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Geotechnical Design Report – Revision 1

Napanee Water Pollution Control Plant Expansion & Upgrades
300 Water Street West
Napanee, Ontario

Client Name: EVB Engineering on behalf of the Town of Greater Napanee
Date: January 21, 2024
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1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Thurber Engineering Ltd. (Thurber) and geotechnical recommendations to support the design and construction of proposed upgrades at the Napanee Water Pollution Control Plant (WPCP) located in the Town of Greater Napanee (the Town). The project area is located southwest of the intersection of Water Street W. and Hessford Street, extending to the Napanee River.

It is noted that a previous draft version of this report was issued on July 16, 2021 to a different design team. Based on that information, a new maintenance garage was designed and is currently under construction on the southwest side of the property. Subsequently, a new design team comprised of EVB Engineering (EVB) and CIMA+ have been retained by the Town to complete the design of the remaining proposed upgrades, which have been modified since Thurber's original draft report was submitted. In addition, new geophysical testing was carried out for the project in November 2023, and a supplemental geotechnical investigation was carried out in February 2024. This current version of Thurber's geotechnical report has been prepared specifically for the current design team (EVB and CIMA+) regarding the proposed upgrades that still remain in the design stage. Recommendations that were used for the design of the maintenance garage are also provided in this report for records purposes.

It is understood that the current stage of the project will include construction of new wastewater treatment structures and ancillary buildings on land adjacent to the existing WPCP. Specifically, the upgrades include the following:

- A single storey multi-use building including headworks, electrical and mechanical rooms, lab, and offices. The footprint of the building will be approximately 22 m wide and 32 m long. The building will have two floor slab levels, with the office are having a finished floor Elevation of 81.76 m and the headworks area having a finished floor Elevation of 80.90 m. A vortex tank within the headworks will have a founding Elevation of 76.03 m.

- New influent buffer tanks and sludge buffer tank adjoining the headworks building to the east and south, respectively. The footprint of the influent tanks will be approximately 9 m wide and 17 m long, and the sludge tanks will be approximately 6 m wide and 18 m long. The influent buffer tank and sludge buffer tanks will be founded below grade on raft slabs with founding Elevations of 71.70 m and 73.90 m, respectively.

- Three AGS reactor tanks with an approximate width of 33 m and total length of 54.2 m. The tanks will be founded below grade on a raft slab with a founding Elevation of 75.45 m.

- A post-equalization tank adjoining the AGS tanks. The tank will be approximately 9 m wide and 29 m long. The tank will be founded on a raft slab with a founding Elevation of 77.84 m. A pad of lean concrete will be provided beneath the raft slab to an Elevation of 75.45 m (equal to the founding elevation of the AGS tanks).

- A new two-storey operation building including solids thickener, AGS controls, tanks access, biogas boiler, pump gallery, piping, electrical and mechanical. The building will be approximately 14 m wide and 39 m long. The building will have a basement level and will be founded on a raft slab with a founding Elevation of 76.4 m.

- A single storey tertiary/ultraviolet disinfection building with flocculation tanks. The footprint of the building will be approximately 16 m wide and 27 m long. The building will have a basement level with a raft slab founding Elevation of 75.068 m).

- A sanitary pumping station to the east of the tertiary building. The wet well for the pumping station will be approximately 2.4 m wide and 2.4 m long, with a base Elevation of approximately 73.0 m.

- Retaining walls at the north and south side of the operation building.

- Access roads, a parking lot, yard piping and below grade duct banks.

- Generator and exterior stairs supported on floating concrete pads.

The purpose of the geotechnical investigation was to explore the subsurface conditions within the project limits and based on the data obtained, to provide a borehole location plan, record of borehole sheets, laboratory test results, and a written description of the subsurface conditions. These interpreted subsurface conditions and available project details were used to provide geotechnical recommendations regarding the design of foundations, shoring systems, open cut utility installation, and asphalt pavement.

A limited analytical testing program was completed on selected soil samples to evaluate the environmental quality and provide preliminary management options for excavated soils that may be generated during the proposed construction works. It is understood that a Phase 1 Environmental Site Assessment (ESA) was previously carried out at the site by others. Thurber's scope of work for this assignment was limited to soil and groundwater sampling and testing at the borehole and monitoring well locations. Preparation of Planning Documents in accordance with O.Reg. 406/19 were not within Thurber's scope for this assignment.

A hydrogeological assessment was completed concurrently for this project. The results of hydrogeological assessment are provided under a separate cover and should be read in conjunction with this report.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. BACKGROUND INFORMATION

2.1 Site Description

The project site is located at 300 Water Street West, Napanee, Ontario. The Property is bounded by Water Street West to the north and the Napanee River to the south. The west and east sides of the property are bounded by the Riverine Retirement Home property line and Hessford Street, respectively.

The ground surface of the project site slopes towards the river to the south and ranges from approximately Elevation 85 m in the north to 75 m in the south of the site. The project area lies within the Napanee River Valley and the valley slope rises north of the project site to approximately Elevation 100 m.

In general, the land use surrounding the project area is residential or vacant. A retirement home lies to the west of the site, while homes, a restaurant, and an apartment building are north and east of the site. The project site itself is industrial and municipal wastewater treatment is conducted on site.

2.2 Geology

Based on the information in *The Physiography of Southern Ontario* by Chapman and Putnam (1984), the site is located within the Napanee Plain physiographic region. The Napanee Plain is characterized by flat-to-undulating limestone with little overburden, except for within stream valleys and along the Napanee River and Salmon River Valleys, which may contain a variety of alluvial deposits. The physiographic landform of the project site is a clay plain, with fine textured glaciolacustrine deposits of silt and clay with minor sands and gravel.

Based on *Quaternary Geology Map M2588* (1983), the surficial deposits in the vicinity are generally deeper water glaciolacustrine deposits of massive to laminated silt and clays with minor sand and gravel.

According to *Paleozoic Geology Map P2497 (1982)*, the underlying bedrock in the area consists of the Bobcaygeon Formation. This formation contains limestone with minor shale partings. This formation ranges from micritic limestone to a course grainstone with abundant reworked clasts and calcareous fossils. Locally, the Bobcaygeon Formation is bounded by a fault which runs along the Napanee River south of the project area.

2.3 Previous Investigations

Reports from three previous investigations completed on the WPCP site were made available for review. The report references are provided below:

- Geotechnical Investigation (DRAFT), Upgrades to Wastewater Treatment Plant, 300 Water Street West, Napanee, Ontario, by GHD dated June 21, 2018.
- Geotechnical Investigation, Proposed Tank Installation, Napanee Plant, 300 Water Street by Inspec-Sol Inc, dated November 15, 1999.
- Geotechnical Investigation, Stage 2 Contract Soil Investigation, by Site Investigation Services dated October 5, 1977.

A total of 31 sampled boreholes were drilled as part of the referenced geotechnical investigations. All boreholes from these investigations were reviewed and Boreholes BH1-17, BH13-17, BH14-17, MW15-17, BH16-17, MW17-17, and BH19-17 from the GHD were considered most relevant to the current works and have been reproduced and included in Appendix B along with the borehole location drawing. The previous investigations were used to provide supplemental bedrock and groundwater information for design and are noted in the summarized bedrock physical properties.

3. INVESTIGATION PROCEDURES

3.1 Testhole Drilling

The field investigation was carried out in two stages, with the first stage occurring between February 22 and March 2, 2021 and the second stage occurring between February 20 and 21, 2024. In total, the two stages included the installation of 24 sampled geotechnical boreholes (BH01 through BH14, BH19 through BH26, MW24-101, and BH24-301), four unsampled auger probes (BH15, BH16, BH17, BH18), and six cone penetration tests (CPTu) tests (CPT24-201, through CPT24-206). Additional details regarding the CPT testing equipment and methodology are provided in Appendix J.

A summary of the borehole, auger probe, and CPT details are provided in Table 3.1. Borehole details are also provided on the Record of Borehole sheets included in Appendix B. The approximate locations of the boreholes, auger probes, and CPTs are shown on the Testhole Location Plan, Drawing No. 40745-1 provided in Appendix A.

Table 3.1 – Borehole Details

Testhole ID	Northing (m)	Easting (m)	Ground Surface Elev. (m)	Termination Depth (m)	Termination Elev. (m)	MW Installed?
BH-01	4 900 363.3	343 393.4	80.9	10.2	70.7	N
BH-02	4 900 376.0	343 427.4	79.0	8.8	70.2	Y
BH-03	4 900 314.4	343 421.8	76.4	10.3	66.2	Y
BH-04	4 900 313.1	343 466.0	77.2	10.2	67.0	Y
BH-05	4 900 278.5	343 451.1	76.3	11.6	64.7	N
BH-06	4 900 323.2	343 358.1	78.5	5.8	72.7	Y
BH-07	4 900 335.5	343 376.2	78.5	5.9	72.6	N
BH-08	4 900 312.0	343 386.0	77.2	6.5	70.6	N
BH-09	4 900 314.9	343 400.5	76.8	2.9	73.9	N
BH-10	4 900 286.0	343 480.9	76.5	3.7	72.9	N
BH-11	4 900 293.0	343 503.0	76.4	3.7	72.7	Y
BH-12	4 900 302.0	343 528.0	76.4	3.7	72.7	N
BH-13	4 900 388.5	343 400.4	81.7	3.7	78.1	N
BH-14	4 900 385.9	343 445.9	80.4	3.7	76.7	N
BH-15*	4 900 334.4	343 401.2	77.7	6.3	71.4	N
BH-16*	4 900 348.3	343 451.0	78.2	7.8	70.4	N
BH-17*	4 900 301.2	343 445.0	76.5	9.8	66.7	N
BH-18*	4 900 305.4	343 483.5	76.9	11.3	65.6	N
BH-19	4 900 314.3	343 501.3	77.5	5.2	72.4	N
BH-20	4 900 375.0	343 378.0	80.0	2.9	77.1	N
BH-21	4 900 395.1	343 423.1	80.5	2.9	77.6	N
BH-22	4 900 334.8	343 465.,3	77.7	3.7	74.1	N
BH-23	4 900 302.4	343 359.7	77.5	2.9	74.7	N
BH-24	4 900 283.0	343 428.0	75.9	2.9	73.1	N
BH-25	4 900 364.7	343 500.3	77.7	8.2	69.5	N
BH-26	4 900 345.9	343 514.1	77.4	8.2	69.2	N
MW24-101	4 900 343.9	343 412.5	79.0	9.8	69.2	Y
BH24-301	4 900 313.0	343 462.9	77.2	8.5	68.7	N
CPT24-201	4 900 310.8	343 463.9	77.1	8.7	68.4	N

Testhole ID	Northing (m)	Easting (m)	Ground Surface Elev. (m)	Termination Depth (m)	Termination Elev. (m)	MW Installed?
CPT24-202	4 900 284.2	343 464.4	76.8	10.8	66.0	N
CPT24-203	4 900 311.8	343 432.2	76.5	7.2	69.3	N
CPT24-204	4 900 328.9	343 439.0	77.9	7.9	70.0	N
CPT24-205	4 900 352.9	343 439.6	78.3	7.3	71.0	N
CPT24-206	4 900 344.1	343 460.1	78.0	8.5	69.5	N

Notes: MW – Monitoring well

* - Auger probes to determine approximate bedrock depth.

The testhole locations were established in the field by Thurber using a portable GPS receiver and verified relative to existing site features. All testhole locations were cleared of utilities prior to commencement of drilling. The testholes were repositioned as necessary in consideration of surface features, underground utilities, and overhead obstructions. Borehole location coordinates are presented in the Universal Transverse Mercator (UTM) system (NAD83, CSRS 2010.0).

The boreholes and auger probes were advanced using hollow stem and solid stem augers, powered by track mounted CME 55 drill rigs operated by GET Drilling. Boreholes MW24-101 and BH24-301 were advanced using mud rotary techniques powered by a Gtech GT8 drill rig operated by ConeTec Investigations Ltd.. Within the boreholes, soil samples were obtained at selected intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT). During the 2021 investigation, in-situ vane shear testing was conducted in the cohesive deposits at selected locations/depths with an MTO N-sized vane. During the 2024 investigation, three Nilcon vane tests were carried out at selected depths in BH24-301. Thin-Walled (Shelby) tube samples were pushed and retrieved at various elevations in the boreholes to obtain relatively undisturbed cohesive soil samples for further laboratory testing. Bedrock core samples were recovered in BH-01, BH-02, BH-03 and MW24-101 using NQ or HQ size diamond drill core barrels.

The field investigation was carried out under the full-time supervision of Thurber technical staff. Soil samples were identified, placed in labelled containers, logged in the field, and transported back to Thurber's laboratory for further visual examination and laboratory testing, including moisture content, grain size distribution testing, and Atterberg limits. Where soil samples were selected for analytical testing, one portion of each soil sample was placed into a laboratory-supplied labelled glass jar or vial and stored on ice in an insulated cooler to maintain a cool environment for possible analytical testing. A second portion of the sample was placed inside a labelled plastic bag for screening of headspace soil vapours, visual assessment, classification of the soils and additional geotechnical laboratory testing. The recovered rock core samples were described and photographed in the field, packaged in core boxes, and transported back to Thurber's laboratory for further examination and testing.

3.2 Groundwater Monitoring and Testing

3.2.1 Monitoring Well Installation

Monitoring wells were installed in selected boreholes to permit monitoring of the groundwater levels at the site, to allow for water quality samples to be collected and submitted for analytical testing and to allow for single well response testing. The monitoring wells were installed by an MECP licensed well technician in accordance with O.Reg. 903, as amended. The monitoring wells consisted of 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. The annular space of the borehole around the screen was backfilled with clean filter sand covered by a bentonite seal. The installation details are summarized in Table 3.2 below.

Table 3.2 – Monitoring Well Details

Borehole/ Monitoring Well No.	GS Elev. (m)	Monitoring Well Tip		Slotted Screen Length (m)	Mid-Screen Depth (m)	Mid-Screen Elev. (m)	Screened Material
		Depth (m)	Elev. (m)				
02 Shallow	79.0	5.7	73.3	3.0	4.2	74.8	Silty Clay
02 Deep		8.8	70.2	2.4	7.6	71.4	Bedrock
03 Shallow	76.4	7.2	69.2	3.0	5.7	70.7	Silty Clay / Silt
03 Deep		10.3	66.2	2.4	9.1	67.4	Bedrock
04 Shallow	77.2	6.1	71.1	3.0	4.6	72.6	Silty Clay
04 Deep		10.2	67.0	3.0	8.7	68.5	Silty Clay
06	78.5	5.8	72.7	3.0	4.3	74.2	Silty Clay / Silty Sand
11	76.4	3.1	73.3	1.5	2.3	74.1	Sand / Silty Clay
MW 24-101	79.0	9.4	69.6	1.5	8.6	70.4	Bedrock

Notes: GS – Ground surface

The remaining boreholes were backfilled with bentonite to the ground surface in general accordance with O.Reg. 903, as amended.

3.2.2 Water Level Measurements

The groundwater conditions at the borehole locations were assessed during drilling by visual examination of the soil, the sampler and the drill rods as the samples were retrieved and when appropriate by measurement of the water level in the open borehole.

Water levels were measured in the monitoring wells using a groundwater level reader.

3.2.3 Single Well Response Tests and Groundwater sampling

The hydraulic conductivity of the screened geologic media was estimated through Single Well Response Tests (rising head “slug tests”) in all monitoring wells. Groundwater samples were collected from select monitoring wells for water quality testing. Further discussion of this testing and the results of the testing are available in the Hydrogeological Report.

3.3 Geophysical Testing

Geophysical testing was carried out on November 2, 2023 using seismic refraction and Multichannel Analysis of Surface Waves (MASW) methods by Geophysics GPR International Inc. Three seismic refraction lines were completed within the footprint of the proposed structures for the purpose of assessing the bedrock surface profile. A separate MASW line was completed for assessing the shear wave velocities of the underlying soil and bedrock to determine the seismic Site Class. Additional details about the test methodology are presented in Appendix I.

4. LABORATORY TESTING

4.1 Geotechnical

Geotechnical laboratory testing of soil samples was carried out at Thurber’s laboratory. All recovered soil samples were subjected to visual identification and to natural moisture content determination. Selected samples were also subjected to grain size distribution analysis (hydrometer and/or sieve) and Atterberg Limits testing, where appropriate.

Advanced laboratory testing consisting of consolidation tests was carried out on selected undisturbed Shelby tube samples at Thurber’s laboratory.

Geotechnical laboratory testing of rock core samples consisted of point load strength and unconfined compressive strength testing.

Results of the geotechnical soil and rock laboratory testing are presented on the Record of Borehole sheets in Appendix B and in detail in Appendices C and D, respectively.

Selected soil samples were also submitted for analytical testing to assess the corrosion potential of the soil to ductile iron and the potential for sulphate attack on subsurface concrete structures. The analyses were carried out by ALS Laboratory Group (ALS), a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory. The results of the corrosivity testing are summarized in Section 6.13 and laboratory Certificates of Analysis are included in Appendix F.

4.2 Geo-Environmental

4.2.1 Field Screening Measurements

All soil samples recovered from the boreholes were screened for both volatile organic compounds (VOCs), calibrated with isobutylene, and combustible gases, calibrated with hexane, using an RKI Eagle 2 instrument. The field screening was conducted on soil samples contained in sealed, plastic bags in order to measure the concentrations of gases/vapours in the headspace of the bags.

Field screening of soil was conducted to provide a semi-quantitative assessment of volatile parameters in soil which involves the measurement of undifferentiated organic compounds and does not discriminate among the various organic parameters. As such, the gas/vapour readings are not considered to be actual concentrations of gases and vapours in the soil samples but are indicative of the relative concentrations in the samples. The headspace measurements are typically taken to guide the selection of soil samples for chemical analysis of organic compounds such as volatile constituents and/or petroleum hydrocarbons. A summary of the recorded gas/vapour readings is presented in Table G7 in Appendix G.

4.2.2 Soil

Visual and olfactory examination of the soil samples was completed on the recovered samples from the geotechnical field investigation program to identify potential staining and/or odours that may be indicative of hydrocarbon impact or other contamination and are presented on the Record of Borehole Sheets in Appendix B.

To evaluate the general environmental quality of the soils near the proposed excavations, representative samples of the soils recovered from the boreholes were submitted to ALS Laboratory Group for analysis of selected metals and inorganic parameters, petroleum hydrocarbons (PHCs) Fractions F1 to F4, benzene, ethylbenzene, toluene and xylenes (BTEX), and volatile organic compounds (VOCs) as outlined in Table G1, in Appendix G. Five composite soil samples were also submitted to the laboratory for analysis of Synthetic Precipitation Leaching Procedure (SPLP) for select metals and VOCs.

The sample locations/depths and material types selected for testing are summarized in Table G1, included in Appendix G. The results of the analytical testing are discussed Section 0. Analytical summary tables are provided in Appendix G and laboratory Certificates of Analysis are included in Appendix H.

It should be noted that excess soil in Ontario is now regulated under O. Reg. 406/19, as amended, made under the Environmental Protection Act, "On-site and Excess Soil Management" that was initially filed on December 4, 2019 ("Excess Soil Regulation"). The regulation does not apply to the reuse of excavated soils on Site, or to the handling of waste that is regulated by O. Reg. 347/90, as amended, "General – Waste Management".

To comply with O. Reg. 406/19, as amended, project specific details such as excess soil quantities, soil management strategies and receiving site acceptance criteria are required which are unknown at this time.

The scope of the required testing and planning documentation can vary significantly depending on the quantity of excess soils that will be generated as a result of the final design. Without the final design information and management strategies (i.e. on-site or off-site reuse, actual excess soil quantities, reuse site acceptance criteria), the full requirements of the new regulation may not be met. Therefore, although the proposed work plan has considered aspects of the regulation, it should only be regarded as due diligence sampling and testing at this time. Supplemental sampling and testing, as well as planning documentation, beyond the current program may be necessary to meet the requirements of the Excess Soil Regulation.

4.2.3 Quality Assurance and Quality Control Measures

The quality assurance and quality control (QA/QC) program included the use of the laboratory supplied sampling containers, and handling of samples under Chain-of-Custody protocol. The samples were placed directly into laboratory supplied sampling containers that were pre-labelled with analytical parameters and preservatives, where required using dedicated nitrile gloves that were changed between each sample collected. VOC and PHC F1 samples were collected using dedicated Terra Core ® samplers for each sample and placed directly into glass vials containing methanol.

Each soil sample was labeled with sample identification and sampling date and carefully preserved on ice in insulated coolers from the time of collection to the time of delivery to the laboratory to maintain storage temperatures required by Ministry of Environment, Conservation and Parks (MECP's) "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, March 9, 2004, amended as of July 1, 2011".

ALS Labs conducted an internal Quality Assurance program in accordance with O. Reg. 153/04 analytical protocols. This included testing of duplicates and reference material spike samples to verify the precision, accuracy and reliability of the reported analytical test results.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix B. A general summary of the stratigraphy, based on the conditions encountered in the boreholes, is given in the following sections. However, the factual data presented on the Record of Borehole sheets takes precedence over this summary and must be used for interpretation of the site conditions. It should be recognized and expected that soil conditions will vary between and beyond borehole locations.

The subsurface stratigraphy encountered in the boreholes typically consisted of surficial materials (pavement structure, topsoil/organics or fill) overlying a native deposit of silty clay, which was encountered throughout the site and either directly underlain by limestone bedrock or a relatively thin layer of sand/silt which was underlain by the limestone bedrock. An upper native sand layer overlaid the silty clay unit in several boreholes closest to the river.

More detailed summaries of the individual strata encountered during the investigation are presented below.

5.1 Pavement Structure

The existing pavement structure encountered at the ground surface consisted of asphalt, underlain by granular fill. Pavement was observed at Boreholes BH-14, BH-21, BH-25, and BH-26. The asphalt thickness ranged from approximately 60 mm to 150mm, and the granular fill thickness ranged from approximately 0.1 m to 2.1 m. The granular fill was described as sandy gravel, sand and gravel, or gravelly sand and contained trace silt. SPT N-values for the granular fill ranged from 4 to 56 blows per 0.3 m of penetration, indicating a loose to very dense relative density. Moisture contents measured in the granular fill ranged from approximately 5 to 18%.

The results of one grain size distribution analysis conducted on a selected sample of the granular fill are presented on Figure C1 of Appendix C. The results of the grain size distribution analysis are summarized in Table 5.1 below.

Table 5.1 – Grain Size Distribution Granular Fill

Soil Particle	Percentage (%)
Gravel	51
Sand	42
Silt & Clay	7

5.2 Topsoil and Organics

An approximately 150 mm to 690 mm thick layer of topsoil/organics was encountered at the ground surface throughout the site where fill/pavement was not encountered. Topsoil/organics were encountered at the ground surface at the following boreholes: 04, 05, 07, 08, 09, and 24. A buried layer of topsoil approximately 75 mm thick was encountered below a thin layer of fill in Borehole 02.

An approximately 430 mm thick layer of peat was observed at the ground surface at Borehole 03, and the surrounding ground at surface appeared marshy and wet. A buried layer of peat approximately 0.9 m thick was also observed at 1.4 m below ground surface in Borehole 22. The SPT N-values measured in the peat ranged from 2 to 3 blows for 0.3 m of penetration indicating a very soft consistency. Moisture contents in the peat ranged from 72% to 317%.

The topsoil/organics and peat thicknesses will vary between and beyond the borehole locations and the reported thicknesses are not meant to be used for estimating quantities.

5.3 Silty Clay to Clayey Silt Fill

Silty clay to clayey silt fill ranging in thickness from 0.7 m to 2.2 m was found at the ground surface in several boreholes (01, 06, 10, 11, 12, 14, 20, 23, and MW24-101). In Boreholes 13, 22, and 26, the cohesive fill was approximately 0.8 m thick and was found either below a layer of cohesionless fill or the pavement structure. The fill contained variable amounts of sand and gravel. In some locations, organic material, brick fragments and/or cobbles were noted within the fill.

SPT N-values in the cohesive fill ranged from 4 to 36 blows per 0.3 m of penetration. The shallow SPTs were generally frozen at the time of drilling which may have artificially increased the N-values in some tests. Natural moisture contents of the cohesive fill ranged from 13% to 36%.

The results of grain size distribution analyses conducted on selected samples of the cohesive fill are presented on Figure C2 of Appendix C. The results of the grain size distribution analyses are summarized in Table 5.2 below.

Table 5.2 – Grain Size Distribution Silty Clay to Clayey Silt Fill

Soil Particle	Percentage (%)
Gravel	0 to 3
Sand	13 to 22
Silt	49 to 59
Clay	26 to 28

5.4 Silty Sand to Sandy Silt Fill

Two (2) boreholes, 13 and 22, had a surficial layer of silty sand to sandy silt fill ranging in thickness from approximately 0.6 m to 0.7 m overlying the silty clay fill. In Boreholes 19 and 21, a layer of silty sand to sandy silt fill was found below silty clay fill and pavement structure, respectively. This fill contained trace gravel and trace to some clay.

SPT N-values recorded in this fill ranged from 14 to over 59 blows per 0.3 m of penetration, indicating a compact to very dense relative density. Surface samples were frozen at the time of drilling which may have artificially increased the N-value. Natural moisture contents of the sand fill ranged from 11% to 19%.

The results of one grain size distribution analysis conducted on a selected sample of the silty sand to sandy silt fill are presented on Figure C3 of Appendix C. The results of the grain size distribution analysis are summarized in Table 5.3 below.

Table 5.3 – Grain Size Distribution Silty Sand to Sandy Silt Fill

Soil Particle	Percentage (%)
Gravel	5
Sand	63
Silt	22
Clay	10

5.5 Silty Clay

Native silty clay was encountered in each borehole below the pavement structure or fill described above or below the sand/silt layers described below. This unit was contacted at depths of approximately 0.2 to 2.6 m and was fully penetrated at depths of approximately 4.1 to 11.0 m below ground surface, where it overlies bedrock, sand, or silt. The layer contained trace to some sand, occasional gravel, and occasional organic material. Sand and silt seams were noted within this material. The extruded Shelby tube samples from Borehole 24-301 indicated that the deposit is varved.

SPT N-values recorded in this layer ranged from 1 to 32 blows per 0.3 m of penetration. Four in situ shear vane tests were completed within the silty clay deposit in Boreholes 03, 04 and 05. Measured undrained shear strengths ranged from approximately 39 kPa to 78 kPa, indicating a firm to stiff consistency for the intervals tested. The remoulded shear strengths ranged from 20 kPa to 59 kPa, generally indicating a medium sensitivity. Three Nilcon vane shear tests were completed within the silty clay deposit in Borehole 24-301 and the measured undrained shear strengths ranged from 84 kPa to greater than 100 kPa indicating a stiff to very stiff consistency for the intervals tested. Results from the CPT testing generally indicated undrained shear strengths in the range of 70 kPa to 300 kPa, indicating a stiff to hard consistency. Results of the shear vane tests are provided on the Record of Borehole sheets in Appendix B. Results of the CPT tests are provided in Appendix J and on the Summary of Engineering Properties in Appendix B.

The Nilcon vane testing and CPTs generally indicated undrained shear strengths in the range of 70 to 300 kPa, indicating a stiff to hard consistency.

The moisture content of the silty clay layer ranged from 9 to 59%. It is noted that organic inclusions were encountered within this soil unit in BH-22. The water content of the silty clay extended to 91% due to the organics noted.

The results of grain size distribution analyses conducted on selected samples of the silty clay are presented on Figure C4 to C7 of Appendix C. The results of the grain size distribution analyses are summarized in Table 5.4 below.

Table 5.4 – Grain Size Distribution Silty Clay

Soil Particle	Percentage (%)
Gravel	0 to 2
Sand	0 to 25
Silt	12 to 70
Clay	25 to 81

The results of Atterberg Limits testing carried out on this material indicate that the layer ranges from low to high plastic silty clay (CL, CI, and CH). The ranges of the testing results are presented in Figure C10 and C11 in Appendix C and are summarized in Table 5.5 below.

Table 5.5 – Atterberg Limits Silty Clay

Index Property	Percentage (%)
Liquid Limit	22 to 71
Plastic Limit	14 to 29
Plasticity Index	9 to 46

The results of five consolidation tests completed on the silty clay are summarized below in Table 5.6. Detailed results of the consolidation tests are provided in Appendix C.

Table 5.6 – Consolidation Test Results

BH No.	Depth (m)	Elev. (m)	Natural Moisture Content (%)	Initial Void Ratio	Estimated Effective Overburden Pressure (kPa)	Estimated Preconsolidation Pressure (kPa)	Overconsolidation Ratio	Recompression Index, Cr	Compression Index, Cc
19	4.6-5.2	72.7	43.7	1.221	100	900	9.0	0.006	0.588
22	3.0-3.7	77.7	33.7	0.990	70	190	2.7	0.003	0.229
24-301	6.1	71.1	40.4	1.189	75	240	3.2	0.007	0.556
24-301	6.4	70.8	31.6	0.894	80	290	3.6	0.008	0.294
24-301	7.6	69.6	31.4	0.852	90	250	2.8	0.007	0.319

5.6 Silt to Sand

A layer of sand approximately 0.3 to 1.6 m thick was observed beneath the fill or organic deposits at depths of approximately 0.6 to 1.1 m in Boreholes 05, 09, 10, 11, and 12. This layer contained trace silt to silty, trace clay and trace gravel. A deeper layer of silt to sand was observed overlaying bedrock in Boreholes 01, 03, 05, 06 and 08. This layer contained trace to some clay and trace gravel. This layer was often observed to contain bedding.

SPT N-values recorded in the silt to sand ranged from 0 to 16 blows per 0.3 m of penetration, indicating very loose to compact conditions. The moisture content of the silt to sand layers ranged from 4 to 31%.

The results of grain size distribution analyses conducted on selected samples of the silty sand are presented on Figure C8 and C9 of Appendix C. The results of the grain size distribution analyses are summarized in Table 5.7 below.

Table 5.7 – Grain Size Distribution Silt to Sand

Soil Particle	Percentage (%)
Gravel	0 to 4
Sand	17 to 84
Silt	12 to 71
Clay	1 to 26

5.7 Limestone Bedrock

Limestone bedrock was encountered underlying the overburden soils in many of the boreholes. Bedrock was confirmed in the four boreholes (01, 02, 03 and MW 24-101) by coring 2.4 to 3.2 m into the rock. Boreholes 04, 05, 06, 07 and 08 were terminated upon auger refusal on probable bedrock and auger probes 15, 16, 17 and 18 were also terminated upon refusal on probable bedrock. The bedrock/probable bedrock surface was encountered at depths ranging from approximately 5.7 to 11.6 m (Elev. 64.7 to 73.8 m), generally sloping down towards the river. The depths and elevations at which bedrock/probable bedrock was encountered are summarized in Table 5.8 below.

Table 5.8 – Bedrock Contact Depths and Elevations

Borehole	Bedrock Surface	
	Depth (m)	Elevation
01	7.1	73.8
02	5.7	73.3
03	7.2	69.2
MW 24-101	7.3	71.7
04*	10.2	67.0
05*	11.6	64.7
06*	5.8	72.7
07*	5.9	72.6
08*	6.6	70.6
15*	6.3	71.4
16*	7.8	70.4
17*	9.8	66.7
18*	11.3	65.6

*Borehole/auger probe was terminated upon auger refusal on probable bedrock.

Interpreted bedrock surface profiles obtained from the geophysical survey are presented in Appendix I.

The limestone bedrock was visually identified as grey limestone of the Bobcaygeon Formation. The limestone was generally grey and fine grained with fine, wavy interbeds of black shale with occasional 5 mm clasts. The limestone is fossiliferous and has occasional calcite infilling of vugs.

Photographs of the retrieved rock core are provided in Appendix E.

5.7.1 Physical Properties

5.7.1.1 Total Core Recovery

Total Core Recovery (TCR) is the total cumulative length of all core recovered in the core barrel expressed as a percentage of the length of the core run and is recorded on a per run basis. Prior to measuring the recovered length, the core was assembled to align joints and rubble zones were reassembled to the extent practicable. The TCR of the rock cores consistently ranged between 93 and 100%.

5.7.1.2 Solid Core Recovery

Solid Core Recovery (SCR) is the total cumulative length of all solid, cylindrical pieces of core recovered in the core barrel expressed as a percentage of the length of the core run and is recorded on a per run basis. The SCR of the rock cores recovered typically ranged from 77 to 97%.

5.7.1.3 Rock Quality Designation

Rock Quality Designation (RQD) is the total cumulative length of intact core recovered in the core barrel expressed as a percentage of the length of the core run and is recorded on a per run basis. Intact core was measured along the centreline and a 100 mm requisite length was used for the purposes of standardization and comparison. It is considered that with good drilling techniques, the lengths of the core pieces, measured along the centerline, will generally be the same regardless of core diameter since the spacing of natural unbonded joints does not change. The RQD of the rock cores ranged from 70 to 92%, indicating that the RQD was determined to be fair to excellent.

Bedrock within the current investigation area was also historically cored in two boreholes (13-17 and 17-17-d) from the GHD report. The RQD of the rock cores ranged from 83 to 100%, indicating that the RQD was good to excellent.

5.7.1.4 Fracture Index

The fracture index records the number of natural fractures per 0.3 m length of core run. The fracture index of the limestone bedrock generally ranged from 0 to 4.

5.7.1.5 Weathering

In general, the limestone was judged to be slightly weathered near the contact surface of the bedrock. The rock weathering generally improved with depth, becoming fresh within the first meter of coring. It is noted that a localized highly fractured zones were observed within the core of approximately 50 mm in length.

5.7.2 Index Properties

5.7.2.1 Point Load Testing

Point load index strength tests were carried out on selected intact rock core samples. The test results are presented in Appendix D. Determination of the unconfined compressive strength was based on the empirical relationship between unconfined compressive strength and point load index strength as follows:

$$\text{Unconfined compressive strength (MPa)} = 24\ I_{S(60)}$$

Where $I_{S(50)}$ is the point load index strength in MPa for a 50 mm equivalent diameter core. The correlation value of 24 is site specific and was developed based on a comparison of the UCS tests and the point load index tests.

The unconfined compressive strength (UCS) of the rock, estimated from the results of point load tests, varied from 46 to 209 MPa, indicating a medium strong to very strong rock strength classification. In general, the presence of shale did not significantly decrease the strength of the limestone. The results are summarized on the Record of Borehole sheets included in Appendix B and on the Point Load Test Sheets in Appendix D.

5.7.2.2 Unconfined Compressive Strength Testing

Unconfined compressive strength (UCS) testing was completed on a total of 4 limestone samples. The results of the UCS testing are provided in Appendix D and are shown on the Record of Borehole Sheets, provided in Appendix B.

The results of the UCS testing indicate the strength ranges from 92.7 to 130.6 MPa with a mean value of 110.6 MPa.

5.8 Groundwater Conditions

The groundwater conditions at the borehole locations were assessed during drilling by visual examination of the soil, the sampler and the drill rods as the samples were retrieved and when appropriate by measurement of the water level in the open borehole. The groundwater depths and elevations measured in the monitoring wells installed in the boreholes are summarized in Table 5.9 below.

Table 5.9 – Summary of Groundwater Level Observations

MW No.	Ground Water Depth / Elevation (m)				
	February 26, 2021	March 12, 2021	April 14, 2021	May 11, 2021	February 21, 2024
02 Shallow	0.7 / 78.3	0.6 / 78.4	0.6 / 78.4	0.5 / 78.5	0.7 / 78.3
02 Deep	0.8 / 78.2	0.7 / 78.3	0.8 / 78.2	0.6 / 78.4	1.0 / 78.0
03 Shallow	0.2 / 76.3	-0.2* / 76.7	-0.1* / 76.5	-0.2* / 76.7	-
03 Deep	-0.2* / 76.6	0.7 / 75.8	0.6 / 75.9	0.5 / 76.0	-
04 Shallow	2.9 / 74.3	1.0 / 76.1	1.2 / 75.9	1.0 / 76.2	0.9 / 76.2
04 Deep	1.8 / 75.4	1.8 / 75.4	1.8 / 75.4	1.6 / 75.6	1.6 / 75.6
06	-0.8* / 79.3	-1.0* / 79.5	-0.8* / 79.3	-0.9* / 79.4	
11	2.2 / 74.2	2.1 / 74.3	2.1 / 74.3	2.1 / 74.3	
24-101	-	-	-	-	1.8 / 77.2

* Negative water level indicates water level measured above the ground surface.

The above groundwater level measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected. Further, groundwater levels may be higher after prolonged periods of precipitation.

6. GEOTECHNICAL ENGINEERING RECOMMENDATIONS

This section of the report provides geotechnical recommendations for the design and construction of the proposed buildings, water storage tanks, retaining walls, pavements, pumping station, outfall pipe, and yard piping. The recommendations are based on the subsurface soil, bedrock, and groundwater conditions encountered during the investigation. The soil and bedrock conditions may vary between and beyond the borehole locations and accordingly geotechnical inspection during construction is important to assess any variation of subsurface conditions and to provide additional recommendations if necessitated by such variations.

The geotechnical interpretations and recommendations contained in this section are intended for the use of the design team (EVB Engineering and CIMA) and the Town, and shall not be used or relied upon for any other purposes or by any other parties including the construction contractor.

The contractor must make their own interpretation based on the factual data presented in this report. Where comments are made on construction, they are provided only in order to highlight those aspects which could affect the design of the project. Contractors must make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction methods and scheduling.

The following recommendations are provided on the basis that the building upgrades will be designed in accordance with Part 4 of the 2012 Ontario Building Code (OBC), as amended (R2020).

The comments and recommendations in this report should be reviewed to ensure their applicability if there are any changes to the final design.

6.1 Seismic Considerations

The seismic hazard data for the current version of the OBC is based on the sixth-generation seismic model developed by the Geological Survey of Canada (GSC). Seismic hazard data for this site has been obtained from the GSC's seismic hazard calculator. The data includes peak ground acceleration (PGA), peak ground velocity (PGV), and the 5% damped spectral response acceleration values (Sa(T)) for the site-specific Site Class for a range of periods (T) and for a range of return periods including the 475-year, 975-year and 2475-year events. The GSC seismic hazard calculation data sheet for this site is presented in Appendix I.

The site coefficients used to determine the design spectral acceleration and displacement values are a function of the Site Class and the PGA, which is 0.13g at this site.

The seismic Site Class was assessed by Geophysics GPR International Inc. by means of site-specific MASW shear wave velocity testing. The results of the testing are provided in Appendix I. Based on the results of that testing, the site has been classified as a Site Class C in accordance with Section 4.1.8.4 of the OBC (R2020); however, structures that are founded directly on the bedrock surface can be designed using a Site Class A, and structures founded within overburden with a thickness less than 3 m above the bedrock surface can be designed using a Site Class B. According, the following Site Classes would apply to the proposed structures:

- Site Class A – Influent buffer tank
- Site Class B – Sludge buffer tank and vortex tank
- Site Class C – Headworks building, AGS tanks, post-equalization tank, operation building, and tertiary building.

The Boulanger & Idriss (2014) Simplified Method was used to assess the potential for liquefaction of the cohesionless deposits at this site. Based on the PGA and the subsurface conditions reported below the foundations, the non-cohesive soils are not considered susceptible to liquefaction during a seismic event.

The susceptibility of the cohesive soils at the site to experience cyclic mobility or cyclic softening was initially assessed using the Bray et al. (2004) criteria and the results of index property testing. Soils that were considered potentially susceptible were subsequently assessed based on in-situ shear strength measurements using the simplified procedure outlined in Boulanger and Idriss (2007). Based on the results of the analyses, the cohesive material at this site is not considered susceptible to cyclic mobility or cyclic softening during a seismic event.

6.2 Site Grading

It is understood that grade raises in the range of 2 to 4 m will be required. In general, the clay deposit underlying the site is sufficiently over-consolidated to accommodate the proposed grade raises, recognizing that post-construction surface settlements of up to 25 mm should be expected to occur within 1 to 2 years following placement of the grade raise material. To limit the effect of settlement on surface drainage and paved surfaces, it is recommended that the final grading and paving be delayed as long as possible after placement of the grade raise material.

The proposed grade raise has been considered in the foundation design analysis presented below. If alternative grade raises are considered, the bearing resistance values provided in Section 6.3 will need to be re-evaluated.

6.3 Foundation Design

It is understood that shallow foundations (a combination of spread footings and mat foundations) will be utilized for this project, recognizing that total and differential settlements will need to be considered in the design due to the presence of the clay deposit underlying the site. Where the estimated settlements cannot be tolerated, which is understood to be the case under the AGS tanks, it is understood that ground improvement techniques will be utilized to control settlement.

The bearing resistance factors that will apply are dependent on the foundation depth, size of the footings (width and length), and the subsurface conditions that are present beneath the foundation.

Unless stated otherwise, the post-construction total and differential settlements of footings sized using the net SLS bearing resistance values provided in the sections below should be less than about 25 and 15 mm, respectively, provided that the soil at or below founding level is not disturbed during construction.

It is understood the structures will be designed to be drained with perimeter and/or underslab subdrains to maintain groundwater levels below Elevation 76.50 m, in order to limit uplift forces due to buoyancy. Permanent groundwater level lowering to Elevation 76.50 m has been considered in Thurber's analyses. Thurber should be consulted if additional groundwater level lowering below Elevation 76.50 m is required.

6.3.1 Headworks Building

It is understood that the headworks building will be located at the north end of the site and will have dimensions of approximately 22 m wide and 32 m long. It is understood that the building (excluding the adjacent buried tanks) will have a slab on grade and will be founded on shallow spread footings that have an underside elevation of 79.70 m. A grade raise of up to 2.8 m will be required.

The subsurface conditions at the proposed founding elevation consists of fill. In some areas, the proposed founding elevation is higher than the existing ground elevation. The existing fill and surficial organics should be subexcavated down to the very stiff native silty clay and replaced up to the founding level with a pad of engineered fill constructed in accordance with Section 6.4 of this report. It is recommended that the subexcavation of the existing fill be carried out within the entire building footprint and replaced with a pad of engineered fill to provide predictable performance of the slab on grade. Further discussion on the slab on grade is provided in Section 6.7.

Shallow spread footings up to 1.0 m wide and bearing on a pad of engineered fill that extends to the native silty clay can be designed using a net geotechnical resistance at SLS of 150 kPa and a factored geotechnical resistance at ULS of 225 kPa, assuming that the floor load does not exceed 25 kPa and the exterior grade raise does not exceed 2.8 m. For wider footings up to 2.0 m in width, a net geotechnical resistance at SLS of 125 kPa will apply.

6.3.2 Vortex, Influent, and Sludge Tanks

It is understood that that following below-grade tanks will be located within or in close proximity to the headworks building:

- A vortex tank within the headworks with a raft slab founding Elevation of 76.03 m. The founding conditions at this elevation are anticipated to consist of native silty clay. The maximum sustained load beneath the raft slab will be 110 kPa.
- Influent buffer tanks to the west of the headworks with a footprint of approximately 9 m wide and 17 m long, and a raft slab founding Elevation of 72.55 m. The founding conditions at this elevation are anticipated to consist of native silty clay; however, the bedrock surface Elevation in this area is approximately 71.7 m. Due to the limited thickness of silty clay, subexcavation of the silty clay to the bedrock surface and backfilling with mass concrete up to founding level should be anticipated. The sustained load beneath the raft slab will be 110 kPa.
- Sludge buffer tanks to the south of the headworks with a footprint of approximately 6.9 m wide and 18.0 m long, and a raft slab founding Elevation of 73.90 m. The founding conditions at this elevation are anticipated to consist of native silty clay or sand. The maximum sustained load beneath the raft slab will be 125 kPa.

