Geotechnical and Limited Environmental Investigation, Small Vessel Repair and Carpentry Shop, Southside Road, St John's, NL

Prepared for:

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Final Report

File No: 140132351

October 26, 2016

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1.1 Introduction

Stantec Consulting Ltd. (Stantec) has completed a geotechnical investigation in support of the proposed paved laydown area adjacent to the existing DFO building on Southside Road, in St John's, Newfoundland and Labrador (NL). It is understood that the existing building will be renovated in to a new carpentry shop, work shop and storage area. The new proposed laydown area will be developed adjacent to the existing building.

The purpose of this geotechnical investigation was to determine the subsurface conditions to facilitate planning and design of the proposed development. The scope of work completed for this project was in general accordance with Stantec's proposal dated June 20, 2016, and included the following:

- A geotechnical field subsurface investigation consisting of five (5) mechanically excavated test pits. The original scope of work recommended excavation of six (6) test pits; however, one (1) test pit was cancelled due to presence of underground utility services.
- Geotechnical laboratory testing on two (2) representative soil samples; and
- A geotechnical report presenting the findings of the field investigation, including test pit records and laboratory results, as well as provide comments and recommendations for site development, and pavement structure for the proposed development.

This report has been prepared specifically and solely for the proposed development described herein and contains all the findings of this investigation.

1.2 Site and Geology

The site is located at the existing DFO site on Southside road, St John's, Newfoundland and Labrador as shown on the attached Figure No: GE-01. Based on previous experience in the area and available geological literature, the natural subsurface conditions in the area are understood to consist of surficial organic soils/fill overlying fluvial deposit and/or glacial till, extending to bedrock. Bedrock geology at the site is mapped as interbedded gray to black sandstone, siltstone, and shale of Outer Cove Formation, St. John's Group.

1.3 Field Procedures

The field investigation was completed on August 19, 2016 and consisted of excavating five (5) test pits using a rubber-tired 310-SL DEERE backhoe provided by Stantec. The approximate test pit locations are shown on the attached Figure No: GE-01: Test Pit Location Plan. Test pit locations

were selected and established by Stantec in the field based on existing structures on site. Final test pit locations were staked by Stantec.

All test pits were excavated either refusal on probable/inferred bedrock or were terminated due to side wall sloughing and/or practical limit of the backhoe reach. Test pits were excavated to depths ranging from 3.2 m to 4.2 m below the ground surface. Upon completion, the test pits were backfilled with the excavated material and nominally compacted using the excavator bucket. Once Stantec has departed the site, it is the responsibility of the Client and/or Owner to address any potential hazards due to settlement of backfilled materials.

The field work was conducted under the inspection of Stantec personnel who maintained detailed field records of the various soil strata and groundwater conditions encountered during the investigation. The soils were classified in general accordance with the procedures outlined in the attached explanatory key: Symbol and Terms Used on Borehole and Test Pit Records. Representative soil samples were obtained directly from the test pit walls or from the backhoe bucket during the field investigation. All soil samples were stored in moisture proof containers and sent to our laboratory for storage and selected testing. Samples remaining after testing will be stored for a period of three (3) months at which time they will be discarded, unless instructions to the contrary are received.

1.4 Laboratory Testing

Laboratory testing consisting of soil gradations and moisture content determinations were performed on representative samples obtained from TP-04 and TP-05. The laboratory test results are presented in the attached Figure 1– Gradation Curves. Note that the samples tested for soil gradation excluded over-size materials larger than 75 mm (3 inches).

1.5 Summarized Subsurface Conditions

Subsurface conditions observed in the test pits are summarized in the subsections below and described in detail on the attached Test Pit Records along with an accompanying explanatory key: Symbols and Terms used on Borehole and Test Pit Records. Representative photographs of the excavated test pits and spoil piles are also attached.

Fill materials were encountered at all test pit locations and extended to a depth of 4.2 m below the existing ground surface. The thickness of the fill ranged from 1.2 m to 4.2 m. Based on our field observations and laboratory testing, fill is described as a grey to brown, silty sand with gravel (SM) to silty gravel with sand (GM) with occasional to some cobbles and occasional boulders. Occasional debris was encountered within the fill layer and a hydrocarbon odour was noted in TP-03 and TP-04. In terms of relative density, based on direct inspection in the test pit and excavator performance, the fill can be generally classified as compact to dense.

A layer of native glacial till was encountered underlying the fill materials at TP-01 and TP-04. The till layer was observed at depths ranging from 1.2 m to 3.6 m, and generally extended to the underlying inferred/probable bedrock or termination of the test pit. The till can be generally classified as well-graded sand with silt and gravel (SW-SM) to silty sand with gravel (SM) with occasional to frequent cobbles. In terms of relative density, based on direct inspection in the test pits and excavator performance, the till is generally classified as compact to dense.

Inferred/probable bedrock was encountered at TP-01 and TP-04 only at a depth of 3.2 m and 3.6 m respectively below existing ground surface. Inferred/probable bedrock as noted herein has been inferred based on excavator refusal.

Groundwater seepage was encountered at all test pit locations except TP-03. Based on observations during test pit excavations, slow to moderate water seepage was observed at depths ranging from 1.2 m to 3.4 m below the ground surface. It should be noted that test pits were not left open for a sufficient length of time for water levels to stabilize.

1.6 Discussion and Recommendations

Based on the information provided by the Client, it is understood that existing building will be renovated in to a new carpentry shop, work shop and storage area, and a new paved laydown area will be developed adjacent to the shop as shown on the attached Figure No: GE-01.

At the time of issuing this report, it is understood that a new paved laydown area is planned to be constructed; however, detailed engineering or design information for the proposed development have not been provided to Stantec. Therefore, the comments and recommendations presented in this report are for general preliminary planning and design purposes only and should be reviewed by Stantec once the design details are known.

1.6.1 Site Preparation

The existing site fill materials will provide a suitable base for the proposed paved laydown area. Site development and subgrade preparation should involve the excavation of fill materials to the necessary design subgrade elevations. Excavated areas should be proof rolled and, if required, built to grade with an approved structural fill as described below. Any softened areas evident upon proof rolling must be removed and replaced with suitably compacted structural fill. Test pit locations should be over-excavated and replaced with a compacted structural fill material.

The site is underlain by soils with variable fines contents (silts / clays) on the order of 11% to 14%. Typically, where the fines content of a soil is in excess of 12%, the soil will tend to soften and become unsuitable and difficult to work when it becomes wetter than its optimum moisture content and is disturbed. In addition, silty soils that have been successfully compacted and approved, may require removal if they subsequently become wet and softened from water infiltration, precipitation or freezing.

Excavations may encounter groundwater seepage and/or surface water runoffs during site preparation earthworks. All water seepage should be controlled using appropriate measures, such as drainage ditching and/or conventional pump and sump arrangements.

1.6.2 Structural Fill

Structural fill should consist of a well-graded, free-draining granular material such as pit run sand and gravel or processed blasted rockfill. The maximum particle size should not exceed 150 mm.

Site excavated soil materials may be suitable for re-use as structural fill provided the moisture content is maintained within 1 to 2 percent below its optimum value and are free of deleterious materials (i.e. organics, debris etc.). If consideration is given to reusing the in-situ soils, the above noted concerns regarding handling and placement of these materials under wet and freezing conditions must be considered.

Structural fill should be placed in horizontal lifts and compacted to the specifications outlined below in Table 6.1. In addition to the compaction requirements presented in Table 6.1, visual approval of all structural fill during placement is recommended. The lift thickness used during fill placement should be compatible with the compaction equipment and material type to ensure the required density throughout. Due to the particle size distribution of coarser grained soils (e.g., rockfill), verification of the field density by visual inspection during proof rolling by geotechnical personnel will be required. As a general guide, structural fill should be placed in 300 to 400 mm lifts and compacted with a 10 tonne vibratory roller.

Table 1.1 Recommended Structural Fill Compaction Requirements

Structural Fill Application	Minimum Compaction Requirements Percent of Standard Proctor (ASTM D698) Maximum Dry Density, %
Pavement Areas	98
General Backfill	95

1.6.3 Pavement Structures/Areas

Site preparation and structural fill placement should be completed in accordance with the previous Sections to achieve the required elevation. Preliminary recommendations for pavement structure are presented below in Table 6.2.

Table 1.2 Preliminary Recommendations for Pavement Structure

Materials	Standard Traffic Loading
Asphalt	75 mm
Class A Gravel	150 mm
Granular Subbase (Class B)	150 mm

Materials types and placement specifications conforming to the City of St. John's Department of Engineering Specifications or equivalent will be suitable for this application. Proper surface and subgrade drainage is recommended to ensure that the recommended pavement structure will perform satisfactorily.

