21-Oct-13	1.4 - 1.6	nd	nd	nd	nd	22	120	118	No	260	FO/NR
SS8	21-Oct-13	1.4 - 1.6	nd	0.29	**1.3**	**18**	210	300	88	Yes	600	FO
SS9	21-Oct-13	1.4 - 1.6	nd	0.11	**1.7**	**22**	430	260	72	Yes	760	FO
SS10	21-Oct-13	1.4 - 1.6	nd	nd	nd	0.56	72	210	55	Yes	340	FO
SS11	21-Oct-13	1.4 - 1.6	nd	nd	nd	nd	3.8	35	35	Yes	73	FO/NR
RDL			0.025	0.025	0.025	0.05	2.5	10	25	-	15	-
Tier I ESLs - Plants and Soil Inv. (Commercial) [1]			180	250	300	350	320	260	1,700	-	-	-
Tier I RBSLs (Commercial) [2]			2.5	10,000	10,000	110	-	-	-	-	870	-
CCME CWS[3]			-	-	-	-	970	380	-	-	-	-
NLDEC Landfill Disposal [4]			0.03	0.37	0.082	11	-	-	-	-	1,000	-

Notes:

1 = Atlantic Partnership in RBCA (Risk-Based Corrective Action) Implementation (PIRI) Tier I Soil Ecological Screening Levels (ESLs) for the Protection of Plants and Soil Invertebrates; Direct Soil Contact (Table 1a), for an industrial or commercial site with coarse grained soil (July 2012). Screening levels apply to the top 1.5 m of the soil profile (samples denoted with a " * ").
2 = Atlantic PIRI Tier I Risk-Based Screening Levels (RBSLs) for an industrial or commercial site with non-potable groundwater, coarse grained soil, and gasoline impacts (July 2012).
3 = Canadian Council of Ministers of the Environment (CCME) Canada-Wide Standard (CWS) Protection of Aquatic Life from Soil Leaching to Groundwater Pathway.
4 = Typical landfill acceptance criteria. BTEX acceptance criteria based on CCME Canadian Soil Quality Guidelines (CSQGs) for an Industrial site (2012) with coarse grained soil and non-potable groundwater.
5 = Atlantic PIRI analytical method does not analyze for >C_{32}. Laboratory certificate indicates (Yes or No) whether chromatogram for each sample returns to baseline after C_{32}. Samples are considered to have returned to baseline if the area from C_{32}-C_{36} is less than 10% of the area from C_{10}-C_{32}.
6 = Modified TPH = TPH C_6 - C_{32} (excluding BTEX).
"-" = not analyzed, not applicable or no applicable guideline.
RDL = Reportable Detection Limit.
nd = Not Detected above RDL.
Lab-Dup = Laboratory duplicate sample.
SS9 = Field Duplicate of SS8
Underlined = Value exceeds Tier I ESL for a commercial site (Table 1a).
Underlined and Italics = Value exceeds CCME CWS.
Bold = Value exceeds Tier I RBSL for a commercial site (Table 4a).
Bold and Shaded = Value exceeds NLDEC Landfill Disposal criteria.
Resemblance:
FO = Fuel oil fraction.
FO/NR = Fuel oil fraction. No resemblance to petroleum products in lube oil range.

Table D.2 Historical Results of Laboratory Analyses for Petroleum Hydrocarbons in Soil
Soil Sampling, Contaminated Stockpile
Wabush Airport, Wabush, NL
Stantec Project No. 121412845