For the vortex tank and sludge buffer tanks, the SLS net bearing resistance corresponding to 25 mm of total settlement exceeds the maximum sustained bearing pressure of 125 kPa. For this applied bearing pressure, the total settlement is estimated to be in the range of 5 to 15 mm. The factored geotechnical resistance at ULS can be taken as 300 kPa.

For the influent buffer tanks, the foundation is expected to extend to the bedrock surface and therefore the settlement should be negligible. The factored geotechnical resistance at ULS can be taken as 1,000 kPa.

It is noted that the total settlement of the headworks building may be up to 25 mm in magnitude, and therefore differential settlement of up to 25 mm between the headworks and adjoining tanks should be considered in the design (e.g., for piping connections). It is understood that this magnitude of differential settlement can be accommodated in the design.

A modulus of subgrade reaction has also been requested to design the tank raft slab foundations. It is noted that the modulus of subgrade reaction is not a fundamental soil property, and some iteration may be required once the design loads are identified. For design purposes, the following ranges of modulus of subgrade reaction can be assumed. These ranges reflect both uncertainty and variability in the properties of the subgrade soils. The structural design should be determined based on whichever value causes the larger effect, since either the maximum or minimum modulus values may govern for different locations and load effects.

- Vortex tank – 14 to 18 MPa/m
- Sludge buffer tank – 20 to 25 MPa/m
- Influent buffer tank – 500 to 1000 MPa/m
- Elevated interior channels – 35 MPa/m*

  * underlain by a minimum of 500 mm of engineered fill constructed per Section 6.4

6.3.3 AGS, Post-Equalization Tanks, and Operations Building

It is understood that three AGS reactor tanks will be located near the centre of the site with an approximate width of 33 m and total length of 54.2 m. The tanks will be founded below grade on a raft slab with a founding Elevation of 75.45 m. In addition, an adjoining post-equalization tank (approximately 9 m wide and 29 m long) will be located to the west of the AGS tanks. The tank will be founded on a raft slab with a founding Elevation of 77.84 m. A pad of lean concrete will be provided beneath the raft slab to an Elevation of 75.45 m (equal to the founding elevation of the AGS tanks).

A new two-storey operations building will also be connected to the AGS tanks using an expansion joint on the east side. The building will be approximately 13 m wide and 39 m long. The building will have a basement level and will be founded on a raft slab with a founding Elevation of 76.4 m.

The subsurface conditions at the anticipated founding elevations consist of very stiff to stiff native silty clay. A raft slab foundation bearing on the native silty clay can be designed using a net geotechnical resistance at SLS of 125 kPa, corresponding to a maximum total settlement of 50 mm, and a factored geotechnical resistance at ULS of 300 kPa. It is noted that settlement will be variable beneath the AGS tanks due to the varying thickness of the underlying silty clay deposit. Overall, the settlements are estimated to range from approximately 15 to 50 mm, generally increasing to the south (i.e., the differential settlement may be up to 35 mm in magnitude). The majority of this settlement is 'elastic' and would occur as the structure is loaded; however, up to 15 mm of reconsolidation settlement should be expected to occur within the silty clay deposit over a period of about 1 year following construction.

It is understood that the estimated differential settlement and post-construction reconsolidation settlement is not feasible. Alternatively, ground improvement (e.g. rigid inclusions) has been proposed to mitigate the potential for differential settlement to allow for a SLS bearing resistance of 125 kPa while maintaining settlements below 25 mm in magnitude. The feasibility of ground improvement and the possible bearing resistance that can be achieved may be dependent on the available equipment and expertise of the specialist ground improvement contractor undertaking the work. Consultation with a design-build ground improvement contractor is recommended to further assess this option. Performance specifications should be provided to achieve the design objectives in regard to bearing resistance, settlement, and modulus of subgrade reaction.

6.3.4 Tertiary/UV Building

It is understood that a single storey tertiary / ultraviolet disinfection building with flocculation tanks will be constructed at the south end of the site. The footprint of the building will be approximately 16 m wide and 30 m long. The building will have a basement level with a raft slab founding Elevation of 75.068 m).

The subsurface conditions at the proposed founding elevation are anticipated to consist of native silty clay, although a thin layer of native sand may also be present above the silty clay. The existing fill and surficial sand, if present, should be subexcavated down to the native silty clay and replaced up to the founding level with a pad of engineered fill constructed in accordance with Section 6.4 of this report. It is recommended that the subexcavation of the existing fill be carried out within the entire building footprint and replaced with a pad of engineered fill to provide predictable performance of the slab on grade. Further discussion on the slab on grade is provided in Section 6.7.

A raft slab foundation bearing on the native silty clay can be designed using a net geotechnical resistance at SLS of 125 kPa, corresponding to a maximum total settlement of 50 mm, and a factored geotechnical resistance at ULS of 300 kPa. Differential settlement is estimated to be in the range of 25 mm. The majority of this settlement is ‘elastic’ and would occur as the structure is loaded; however, up to 10 mm of reconsolidation settlement should be expected to occur within the silty clay deposit over a period of about 1 to 3 years following construction.

It is understood that the estimated differential settlement and post-construction reconsolidation settlement is of concern to the designers. Alternatively, ground improvement (e.g. rigid inclusions) has been proposed to mitigate the potential for differential settlement to allow for a SLS bearing resistance of 125 kPa while maintaining settlements below 25 mm in magnitude. The feasibility of ground improvement and the possible bearing resistance that can be achieved may be dependent on the available equipment and expertise of the specialist ground improvement contractor undertaking the work. Consultation with a design-build ground improvement contractor is recommended to further assess this option. Performance specifications should be provided to achieve the design objectives in regard to bearing resistance, settlement, and modulus of subgrade reaction. It is noted that surficial organics should be removed prior to the ground improvement contractor placing their ‘load transfer cushion’.

6.4 Engineered Fill

Where subexcavation is required (e.g., to remove the surficial fill, sand cap, organic soils, or a disturbed subgrade), an engineered fill pad should be constructed within the zone of influence of the foundation from the base of the new subgrade up to the founding level. At a minimum, the zone of influence should be taken as a 1H:1V slope extending down and away from the footing/ slab to a suitable bearing stratum (e.g., native stiff silty clay). It is also recommended that the engineered fill pad extend laterally beyond the edges of the footing/slab by a minimum of 1.0 m to provide a suitably sized working pad to construct the foundation. For constructability purposes, a minimum thickness of 300 mm is recommended for the engineered fill pad.

The engineered fill pad should then be constructed up to the founding level using OPSS.MUNI Granular B Type II or Granular A. The engineered fill should be placed in maximum loose lifts of 200 mm and compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

6.5 Frost Protection

The native soils at this site are considered frost susceptible. The frost penetration depth at this site is 1.5 m per OPSD 3090.101. Unheated foundation elements subject to freezing temperatures should be provided with a minimum of 1.5 m of earth cover for frost protection purposes. The minimum thickness of earth cover can be reduced to 1.2 m for foundation elements beneath heated buildings. If these earth cover requirements are not feasible, consideration can be given to insulating the foundation elements with rigid foam insulation.

Exterior slabs (e.g., for the generator pad and stairs) should be underlain by a layer of high-density rigid foam insulation beneath and beyond the edges of the concrete slab. Assuming the insulation will be placed beneath a minimum 300 mm thick layer of non frost susceptible Granular A, a minimum 50 mm thick layer of insulation is recommended. The insulation should cover the entire slab area and should extend beyond the edges of the slab for minimum lateral distance of 1.2 m in all directions. The type of insulation should be selected such that the static bearing pressure on the insulation due to the slab load (including the self-weight of the concrete and underslab fill) does not exceed about 33% if the insulation’s quoted compressive strength due to the time dependent creep characteristics of this material. For example, bearing resistance values for various types of insulation for SLS and ULS are provided below:

INSULATION TYPE	SLS RESISTANCE (kPa)	ULS FACTORED RESISTANCE (kPa)
Styrofoam SM30	65	100
Styrofoam Highload 40	90	135
Styrofoam Highload 60	145	205
Styrofoam Highload 100	240*	340*

* Note – the design bearing values should not exceed those given in Section 6.7.3

In preparation for the insulation, a levelling mat consisting of 25 mm of concrete/mortar sand or 50 mm of lean concrete should be placed on the approved bearing surface. Care must be taken to ensure that the insulation is not damaged during construction. Joints should be carefully lap jointed and glued. A minimum of 300 mm of soil should be placed above the insulation to protect it from damage.

It is also understood that the top slabs of the influent and sludge buffer tanks will be buried with less than 1.2 m of cover, and that insulating the structures is preferred. In that case, a 50 mm thick horizontal layer of rigid extruded polystyrene insulation is recommended over the surface of the top slabs. The insulation should cover the entire slab area and should extend beyond the edges of the slab for a minimum lateral distance of 0.6 m in all directions. It is anticipated that Styrofoam SM30 XPS (or equivalent) insulation is appropriate for the proposed purpose; however, this should be confirmed by the designers. Highload 40, 60 or 100 may be appropriate if the overlying ground surface will be trafficked with heavy trucks. The type of insulation should be selected such that the static bearing pressure on the insulation does not exceed about 33% if the insulation’s quoted compressive strength due to the time dependent creep characteristics of this material.

6.6 Sliding Resistance

Resistance to sliding due to lateral forces across the interface between cast-in-place concrete footings/slabs and the foundation soils may be calculated using the following parameters:

Interface and Loading Conditions	Parameter
Concrete – Engineered Fill Pad	Friction factor = 0.6
Concrete – Clay (short term – seismic)	Adhesion = 48 kPa
Concrete – Clay (long term – static)	Friction factor = 0.5

The values provided above are unfactored. A resistance factor of 0.8 should be used for non-cohesive soils (e.g., engineered fill), and a resistance factor of 0.6 should be used for cohesive (i.e., clay) soils.

If friction/adhesion alone is not sufficient to resist lateral forces, lateral resistance could potentially be provided by rock anchors or through passive resistance provided by the basement walls. Additional guidance in this regard can be provided, it requested.

6.7 Floor Slabs

6.7.1 General

In preparation for the construction of floor slabs, either slabs on grade or basement/tank floor slabs, all fill material and any remaining loose, wet, and disturbed material should be removed from beneath the floor slab.

6.7.2 Interiors Slabs on Grade (Buildings)

For predictable performance of interior slabs on grade, it is recommended that the surficial fill be subexcavated down to the native stiff silty clay and replace the sub-excavated material with a pad of non-frost susceptible engineered fill up to the founding level in accordance with Section 6.4 of this report.

At least 150 mm of OPSS Granular A should be placed to form the base for the floor slab. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II, or the Granular A could be thickened. The underslab fill should be placed in maximum 200 mm thick loose lifts and should be compacted to at least 98% of the material's SPMDD using suitable vibratory compaction equipment.

The modulus of subgrade reaction can be taken as 35 MPa/m for slabs underlaid by a base of compacted Granular A with a minimum thickness of 150 mm.

6.7.3 Exterior Slabs on Grade (Generator Pad and Stairs)

For predictable performance of exterior slabs on grade (e.g., for the generator pad and stair foundations), it is recommended that the surficial fill be subexcavated down to the native stiff silty clay and replace the sub-excavated material with a pad of non-frost susceptible engineered fill up to the founding level in accordance with Section 6.4 of this report.

At least 300 mm of OPSS Granular A should be placed to form the base for the slabs. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II, or the Granular A could be thickened. The underslab fill should be placed in maximum 200 mm thick loose lifts and should be compacted to at least 98% of the material's SPMDD using suitable vibratory compaction equipment.

For exteriors slabs that require foundation design, the SLS net bearing resistance corresponding to 25 mm of total settlement can be taken as 150 kPa, and the factored geotechnical resistance at ULS can be taken as 200 kPa. These values assume a minimum width of 1.5 m and a maximum length of 12.0 m. The modulus of subgrade reaction can be taken as 50 MPa/m for slabs underlaid by a base of compacted Granular A with a minimum thickness of 300 mm.

Exterior slabs on grade should be insulated in accordance with Section 6.5 of this report.

6.7.4 Drained Tank Floor Slabs

It is understood the tank structures will be designed to be drained with perimeter and/or underslab subdrains to maintain groundwater levels below the 100-year design flood Elevation of 76.50 m, in order to limit uplift forces due to buoyancy. Where sub-floor drainage is deemed required by the designers to limit uplift pressure, provision should be made for at least 300 mm of free draining granular material, such as 19 mm clear crushed stone, to form the base of the floor slab. A geotextile should be provided between the clear stone underslab fill and the subgrade soils to avoid loss of fine soil particles from the subgrade soil into the voids in the clear stone. The geotextile should consist of a Class II non-woven geotextile with a Filtration Opening Size not exceeding about 100 microns, in accordance with OPSS 1860. To prevent hydrostatic pressure build up beneath the floor slabs, the granular base for the floor slab should be drained. This can be achieved by installing rigid 100 mm diameter perforated pipes in the floor slab bedding at about 6 m centres (see Figure 23.4 in the Canadian Foundation Engineering Manual, 5th edition). The perforated pipes should discharge to a positive outlet by gravity, or to a sump from which the water is pumped.

The clear stone fill must be compacted with suitable vibratory compaction equipment to achieve a level and stable configuration prior to pouring the floor slab.

Further discussion on perimeter drains is provided in Section 6.9.

6.7.5 Undrained Tank Floor Slabs

For basement/tank raft foundation slabs that are designed to be water-tight, the concrete can be poured directly on the approved undisturbed and inorganic subgrade or on the surface of a working mud slab that has been placed in advance to protect the subgrade. It is anticipated that a waterproofing membrane will also be required. These basement floor slabs will need to be designed to resist hydrostatic uplift pressures. A discussion of counter-buoyancy measures is provided in Section 6.8 below.

6.8 Buoyancy

The proposed tank structures will extend below the existing groundwater level and it is understood that they will be designed to be drained to an Elevation of 76.50 m. If the tank floor below this elevation is designed to be water-tight and will be lower than the groundwater level, uplift pressure due to buoyancy will need to be considered, which will apply to the proposed sanitary pumping station. It is understood that a buoyancy-ring will be provided around the pumping station wet well to resist uplift. For that case, the resistance provided by the backfill over the buoyancy ring can be calculated assuming a unit weight of the backfill soil of 20 kN/m^3. The shear resistance provided by the backfill soil should be neglected in the design, since upward movement of the wet well would be required prior to mobilizing the passive shear resistance.

It is noted that this condition should also be considered for when the tanks are emptied for maintenance. Further assistance with buoyancy resistance can be provided, if requested.

6.9 Foundation Wall Backfill and Lateral Earth Pressures

Where shallow foundations will be supported by basement wall backfill, the backfill behind the basement wall should consist engineered fill that is constructed in accordance with Section 6.4 of this report. Otherwise, the buried portion of the tank walls should be backfilled with free draining, non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS.MUNI Granular B Type I. This non-frost susceptible backfill should have a minimum thickness of 1.5 m for frost protection purposes. The existing fill and native clay should not be used as foundation wall backfill; otherwise, surface settlement and frost pressures on the walls should be expected. Further guidance on insulation to prevent frost pressure on the walls can be provided if requested. The existing fill that was encountered in the boreholes is generally frost susceptible and therefore is not considered suitable for foundation wall backfill and should only be re-used as grade raise fill or as backfill material in utility trenches.

To avoid ground settlements around the foundations, which could affect site grading and drainage, all of the backfill materials should be placed in maximum 200 mmm thick loose lifts and compacted to at least 98% of its SPMDD.

It is understood that the basement wall backfill above Elevation 76.50 m will be drained. This can be accomplished by means of a 100 mm diameter perforated pipe subdrain in a 150 mm thick surround of 19 mm clear stone, fully wrapped in a geotextile, which leads by positive drainage to a storm sewer or to a sump from which the water is pumped.

The static lateral earth pressure acting on vertical non-yielding structures should be computed using the following expression:

$$\sigma_h = K_0 * (\gamma * d + q) + U$$

where:

- σ_h = lateral earth pressure at depth d (kPa)
- K_0 = at-rest earth pressure coefficient, use:
  - 0.5 for compacted granular backfill
  - 0.8 for native silty clay (retained by water-tight shoring beside influent tanks and sludge buffer tank)
- γ = unit weight of retained soil, use:
  - 22 kN/m^3 for compacted granular backfill above the water level and 12 kN/m^3 below the water level
  - 19.5 kN/m3 for native silty clay above the water level and 9.5 kN/m^3 below the water level
- D = depth below top of fill where pressure is computed (m)
- q = stress from any surcharge (kPa), including loads from adjacent structure foundations, recommended to be no less than 12 kPa to account for backfill pressure during compaction.
- U = hydrostatic water pressure (kPa)

The design should also consider lateral earth pressure under seismic loading. The total pressure due to combined static and seismic loads acting at a specific depth below the top of the wall may be determined using the following equation:

$$\sigma_h = K_0 * \gamma * d + (K_{AE} – K_a) * \gamma * (H - d)$$

where:

σ_h	=	lateral earth pressure at depth d (kPa)
d	=	depth below top of fill where pressure is computed (m)
K_0	=	at-rest earth pressure coefficient, use: ▪ 0.5 for compacted granular backfill ▪ 0.8 for native silty clay (retained by water-tight shoring beside influent tanks and sludge buffer tank)
K_{AE}	=	combined static and seismic earth pressure coefficient, use 0.42
K_a	=	active earth pressure coefficient, use: ▪ 0.33 for compacted granular backfill ▪ 0.27 for native silty clay
γ	=	unit weight of retained soil, use: ▪ 22 kN/m^3 for compacted granular backfill above the water level and 12 kN/m^3 below the water level ▪ 19.5 kN/m3 for native silty clay above the water level and 9.5 kN/m^3 below the water level
H	=	total height of the wall (m)

Alternatively, for non-yielding structures, the dynamic thrust and overturning moments could be checked using the Woods (1973) method using the following expression:

$$\Delta P_{eq} = \gamma\, H^2(a_h/g) \qquad \text{and} \qquad \Delta M_{eq} = 0.6\, \gamma\, H^3(a_h/g)$$

Where:	ΔP_{eq}	=	the dynamic thrust, in kN/m width of the structure;
	ΔM_{eq}	=	the dynamic overturning moment, in kN/m per metre width of the structure;
	γ	=	the unit weight of the retained soil or granular backfill, in kN/m^3
	H	=	the total height of the structure
	a_h/g	=	the peak horizontal ground acceleration, use 0.13.

The formulas given above are considered to be a conservative approach. If requested, more rigorous numerical modelling could be carried out to evaluate the earthquake effects acting on these structures by using simplified de-coupled soil-structure interaction analysis. These more rigourous analyses would consist of carrying out ground response analyses to estimate free field soil movements due to the design ground motions.

The lateral earth pressure may change if the walls are cast against formwork with a narrow-backfilled gallery between the foundation wall and the temporary shoring. Additional design guidance in this regard can be provided, if required.

It should be noted that the earth pressures presented above assume that the back of the wall is vertical and that the ground surface behind the wall is flat. Additional analysis will be required if sloping backfill will be present above the top of the wall.

6.10 Retaining Walls

It is understood retaining walls up to 2 m in height will be required. Selection of the preferred wall type must consider the height of retained soil, the subsurface conditions along the wall alignment, and any space restrictions affecting construction of the wall. Where the grade difference does not exceed 1.8 m, a concrete toe wall designed as per OPSD 3120.100 is feasible and considered to be a cost-effective retaining wall. Subdrains should be installed to drain the backfill behind the wall.

Retaining walls may be founded on undisturbed native soil or a pad of engineered fill that extends to the native soil in accordance with Section 6.4 of this report. The factored geotechnical resistances of the foundation soil may be taken as follows.

- Factored Geotechnical Resistance at ULS of 225 kPa for a min. embedment of 0.5 m
- Factored Geotechnical Resistance at SLS of 150 kPa for base width up to 2.0 m in width

It is assumed that a flexible wall system that is typically not founded at full frost depth will be used; if a wall design sensitive to frost movements is selected, it should be founded with embedment greater than or equal to the design frost depth of 1.5 m.

Resistance to lateral forces/sliding resistance can be calculated in accordance with Section 6.6 of this report.

Lateral earth pressures can be calculated in accordance with Section 6.9 of this report using a K_a value of 0.33 for compacted granular backfill, assuming that the wall assuming that the back of the wall is vertical and that the ground surface behind the wall is flat. Additional analysis will be required if sloping backfill will be present above the top of the wall.

6.11 Piping

We understand a new outfall pipe may be installed using open cut methods between the Tertiary / UV Disinfection Building and an existing chamber a distance of approximately 50 m. Boreholes 10, 11 and 12 are located along the proposed alignment of the outfall pipe. The proposed diameter of the new pipe is 710 mm and the depth of the pipe will be up to approximately 2 m below the existing ground surface.

Based on Boreholes 10, 11 and 12, the soils at the base of the trench will consist of very loose to loose silty sand to sand. The groundwater elevation in the area of the outfall pipe is near Elevation 74.3 m based on water level readings from the monitoring well installed in Borehole 11.

Prior to placement of the pipe bedding, the base of the trench should be maintained in a dry condition, free of loose or disturbed material. The pipe must be placed on a uniformly competent subgrade. Pipe bedding materials, compaction, and cover should follow OPSD 802.030 to 803.034, and/or City of Napanee specifications.

In areas where less competent subgrade is encountered, it may be necessary to increase the pipe bedding thickness. Any excessively soft, loose or compressible materials at the pipe subgrade should be subexcavated and replaced with OPSS Granular A material compacted to at least 95% of SPMDD.

Trench backfill materials, above the cover material, should be placed in loose lift thicknesses not exceeding 300 mm and compacted to at least 95% of SPMDD. Portions of the trench located beneath access roads, OPSS Granular A or B material, or unshrinkable fill should be employed as backfill.

For portions of the trench located outside of access roads or other settlement sensitive areas, the portion of the trench above the pipe cover can be backfilled with excavated material provided it is free of organics, debris, and other deleterious materials. The placement moisture content should be within about 2% of the optimum moisture content for efficient compaction.

The fill which will be excavated from the top portion of the trench will generally not be suitable as trench backfill as it contains organic material. The sand to silty sand below the fill should generally be suitable for reuse as trench backfill.

It should be noted that the foregoing comments pertain to material reusability based on geotechnical considerations. Further restrictions on re-use may apply based on geoenvironmental considerations.

Comments on trench excavation and dewatering can be found in the sections below.

6.12 Asphalt Pavement

It is understood the proposed design for this facility will include new light vehicle parking areas, and an access road to be utilized by water/pump truck or dump-truck.

It was assumed water/pump truck with three or four-axles on a single-unit truck will travel within this facility. Using axle load equivalency factors, the different axle-loads and axle-groups are converted to a standard axle load known as an Equivalent Single Axle Load (ESAL). The ESAL calculation was completed in accordance with the MTO Procedures for Estimating Traffic Loads for Pavement Designs. A truck load equivalency factor of 4.0 was considered for water/pump truck. This value is consistent with the Truck Factor used by the MTO for this class of vehicles.

Light Duty Pavement / Parking Area Detailed traffic information was not available for the parking lot; however, for design purposes it has been assumed that the parking lot pavement will be used for light duty vehicles.

6.12.1 Light Duty Pavement / Parking Areas

The recommended pavement design for all light-duty pavement areas should comprise a new asphalt and granular base material. Thicknesses of the new asphalt and granular base should consist of:

40 mm	HL3 (HS) Surface Course
50 mm	HL8 Binder Course
150 mm	New Granular A Base
350 mm	New Granular B Subbase

6.12.2 Heavy Duty Pavement / Access Road

Detailed traffic information was not available for this facility. For the purposes of developing pavement designs for the access road, it was assumed that 4 truck per hour will be using the access road. An Equivalent Single Axle Load (ESALs) of 1.7 million was calculated for 15-year design life.

The AASHTO procedure for the design of flexible pavements determines a required Structural Number that characterizes the structural capacity of the pavement layers, for a given set of inputs. The following design inputs were used in the AASHTO design analysis for the access road:

- Initial serviceability = 4.2
- Terminal serviceability = 2.0
- Estimated mean soil resilient modulus = 20 MPa
- Reliability level = 85 percent
- Overall standard of deviation = 0.44

The recommended pavement structure for the proposed access road shall consist of

40 mm	HL3 (HS) Surface Course
110 mm	HL8 Binder Course (2 lifts of 55 mm)
150 mm	New Granular A Base
400 mm	New Granular B Subbase

6.12.3 New Asphalt Materials

All Hot Mix Asphalt (HMA) material should meet the requirements of OPSS.MUNI 310. All asphalt lifts should be placed and compacted to levels between 92 and 96.5 percent of the Marshall Maximum Relative Density (MRD). The recommended asphalt cement grade for HL3 and HL8 mixes should be PG 58-28, and shall conform to OPSS.MUNI 1101. Aggregates for the asphalt mixes should be in accordance with OPSS.MUNI 1003.

6.12.4 New Granular Base Materials

All new granular material should meet the requirements of OPSS.MUNI 1010, be compacted to at least 100 percent of the SPMDD, within 2 percent of Optimum Moisture Content (OMC). Quality control testing should be completed during the placement of new granular material, and should be checked for densities, thickness, and gradation.

6.12.5 Subgrade Preparation

In all new pavement areas, the surficial organics should be removed. The contractor must be diligent in removing existing topsoil, and care must be taken not to rut and disturb the underlying subgrade soils by operating construction equipment during spring-thaw or wet conditions. The subgrade soils in this project area are prone to softening if subjected to ingress of water.

Construction site drainage must be provided prior to stripping and subgrade preparation to control moisture conditions at the top of subgrade. Construction equipment must not be allowed to travel on prepared subgrade. The prepared subgrade should be graded to a minimum 3 percent crossfall to promote positive drainage toward all drainage features. The pavement parking areas should be constructed with subdrains beneath the pavement surface to improve subsurface drainage.

The underlying subgrade soils should be graded as required to accommodate the new pavement platform. The exposed subgrade should be compacted and proof-rolled with a heavy roller and examined to identify areas of unstable subgrade. Any soft/wet areas identified should be subexcavated and replaced with approved material (or additional granular base material) within 2 percent of optimum moisture content and compacted to at least 98 percent of SPMDD.

6.12.6 Pavement Drainage

In all new pavement areas, positive drainage must be maintained at the top of pavement surface and top of subgrade. Maintaining drainage on the pavement surface, should be completed by grading the paved surface to channel runoff toward drainage features (i.e. catchbasins) and into the storm sewer system.

Subsurface drainage should be managed by grading the top of subgrade toward subdrain pipes installed beneath the curb and gutter at the edge of the pavement platform; although in large pavement areas, additional subdrains may be required crossing the parking area. Construction of new facilities with an urban platform should be in accordance with OPSD 216 series. Subdrains should be constructed using standard 150 mm diameter (minimum) filter cloth wrapped flexible perforated pipe, installed as per the wrapped trench detail in OPSD 216.021.

6.13 Corrosion and Cement Type

Seven analytical tests were conducted to determine the water-soluble sulphate ion (SO_4) content of select soil samples recovered from the boreholes. These tests showed the presence of less than 0.002 to 0.0147 percent water-soluble sulphate ion content in the soil samples indicating that there is low potential for sulphate attack on the subsurface concrete. As a result, CSA Type GU (General Use hydraulic cement) may be used in the subsurface concrete at this project site. The choice of class of concrete must also consider adverse effects of deicing salt.

The recommendations stated above for the subsurface concrete at this site may require further additions and/or modifications due to structural, durability, service life or other considerations that are beyond the geotechnical scope.

In addition, if imported material is required to be used at the site and will be in contact with concrete, it is recommended that the fill soil be tested for sulphate content to determine whether the above stated recommendations remain valid.

The pH, resistivity and chloride concentration provide an indication of the degree of corrosivity of the subsurface environment. The tests results provided in Table F1 may be used to aid in the selection of coatings and corrosion protection systems for buried steel objects. The soil resistivity results indicate the soil has a moderate to high potential for corrosion.

Certificates of analysis presenting the analytical test results are attached in Appendix F.

6.14 Construction Considerations

6.14.1 Excavations and Temporary Shoring

Shallow excavations for the outfall pipe are expected to extend through surficial fill and into the underlying silty sand to sand. Deeper excavations for the water retention tanks and attached buildings are expected to extend through the surficial fill and organics, the silty clay, the sand and silt layer and into the underlying limestone bedrock.

Use of hydraulic excavator should be suitable for excavation in the fill and native overburden soils. Difficulties in excavating possible debris within the fill should be anticipated. Provision should be made for handling of the existing pavement structure, as well as cobbles and boulders and rock fragments during excavation.

All excavations should be carried out in accordance with the requirements of the Occupational Health and Safety Act (OHSA) and local regulations. For the purposes of OHSA, the soils within the likely depth of excavation may be classified as Type 3 soils for fill above the water table, the firm to stiff silty clay and the loose to compact sands and silts above the water table. The loose to compact sands and silts below the water table should be classified as Type 4 soils under OHSA.

Temporary excavations for the outfall pipe and other shallow trench excavations should conform with the requirements of OHSA, but should not be steeper than 1H:1V. Flatter slopes may be required at locations where water seepage or sloughing occurs during excavation. Where space restrictions preclude excavation of inclined slopes, service installation may be carried out using a trench box. Soils should not be stockpiled within a horizontal distance from the trench wall equal to the depth of the excavation.

The excavation for the water retention tanks and attached buildings will extend through the overburden and to the limestone bedrock surface at the influent buffer tanks. Excavations through the overburden can be carried out with the use of a hydraulic excavator as described above. If excavations into the bedrock are required, Thurber should be consulted to provide additional guidance.

Given the depth and size of the excavations for the influent and sludge buffer tanks, it is anticipated the excavation for these tanks may have to be undertaken within the confines of an engineered support system that is designed to mitigate groundwater seepage from the overburden into the excavation. The engineering support system should be designed by a licensed professional engineer experienced in design of shoring systems. The design of all members in the shoring system should include the effects of surcharge loads such as those imposed by adjacent utilities and construction equipment. Soil should not be stockpiled in the vicinity of the excavation.

The engineering support system employed for the conditions at the site should be designed in accordance with the Canadian Foundation Engineering Manual. The following parameters can be used in the design:

K_a	=	0.35 fill
	=	0.38 for silty clay
	=	0.33 for native sand/silt
γ	=	20 kN/m^3 for fill and silty clay
	=	21 kN/m^3 for native sand/silt

For watertight shoring the groundwater level should be assumed to be at the ground surface.

6.14.2 Subgrade Preparation

Foundations and outfall pipe bedding must be placed on uniformly competent subgrade that is maintained in a dry condition. The subgrade must consist of undisturbed inorganic native soil or bedrock free of loose or disturbed material. Otherwise, excessive post-construction settlement should be expected.

Preventing subgrade disturbance is ultimately the responsibility of the contractor. To limit the potential for subgrade disturbance from construction traffic and groundwater inflow within the deeper water retention tank excavation, a mud slab of lean concrete, at least 50 mm in thickness, should be provided on the silty clay subgrade surface following review/approval of the subgrade surface by qualified geotechnical personnel.

6.14.3 Dewatering

Subgrade preparation, foundation construction, and placement and compaction of bedding/ backfill must be carried out in the dry. All excavations for foundation construction must be dewatered prior to the placement of concrete, as per OPSS.MUNI 902.

For the outfall pipe and southern structures (AGS tanks, operations building, and tertiary building), it is anticipated that any seepage into the excavation can be handled by unwatering from within the trench using sumps and pumps.

It is anticipated the excavation for the tanks adjacent to the headworks will take place within the confines of an engineered support system. It is recommended that the support system be watertight in order to cut-off groundwater flows from the sand/silt layer encountered on top of bedrock. Secant pile walls socketed a minimum of 1 m into the limestone bedrock is considered a feasible option for the support system.

Further information on estimated groundwater inflow is provided in Thurber's hydrogeology report for this project, which is provided under separate cover. It is noted that the hydrogeology report assumes that the groundwater level will be lowered to about 1 m below the base of excavations terminating in overburden and about 0.5 m below the base of excavations terminating in bedrock, to facilitate a dry, stable work area.

Where the excavation extends into the bedrock, concentrated seepage may be experienced from fractures and cavities within the limestone bedrock. Grouting of fractures may be required to reduce the flow. The contractor should be prepared to pump groundwater from the bedrock out of the excavation from inside the watertight shoring system.

The design of the dewatering system is the responsibility of the contractor. The contractor should retain a specialized dewatering subcontractor to design the dewatering system, which will need to remain operational and effective until the tanks and buildings are in place and then should be decommissioned and removed. The design of the system should follow OPSS.MUNI 517. The dewatering plan should be reviewed by qualified geotechnical/hydrogeological personnel retained by the owner to confirm that the contractor's dewatering plan meets the design intent, prior to the commencement of excavations. It is noted that temporary groundwater level lowering has the potential to cause settlement of adjacent structures. Further discussion in this regard is provided in Section 6.14.4.

For additional information on dewatering, the reader is referred to the hydrogeological report prepared by Thurber for this project, which has been provided under separate cover.

6.14.4 Impacts to Adjacent Structures

Open cut excavations should not undermine the zone of influence of any foundations of structures or bedding of service pipes. The zone of influence is defined by a theoretical 1H:1V surface extending down and away from the underside of the foundation/bedding to the outside edge of the excavation. If the zone of influence of any structure or service pipe is undermined, an appropriate form of temporary shoring/support will be needed. If this is deemed required by the designers, the contractor should be made responsible for the design of the temporary shoring/ support and associated monitoring program. The design of the temporary protection system should be carried out by and sealed by a qualified Professional Engineer. Prior to construction, the contractor should be required to submit to the contract administrator for review stamped shop drawings that show details of the shoring system, monitoring program and estimated movement of the adjacent structures to be protected. The protection system should meet the requirements of OPSS.MUNI 539 (performance level 1a).

It is noted that dewatering activities have the potential to cause settlement of adjacent structures due to an increase in the effective stress of the foundation soils caused by groundwater level lowering. For this project the risk of settlement beneath the existing structures is considered low provided that watertight shoring systems are used for deep excavations that extend into the sand/ silt and bedrock. Notwithstanding this assessment, a settlement monitoring program should be carried out during construction as a precautionary measure to confirm that the existing structures do not settle excessively. Thurber can assist with the preparation of a settlement monitoring specification, if requested.

6.14.5 Construction Inspection and Testing

The successful performance of the new facilities will depend largely on good workmanship and quality control during construction. It is therefore recommended that geotechnical inspection and testing by qualified personnel be provided during construction. The inspection and testing should include observation and inspection of foundation subgrade conditions, compaction testing of engineered fill, and concrete and asphalt testing.

7. ENVIRONMENTAL CONSIDERATIONS

A limited analytical testing program was completed on selected soil samples to evaluate the environmental quality and provide preliminary management options for excavated materials that may be generated during the proposed construction works.

For preliminary characterization of the soil samples and potential reuse of the excavated soils on-Site for a beneficial purpose, the “bulk sample” analytical data was compared to the generic Site Condition Standards (SCSs) provided under O.Reg. 153/04 in MECP’s document “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of Environmental Protection Act”, April 15, 2011 (“2011 MECP Document”). The analytical results were compared to the MECP’s Table 1: Full Depth Generic Site Condition Standards for Residential / Parkland / Institutional / Industrial / Commercial / Community Property Uses (MECP Table 1 Standards) and to the MECP’s Table 2: Full Depth Generic Site Condition Standards for Industrial / Commercial / Community Property Uses (MECP Table 2 Standards). If the final design changes and reuse of soil on-Site is considered within 30 m of the Napanee River, additional evaluation of the environmental quality of the soils would be required.

The MECP filed O.Reg. 406/19 On-Site and Excess Soil Management on December 4, 2019, where the Rules for Soil Management and Excess Soil Quality Standards under this regulation are to be adopted on January 1, 2021, and required Planning Documents and Registration filing will apply for certain projects on January 1, 2022. The Regulation sets out standards for a prescribed list of potential contaminants and the applicable Excess Soil Quality Standards (ESQSs). In general, the applicable ESQS depend on the property use, potable versus non-potable groundwater condition, proximity to areas of natural significance, soil pH and texture, proximity to a water body, and soil depth at the investigation site.

To assess the potential for reuse of excess soils off-Site at locations requiring fill for a beneficial purpose, the analytical results were compared to the MECP Table 1 “Full Depth Background Site Condition Standards” for reuse Site property uses other than agricultural (MECP Table 1 Standards). In addition, the analytical data were compared to MECP’s Table 2.1 of the Excess Soil Quality Standards (ESQSs) for Residential / Parkland / Institutional (RPI) reuse Site property uses and MECP’s Table 2.1 of the Excess Soil Quality Standards (ESQSs) for Industrial / Commercial /Community (ICC) reuse Site property uses provided in Appendix 1 of MECP’s Rules for Soil Management under O.Reg. 406/19.

The “bulk” analytical testing completed is intended as an initial environmental screening of the soils to guide soil management options for the detailed design involving the beneficial reuse of excavated soils that are generated during the proposed construction works and does not meet the testing requirements of O.Reg. 406/19 as this was beyond the scope of this assignment and may or may not be applicable depending on the anticipated project design, reuse of the materials, and schedule. Additional sampling, analytical testing, and associated filing of reports with MECP by O.Reg. 153/04 Qualified Person (QP) may be required if it is determined that the O.Reg. 406/19 is applicable based on the actual project design and schedule.

7.1 General Comments

The foregoing sampling and testing program was completed to obtain a general understanding of the environmental quality of project-related excavated materials in relation to applicable regulatory requirements and does not meet the soil sampling requirements set out by O.Reg. 406/19. Our current understanding of the Site subsurface material conditions was inferred from a limited number of sampling locations in accessible areas that targeted the preliminary environmental characterization of materials. The spatial and vertical extent of the quality of the materials that may be encountered during construction was not accurately delineated. As such, the environmental data and preliminary recommendations were provided as guidance to the contractor on the requirements for reuse or disposal of materials generated during the proposed construction works and should not be used to quantify or estimate the costs related to the management and handling of the materials.

In general, elevated concentrations of Electrical Conductivity (EC) and/or Sodium Adsorption Ratio (SAR) exceeding one or both of the MECP Table 1 Standards are likely related to the application of de-icing salts for safety purposes. Therefore, the reported concentrations of EC and SAR above the MECP Table Standards referenced in this report are not deemed as exceedances and excavated materials with only EC and SAR impacts may be managed for reuse in engineering applications on-Site or off-Site (i.e. site grading fill or backfill) at sites accepting such materials. The material should not be used in landscaped areas in close proximity to vegetation, or within close proximity to water bodies.

Materials encountered during construction which exhibit visual or olfactory evidence of environmental impact (i.e. staining, odours, contains debris or asphalt) are to be handled as waste. Alternatively, these materials will need to be segregated under the direction of QP into separate stockpiles on-Site to determine appropriate handling options. Stockpiled impacted soil will need to be tested by the Contractor and reassessed at that time to determine if the stockpiled materials can be reused or will need to be handled as waste and disposed of at a licensed facility.

Due to the inherent variability of subsurface conditions, inspection will be required during construction in order to confirm that the quality of the excess excavated soils is consistent with the conditions documented during this investigation. Additional analytical testing of excavated soils may be required prior to or during construction to further evaluate the environmental quality of the soil, confirm reuse and disposal options, and meet the requirements of re-use on-Site and/or the receivers of excess soils off-Site.

Where excavation of existing pavement structures is required, asphalt should be removed separately from granular materials and recycled at an approved recycling facility or disposed of appropriately off-Site. Asphalt should not be mixed with excess excavated soil; fill receivers may not accept excess excavated soils if it contains asphalt.

No statement made herein should be construed as relieving the Contractor's responsibility to comply with all applicable federal and provincial regulations, municipal by-laws and guidelines related to the handling or disposal/discharge of excavated materials and/or extracted groundwater. It should be noted that the current regulatory requirements that were considered in this report are subject to change over time.

7.2 On-Site Soil Reuse Option

The reported concentrations of the tested parameters within the 21 submitted soil samples collected from boreholes within the proposed excavation areas were generally below the MECP Table 1 Standards and the MECP Table 2 ICC Standards with the exception of the results listed below:

Samples from BH-01, BH-02, BH-04, BH-05, BH-06, BH-07, BH-14, BH-19, BH-20, BH-23, BH-25, BH-26 contained one or more exceedances of the Table 1 Standards for select metals including barium, chromium VI, cobalt, mercury, silver, and zinc. The sample from BH-14 also exceeded the Table 1 Standard for toluene.

The sample from BH-13 SS1 exceeded the Table 1 Standard for only SAR.

The sample from BH-21 SS3 (1.5 m to 2.1 m) exceeded the Table 2 ICC Standard for Barium and Vanadium; however, barium and vanadium are considered naturally occurring in the native Champlain Sea clay deposit. Notwithstanding, the concentration of Barium from BH-21 (783 µg/g) was reported above the MECP Table 3 ICC Standard (670 µg/g) and geo-regional background value for naturally occurring barium in Champlain Sea clay (460 µg/g); therefore, should be handled as waste and disposed of at an MECP licenced landfill. The horizontal and vertical extent of the metals impacts were not determined during the investigation.

Brick fragments were observed in the collected samples from BH-01 SS2, and BH-06 SS1. Due to the presence of construction debris in the fill samples, the surficial soils at BH-01 and BH-06 should be considered waste and are not suitable for re-use. Alternatively, the debris can be removed/screened prior to reusing the material on site.

Based on the results of the investigation, excavated materials within the proposed excavation areas generally met the MECP Table 2 ICC Site Condition Standards for reuse on-Site, with the exception of soils near BH-21 (Table 2 ICC Soil Exceedances), and soils near BH-01 and BH-06 (presence of debris / construction waste) which should be handled as waste for off-Site disposal.

7.3 Off-Site Reuse Option

For management of excess soils, the analytical data were compared to the Excess Soil Quality Standards (ESQSs) of O. Reg. 406/19 made under the Environmental Protection Act, On-site and Excess Soil Management filed December 4, 2019 ("Excess Soil Regulation"). The results were compared to the O. Reg. 406/19, Table 2.1 for residential/parkland/institutional (RPI) and industrial/commercial/community (ICC) land uses within a potable groundwater condition. Analytical summary tables are provided in Appendix G and the laboratory Certificates of Analysis are included in Appendix H.

The results of the analytical laboratory testing indicate the concentrations of the tested parameters from the submitted samples generally met the applicable ESQSs, with the exception of the samples listed below:

- BH13 SS1: SAR was in exceedances of the Table 2.1 RPI ESQSs (approximate sample depth of 0 m to 0.6 m).
- BH14 SS2: SAR was in exceedances of the Table 2.1 RPI ESQSs, while Mercury and Toluene were in exceedance of both the Table 2.1 RPI and Table 2.1 ICC ESQSs (approximate sample depth of 0.8 m to 1.4 m).
- BH21 SS3: EC, SAR, and Cobalt were in exceedance of the Table 2.1 RPI ESQSs and Barium and Vanadium were in exceedance of both the Table 2.1 RPI and Table 2.1 ICC ESQSs (approximate sample depth of 1.5 m to 2.1 m).

The samples that were reported above the selected ESQSs were located within the northwest quadrant of the proposed construction area and may not be suitable for off-Site reuse and should be treated as waste for disposal at an MECP licenced landfill.