1.6.4 Quality Assurance/Quality Control

It is recommended that a program of quality assurance, quality control and inspection be carried out by geotechnical personnel during earthworks. Such a program should include verification of excavation bases and approval before placement of additional fill; compaction testing during fill placement; subgrade proof-rolling, and field and laboratory testing during placement of granular fill and asphalt materials.

2.0 RESULTS OF ENVIRONMENTAL SOIL SAMPLING

As part of the current geotechnical investigation, soil samples collected from the test pits were screened and submitted for chemical laboratory analysis to further evaluate the environmental condition of soils at each test pit location. Specifically, the following components of environmental work were carried out by Stantec on the subject property as part of the current project:

- Collect soil samples from the five (5) test pits for laboratory analysis.
- Carry out head space vapour screening to select soil samples for laboratory analysis.
- Submit selected soil samples for laboratory analysis of petroleum hydrocarbons, including petroleum hydrocarbon (PHC) fractions F1 to F4 and benzene, toluene, ethylbenzene and xylenes (BTEX) parameters, metals, polycyclic aromatic hydrocarbons (PAHs), and leachate, as required.
- Evaluate observations and results of the environmental components of work and present in the project report, which outlines the methodology, results, conclusions and recommendations from the investigation.

2.1 Methodology

Environmental soil samples were collected from the test pits as part of the geotechnical investigation. In the test pits, soils were sampled directly by bulk sample methods from the test pit walls or from the excavator bucket. Soil samples were recovered from the test pits at frequent intervals over their respective depths, the number of which varied with the test pit depth. In the test pits, where possible, one sample was collected near surface, one at maximum test pit depth and one additional sample per 0.5 m to 1.5 m of depth. The soil samples were examined for field evidence of petroleum hydrocarbon impacts at the time of collection. Duplicate soil samples were collected at each sample location, where possible. The samples were placed in new laboratory-supplied glass jars, placed in sample coolers and returned to Stantec's office in St. John's, NL for soil vapour testing. Head space soil vapour concentrations were measured in the duplicate sample jars using a MiniRAE 2000 photo ionization detector (PID). The PID readings are presented in Table 2.1 below.

Based on the PID readings, site observations and site history, selected soil samples were submitted to Maxxam Analytics in St. John's, NL and Bedford, Nova Scotia (NS) for laboratory analysis of petroleum hydrocarbons (PHC fractions F1 to F4 and BTEX), available metals, PAHs, and leachate.

2.1.1 Soil Vapour Concentrations

The soil vapour concentrations measured in soil samples collected from the site are provided in Table 2.1. The soil vapour concentrations measured ranged from 0.0 ppm in ten (10) soil samples (*i.e.*, TP1-S-1 to S-3, TP2-S-1 to S-3, TP4-S-1 and S-2, and TP5-S-2 and S-3) to 19.6 ppm in soil sample TP3-S-1.

Soil vapour concentrations vary with both fuel type and age, and it should be noted that the readings are intended to provide only a qualitative indication of volatile hydrocarbon levels and are not directly equivalent to soil analytical results.

Table 2.1 Soil Sample Vapour Concentrations

Test Pit	Sample Number	Sample Depth	PID Reading (ppm)
TP1	S-1	0.2	0
	S-2	2	0
	S-3	3.2	0
TP2	S-1	0.2	0
	S-2	2.1	0
	S-3	3.5	0

Test Pit	Sample Number	Sample Depth	PID Reading (ppm)
TP3	S-1	0.8	19.6
	S-2	2.2	1.3
	S-3	3.5	1.4
TP4	S-1	0.5	0
	S-2	2.5	0
	S-3	4.2	3.3
TP5	S-1	0.5	0.1
	S-2	2.5	0
	S-3	4.2	0

2.1.2 Liquid Phase Petroleum Hydrocarbons

Free liquid phase petroleum hydrocarbons (*i.e.,* free product) were not observed on the soil or on the groundwater surface in the test pits during the current investigation.

2.2 Soil Analytical Results

Results of the laboratory analyses of soil samples for TPH/BTEX, available metals, PAHs, and leachate in soil are presented in Tables A.1 to A.4, attached, along with the corresponding analytical report from Maxxam Analytics, and the appropriate regulatory criteria for a commercial site with non-potable groundwater and coarse grained soil. As the site is federally-owned, federal guidelines have been referenced for TPH/BTEX, available metals, and PAHs, including the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standard (CWS) for Petroleum Hydrocarbons (PHC), and the Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines (CSQGs) for the Protection of Environmental and Human Health (1999 and Updates). For results of leachate analysis, results are compared to the Newfoundland and Labrador Department of Environment (NLDE), 2003. Leachable Toxic Waste, Testing and Disposal. NLDE Pollution Prevention Division Guidance Document GD-PPD-26.1. Revised November, 2003 (Schedule II).

2.2.1 Petroleum Hydrocarbons in Soil

Petroleum hydrocarbon (TPH/BTEX) analysis was conducted on five (5) soil samples, including one each from each of the test pits. Results of the laboratory analysis for TPH/BTEX in soil are presented in Table A.1, attached.

Various concentrations of PHC fractions F1, F2, F3, and F4 were detected in the soil samples; however, none of the detected concentrations exceeded the applicable CCME CWS Tier I screening values for a commercial site.

Benzene was detected in one (1) soil sample, TP5-S-3, and returned a concentration that exceeded the applicable CCME guideline of 0.03 mg/kg for a commercial site with coarse-grained soil (i.e., 0.1 mg/kg).

Various concentrations of toluene, ethylbenzene and xylenes were detected in the soil samples collected from test pits TP1 to TP4; however, none of the detected concentrations of these parameters exceed the applicable CCME guideline for a commercial site.

2.2.2 Available Metals in Soil

Available metals analysis was conducted on four (4) soil samples including one each from test pits TP1, TP3, TP4 and TP5. Results of the laboratory analysis for available metals in soil are presented in Table A.2, attached.

Various metals parameters were detected in the soil samples analyzed; however, only the detected concentration of arsenic in soil sample TP5-S-3 exceeded the applicable CCME guidelines for soil at a commercial site, returning a value of 60 mg/kg versus a criteria of 12 mg/kg.

2.2.3 PAHs in Soil

PAH analysis was conducted on four (4) soil samples including one each from test pits TP1, TP3, TP4 and TP5. Results of the laboratory analysis for PAHs in soil are presented in Table A.3, attached.

Various PAH parameters were detected in the soil samples analyzed; however, none of the detected levels of PAHs exceeded the applicable CCME guidelines for soil at a commercial site, where such guidelines exist.

2.2.4 Leachate in Soil

Leachability for arsenic was carried out on one soil sample, TP5-S-3, which returned a soil concentration that exceed applicable CCME guidelines for this parameter. The results are presented in Table A.4 in attached.

No concentration of leachable arsenic was detected in the soil sample analyzed.

2.3 Conclusions and Recommendations

The conclusions and recommendations of the soil sampling and laboratory analysis are as follows:

1. No free liquid phase petroleum hydrocarbons in soil or sheening on the surface of groundwater were observed on site during the current geotechnical test pitting program.
2. With the exception of benzene detected in soil sample TP5-S-3, none of the other detected concentrations of petroleum hydrocarbon parameters (i.e., PHC F1-F4 and BTEX) exceeded the applicable CWS and CCME guidelines. The detected concentration of benzene was only slightly above the applicable CCME guideline, returning a concentration of 0.1 mg/kg versus 0.03 mg/kg. Given this low concentration, and localized occurrence at one test pit location, the detected concentration of benzene in test pit TP is not considered to be an environmental concern.
3. With the exception of arsenic detected in soil sample TP5-S-3, none of the other detected concentrations of metals exceeded the applicable CCME guidelines, where such guidelines exist. Leachate analysis carried out on this sample returned no detectable concentrations of leachable arsenic indicating that any surplus material from this area during construction excavation requiring off-site disposal would be suitable for disposal at the municipal landfill, subject to authorization by the landfill operator.
4. There is soil on the site with detectable petroleum hydrocarbon concentrations (within the provincial government landfill disposal guideline of 1,000 mg/kg) and PAHs. Therefore, any surplus soil removed as part of excavation activities from the areas of these test pits will require transport and disposal to a landfill.
5. If site conditions or land uses change (e.g., residential land use, potable groundwater), the results of the current assessment may need to be revisited to ensure that there are no additional or increased risks to potential receptors, on-site or off-site.

3.0 CLOSURE

Use of this report is subject to the Statement of General Conditions, attached. It is the responsibility of Public Works and Governments Services who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these not be satisfied. The Statement of General Conditions addresses the following: use of the report; basis of the report; standard of care; interpretation of site conditions; varying or unexpected site conditions; and planning, design, or construction.