Sample I.D.	Sample Date	Sample Depth (mbgs)	Parameters									Comment/ Resemblance
			Benzene	Toluene	Ethyl-benzene	Xylenes (Total)	C_6-C_{10} (less BTEX)	>C_{10}-C_{16} Hydrocarbons	>C_{16}-C_{21} Hydrocarbons	>C_{21}-<C_{32} Hydrocarbons	Modified TPH [3] (Tier 1)	
September 2006												
Top-1	11-Sep-06	1.0 - 1.6	nd	0.05	0.03	2.6	33	22		nd	54	WGF
Top-2	11-Sep-06	1.0 - 1.6	0.14	14	7.5	69	600	550		nd	**1,100**	GF
Corner-3	11-Sep-06	0.8 - 1.4	nd	6.8	3.6	160	900	600		24	**1,500**	GF
Corner-4	11-Sep-06	0.8 - 1.4	nd	0.11	0.08	28	240	380		320	**940**	FO
Corner-5	11-Sep-06	0.8 - 1.4	0.17	9.1	2.7	110	950	310		40	**1,300**	GF
Corner-6	11-Sep-06	0.8 - 1.4	0.16	8	2	82	540	520		nd	**1,100**	GF
BS7	11-Sep-06	0.8 - 1.4	nd	nd	nd	0.77	54	410		nd	**460**	FO
BS8	11-Sep-06	0.8 - 1.4	nd	nd	nd	0.08	17	45		nd	62	FO
BS9	11-Sep-06	0.8 - 1.4	nd	1.2	1.6	19	800	440		nd	**1,200**	GF
BS10	11-Sep-06	0.8 - 1.4	nd	0.04	0.06	1.2	180	260		36	**480**	FO
BS11	11-Sep-06	0.8 - 1.4	nd	nd	nd	0.19	71	250		47	360	FO
July 2009												
Top-1	-	-	Not Sampled									-
Top-2	-	-	Not Sampled									-
Corner-3	02-Jul-09	0.6	nd	nd	0.44	14	280	200		71	**550**	WFO/LO
Corner-4	02-Jul-09	0.6	nd	nd	0.13	4.5	140	340		130	**610**	GF/FL/LO
Corner-5	02-Jul-09	0.6	nd	nd	nd	5.7	140	480		40	**660**	GF/FO
Corner-6	02-Jul-09	0.60	nd	nd	nd	20	240	710		32	**980**	GF/FO
BS7	02-Jul-09	0.9	nd	0.58	0.47	73	560	670		41	**1,300**	GF/FO
BS8	-	-	Not Sampled									-
BS9	02-Jul-09	0.9	nd	nd	nd	nd	10	150		32	190	WFO
BS10	-	-	Not Sampled									-
BS11	-	-	Not Sampled									-
SA-1	02-Jul-09	1.5	nd	0.05	0.29	63	540	1,400		62	**2,000**	GF/FO
SA-2	02-Jul-09	1.5	nd *	0.11	2	74	610	960		61	**1,600**	GF/FO
SA-3	02-Jul-09	1.5	nd *	0.56	2.4	39	390	620		42	**1,100**	GF/FO
SA-4	02-Jul-09	1.5	nd	0.05	0.27	59	500	890		42	**1,400**	GF/FO
September 2010												
Top-1	30-Sep-10	1.2 - 1.6	nd *	0.37	6.3	120	990	1,900	370	75	**3,300**	PGF/WFO
Top-1 DUP	30-Sep-10	1.2 - 1.6	nd *	0.49	8.2	110	790	1,700	340	69	**2,900**	PGF/WFO
Top-2	30-Sep-10	1.2 - 1.6	nd	0.53	7.0	100	800	1,500	290	72	**2,600**	PGF/WFO
Corner-3	30-Sep-10	1.2 - 1.6	nd	nd	0.23	1.6	69	350	70	46	**540**	PGF/WFO
Corner-4	30-Sep-10	1.2 - 1.6	nd	nd *	6.7	89	970	490	110	44	**1,600**	GF/WFO
Corner-5	30-Sep-10	1.2 - 1.6	nd	nd	4.4	44	730	630	120	47	**1,500**	GF/WFO
Corner-6	30-Sep-10	1.2 - 1.6	nd	nd	1.9	29	290	380	65	29	**770**	GF/WFO
BS7	30-Sep-10	1.2 - 1.6	nd	0.22	6.8	86	780	1,000	170	240	**2,200**	GF/WFO
BS8	30-Sep-10	1.2 - 1.6	nd	nd	0.55	17	300	390	58	nd	**750**	GF/WFO
BS8 Lab-Dup	30-Sep-10	1.2 - 1.6	nd	nd	0.57	17	230	450	68	20	-	-
BS9	30-Sep-10	1.2 - 1.6	nd	nd	0.27	3.7	260	170	32	22	**490**	PGF/WFO
BS9 Lab-Dup	30-Sep-10	1.2 - 1.6	nd	nd	0.15 †	3.4	240	230	37	19	-	-
BS10	30-Sep-10	1.2 - 1.6	nd	nd *	2.7	61	540	770	140	38	**1,500**	PGF/WFO
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-
		RDL	0.03	0.03	0.03	0.05	3	10	10	15	20	-
		Tier I RBSLs [1]	1.8	160	430	200	-	-	-	-	450	-
		NLDEC Landfill Disposal [2]	-	-	-	-	-	-	-	-	1,000	-

Notes:

1 = Atlantic RBCA Tier I Risk Based Screening Level for a commercial site with non-potable groundwater use, coarse-grained soil and gasoline impacts.

2 = Newfoundland and Labrador Department of Environment and Conservation Guideline for disposal in a landfill.

3 = Modified TPH does not include BTEX parameters.