The results of the SPLP analytical laboratory testing indicate the concentrations of the tested parameters from the five composite soil samples, met the Table 2.1 leachate screening level standards (LSLs) for Residential/Parkland/Institutional and Industrial/Commercial/Community property uses, respectively. The measured values and corresponding LSLs are shown on Table G6 in Appendix G. Laboratory Certificates of Analysis are included in Appendix H.

If excess soil is generated that requires off-site management, project specific details such as the timing of construction, excavation quantities, excess soil management strategies and reuse site requirements need to be known to comply with the regulation, as previously indicated. Without this information, the full requirements of O. Reg. 406/19 may not be met. Therefore, the due diligence level of sampling and testing that was completed at this time should only be considered to provide the preliminary baseline conditions of the environmental quality of excavated soils that may be generated during construction to help assess potential re-use and disposal options. Once the detailed design information is known, supplemental sampling and testing beyond the current program, as well as preparation of planning documents, may be necessary to meet the requirements of the Excess Soil Regulation or the acceptance criteria of the potential reuse site selected by the Contractor.

In this regard, it may be prudent for the contract to include a provision that additional requirements that need to be met to comply with O. Reg. 406, as amended, would be the responsibility of the Contractor.

The assessment for the management of the excess soils as re-useable fill is from an environmental quality perspective only and is not an indicator of the geotechnical suitability of the material for re-use. In this respect, reference should be made to the discussion of the geotechnical parameters in the previous sections of this report.

7.4 Waste Disposal

If the final design dictates that soil may not be re-used on site and an excess soil receival site cannot be obtained, the potential to dispose of the soil at a landfill may be evaluated. Analysis of Toxicity Characteristic Leaching Procedure (TCLP) samples will need to be completed on the actual materials to be landfilled to verify the waste classification and that the acceptance criteria of the waste management facility selected by the Contractor has been met. Specific requirements of the contractors selected disposal site may also include required testing per volume of soil to be disposed of.

It is recommended that the contract include a provision for the handling and disposal of contaminated soils to account for soils with metals impacts and the possibility of encountering isolated zones of contamination during construction. In this regard, excavated materials that exhibit visual or olfactory evidence of environmental impact (i.e. stained, odorous) should be screened during construction using a soil vapour/gas field screening instrument and segregated into separate stockpiles and tested to verify appropriate handling options involving on-site / off-site reuse, or disposal at a MECP licensed facility (i.e., landfill and/or treatment facilities). The soil screening should be completed under the direction of an O. Reg. 153/04 Qualified Person.

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8. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact the undersigned at your convenience.

LICENSED PROFESSIONAL ENGINEER
S. W. DUNLOP
100151238
Jan. 21, 2025
PROVINCE OF ONTARIO

Ibrahim Khan, M.Eng
Engineering Intern

Stephen Dunlop, M.A.Sc., P. Eng.
Principal, Senior Geotechnical Engineer

Date: January 21, 2024
File: ***40745***

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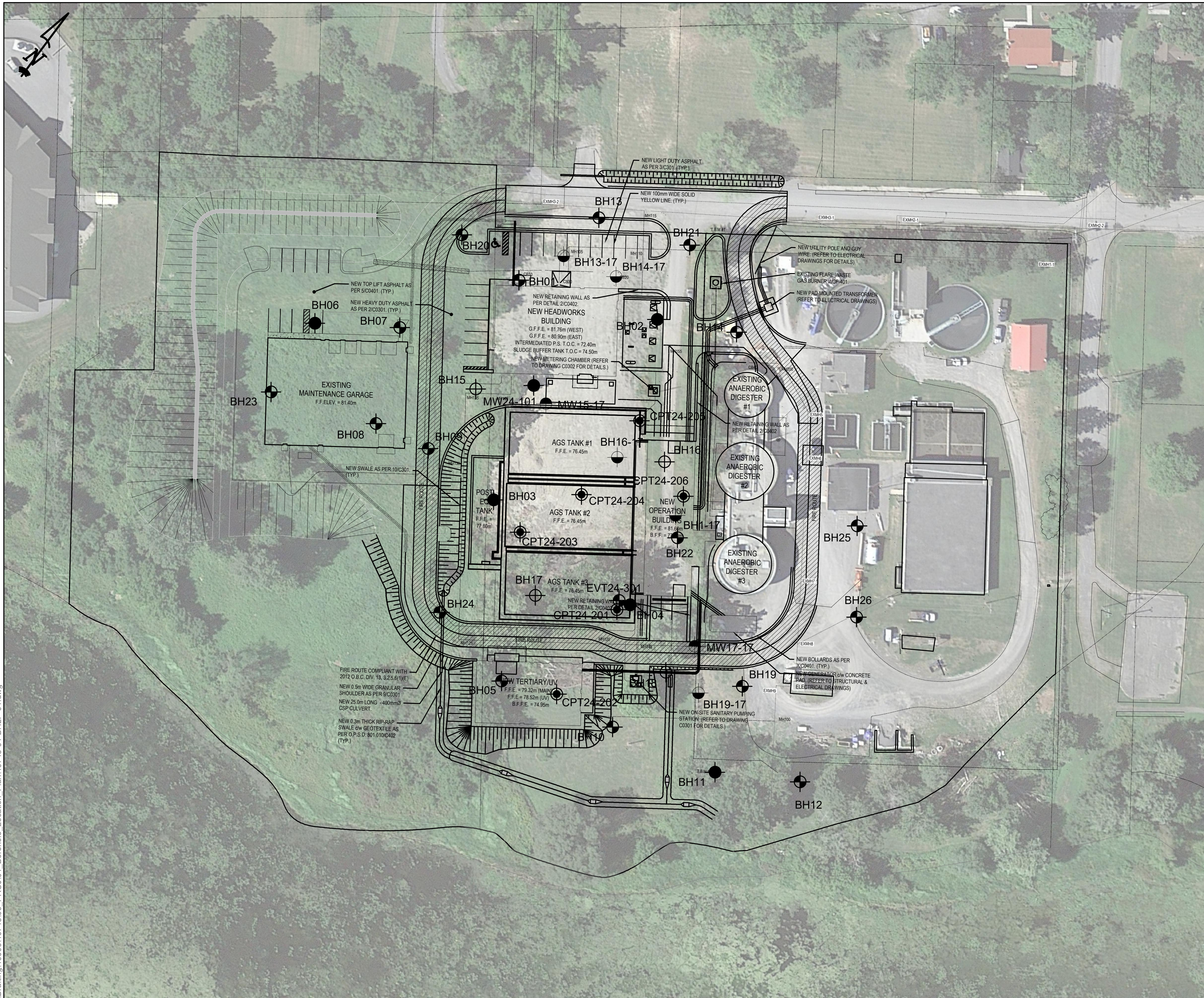
APPENDIX A

Testhole Location Plan



LEGEND

- BOREHOLE LOCATION (THURBER, 2021/2024)
- BOREHOLE WITH MONITORING WELL LOCATION (THURBER, 2021/2024)
- AUGER PROBE LOCATION (THURBER, 2021)
- CONE PENETRATION TESTING LOCATION (THURBER, 2024)
- BOREHOLE LOCATION (GHD, 2018)
- BOREHOLE WITH MONITORING WELL LOCATION (GHD, 2018)

20 0 20 40m

SCALE 1:1000

CLIENT

EVB ENGINEERING

PROJECT

NAPANEE WATER POLLUTION CONTROL PLANT

TEST HOLE LOCATION PLAN

PROJECT No.	40745
DESIGNED	RB
DRAWN	JEM
APPROVED	SD
DATE	2024-04-30
DRAWING No.	40745-1

THURBER ENGINEERING LTD.

H:\Drafting\40000\40745\99_PROJ01_Borehole_Location_Plan\40745-01-BHLP-01.dwg

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APPENDIX B

Symbols and Terms

Record of Borehole Sheets (Thurber 2021/2024)

Summary of Engineering Properties

Borehole Logs (GHD 2018)

THURBER

SYMBOLS, ABBREVIATIONS AND TERMS USED ON TEST HOLE RECORDS

TERMINOLOGY DESCRIBING COMMON SOIL GENESIS

Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of fragments of decayed organic matter
Till	unstratified glacial deposit which may include particles ranging in sizes from clay to boulder
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 materials, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of 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

RECOVERY:

For soil samples, the recovery is recorded as the length of the soil sample recovered.

N-VALUE:

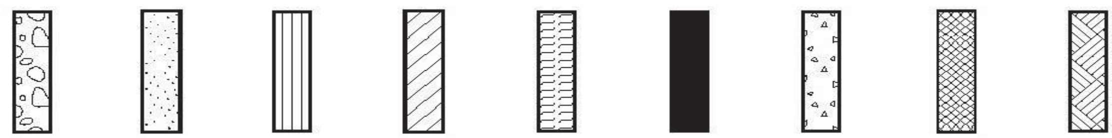
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 63.5 kg hammer falling 0.76 m, required to drive a 50 mm O.D. split spoon sampler 0.3 m into undisturbed soil. For samples where insufficient penetration was achieved and N-value cannot be presented, the number of blows are reported over the sampler penetration in millimetres (e.g. 50/75).

DYNAMIC CONE PENETRATION TEST (DCPT):

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to an "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 0.3 m into the soil. The DCPT is used as a probe to assess soil variability.

STRATA PLOT:

Strata plots symbolize the soil and 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.



TEXTURING CLASSIFICATION OF SOILS

Classification	Particle Size
Boulders	Greater than 200 mm
Cobbles	75 – 200 mm
Gravel	4.75 – 75 mm
Sand	0.075 – 4.75 mm
Silt	0.002 – 0.075 mm
Clay	Less than 0.002 mm

TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

Descriptive Term	Undrained Shear Strength (kPa)
Very Soft	12 or less
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	100 – 200
Hard	Greater than 200

NOTE: Clay sensitivity is defined as the ratio of the undisturbed strength over the remolded strength.

SAMPLE TYPES

SS	Split spoon samples
ST	Shelby tube or thin wall tube
DP	Direct push sample
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ etc.	Rock core sample obtained with the use of standard size diamond coring equipment

TERMS DESCRIBING CONSISTENCY (COHESIONLESS SOILS ONLY)

Descriptive Term	SPT “N” Value
Very Loose	Less than 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	Greater than 50

THURBER

MODIFIED UNIFIED SOIL CLASSIFICATION

Major Divisions		Group Symbol	Typical Description
COARSE GRAINED SOIL	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILT AND CLAY SOILS $W_L < 35\%$	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILT AND CLAY SOILS $35\% < W_L < 50\%$	MI	Inorganic compressible fine sandy silt with clay of medium plasticity, clayey silts.
		CI	Inorganic clays of medium plasticity, silty clays.
		OI	Organic silty clays of medium plasticity.
	SILT AND CLAY SOILS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy of silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other organic soils.

Note - W_L= Liquid Limit

THURBER

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock materials.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structures are preserved.

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1 m in length or larger, as a percentage of total core length
Unconfined Compressive Strength: (UCS)	Axial stress required to break the specimen.
Fracture Index: (FI)	Frequency of natural fractures per 0.3 m of core run.

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 to 2 m
Medium bedded	0.2 to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 to 60 mm
Laminated	6 to 20 mm
Thinly laminated	Less than 6 mm

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)
Extremely Strong	Greater than 250
Very Strong	100 – 250
Strong	50 – 100
Medium Strong	25 – 50
Weak	5 – 25
Very Weak	1 – 5
Extremely Weak	0.25 – 1

RECORD OF BOREHOLE MW24-101

PROJECT : Napnee WPCP Detailed Design
LOCATION : 300 Water Street N 4 900 343.9 E 343 412.5
STARTED : February 20, 2024
COMPLETED : February 20, 2024
DRILLER: ConeTec
DRILL RIG: Gtech GT8
Project No. 40745
SHEET 1 OF 2
DATUM CGVD28

Boring Method	Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m	Comments	Additional Lab. Testing	Piezometer or Standpipe Installation
	GROUND SURFACE	79.0						
HW Casing / Mud Rotary	SILTY CLAY with gravel some to trace organics brown moist **FILL**	0.0	1	SS	10			Bentonite
			2	SS	4			
	SILTY CLAY very stiff brown to grey moist to wet moist	77.5 1.5	3	SS	17			
			4	SS	8			
			5	SS	13			
			6	SS	13			
			7	SS	6			
	- some silt/sand seams below 5.3 m		8	SS	6			
HQ Coring / Diamond Drilling	**LIMESTONE BEDROCK** slightly weathered to fresh strong to very strong thinly bedded flat to wavy folation fossiliferous fined grained matrix with occasional <5mm clasts with black shale interbeds (15-30mm) and occasional calcite infilling and calcite filled vugs (Bobcageon Formation)	71.7 7.3	1	RUN		TCR=95% SCR=89% RQD=89%	FI >10 2 2 1	Filter Sand Slotted Screen
			2	RUN		TCR=100% SCR=100% RQD=89%	2 2 0 1	Sand
	End of Borehole	69.2 9.8						

Depth scale (metres): 1, 2, 3, 4, 5, 6, 7, 8, 9

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ — 20 40 60 80

WATER CONTENT, PERCENT — wp ⊢ ○w ⊣ wl — 20 40 60 80

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION
February 20, 2024

▼ WATER LEVEL IN WELL/PIEZOMETER
February 21, 2024

LOGGED : IK
CHECKED : SD

THURBER

RECORD OF BOREHOLE MW24-101

PROJECT : Napnee WPCP Detailed Design
LOCATION : 300 Water Street N 4 900 343.9 E 343 412.5
STARTED : February 20, 2024
COMPLETED : February 20, 2024

DRILLER: ConeTec
DRILL RIG: Gtech GT8

Project No. 40745

DATUM CGVD28

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH: Cu, KPa nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 20 40 60 80 / WATER CONTENT, PERCENT wp w wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Monitoring well 24-101 installed: Schedule 40 PVC standpipe of 50 mm diameter with 1.5 m screen length. Monument casing installed at ground surface.									
		Well Readings:									
		Date: Depth (m): Elev. (m):									
11		2024/02/20 1.5 77.5									
		2024/02/21 1.8 77.2									
		2024/02/22 1.8 77.2									
12											
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION
February 20, 2024

▼ WATER LEVEL IN WELL/PIEZOMETER
February 21, 2024

LOGGED : IK
CHECKED : SD

THURBER

RECORD OF BOREHOLE EVT24-301

PROJECT : Napnee WPCP Detailed Design
LOCATION : 300 Water Street N 4 900 313.0 E 343 462.9
STARTED : February 21, 2024
COMPLETED : February 21, 2024

DRILLER: ConeTec
DRILL RIG: Gtech GT8

Project No. 40745
SHEET 1 OF 1
DATUM CGVD28

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		77.2							
0	HW Casing / Mud Rotary	**Note:** Refer to Project No. 30726 Borehole No. BH-04 dated February 24, 2021 for upper stratigraphy		0.0							
4.6		**CLAY** very stiff grey wet		72.6 / 4.6							
5					1	ST	-				
5.5		Nilcon Vane Test by Conetec at 5.5 m peak torque achieved without shearing									
6.4					2	ST	-				
7		Nilcon Vane Test by Conetec at 7.0 m									
7.9					3	ST	-				
8.5		Nilcon Vane Test by Conetec at 8.5 m peak torque achieved without shearing End of Borehole		68.7 / 8.5							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : IK
CHECKED : SD

THURBER

THURBER2S 40745 NAPANEE WPCP - DRAFT LOGS.GPJ 1-21-25

RECORD OF BOREHOLE BH-01

PROJECT : Napanee Water Pollution Control Plant Expansion — Project No. 30726
LOCATION : N 4 900 363.3 E 343 393.4
STARTED : February 23, 2021 — SHEET 1 OF 2
COMPLETED : February 23, 2021 — DATUM Geodetic

Depth (m)	Boring Method	Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m	Comments	Water Content	Additional Lab. Testing
		GROUND SURFACE	80.9 / 0.0						
0–2.2	Hollow Stem Augers	**CLAY**, silty, trace to some gravel, trace to some sand, trace organics, stiff to very stiff, brown, moist: (FILL)		1	SS	11			
		Occasional brick fragments in SS2		2	SS	9			
		Occasional cobbles		3	SS	16			
2.2–5.6	Hollow Stem Augers	**CLAY**, silty, trace sand, occasional gravel, frequent sand seams, stiff, grey, moist	78.7 / 2.2	4	SS	4	Grain Size Analysis: Gr 1%/ Sa 37%/Si 41%/ Cl 21%	wp–w–wl	
				5	SS	8			
		Some sand		6	SS	10			
5.6–7.1	Hollow Stem Augers	**SAND**, some silt to silty, trace Gravel, trace clay, loose, brown, wet	75.3 / 5.6	7	SS	7	Grain Size Analysis: Gr 3%/ Sa 84%/Si 12%/ Cl 1%		
7.1–	NQ Coring	**LIMESTONE** slightly weathered to fresh, strong to very strong, thinly bedded, grey with black mudstone interbeds and occasional calcite filled vugs (Bobcageon Formation)	73.8 / 7.1	1	RUN		UCS = 113.5MPa; TCR=100% SCR=88% RQD=87%; UCS = 75MPa (Average) (PLT)		FI: 3, 2, 1, 2, 2
		Subvertical fracture at 8.6 m (125 mm in length)		2	RUN		TCR=100% SCR=92% RQD=92%; UCS = 119MPa (Average) (PLT)		3, 2, 0, 2

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE: DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m); SAMPLES: NUMBER, TYPE, BLOWS/0.3m; COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: Cu, KPa (nat V - ✚, Q - ✖, rem V - ●, Cpen ▲; 20 40 60 80); WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-01

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 363.3 E 343 393.4
STARTED : February 23, 2021
COMPLETED : February 23, 2021

Project No. 30726

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
										1	
		END OF BOREHOLE AT 10.2m. BOREHOLE BACKFILLED WITH HOLEPLUG.		70.7 10.2							
11											
12											
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-02

PROJECT : Napanee Water Pollution Control Plant Expansion
Project No. 30726
LOCATION : N 4 900 376.0 E 343 427.4
STARTED : February 22, 2021
SHEET 1 OF 2
COMPLETED : February 23, 2021
DATUM Geodetic

Depth (m)	Boring Method	Description	Elev. / Depth (m)	No.	Type	Blows/0.3m	Comments	Water Content (%)	Additional Lab. Testing	Piezometer
0	Hollow Stem Augers	GROUND SURFACE	79.0							
		FILL (100mm)	0.1							
		TOPSOIL (75mm)	0.2							
		CLAY, silty, trace to some sand, very stiff to stiff, brown, moist		1	SS	17				Shallow / Deep
1				2	SS	17	Grain Size Analysis: Gr 0%/ Sa 18%/ Si 38%/ Cl 44%	53		Bentonite
2				3	SS	13				
				4	SS	5				Filter Sand
3		Becoming grey		5	SS	5				
4										Slotted Screen
5		Frequent sand seams (2-3 mm thick) in SS6		6	SS	15	Grain Size Analysis: Gr 0%/ Sa 1%/ Si 25%/ Cl 74%			
		Rock fragments in SS7	73.3 / 5.7	7	SS	50/ 0.050			FI	
6	NQ Coring	**LIMESTONE**, slightly weathered to fresh, strong to very strong, thinly bedded, flat to wavy foliation, fossiliferous, fine grained matrix with occasional <5mm clasts, with black shale interbeds (15-30mm) and occasional calcite infilling and calcite filled vugs (Bobcageon Formation)					UCS = 105.9MPa		1	
									3	Filter Sand
				1	RUN		TCR=97% SCR=87% RQD=70% UCS = 113MPa (Average) (PLT)		3	
7									3	
									3	
									1	
		vertical fracture at 7.7m (125mm long)							4	Slotted Screen
8				2	RUN		TCR=98% SCR=89% RQD=82% UCS = 89MPa (Average) (PLT)		2	
									2	
									1	
9		END OF BOREHOLE AT 8.84m.	70.2 / 8.8							
		Deep Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 2.44m slotted screen.								
		Shallow monitoring well was installed in a separate borehole drilled approximately 1m away from the sampled borehole. The								

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE: DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m); SAMPLES: NUMBER, TYPE, BLOWS/0.3m; COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH: Cu, KPa nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 20 40 60 80; WATER CONTENT, PERCENT wp w wl 10 20 30 40; ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER April 14, 2021

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-02

PROJECT : Napanee Water Pollution Control Plant Expansion
Project No. 30726
LOCATION : N 4 900 376.0 E 343 427.4
STARTED : February 22, 2021
SHEET 2 OF 2
COMPLETED : February 23, 2021
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH: Cu, KPa nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 20 40 60 80 / WATER CONTENT, PERCENT wp ⊢ w ○ ⊣ wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		shallow well installation consists of a 50mm diameter Schedule 40 PVC pipe with a 3.04 m slotted screen.									
		DEEP WELL WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m)									
11		Feb 26-21 0.80 78.20 Mar 03-21 0.70 78.30 Apr 14-21 0.60 78.40									
		SHALLOW WELL WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m)									
12		Feb 26-21 0.70 78.30 Mar 12-21 0.60 78.40 Apr 14-21 0.60 78.40									
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER April 14, 2021

LOGGED : RB

CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-03

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 314.4 E 343 421.8
STARTED : February 23, 2021
COMPLETED : February 24, 2021

Project No. 30726
SHEET 1 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT, PERCENT (wp, w, wl) / SHEAR STRENGTH	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	76.4							
	Hollow Stem Augers	**PEAT**	0.0	1	SS	2		w = 72		Deep (water level)
		CLAY, silty, trace sand, very stiff to firm, brown, moist	76.0 / 0.4							
1		Trace to some organic material in SS2		2	SS	10				
2				3	SS	8				Bentonite
				4	SS	14				
3		Frequent silt lenses (1mm thick) in SS5 and SS6, becoming grey		5	SS	8	Grain Size Analysis: Gr 0%/ Sa 1%/ Si 30%/ Cl 69%	w = 61		
4										Filter Sand
5				6	SS	5	Note: Vane test completed in separate borehole adjacent to sampled borehole.			
		SILT, some sand, some clay, trace gravel, frequent sand interbeds, compact, brown, wet	70.8 / 5.6							Slotted Screen
6				7	SS	10	Grain Size Analysis: Gr 1%/ Sa 17%/ Si 68%/ Cl 14%			
7	NQ Coring	**LIMESTONE**, fresh, strong to very strong, thinly bedded, flat to wavy foliation, fossiliferous, fine grained matrix with occasional <5mm clasts, interbedded with black mudstone and occasional calcite infilling (Bobcageon Formation)	69.2 / 7.2				UCS = 130.6MPa		FI: 1, 2	
8				1	RUN		TCR=93% SCR=97% RQD=92% UCS = 157MPa (Average) (PLT)		3, 1, 1	
9		Highly fractured zone at 9.2m		2	RUN		TCR=97% SCR=77% RQD=75% UCS = 104MPa (Average) (PLT)		2, 3, 3, 1	Slotted Screen

SHEAR STRENGTH: Cu, KPa — nat V - ✚, rem V - ●, Q - ✖, Cpen ▲ (20, 40, 60, 80)
DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)
WATER CONTENT, PERCENT — wp, w, wl (10, 20, 30, 40)

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER April 14, 2021

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-03

PROJECT : Napanee Water Pollution Control Plant Expansion

LOCATION : N 4 900 314.4 E 343 421.8

STARTED : February 23, 2021

COMPLETED : February 24, 2021

Project No. 30726

SHEET 2 OF 2

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH: Cu, KPa nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 20 40 60 80 / WATER CONTENT, PERCENT wp ⊢ w ⊣ wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		END OF BOREHOLE AT 10.26m.		66.2 10.3						3	
11		Deep Monitoring Wells installation consists of 50mm diameter Schedule 40 PVC pipe with a 2.44m slotted screen. Shallow monitoring well installed in a separate borehole drilled approximately 1 m away from the sampled borehole. Shallow monitoring well installation consists of a 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.									
12		**DEEP WELL** WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Feb 26-21 -0.20 76.64 Mar 03-21 0.70 75.74 Apr 14-21 0.60 75.84									
13		**SHALLOW WELL** WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Feb 26-21 0.20 76.24 Mar 12-21 -0.20 76.64 Apr 14-21 -0.10 76.54									
14		(Negative water level indicates water level measured above the ground surface)									
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER April 14, 2021

LOGGED : RB

CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-04

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 313.1 E 343 466.0
STARTED : February 24, 2021
COMPLETED : February 24, 2021

Project No. 30726
SHEET 1 OF 2
DATUM Geodetic

Depth (m)	Boring Method	Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m	Comments	Water content / Shear strength	Piezometer
	Hollow Stem Augers	GROUND SURFACE	77.2						
0.0		**ORGANICS**	0.0	1	SS	12			
0.5		**CLAY**, silty, trace sand, very stiff to soft, brown, moist	76.7 / 0.5						
1				2	SS	9			Shallow Bentonite
2				3	SS	11			Deep
2.5		Becoming grey		4	SS	10		>>	Filter Sand
3.3		Frequent silt lenses (1mm thick) in SS5		5	SS	12	Grain Size Analysis: Gr 0%/ Sa 2%/ Si 45%/ Cl 53%	>>	
4.8				6	SS	3		59	Slotted Screen
6.3				7	SS	2			Filter Sand
7.9		Frequent silt/sand lenses in SS8 and SS9		8	SS	1			Slotted Screen
9.4				9	SS	7	Grain Size Analysis: Gr 0%/ Sa 5%/ Si 70%/ Cl 25%		

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE: DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m); SAMPLES: NUMBER, TYPE, BLOWS/0.3m; COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 20 40 60 80); WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER
April 14, 2021

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-04

PROJECT : Napanee Water Pollution Control Plant Expansion
Project No. 30726
LOCATION : N 4 900 313.1 E 343 466.0
STARTED : February 24, 2021
SHEET 2 OF 2
COMPLETED : February 24, 2021
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚ Q - ✖ rem V - ● Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp w wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		END OF BOREHOLE AT 10.16m UPON AUGER REFUSAL ON PROBABLE BEDROCK. Deep Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. Shallow monitoring well installed in separate borehole drilled approximately 1m away from the sampled borehole. Shallow monitoring well installation consists of a 50mm diameter Schedule 40 PVC pipe with a 3.05 m slotted screen.		67.0 10.2							
11											
12		**DEEP WELL** WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Feb 26-21 1.80 75.36 Mar 02-21 1.80 75.36 Apr 14-21 1.80 75.36									
13		**SHALLOW WELL** WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Feb 26-21 2.90 74.26 Mar 12-21 1.00 76.16 Apr 14-21 1.20 75.96									
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
April 14, 2021

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-05

PROJECT : Napanee Water Pollution Control Plant Expansion — Project No. 30726
LOCATION : N 4 900 278.5 E 343 451.1
STARTED : February 25, 2021 — SHEET 1 OF 2
COMPLETED : February 25, 2021 — DATUM Geodetic

Boring method: Hollow Stem Augers

Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m	Comments
GROUND SURFACE	76.3 / 0.0				
ORGANICS, some sand, trace silt, trace clay, black, moist, loose		1	SS	8	
SAND, some silt, trace clay, very loose, brown, moist	75.6 / 0.7	2	SS	2	
CLAY, silty, trace sand, stiff to firm, brown, moist	74.9 / 1.4	3	SS	8	
		4	SS	7	
Trace gravel		5	SS	11	
Becoming grey		6	SS	7	Grain Size Analysis: Gr 0%/ Sa 1%/ Si 20%/ Cl 79%
		7	SS	4	
		8	SS	3	
Varved, becoming very stiff		9	SS	28	

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-05

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 278.5 E 343 451.1
STARTED : February 25, 2021
COMPLETED : February 25, 2021

Project No. 30726

SHEET 2 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, Q - ✖, rem V - ●, Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
11		**SILT**, some sand to sandy, trace to some clay, very loose, wet		65.3 11.0	10	SS	WH	Grain Size Analysis: Gr 0%/ Sa 19%/ Si 71%/ Cl 10%			
		END OF BOREHOLE AT 11.58m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.		64.7 11.6							
12											
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-06

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 323.2 E 343 358.1
STARTED : February 24, 2021
COMPLETED : February 24, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT (%)	SHEAR STRENGTH Cpen (KPa)	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	78.5							
0	Hollow Stem Augers	**CLAY**, silty, some gravel, trace sand, some organics, occasional brick fragments firm, reddish brown, moist: (FILL)	0.0	1	SS	6			>>	Bentonite
		CLAY, silty, trace sand, firm to very stiff, brown, moist	77.8 / 0.7	2	SS	3				
				3	SS	13	Grain Size Analysis: Gr 0%/ Sa 6%/ Si 56%/ Cl 38%		>>	Filter Sand
				4	SS	7			>>	
				5	SS	8			>>	
		SAND, silty, some clay to clayey, loose, brown, wet (bedded in 20 to 50 mm layers)	74.4 / 4.1							Slotted Screen
				6	SS	7	Grain Size Analysis: Gr 0%/ Sa 44%/ Si 30%/ Cl 26%			
		END OF BOREHOLE AT 5.79m UPON AUGER REFUSAL ON PROBABLE BEDROCK.	72.7 / 5.8							

Monitoring Wells installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.

WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Feb 26-21	-0.23	78.72
Mar 12-21	-0.30	78.79
Apr 14-21	-0.24	78.73

(Negative water level indicates water level measured above the ground surface)

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ — 20 40 60 80

WATER CONTENT, PERCENT — wp — w — wl — 10 20 30 40

ADDITIONAL LAB. TESTING

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-07

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 335.3 E 343 376.2
STARTED : February 26, 2021
COMPLETED : February 26, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT, PERCENT (w)	ADDITIONAL LAB. TESTING
		GROUND SURFACE	78.5						
	Hollow Stem Augers	**CLAY** and **ORGANICS**, silty, some sand, moist, firm, black (topsoil)	0.0	1	SS	5		~18	
		CLAY, silty, trace to some sand, brown, moist, very stiff to stiff, frequent sand lenses (1mm thick)	77.9 / 0.6						
1				2	SS	5	Grain Size Analysis: Gr 0%/ Sa 12%/ Si 54%/ Cl 34%	~23	>>▲
2				3	SS	8		~32	>>▲
				4	SS	13		~28	>>▲
3				5	SS	9	Grain Size Analysis: Gr 0%/ Sa 3%/ Si 48%/ Cl 49%	~30 (wp ~21)	>>▲
4									
5		Frequent sand layers (50mm to 75mm thick) in SS6		6	SS	11		~39	>>▲
6		END OF BOREHOLE AT 5.89m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN TO 4.88m AND WATER LEVEL AT 3.66m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE.	72.6 / 5.9						
7									
8									
9									

SHEAR STRENGTH: Cu, KPa — nat V - ✚ rem V - ● Q - ✖ Cpen ▲ (20, 40, 60, 80)
DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)
WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl (10, 20, 30, 40)
PIEZOMETER OR STANDPIPE INSTALLATION: ▽ water level upon completion at approx. 3.66 m

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION   ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-08

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 312.0 E 343 386.0
STARTED : February 26, 2021
COMPLETED : February 26, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

Boring Method: Hollow Stem Augers

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ (20, 40, 60, 80)
WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl (10, 20, 30, 40)
DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION

DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	77.2
TOPSOIL: (150mm)	0.0
CLAY, silty, some sand, some organics, firm, brown, moist	0.2
CLAY, silty, trace sand, very stiff to stiff, brown, moist Becoming grey	76.5 0.7
SILT, sandy (bedded), trace clay, trace gravel, compact, brown, wet	71.5 5.6
END OF BOREHOLE AT 6.55m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN TO 6.25m AND WATER LEVEL AT 2.44m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO GROUND SURFACE.	70.6 6.6

SAMPLE NUMBER	TYPE	BLOWS/0.3m	COMMENTS
1	SS	5	
2	SS	11	
3	SS	15	Grain Size Analysis: Gr 0%/ Sa 6%/ Si 57%/ Cl 37%
4	SS	12	
5	SS	9	
6	SS	7	
7	SS	9	Grain Size Analysis: Gr 1%/ Sa 27%/ Si 70%/ Cl 2%

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-09

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 314.9 E 343 400.5
STARTED : February 26, 2021
COMPLETED : February 26, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT, PERCENT	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	76.8					
	Solid Stem Augers	**TOPSOIL:** (600mm)	0.0	1	SS	4	65	
		SAND, trace to some silt, trace gravel, loose, brown, wet	76.2 / 0.6					▽
1		**CLAY**, silty, trace sand, stiff, brown, moist	75.9 / 0.9	2	SS	9		
		SAND, some gravel, trace silt, compact, brown, moist	75.5 / 1.4					
2		**CLAY**, silty, trace sand, very stiff, brown, moist	75.0 / 1.8	3	SS	13		
		SAND, trace gravel, trace silt, compact, brown, moist	74.6 / 2.3	4	SS	11		
3		END OF BOREHOLE AT 2.90m. BOREHOLE WATER LEVEL AT 0.91m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO GROUND SURFACE.	73.9 / 2.9					

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ — 20 40 60 80

WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl — 10 20 30 40

ADDITIONAL LAB. TESTING

Depth scale: 1 2 3 4 5 6 7 8 9

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-10

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 286.0 E 343 480.9
STARTED : February 25, 2021
COMPLETED : February 25, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT (w, %)	ADDITIONAL LAB. TESTING
		GROUND SURFACE		76.5						
	Solid Stem Augers	**CLAY**, silty, some gravel, some sand, some organics, stiff, brown, moist: (FILL)		0.0	1	SS	14			
1		**SAND**, silty, trace clay, trace gravel, loose, brown, moist		75.8 / 0.7	2	SS	4			
2		**CLAY**, silty, trace to some sand, very stiff, brown, moist; with sand layers up to 100mm thick		75.1 / 1.4	3	SS	13			
3		Becoming grey			4	SS	10			
					5	SS	9	Grain Size Analysis: Gr 0%/ Sa 15%/ Si 24%/ Cl 61%		
4		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG.		72.9 / 3.7						

Depth scale continues: 5, 6, 7, 8, 9

Column headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH: Cu, KPa — nat V - ✚, Q - ✖, rem V - ●, Cpen ▲ (20, 40, 60, 80); WATER CONTENT, PERCENT — wp, w, wl (10, 20, 30, 40); PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-11

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 293.0 E 343 503.0
STARTED : February 25, 2021
COMPLETED : February 25, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	76.4					
0	Hollow Stem Augers	**CLAY**, silty, some sand, trace gravel, some organics, very stiff to firm, brown, moist Note:SS1 was frozen: (FILL)	0.0	1	SS	31		Bentonite
1		**SAND**, some silt, trace clay, very loose to loose, brown, moist	75.3 1.1	2	SS	6		Filter Sand
2				3	SS	3	Grain Size Analysis: Gr 0%/ Sa 81%/ Si 13%/ Cl 6%	Slotted Screen
		CLAY, silty, trace sand, stiff, brown, moist	73.8 2.6	4	SS	6		
3				5	SS	5		
		END OF BOREHOLE AT 3.66m.	72.7 3.7					

Monitoring Wells installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.54m slotted screen.

WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Feb 26-21	2.20	74.19
Mar 03-21	2.09	74.30
Apr 14-21	2.10	74.29

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ — 20 40 60 80

WATER CONTENT, PERCENT — wp ⊢ ○w ⊣ wl — 10 20 30 40

ADDITIONAL LAB. TESTING

Depth scale: 1 2 3 4 5 6 7 8 9

GROUNDWATER ELEVATIONS

WATER LEVEL UPON COMPLETION

WATER LEVEL IN WELL/PIEZOMETER April 14, 2021

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-12

PROJECT : Napanee Water Pollution Control Plant Expansion — Project No. 30726
LOCATION : N 4 900 302.0 E 343 528.0
STARTED : February 25, 2021 — SHEET 1 OF 1
COMPLETED : February 25, 2021 — DATUM Geodetic

Depth (m)	Boring Method	Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m	Comments	Water Content (%)
		GROUND SURFACE	76.4					
0.0–0.8	Solid Stem Augers	**CLAY**, silty, trace sand, trace gravel, trace organics, very stiff, brown, moist: (FILL)	76.4 / 0.0	1	SS	16		
0.8–2.3	Solid Stem Augers	**SAND**, some silt, trace clay, trace gravel, compact to loose, brown, moist; with layers of find sand/silt (~25mm thick)	75.6 / 0.8	2	SS	16	Grain Size Analysis: Gr 4%/ Sa 75%/ Si 15%/ Cl 6%	
				3	SS	8		
2.3–3.7	Solid Stem Augers	**CLAY**, silty, trace sand, stiff, moist, grey	74.1 / 2.3	4	SS	7		
				5	SS	6		
3.7		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND WATER LEVEL AT 3.50m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG.	72.7 / 3.7					

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)); SAMPLES (NUMBER, TYPE, BLOWS/0.3m); COMMENTS (DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100); SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 20 40 60 80); WATER CONTENT, PERCENT (wp ├ w ○ ┤ wl; 10 20 30 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-13

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 388.5 E 343 400.4
STARTED : March 2, 2021
COMPLETED : March 2, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

BORING METHOD: Solid Stem Augers

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	81.8			
SAND, silty, trace gravel, trace clay, very dense, brown, frozen: (FILL)	0.0	1	SS	59
CLAY, silty, trace sand, trace gravel, trace oxidation/rust, stiff, brown, moist: (FILL)	81.1 / 0.6	2	SS	8
CLAY, silty, trace sand, trace oxidation, very stiff, brown, moist	80.3 / 1.4	3	SS	10
		4	SS	15
		5	SS	9
END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE.	78.1 / 3.7			

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; COMMENTS — DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH: Cu, KPa — nat V - ✚, rem V - ●, Q - ✖, Cpen ▲ (20, 40, 60, 80); WATER CONTENT, PERCENT — wp, w, wl (10, 20, 30, 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

Shear strength (Cpen): >> at samples 2, 3, 4, 5

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-14

PROJECT : Napanee Water Pollution Control Plant Expansion — Project No. 30726
LOCATION : N 4 900 385.9 E 343 445.9
STARTED : March 1, 2021 — SHEET 1 OF 1
COMPLETED : March 1, 2021 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		80.4							
	Solid Stem Augers	**ASPHALT:** (60mm)		0.1							
		SAND, gravelly, trace silt, compact to loose, brown, moist (FILL)			1	SS	30				
1					2	SS	4				
		CLAY, silty, sandy, trace gravel, stiff to hard, brown, moist		78.9 1.4							
2					3	SS	4	Grain Size Analysis: Gr 2%/ Sa 25%/ Si 48%/ Cl 25%			
					4	SS	32				
3					5	SS	22				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH HOLEPLUG.		76.7 3.7							
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-19

PROJECT : Napanee Water Pollution Control Plant Expansion — Project No. 30726
LOCATION : N 4 900 314.3 E 343 501.3
STARTED : March 2, 2021 — SHEET 1 OF 1
COMPLETED : March 2, 2021 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT, PERCENT
		GROUND SURFACE	77.5					
0	Solid Stem Augers	**CLAY**, silty, trace to some sand, trace to some gravel, hard to very stiff, brown, moist: (FILL)	0.0	1	SS	36		
1				2	SS	15		
		SAND, silty, trace to some clay, trace gravel, compact, brown, moist (FILL)	76.1 / 1.4	3	SS	14	Grain Size Analysis: Gr 5%/ Sa 63%/ Si 22%/ Cl 10%	
2		**CLAY**, silty, trace sand, very stiff, brown, moist	75.2 / 2.3	4	SS	17		Cpen >>
3				5	SS	14	Grain Size Analysis: Gr 0%/ Sa 6%/ Si 54%/ Cl 40%	
4–5				1	ST		Grain Size Analysis: Gr 0%/ Sa 0%/ Si 19%/ Cl 81%	wl 72
5.2		END OF BOREHOLE AT 5.18m. BOREHOLE BACKFILLED WITH BENTONITE.	72.4 / 5.2					

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

Column headings: SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 20 40 60 80; WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; STRATA PLOT; ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-20

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 375.0 E 343 378.0
STARTED : February 26, 2021
COMPLETED : February 26, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp w wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		80.0							
	Solid Stem Augers	**CLAY**, silty, trace sand, trace gravel, firm, brown, wet: (FILL)		0.0	1	SS	6		w ≈ 27; Cpen >>		
1		**CLAY**, silty, trace sand, very stiff, brown, moist		79.3 / 0.7	2	SS	19		w ≈ 33; Cpen >>		
2					3	SS	17		w ≈ 21		
					4	SS	18	Grain Size Analysis: Gr 0%/ Sa 8%/ Si 44%/ Cl 48%	w ≈ 17		
3		END OF BOREHOLE AT 2.90m. BOREHOLE OPEN TO 2.9m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE.		77.1 / 2.9							

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-21

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 395.1 E 343 423.1
STARTED : March 2, 2021
COMPLETED : March 2, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	COMMENTS (DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, Q - ✖, rem V - ●, Cpen ▲; 20 40 60 80) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	80.5							
	Solid Stem Augers	**ASPHALT:** (60mm)	0.1							
		GRAVEL, sandy: (FILL)	0.2							
		SILT, sandy, some clay, trace gravel, compact, brown, moist: (FILL)	0.4	1	SS	21				
1		**CLAY**, silty, trace sand, very stiff, brown, moist		2	SS	11				
2				3	SS	12		>>		
				4	SS	18		>>		
3		END OF BOREHOLE AT 2.90m. BOREHOLE BACKFILLED WITH BENTONITE TO 0.2m AND THEN ASPHALT PATCH TO SURFACE.	77.6 / 2.9							
4										
5										
6										
7										
8										
9										

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-22

PROJECT : Napanee Water Pollution Control Plant Expansion
Project No. 30726
LOCATION : N 4 900 334.8 E 343 465.3
STARTED : March 2, 2021
SHEET 1 OF 1
COMPLETED : March 2, 2021
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT, PERCENT
		GROUND SURFACE	77.7					
	Solid Stem Augers	**SILT**, sandy, some clay, trace gravel, compact, brown, moist: (FILL)	0.0	1	SS	14		
1		**CLAY**, silty, sandy, trace gravel, trace organics, firm, brown, moist: (FILL)	77.0 0.7	2	SS	6	Grain Size Analysis: Gr 3%/ Sa 22%/ Si 49%/ Cl 26%	○
2		**PEAT**, soft, black, wet	76.3 1.4	3	SS	3		317
3		**CLAY**, silty, some organics, firm, grey, wet	75.4 2.3	4	SS	2		91
				1	ST		Grain Size Analysis: Gr 0%/ Sa 5%/ Si 47%/ Cl 48%	wp–wl
4		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND WATER LEVEL AT 0.66m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.	74.1 3.7					

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ (20, 40, 60, 80)
DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)
WATER CONTENT, PERCENT — wp ⊢ ○w ⊣ wl (10, 20, 30, 40)
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

THURBER2S TEL-30726.GPJ 4-30-24

RECORD OF BOREHOLE BH-23

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 302.4 E 343 359.7
STARTED : February 26, 2021
COMPLETED : February 26, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS (DYNAMIC CONE PENETRATION RESISTANCE PLOT)	WATER CONTENT, PERCENT (w)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		77.5							
0	Solid Stem Augers	**SILT**, clayey, some sand, trace to some gravel, firm, black/brown/red, moist: (FILL)		0.0	1	SS	19		~19		
1					2	SS	8		~20		
		CLAY, silty, trace sand, stiff to very stiff, brown, moist		76.1 1.4	3	SS	9		~29		
2					4	SS	19		~30		
3		END OF BOREHOLE AT 2.90m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE.		74.7 2.9							