GEOTECHNICAL AND LIMITED ENVIRONMENTAL INVESTIGATION, SMALL VESSEL REPAIR AND CARPENTRY SHOP, SOUTHSIDE ROAD, ST JOHN'S, NL

CLOSURE
October 26, 2016

We trust this report meets your present requirements. This report has been prepared by the undersigned and Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo. Should any additional information be required, please do not hesitate to contact our office at your convenience.

Sincerely,
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PROVINCE OF NEWFOUNDLAND AND LABRADOR
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This Permit Allows
STANTEC CONSULTING LTD.
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEGNL 30291
which is valid for the year 2016

ATTACHMENTS

Statement of General Conditions
Symbols and Terms Used on Borehole and Test Pit Records
Test Pit Records
Test Pit Photographs
Figure 1 – Gradation Curves
Figure No: GE-01: Test Pit Location Plan
Environmental Laboratory Analytical Results Summary Tables (A.1 to A.4)
Maxxam Analytical Laboratory Reports

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

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Stantec

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

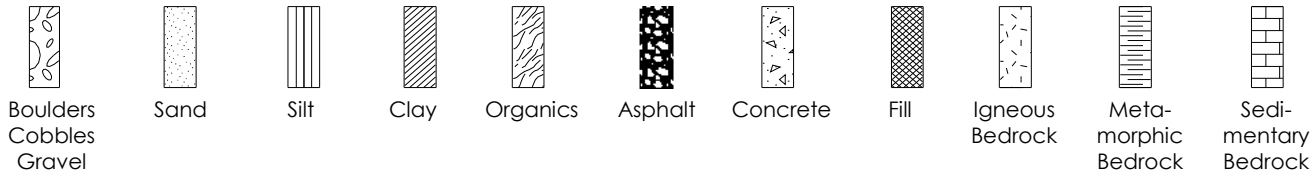
Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

TEST PIT RECORD

Stantec

CLIENT: Public Works & Government Services Canada
PROJECT: Geotech & Limited Environ Investigation - Small Vessel Repair and Carpentry Shop
LOCATION: Southside Road, St. Johns, NL
DATES (mm-dd-yy): DUG 8-19-16 WATER LEVEL 2.8m

TEST PIT No. TP-01
PROJECT No. 140132351
DATUM N/A

DEPTH (m)	ELEVATION (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES OTHER TESTS
0		Compact to dense, grey to brown, silty GRAVEL with sand (GM); some cobbles, occasional boulders: FILL - occasional debris (wood) encountered - approximate boulder size 300-400 mm			BS	01	
1		Compact to dense, brown to reddish brown, well-graded SAND with silt and gravel (SW-SM) to silty SAND with gravel (SM); some to frequent cobbles: TILL					
2				▽			
3		Dense, grey, well-graded SAND with silt and gravel (SW-SM) to silty SAND with gravel (SM); some to frequent cobbles: TILL					
		End of Test Pit Moderate water seepage observed at 2.8 m depth. Backhoe refusal on inferred bedrock or boulders.					
4							
5							
6							

UNDRAINED SHEAR STRENGTH - kPa ★
20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
10 20 30 40 50 60 70 80

TEST PIT RECORD

Stantec

CLIENT: Public Works & Government Services Canada
PROJECT: Geotech & Limited Environ Investigation - Small Vessel Repair and Carpentry Shop
LOCATION: Southside Road, St. Johns, NL
DATES (mm-dd-yy): DUG 8-19-16 WATER LEVEL 3.2m

TEST PIT No. TP-02
PROJECT No. 140132351
DATUM N/A

DEPTH (m)	ELEVATION (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES OTHER TESTS
0		Compact to dense, brown to light grey, silty GRAVEL with sand (GM); some cobbles, occasional boulders: FILL - occasional debris (e.g. metal, wood, glass) encountered					
1		Loose to compact, brown to dark grey, silty SAND with gravel (SM) to silty GRAVEL with sand (GM); some cobbles, occasional boulders: PROBABLE FILL - occasional debris (e.g. rootlets, wood) encountered					
2							
3				▽			
		End of Test Pit Moderate water seepage observed at 3.2 m depth. Test pit terminated due to side wall sloughing and practical limit of backhoe reach.					
4							
5							
6							

UNDRAINED SHEAR STRENGTH - kPa ★
20 40 60 80

WATER CONTENT & ATTERBERG LIMITS w_P w w_L
10 20 30 40 50 60 70 80

TEST PIT RECORD

Stantec

CLIENT: Public Works & Government Services Canada
PROJECT: Geotech & Limited Environ Investigation - Small Vessel Repair and Carpentry Shop
LOCATION: Southside Road, St. Johns, NL
DATES (mm-dd-yy): DUG 8-19-16 WATER LEVEL N/A

TEST PIT No. TP-03
PROJECT No. 140132351
DATUM N/A

DEPTH (m)	ELEVATION (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa (20, 40, 60, 80) / WATER CONTENT & ATTERBERG LIMITS (W_P W W_L) (10, 20, 30, 40, 50, 60, 70, 80)
0		Compact to dense, brown to grey, silty GRAVEL with sand (GM); occasional to some cobbles: FILL - occasional debris (e.g. concrete, brick, asphalt) encountered						
1		- moderately strong hydrocarbon odor encountered Compact, grey to black, silty GRAVEL with sand (GM) to silty SAND with gravel (SM): FILL						
2		- frequent debris (e.g. bricks, wood) encountered Loose to compact, brown to dark grey, silty SAND with gravel (SM) to silty GRAVEL with sand (GM); occasional cobbles: PROBABLE FILL - occasional debris (e.g. rootlets, wood) encountered						
3								
4		End of Test Pit No water seepage observed. Test pit terminated due to practical limit of backhoe reach.						
5								
6								

TEST PIT RECORD

Stantec

CLIENT: Public Works & Government Services Canada
PROJECT: Geotech & Limited Environ Investigation - Small Vessel Repair and Carpentry Shop
LOCATION: Southside Road, St. Johns, NL
DATES (mm-dd-yy): DUG 8-19-16 WATER LEVEL 1.2m

TEST PIT No. TP-04
PROJECT No. 140132351
DATUM N/A

DEPTH (m)	ELEVATION (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa (20, 40, 60, 80) / WATER CONTENT & ATTERBERG LIMITS (W_P, W, W_L) (10, 20, 30, 40, 50, 60, 70, 80)
0		Clean, road gravel						
		Compact to dense, brown to grey, silty GRAVEL with sand (GM) to silty SAND with gravel (SM); some cobbles: FILL - occasional debris (e.g. brick, metal) encountered - moderate hydrocarbon odor encountered		▽				
1								
2								
		Dense, grey, well-graded SAND with silt and gravel (SW-SM) to silty SAND with gravel (SM); occasional cobbles: TILL						
3					BS	1	S	
		End of Test Pit Slow water seepage observed at 1.2 m depth. Backhoe refusal on inferred bedrock or boulders.						
4								
5								
6								

TEST PIT RECORD

Stantec

CLIENT: Public Works & Government Services Canada
PROJECT: Geotech & Limited Environ Investigation - Small Vessel Repair and Carpentry Shop
LOCATION: Southside Road, St. Johns, NL
DATES (mm-dd-yy): DUG 8-19-16 WATER LEVEL 3.4m

TEST PIT No. TP-05
PROJECT No. 140132351
DATUM N/A

DEPTH (m)	ELEVATION (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa (20, 40, 60, 80) / WATER CONTENT & ATTERBERG LIMITS (w_P, w, w_L) (10, 20, 30, 40, 50, 60, 70, 80)
0		Clean, road gravel						
		Compact, brown, silty SAND with gravel (SM) to silty GRAVEL with sand (GM); occasional to some cobbles: FILL - occasional debris (e.g. brick, metal) encountered - 1.2 m long concrete slab encountered at 2.4 m depth - bottles and metals encountered at 4.0 m depth						
1								
					BS	1	S	
2								
3				▽				
4								
		End of Test Pit Slow water seepage observed at 3.4 m depth. Test Pit terminated due to side wall sloughing and practical limit of backhoe reach.						
5								
6								