RDL = Reportable detection limit.

nd = Not detected above the RDL.

"-" = Not analyzed, not applicable or no applicable guideline.

"*" = Elevated RDL due to failed ion ratio.

"†" = Failed quality assurance criteria.

Lab-Dup = Laboratory duplicate sample.

Bold = Value exceeds the Tier I RBSL.

Bold/Shaded = Value exceeds Tier I RBSLs and Landfill Disposal criteria.

TOP-1-DUP = Field duplicate sample of TOP-1.

BS11 = Field duplicate of BS10.

Resemblance:

GF = Gasoline fraction.

PGF = Possible gasoline fraction.

WGF = Weathered gasoline fraction.

WFO = Weathered fuel oil fraction.

FO = Fuel oil.

LO = Lube oil.

APPENDIX E

Maxxam Analytics Laboratory Analytical Report

Your P.O. #: 16300R-20
Your Project #: 121412845
Site Location: STOCKPILE FTA
Your C.O.C. #: ES796913

Attention: Jacqueline Gillis
Stantec Consulting Ltd
St. John's - Standing Offer
607 Torbay Rd
St. John's, NL
A1A 4Y6

Report Date: 2013/11/04

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3I2799
Received: 2013/10/25, 22:00

Sample Matrix: Soil
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
TEH in Soil (PIRI) (1,2)	1	2013/10/28	2013/10/29	ATL SOP-00197	Based on Atl. PIRI
TEH in Soil (PIRI) (1,2)	5	2013/10/28	2013/10/30	ATL SOP-00197	Based on Atl. PIRI
TEH in Soil (PIRI) (1,2)	5	2013/10/28	2013/10/31	ATL SOP-00197	Based on Atl. PIRI
Moisture	11	N/A	2013/10/29	ATL SOP-00196	MOE Handbook 1983
VPH in Soil (PIRI) (1)	1	2013/10/28	2013/10/29	ATL SOP 00199	Based on Atl. PIRI
VPH in Soil (PIRI) (1)	5	2013/10/28	2013/10/30	ATL SOP 00199	Based on Atl. PIRI
VPH in Soil (PIRI) (1)	5	2013/10/28	2013/10/31	ATL SOP 00199	Based on Atl. PIRI
ModTPH (T1) Calc. for Soil (3)	1	N/A	2013/10/29	N/A	Based on Atl. PIRI
ModTPH (T1) Calc. for Soil (3)	8	N/A	2013/10/31	N/A	Based on Atl. PIRI
ModTPH (T1) Calc. for Soil (3)	2	N/A	2013/11/01	N/A	Based on Atl. PIRI

Remarks:

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

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

(1) Reported on a dry weight basis.
(2) Soils are reported on a dry weight basis unless otherwise specified.
(3) New RDLs in effect due to release of NS Contaminated Sites Regulations. Reduced RDL based on MDL study performance. Low level analytical run checks being implemented.

Encryption Key

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

Rob Whelan, Laboratory Manager
Email: RWhelan@maxxam.ca
Phone# (709) 754-0203

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B3I2799
Report Date: 2013/11/04

Stantec Consulting Ltd
Client Project #: 121412845
Site Location: STOCKPILE FTA
Your P.O. #: 16300R-20
Sampler Initials: JG

RESULTS OF ANALYSES OF SOIL

Maxxam ID		TP8800	TP8805	TP8806	TP8807	TP8808	TP8808		
Sampling Date		2013/10/21	2013/10/21	2013/10/21	2013/10/21	2013/10/21	2013/10/21		
Received Temperature (°C)		8.8	8.8	8.8	8.8	8.8	8.8		
	Units	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**	**SS5 Lab-Dup**	**RDL**	**QC Batch**
Inorganics									
Moisture	%	11	11	11	10	10	10	1	3400755

Maxxam ID		TP8809	TP8810	TP8811	TP8812	TP8813	TP8814		
Sampling Date		2013/10/21	2013/10/21	2013/10/21	2013/10/21	2013/10/21	2013/10/21		
Received Temperature (°C)		8.8	8.8	8.8	8.8	8.8	8.8		
	Units	**SS6**	**SS7**	**SS8**	**SS9**	**SS10**	**SS11**	**RDL**	**QC Batch**
Inorganics									
Moisture	%	10	13	10	11	10	10	1	3400755

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B3I2799
Report Date: 2013/11/04

Stantec Consulting Ltd
Client Project #: 121412845
Site Location: STOCKPILE FTA
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ATLANTIC RBCA HYDROCARBONS (SOIL)