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ — 20 40 60 80
WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl — 10 20 30 40
DYNAMIC CONE PENETRATION RESISTANCE PLOT — 20 40 60 80 100

Depth scale: 1 2 3 4 5 6 7 8 9

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-24

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 283.0 E 343 428.0
STARTED : February 25, 2021
COMPLETED : February 25, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

Boring method: Solid Stem Augers

Depth (m)	Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m	Comments	Water Content (%)	Shear Strength
	GROUND SURFACE	75.9						
0.0–0.7	**ORGANICS**, **CLAY**, silty, soft, brown, moist	0.0	1	SS	4		~23	
0.7–2.9	**CLAY**, silty, trace sand, very stiff, brown, moist	75.3 / 0.7	2	SS	16		~42	Cpen ▲
			3	SS	13	Grain Size Analysis: Gr 0%/ Sa 6%/ Si 68%/ Cl 26%	~23	>> ▲
			4	SS	21		58	>> ▲
2.9	END OF BOREHOLE AT 2.90m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE.	73.0 / 2.9						

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

RECORD OF BOREHOLE BH-25

PROJECT : Napanee Water Pollution Control Plant Expansion

Project No. 30726

LOCATION : N 4 900 364.7 E 343 500.3

STARTED : March 1, 2021

SHEET 1 OF 1

COMPLETED : March 1, 2021

DATUM Geodetic

Boring method: Solid Stem Augers

Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m	Comments	Water content (%)
GROUND SURFACE	77.7 / 0.0					
ASPHALT: (150mm)						
GRAVEL and **SAND**, trace silt, compact to loose, brown to grey, wet: (FILL)	0.2	1	SS	19		
		2	SS	16		
		3	SS	8	Grain Size Analysis: Gr 51%/Sa 42%/ Si & Cl 7%	
CLAY, silty, trace sand, firm to stiff, brown, moist	75.4 / 2.3	4	SS	12		
		5	SS	6		
Becoming grey		6	SS	7		
		7	SS	10	Grain Size Analysis: Gr 2%/ Sa 9%/ Si 12%/ Cl 77%	wl 71
		8	SS	7		
END OF BOREHOLE AT 8.23m. BOREHOLE OPEN AND WATER LEVEL AT 1.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 0.3m THEN ASPHALT PATCH TO SURFACE.	69.5 / 8.2					

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB

CHECKED : JDA/MTB

THURBER

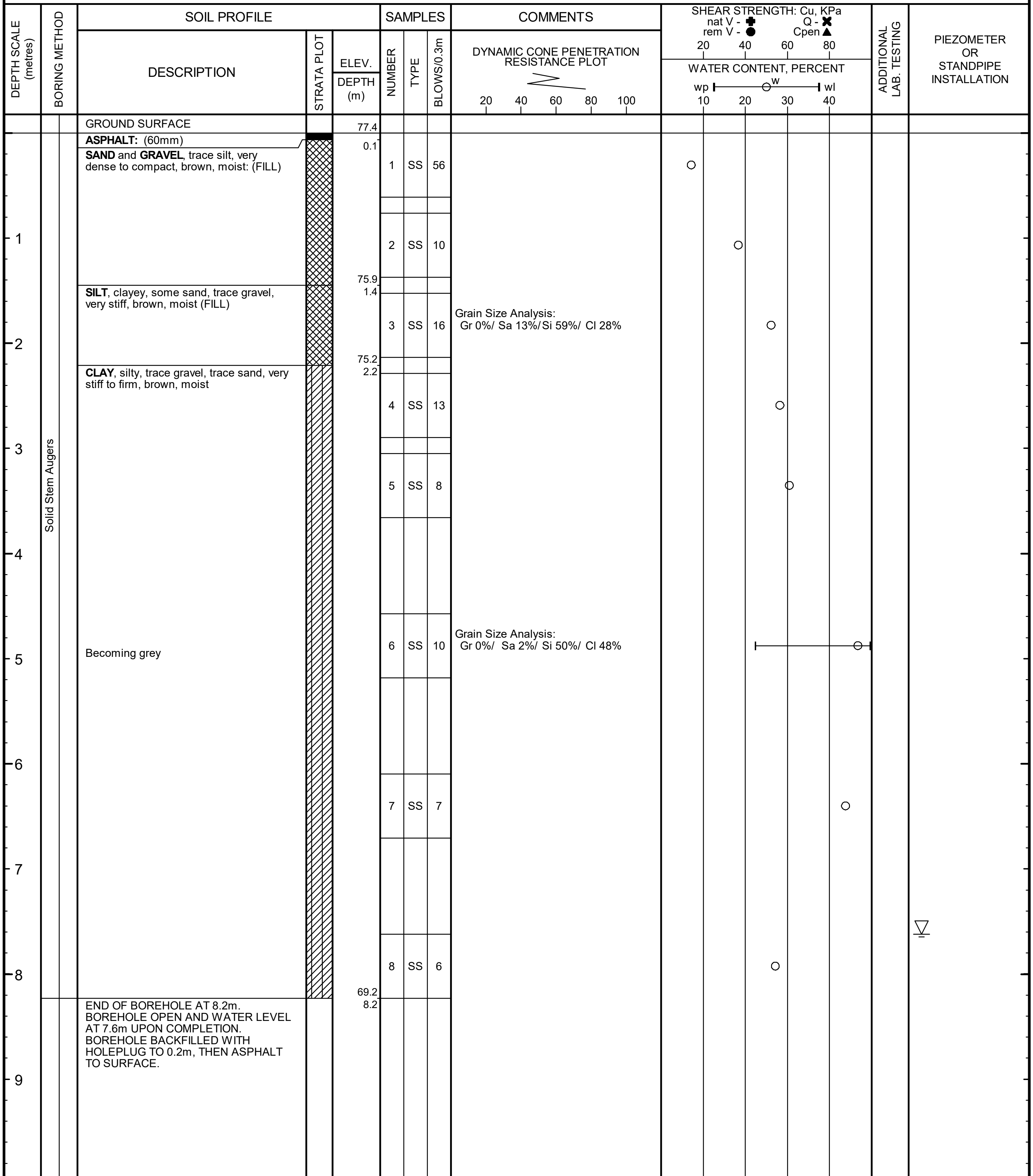
RECORD OF BOREHOLE BH-26

PROJECT : Napanee Water Pollution Control Plant Expansion
LOCATION : N 4 900 345.9 E 343 514.1
STARTED : March 1, 2021
COMPLETED : March 1, 2021

Project No. 30726
SHEET 1 OF 1
DATUM Geodetic

Boring method: Solid Stem Augers

Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m	Comments	Water Content (%)
GROUND SURFACE	77.4					
ASPHALT: (60mm)	0.1					
SAND and **GRAVEL**, trace silt, very dense to compact, brown, moist: (FILL)		1	SS	56		
		2	SS	10		
SILT, clayey, some sand, trace gravel, very stiff, brown, moist (FILL)	75.9 / 1.4	3	SS	16	Grain Size Analysis: Gr 0%/ Sa 13%/ Si 59%/ Cl 28%	
CLAY, silty, trace gravel, trace sand, very stiff to firm, brown, moist	75.2 / 2.2	4	SS	13		
		5	SS	8		
Becoming grey		6	SS	10	Grain Size Analysis: Gr 0%/ Sa 2%/ Si 50%/ Cl 48%	
		7	SS	7		
		8	SS	6		
END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND WATER LEVEL AT 7.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 0.2m, THEN ASPHALT TO SURFACE.	69.2 / 8.2					

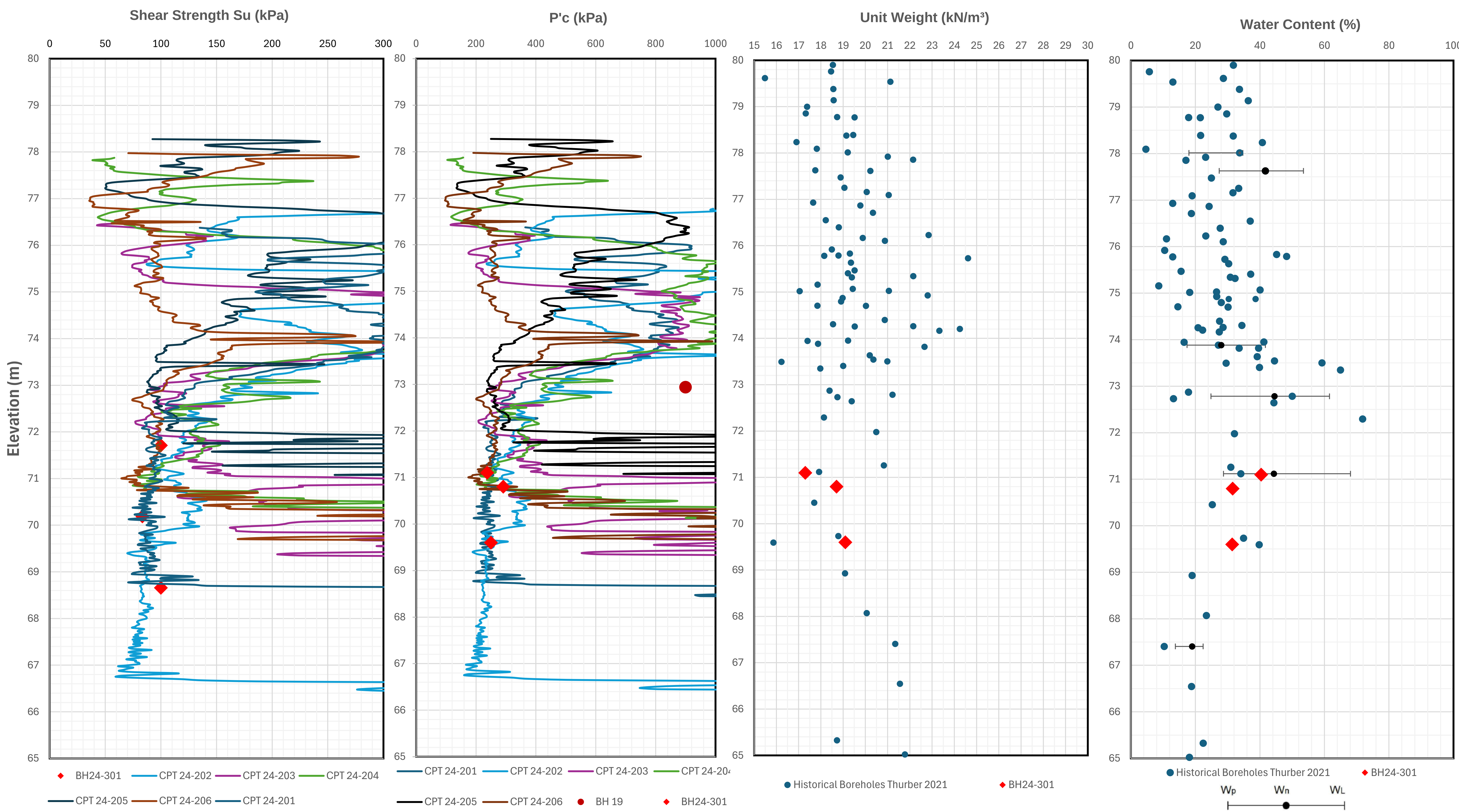


GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : JDA/MTB

THURBER

Summary of Engineering Properties



Source: Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation, September 2015
Coordinate System: NAD 1983 UTM Zone 18N

0 10 20 30
Meters
Coordinate System:
NAD 1983 UTM Zone 18N

N

TOWN OF GREATER NAPANEE
300 WATER STREET WEST, NAPANEE ONTARIO
GEOTECHNICAL INVESTIGATION FOR WWTP UPGRADES

NAPANEE WWTP
PROPOSED NEW STRUCTURES

11140477-A2
Jan 4, 2018

FIGURE 3

GIS File: Q:\GIS\PROJECTS\11140000s\11140477\Layouts\001\11140477-A2(001)GIS-OT006.mxd

REFERENCE No.: 11140477-A1 ENCLOSURE No.: 1

BOREHOLE No.: BH1-17

ELEVATION: 78.09 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.

PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant

LOCATION: 300 Water Street West, Napanee, On

DESCRIBED BY: S.Wheeler CHECKED BY: S. Dunstan

DATE (START): 15 May 2017 DATE (FINISH): 15 May 2017

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- ○ Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE: Depth BGS (meters)	SCALE: Elevation (m)	STRATIGRAPHY: DESCRIPTION OF SOIL AND BEDROCK	SAMPLE DATA: Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
	78.09	GROUND SURFACE				
	78.0	**TOPSOIL-** Brown, damp. (Approximately 75 mm)	SS1	11/24		12
	77.9	**FILL-** Gravel, some silt, compact, brown, damp.				
1.0		**FILL-** Sandy silt, loose, brown, damp. *Becoming moist.	SS2	11/24		2
	76.4	**BURIED TOPSOIL-** Brown, moist.	SS3	20/24		2
2.0	76.3	**SILTY CLAY-** Stiff, grey, moist. *Becoming wet.	FV1			
3.0			SS4	24/24		4
4.0		*Becoming very stiff.	SS5	24/24		4
5.0			ST1			
6.0		*Becoming stiff.	SS6	24/24		4
			SS7	24/24		3
7.0		*FV > 90 kPa vane capacity.	FV2			
8.0	70.3	**SILTY CLAYEY SAND-** Loose, brown, wet.	SS8	24/24		9
			SS9	12/18		R
9.0	69.3	Auger refusal at approximately 8.8 m.				
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						
16.0						

SCALE FOR TEST RESULTS: 50kPa 100kPa 150kPa 200kPa; 10 20 30 40 50 60 70 80 90

S=3

NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by Hopkins-Chitty Surveying Ltd.
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 13

BOREHOLE LOG

BOREHOLE No.: BH13-17
ELEVATION: 81.07 m

Page: 1 of 1

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.
PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant
LOCATION: 300 Water Street West, Napanee, On
DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan
DATE (START): 23 November 2017 DATE (FINISH): 23 November 2017

LEGEND
- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- ○ Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	Description of Soil and Bedrock	Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
0	81.07	GROUND SURFACE				
		FILL- Sandy Silt some Gravel, loose, grey, damp.	SS1	7/24		8
1.0	80.1 / 80.1	**BURIED TOPSOIL-** (Approximately 50 mm thick)	SS2	14/24		9
		FILL- Silt some Sand and Gravel, compact, grey, damp. *Becoming Sandy Silt trace Gravel, loose, brown, damp	SS3	15/24		6
2.0	78.9	**CLAY AND SILT-** Very stiff, brownish grey, damp.	SS4	24/24		7
3.0			SS5	24/24		9
4.0		*Becoming grey	SS6	24/24		7
5.0			SS7	24/24		6
		*Becoming brown	SS8	24/24		6
6.0	75.0	**SAND-** Compact, light brown, wet. *Becoming Silty Sand	SS9	24/24		10
7.0	74.2	**LIMESTONE-** Medium strong, thickly bedded, horizontal, slightly weathered, excellent quality based on RQD.	RC1	63/63		97
9.0			RC2	60/61		93
10.0	71.1	End of borehole at approximately 10.0 m in limestone.				

SCALE FOR TEST RESULTS: 50kPa, 100kPa, 150kPa, 200kPa; 10 20 30 40 50 60 70 80 90

NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 14

BOREHOLE No.: BH14-17

ELEVATION: 81.09 m

BOREHOLE LOG

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.

PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant

LOCATION: 300 Water Street West, Napanee, On

DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan

DATE (START): 23 November 2017 DATE (FINISH): 23 November 2017

LEGEND

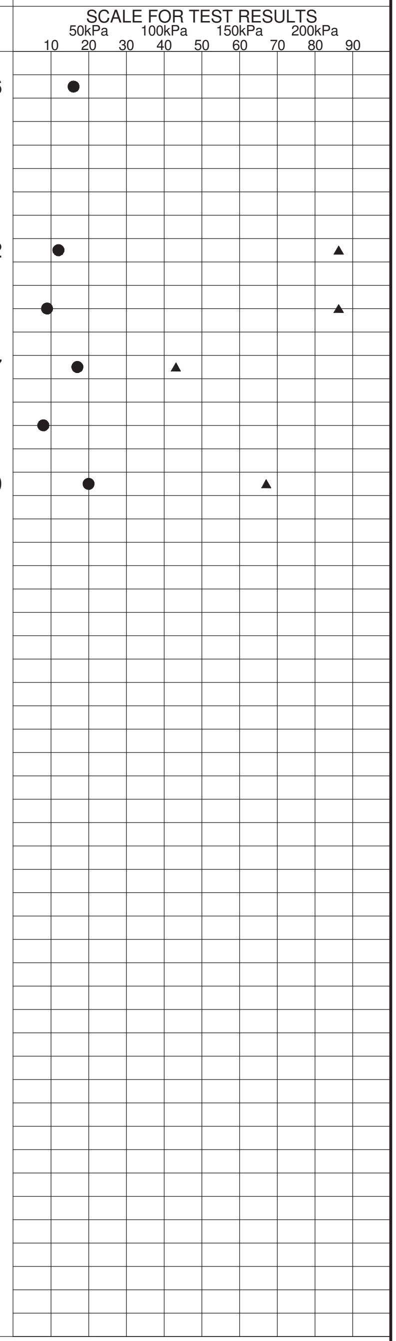
- ☒ SS Split Spoon
- GS Auger Sample
- ▨ ST Shelby Tube
- ▼ Water Level
- ○ Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK
	81.09	GROUND SURFACE
	80.5	**FILL-** Sandy Silt some Gravel, compact, light brown, damp.
1.0	80.5	**BURIED TOPSOIL-** (Approximately 50 mm thick)
		FILL- Silty Gravel some Sand, dense, dark grey, damp. *Becoming Sandy Silt trace Gravel, concrete piece limited recovery
2.0	79.0	**CLAY AND SILT-** Very stiff, brownish grey, damp.
6.0	75.4	**SAND-** Compact, brown, wet. *Becoming some gravel, very dense, light brown, wet, limestone chips in tip of split spoon.
7.0	74.3	Auger refusal at approximately 6.8 m.

Depth scale: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0

SAMPLE DATA

State	Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
☒	SS1	20/24		16
☒	SS2	14/14		R
☒	SS3	6/11		R
☒	SS4	24/24		12
☒	SS5	24/24		9
☒	SS6	22/24		17
☒	SS7	5/24		8
☒	SS8	18/24		20
☒	SS9	14/15		R



NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2

ENCLOSURE No.: 15

BOREHOLE No.: MW15-17-d

ELEVATION: 78.77 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.

PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant

LOCATION: 300 Water Street West, Napanee, On

DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan

DATE (START): 23 November 2017 DATE (FINISH): 23 November 2017

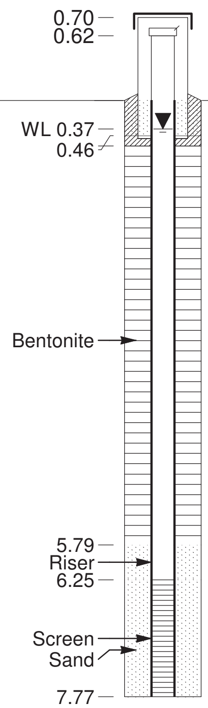
LEGEND

- ☒ SS Split Spoon
- GS Auger Sample
- ▨ ST Shelby Tube
- ▼ Water Level
- ○ Water content (%)
- ├┤ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK
	78.77	GROUND SURFACE
	78.7	**TOPSOIL-** (Approximately 50 mm thick)
	77.7	**FILL-** Sandy Silt some Gravel, loose, dark brown, damp.
	77.7	**BURIED TOPSOIL-** Organic, dark brown to black.
		CLAY AND SILT- Very stiff, brown, damp.
	74.2	**SILTY CLAY-** Very stiff, grey, damp.
	72.1	**SAND-** Compact, brown, wet, some silt seams (approximately 125 mm thick).
	71.0	Auger refusal at approximately 7.8 m.

Depth scale: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0

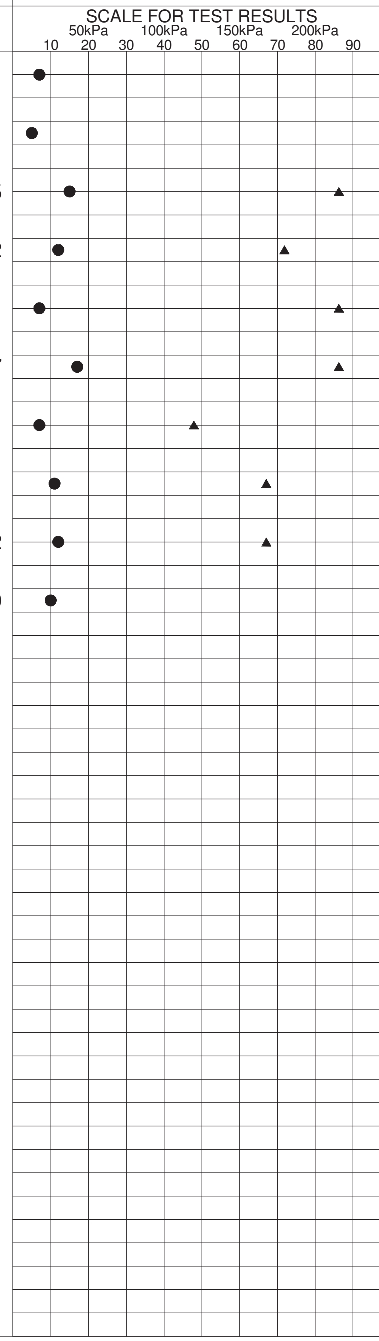
MONITOR WELL



SAMPLE DATA

Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
SS1	18/24		7
SS2	22/24		5
SS3	24/24		15
SS4	24/24		12
SS5	24/24		7
SS6	24/24		17
SS7	24/24		7
SS8	24/24		11
SS9	24/24		12
SS10	24/24		10
SS11	5/5		R

SCALE FOR TEST RESULTS



NOTES:

*No sheen odour or staining noted in borehole

*Borehole location and elevation surveyed by GHD field staff

*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 16

BOREHOLE No.: MW15-17-s

ELEVATION: 78.79 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.

PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant

LOCATION: 300 Water Street West, Napanee, On

DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan

DATE (START): 23 November 2017 DATE (FINISH): 23 November 2017

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- ○ Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	MONITOR WELL
	78.79	GROUND SURFACE	0.73, 0.66
	78.7	**TOPSOIL-** (Approximately 50 mm thick)	0.46; WL 0.61
1.0	77.7	Inferred fill based on MW15-17-d	Bentonite; Solid Pipe
		Inferred clay and silt based on MW15-17-d	2.74; 3.05; Screen; Silica Sand
4.6	74.2	End of borehole at approximately 4.6 m.	4.57

SAMPLE DATA: State | Type and Number | Recovery (%) | OVC (ppm) | Penetration Index / RQD (N)

SCALE FOR TEST RESULTS: 50kPa 100kPa 150kPa 200kPa; 10 20 30 40 50 60 70 80 90

Depth scale: 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0

NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

BOREHOLE No.: BH16-17

ELEVATION: 78.43 m

BOREHOLE LOG

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.
PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant
LOCATION: 300 Water Street West, Napanee, On
DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan
DATE (START): 23 November 2017 DATE (FINISH): 23 November 2017

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- ○ Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
	78.43	GROUND SURFACE				
	78.4	**TOPSOIL-** (Approximately 50 mm thick)	SS1	18/24		7
		FILL- Sandy Silt some Gravel, loose, dark brown, damp.				
1.0	77.6	**CLAY AND SILT-** Very stiff, brown, damp.	SS2	24/24		8
2.0			SS3	24/24		12
3.0			SS4	24/24		16
			SS5	24/24		16
4.0	74.5	**SILTY CLAY-** Very stiff, grey, damp, trace sand veins.	SS6	24/24		18
5.0		*Becoming stiff	SS7	24/24		7
			SS8	24/24		5
6.0	72.3	**SAND-** Compact, brown, wet, some silt seams (approximately 125 to 150 mm thick).	SS9	24/24		8
7.0			SS10	24/24		12
8.0			SS11	24/24		R
	70.1	Auger refusal at approximately 8.4 m.				
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						
16.0						

SCALE FOR TEST RESULTS: 50kPa 100kPa 150kPa 200kPa; 10 20 30 40 50 60 70 80 90

NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 18

BOREHOLE No.: MW17-17-d
ELEVATION: 77.24 m

BOREHOLE LOG

Page: 1 of 1

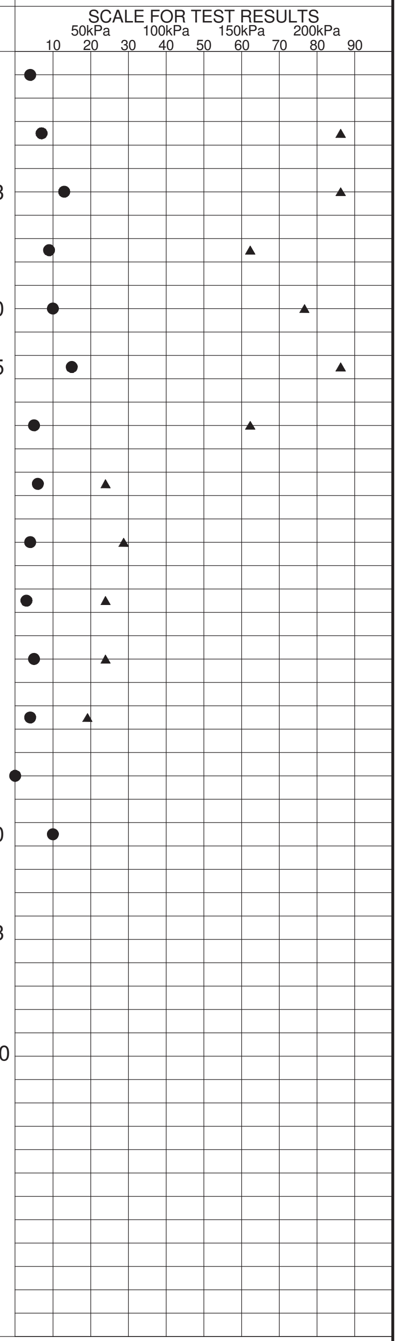
CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.
PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant
LOCATION: 300 Water Street West, Napanee, On
DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan
DATE (START): 24 November 2017 DATE (FINISH): 24 November 2017

LEGEND

- ☒ SS Split Spoon
- GS Auger Sample
- ▨ ST Shelby Tube
- ▼ Water Level
- ○ Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	MONITOR WELL	State	Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
	77.24	GROUND SURFACE	0.70, 0.63					
	77.0	**TOPSOIL-** (Approximately 200 mm thick)	0.46; WL 0.71	☒	SS1	12/24		4
1.0	76.4	**FILL-** Sandy Silt, loose, brown, damp.	0.91	☒	SS2	24/24		7
2.0		**CLAY AND SILT-** Very stiff, brown, damp.		☒	SS3	24/24		13
				☒	SS4	24/24		9
3.0	74.2	**SILTY CLAY-** Very stiff, grey, damp, trace sand veins.		☒	SS5	24/24		10
4.0			Cuttings	☒	SS6	24/24		15
5.0				☒	SS7	24/24		5
6.0		*Becoming stiff		☒	SS8	24/24		6
			6.40	☒	SS9	24/24		4
7.0				☒	SS10	24/24		3
8.0			Bentonite	☒	SS11	24/24		5
9.0		*Becoming firm	8.84	☒	SS12	24/24		4
	68.1	**SAND-** Compact, light brown, wet.	9.09; Sand; Screen	☒	SS13	24/24		0
10.0				☒	SS14	24/24		10
11.0	66.6	**LIMESTONE-** Medium strong, thickly bedded, horizontal, slightly weathered, good quality based on RQD.	10.62; 10.67			61/65		83
12.0–13.0		*Becoming excellent quality based on RQD	Bentonite Seal in Rock			59/59		100
14.0	63.4	End of borehole at approximately 13.8 m in limestone.	13.82					
15.0								
16.0								

SCALE FOR TEST RESULTS



NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

BOREHOLE No.: MW17-17-s

ELEVATION: 77.22 m

BOREHOLE LOG

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.

PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant

LOCATION: 300 Water Street West, Napanee, On

DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan

DATE (START): 24 November 2017 DATE (FINISH): 24 November 2017

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	MONITOR WELL
	77.22	GROUND SURFACE	0.83, 0.76
	77.0	**TOPSOIL-** (Approximately 200 mm thick)	0.46, WL 0.62
	76.4	Inferred fill based on MW17-17-d	0.91, Solid Pipe
		Inferred clay and silt based on MW17-17-d	Cuttings
3.0	74.2	Inferred silty clay based on MW17-17-d	3.05, Bentonite, 5.72, 6.10, Screen, Silica Sand
	69.6	End of borehole at approximately 7.6 m.	7.62

Sample data columns: State, Type and Number, Recovery (%), OVC (ppm), Penetration Index / RQD (N)

SCALE FOR TEST RESULTS: 50kPa 100kPa 150kPa 200kPa; 10 20 30 40 50 60 70 80 90

Depth scale: 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0

NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 20

BOREHOLE No.: **BH18-17**
ELEVATION: 77.62 m

BOREHOLE LOG

Page: 1 of 1

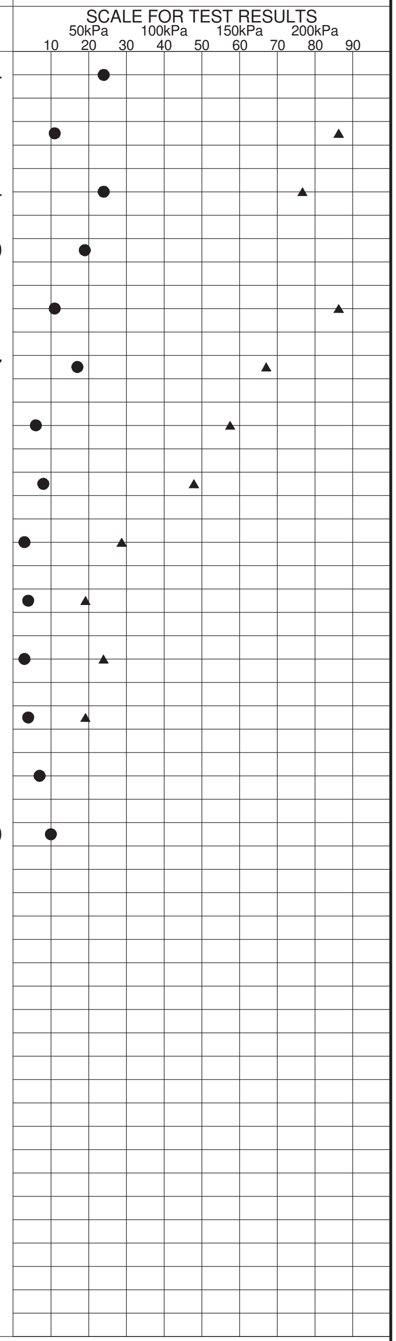
CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.
PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant
LOCATION: 300 Water Street West, Napanee, On
DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan
DATE (START): 24 November 2017 DATE (FINISH): 24 November 2017

LEGEND

- ☒ SS Split Spoon
- GS Auger Sample
- ▨ ST Shelby Tube
- ▼ Water Level
- ○ Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

Depth BGS (meters)	Elevation (m)	Description of Soil and Bedrock	State	Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
0.0	77.62	GROUND SURFACE					
		FILL- Gravel, dense, grey, damp. *Becoming Gravel some Sand and Silt, brown and grey.	☒	SS1	20/24		24
1.0	76.6	*Becoming Gravelly Silt, dark brown, damp	☒	SS2	22/24		11
		CLAY AND SILT- Very stiff, brown, damp.	☒	SS3	24/24		24
			☒	SS4	24/24		19
			☒	SS5	24/24		11
			☒	SS6	24/24		17
	73.1	**SILTY CLAY-** Very stiff, grey, damp, trace sand veins.	☒	SS7	24/24		6
			☒	SS8	24/24		8
		*Becoming stiff	☒	SS9	24/24		3
		*Becoming firm, moist	☒	SS10	24/24		4
			☒	SS11	24/24		3
			☒	SS12	24/24		4
	68.5	**SAND-** Loose, light brown, wet, some silt seams (approximately 200 mm thick).	☒	SS13	24/24		7
			☒	SS14	24/24		10
			☒	SS15	24/24		R
	66.3	Auger refusal at approximately 11.3 m.					

Depth scale: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0



NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 21

BOREHOLE No.: BH19-17
ELEVATION: 76.99 m

BOREHOLE LOG

Page: 1 of 1

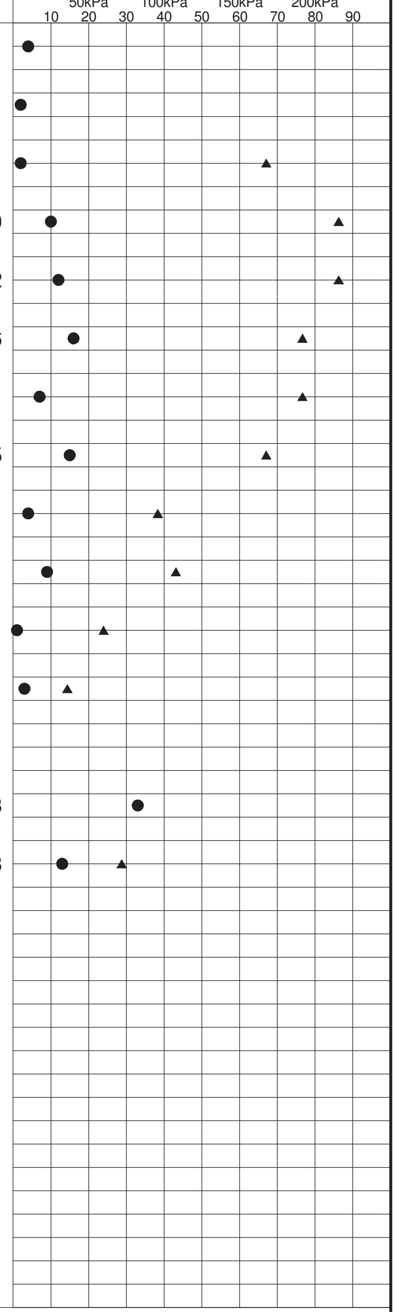
CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.
PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant
LOCATION: 300 Water Street West, Napanee, On
DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan
DATE (START): 24 November 2017 DATE (FINISH): 24 November 2017

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- ○ Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	76.99		GROUND SURFACE			%	ppm	N
	76.9		**TOPSOIL-** (Approximately 125 mm thick)		SS1	6/24		4
			FILL- Sand, very loose, brown, damp.					
1.0					SS2	24/24		2
			*Becoming wet		SS3	22/24		2
2.0	75.2		**CLAY AND SILT-** Very stiff, brown, damp.					
					SS4	14/24		10
3.0					SS5	24/24		12
4.0					SS6	24/24		16
5.0	72.4		**SILTY CLAY-** Very stiff, grey, damp, trace sand veins.		SS7	24/24		7
6.0					SS8	24/24		15
			*Becoming stiff and moist		SS9	24/24		4
7.0					SS10	24/24		9
8.0					SS11	24/24		1
			*Becoming firm		SS12	24/24		3
9.0			*FV > 90 kPa vane capacity.		FV1			
10.0	67.1		**SAND-** Dense, light brown, wet.		SS13	24/24		33
11.0			*Silt seam (approximately 125 mm thick)		SS14	24/24		13
	65.6		Auger refusal at approximately 11.4 m.					
12.0								
13.0								
14.0								
15.0								
16.0								

SCALE FOR TEST RESULTS



NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

REFERENCE No.: 11140477-A2 ENCLOSURE No.: 22

BOREHOLE No.: BH20-17

ELEVATION: 77.87 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Town of Greater Napanee C/o EVB Engineering Inc.

PROJECT: Geotechnical Investigation for Upgrades to Napanee Wastewater Treatment Plant

LOCATION: 300 Water Street West, Napanee, On

DESCRIBED BY: S. Wheeler CHECKED BY: S. Dunstan

DATE (START): 27 November 2017 DATE (FINISH): 27 November 2017

LEGEND

- SS Split Spoon
- GS Auger Sample
- ST Shelby Tube
- Water Level
- ○ Water content (%)
- Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE FOR TEST RESULTS: 50kPa 100kPa 150kPa 200kPa; 10 20 30 40 50 60 70 80 90

Depth BGS (meters)	Elevation (m)	Description of Soil and Bedrock	Type and Number	Recovery (%)	OVC (ppm)	Penetration Index / RQD (N)
	77.87	GROUND SURFACE				
		FILL- Gravelly Sand, loose, brown, damp.	SS1	18/24		8
1.0	76.9	*Becoming Sandy Silt some Gravel, dark brown	SS2	16/24		4
	76.9	**BURIED TOPSOIL-** (Approximately 50 mm thick)				
		FILL- Sand some Silt, loose, dark brown, damp.	SS3	15/24		5
2.0			SS4	20/24		11
	75.2	**CLAY AND SILT-** Very stiff, brown, damp.				
3.0	74.7	**SILTY CLAY-** Very stiff, grey, damp, trace sand veins.	SS5	24/24		6
4.0			SS6	24/24		12
5.0			SS7	24/24		8
6.0			SS8	24/24		10
			SS9	24/24		4
7.0		*Becoming stiff	SS10	24/24		7
8.0			SS11	24/24		3
		*Becoming firm	SS12	24/24		3
9.0			SS13	24/24		3
10.0	67.7	**SAND SOME SILT AND GRAVEL-** Compact, light brown, wet.	SS14	24/24		13
11.0		*Becoming Sand, loose	SS15	20/24		6
		*Becoming compact	SS16	24/24		13
12.0	65.8	Auger refusal at approximately 12.1 m.				
13.0						
14.0						
15.0						
16.0						

NOTES:
*No sheen odour or staining noted in borehole
*Borehole location and elevation surveyed by GHD field staff
*Pocket penetrometer readings are for internal GHD use only and should not be relied upon by others.

THURBER ENGINEERING LTD.