Test Pit TP-01

Test Pit TP-01 Spoil Pile

Test Pit TP-02

Test Pit TP-02 Spoil pile

Test Pit TP-03

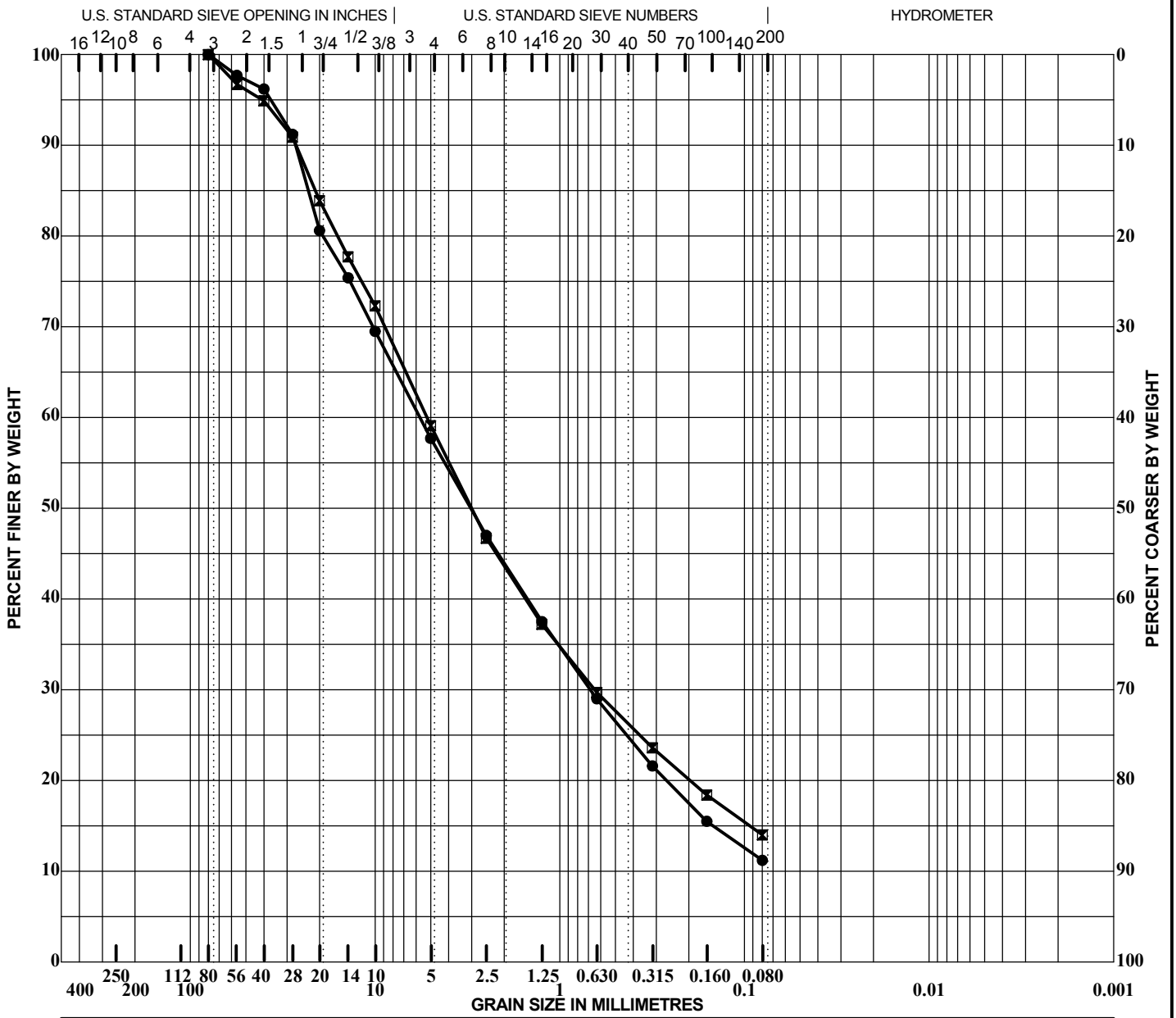
Test Pit TP-03 Spoil Pile

Test Pit TP-04

Test Pit TP-04 Spoil Pile

Test Pit TP-05

Test Pit TP-05 Spoil Pile



COBBLE	GRAVEL		SAND			SILT and CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth (m)	Description	W%	W_L	W_P	I_P
●	TP-04 BS1	3.25	Well-graded SAND with silt and gravel (SW-SM)	6.6			
⊠	TP-05 BS1	1.75	Silty SAND with gravel (SM)	8.9			

	Sample	Depth (m)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-04 BS1	3.25	80.00	5.72	0.683		42.3	46.5	11.2	
⊠	TP-05 BS1	1.75	80.00	5.24	0.648		40.9	45.1	14.0	

REMARKS:

Stantec

Client: **Public Works & Government Services Canada**

Project: **Geotech & Limited Environ Invest - Small Vessel Repair and Carpentry Shop**

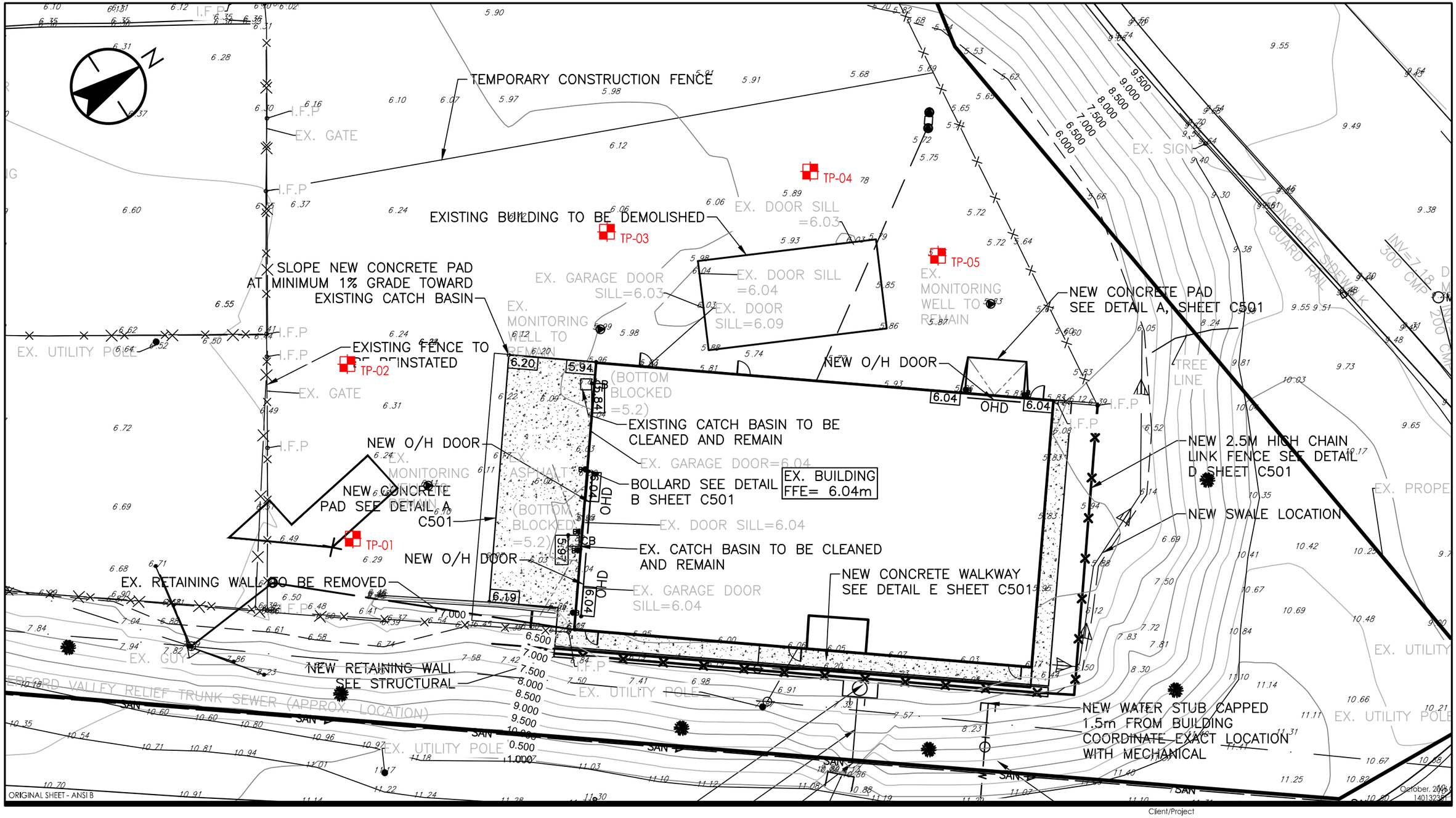
Project No.: **140132351**

Location: **Southside Road, St. Johns, NL**

FIGURE 1

GRADATION CURVES

STANTEC GRAIN SIZE 10/25/16 1:44:15 PM



Stantec

141 Kelsey Drive
St. John's NL
www.stantec.com

Legend

APPROXIMATE TEST PIT LOCATIONS

Client/Project
PWGSC
SMALL VESSEL REPAIR AND CARPENTRY SHOP

Figure No.
GE-01

Title
TEST PIT LOCATION PLAN

Table A.1 Results of Laboratory Analysis of Petroleum Hydrocarbons in Soil
Geotechnical and Limited Environmental Investigation, Small Vessel Repair and Carpentry Shop
Southside Road, St. John's, NL
Stantec Project No. 140132351