Maxxam ID		TP8800	TP8805	TP8806	TP8807		TP8808	TP8808		
Sampling Date		2013/10/21	2013/10/21	2013/10/21	2013/10/21		2013/10/21	2013/10/21		
Received Temperature (°C)		8.8	8.8	8.8	8.8		8.8	8.8		
	Units	**SS1**	**SS2**	**SS3**	**SS4**	**QC Batch**	**SS5**	**SS5 Lab-Dup**	**RDL**	**QC Batch**
Petroleum Hydrocarbons										
Benzene	mg/kg	0.026	0.027	0.41	ND	3402692	ND	ND	0.025	3400995
Toluene	mg/kg	ND	0.10	0.23	ND	3402692	0.092	0.11	0.025	3400995
Ethylbenzene	mg/kg	3.1	2.3	8.5	0.18	3402692	3.9	4.8	0.025	3400995
Xylene (Total)	mg/kg	23	38	52	2.2	3402692	47	61	0.050	3400995
C6 - C10 (less BTEX)	mg/kg	670	450	860	340	3402692	880	1100	2.5	3400995
>C10-C16 Hydrocarbons	mg/kg	780	380	820	360	3402706	760	770	10	3401000
>C16-C21 Hydrocarbons	mg/kg	130	64	130	69	3402706	110	110	10	3401000
>C21-<C32 Hydrocarbons	mg/kg	39	20	45	77	3402706	ND	24	15	3401000
Modified TPH (Tier1)	mg/kg	1600	910	1800	850	3398828	1700		15	3398828
Reached Baseline at C32	mg/kg	YES	YES	YES	YES	3402706	YES	YES	N/A	3401000
Hydrocarbon Resemblance	mg/kg	SEECOMMENT (1)	SEECOMMENT (1)	SEECOMMENT (1)	SEECOMMENT (1)	3402706	SEECOMMENT (1)		N/A	3401000
Surrogate Recovery (%)										
Isobutylbenzene - Extractable	%	95	97	93	98	3402706	105	108		3401000
Isobutylbenzene - Volatile	%	108	111	103	111	3402692	103	98		3400995
n-Dotriacontane - Extractable	%	111	109	114	107	3402706	106	110		3401000

N/A = Not Applicable
ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - Fuel oil fraction.

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Maxxam Job #: B3I2799
Report Date: 2013/11/04

Stantec Consulting Ltd
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Sampler Initials: JG

ATLANTIC RBCA HYDROCARBONS (SOIL)

Maxxam ID		TP8809		TP8810	TP8811	TP8812	TP8813	TP8814		
Sampling Date		2013/10/21		2013/10/21	2013/10/21	2013/10/21	2013/10/21	2013/10/21		
Received Temperature (°C)		8.8		8.8	8.8	8.8	8.8	8.8		
	Units	**SS6**	**QC Batch**	**SS7**	**SS8**	**SS9**	**SS10**	**SS11**	**RDL**	**QC Batch**
Petroleum Hydrocarbons										
Benzene	mg/kg	0.56	3402692	ND	ND	ND	ND	ND	0.025	3404268
Toluene	mg/kg	19	3402692	ND	0.29	0.11	ND	ND	0.025	3404268
Ethylbenzene	mg/kg	18	3402692	ND	1.3	1.7	ND	ND	0.025	3404268
Xylene (Total)	mg/kg	120	3402692	ND	18	22	0.56	ND	0.050	3404268
C6 - C10 (less BTEX)	mg/kg	1100	3402692	22	210	430	72	3.8	2.5	3404268
>C10-C16 Hydrocarbons	mg/kg	670	3402706	120	300	260	210	35	10	3404294
>C16-C21 Hydrocarbons	mg/kg	110	3402706	43	43	43	33	15	10	3404294
>C21-<C32 Hydrocarbons	mg/kg	30	3402706	75	45	29	22	20	15	3404294
Modified TPH (Tier1)	mg/kg	1900	3398828	260	600	760	340	73	15	3398828
Reached Baseline at C32	mg/kg	YES	3402706	NO	YES	YES	YES	NO	N/A	3404294
Hydrocarbon Resemblance	mg/kg	SEECOMMENT(1)	3402706	SEECOMMENT(2)	SEECOMMENT(1)	SEECOMMENT(1)	SEECOMMENT(1)	SEECOMMENT(2)	N/A	3404294
Surrogate Recovery (%)										
Isobutylbenzene - Extractable	%	93	3402706	104	96	95	96	98		3404294
Isobutylbenzene - Volatile	%	97	3402692	108	109	111	106	105		3404268
n-Dotriacontane - Extractable	%	112	3402706	101	106	105	103	101		3404294

N/A = Not Applicable
ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - Fuel oil fraction.
(2) - Fuel oil fraction. No resemblance to petroleum products in lube oil range.