APPENDIX C

Particle Size Analysis Figures

Atterberg Limit Figures

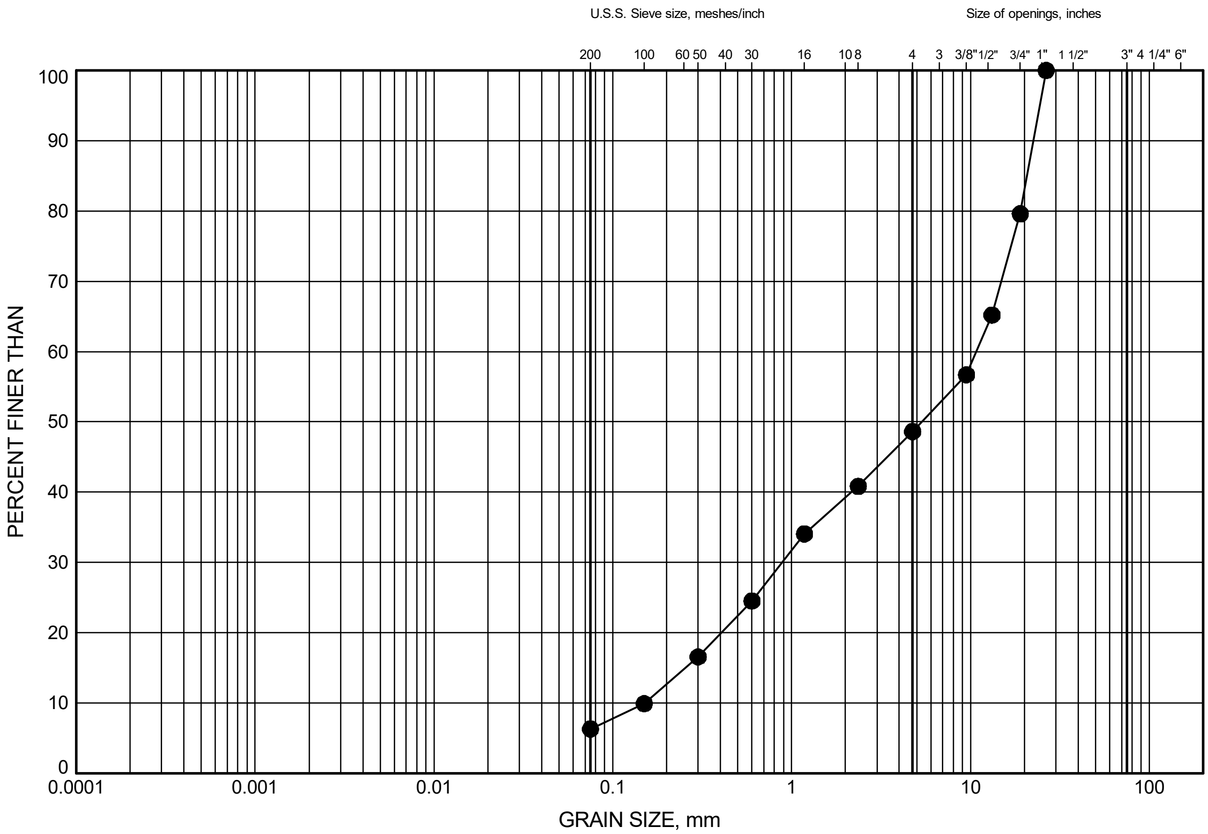
Consolidation Testing Figures

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C1

GRANULAR FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-25	1.8	75.9

Date January 2025

30726

THURBER

Prep'd RH

Chkd. SD

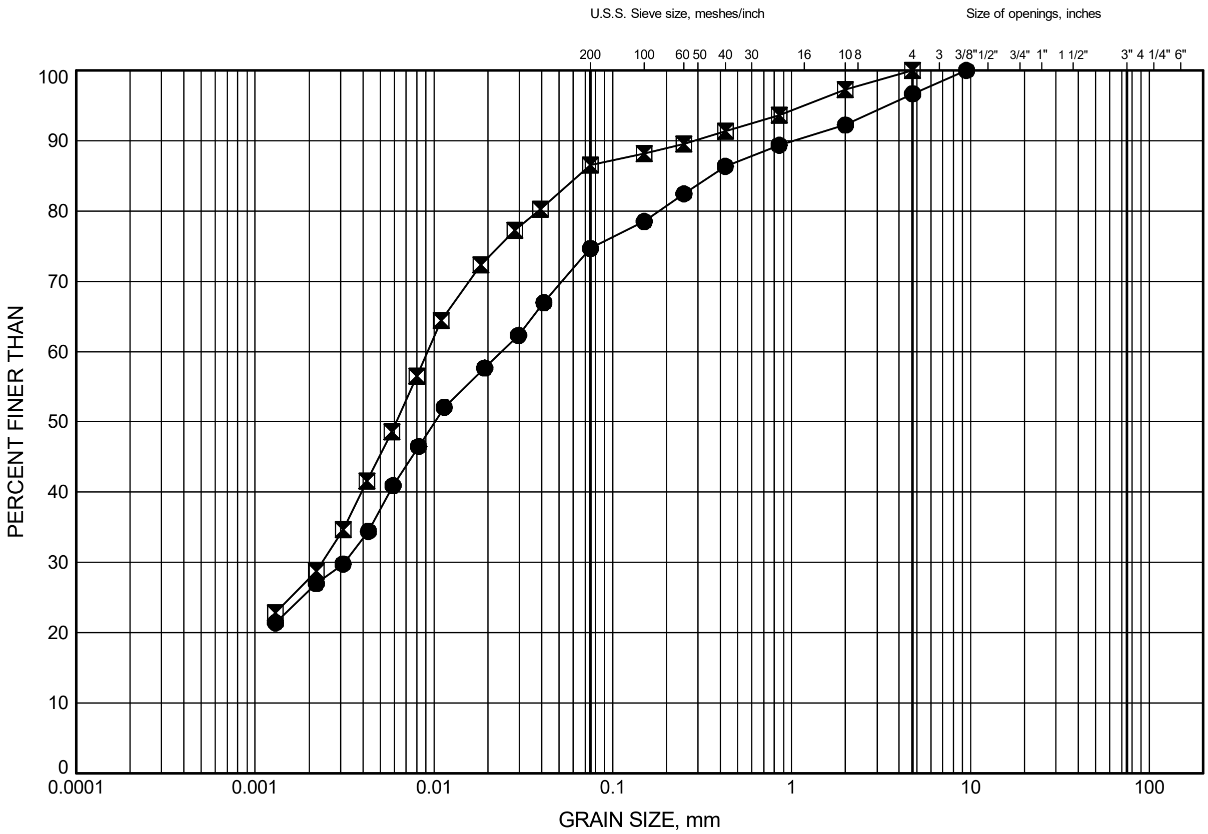
GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C2

SILTY CLAY TO CLAYEY SILT FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-22	1.1	76.7
⧗	BH-26	1.8	75.6

GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Date January 2025

30726

THURBER

Prep'd RH

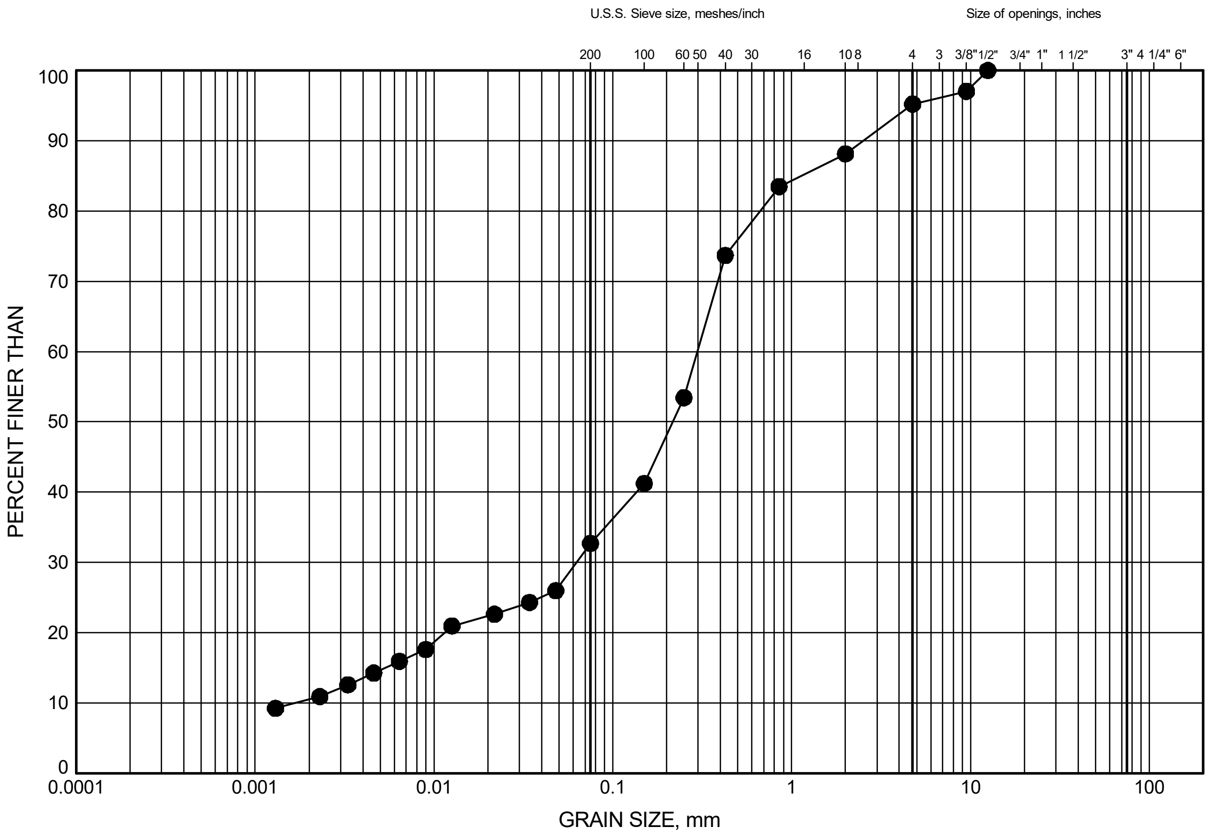
Chkd. SD

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C3

SILTY SAND TO SANDY SILT FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-19	1.8	75.7

GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Date January 2025

30726

THURBER

Prep'd RH

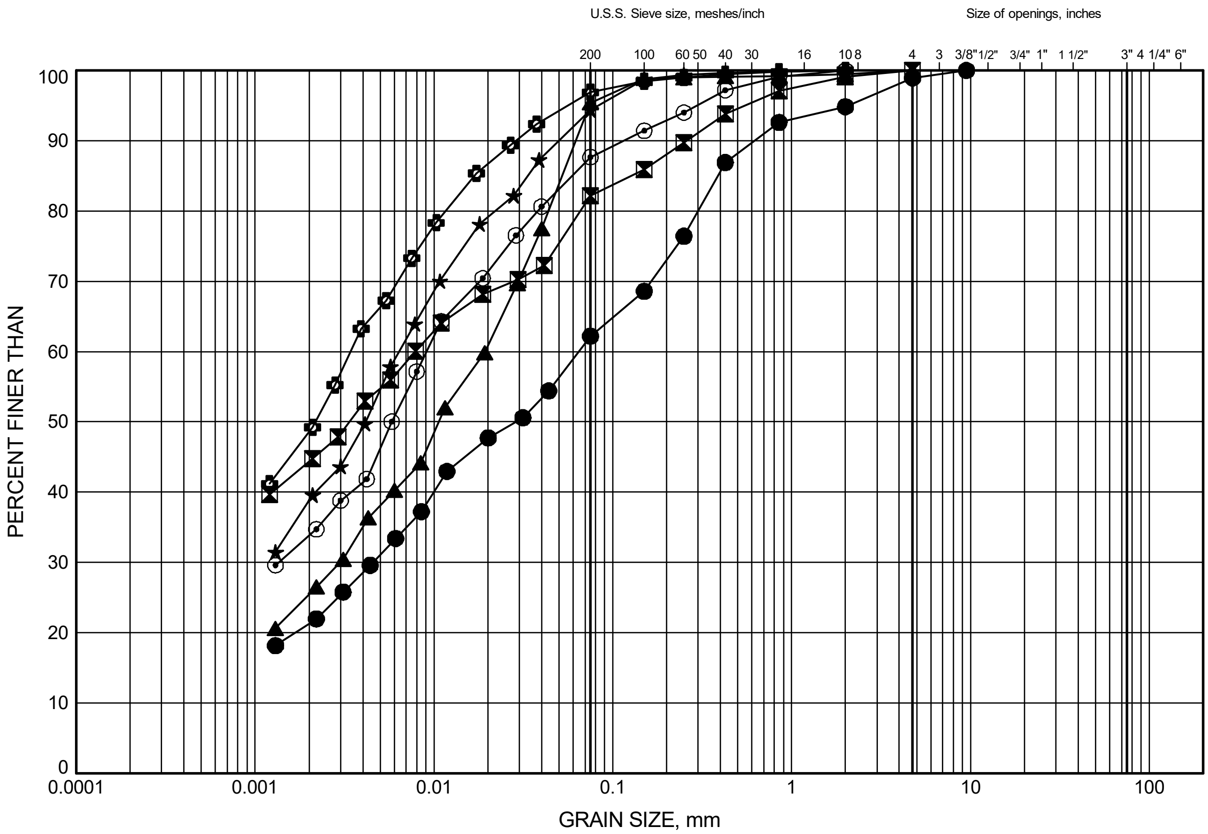
Chkd. SD

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C4

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-01	2.6	78.3
⧗	BH-02	1.1	77.9
▲	BH-04	9.4	67.7
★	BH-06	1.8	76.7
⊙	BH-07	1.1	77.5
✿	BH-07	3.4	75.2

Date January 2025

30726

THURBER

Prep'd RH

Chkd. SD

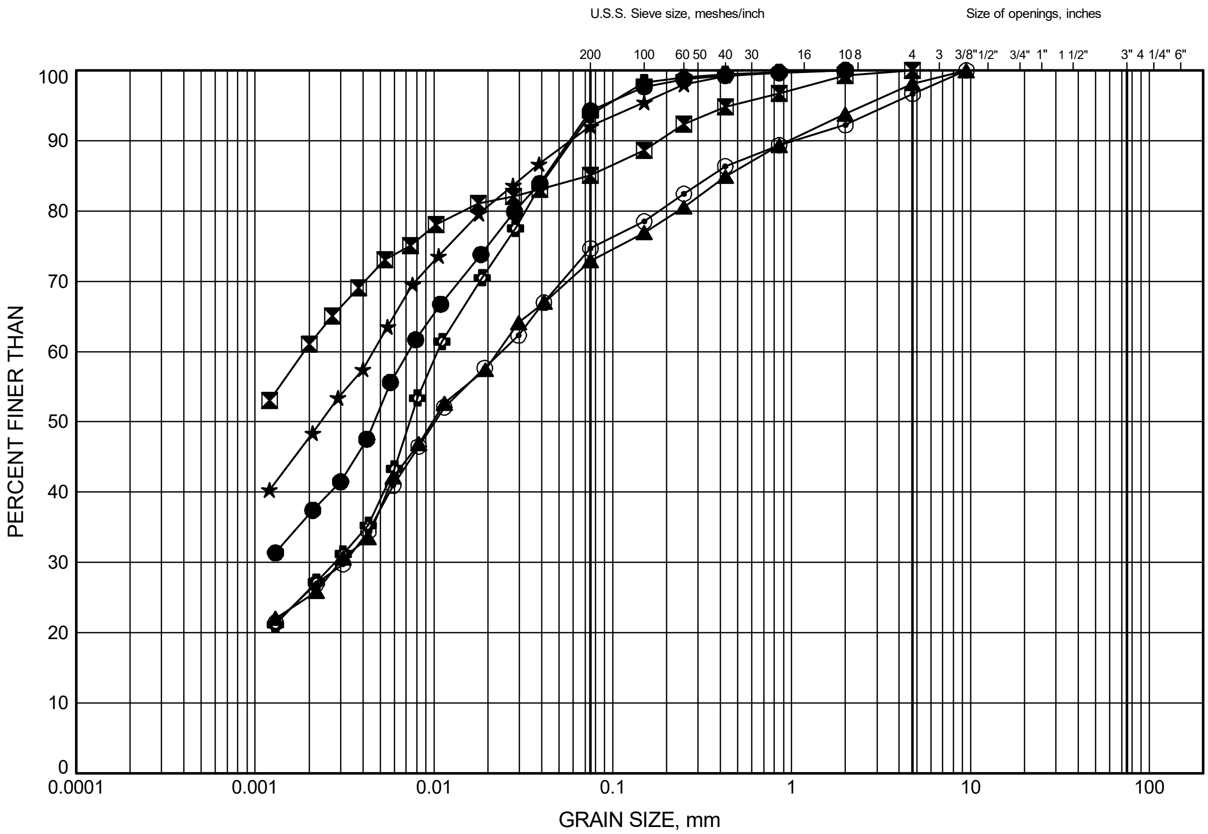
GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C5

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-08	1.8	75.3
⧗	BH-10	3.4	73.2
▲	BH-14	1.8	78.5
★	BH-20	2.6	77.4
⊙	BH-22	1.1	76.7
✤	BH-24	1.8	74.1

Date January 2025

30726

THURBER

Prep'd RH

Chkd. SD

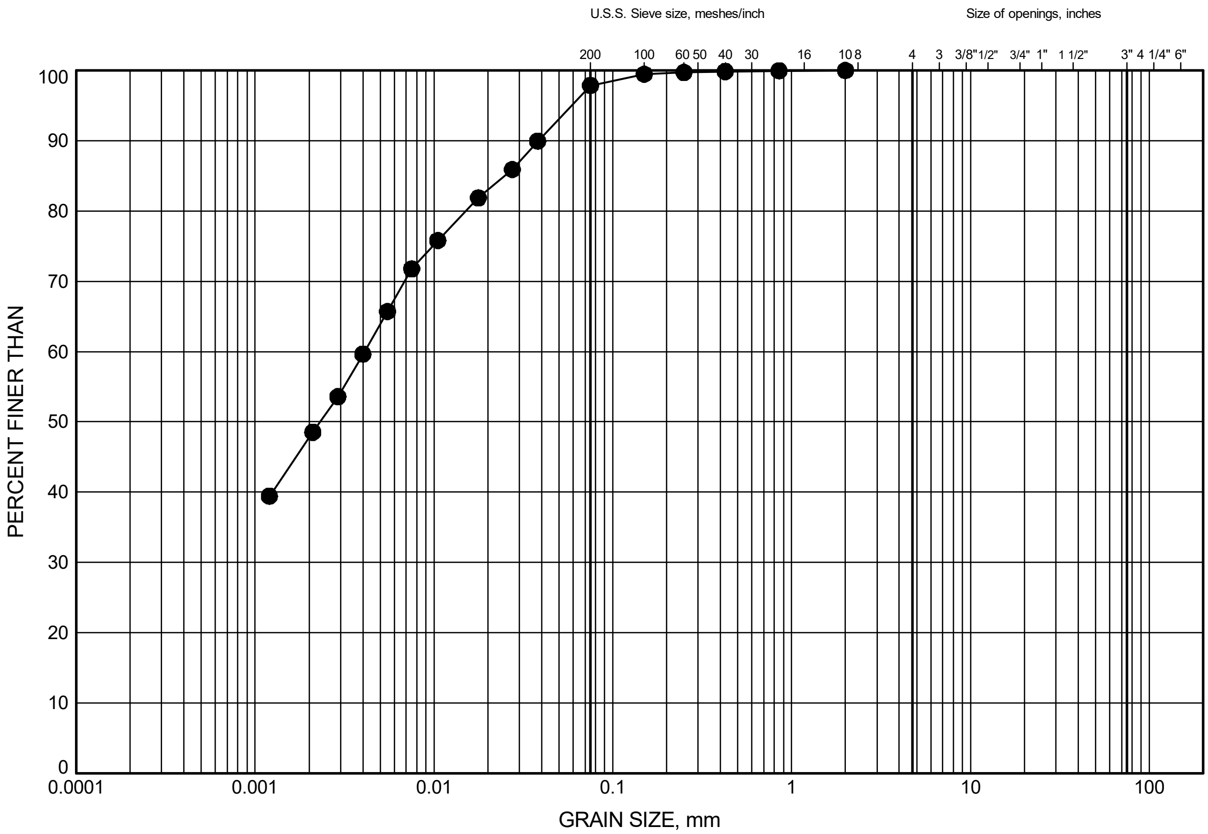
GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C6

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-26	4.9	72.5

Date January 2025

30726

THURBER

Prep'd RH

Chkd. SD

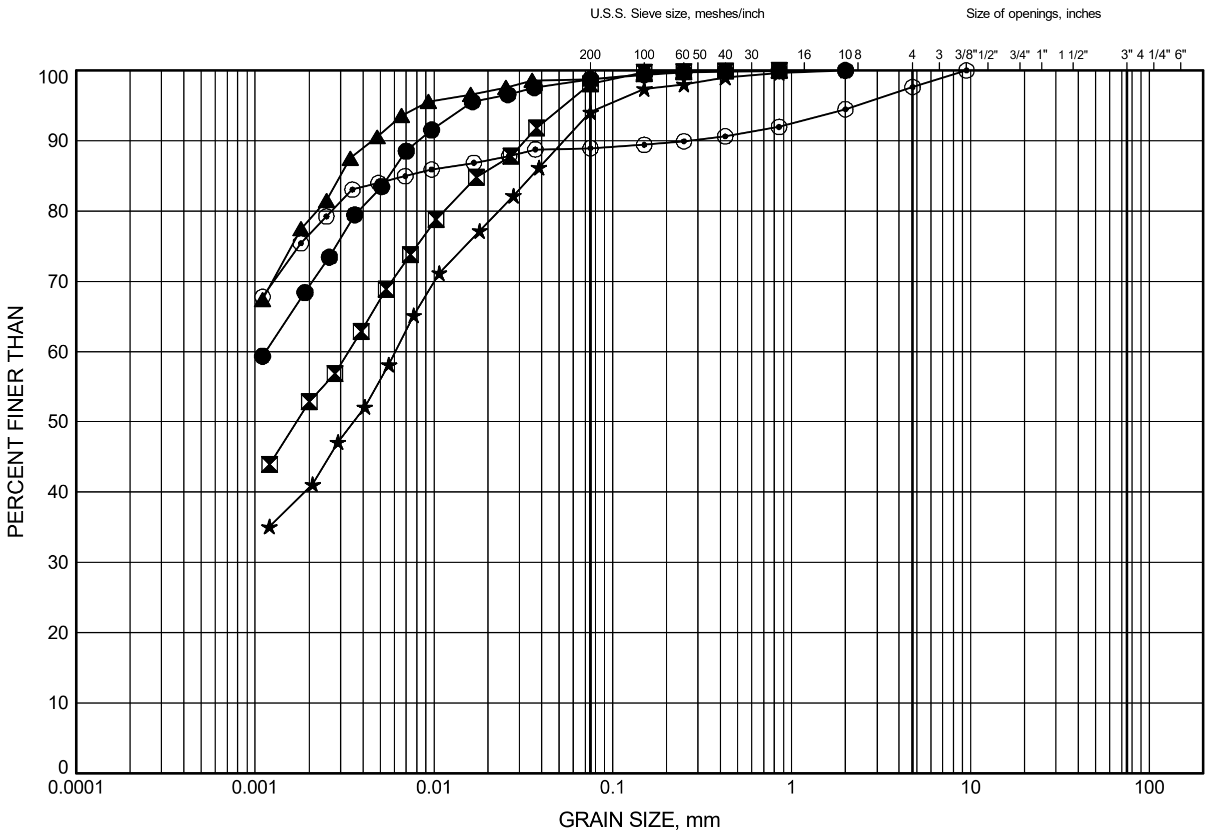
GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C7

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-03	3.4	73.1
⊠	BH-04	3.4	73.8
▲	BH-05	4.9	71.4
★	BH-19	3.4	74.2
⊙	BH-25	6.4	71.3

Date January 2025

30726

THURBER

Prep'd RH

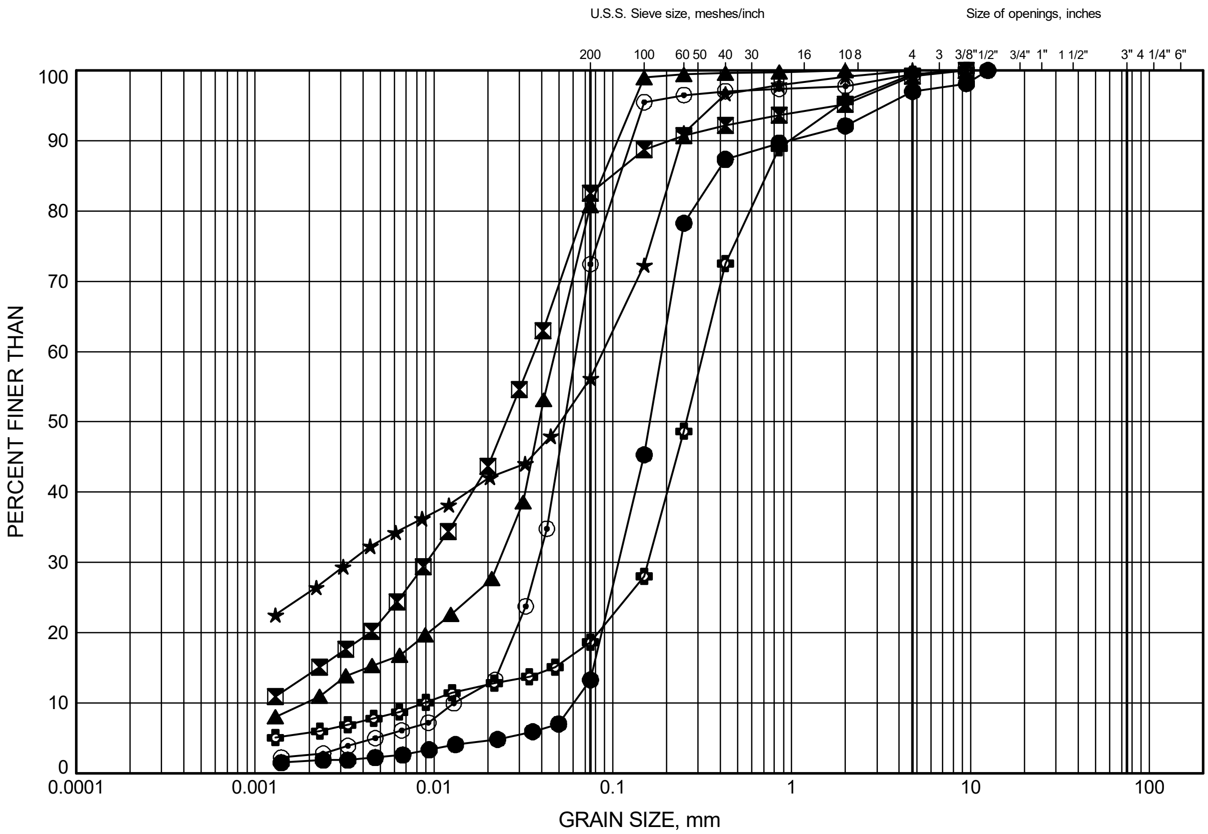
Chkd. SD

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C8

SILT TO SAND



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<tr><td>SILT and CLAY</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td>FINE</td><td>COARSE</td><td rowspan="2">COBBLE SIZE</td></tr>
<tr><td>FINE GRAINED</td><td colspan="3">SAND</td><td colspan="2">GRAVEL</td></tr>
</table>

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-01	6.3	74.6
⧗	BH-03	6.4	70.0
▲	BH-05	11.1	65.2
★	BH-06	4.9	73.6
⊙	BH-08	6.3	70.8
✿	BH-11	1.8	74.6

Date January 2025

30726

THURBER

Prep'd RH

Chkd. SD

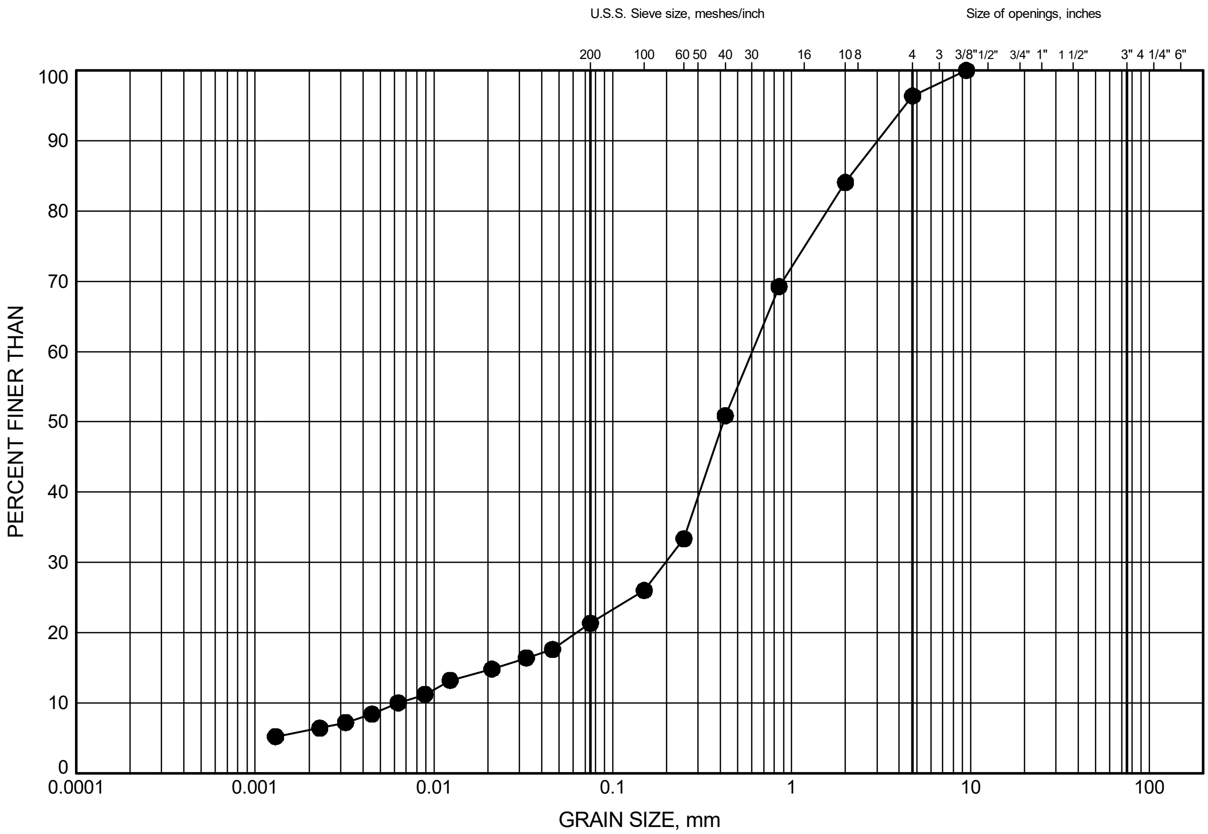
GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Napanee Water Pollution Control Plant Expansion

GRAIN SIZE DISTRIBUTION

FIGURE C9

SILT TO SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH-12	1.1	75.3

Date January 2025

30726

THURBER

Prep'd RH

Chkd. SD

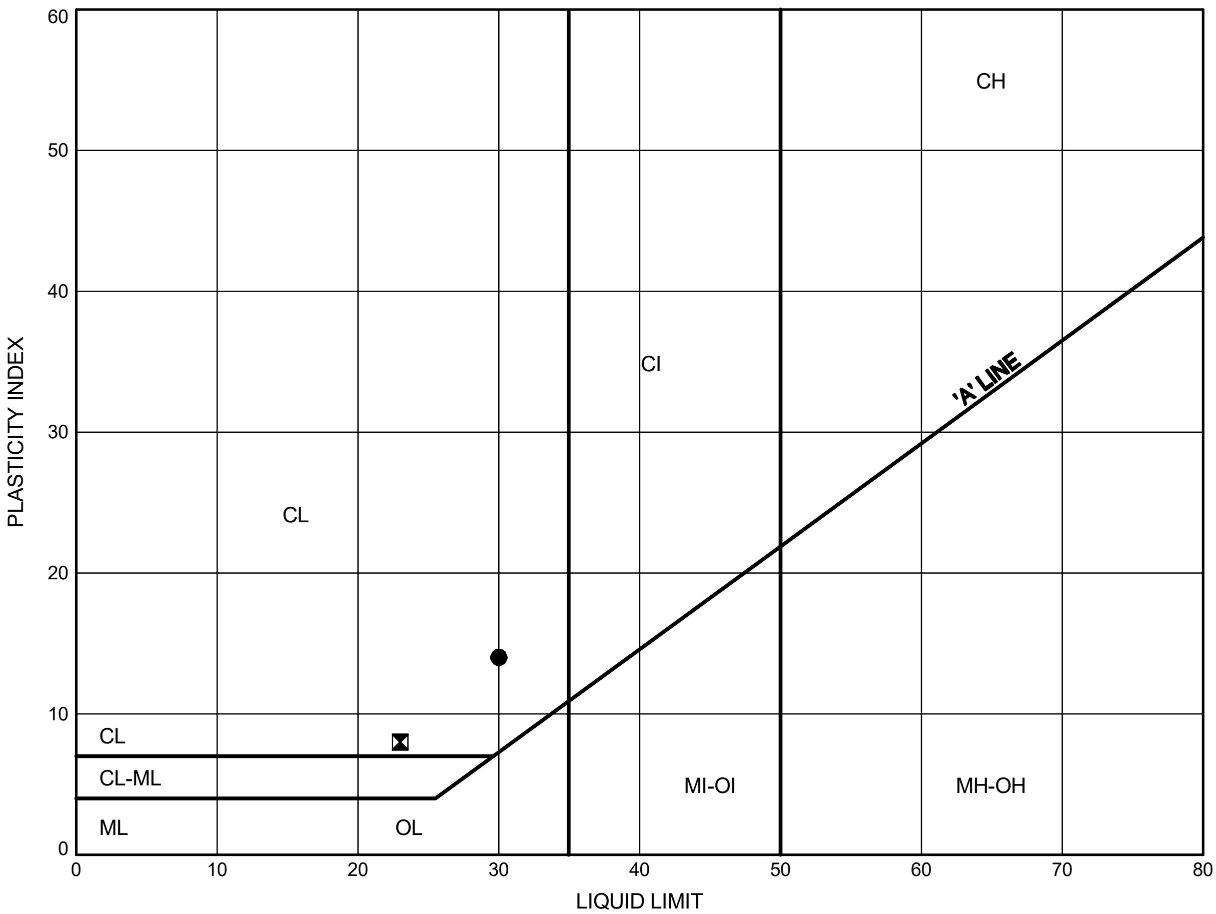
GRAIN SIZE DISTRIBUTION - THURBER TEL-30726.GPJ 1-21-25

Napnee WPCP Detailed Design

ATTERBERG LIMITS TEST RESULTS

FIGURE C10

Clay



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EVT24-301	6.4	70.8
⧗	EVT24-301	7.9	69.3

THURBALT 40745 NAPANEE WPCP - DRAFT LOGS.GPJ 1-21-25

Date January 2025

40745

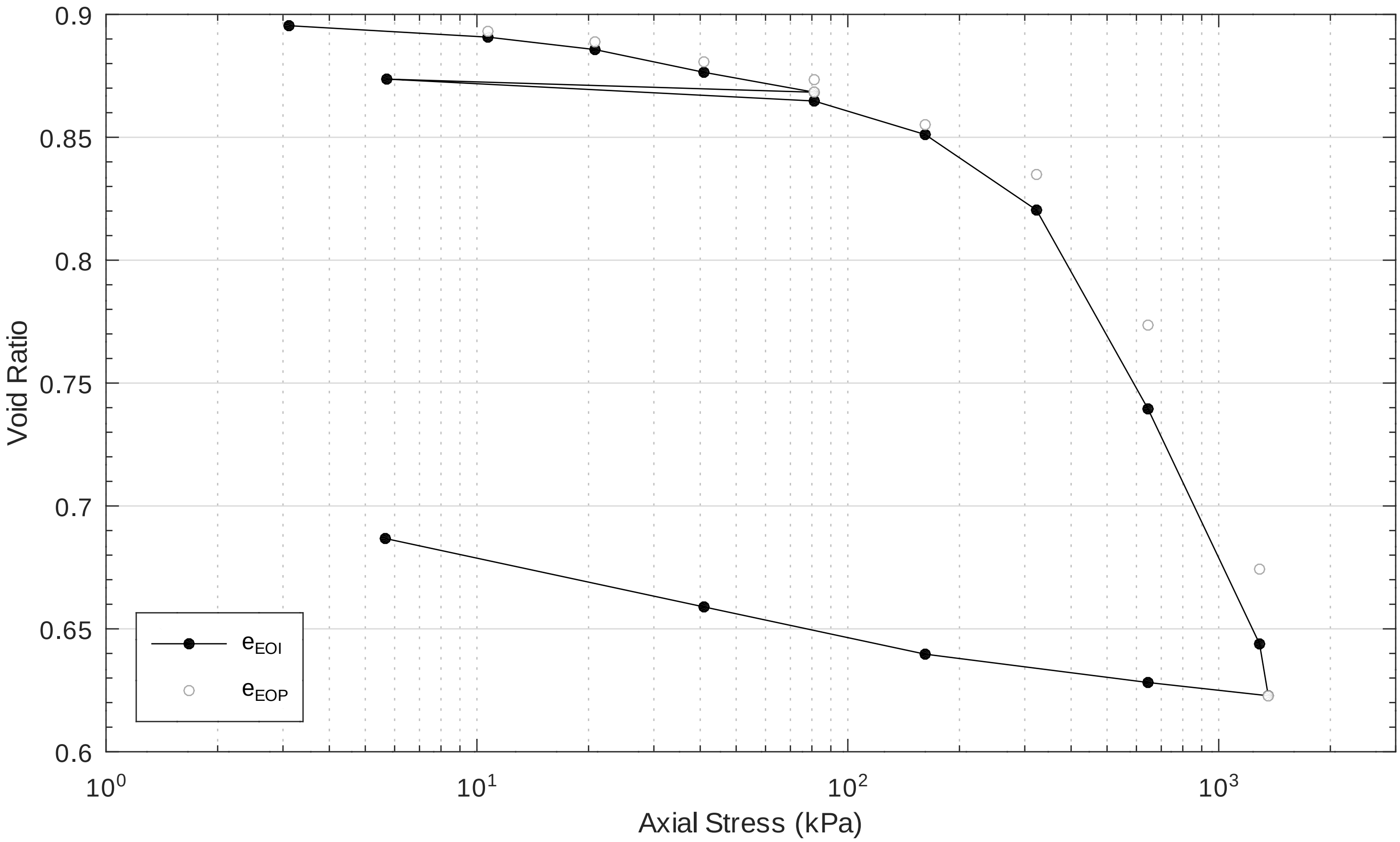
THURBER

Prep'd RH

Chkd. SD

THURBER

Project: 40745
Napanee WPCP Upgrades
Borehole: EVT21-301
Sample: ST2
Depth: 6.4m
Client: Town of Greater Napanee



Start of Test			2024-03-01
Diameter of Sample	cm	D	6.330
Height of Sample	cm	H_o	2.538
Height of Solids	cm	H_s	1.340
Water Content	%	w_o	31.58
Dry Density	g/cm^3	ρ_d	1.45
Moist Unit Weight	kN/m^3	γ	18.7
Void Ratio	-	e_o	0.894
Degree of Saturation	-	S_{ro}	0.97
Specific Gravity	-	G_s	2.750

TRIMMING: the specimen was manually trimmed to the size of the consolidation ring, then mounted in a fixed ring consolidometer

LOADING: the consolidometer was flooded with water with the seating load adjusted to limit swelling

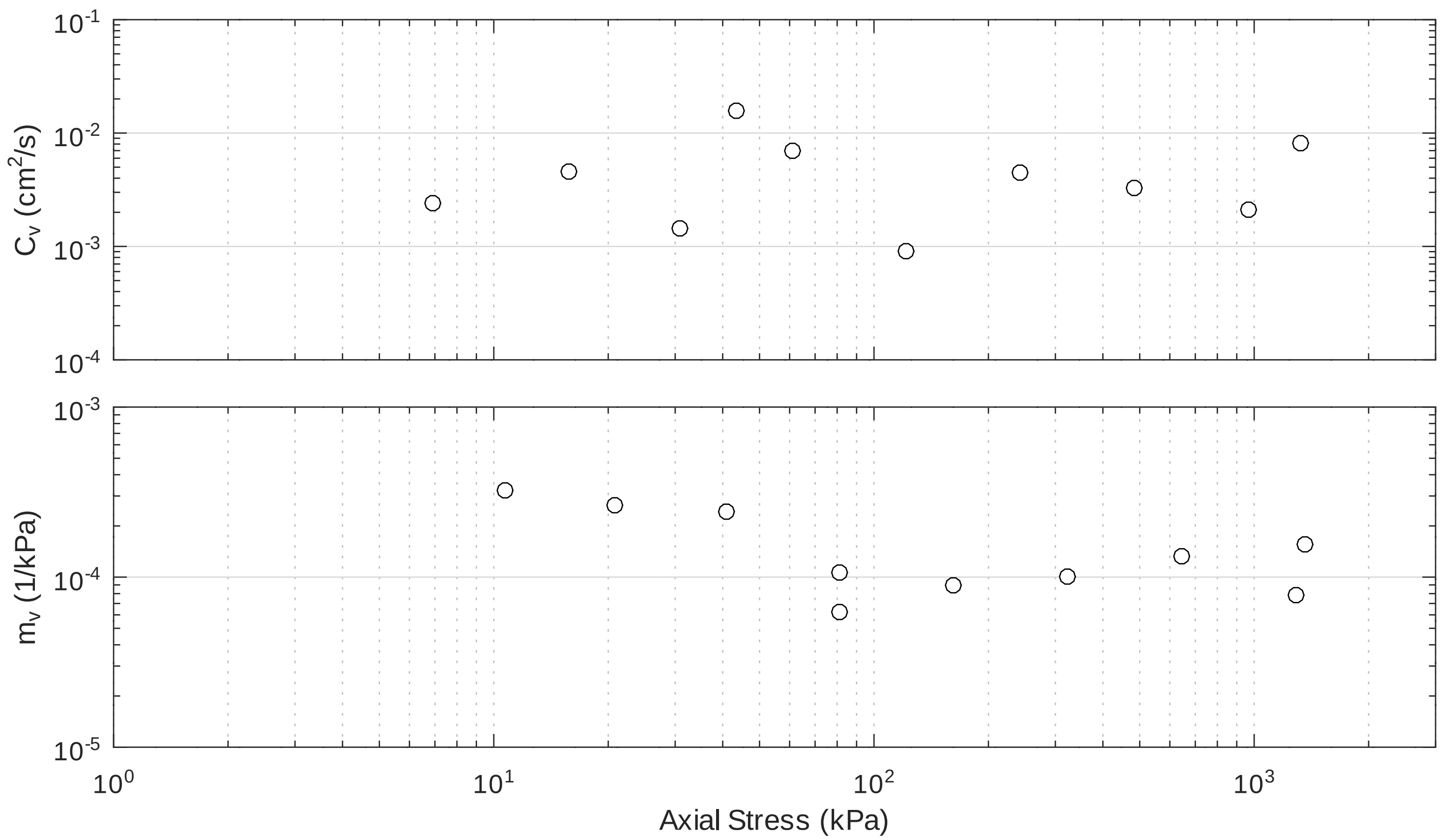
CALCULATIONS: coefficients of consolidation were calculated by the square root time method, secondary consolidation was calculated based on the available duration of the time step

End of Test			2024-03-18
Height of Sample	cm	H_f	2.260
Water Content	%	w_f	25.52
Void Ratio	-	e_f	0.687

Check: AO Review: PK/KS

THURBER

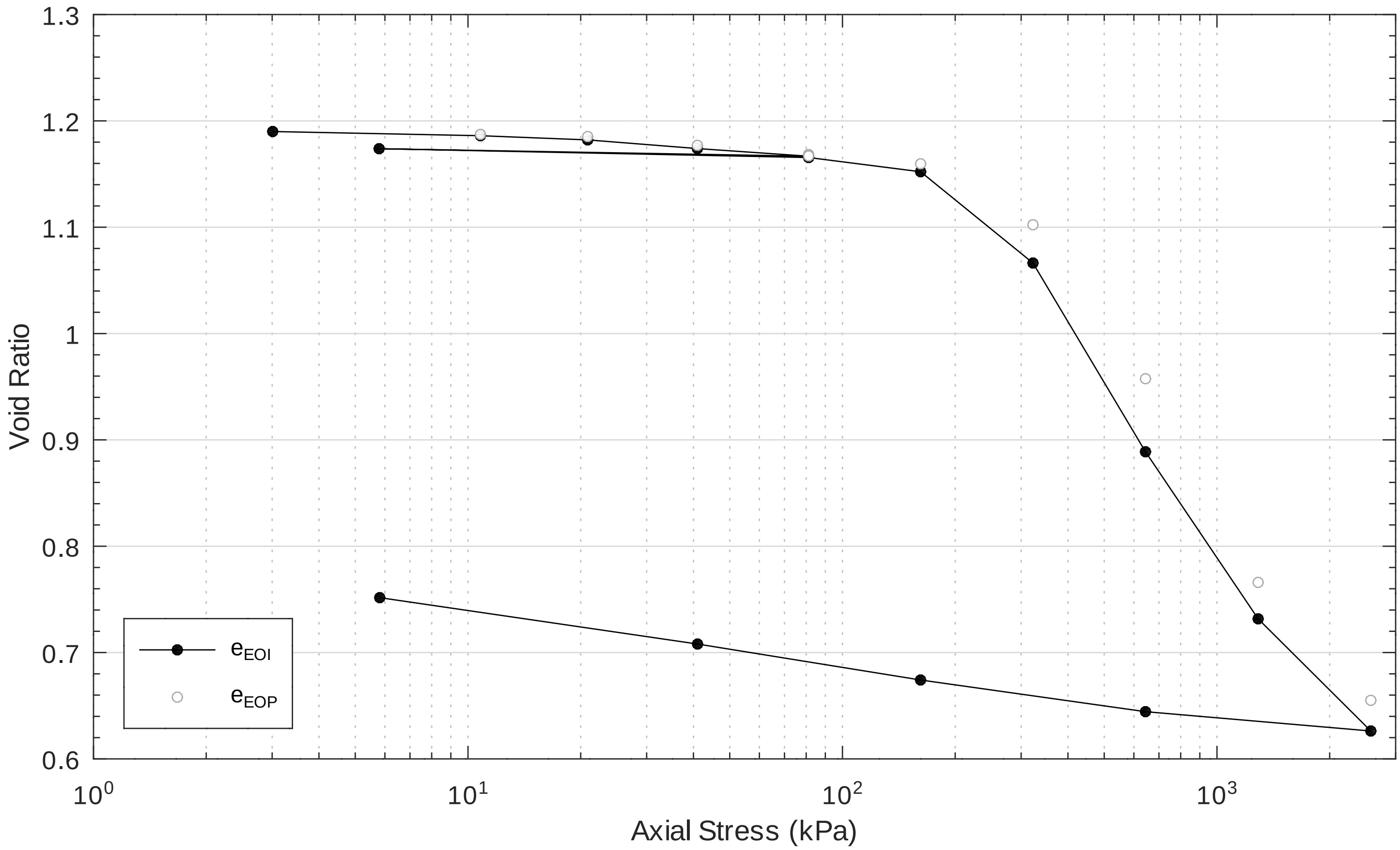
Project: 40745
Napanee WPCP Upgrades
Borehole: EVT21-301
Sample: ST2
Depth: 6.4m
Client: Town of Greater Napanee