Sample ID	Depth (mbgs)	Benzene	Toluene	Ethylbenzene	Xylenes	C_6-C_{10} F1	C_{10}-C_{16} F2	C_{16}-C_{34} F3	>C_{34} F4	Baseline Reached?
	RDL	0.005	0.02	0.01	0.04	10	10	50	50	-
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-
	CWS [1, 2]	0.03	0.37	0.082	11	320 (eco/ indoor) 970 (gw)	1,700 (indoor) 260 (eco) 380 (gw)	1,700 (eco)	3,300 (eco)	-
	CWS Management Limit [3]	-	-	-	-	700	1,000	3,500	10,000	-
TP1-S-1	**0.5 - 1**	nd	nd	nd	nd	nd	19	350	200	yes
TP2-S-2	**2.1 - 2.4**	nd	nd	nd	nd	nd	nd	78	nd	no
TP3-S-3	**3.3 - 3.5**	nd	0.036	nd	nd	nd	36	52	nd	no
TP4-S-2	**2.5 - 2.7**	nd	nd	nd	nd	nd	nd	53	nd	yes
TP5-S-3	**4.0 - 4.2**	**0.10**	0.14	0.044	0.16	nd	nd	79	nd	no

Notes:

1 = CCME CSQG = Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines (CSQGs) for the Protection of Environmental and Human Health for BTEX (1999 and Updates) - commercial site, coarse-grained soil

2 = CCME CWS PHC = CCME Canada Wide Standards (CWS) for Petroleum Hydrocarbons (PHC) in Soil (January 2008) - commercial site (eco soil contact, vapour inhalation (indoor) and protection of groundwater for aquatic life) (Table 3)

3 = CCME CWS PHC Management Limit for a Commercial Site (January 2008)

RDL = Reportable Detection Limit for routine analysis; nd = Not detected above standard RDL; '-' = Not applicable

mbgs = metres below ground surface

Bold/Shaded = Value exceeds CCME and/or CWS eco guideline

Table A.2 Results of Laboratory Analysis of Available Metals in Soil
Geotechnical and Limited Environmental Investigation, Small Vessel Repair and Carpentry
Southside Road, St. John's, NL
Stantec Project No. 140132351

Parameters	RDL	Units	Guideline[1]	TP1-S-1	TP3-S-3	TP4-S-2	TP5-S-3
				0.5 - 1 mbgs	3.3 - 3.5 mbgs	2.5 - 2.7 mbgs	4.0 - 4.2 mbgs
Aluminum	10	mg/kg	-	14,000	22,000	20,000	17,000
Antimony	2.0	mg/kg	40	nd	nd	nd	3.6
Arsenic	2.0	mg/kg	12	3.9	7.6	7.5	**60**
Barium	5.0	mg/kg	2,000	44	42	30	72
Beryllium	2.0	mg/kg	8	nd	nd	nd	nd
Bismuth	2.0	mg/kg	-	nd	nd	nd	nd
Boron	50.0	mg/kg	-	nd	nd	nd	nd
Cadmium	0.30	mg/kg	22	nd	nd	nd	0.36
Chromium	2.0	mg/kg	87	9.6	19	19	19
Cobalt	1.0	mg/kg	300	9.5	15	13	12
Copper	2.0	mg/kg	91	33	28	60	58
Iron	50	mg/kg	-	27,000	38,000	36,000	39,000
Lead	0.50	mg/kg	260	25	42	36	250
Lithium	2.00	mg/kg	-	37	50	49	37
Manganese	2.0	mg/kg	-	890	1,100	880	1,100
Mercury	0.10	mg/kg	24	nd	0.13	nd	0.16
Molybdenum	2.0	mg/kg	40	nd	nd	nd	4.0
Nickel	2.0	mg/kg	50	13	22	22	24
Rubidium	2.0	mg/kg	-	3.9	6	4.5	5.4
Selenium	2.0	mg/kg	2.9	nd	nd	nd	2.2
Silver	0.50	mg/kg	40	nd	nd	nd	nd
Strontium	5.0	mg/kg	-	14	11	14	30
Thallium	0.10	mg/kg	1	nd	nd	nd	0.35
Tin	2.0	mg/kg	300	nd	4.4	3.2	28
Uranium	0.10	mg/kg	33	0.48	0.31	0.33	0.54
Vanadium	2.0	mg/kg	130	13	25	22	27
Zinc	5.0	mg/kg	360	88	88	93	160

Notes:

1 = Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines (1999 and Updates). Commercial land use.

RDL = Reportable Detection Limit for routine analysis

nd = Not detected above standard RDL

mbgs = metres below ground surface

Bold/Shaded = Value exceeds applicable guideline

Table A.3 Results of Laboratory Analysis of Polycyclic Aromatic Hydrocarbons in Soil
Geotechnical and Limited Environmental Investigation, Small Vessel Repair and Carpentry Shop
Southside Road, St. John's, NL
Stantec Project No. 140132351

Parameter	RDL	Units	B(a)P PEF	CCME $CSQG_{HH}$[1] (All Land Uses)	HH Guidelines - Other Jurisdictions[2] (All Land Uses)	CCME $CSQG_{EH}$[1] - (Comm.)	TP1-S-1	TP3-S-3	TP4-S-2	TP5-S-3
							0.5 - 1.0 mbgs	3.3 - 3.5 mbgs	2.5 - 2.7 mbgs	4.0 - 4.2 mbgs
Non-Carcinognic PAHs										
1-Methylnaphthalene	0.01	mg/kg	-	-	76[3]	-	nd	0.014	nd	0.088
2-Methylnaphthalene	0.01	mg/kg	-	-	76[3]	-	nd	0.015	nd	0.12
Acenaphthene	0.01	mg/kg	-	-	8,000[2]	-	nd	0.022	0.011	0.056
Acenaphthylene	0.01	mg/kg	-	-	6.6[3]	-	0.031	nd	0.011	0.041
Anthracene	0.01	mg/kg	-	-	37,000[2]	32[1]	0.011	0.037	0.059	0.12
Fluoranthene	0.01	mg/kg	-	-	5,300[2]	180[1]	0.16	0.19	0.24	0.71
Fluorene	0.01	mg/kg	-	-	4,100[2]	-	nd	0.018	0.027	0.053
Naphthalene	0.01	mg/kg	-	-	25[2]	22[1]	nd	nd	0.011	0.1
Perylene	0.01	mg/kg	-	-	-	-	0.034	0.018	0.031	0.089
Phenanthrene	0.01	mg/kg	-	-	-	50[1]	0.043	0.18	0.16	0.51
Pyrene	0.01	mg/kg	-	-	3,200[2]	100[1]	0.14	0.18	0.20	0.64
Carcinogenic PAHs										
Benzo[a]anthracene	0.01	mg/kg	0.1	-	-	10[1]	0.11	0.094	0.11	0.38
Benzo[a]pyrene	0.01	mg/kg	1	-	-	72[1]	0.12	0.074	0.093	0.38
Benzo[b]fluoranthene	0.01	mg/kg	0.1	-	-	10[1]	0.12	0.064	0.082	0.41
Benzo[ghi]perylene	0.01	mg/kg	0.01	-	-	-	0.11	0.055	0.064	0.40
Benzo[j]fluoranthene	0.01	mg/kg	0.1	-	-	10[1]	0.058	0.041	0.051	0.22
Benzo[k]fluoranthene	0.01	mg/kg	0.1	-	-	10[1]	0.066	0.034	0.048	0.21
Chrysene	0.01	mg/kg	0.01	-	-	-	0.15	0.11	0.12	0.44
Indeno[1,2,3-cd]pyrene	0.01	mg/kg	0.1	-	-	10[1]	0.086	0.043	0.052	0.33
Dibenz[a,h]anthracene	0.01	mg/kg	1	-	-	10[1]	0.026	0.012	0.018	0.088
Benzo(a)pyrene TPE concentration				5.3[1,4]	-	-	0.2	0.1	0.1	0.6

Notes:

1 = Canadian Counsel of Ministers of the Environment (CCME) Soil Quality Guidelines for the Protection of Environmental and Human Health (1999 and Updates). As per CCME recommendations, soil samples are compared against the soil quality guidelines for the protection of human health and environmental health separately. Commercial land use.