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Maxxam Job #: B3I2799
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Stantec Consulting Ltd
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GENERAL COMMENTS

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QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
3400755	Moisture	2013/10/29							0	25
3400995	Isobutylbenzene - Volatile	2013/10/29			100	60 - 140	100	%		
3400995	Benzene	2013/10/29			92	60 - 140	ND, RDL=0.025	mg/kg	NC	50
3400995	Toluene	2013/10/29			83	60 - 140	ND, RDL=0.025	mg/kg	NC	50
3400995	Ethylbenzene	2013/10/29			81	60 - 140	ND, RDL=0.025	mg/kg	22.1	50
3400995	Xylene (Total)	2013/10/29			94	60 - 140	ND, RDL=0.050	mg/kg	26.6	50
3400995	C6 - C10 (less BTEX)	2013/10/29					ND, RDL=2.5	mg/kg	21.1	50
3401000	Isobutylbenzene - Extractable	2013/10/29	104	30 - 130	93	30 - 130	91	%		
3401000	n-Dotriacontane - Extractable	2013/10/29	111	30 - 130	106	30 - 130	94	%		
3401000	>C10-C16 Hydrocarbons	2013/10/29	NC	30 - 130	87	30 - 130	ND, RDL=10	mg/kg	1.8	50
3401000	>C16-C21 Hydrocarbons	2013/10/29	105	30 - 130	94	30 - 130	ND, RDL=10	mg/kg	2.4	50
3401000	>C21-<C32 Hydrocarbons	2013/10/29	112	30 - 130	98	30 - 130	ND, RDL=15	mg/kg	NC	50
3402692	Isobutylbenzene - Volatile	2013/10/30			102	60 - 140	102	%		
3402692	Benzene	2013/10/30			82	60 - 140	ND, RDL=0.025	mg/kg	NC	50
3402692	Toluene	2013/10/30			72	60 - 140	ND, RDL=0.025	mg/kg	NC	50
3402692	Ethylbenzene	2013/10/30			69	60 - 140	ND, RDL=0.025	mg/kg	NC	50
3402692	Xylene (Total)	2013/10/30			83	60 - 140	ND, RDL=0.050	mg/kg	NC	50
3402692	C6 - C10 (less BTEX)	2013/10/30					ND, RDL=2.5	mg/kg	NC	50
3402706	Isobutylbenzene - Extractable	2013/10/30	93	30 - 130	98	30 - 130	99	%		
3402706	n-Dotriacontane - Extractable	2013/10/30	106	30 - 130	111	30 - 130	101	%		
3402706	>C10-C16 Hydrocarbons	2013/10/30	NC	30 - 130	90	30 - 130	ND, RDL=10	mg/kg	26.5	50
3402706	>C16-C21 Hydrocarbons	2013/10/30	92	30 - 130	96	30 - 130	ND, RDL=10	mg/kg	18.8	50
3402706	>C21-<C32 Hydrocarbons	2013/10/30	106	30 - 130	108	30 - 130	ND, RDL=15	mg/kg	NC	50
3404268	Isobutylbenzene - Volatile	2013/10/31			100	60 - 140	100	%		
3404268	Benzene	2013/10/31			80	60 - 140	ND, RDL=0.025	mg/kg		
3404268	Toluene	2013/10/31			72	60 - 140	ND, RDL=0.025	mg/kg		
3404268	Ethylbenzene	2013/10/31			68	60 - 140	ND, RDL=0.025	mg/kg		
3404268	Xylene (Total)	2013/10/31			81	60 - 140	ND, RDL=0.050	mg/kg		
3404268	C6 - C10 (less BTEX)	2013/10/31					ND, RDL=2.5	mg/kg		
3404294	Isobutylbenzene - Extractable	2013/10/31	93	30 - 130	93	30 - 130	96	%		
3404294	n-Dotriacontane - Extractable	2013/10/31	108	30 - 130	107	30 - 130	100	%		
3404294	>C10-C16 Hydrocarbons	2013/10/31	101	30 - 130	96	30 - 130	ND, RDL=10	mg/kg	NC	50

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QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
3404294	>C16-C21 Hydrocarbons	2013/10/31	110	30 - 130	102	30 - 130	ND, RDL=10	mg/kg	NC	50
3404294	>C21-<C32 Hydrocarbons	2013/10/31	112	30 - 130	115	30 - 130	ND, RDL=15	mg/kg	NC	50

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B3I2799

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

Paula Chaplin, Project Manager

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