Load No.	Axial Stress	Load Duration	System Deflec.	Dial	Sample Height	Axial Strain	Void Ratio	Void Ratio	Time U(0.99)	C_v	k_v	$C_{a\varepsilon}$
	kPa	min	mm	mm	cm	%	(EOI)	(EOP)	min	cm^2/s	cm/s	-
0				10.000	2.538	0.00	0.894					
1	3.1	1440.1	0.003	10.012	2.540	-0.06	0.895					
2	10.7	1440.1	0.036	9.917	2.534	0.19	0.891	0.893	19.5	2.41e-03	7.65e-08	0.0006
3	20.8	1440.1	0.071	9.814	2.527	0.45	0.886	0.889	10.3	4.57e-03	1.19e-07	0.0007
4	40.9	1440.1	0.113	9.649	2.514	0.94	0.876	0.881	31.9	1.44e-03	3.43e-08	0.0016
5	81.2	1440.2	0.187	9.466	2.504	1.37	0.868	0.873	6.5	6.97e-03	7.28e-08	0.0011
6	5.7	1440.3	0.078	9.646	2.511	1.09	0.874					
7	81.2	1440.1	0.188	9.417	2.499	1.56	0.865	0.868	2.9	1.57e-02	9.62e-08	0.0006
8	161.7	1440.1	0.254	9.167	2.480	2.28	0.851	0.855	49.0	9.08e-04	7.98e-09	0.0015
9	322.7	1440.2	0.363	8.647	2.439	3.90	0.820	0.835	9.3	4.48e-03	4.42e-08	0.0034
10	644.6	1440.1	0.474	7.452	2.331	8.17	0.739	0.774	10.5	3.28e-03	4.27e-08	0.0089
11	1288.7	1440.0	0.626	6.019	2.203	13.22	0.644	0.674	12.7	2.11e-03	1.62e-08	0.0083
12	1360.1	1440.5	0.640	5.723	2.175	14.33	0.623	0.623	4.4	8.14e-03	1.25e-07	0.0000
13	644.7	1440.3	0.594	5.843	2.182	14.05	0.628					
14	161.6	1440.1	0.443	6.148	2.197	13.44	0.640					
15	40.9	1440.1	0.349	6.498	2.223	12.42	0.659					
16	5.7	2340.1	0.256	6.965	2.260	10.95	0.687					

THURBER

Project: 40745
Napanee WPCP Upgrades
Borehole: EVT24-301
Sample: ST2
Depth: 6.4m
Client: Town of Greater Napanee



Start of Test			2024-03-01
Diameter of Sample	cm	D	6.332
Height of Sample	cm	H_o	2.531
Height of Solids	cm	H_s	1.156
Water Content	%	w_o	40.40
Dry Density	g/cm^3	ρ_d	1.26
Moist Unit Weight	kN/m^3	γ	17.3
Void Ratio	-	e_o	1.189
Degree of Saturation	-	S_{ro}	0.93
Specific Gravity	-	G_s	2.750

End of Test			2024-03-18
Height of Sample	cm	H_f	2.025
Water Content	%	w_f	28.53
Void Ratio	-	e_f	0.752

TRIMMING: the specimen was manually trimmed to the size of the consolidation ring, then mounted in a fixed ring consolidometer

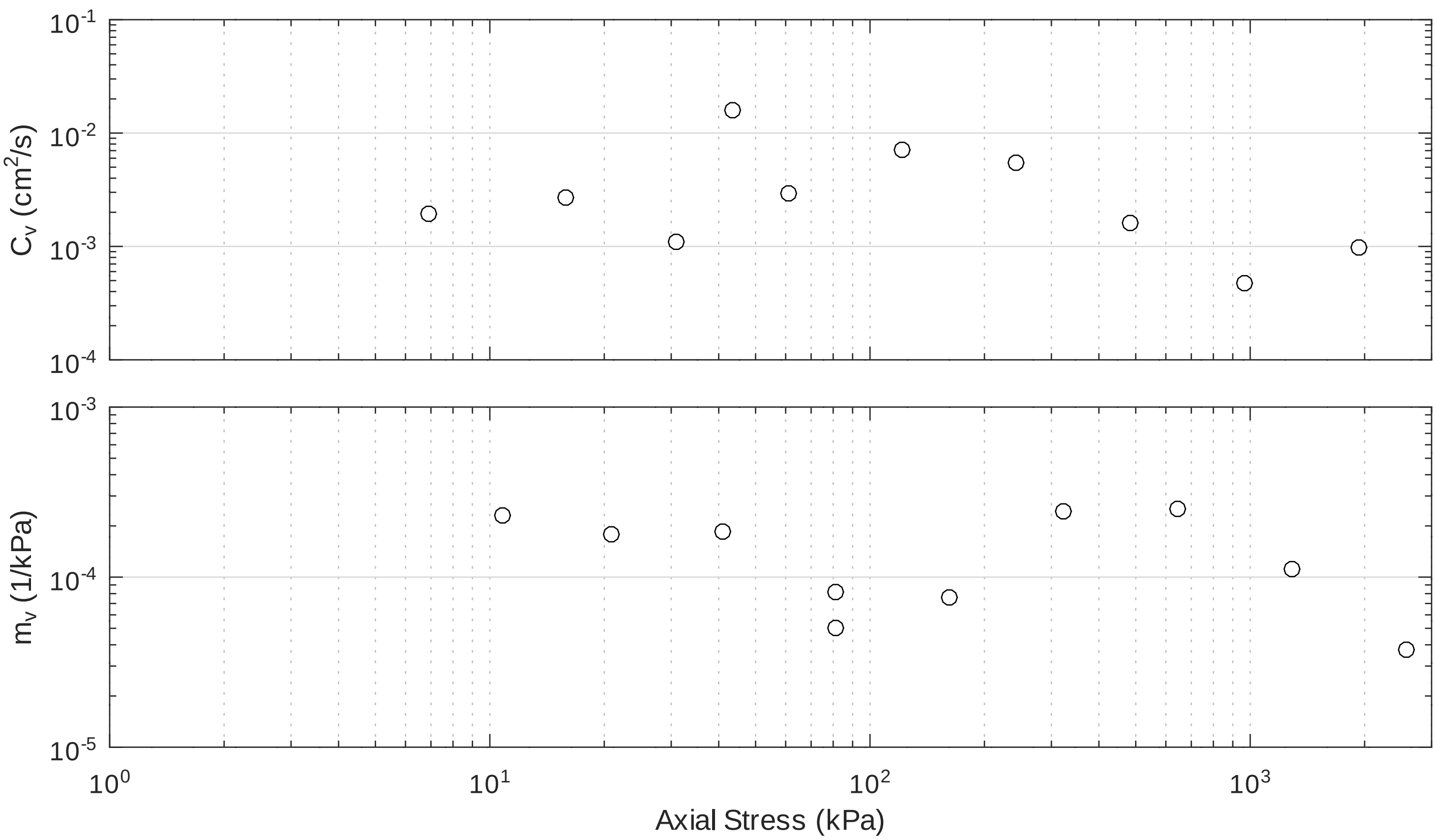
LOADING: the consolidometer was flooded with water with the seating load adjusted to limit swelling

CALCULATIONS: coefficients of consolidation were calculated by the square root time method, secondary consolidation was calculated based on the available duration of the time step

Check: AO   Review: PK/KS

THURBER

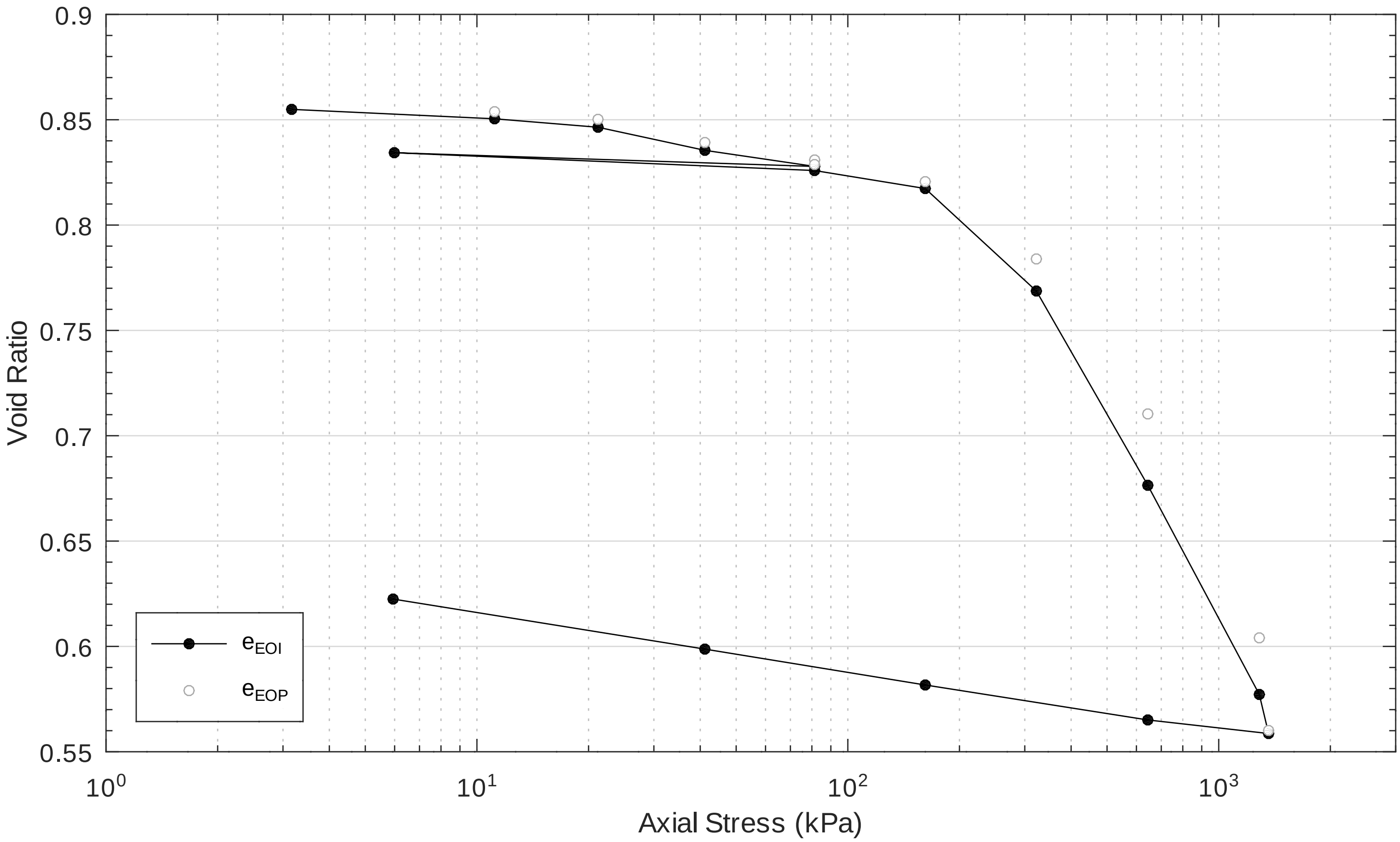
Project: 40745
Napanee WPCP Upgrades
Borehole: EVT24-301
Sample: ST2
Depth: 6.4m
Client: Town of Greater Napanee



Load No.	Axial Stress	Load Duration	System Deflec.	Dial	Sample Height	Axial Strain	Void Ratio	Void Ratio	Time U(0.99)	C_v	k_v	$C_{a\varepsilon}$
	kPa	min	mm	mm	cm	%	(EOI)	(EOP)	min	cm^2/s	cm/s	-
0				10.000	2.531	0.00	1.189					
1	3.0	1440.4	0.004	10.003	2.532	-0.03	1.190					
2	10.8	1440.5	0.041	9.920	2.527	0.15	1.186	1.187	24.3	1.94e-03	4.39e-08	0.0003
3	20.9	1440.1	0.092	9.823	2.523	0.33	1.182	1.185	17.4	2.70e-03	4.73e-08	0.0007
4	41.0	1440.5	0.129	9.689	2.513	0.70	1.174	1.177	42.7	1.10e-03	1.99e-08	0.0011
5	81.2	1440.1	0.183	9.551	2.505	1.03	1.167	1.168	15.9	2.94e-03	2.36e-08	0.0004
6	5.8	1440.0	0.094	9.721	2.513	0.71	1.174					
7	81.2	1440.1	0.185	9.533	2.503	1.09	1.166	1.167	2.9	1.59e-02	7.84e-08	0.0002
8	161.7	1440.0	0.246	9.317	2.488	1.70	1.152	1.160	6.4	7.11e-03	5.30e-08	0.0015
9	322.6	1440.1	0.319	8.252	2.389	5.62	1.066	1.102	7.1	5.47e-03	1.31e-07	0.0074
10	644.4	1440.0	0.413	6.108	2.184	13.73	0.889	0.958	16.0	1.61e-03	3.98e-08	0.0173
11	1288.1	1440.5	0.532	4.171	2.002	20.90	0.732	0.766	33.2	4.74e-04	5.19e-09	0.0114
12	2575.3	1440.5	0.705	2.779	1.880	25.72	0.626	0.655	18.2	9.79e-04	3.59e-09	0.0086
13	644.4	1440.0	0.495	3.200	1.901	24.89	0.644					
14	161.6	1440.4	0.396	3.643	1.935	23.53	0.674					
15	41.0	1440.3	0.311	4.119	1.975	21.98	0.708					
16	5.8	2340.1	0.245	4.689	2.025	19.99	0.752					

THURBER

Project: 40745
Napanee WPCP Detailed Design
Borehole: EVT24-301
Sample: ST3
Depth: 7.6m
Client: Town of Greater Napanee



Start of Test			2024-03-01
Diameter of Sample	cm	D	6.336
Height of Sample	cm	H_o	2.535
Height of Solids	cm	H_s	1.369
Water Content	%	w_o	31.41
Dry Density	g/cm^3	ρ_d	1.48
Moist Unit Weight	kN/m^3	γ	19.1
Void Ratio	-	e_o	0.852
Degree of Saturation	-	S_{ro}	1.01
Specific Gravity	-	G_s	2.750

End of Test			2024-03-18
Height of Sample	cm	H_f	2.221
Water Content	%	w_f	22.97
Void Ratio	-	e_f	0.622

TRIMMING: the specimen was manually trimmed to the size of the consolidation ring, then mounted in a fixed ring consolidometer

LOADING: the consolidometer was flooded with water with the seating load adjusted to limit swelling

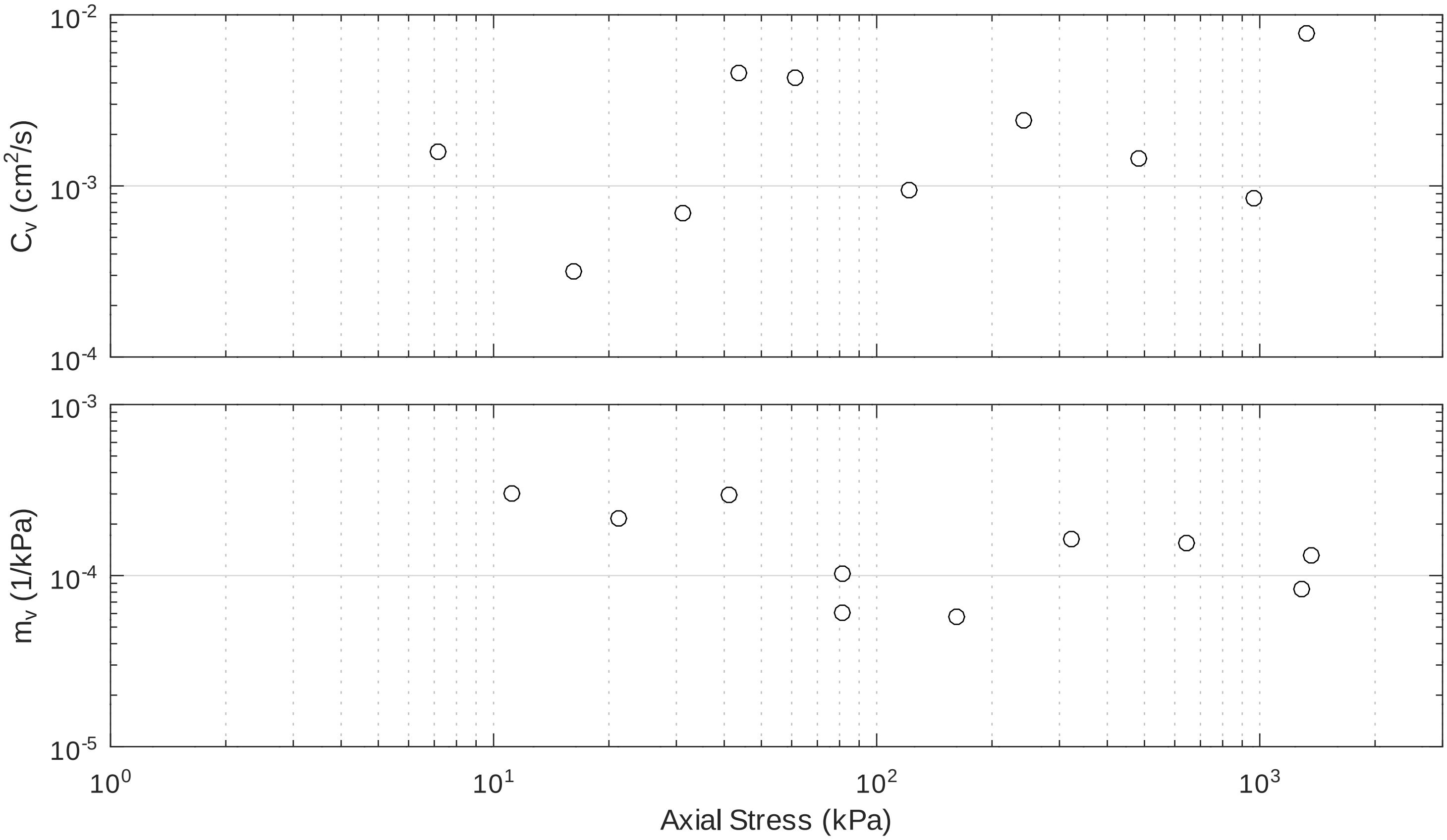
CALCULATIONS: coefficients of consolidation were calculated by the square root time method, secondary consolidation was calculated based on the available duration of the time step

Check: AO Review: PK/KS

One-Dimensional Consolidation, ASTM D2435-11

THURBER

Project: 40745
Napanee WPCP Detailed Design
Borehole: EVT24-301
Sample: ST3
Depth: 7.6m
Client: Town of Greater Napanee



Load No.	Axial Stress	Load Duration	System Deflec.	Dial	Sample Height	Axial Strain	Void Ratio	Void Ratio	Time U(0.99)	C_v	k_v	$C_{a\varepsilon}$
	kPa	min	mm	mm	cm	%	(EOI)	(EOP)	min	cm²/s	cm/s	-
0				10.000	2.535	0.00	0.852					
1	3.2	1440.4	0.026	10.011	2.539	-0.14	0.855					
2	11.2	1440.2	0.085	9.890	2.533	0.10	0.850	0.854	29.7	1.58e-03	4.69e-08	0.0011
3	21.2	1440.1	0.183	9.738	2.527	0.31	0.846	0.850	146.1	3.16e-04	6.70e-09	0.0027
4	41.2	1440.3	0.227	9.543	2.512	0.91	0.835	0.839	65.1	6.93e-04	2.01e-08	0.0018
5	81.4	1440.0	0.308	9.357	2.502	1.32	0.828	0.831	10.4	4.29e-03	4.32e-08	0.0008
6	6.0	1440.5	0.205	9.548	2.511	0.97	0.834					
7	81.3	1440.5	0.313	9.324	2.499	1.42	0.826	0.829	10.0	4.57e-03	2.72e-08	0.0007
8	161.7	1440.5	0.387	9.134	2.487	1.88	0.817	0.821	47.3	9.45e-04	5.32e-09	0.0012
9	322.3	1440.2	0.474	8.382	2.421	4.51	0.769	0.784	15.6	2.42e-03	3.87e-08	0.0043
10	643.8	1440.5	0.579	7.014	2.294	9.49	0.676	0.710	20.6	1.45e-03	2.20e-08	0.0103
11	1286.6	1440.4	0.704	5.529	2.159	14.85	0.577	0.604	27.6	8.47e-04	6.93e-09	0.0094
12	1362.9	1440.1	0.715	5.265	2.133	15.85	0.559	0.560	4.4	7.79e-03	1.00e-07	0.0003
13	643.8	1440.0	0.660	5.408	2.142	15.50	0.565					
14	161.7	1440.0	0.538	5.758	2.165	14.61	0.582					
15	41.2	1440.2	0.440	6.088	2.188	13.69	0.599					
16	5.9	2340.1	0.375	6.479	2.221	12.40	0.622					

THURBER ENGINEERING LTD.

Consolidation Test Report

CLIENT: R.V. Anderson Associates Ltd. FILE NUMBER: 30726

PROJECT: Napanee Water Pollution Control Plant REPORT DATE: May 3, 2021

TEST DATES: April 15, 2021 - April 25, 2021

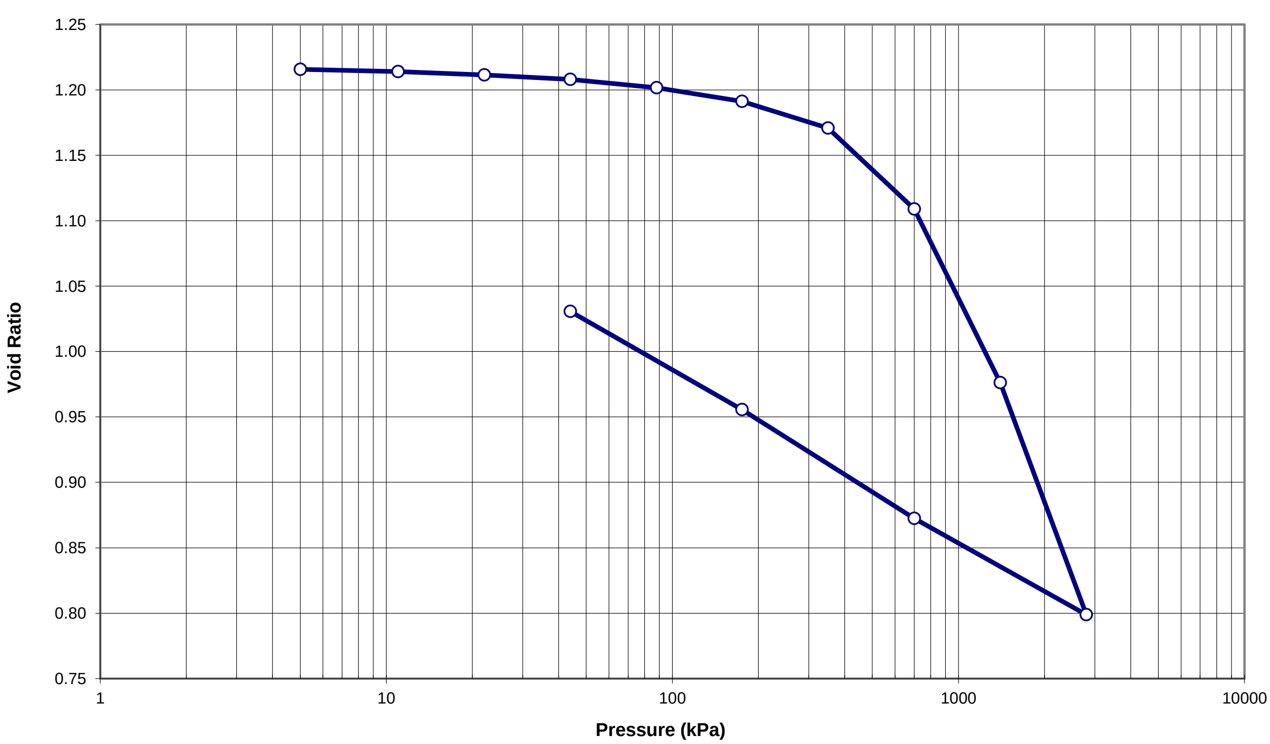
SAMPLE: BH19 ST1 15'-17'
Silty clay, grey, moist
LL = 72.0, PL = 26.1, I_p = 45.9

PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-11, method B.

	Start of Test	End of Test
Sample Height (mm)	25.40	23.22
Wet Dens. (kg/m^3)	1796.7	1875.4
Dry Dens. (kg/m^3)	1250.7	1368.0
Moisture Cont. (%)	43.7	37.1
Void Ratio	1.221	1.031
Saturation (%)	99.3	100.0

Note: A Specific Gravity (Gs) of 2.778 was obtained for the void ratio and saturation calculations.

Void Ratio vs. Pressure



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Napanee Water Pollution Control Plant
30726 BH19 ST1 15'-17'

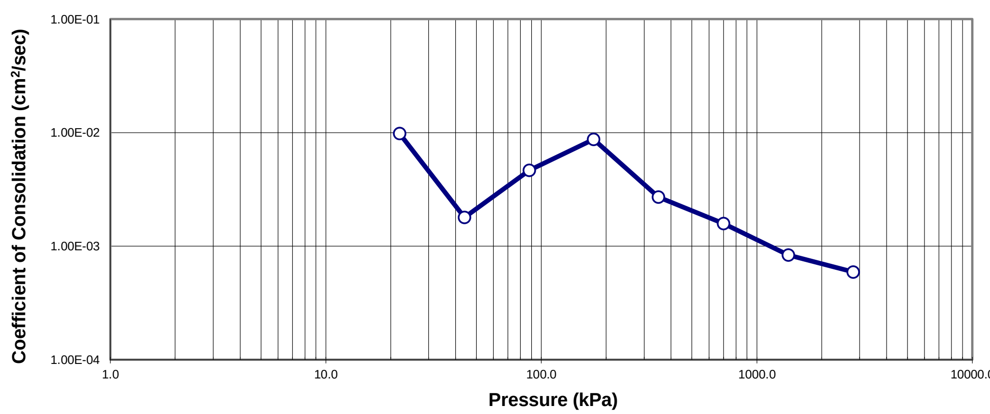
TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer. The average moisture content of the trimmings was 43.9%.

LOADING: A seating load of 5 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after 100% primary consolidation was reached at each load increment.

CALCULATIONS: Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	D_{90} (mm)	t_{90} (min)	c_v (cm^2/s)	Void Ratio	m_v (m^2/kN)	k (cm/s)
0.0	25.400					1.221		
5.0	25.340	25.370				1.216	4.76E-04	
11.0	25.319	25.329				1.214	1.35E-04	
22.0	25.291	25.305	-0.023	2.31	9.79E-03	1.211	9.95E-05	9.56E-08
44.0	25.251	25.271	-0.033	12.60	1.79E-03	1.208	7.17E-05	1.26E-08
88.0	25.179	25.215	-0.053	4.84	4.64E-03	1.202	6.53E-05	2.97E-08
175.0	25.060	25.119	-0.093	2.56	8.71E-03	1.191	5.42E-05	4.63E-08
350.0	24.826	24.943	-0.187	8.12	2.71E-03	1.171	5.35E-05	1.42E-08
700.0	24.118	24.472	-0.430	13.40	1.58E-03	1.109	8.14E-05	1.26E-08
1400.0	22.600	23.359	-0.980	23.04	8.37E-04	0.976	8.99E-05	7.38E-09
2800.0	20.572	21.586	-1.400	27.77	5.93E-04	0.799	6.41E-05	3.73E-09
700.0	21.413	20.993				0.872		
175.0	22.364	21.888				0.956		
44.0	23.223	22.793				1.031		

Coefficient of Consoildation vs. Pressure



Note: C_v and k calculated using t_{90} values (square root of time method)

TEST DONE BY: BT
REVIEWED BY: WM

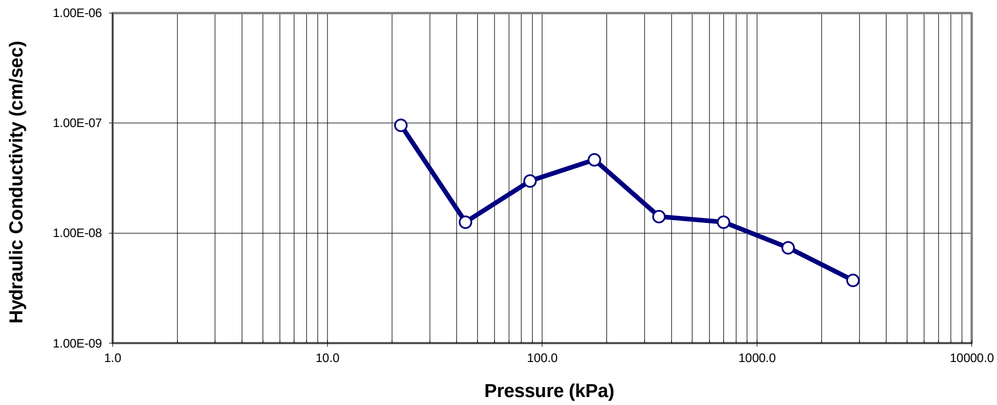
THURBER ENGINEERING LTD.

Consolidation Test Report

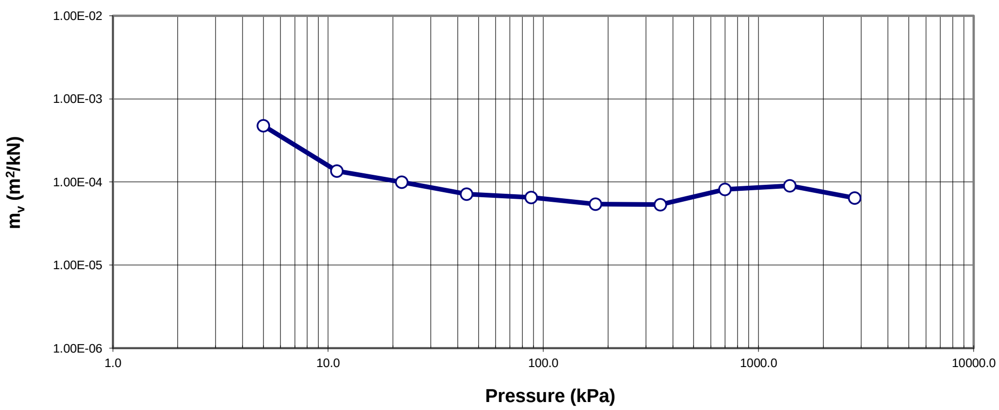
Napanee Water Pollution Control Plant
30726

BH19 ST1 15'-17'

Hydraulic Conductivity vs. Pressure



m_v vs. Pressure



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

CLIENT: R.V. Anderson Associates Ltd. FILE NUMBER: 30726

PROJECT: Napanee Water Pollution Control Plant REPORT DATE: May 4, 2021

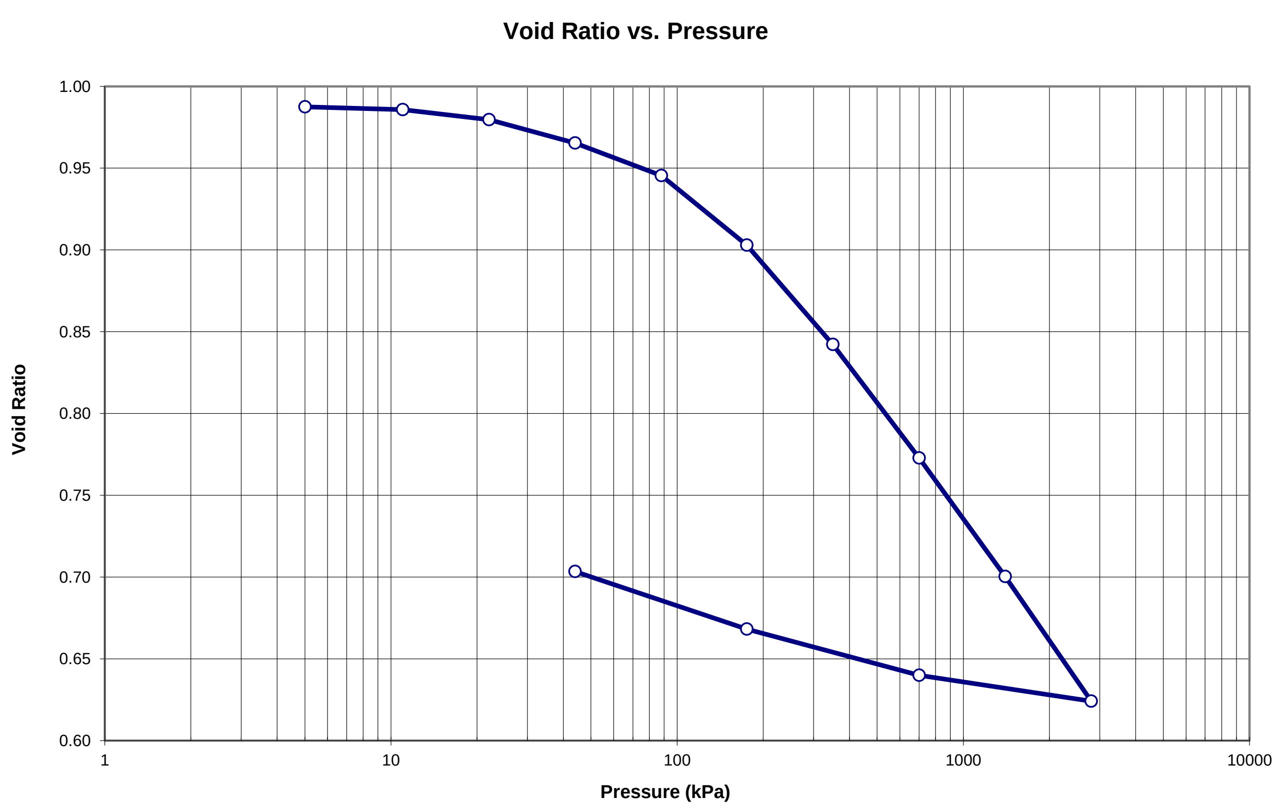
TEST DATES: April 15, 2021 - April 27, 2021

SAMPLE: BH22 ST1 10'-12'
Silty clay, grey, moist
LL = 37.4, PL = 18.0, I_p = 19.4

PROCEDURE: Test carried out in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-11, method B.

	Start of Test	End of Test
Sample Height (mm)	25.40	21.74
Wet Dens. (kg/m^3)	1867.7	2045.3
Dry Dens. (kg/m^3)	1397.3	1632.3
Moisture Cont. (%)	33.7	25.3
Void Ratio	0.990	0.703
Saturation (%)	94.6	100.0

Note: A Specific Gravity (Gs) of 2.781 was obtained for the void ratio and saturation calculations.



TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Napanee Water Pollution Control Plant
30726 BH22 ST1 10'-12'

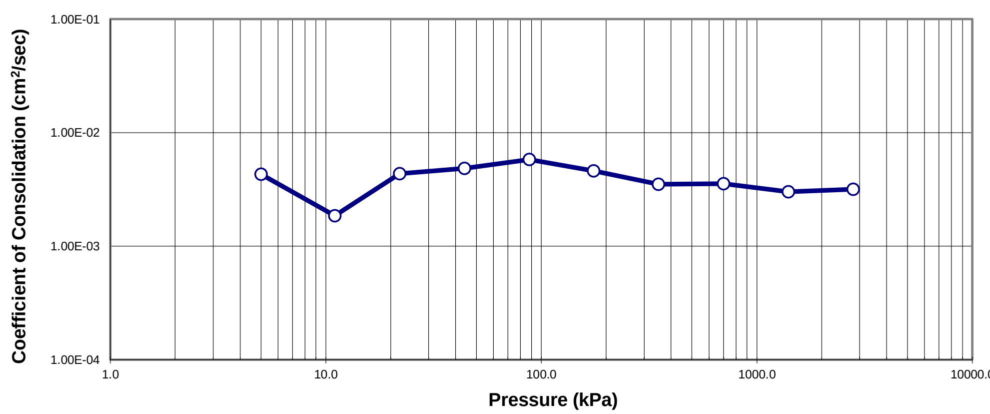
TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer. The average moisture content of the trimmings was 34.6%.

LOADING: A seating load of 5 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied after 100% primary consolidation was reached at each load increment.

CALCULATIONS: Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. H. (mm)	Avg. H. (mm)	D_{90} (mm)	t_{90} (min)	c_v (cm^2/s)	Void Ratio	m_v (m^2/kN)	k (cm/s)
0.0	25.400					0.990		
5.0	25.368	25.384	-0.023	5.29	4.30E-03	0.988	2.50E-04	1.06E-07
11.0	25.347	25.358	-0.051	12.25	1.85E-03	0.986	1.41E-04	2.56E-08
22.0	25.267	25.307	-0.073	5.20	4.35E-03	0.980	2.85E-04	1.22E-07
44.0	25.086	25.177	-0.135	4.62	4.85E-03	0.965	3.26E-04	1.55E-07
88.0	24.832	24.959	-0.210	3.80	5.79E-03	0.945	2.30E-04	1.31E-07
175.0	24.289	24.560	-0.365	4.62	4.61E-03	0.903	2.51E-04	1.14E-07
350.0	23.514	23.902	-0.535	5.76	3.50E-03	0.842	1.82E-04	6.26E-08
700.0	22.629	23.072	-0.605	5.29	3.56E-03	0.773	1.08E-04	3.75E-08
1400.0	21.703	22.166	-0.660	5.76	3.01E-03	0.700	5.85E-05	1.73E-08
2800.0	20.730	21.216	-0.740	5.02	3.17E-03	0.624	3.20E-05	9.95E-09
700.0	20.933	20.832				0.640		
175.0	21.292	21.113				0.668		
44.0	21.743	21.518				0.703		

Coefficient of Consoildation vs. Pressure



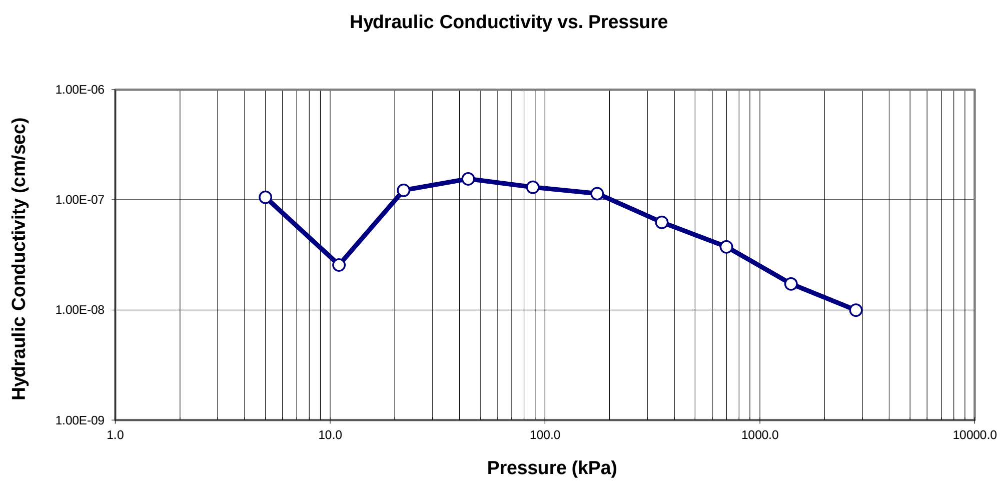
Note: C_v and k calculated using t_{90} values (square root of time method)

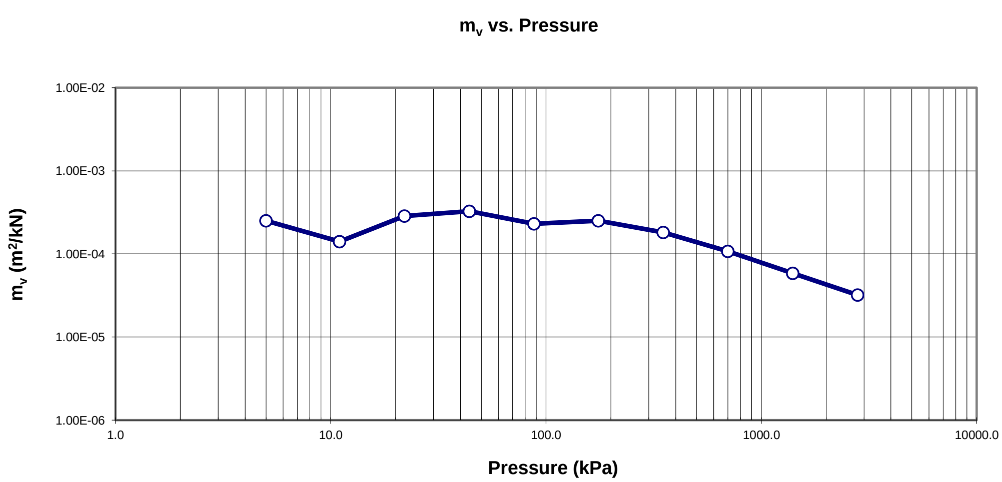
TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

Consolidation Test Report

Napanee Water Pollution Control Plant
30726 BH22 ST1 10'-12'





TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

APPENDIX D

Unconfined Compressive Strength Testing Results

Stantec Consulting Ltd.
2781 Lancaster Rd, Suite 100 A&B, Ottawa ON K1B 1A7

March 11, 2024
File: 122410864

Client: Thurber Engineering, File #40745

Reference: ASTM D7012, Method C, Unconfined Compressive Strength of Intact Rock Core
Water Pollution Plant

The following table summarizes unconfined compressive strength results for three intact rock cores.

Location	Sample Depth	Compressive Strength (MPa)	Description of Break
MW24-101 Run-1	26'-26'8''	92.7	Reasonably well-formed cones on both ends.

Sincerely,

Stantec Consulting Ltd.

Brian Prevost

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

THURBER ENGINEERING LTD.

POINT LOAD TEST SHEET
ASTM D5731-16

Job No:	30726	**Date Drilled:**	23-Feb-21
Client:	R.V. Anderson Associates	**Date Tested:**	16-Mar-21
Project Name:	Napanee Water Pollution Control Plant	**Tester:**	RB, MC
Core Size:	NQ **BH No :** BH-01	**Reviewed by:**	

Test No.	Run No.	Depth (m)	Axial or Diametral	Gauge (MPa)	Diameter (mm)	Length (mm)	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
2	1	7.1	Axial	13.3	47.3	46.4	4.6	111.1	mestone and Sha	Very Strong
3	1	8.5	Diametrial	11.4	47.4	71.4	2.8	67.9	mestone and Sha	Strong
4	1	8.6	Axial	5.8	47.4	49.2	1.9	46.0	Limestone	Medium Strong
5	2	9.1	Axial	15.9	47.2	44.2	5.8	138.2	Limestone	Very Strong
6	2	9.2	Axial	13.3	47.3	46.4	4.6	111.1	Limestone	Very Strong
7	2	9.6	Axial	13.3	47.3	47.7	4.5	108.3	Limestone	Very Strong
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* It is ideal to perform axial test on core specimens with D/L ratio of 1.1 ± 0.1
Long pieces of core can be tested diametrically to produce suitable lengths for axial testing
* Diametral Test should have 0.7 x D on either side of test point.
* Correlation factor to obtain UCS values is 24.

Last Modified: October 28, 2020

THURBER ENGINEERING LTD.

POINT LOAD TEST SHEET
ASTM D5731-16

Job No:	30726	**Date Drilled:**	23-Feb-21
Client:	R.V. Anderson Associates	**Date Tested:**	16-Mar-21
Project Name:	Napanee Water Pollution Control Plant	**Tester:**	RB, MC
Core Size:	NQ **BH No :** BH-02	**Reviewed by:**	

Test No.	Run No.	Depth (m)	Axial or Diametral	Gauge (MPa)	Diameter (mm)	Length (mm)	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
2	1	6.4	Diametrial	8.5	47.6	69.0	2.2	52.2	mestone and Sha	Strong
3	1	6.2	Axial	18.9	47.5	46.9	6.5	156.2	mestone and Sha	Very Strong
4	1	6.8	Axial	17.1	47.4	51.4	5.5	131.5	mestone and Sha	Very Strong
5	2	7.4	Axial	11.8	47.4	51.0	3.8	91.4	Limestone	Strong
6	2	8.2	Axial	7.8	47.3	45.7	2.7	65.9	mestone and Sha	Strong
7	2	8.7	Axial	12.7	47.4	44.5	4.6	109.8	mestone and Sha	Very Strong
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* It is ideal to perform axial test on core specimens with D/L ratio of 1.1 ± 0.1
Long pieces of core can be tested diametrically to produce suitable lengths for axial testing
* Diametral Test should have 0.7 x D on either side of test point.
* Correlation factor to obtain UCS values is 24.