2 = Alberta Tier I Soil and Groundwater Remediation Guidelines: Table A-5 Surface Soil Remediation Guidelines for Commercial Land Use - All Exposure Pathways (2010) assuming non-potable groundwater

3 = Soil and Groundwater Standards for Use at Contaminated Sites in Ontario: Table 3 - Full Depth, Non-Potable Water Scenario, Commercial/Industrial Land Use (2011)

4 = Carcinogenic PAHs assessed as B[a]P TPE for Human Health. Based on CCME guidelines for ingestion, inhalation and dermal exposures. Where a parameter is not detected, 1/2 of the RDL is used in the TPE calculation. Values were not multiplied by a factor of 3, as there was no evidence of creosote treated wood on the property.

B(a)P TPE = Benzo(a)pyrene Total Potency Equivalent concentration.
RDL = Reportable Detection Limit for routine analysis
nd = not detected above standard RDL
" - " = no guideline available
mbgs = metres below ground surface

Table A.4 Results of Laboratory Analysis of Leachable Metals
Geotechnical and Limited Environmental Investigation, Small Vessel Repair and Carpentry S
Southside Road, St. John's, NL
Stantec Project No. 140132351

Parameters	RDL	Units	Guideline[1]	TP5-S-3
			Sample Depth (m):	**3.0 - 3.5**
Leachable Metals				
Leachable Arsenic	20	µg/L	2,500	nd

Notes:

1 = Newfoundland and Labrador Department of Environment (NLDE), 2003. Leachable Toxic Waste, Testing and Disposal. NLDE Pollution Prevention Division. Guidance Document GD-PPD-26.1. Revised November, 2003 (Schedule II).

RDL = Reportable Detection Limit.

Maxxam
A Bureau Veritas Group Company

Your Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Your C.O.C. #: N/A

Attention:Carolyn Anstey-Moore

Stantec Consulting Ltd
141 Kelsey Drive
St. John's, NL
A1B 0L2

Report Date: 2016/09/27
Report #: R4181442
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B6I2419
Received: 2016/08/26, 15:30

Sample Matrix: Soil
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Petroleum Hydro. CCME F1 & BTEX in Soil (1, 3)	5	N/A	2016/09/04	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Soil (1, 4)	5	2016/09/02	2016/09/02	OTT SOP-00001	CCME CWS
Metals Leach TCLP/CGSB extraction (2)	1	2016/09/22	2016/09/23	ATL SOP 00058	EPA 6020A R1 m
Metals Solids Acid Extr. ICPMS (2)	4	2016/09/02	2016/09/03	ATL SOP 00058	EPA 6020A R1 m
Moisture (2)	4	N/A	2016/09/02	ATL SOP 00001	OMOE Handbook 1983 m
MOISTURE (1)	1	N/A	2016/09/06	CAM SOP-00445	McKeague 2nd ed 1978
PAH Compounds by GCMS (SIM) (2, 5)	4	2016/09/02	2016/09/03	ATL SOP 00102	EPA 8270D 2007 m
TCLP Inorganic extraction - pH (2)	1	N/A	2016/09/22	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight (2)	1	N/A	2016/09/22	ATL SOP 00035	EPA 1311 m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Ottawa
(2) This test was performed by Maxxam Bedford
(3) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(4) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(5) Soils are reported on a dry weight basis unless otherwise specified.

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

Maxxam Analytics International Corporation o/a Maxxam Analytics 49-55 Elizabeth Ave, Suite 101A, St.John's, NL, Canada A1A 1W9 Tel: 709-754-0203 Toll Free: 888-492-7227 Fax: 709-754-8612 www.maxxamanalytics.com

Maxxam Job #: B6I2419
Report Date: 2016/09/27

Stantec Consulting Ltd
Client Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

ATLANTIC TCLP LEACHATE + METALS (SOIL)

Maxxam ID		CYP677			
Sampling Date		2016/08/19			
COC Number		N/A			
	UNITS	**TP5-S-3**	**RDL**	**QC Batch**	**MDL**
Inorganics					
Sample Weight (as received)	g	65	N/A	4670054	N/A
Initial pH	N/A	4.9		4670057	
Final pH	N/A	4.9		4670057	
Metals					
Leachable Arsenic (As)	ug/L	<20	20	4671530	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 49-55 Elizabeth Ave, Suite 101A, St.John's, NL, Canada A1A 1W9 Tel: 709-754-0203 Toll Free: 888-492-7227 Fax: 709-754-8612 www.maxxamanalytics.com

Maxxam Job #: B6I2419
Report Date: 2016/09/27

Stantec Consulting Ltd
Client Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

RESULTS OF ANALYSES OF SOIL

Maxxam ID		CYP640	CYP674	CYP675	CYP676	CYP677			
Sampling Date		2016/08/19	2016/08/19	2016/08/19	2016/08/19	2016/08/19			
COC Number		N/A	N/A	N/A	N/A	N/A			
	UNITS	**TP1-S-1**	**TP2-S-2**	**TP3-S-3**	**TP4-S-2**	**TP5-S-3**	**RDL**	**QC Batch**	**MDL**
Inorganics									
Moisture	%		8.4				0.2	4645869	N/A
Moisture	%	6.3		14	9.4	21	1.0	4644164	0.20

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6I2419
Report Date: 2016/09/27

Stantec Consulting Ltd
Client Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		CYP640	CYP675	CYP676	CYP677			
Sampling Date		2016/08/19	2016/08/19	2016/08/19	2016/08/19			
COC Number		N/A	N/A	N/A	N/A			
	UNITS	**TP1-S-1**	**TP3-S-3**	**TP4-S-2**	**TP5-S-3**	**RDL**	**QC Batch**	**MDL**
Metals								
Acid Extractable Aluminum (Al)	mg/kg	14000	22000	20000	17000	10	4645732	N/A
Acid Extractable Antimony (Sb)	mg/kg	<2.0	<2.0	<2.0	3.6	2.0	4645732	N/A
Acid Extractable Arsenic (As)	mg/kg	3.9	7.6	7.5	60	2.0	4645732	N/A
Acid Extractable Barium (Ba)	mg/kg	44	42	30	72	5.0	4645732	N/A
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	<2.0	<2.0	2.0	4645732	N/A
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	<2.0	<2.0	<2.0	2.0	4645732	N/A
Acid Extractable Boron (B)	mg/kg	<50	<50	<50	<50	50	4645732	N/A
Acid Extractable Cadmium (Cd)	mg/kg	<0.30	<0.30	<0.30	0.36	0.30	4645732	N/A
Acid Extractable Chromium (Cr)	mg/kg	9.6	19	19	19	2.0	4645732	N/A
Acid Extractable Cobalt (Co)	mg/kg	9.5	15	13	12	1.0	4645732	N/A
Acid Extractable Copper (Cu)	mg/kg	33	28	60	58	2.0	4645732	N/A
Acid Extractable Iron (Fe)	mg/kg	27000	38000	36000	39000	50	4645732	N/A
Acid Extractable Lead (Pb)	mg/kg	25	42	36	250	0.50	4645732	N/A
Acid Extractable Lithium (Li)	mg/kg	37	50	49	37	2.0	4645732	N/A
Acid Extractable Manganese (Mn)	mg/kg	890	1100	880	1100	2.0	4645732	N/A
Acid Extractable Mercury (Hg)	mg/kg	<0.10	0.13	<0.10	0.16	0.10	4645732	N/A
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	<2.0	<2.0	4.0	2.0	4645732	N/A
Acid Extractable Nickel (Ni)	mg/kg	13	22	22	24	2.0	4645732	N/A
Acid Extractable Rubidium (Rb)	mg/kg	3.9	6.0	4.5	5.4	2.0	4645732	N/A
Acid Extractable Selenium (Se)	mg/kg	<1.0	<1.0	<1.0	2.2	1.0	4645732	N/A
Acid Extractable Silver (Ag)	mg/kg	<0.50	<0.50	<0.50	<0.50	0.50	4645732	N/A
Acid Extractable Strontium (Sr)	mg/kg	14	11	14	30	5.0	4645732	N/A
Acid Extractable Thallium (Tl)	mg/kg	<0.10	<0.10	<0.10	0.35	0.10	4645732	N/A
Acid Extractable Tin (Sn)	mg/kg	<2.0	4.4	3.2	28	2.0	4645732	N/A
Acid Extractable Uranium (U)	mg/kg	0.48	0.31	0.33	0.54	0.10	4645732	N/A
Acid Extractable Vanadium (V)	mg/kg	13	25	22	27	2.0	4645732	N/A
Acid Extractable Zinc (Zn)	mg/kg	88	88	93	160	5.0	4645732	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B6I2419
Report Date: 2016/09/27

Stantec Consulting Ltd
Client Project #: 140132351
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Sampler Initials: JN

SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		CYP640	CYP675	CYP676	CYP677			
Sampling Date		2016/08/19	2016/08/19	2016/08/19	2016/08/19			
COC Number		N/A	N/A	N/A	N/A			
	UNITS	**TP1-S-1**	**TP3-S-3**	**TP4-S-2**	**TP5-S-3**	**RDL**	**QC Batch**	**MDL**
Polyaromatic Hydrocarbons								
1-Methylnaphthalene	mg/kg	<0.010	0.014	<0.010	0.088	0.010	4645667	N/A
2-Methylnaphthalene	mg/kg	<0.010	0.015	<0.010	0.12	0.010	4645667	N/A
Acenaphthene	mg/kg	<0.010	0.022	0.011	0.056	0.010	4645667	N/A
Acenaphthylene	mg/kg	0.031	<0.010	0.011	0.041	0.010	4645667	N/A
Anthracene	mg/kg	0.011	0.037	0.059	0.12	0.010	4645667	N/A
Benzo(a)anthracene	mg/kg	0.11	0.094	0.11	0.38	0.010	4645667	N/A
Benzo(a)pyrene	mg/kg	0.12	0.074	0.093	0.38	0.010	4645667	N/A
Benzo(b)fluoranthene	mg/kg	0.12	0.064	0.082	0.41	0.010	4645667	N/A
Benzo(g,h,i)perylene	mg/kg	0.11	0.055	0.064	0.40	0.010	4645667	N/A
Benzo(j)fluoranthene	mg/kg	0.058	0.041	0.051	0.22	0.010	4645667	N/A
Benzo(k)fluoranthene	mg/kg	0.066	0.034	0.048	0.21	0.010	4645667	N/A
Chrysene	mg/kg	0.15	0.11	0.12	0.44	0.010	4645667	N/A
Dibenz(a,h)anthracene	mg/kg	0.026	0.012	0.018	0.088	0.010	4645667	N/A
Fluoranthene	mg/kg	0.16	0.19	0.24	0.71	0.010	4645667	N/A
Fluorene	mg/kg	<0.010	0.018	0.027	0.053	0.010	4645667	N/A
Indeno(1,2,3-cd)pyrene	mg/kg	0.086	0.043	0.052	0.33	0.010	4645667	N/A
Naphthalene	mg/kg	<0.010	<0.010	0.011	0.11	0.010	4645667	N/A
Perylene	mg/kg	0.034	0.018	0.031	0.089	0.010	4645667	N/A
Phenanthrene	mg/kg	0.043	0.18	0.16	0.51	0.010	4645667	N/A
Pyrene	mg/kg	0.14	0.18	0.20	0.64	0.010	4645667	N/A
Surrogate Recovery (%)								
D10-Anthracene	%	93	94	83	91		4645667	
D14-Terphenyl (FS)	%	92	94	82	96		4645667	
D8-Acenaphthylene	%	79	90	90	91		4645667	

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
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PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		CYP640	CYP674	CYP675	CYP676	CYP677			
Sampling Date		2016/08/19	2016/08/19	2016/08/19	2016/08/19	2016/08/19			
COC Number		N/A	N/A	N/A	N/A	N/A			
	UNITS	**TP1-S-1**	**TP2-S-2**	**TP3-S-3**	**TP4-S-2**	**TP5-S-3**	**RDL**	**QC Batch**	**MDL**
BTEX & F1 Hydrocarbons									
Benzene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	0.10	0.0050	4645838	N/A
Toluene	ug/g	<0.020	<0.020	0.036	<0.020	0.14	0.020	4645838	N/A
Ethylbenzene	ug/g	<0.010	<0.010	<0.010	<0.010	0.044	0.010	4645838	N/A
o-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	0.056	0.020	4645838	N/A
p+m-Xylene	ug/g	<0.040	<0.040	<0.040	<0.040	0.11	0.040	4645838	N/A
Total Xylenes	ug/g	<0.040	<0.040	<0.040	<0.040	0.16	0.040	4645838	N/A
F1 (C6-C10)	ug/g	<10	<10	<10	<10	<10	10	4645838	N/A
F1 (C6-C10) - BTEX	ug/g	<10	<10	<10	<10	<10	10	4645838	N/A
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/g	19	<10	36	<10	<10	10	4645879	N/A
F3 (C16-C34 Hydrocarbons)	ug/g	350	78	52	53	79	50	4645879	N/A
F4 (C34-C50 Hydrocarbons)	ug/g	200	<50	<50	<50	<50	50	4645879	N/A
Reached Baseline at C50	ug/g	Yes	No	No	Yes	No		4645879	
Surrogate Recovery (%)									
1,4-Difluorobenzene	%	95	99	95	96	109		4645838	
4-Bromofluorobenzene	%	94	103	96	92	106		4645838	
D10-Ethylbenzene	%	108	106	109	121	118		4645838	
D4-1,2-Dichloroethane	%	96	113	97	101	112		4645838	
o-Terphenyl	%	78	72	78	80	83		4645879	

RDL = Reportable Detection Limit
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N/A = Not Applicable

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Sampler Initials: JN

TEST SUMMARY

Maxxam ID: CYP640
Sample ID: TP1-S-1
Matrix: Soil

Collected: 2016/08/19
Shipped:
Received: 2016/08/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	4645838	N/A	2016/09/04	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	4645879	2016/09/02	2016/09/02	Arezoo Habibagahi
Metals Solids Acid Extr. ICPMS	ICP/MS	4645732	2016/09/02	2016/09/03	Bryon Angevine
Moisture	BAL	4644164	N/A	2016/09/02	Victoria Legge
PAH Compounds by GCMS (SIM)	GC/MS	4645667	2016/09/02	2016/09/03	Robin Smith-Armstrong

Maxxam ID: CYP674
Sample ID: TP2-S-2
Matrix: Soil

Collected: 2016/08/19
Shipped:
Received: 2016/08/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	4645838	N/A	2016/09/04	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	4645879	2016/09/02	2016/09/02	Arezoo Habibagahi
MOISTURE	BAL	4645869	N/A	2016/09/06	Arezoo Habibagahi

Maxxam ID: CYP675
Sample ID: TP3-S-3
Matrix: Soil

Collected: 2016/08/19
Shipped:
Received: 2016/08/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	4645838	N/A	2016/09/04	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	4645879	2016/09/02	2016/09/02	Arezoo Habibagahi
Metals Solids Acid Extr. ICPMS	ICP/MS	4645732	2016/09/02	2016/09/03	Bryon Angevine
Moisture	BAL	4644164	N/A	2016/09/02	Victoria Legge
PAH Compounds by GCMS (SIM)	GC/MS	4645667	2016/09/02	2016/09/03	Robin Smith-Armstrong

Maxxam ID: CYP676
Sample ID: TP4-S-2
Matrix: Soil

Collected: 2016/08/19
Shipped:
Received: 2016/08/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	4645838	N/A	2016/09/04	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	4645879	2016/09/02	2016/09/02	Arezoo Habibagahi
Metals Solids Acid Extr. ICPMS	ICP/MS	4645732	2016/09/02	2016/09/03	Bryon Angevine
Moisture	BAL	4644164	N/A	2016/09/02	Victoria Legge
PAH Compounds by GCMS (SIM)	GC/MS	4645667	2016/09/02	2016/09/03	Robin Smith-Armstrong

Maxxam ID: CYP677
Sample ID: TP5-S-3
Matrix: Soil

Collected: 2016/08/19
Shipped:
Received: 2016/08/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	4645838	N/A	2016/09/04	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	4645879	2016/09/02	2016/09/02	Arezoo Habibagahi
Metals Leach TCLP/CGSB extraction	CICP	4671530	2016/09/22	2016/09/23	Bryon Angevine

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Client Project #: 140132351
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TEST SUMMARY

Maxxam ID: CYP677
Sample ID: TP5-S-3
Matrix: Soil

Collected: 2016/08/19
Shipped:
Received: 2016/08/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Solids Acid Extr. ICPMS	ICP/MS	4645732	2016/09/02	2016/09/03	Bryon Angevine
Moisture	BAL	4644164	N/A	2016/09/02	Victoria Legge
PAH Compounds by GCMS (SIM)	GC/MS	4645667	2016/09/02	2016/09/03	Robin Smith-Armstrong
TCLP Inorganic extraction - pH		4670057	N/A	2016/09/22	Emma deLory
TCLP Inorganic extraction - Weight		4670054	N/A	2016/09/22	Emma deLory

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GENERAL COMMENTS

Revised report: Added TCLP Leachate + As testing to sample CYP677 as requested by C. Anstey-Moore. 2016/09/19 MHL

Sample CYP677-01 : Method Deviation Comment: Reduced sample weight used for leachate procedure due to insufficient sample. All extraction ratios maintained. Minimal impact on sample data quality.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