Last Modified: October 28, 2020

THURBER ENGINEERING LTD.

POINT LOAD TEST SHEET
ASTM D5731-16

Job No:	30726	**Date Drilled:**	23-Feb-21
Client:	R.V. Anderson Associates	**Date Tested:**	16-Mar-21
Project Name:	Napanee Water Pollution Control Plant	**Tester:**	RB, MC
Core Size:	NQ **BH No :** BH-02	**Reviewed by:**	

Test No.	Run No.	Depth (m)	Axial or Diametral	Gauge (MPa)	Diameter (mm)	Length (mm)	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
2	1	7.2	Diametrial	13.3	47.1	67.1	3.5	83.7	mestone and Sha	Strong
3	1	7.9	Axial	23.8	47.1	54.0	7.4	177.2	Limestone	Very Strong
4	1	8.7	Axial	23.8	47.2	43.6	8.7	208.9	mestone and Sha	Very Strong
5	2	8.9	Axial	10.7	47.3	44.5	3.9	92.6	mestone and Sha	Strong
6	2	9.3	Axial	14.4	47.3	43.4	5.3	126.8	mestone and Sha	Very Strong
7	2	10.2	Axial	11.8	47.4	49.4	3.9	93.8	mestone and Sha	Strong
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* It is ideal to perform axial test on core specimens with D/L ratio of 1.1 ± 0.1
Long pieces of core can be tested diametrically to produce suitable lengths for axial testing

* Diametral Test should have 0.7 x D on either side of test point.

* Correlation factor to obtain UCS values is 24.

Last Modified: October 28, 2020

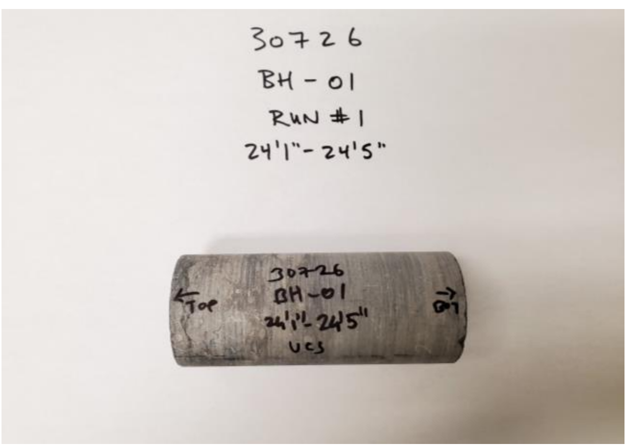
UNCONFINED COMPRESSION TEST REPORT

ASTM D7012-14

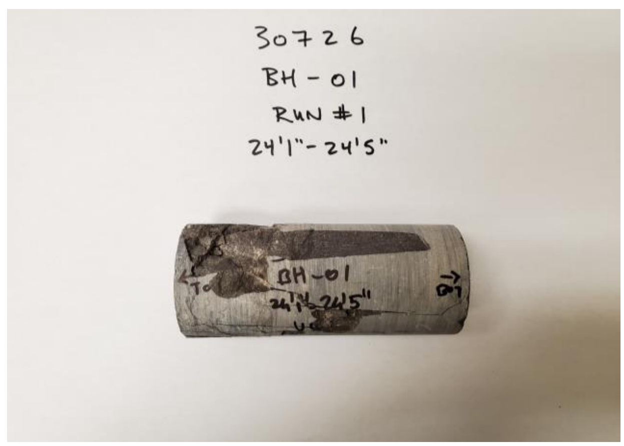
CLIENT:	R.V. Anderson Associates	FILE NUMBER:	30726
PROJECT NAME:	Napanee Water Pollution Control Plant	REPORT DATE:	28-Jun-21
BOREHOLE No.:	BH-01	TEST DATE:	28-Jun-21
SAMPLE No.:	NQ Run 1		
SAMPLE DEPTH:	24'1" - 24'5"		
DESCRIPTION:	Limestone		

Avg. Height (cm):	10.5	Weight (g):	499.1
Avg. Diameter (cm):	4.7	Wet Density (kg/m^3):	2,685
H. to Dia. Ratio**:	2.2:1	Dry Density (kg/m^3):	2,685
Cross Sectional Area (cm^2):	17.62	Moisture Content* (%):	N/A
Sample Volume (cm^3):	185.91		

ORIGINAL SPECIMEN



FRACTURED SPECIMEN



AVERAGE LOADING RATE TO FAILURE:	0.250 MPa/s
MAXIMUM COMPRESSIVE LOAD:	200.0 kN
UNCONFINED COMPRESSIVE STRENGTH:	113.5 MPa

Note: * Dimensions of Specimen conform to ASTM D 4543-04.

TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

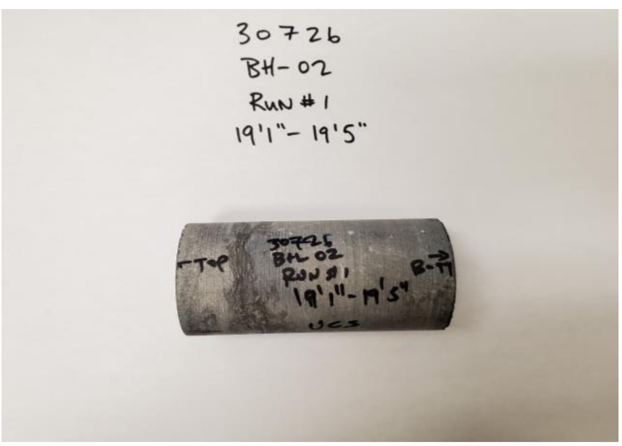
UNCONFINED COMPRESSION TEST REPORT

ASTM D7012-14

CLIENT:	R.V. Anderson Associates	FILE NUMBER:	30726
PROJECT NAME:	Napanee Water Pollution Control Plant	REPORT DATE:	28-Jun-21
BOREHOLE No.:	BH-02	TEST DATE:	28-Jun-21
SAMPLE No.:	NQ Run 1		
SAMPLE DEPTH:	19'1" - 19'5"		
DESCRIPTION:	Limestone		

Avg. Height (cm):	9.8	Weight (g):	465.2
Avg. Diameter (cm):	4.7	Wet Density (kg/m^3):	2,698
H. to Dia. Ratio**:	2.1:1	Dry Density (kg/m^3):	2,698
Cross Sectional Area (cm^2):	17.58	Moisture Content* (%):	N/A
Sample Volume (cm^3):	172.45		

ORIGINAL SPECIMEN



FRACTURED SPECIMEN

AVERAGE LOADING RATE TO FAILURE:	0.250 MPa/s
MAXIMUM COMPRESSIVE LOAD:	186.2 kN
UNCONFINED COMPRESSIVE STRENGTH:	105.9 MPa

Note: * Dimensions of Specimen conform to ASTM D 4543-04.

TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

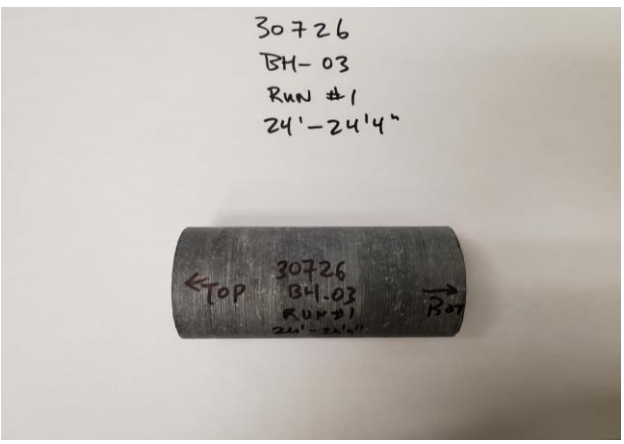
UNCONFINED COMPRESSION TEST REPORT

ASTM D7012-14

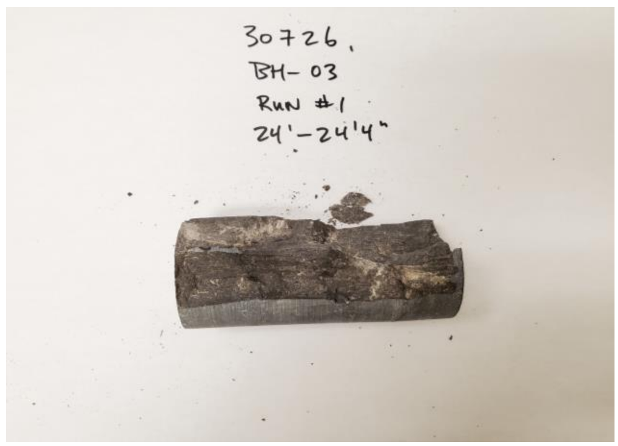
CLIENT:	R.V. Anderson Associates	FILE NUMBER:	30726
PROJECT NAME:	Napanee Water Pollution Control Plant	REPORT DATE:	28-Jun-21
BOREHOLE No.:	BH-03	TEST DATE:	28-Jun-21
SAMPLE No.:	NQ Run 1		
SAMPLE DEPTH:	24'0" - 24'4"		
DESCRIPTION:	Limestone		

Avg. Height (cm):	10.3	Weight (g):	488.8
Avg. Diameter (cm):	4.7	Wet Density (kg/m^3):	2,693
H. to Dia. Ratio**:	2.2:1	Dry Density (kg/m^3):	2,693
Cross Sectional Area (cm^2):	17.57	Moisture Content* (%):	N/A
Sample Volume (cm^3):	181.51		

ORIGINAL SPECIMEN



FRACTURED SPECIMEN



AVERAGE LOADING RATE TO FAILURE:	0.250 MPa/s
MAXIMUM COMPRESSIVE LOAD:	229.5 kN
UNCONFINED COMPRESSIVE STRENGTH:	130.6 MPa

Note: * Dimensions of Specimen conform to ASTM D 4543-04.

TEST DONE BY: BT
REVIEWED BY: WM

THURBER ENGINEERING LTD.

APPENDIX E

Bedrock Core Photographs

Napanee Water Pollution Control Plant

Photographs of Rock Core

Borehole BH-01 – Run 1 – 7.06-8.59 m

Borehole BH-01 – Run 2 – 8.59-10.19m

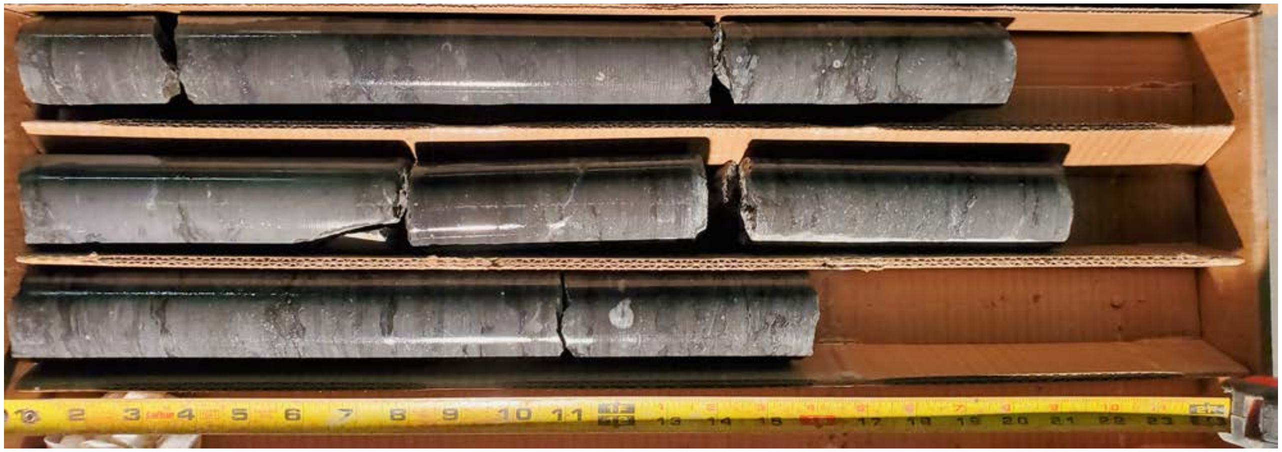
Napanee Water Pollution Control Plant
Photographs of Rock Core

Borehole BH-02 – Run 1 – 5.69-7.39 m

Borehole BH-02 – Run 2 – 7.39-8.84 m

Napanee Water Pollution Control Plant
Photographs of Rock Core

Borehole BH-03 – Run 1 – 7.21-8.74 m



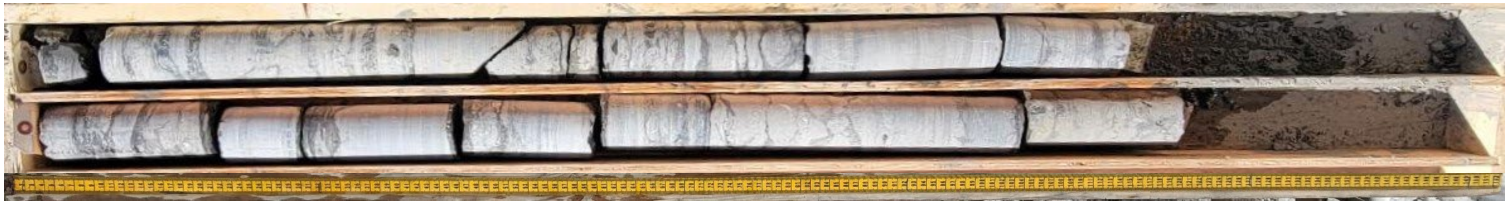
Borehole BH-03 – Run 2 – 8.74-10.26 m

Borehole MW 24-101

Runs 1 to 2
Depth 7.3 m to 9.7 m
Elevation 71.6 m to 69.2 m
Dry Sample

Run 1 Start
elev. 71.6 m

Run 1 End
elev. 70.4 m



Run 2 Start
elev. 70.4 m

Run 2 End
elev. 69.2 m

THURBER ENGINEERING LTD.

Geotechnical Investigation
Water Pollution Control Plant
City of Great Napanee

BH MW 24-101
Project No.: 40745

Borehole MW 24-101

Runs 1 to 2
Depth 7.3 m to 9.7 m
Elevation 71.6 m to 69.2 m
Wet Sample

Run 1 Start
elev. 71.6 m

Run 1 End
elev. 70.4 m

Run 2 Start
elev. 70.4 m

Run 2 End
elev. 69.2 m

THURBER ENGINEERING LTD.

Geotechnical Investigation
Water Pollution Control Plant
City of Great Napanee

BH MW 24-101
Project No.: 40745

THURBER ENGINEERING LTD.

APPENDIX F

Corrosivity and Sulphate Analytical Test Results

Napanee Water Pollution Control Plant Expansion

Table F1 – Summary of Corrosivity Test Results

Sample ID	Depth (m)	Description	Chloride (µg/g)	Sulphate (µg/g)	pH	Conductivity (mS/cm)	Resistivity (ohm.cm)	Redox Potential (mV)	Acid Volatile Sulphides (mg/kg)
BH 01 SS2 CORR	0.8 – 1.4	Silty Clay Fill	12.4	88	7.78	0.393	2540	241	0.81
BH 03 SS2 CORR	0.8 1.4	Silty Clay	43.3	33	7.63	0.261	3830	260	0.36
BH 05 SS3 CORR	1.5 – 2.1	Silty Clay	30.7	26	7.70	0.208	4810	263	<0.20
BH 08 SS1 CORR	0 – 0.6	Silty Clay	7.0	<20	6.98	0.229	4370	286	<0.20
BH 19 SS1 CORR	0 – 0.6	Silty Clay Fill	14.7	147	7.64	0.319	3130	290	0.22
BH 25 SS3 CORR	1.5- 2.1	Granular Fill	114	45	10.04	0.603	1660	108	0.38
BH 26 SS3 CORR	1.5 – 2.1	Clayey Silt Fill	422	55	7.75	0.889	1120	245	0.20

Thurber Engineering Ltd. (Oakville)
ATTN: Rachel Bourssa
2010 Winston Park Drive
Unit 103
Oakville ON L6H 5R7

Date Received: 05-MAR-21
Report Date: 17-MAR-21 15:44 (MT)
Version: FINAL

Client Phone: 905-829-8666

Certificate of Analysis

Lab Work Order #: L2564163

Project P.O. #: NOT SUBMITTED
Job Reference: 30726
C of C Numbers:
Legal Site Desc:

Amanda Overholster
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2564163-1 BH 03 SS2 CORR Sampled By: CLIENT on 23-FEB-21 @ 15:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.261		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	23.4		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	7.63		0.10	pH units		15-MAR-21	R5401396
Redox Potential	260		-1000	mV		15-MAR-21	R5401275
Resistivity	3830		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	43.3		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	33		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	0.36		0.20	mg/kg	09-MAR-21	09-MAR-21	R5398510
L2564163-2 BH 05 SS3 CORR Sampled By: CLIENT on 23-FEB-21 @ 15:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.208		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	23.1		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	7.70		0.10	pH units		15-MAR-21	R5401396
Redox Potential	263		-1000	mV		15-MAR-21	R5401275
Resistivity	4810		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	30.7		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	26		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	<0.20		0.20	mg/kg	09-MAR-21	09-MAR-21	R5398510
L2564163-3 BH 08 SS1 CORR Sampled By: CLIENT on 26-FEB-21 @ 16:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.229		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	19.2		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	6.98		0.10	pH units		15-MAR-21	R5401396
Redox Potential	286		-1000	mV		15-MAR-21	R5401275
Resistivity	4370		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	7.0		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	<20		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	<0.20		0.20	mg/kg	10-MAR-21	10-MAR-21	R5399173
L2564163-4 BH 19 SS1 CORR Sampled By: CLIENT on 02-MAR-21 @ 09:00 Matrix: SOIL							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2564163-4 BH 19 SS1 CORR Sampled By: CLIENT on 02-MAR-21 @ 09:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.319		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	14.5		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	7.64		0.10	pH units		15-MAR-21	R5401396
Redox Potential	290		-1000	mV		15-MAR-21	R5401275
Resistivity	3130		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	14.7		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	147		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	0.22		0.20	mg/kg	11-MAR-21	11-MAR-21	R5399796
L2564163-5 BH 25 SS3 CORR Sampled By: CLIENT on 01-MAR-21 @ 17:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.603		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	11.6		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	10.04		0.10	pH units		15-MAR-21	R5401396
Redox Potential	108		-1000	mV		15-MAR-21	R5401276
Resistivity	1660		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	114		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	45		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	0.38		0.20	mg/kg	11-MAR-21	11-MAR-21	R5399796
L2564163-6 BH 26 SS3 CORR Sampled By: CLIENT on 01-MAR-21 @ 13:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.889		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	15.8		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	7.75		0.10	pH units		15-MAR-21	R5401396
Redox Potential	245		-1000	mV		15-MAR-21	R5401276
Resistivity	1120		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	422		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	55		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	0.20		0.20	mg/kg	11-MAR-21	11-MAR-21	R5399796
L2564163-7 BH 01 SS2 CORR Sampled By: CLIENT on 22-FEB-21 @ 08:00 Matrix: SOIL							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2564163-7 BH 01 SS2 CORR Sampled By: CLIENT on 22-FEB-21 @ 08:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.393		0.0040	mS/cm		16-MAR-21	R5401922
% Moisture	14.8		0.25	%	11-MAR-21	11-MAR-21	R5399499
pH	7.78		0.10	pH units		15-MAR-21	R5401396
Redox Potential	241		-1000	mV		15-MAR-21	R5401276
Resistivity	2540		1.0	ohm*cm		16-MAR-21	
Leachable Anions & Nutrients							
Chloride	12.4		5.0	ug/g	12-MAR-21	13-MAR-21	R5402621
Anions and Nutrients							
Sulphate	88		20	mg/kg	09-MAR-21	09-MAR-21	R5398993
Inorganic Parameters							
Acid Volatile Sulphides	0.81		0.20	mg/kg	08-MAR-21	08-MAR-21	R5397981

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-R511-WT	Soil	Chloride-O.Reg 153/04 (July 2011)	EPA 300.0

5 grams of dried soil is mixed with 10 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580

This analysis is carried out in accordance with the procedure described in the "APHA" method 2580 "Oxidation-Reduction Potential" 2012. Samples are extracted at a fixed ratio with DI water. Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

ALS Test Code	Matrix	Test Description	Method Reference**
RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B

"Soil Resistivity (calculated)" is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

ALS Test Code	Matrix	Test Description	Method Reference**
SO4-WT	Soil	Sulphate	EPA 300.0

5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

ALS Test Code	Matrix	Test Description	Method Reference**
SULPHIDE-WT	Soil	Sulphide, Acid Volatile	APHA 4500S2J

This analysis is carried out in accordance with the method described in APHA 4500 S2-J. Hydrochloric acid is added to sediment samples within a purge and trap system. The evolved hydrogen sulphide (H2S) is carried into a basic solution by inert gas. The acid volatile sulfide is then determined colourimetrically.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-R511-WT	**Soil**							
Batch R5402621								
WG3501458-3 CRM		**AN-CRM-WT**						
Chloride			110.1		%		70-130	13-MAR-21
WG3501458-4 DUP		**L2563776-5**						
Chloride		158	157		ug/g	0.2	30	13-MAR-21
WG3501458-2 LCS								
Chloride			99.6		%		80-120	13-MAR-21
WG3501458-1 MB								
Chloride			<5.0		ug/g		5	13-MAR-21
EC-WT	**Soil**							
Batch R5401922								
WG3502008-4 DUP		**WG3502008-3**						
Conductivity		0.170	0.180		mS/cm	5.7	20	16-MAR-21
WG3502008-2 IRM		**WT SAR4**						
Conductivity			104.2		%		70-130	16-MAR-21
WG3503074-1 LCS								
Conductivity			97.8		%		90-110	16-MAR-21
WG3502008-1 MB								
Conductivity			<0.0040		mS/cm		0.004	16-MAR-21
MOISTURE-WT	**Soil**							
Batch R5399499								
WG3500313-3 DUP		**L2564016-20**						
% Moisture		19.9	19.6		%	1.3	20	11-MAR-21
WG3500313-2 LCS								
% Moisture			100.2		%		90-110	11-MAR-21
WG3500313-1 MB								
% Moisture			<0.25		%		0.25	11-MAR-21
PH-WT	**Soil**							
Batch R5401396								
WG3500317-1 DUP		**L2564016-21**						
pH		7.98	7.94	J	pH units	0.04	0.3	15-MAR-21
WG3502480-1 LCS								
pH			7.02		pH units		6.9-7.1	15-MAR-21
REDOX-POTENTIAL-WT	**Soil**							
Batch R5401275								
WG3502204-1 CRM		**WT-REDOX**						
Redox Potential			102.7		%		80-120	15-MAR-21
WG3499681-2 DUP		**L2563836-1**						

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
REDOX-POTENTIAL-WT	**Soil**							
Batch R5401275								
WG3499681-2 DUP		**L2563836-1**						
Redox Potential		305	279		mV	8.9	25	15-MAR-21
Batch R5401276								
WG3502206-1 CRM		**WT-REDOX**						
Redox Potential			105.5		%		80-120	15-MAR-21
WG3500936-1 DUP		**L2563776-5**						
Redox Potential		257	237		mV	8.1	25	15-MAR-21
SO4-WT	**Soil**							
Batch R5398993								
WG3498947-4 CRM		**AN-CRM-WT**						
Sulphate			126.4		%		60-140	09-MAR-21
WG3498947-3 DUP		**L2564163-1**						
Sulphate		33	34		mg/kg	2.9	30	09-MAR-21
WG3498947-2 LCS								
Sulphate			101.4		%		80-120	09-MAR-21
WG3498947-1 MB								
Sulphate			<20		mg/kg		20	09-MAR-21
SULPHIDE-WT	**Soil**							
Batch R5397981								
WG3498428-3 DUP		**L2563017-1**						
Acid Volatile Sulphides		<0.20	<0.20	RPD-NA	mg/kg	N/A	45	08-MAR-21
WG3498428-2 LCS								
Acid Volatile Sulphides			103.8		%		70-130	08-MAR-21
WG3498428-1 MB								
Acid Volatile Sulphides			<0.20		mg/kg		0.2	08-MAR-21
Batch R5398510								
WG3499108-3 DUP		**L2563254-12**						
Acid Volatile Sulphides		0.50	0.55		mg/kg	8.6	45	09-MAR-21
WG3499108-2 LCS								
Acid Volatile Sulphides			109.6		%		70-130	09-MAR-21
WG3499108-1 MB								
Acid Volatile Sulphides			<0.20		mg/kg		0.2	09-MAR-21
Batch R5399173								
WG3499762-3 DUP		**L2563776-1**						
Acid Volatile Sulphides		6.9	7.2		mg/kg	4.3	45	10-MAR-21
WG3499762-2 LCS								

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SULPHIDE-WT	**Soil**							
Batch R5399173								
WG3499762-2 LCS								
Acid Volatile Sulphides			85.6		%		70-130	10-MAR-21
WG3499762-1 MB								
Acid Volatile Sulphides			<0.20		mg/kg		0.2	10-MAR-21
Batch R5399796								
WG3500439-3 DUP		**L2564163-4**						
Acid Volatile Sulphides		0.22	0.23		mg/kg	5.2	45	11-MAR-21
WG3500439-2 LCS								
Acid Volatile Sulphides			94.2		%		70-130	11-MAR-21
WG3500439-1 MB								
Acid Volatile Sulphides			<0.20		mg/kg		0.2	11-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS www.alsglobal.com

Chain of L2564163-COFC

COC Number: 20 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Thurber Engineering Ltd.
Contact:	Rachel Bourassa
Phone:	~~905-829-8666~~ 416 523 1015
	Company address below will appear on the final report
Street:	2010 Winston Park Drive, Suite 103
City/Province:	Oakville, Ontario
Postal Code:	L6H 5R7
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Thurber Engineering Ltd.
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☑ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax rbourassa@thurber.ca

Email 2

Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax accountingON@thurber.ca

Email 2

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information

ALS Account # / Quote #: 25053 / 84199

Job #: 30726

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): L2564163

ALS Contact: Amanda Overholster | Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O. Reg. 153/04 Metals & Inorganics	O. Reg. 153/04 BTEX/PHC F1-F4	O. Reg. 153/04 VOCs		Corrosivity	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH 03 SS2 Corr	23 Feb 21	3:00	Soil	1					✓			
	BH 05 SS3 Corr	23-Feb-21	3:00	"	1					✓			
	BH 08 SS1 Corr	26-Feb-21	4:00	"	1					✓			
	BH 19 SS1 Corr	02-Mar-21	9:00	"	1					✓			
	BH 25 SS3 Corr	01-Mar-21	5:00	"	1					✓			
	BH 26 SS3 Corr	01-Mar-21	1:00	"	1					✓			
	BH 01 SS2 Corr	22-Feb-21	8:00	"	1					✓			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 8.5

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rachel Bourassa	Date: March 5 /2021	Time:	Received by:	Date:	Time:	Received by:	Date: Mar 5/21	Time: 16:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

THURBER ENGINEERING LTD.

APPENDIX G

Soil and Groundwater Environmental Quality Summary Tables

Table G1
Summary of Soil Analytical Testing

BH Number	Sample ID	Sample Depth		Soil Description	Metals & Inorganics	PHCs	BTEX	VOCs	SPLP
		From (m)	To (m)						
BH-01	BH-01 SS1 (0'-2')	0.0	0.6	Silty Clay Fill	x	x	x		
BH-01	BH01 SPLP	NA	NA	Composite					x
BH-02	BH-02 SS5 (10'-12')	3.0	3.7	Silty Clay	x	x	x	x	
BH-03	BH-03 SS1 (0'-2')	0.0	0.6	Peat	x	x	x		
BH-04	BH-04 SS2 (2'6"-4'6")	0.8	1.4	Silty Clay	x	x	x	x	
BH-05	BH-05 SS8 (25'-27')	7.6	8.2	Clay Some Silt	x	x	x		
BH-05	BH05 SPLP	NA	NA	Composite					x
BH-06	BH-06 SS1 (0'-2')	0.0	0.6	Silty Clay Fill	x	x	x		
BH-06	BH-06 SS2 (2'6"-4'6")	0.8	1.4	Silty Clay			x	x	
BH-07	BH-07 SS6 (15'-17')	4.6	5.2	Silty Clay	x	x	x		
BH-08	BH-08 SS2 (2'6"-4'6")	0.8	1.4	Silt and Clay	x	x	x	x	
BH-08	BH08 SPLP	NA	NA	Composite					x
BH-10	BH-10 SS4 (7'6"-9'6")	2.3	2.9	Silty Clay	x	x	x	x	
BH-11	BH-11 SS1 (0'-2')	0.0	0.6	Clay	x	x	x		
BH-12	BH-12 SS3 (5'-7')	1.5	2.1	Sand some silt	x	x	x	x	
BH-12	BH12 SPLP	NA	NA	Composite					x
BH-13	BH-13 SS1 (0'-2')	0.0	0.6	Sand Fill	x	x	x		
BH-14	BH-14 SS2 (2'6"-4'6")	0.8	1.4	Clayey Silt	x	x	x	x	
BH-19	BH-19 SS4 (7'6" - 9'6")	2.3	2.9	Silt and Clay	x	x	x		
BH-20	BH-20 SS1 (0'-2')	0.0	0.6	Silty Clay	x	x	x		
BH-21	BH-21 SS3(5'-7')	1.5	2.1	Silty Clay	x	x	x	x	
BH-23	BH-23 SS1 (0'-2')	0.0	0.6	Clay Fill	x	x	x	x	
BH-24	BH-24 SS1 (0'-2')	0.0	0.6	Clay and Organics	x	x	x		
BH-25	BH-25 SS4 (7'6"-9'6")	2.3	2.9	Clay Some Silt	x	x	x	x	
BH-25	BH25	NA	NA	Composite					x
BH-26	BH-26 SS5 (10'-12')	3.0	3.7	Silt and Clay	x	x	x		

Table G2
Summary of O.Reg 153/04 Metals and Inorganics Results

				Client Sample ID	BH01 SS1 (0'-2')	BH02 SS5 (10-12)	BH03 SS1 (0'-2')	BH04 SS2 (2'6"-4'6")	BH 05 SS8 (25'-27')	BH06 SS1 (0'-2')	BH07 SS6 (15'-17')	BH08 SS2 (2'6"-4'6")	BH10 SS4 (7'6"-9'6")	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')
				Date Sampled	23-Feb-2021	22-Feb-2021	23-Feb-2021	24-Feb-2021	25-Feb-2021	24-Feb-2021	26-Feb-2021	26-Feb-2021	25-Feb-2021	25-Feb-2021	25-Feb-2021	2-Mar-2021
				Time Sampled	13:00	14:00	17:00	15:00	12:00	11:00	11:30	9:15	12:00	12:00	14:00	12:00
				ALS Sample ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5	L2564179-6	L2564179-8	L2564179-9	L2564179-10	L2564179-11	L2564179-12	L2564179-13
Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests (Soil)																
Conductivity	0.004	mS/cm	0.57	1.4	0.215	0.3	0.416	0.15	0.266	0.262	0.235	0.136	0.18	0.198	0.126	0.46
% Moisture	0.25	%			19.8	24.2	39.6	25.1	25.5	26	24.7	14.6	22.9	11.5	5.81	8.29
pH	0.1	pH units	5-9 (5-11)	5-9 (5-11)	7.71	7.89	7.32	7.52	8.25	7.34	7.85	7.65	7.84	7.26	8.19	7.76
Cyanides (Soil)																
Cyanide, Weak Acid Diss	0.05	ug/g	0.051	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables (Soil)																
SAR	0.1	SAR	2.4	12	1.57	0.46	1.45	0.42	0.34	<0.10	0.56	0.36	0.61	<0.10	0.11	***6.77***
Calcium (Ca)	0.5	mg/L			16.8	39.8	44.1	18.9	15.1	41.1	23.3	17.8	16.6	32.9	20	10.4
Magnesium (Mg)	0.5	mg/L			4.25	8.2	6.91	3.54	20.6	3.65	4.27	3.01	4.38	3.87	2.02	0.64
Sodium (Na)	0.5	mg/L			27.8	12.2	39.1	7.56	8.77	1.33	11.2	6.3	10.9	1.22	1.91	83.2
Metals (Soil)																
Antimony (Sb)	1	ug/g	1.3	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	1	ug/g	18	18	4	2.5	3	4.5	2.5	4.7	1.5	3.4	2	5.7	1.3	1.3
Barium (Ba)	1	ug/g	220	670	***359***	***280***	210	***275***	***275***	***264***	***246***	206	171	104	41.5	58.8
Beryllium (Be)	0.5	ug/g	2.5	8	1.09	0.86	0.58	0.88	0.7	0.77	0.5	0.78	0.67	<0.50	<0.50	<0.50
Boron (B), Hot Water Ext.	0.1	ug/g	36	2	<0.10	<0.10	0.56	0.19	0.29	0.24	<0.10	0.1	<0.10	0.31	0.11	<0.10
Boron (B)	5	ug/g	36	120	16.9	12.8	8.9	10.1	18.5	10.4	7.8	12.2	10.8	7.9	8.6	6.6
Cadmium (Cd)	0.5	ug/g	1.2	1.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	1	ug/g	70	160	54.7	45.7	30.6	50.6	42.7	43.4	27.9	41	33.9	23.2	13.2	15.5
Cobalt (Co)	1	ug/g	21	80	17.8	14.3	8.3	12.4	11	12.7	10	11.5	11	7.5	3.7	5.4
Copper (Cu)	1	ug/g	92	230	34.3	28.1	26.6	29.5	21.7	31	18.9	26.3	21.6	17	9.8	11.5
Lead (Pb)	1	ug/g	120	120	11.9	7.8	59.1	7.9	6.2	62.4	4.9	6.5	6.4	22.6	5.7	3.7
Mercury (Hg)	0.005	ug/g	0.27	3.9	0.0116	0.0072	0.089	0.0126	<0.0050	0.122	<0.0050	0.0138	0.0067	0.0739	0.0642	0.0067
Molybdenum (Mo)	1	ug/g	2	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	1	ug/g	82	270	37.7	29.6	18.1	29.7	23.2	26.3	19.6	23.6	21.7	14.5	7.7	8.8
Selenium (Se)	1	ug/g	1.5	5.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	0.2	ug/g	0.5	40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	0.5	ug/g	1	3.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	1	ug/g	2.5	33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	1	ug/g	86	86	78.2	66.1	39.7	69.2	61.6	58.4	42.1	65.2	51.7	37.4	22.4	28.7
Zinc (Zn)	5	ug/g	290	340	93.5	75	148	72.9	55.2	135	51.4	56.3	55.1	60.8	23.6	29.2
Speciated Metals (Soil)																
Chromium, Hexavalent	0.2	ug/g	0.66	8	0.37	0.27	0.48	***1.1***	<0.20	0.33	<0.20	0.34	0.26	0.29	<0.20	0.27

BOLD	Vaule exceeds the MECP Table 1 Site Condition Standards
BOLD	Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G2
Summary of O.Reg 153/04 Metals and Inorganics Results

Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")	BH26 SS5 (10'-12')
				Date Sampled	1-Mar-2021	2-Mar-2021	26-Feb-2021	2-Mar-2021	26-Feb-2021	25-Feb-2021	1-Mar-2021	1-Mar-2021
				Time Sampled	14:00	14:00	12:00	11:00	10:00	16:00	11:00	15:30
				ALS Sample ID	L2564179-14	L2564179-15	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20	L2564179-21
					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests (Soil)												
Conductivity	0.004	mS/cm	0.57	1.4	***0.675***	0.379	0.296	***0.778***	0.405	0.34	0.289	0.238
% Moisture	0.25	%			27.4	26.9	27.1	27.5	16.2	20.5	28.4	23.2
pH	0.1	pH units	5-9 (5-11)	5-9 (5-11)	7.51	7.61	7.37	7.63	7.13	7.45	8.38	7.69
Cyanides (Soil)												
Cyanide, Weak Acid Diss	0.05	ug/g	0.051	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables (Soil)												
SAR	0.1	SAR	2.4	12	***7.16***	0.99	0.4	***8.93***	<0.10	0.97	0.88	1.24
Calcium (Ca)	0.5	mg/L			19.7	35.1	37.3	18	62.8	33.3	29.4	19.6
Magnesium (Mg)	0.5	mg/L			1.19	7.85	5.45	1.72	5.28	5.81	7.38	4.01
Sodium (Na)	0.5	mg/L			121	25	9.82	148	1.35	23.1	20.6	23.1
Metals (Soil)												
Antimony (Sb)	1	ug/g	1.3	40	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0
Arsenic (As)	1	ug/g	18	18	3	3.5	3	5	5.4	4.7	3.5	3.6
Barium (Ba)	1	ug/g	220	670	159	***298***	***276***	***783***	***248***	204	***380***	***242***
Beryllium (Be)	0.5	ug/g	2.5	8	0.63	0.94	0.79	1.43	0.74	0.69	1.09	0.76
Boron (B), Hot Water Ext.	0.1	ug/g	36	2	0.16	<0.10	0.35	0.11	0.47	0.24	<0.10	<0.10
Boron (B)	5	ug/g	36	120	9.3	13.2	12.3	14.5	11.3	10.9	17.2	11.1
Cadmium (Cd)	0.5	ug/g	1.2	1.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	1	ug/g	70	160	32.5	49.1	43.1	***70.8***	37.1	35.8	59.8	41.7
Cobalt (Co)	1	ug/g	21	80	9.3	16.8	10.9	***25.2***	11.8	11.5	17.9	14.4
Copper (Cu)	1	ug/g	92	230	39.6	31.2	25.9	48.3	31	24.1	36.2	26.6
Lead (Pb)	1	ug/g	120	120	69.5	8.8	10.7	13.4	62.6	13.9	9.8	7.4
Mercury (Hg)	0.005	ug/g	0.27	3.9	***1.06***	0.0094	0.0223	0.0102	0.187	0.0252	0.0228	0.0067
Molybdenum (Mo)	1	ug/g	2	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	1	ug/g	82	270	19.6	34.3	23.9	51.6	24.1	23.5	38.8	29.4
Selenium (Se)	1	ug/g	1.5	5.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	0.2	ug/g	0.5	40	***0.99***	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	0.5	ug/g	1	3.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	1	ug/g	2.5	33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	1	ug/g	86	86	46.9	73	59.8	***96.2***	53.5	55.3	83.1	64.4
Zinc (Zn)	5	ug/g	290	340	***326***	87.7	67	130	119	68.9	107	69.2
Speciated Metals (Soil)												
Chromium, Hexavalent	0.2	ug/g	0.66	8	0.36	0.41	***1.63***	0.38	<0.20	0.25	0.47	0.33

BOLD	Vaule exceeds the MECP Table 1 Site Condition Standards
BOLD (shaded)	Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G3
Summary of O.Reg 153/04 PHCs/VOCs Results

Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	BH01 SS1 (0'-2')	BH02 SS5 (10-12)	BH03 SS1 (0'-2')	BH04 SS2 (2'6"-4'6")	BH 05 SS8 (25'-27')
				Date Sampled	23-Feb-2021	22-Feb-2021	23-Feb-2021	24-Feb-2021	25-Feb-2021
				Time Sampled	13:00	14:00	17:00	15:00	12:00
				ALS Sample ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5
					Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	16		<0.50		<0.50	
Benzene	0.0068	ug/g	0.02	0.32	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	1.5		<0.050		<0.050	
Bromoform	0.05	ug/g	0.05	0.61		<0.050		<0.050	
Bromomethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Carbon tetrachloride	0.05	ug/g	0.05	0.21		<0.050		<0.050	
Chlorobenzene	0.05	ug/g	0.05	2.4		<0.050		<0.050	
Dibromochloromethane	0.05	ug/g	0.05	2.3		<0.050		<0.050	
Chloroform	0.05	ug/g	0.05	0.47		<0.050		<0.050	
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichlorobenzene	0.05	ug/g	0.05	1.2		<0.050		<0.050	
1,3-Dichlorobenzene	0.05	ug/g	0.05	9.6		<0.050		<0.050	
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.2		<0.050		<0.050	
Dichlorodifluoromethane	0.05	ug/g	0.05	16		<0.050		<0.050	
1,1-Dichloroethane	0.05	ug/g	0.05	0.47		<0.050		<0.050	
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1-Dichloroethylene	0.05	ug/g	0.05	0.064		<0.050		<0.050	
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	1.9		<0.050		<0.050	
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	1.3		<0.050		<0.050	
Methylene Chloride	0.05	ug/g	0.05	1.6		<0.050		<0.050	
1,2-Dichloropropane	0.05	ug/g	0.05	0.16		<0.050		<0.050	
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.059		<0.042		<0.042	
Ethylbenzene	0.018	ug/g	0.05	1.1	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	0.05	46		<0.050		<0.050	
Methyl Ethyl Ketone	0.5	ug/g	0.5	70		<0.50		<0.50	
Methyl Isobutyl Ketone	0.5	ug/g	0.5	31		<0.50		<0.50	
MTBE	0.05	ug/g	0.05	1.6		<0.050		<0.050	
Styrene	0.05	ug/g	0.05	34		<0.050		<0.050	
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.087		<0.050		<0.050	
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Tetrachloroethylene	0.05	ug/g	0.05	1.9		<0.050		<0.050	
Toluene	0.08	ug/g	0.2	6.4	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.05	6.1		<0.050		<0.050	
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Trichloroethylene	0.01	ug/g	0.05	0.55		<0.010		<0.010	
Trichlorofluoromethane	0.05	ug/g	0.25	4		<0.050		<0.050	
Vinyl chloride	0.02	ug/g	0.02	0.032		<0.020		<0.020	
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.05	26	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	55	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	55	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	230	<10	<10	<10	<10	<10
F3 (C16-C34)	50	ug/g	240	1700	136	<50	<50	<50	<50
F4 (C34-C50)	50	ug/g	120	3300	***290***	<50	<50	<50	<50
F4G-SG (GHH-Silica)	250	ug/g	120	3300	***1040***				
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	426	<72	<72	<72	<72

BOLD Vaule exceeds the MECP Table 1 Site Condition Standards

BOLD Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G3
Summary of O.Reg 153/04 PHCs/VOCs Results