Stantec Consulting Ltd
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Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
4645667	D10-Anthracene	2016/09/03	92	30 - 130	91	30 - 130	94	%		
4645667	D14-Terphenyl (FS)	2016/09/03	81	30 - 130	84	30 - 130	92	%		
4645667	D8-Acenaphthylene	2016/09/03	89	30 - 130	79	30 - 130	81	%		
4645838	1,4-Difluorobenzene	2016/09/04			99	60 - 140	101	%		
4645838	4-Bromofluorobenzene	2016/09/04			119	60 - 140	107	%		
4645838	D10-Ethylbenzene	2016/09/04			107	30 - 130	130	%		
4645838	D4-1,2-Dichloroethane	2016/09/04			100	60 - 140	102	%		
4645879	o-Terphenyl	2016/09/02	69	30 - 130	76	30 - 130	77	%		
4645667	1-Methylnaphthalene	2016/09/03	82	30 - 130	75	30 - 130	<0.010	mg/kg	NC	50
4645667	2-Methylnaphthalene	2016/09/03	86	30 - 130	77	30 - 130	<0.010	mg/kg	NC	50
4645667	Acenaphthene	2016/09/03	88	30 - 130	81	30 - 130	<0.010	mg/kg	NC	50
4645667	Acenaphthylene	2016/09/03	87	30 - 130	80	30 - 130	<0.010	mg/kg	NC	50
4645667	Anthracene	2016/09/03	92	30 - 130	90	30 - 130	<0.010	mg/kg	NC	50
4645667	Benzo(a)anthracene	2016/09/03	95	30 - 130	83	30 - 130	<0.010	mg/kg	NC	50
4645667	Benzo(a)pyrene	2016/09/03	101	30 - 130	103	30 - 130	<0.010	mg/kg	NC	50
4645667	Benzo(b)fluoranthene	2016/09/03	110	30 - 130	109	30 - 130	<0.010	mg/kg	NC	50
4645667	Benzo(g,h,i)perylene	2016/09/03	94	30 - 130	97	30 - 130	<0.010	mg/kg	NC	50
4645667	Benzo(j)fluoranthene	2016/09/03	101	30 - 130	99	30 - 130	<0.010	mg/kg	NC	50
4645667	Benzo(k)fluoranthene	2016/09/03	111	30 - 130	100	30 - 130	<0.010	mg/kg	NC	50
4645667	Chrysene	2016/09/03	103	30 - 130	93	30 - 130	<0.010	mg/kg	NC	50
4645667	Dibenz(a,h)anthracene	2016/09/03	95	30 - 130	95	30 - 130	<0.010	mg/kg	NC	50
4645667	Fluoranthene	2016/09/03	90	30 - 130	89	30 - 130	<0.010	mg/kg	NC	50
4645667	Fluorene	2016/09/03	97	30 - 130	87	30 - 130	<0.010	mg/kg	NC	50
4645667	Indeno(1,2,3-cd)pyrene	2016/09/03	93	30 - 130	96	30 - 130	<0.010	mg/kg	NC	50
4645667	Naphthalene	2016/09/03	82	30 - 130	74	30 - 130	<0.010	mg/kg	NC	50
4645667	Perylene	2016/09/03	94	30 - 130	97	30 - 130	<0.010	mg/kg	NC	50
4645667	Phenanthrene	2016/09/03	89	30 - 130	85	30 - 130	<0.010	mg/kg	NC	50
4645667	Pyrene	2016/09/03	87	30 - 130	89	30 - 130	<0.010	mg/kg	NC	50
4645732	Acid Extractable Aluminum (Al)	2016/09/06					<10	mg/kg	3.2	35
4645732	Acid Extractable Antimony (Sb)	2016/09/06	104	75 - 125	103	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Arsenic (As)	2016/09/06	99	75 - 125	100	75 - 125	<2.0	mg/kg	NC	35

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QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
4645732	Acid Extractable Barium (Ba)	2016/09/06	NC	75 - 125	100	75 - 125	<5.0	mg/kg	2.3	35
4645732	Acid Extractable Beryllium (Be)	2016/09/06	103	75 - 125	102	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Bismuth (Bi)	2016/09/06	108	75 - 125	103	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Boron (B)	2016/09/06	102	75 - 125	103	75 - 125	<50	mg/kg	NC	35
4645732	Acid Extractable Cadmium (Cd)	2016/09/06	102	75 - 125	101	75 - 125	<0.30	mg/kg	NC	35
4645732	Acid Extractable Chromium (Cr)	2016/09/06	97	75 - 125	99	75 - 125	<2.0	mg/kg	11	35
4645732	Acid Extractable Cobalt (Co)	2016/09/06	96	75 - 125	100	75 - 125	<1.0	mg/kg	15	35
4645732	Acid Extractable Copper (Cu)	2016/09/06	96	75 - 125	99	75 - 125	<2.0	mg/kg	10	35
4645732	Acid Extractable Iron (Fe)	2016/09/06					<50	mg/kg	12	35
4645732	Acid Extractable Lead (Pb)	2016/09/06	102	75 - 125	101	75 - 125	<0.50	mg/kg	0.95	35
4645732	Acid Extractable Lithium (Li)	2016/09/06	108	75 - 125	105	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Manganese (Mn)	2016/09/06	NC	75 - 125	108	75 - 125	<2.0	mg/kg	15	35
4645732	Acid Extractable Mercury (Hg)	2016/09/06	101	75 - 125	102	75 - 125	<0.10	mg/kg	NC	35
4645732	Acid Extractable Molybdenum (Mo)	2016/09/06	102	75 - 125	124	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Nickel (Ni)	2016/09/06	96	75 - 125	100	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Rubidium (Rb)	2016/09/06	98	75 - 125	101	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Selenium (Se)	2016/09/06	99	75 - 125	99	75 - 125	<1.0	mg/kg	NC	35
4645732	Acid Extractable Silver (Ag)	2016/09/06	105	75 - 125	106	75 - 125	<0.50	mg/kg	NC	35
4645732	Acid Extractable Strontium (Sr)	2016/09/06	106	75 - 125	105	75 - 125	<5.0	mg/kg	NC	35
4645732	Acid Extractable Thallium (Tl)	2016/09/06	101	75 - 125	106	75 - 125	<0.10	mg/kg	NC (1)	35
4645732	Acid Extractable Tin (Sn)	2016/09/06	106	75 - 125	106	75 - 125	<2.0	mg/kg	NC	35
4645732	Acid Extractable Uranium (U)	2016/09/06	105	75 - 125	103	75 - 125	<0.10	mg/kg	NC	35
4645732	Acid Extractable Vanadium (V)	2016/09/06	96	75 - 125	99	75 - 125	<2.0	mg/kg	11	35
4645732	Acid Extractable Zinc (Zn)	2016/09/06	97	75 - 125	99	75 - 125	<5.0	mg/kg	NC	35
4645838	Benzene	2016/09/04			107	60 - 140	<0.0050	ug/g	27	50
4645838	Ethylbenzene	2016/09/04			96	60 - 140	<0.010	ug/g	19	50
4645838	F1 (C6-C10) - BTEX	2016/09/04					<10	ug/g		
4645838	F1 (C6-C10)	2016/09/04			110	80 - 120	<10	ug/g	0.027	50
4645838	o-Xylene	2016/09/04			111	60 - 140	<0.020	ug/g	34	50
4645838	p+m-Xylene	2016/09/04			85	60 - 140	<0.040	ug/g	18	50
4645838	Toluene	2016/09/04			91	60 - 140	<0.020	ug/g	23	50

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Maxxam Job #: B6I2419
Report Date: 2016/09/27

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
4645838	Total Xylenes	2016/09/04					<0.040	ug/g		
4645869	Moisture	2016/09/06							1.8	50
4645879	F2 (C10-C16 Hydrocarbons)	2016/09/02	77	50 - 130	85	80 - 120	<10	ug/g	NC	50
4645879	F3 (C16-C34 Hydrocarbons)	2016/09/02	77	50 - 130	85	80 - 120	<50	ug/g	15	50
4645879	F4 (C34-C50 Hydrocarbons)	2016/09/02	77	50 - 130	85	80 - 120	<50	ug/g	NC	50
4670054	Sample Weight (as received)	2016/09/22					NA	g		
4671530	Leachable Arsenic (As)	2016/09/23	94	75 - 125	97	80 - 120	<20	ug/L		

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

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

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

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

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

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

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

(1) Poor RPD due to sample inhomogeneity. Results confirmed with repeat digestion and analysis.

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Maxxam Job #: B6I2419
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Stantec Consulting Ltd
Client Project #: 140132351
Site Location: DFO SOUTHSIDE RD
Sampler Initials: JN

VALIDATION SIGNATURE PAGE

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

Mike MacGillivray, Scientific Specialist (Inorganics)

Phil Deveau

Paul Rubinato, Analyst, Maxxam Analytics

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

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