				Client Sample ID	BH06 SS1 (0'-2')	BH06 SS2 (2'6"-4'6")	BH07 SS6 (15'-17')	BH08 SS2 (2'6"-4'6")	BH10 SS4 (7'6"-9'6")
				Date Sampled	24-Feb-2021	24-Feb-2021	26-Feb-2021	26-Feb-2021	25-Feb-2021
				Time Sampled	11:00	11:10	11:30	9:15	12:00
				ALS Sample ID	L2564179-6	L2564179-7	L2564179-8	L2564179-9	L2564179-10
Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	16		<0.50		<0.50	<0.50
Benzene	0.0068	ug/g	0.02	0.32	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	1.5		<0.050		<0.050	<0.050
Bromoform	0.05	ug/g	0.05	0.61		<0.050		<0.050	<0.050
Bromomethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Carbon tetrachloride	0.05	ug/g	0.05	0.21		<0.050		<0.050	<0.050
Chlorobenzene	0.05	ug/g	0.05	2.4		<0.050		<0.050	<0.050
Dibromochloromethane	0.05	ug/g	0.05	2.3		<0.050		<0.050	<0.050
Chloroform	0.05	ug/g	0.05	0.47		<0.050		<0.050	<0.050
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,2-Dichlorobenzene	0.05	ug/g	0.05	1.2		<0.050		<0.050	<0.050
1,3-Dichlorobenzene	0.05	ug/g	0.05	9.6		<0.050		<0.050	<0.050
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.2		<0.050		<0.050	<0.050
Dichlorodifluoromethane	0.05	ug/g	0.05	16		<0.050		<0.050	<0.050
1,1-Dichloroethane	0.05	ug/g	0.05	0.47		<0.050		<0.050	<0.050
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,1-Dichloroethylene	0.05	ug/g	0.05	0.064		<0.050		<0.050	<0.050
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	1.9		<0.050		<0.050	<0.050
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	1.3		<0.050		<0.050	<0.050
Methylene Chloride	0.05	ug/g	0.05	1.6		<0.050		<0.050	<0.050
1,2-Dichloropropane	0.05	ug/g	0.05	0.16		<0.050		<0.050	<0.050
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	<0.030
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	<0.030
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.059		<0.042		<0.042	<0.042
Ethylbenzene	0.018	ug/g	0.05	1.1	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	0.05	46		<0.050		<0.050	<0.050
Methyl Ethyl Ketone	0.5	ug/g	0.5	70		<0.50		<0.50	<0.50
Methyl Isobutyl Ketone	0.5	ug/g	0.5	31		<0.50		<0.50	<0.50
MTBE	0.05	ug/g	0.05	1.6		<0.050		<0.050	<0.050
Styrene	0.05	ug/g	0.05	34		<0.050		<0.050	<0.050
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.087		<0.050		<0.050	<0.050
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Tetrachloroethylene	0.05	ug/g	0.05	1.9		<0.050		<0.050	<0.050
Toluene	0.08	ug/g	0.2	6.4	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.05	6.1		<0.050		<0.050	<0.050
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Trichloroethylene	0.01	ug/g	0.05	0.55		<0.010		<0.010	<0.010
Trichlorofluoromethane	0.05	ug/g	0.25	4		<0.050		<0.050	<0.050
Vinyl chloride	0.02	ug/g	0.02	0.032		<0.020		<0.020	<0.020
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.05	26	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	55	<5.0		<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	55	<5.0		<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	230	<10		<10	<10	<10
F3 (C16-C34)	50	ug/g	240	1700	<50		<50	<50	<50
F4 (C34-C50)	50	ug/g	120	3300	<50		<50	<50	<50
F4G-SG (GHH-Silica)	250	ug/g	120	3300					
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	<72		<72	<72	<72

BOLD	Vaule exceeds the MECP Table 1 Site Condition Standards
BOLD	Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G3
Summary of O.Reg 153/04 PHCs/VOCs Results

				Client Sample ID	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")
				Date Sampled	25-Feb-2021	25-Feb-2021	2-Mar-2021	1-Mar-2021	2-Mar-2021
				Time Sampled	12:00	14:00	12:00	14:00	14:00
				ALS Sample ID	L2564179-11	L2564179-12	L2564179-13	L2564179-14	L2564179-15
Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	16		<0.50		<0.50	
Benzene	0.0068	ug/g	0.02	0.32	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	1.5		<0.050		<0.050	
Bromoform	0.05	ug/g	0.05	0.61		<0.050		<0.050	
Bromomethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Carbon tetrachloride	0.05	ug/g	0.05	0.21		<0.050		<0.050	
Chlorobenzene	0.05	ug/g	0.05	2.4		<0.050		<0.050	
Dibromochloromethane	0.05	ug/g	0.05	2.3		<0.050		<0.050	
Chloroform	0.05	ug/g	0.05	0.47		<0.050		<0.050	
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichlorobenzene	0.05	ug/g	0.05	1.2		<0.050		<0.050	
1,3-Dichlorobenzene	0.05	ug/g	0.05	9.6		<0.050		<0.050	
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.2		<0.050		<0.050	
Dichlorodifluoromethane	0.05	ug/g	0.05	16		<0.050		<0.050	
1,1-Dichloroethane	0.05	ug/g	0.05	0.47		<0.050		<0.050	
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1-Dichloroethylene	0.05	ug/g	0.05	0.064		<0.050		<0.050	
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	1.9		<0.050		<0.050	
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	1.3		<0.050		<0.050	
Methylene Chloride	0.05	ug/g	0.05	1.6		<0.050		<0.050	
1,2-Dichloropropane	0.05	ug/g	0.05	0.16		<0.050		<0.050	
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.059		<0.042		<0.042	
Ethylbenzene	0.018	ug/g	0.05	1.1	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	0.05	46		<0.050		<0.050	
Methyl Ethyl Ketone	0.5	ug/g	0.5	70		<0.50		<0.50	
Methyl Isobutyl Ketone	0.5	ug/g	0.5	31		<0.50		<0.50	
MTBE	0.05	ug/g	0.05	1.6		<0.050		<0.050	
Styrene	0.05	ug/g	0.05	34		<0.050		<0.050	
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.087		<0.050		<0.050	
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Tetrachloroethylene	0.05	ug/g	0.05	1.9		<0.050		<0.050	
Toluene	0.08	ug/g	0.2	6.4	<0.080	<0.080	<0.080	***0.275***	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.05	6.1		<0.050		<0.050	
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Trichloroethylene	0.01	ug/g	0.05	0.55		<0.010		<0.010	
Trichlorofluoromethane	0.05	ug/g	0.25	4		<0.050		<0.050	
Vinyl chloride	0.02	ug/g	0.02	0.032		<0.020		<0.020	
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.05	26	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	55	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	55	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	230	<10	<10	<10	<10	<10
F3 (C16-C34)	50	ug/g	240	1700	56	<50	<50	57	<50
F4 (C34-C50)	50	ug/g	120	3300	71	<50	<50	68	<50
F4G-SG (GHH-Silica)	250	ug/g	120	3300					
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	127	<72	<72	125	<72

BOLD	Vaule exceeds the MECP Table 1 Site Condition Standards
BOLD	Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G3
Summary of O.Reg 153/04 PHCs/VOCs Results

				Client Sample ID	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")
				Date Sampled	26-Feb-2021	2-Mar-2021	26-Feb-2021	25-Feb-2021	1-Mar-2021
				Time Sampled	12:00	11:00	10:00	16:00	11:00
				ALS Sample ID	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20
Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	16		<0.50	<0.50		<0.50
Benzene	0.0068	ug/g	0.02	0.32	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	1.5		<0.050	<0.050		<0.050
Bromoform	0.05	ug/g	0.05	0.61		<0.050	<0.050		<0.050
Bromomethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Carbon tetrachloride	0.05	ug/g	0.05	0.21		<0.050	<0.050		<0.050
Chlorobenzene	0.05	ug/g	0.05	2.4		<0.050	<0.050		<0.050
Dibromochloromethane	0.05	ug/g	0.05	2.3		<0.050	<0.050		<0.050
Chloroform	0.05	ug/g	0.05	0.47		<0.050	<0.050		<0.050
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,2-Dichlorobenzene	0.05	ug/g	0.05	1.2		<0.050	<0.050		<0.050
1,3-Dichlorobenzene	0.05	ug/g	0.05	9.6		<0.050	<0.050		<0.050
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.2		<0.050	<0.050		<0.050
Dichlorodifluoromethane	0.05	ug/g	0.05	16		<0.050	<0.050		<0.050
1,1-Dichloroethane	0.05	ug/g	0.05	0.47		<0.050	<0.050		<0.050
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,1-Dichloroethylene	0.05	ug/g	0.05	0.064		<0.050	<0.050		<0.050
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	1.9		<0.050	<0.050		<0.050
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	1.3		<0.050	<0.050		<0.050
Methylene Chloride	0.05	ug/g	0.05	1.6		<0.050	<0.050		<0.050
1,2-Dichloropropane	0.05	ug/g	0.05	0.16		<0.050	<0.050		<0.050
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030	<0.030		<0.030
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030	<0.030		<0.030
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.059		<0.042	<0.042		<0.042
Ethylbenzene	0.018	ug/g	0.05	1.1	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	0.05	46		<0.050	<0.050		<0.050
Methyl Ethyl Ketone	0.5	ug/g	0.5	70		<0.50	<0.50		<0.50
Methyl Isobutyl Ketone	0.5	ug/g	0.5	31		<0.50	<0.50		<0.50
MTBE	0.05	ug/g	0.05	1.6		<0.050	<0.050		<0.050
Styrene	0.05	ug/g	0.05	34		<0.050	<0.050		<0.050
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.087		<0.050	<0.050		<0.050
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Tetrachloroethylene	0.05	ug/g	0.05	1.9		<0.050	<0.050		<0.050
Toluene	0.08	ug/g	0.2	6.4	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.05	6.1		<0.050	<0.050		<0.050
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Trichloroethylene	0.01	ug/g	0.05	0.55		<0.010	<0.010		<0.010
Trichlorofluoromethane	0.05	ug/g	0.25	4		<0.050	<0.050		<0.050
Vinyl chloride	0.02	ug/g	0.02	0.032		<0.020	<0.020		<0.020
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.05	26	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	55	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	55	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	230	<10	<10	<10	<10	<10
F3 (C16-C34)	50	ug/g	240	1700	<50	<50	<50	<50	<50
F4 (C34-C50)	50	ug/g	120	3300	<50	<50	<50	<50	<50
F4G-SG (GHH-Silica)	250	ug/g	120	3300					
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	<72	<72	<72	<72	<72

BOLD Vaule exceeds the MECP Table 1 Site Condition Standards

BOLD (shaded) Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G3
Summary of O.Reg 153/04 PHCs/VOCs Results

				Client Sample ID	BH26 SS5 (10'-12')
				Date Sampled	1-Mar-2021
				Time Sampled	15:30
				ALS Sample ID	L2564179-21
Parameter	Lowest Detection Limit	Units	MECP Table 1	MECP Table 2 ICC	Soil
Volatile Organic Compounds (Soil)					
Acetone	0.5	ug/g	0.5	16	
Benzene	0.0068	ug/g	0.02	0.32	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	1.5	
Bromoform	0.05	ug/g	0.05	0.61	
Bromomethane	0.05	ug/g	0.05	0.05	
Carbon tetrachloride	0.05	ug/g	0.05	0.21	
Chlorobenzene	0.05	ug/g	0.05	2.4	
Dibromochloromethane	0.05	ug/g	0.05	2.3	
Chloroform	0.05	ug/g	0.05	0.47	
1,2-Dibromoethane	0.05	ug/g	0.05	0.05	
1,2-Dichlorobenzene	0.05	ug/g	0.05	1.2	
1,3-Dichlorobenzene	0.05	ug/g	0.05	9.6	
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.2	
Dichlorodifluoromethane	0.05	ug/g	0.05	16	
1,1-Dichloroethane	0.05	ug/g	0.05	0.47	
1,2-Dichloroethane	0.05	ug/g	0.05	0.05	
1,1-Dichloroethylene	0.05	ug/g	0.05	0.064	
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	1.9	
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	1.3	
Methylene Chloride	0.05	ug/g	0.05	1.6	
1,2-Dichloropropane	0.05	ug/g	0.05	0.16	
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV	
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV	
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.059	
Ethylbenzene	0.018	ug/g	0.05	1.1	<0.018
n-Hexane	0.05	ug/g	0.05	46	
Methyl Ethyl Ketone	0.5	ug/g	0.5	70	
Methyl Isobutyl Ketone	0.5	ug/g	0.5	31	
MTBE	0.05	ug/g	0.05	1.6	
Styrene	0.05	ug/g	0.05	34	
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.087	
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05	
Tetrachloroethylene	0.05	ug/g	0.05	1.9	
Toluene	0.08	ug/g	0.2	6.4	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.05	6.1	
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05	
Trichloroethylene	0.01	ug/g	0.05	0.55	
Trichlorofluoromethane	0.05	ug/g	0.25	4	
Vinyl chloride	0.02	ug/g	0.02	0.032	
o-Xylene	0.02	ug/g	NV	NV	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030
Xylenes (Total)	0.05	ug/g	0.05	26	<0.050
Hydrocarbons (Soil)					
F1 (C6-C10)	5	ug/g	25	55	<5.0
F1-BTEX	5	ug/g	25	55	<5.0
F2 (C10-C16)	10	ug/g	10	230	<10
F3 (C16-C34)	50	ug/g	240	1700	<50
F4 (C34-C50)	50	ug/g	120	3300	<50
F4G-SG (GHH-Silica)	250	ug/g	120	3300	
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	<72

BOLD	Vaule exceeds the MECP Table 1 Site Condition Standards
BOLD	Vaule exceeds the MECP Table 2 I/C/C Site Condition Standards

Table G4
Summary of O.Reg 406/19 Metals and Inorganics Results

				Client Sample ID	BH01 SS1 (0'-2')	BH02 SS5 (10-12)	BH03 SS1 (0'-2')	BH04 SS2 (2'6"-4'6")	BH 05 SS8 (25'-27')	BH06 SS1 (0'-2')	BH07 SS6 (15'-17')	BH08 SS2 (2'6"-4'6")	BH10 SS4 (7'6"-9'6")	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')
				Date Sampled	23-Feb-2021	22-Feb-2021	23-Feb-2021	24-Feb-2021	25-Feb-2021	24-Feb-2021	26-Feb-2021	26-Feb-2021	25-Feb-2021	25-Feb-2021	25-Feb-2021
				Time Sampled	13:00	14:00	17:00	15:00	12:00	11:00	11:30	9:15	12:00	12:00	14:00
				ALS Sample ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5	L2564179-6	L2564179-8	L2564179-9	L2564179-10	L2564179-11	L2564179-12
Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests (Soil)															
Conductivity	0.004	mS/cm	0.7	1.4	0.215	0.3	0.416	0.15	0.266	0.262	0.235	0.136	0.18	0.198	0.126
% Moisture	0.25	%			19.8	24.2	39.6	25.1	25.5	26	24.7	14.6	22.9	11.5	5.81
pH	0.1	pH units	5-9 (5-11)	5-9 (5-11)	7.71	7.89	7.32	7.52	8.25	7.34	7.85	7.65	7.84	7.26	8.19
Cyanides (Soil)															
Cyanide, Weak Acid Diss	0.05	ug/g	0.051	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables (Soil)															
SAR	0.1	SAR	5	12	1.57	0.46	1.45	0.42	0.34	<0.10	0.56	0.36	0.61	<0.10	0.11
Calcium (Ca)	0.5	mg/L			16.8	39.8	44.1	18.9	15.1	41.1	23.3	17.8	16.6	32.9	20
Magnesium (Mg)	0.5	mg/L			4.25	8.2	6.91	3.54	20.6	3.65	4.27	3.01	4.38	3.87	2.02
Sodium (Na)	0.5	mg/L			27.8	12.2	39.1	7.56	8.77	1.33	11.2	6.3	10.9	1.22	1.91
Metals (Soil)															
Antimony (Sb)	1	ug/g	7.5	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	1	ug/g	18	18	4	2.5	3	4.5	2.5	4.7	1.5	3.4	2	5.7	1.3
Barium (Ba)	1	ug/g	390	670	359	280	210	275	275	264	246	206	171	104	41.5
Beryllium (Be)	0.5	ug/g	4	8	1.09	0.86	0.58	0.88	0.7	0.77	0.5	0.78	0.67	<0.50	<0.50
Boron (B), Hot Water Ext.	0.1	ug/g	1.5	2	<0.10	<0.10	0.56	0.19	0.29	0.24	<0.10	0.1	<0.10	0.31	0.11
Boron (B)	5	ug/g	120	120	16.9	12.8	8.9	10.1	18.5	10.4	7.8	12.2	10.8	7.9	8.6
Cadmium (Cd)	0.5	ug/g	1.2	1.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	1	ug/g	160	160	54.7	45.7	30.6	50.6	42.7	43.4	27.9	41	33.9	23.2	13.2
Cobalt (Co)	1	ug/g	22	80	17.8	14.3	8.3	12.4	11	12.7	10	11.5	11	7.5	3.7
Copper (Cu)	1	ug/g	140	230	34.3	28.1	26.6	29.5	21.7	31	18.9	26.3	21.6	17	9.8
Lead (Pb)	1	ug/g	120	120	11.9	7.8	59.1	7.9	6.2	62.4	4.9	6.5	6.4	22.6	5.7
Mercury (Hg)	0.005	ug/g	0.27	0.27	0.0116	0.0072	0.089	0.0126	<0.0050	0.122	<0.0050	0.0138	0.0067	0.0739	0.0642
Molybdenum (Mo)	1	ug/g	6.9	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	1	ug/g	100	270	37.7	29.6	18.1	29.7	23.2	26.3	19.6	23.6	21.7	14.5	7.7
Selenium (Se)	1	ug/g	2.4	5.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	0.2	ug/g	20	40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	0.5	ug/g	1	3.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	1	ug/g	23	33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	1	ug/g	86	86	78.2	66.1	39.7	69.2	61.6	58.4	42.1	65.2	51.7	37.4	22.4
Zinc (Zn)	5	ug/g	340	340	93.5	75	148	72.9	55.2	135	51.4	56.3	55.1	60.8	23.6
Speciated Metals (Soil)															
Chromium, Hexavalent	0.2	ug/g	8	8	0.37	0.27	0.48	1.1	<0.20	0.33	<0.20	0.34	0.26	0.29	<0.20

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Standards
BOLD (shaded)	Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G4

Summary of O.Reg 406/19 Metals and Inorganics Results

Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")	BH26 SS5 (10'-12')
Client Sample ID					BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")	BH26 SS5 (10'-12')
Date Sampled					2-Mar-2021	1-Mar-2021	2-Mar-2021	26-Feb-2021	2-Mar-2021	26-Feb-2021	25-Feb-2021	1-Mar-2021	1-Mar-2021
Time Sampled					12:00	14:00	14:00	12:00	11:00	10:00	16:00	11:00	15:30
ALS Sample ID					L2564179-13	L2564179-14	L2564179-15	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20	L2564179-21
					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests (Soil)													
Conductivity	0.004	mS/cm	0.7	1.4	0.46	0.675	0.379	0.296	***0.778***	0.405	0.34	0.289	0.238
% Moisture	0.25	%			8.29	27.4	26.9	27.1	27.5	16.2	20.5	28.4	23.2
pH	0.1	pH units	5-9 (5-11)	5-9 (5-11)	7.76	7.51	7.61	7.37	7.63	7.13	7.45	8.38	7.69
Cyanides (Soil)													
Cyanide, Weak Acid Diss	0.05	ug/g	0.051	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables (Soil)													
SAR	0.1	SAR	5	12	***6.77***	***7.16***	0.99	0.4	***8.93***	<0.10	0.97	0.88	1.24
Calcium (Ca)	0.5	mg/L			10.4	19.7	35.1	37.3	18	62.8	33.3	29.4	19.6
Magnesium (Mg)	0.5	mg/L			0.64	1.19	7.85	5.45	1.72	5.28	5.81	7.38	4.01
Sodium (Na)	0.5	mg/L			83.2	121	25	9.82	148	1.35	23.1	20.6	23.1
Metals (Soil)													
Antimony (Sb)	1	ug/g	7.5	40	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0
Arsenic (As)	1	ug/g	18	18	1.3	3	3.5	3	5	5.4	4.7	3.5	3.6
Barium (Ba)	1	ug/g	390	670	58.8	159	298	276	***783***	248	204	380	242
Beryllium (Be)	0.5	ug/g	4	8	<0.50	0.63	0.94	0.79	1.43	0.74	0.69	1.09	0.76
Boron (B), Hot Water Ext.	0.1	ug/g	1.5	2	<0.10	0.16	<0.10	0.35	0.11	0.47	0.24	<0.10	<0.10
Boron (B)	5	ug/g	120	120	6.6	9.3	13.2	12.3	14.5	11.3	10.9	17.2	11.1
Cadmium (Cd)	0.5	ug/g	1.2	1.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	1	ug/g	160	160	15.5	32.5	49.1	43.1	70.8	37.1	35.8	59.8	41.7
Cobalt (Co)	1	ug/g	22	80	5.4	9.3	16.8	10.9	***25.2***	11.8	11.5	17.9	14.4
Copper (Cu)	1	ug/g	140	230	11.5	39.6	31.2	25.9	48.3	31	24.1	36.2	26.6
Lead (Pb)	1	ug/g	120	120	3.7	69.5	8.8	10.7	13.4	62.6	13.9	9.8	7.4
Mercury (Hg)	0.005	ug/g	0.27	0.27	0.0067	***1.06***	0.0094	0.0223	0.0102	0.187	0.0252	0.0228	0.0067
Molybdenum (Mo)	1	ug/g	6.9	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	1	ug/g	100	270	8.8	19.6	34.3	23.9	51.6	24.1	23.5	38.8	29.4
Selenium (Se)	1	ug/g	2.4	5.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	0.2	ug/g	20	40	<0.20	0.99	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	0.5	ug/g	1	3.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	1	ug/g	23	33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	1	ug/g	86	86	28.7	46.9	73	59.8	***96.2***	53.5	55.3	83.1	64.4
Zinc (Zn)	5	ug/g	340	340	29.2	326	87.7	67	130	119	68.9	107	69.2
Speciated Metals (Soil)													
Chromium, Hexavalent	0.2	ug/g	8	8	0.27	0.36	0.41	1.63	0.38	<0.20	0.25	0.47	0.33

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Standards
BOLD (shaded)	Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G5
Summary of O.Reg 406/19 PHCs/VOCs Results

				Client Sample ID	BH01 SS1 (0'-2')	BH02 SS5 (10-12)	BH03 SS1 (0'-2')	BH04 SS2 (2'6"-4'6")	BH 05 SS8 (25'-27')
				Date Sampled	23-Feb-2021	22-Feb-2021	23-Feb-2021	24-Feb-2021	25-Feb-2021
				Time Sampled	13:00	14:00	17:00	15:00	12:00
				ALS Sample ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5
Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	0.5		<0.50		<0.50	
Benzene	0.0068	ug/g	0.02	0.02	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Bromoform	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Bromomethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Carbon tetrachloride	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Chlorobenzene	0.05	ug/g	0.083	0.083		<0.050		<0.050	
Dibromochloromethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Chloroform	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichlorobenzene	0.05	ug/g	3.4	6.8		<0.050		<0.050	
1,3-Dichlorobenzene	0.05	ug/g	0.26	0.26		<0.050		<0.050	
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Dichlorodifluoromethane	0.05	ug/g	1.5	1.5		<0.050		<0.050	
1,1-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Methylene Chloride	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichloropropane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.05		<0.042		<0.042	
Ethylbenzene	0.018	ug/g	0.05	0.05	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	2.5	2.5		<0.050		<0.050	
Methyl Ethyl Ketone	0.5	ug/g	0.5	0.5		<0.50		<0.50	
Methyl Isobutyl Ketone	0.5	ug/g	0.5	0.5		<0.50		<0.50	
MTBE	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Styrene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Tetrachloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Toluene	0.08	ug/g	0.2	0.2	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.11	0.12		<0.050		<0.050	
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Trichloroethylene	0.01	ug/g	0.05	0.05		<0.010		<0.010	
Trichlorofluoromethane	0.05	ug/g	0.25	0.25		<0.050		<0.050	
Vinyl chloride	0.02	ug/g	0.02	0.02		<0.020		<0.020	
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.091	0.091	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	25	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	25	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	26	<10	<10	<10	<10	<10
F3 (C16-C34)	50	ug/g	240	240	136	<50	<50	<50	<50
F4 (C34-C50)	50	ug/g	2800	3300	290	<50	<50	<50	<50
F4G-SG (GHH-Silica)	250	ug/g	2800	3300	1040				
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	426	<72	<72	<72	<72

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Standards
BOLD	Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G5
Summary of O.Reg 406/19 PHCs/VOCs Results

Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	BH06 SS1 (0'-2')	BH06 SS2 (2'6"-4'6")	BH07 SS6 (15'-17')	BH08 SS2 (2'6"-4'6")	BH10 SS4 (7'6"-9'6")
Date Sampled					24-Feb-2021	24-Feb-2021	26-Feb-2021	26-Feb-2021	25-Feb-2021
Time Sampled					11:00	11:10	11:30	9:15	12:00
ALS Sample ID					L2564179-6	L2564179-7	L2564179-8	L2564179-9	L2564179-10
					Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	0.5		<0.50		<0.50	<0.50
Benzene	0.0068	ug/g	0.02	0.02	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Bromoform	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Bromomethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Carbon tetrachloride	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Chlorobenzene	0.05	ug/g	0.083	0.083		<0.050		<0.050	<0.050
Dibromochloromethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Chloroform	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,2-Dichlorobenzene	0.05	ug/g	3.4	6.8		<0.050		<0.050	<0.050
1,3-Dichlorobenzene	0.05	ug/g	0.26	0.26		<0.050		<0.050	<0.050
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Dichlorodifluoromethane	0.05	ug/g	1.5	1.5		<0.050		<0.050	<0.050
1,1-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,1-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Methylene Chloride	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,2-Dichloropropane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	<0.030
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	<0.030
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.05		<0.042		<0.042	<0.042
Ethylbenzene	0.018	ug/g	0.05	0.05	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	2.5	2.5		<0.050		<0.050	<0.050
Methyl Ethyl Ketone	0.5	ug/g	0.5	0.5		<0.50		<0.50	<0.50
Methyl Isobutyl Ketone	0.5	ug/g	0.5	0.5		<0.50		<0.50	<0.50
MTBE	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Styrene	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Tetrachloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Toluene	0.08	ug/g	0.2	0.2	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.11	0.12		<0.050		<0.050	<0.050
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	<0.050
Trichloroethylene	0.01	ug/g	0.05	0.05		<0.010		<0.010	<0.010
Trichlorofluoromethane	0.05	ug/g	0.25	0.25		<0.050		<0.050	<0.050
Vinyl chloride	0.02	ug/g	0.02	0.02		<0.020		<0.020	<0.020
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.091	0.091	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	25	<5.0		<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	25	<5.0		<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	26	<10		<10	<10	<10
F3 (C16-C34)	50	ug/g	240	240	<50		<50	<50	<50
F4 (C34-C50)	50	ug/g	2800	3300	<50		<50	<50	<50
F4G-SG (GHH-Silica)	250	ug/g	2800	3300					
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	<72		<72	<72	<72

BOLD Exceeds O.Reg 406/19 Table 2.1 RPI Standards

BOLD Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G5
Summary of O.Reg 406/19 PHCs/VOCs Results

				Client Sample ID	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")
				Date Sampled	25-Feb-2021	25-Feb-2021	2-Mar-2021	1-Mar-2021	2-Mar-2021
				Time Sampled	12:00	14:00	12:00	14:00	14:00
				ALS Sample ID	L2564179-11	L2564179-12	L2564179-13	L2564179-14	L2564179-15
Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	0.5		<0.50		<0.50	
Benzene	0.0068	ug/g	0.02	0.02	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Bromoform	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Bromomethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Carbon tetrachloride	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Chlorobenzene	0.05	ug/g	0.083	0.083		<0.050		<0.050	
Dibromochloromethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Chloroform	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichlorobenzene	0.05	ug/g	3.4	6.8		<0.050		<0.050	
1,3-Dichlorobenzene	0.05	ug/g	0.26	0.26		<0.050		<0.050	
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Dichlorodifluoromethane	0.05	ug/g	1.5	1.5		<0.050		<0.050	
1,1-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Methylene Chloride	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,2-Dichloropropane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030		<0.030	
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.05		<0.042		<0.042	
Ethylbenzene	0.018	ug/g	0.05	0.05	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	2.5	2.5		<0.050		<0.050	
Methyl Ethyl Ketone	0.5	ug/g	0.5	0.5		<0.50		<0.50	
Methyl Isobutyl Ketone	0.5	ug/g	0.5	0.5		<0.50		<0.50	
MTBE	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Styrene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Tetrachloroethylene	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Toluene	0.08	ug/g	0.2	0.2	<0.080	<0.080	<0.080	***0.275***	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.11	0.12		<0.050		<0.050	
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050		<0.050	
Trichloroethylene	0.01	ug/g	0.05	0.05		<0.010		<0.010	
Trichlorofluoromethane	0.05	ug/g	0.25	0.25		<0.050		<0.050	
Vinyl chloride	0.02	ug/g	0.02	0.02		<0.020		<0.020	
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.091	0.091	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	25	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	25	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	26	<10	<10	<10	<10	<10
F3 (C16-C34)	50	ug/g	240	240	56	<50	<50	57	<50
F4 (C34-C50)	50	ug/g	2800	3300	71	<50	<50	68	<50
F4G-SG (GHH-Silica)	250	ug/g	2800	3300					
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	127	<72	<72	125	<72

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Standards
BOLD (shaded)	Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G5
Summary of O.Reg 406/19 PHCs/VOCs Results

Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")
Date Sampled					26-Feb-2021	2-Mar-2021	26-Feb-2021	25-Feb-2021	1-Mar-2021
Time Sampled					12:00	11:00	10:00	16:00	11:00
ALS Sample ID					L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20
					Soil	Soil	Soil	Soil	Soil
Volatile Organic Compounds (Soil)									
Acetone	0.5	ug/g	0.5	0.5		<0.50	<0.50		<0.50
Benzene	0.0068	ug/g	0.02	0.02	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Bromoform	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Bromomethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Carbon tetrachloride	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Chlorobenzene	0.05	ug/g	0.083	0.083		<0.050	<0.050		<0.050
Dibromochloromethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Chloroform	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,2-Dibromoethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,2-Dichlorobenzene	0.05	ug/g	3.4	6.8		<0.050	<0.050		<0.050
1,3-Dichlorobenzene	0.05	ug/g	0.26	0.26		<0.050	<0.050		<0.050
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Dichlorodifluoromethane	0.05	ug/g	1.5	1.5		<0.050	<0.050		<0.050
1,1-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,2-Dichloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,1-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Methylene Chloride	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,2-Dichloropropane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030	<0.030		<0.030
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV		<0.030	<0.030		<0.030
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.05		<0.042	<0.042		<0.042
Ethylbenzene	0.018	ug/g	0.05	0.05	<0.018	<0.018	<0.018	<0.018	<0.018
n-Hexane	0.05	ug/g	2.5	2.5		<0.050	<0.050		<0.050
Methyl Ethyl Ketone	0.5	ug/g	0.5	0.5		<0.50	<0.50		<0.50
Methyl Isobutyl Ketone	0.5	ug/g	0.5	0.5		<0.50	<0.50		<0.50
MTBE	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Styrene	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Tetrachloroethylene	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Toluene	0.08	ug/g	0.2	0.2	<0.080	<0.080	<0.080	<0.080	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.11	0.12		<0.050	<0.050		<0.050
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05		<0.050	<0.050		<0.050
Trichloroethylene	0.01	ug/g	0.05	0.05		<0.010	<0.010		<0.010
Trichlorofluoromethane	0.05	ug/g	0.25	0.25		<0.050	<0.050		<0.050
Vinyl chloride	0.02	ug/g	0.02	0.02		<0.020	<0.020		<0.020
o-Xylene	0.02	ug/g	NV	NV	<0.020	<0.020	<0.020	<0.020	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030	<0.030	<0.030	<0.030	<0.030
Xylenes (Total)	0.05	ug/g	0.091	0.091	<0.050	<0.050	<0.050	<0.050	<0.050
Hydrocarbons (Soil)									
F1 (C6-C10)	5	ug/g	25	25	<5.0	<5.0	<5.0	<5.0	<5.0
F1-BTEX	5	ug/g	25	25	<5.0	<5.0	<5.0	<5.0	<5.0
F2 (C10-C16)	10	ug/g	10	26	<10	<10	<10	<10	<10
F3 (C16-C34)	50	ug/g	240	240	<50	<50	<50	<50	<50
F4 (C34-C50)	50	ug/g	2800	3300	<50	<50	<50	<50	<50
F4G-SG (GHH-Silica)	250	ug/g	2800	3300					
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	<72	<72	<72	<72	<72

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Standards
BOLD (shaded)	Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G5
Summary of O.Reg 406/19 PHCs/VOCs Results

Parameter	Lowest Detection Limit	Units	O.Reg 406 Table 2.1 RPI	O.Reg 406 Table 2.1 ICC	Soil
				Client Sample ID	BH26 SS5 (10'-12')
				Date Sampled	1-Mar-2021
				Time Sampled	15:30
				ALS Sample ID	L2564179-21
Volatile Organic Compounds (Soil)					
Acetone	0.5	ug/g	0.5	0.5	
Benzene	0.0068	ug/g	0.02	0.02	<0.0068
Bromodichloromethane	0.05	ug/g	0.05	0.05	
Bromoform	0.05	ug/g	0.05	0.05	
Bromomethane	0.05	ug/g	0.05	0.05	
Carbon tetrachloride	0.05	ug/g	0.05	0.05	
Chlorobenzene	0.05	ug/g	0.083	0.083	
Dibromochloromethane	0.05	ug/g	0.05	0.05	
Chloroform	0.05	ug/g	0.05	0.05	
1,2-Dibromoethane	0.05	ug/g	0.05	0.05	
1,2-Dichlorobenzene	0.05	ug/g	3.4	6.8	
1,3-Dichlorobenzene	0.05	ug/g	0.26	0.26	
1,4-Dichlorobenzene	0.05	ug/g	0.05	0.05	
Dichlorodifluoromethane	0.05	ug/g	1.5	1.5	
1,1-Dichloroethane	0.05	ug/g	0.05	0.05	
1,2-Dichloroethane	0.05	ug/g	0.05	0.05	
1,1-Dichloroethylene	0.05	ug/g	0.05	0.05	
cis-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05	
trans-1,2-Dichloroethylene	0.05	ug/g	0.05	0.05	
Methylene Chloride	0.05	ug/g	0.05	0.05	
1,2-Dichloropropane	0.05	ug/g	0.05	0.05	
cis-1,3-Dichloropropene	0.03	ug/g	NV	NV	
trans-1,3-Dichloropropene	0.03	ug/g	NV	NV	
1,3-Dichloropropene (cis & trans)	0.042	ug/g	0.05	0.05	
Ethylbenzene	0.018	ug/g	0.05	0.05	<0.018
n-Hexane	0.05	ug/g	2.5	2.5	
Methyl Ethyl Ketone	0.5	ug/g	0.5	0.5	
Methyl Isobutyl Ketone	0.5	ug/g	0.5	0.5	
MTBE	0.05	ug/g	0.05	0.05	
Styrene	0.05	ug/g	0.05	0.05	
1,1,1,2-Tetrachloroethane	0.05	ug/g	0.05	0.05	
1,1,2,2-Tetrachloroethane	0.05	ug/g	0.05	0.05	
Tetrachloroethylene	0.05	ug/g	0.05	0.05	
Toluene	0.08	ug/g	0.2	0.2	<0.080
1,1,1-Trichloroethane	0.05	ug/g	0.11	0.12	
1,1,2-Trichloroethane	0.05	ug/g	0.05	0.05	
Trichloroethylene	0.01	ug/g	0.05	0.05	
Trichlorofluoromethane	0.05	ug/g	0.25	0.25	
Vinyl chloride	0.02	ug/g	0.02	0.02	
o-Xylene	0.02	ug/g	NV	NV	<0.020
m+p-Xylenes	0.03	ug/g	NV	NV	<0.030
Xylenes (Total)	0.05	ug/g	0.091	0.091	<0.050
Hydrocarbons (Soil)					
F1 (C6-C10)	5	ug/g	25	25	<5.0
F1-BTEX	5	ug/g	25	25	<5.0
F2 (C10-C16)	10	ug/g	10	26	<10
F3 (C16-C34)	50	ug/g	240	240	<50
F4 (C34-C50)	50	ug/g	2800	3300	<50
F4G-SG (GHH-Silica)	250	ug/g	2800	3300	
Total Hydrocarbons (C6-C50)	72	ug/g	NV	NV	<72

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Standards
BOLD	Exceeds O.Reg 406/19 Table 2.1 ICC Standards

Table G6
Summary of SPLP Results

				Client Sample ID	BH01 SPLP	BH05 SPLP	BH08 SPLP	BH12 SPLP	BH25 SPLP
				Date Sampled	23-Feb-2021	25-Feb-2021	26-Feb-2021	25-Feb-2021	1-Mar-2021
				Time Sampled	14:00	17:00	12:00	14:00	11:30
				ALS Sample ID	L2564174-1	L2564174-2	L2564174-3	L2564174-4	L2564174-5
Parameter	Table 2.1 RPI LSL	Table 2.1 ICC LSL	Lowest Detection Limit	Units	Composite Soil	Composite Soil	Composite Soil	Composite Soil	Composite Soil
Volatile Organic Compounds									
1,3-Dichloropropene (cis & trans)	NV	NV	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
Sample Preparation									
Initial pH	NV	NV	0.1	pH units	9.21	9.18	9.42	9.06	9.39
Final pH	NV	NV	0.1	pH units	9.05	8.95	9.08	9.07	9.37
SPLP Metals									
Antimony (Sb)	6	6	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic (As)	NV	NV	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0
Barium (Ba)	1000	1000	100	ug/L	<100	<100	<100	<100	<100
Beryllium (Be)	4	4	2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	5000	5000	500	ug/L	<500	<500	<500	<500	<500
Cadmium (Cd)	NV	0.5	0.1	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium (Cr)	50	50	5	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt (Co)	3.8	3.8	2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0
Copper (Cu)	14	14	10	ug/L	<10	<10	<10	<10	<10
Lead (Pb)	NV	NV	2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0
Molybdenum (Mo)	23	23	10	ug/L	<10	<10	<10	<10	<10
Nickel (Ni)	78	78	20	ug/L	<20	<20	<20	<20	<20
Selenium (Se)	10	10	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	0.3	0.3	0.25	ug/L	<0.25	<0.25	<0.25	<0.25	<0.25
Thallium (Tl)	2	2	0.8	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80
Uranium (U)	20	20	15	ug/L	<15	<15	<15	<15	<15
Vanadium (V)	NV	NV	5	ug/L	11.2	<5.0	6.5	8	7.8
Zinc (Zn)	180	180	30	ug/L	<30	<30	<30	<30	<30
SPLP VOCs									
Bromomethane	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon tetrachloride	0.2	0.2	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroform	NV	NV	1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylene dibromide	0.2	0.2	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20
1,2-Dichlorobenzene	0.55	0.55	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethane	NV	NV	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethylene	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,2-Dichloroethylene	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethylene	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,3-Dichloropropene	NV	NV	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20
trans-1,3-Dichloropropene	NV	NV	0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,1,2-Tetrachloroethane	NV	NV	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethylene	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	NV	NV	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50
Trichloroethylene	0.5	0.5	0.5	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50

BOLD	Exceeds O.Reg 406/19 Table 2.1 RPI Leachate Screening Levels
BOLD	Exceeds O.Reg 406/19 Table 2.1 ICC Leachate Screening Levels

Table G7

Summary of Soil Gas/Vapour Headspace Readings

BH ID	BH01		BH02		BH03		BH04		BH05		BH06		BH07		BH08		BH09		BH10		BH11	
Sample ID	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)
SS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	---	---
SS3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
SS5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					0	0
SS6	0	0	0	0	0	0	0	0	0	0	0	0			0	0						
SS7	0	0	0	0	0	0	0	0	0	0					0	0						
SS8							0	0	0	0												
SS9									0	0												
SS10									0	0												

BH ID	BH12		BH13		BH14		BH19		BH20		BH21		BH22		BH23		BH24		BH25		BH26	
Sample ID	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)	HEX (ppm)	IBL (ppm)
SS1	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS3	0	0	0	0	0	0	0	0	0	0	0	0	---	---	0	0	0	0	0	0	0	0
SS4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS5	0	0	0	0	0	0	0	0											0	0	0	0
SS6																			0	0	0	0
SS7																			0	0	0	0
SS8																			0	0	0	0
SS9																						
SS10																						

APPENDIX H

Environmental Laboratory Certificates of Analysis

Thurber Engineering Ltd. (Oakville)
ATTN: Rachel Bourssa
2010 Winston Park Drive
Unit 103
Oakville ON L6H 5R7

Date Received: 05-MAR-21
Report Date: 07-APR-21 11:58 (MT)
Version: FINAL REV. 2

Client Phone: 905-829-8666

Certificate of Analysis

Lab Work Order #: L2564179

Project P.O. #: NOT SUBMITTED
Job Reference: 30726
C of C Numbers:
Legal Site Desc:

Comments: 07-APR-21 Revised report comparing to Reg 153 Table 1&2 RPIICC per client request. - A.Overholster

Amanda Overholster
Account Manager

Environmental

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5	L2564179-6	L2564179-7	L2564179-8	L2564179-9	L2564179-10
		Sampled Date	23-FEB-21	22-FEB-21	23-FEB-21	24-FEB-21	25-FEB-21	24-FEB-21	24-FEB-21	26-FEB-21	26-FEB-21	25-FEB-21
		Sampled Time	13:00	14:00	17:00	15:00	12:00	11:00	11:10	11:30	09:15	12:00
		Sample ID	BH01 SS1 (0'-2')	BH02 SS5 (10-12)	BH03 SS1 (0'-2')	BH04 SS2 (2'6"-4'6")	BH 05 SS8 (25'-27')	BH06 SS1 (0'-2')	BH06 SS2 (2'6"-4'6")	BH07 SS6 (15'-17')	BH08 SS2 (2'6"-4'6")	BH10 SS4 (7'6"-9'6")
Grouping	Analyte	Unit										
Physical Tests	Conductivity	mS/cm	0.215	0.300	0.416	0.150	0.266	0.262		0.235	0.136	0.180
	% Moisture	%	19.8	24.2	39.6	25.1	25.5	26.0	24.1	24.7	14.6	22.9
	pH	pH units	7.71	7.89	7.32	7.52	8.25	7.34		7.85	7.65	7.84
Cyanides	Cyanide, Weak Acid Diss	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050		<0.050	<0.050	<0.050
Saturated Paste Extractables	SAR	SAR	1.57	0.46	1.45	0.42	0.34	<0.10		0.56	0.36	0.61
	Calcium (Ca)	mg/L	16.8	39.8	44.1	18.9	15.1	41.1		23.3	17.8	16.6
	Magnesium (Mg)	mg/L	4.25	8.20	6.91	3.54	20.6	3.65		4.27	3.01	4.38
	Sodium (Na)	mg/L	27.8	12.2	39.1	7.56	8.77	1.33		11.2	6.30	10.9
Metals	Antimony (Sb)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0
	Arsenic (As)	ug/g	4.0	2.5	3.0	4.5	2.5	4.7		1.5	3.4	2.0
	Barium (Ba)	ug/g	359	280	210	275	275	264		246	206	171
	Beryllium (Be)	ug/g	1.09	0.86	0.58	0.88	0.70	0.77		0.50	0.78	0.67
	Boron (B)	ug/g	16.9	12.8	8.9	10.1	18.5	10.4		7.8	12.2	10.8
	Boron (B), Hot Water Ext.	ug/g	<0.10	<0.10	0.56	0.19	0.29	0.24		<0.10	0.10	<0.10
	Cadmium (Cd)	ug/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		<0.50	<0.50	<0.50
	Chromium (Cr)	ug/g	54.7	45.7	30.6	50.6	42.7	43.4		27.9	41.0	33.9
	Cobalt (Co)	ug/g	17.8	14.3	8.3	12.4	11.0	12.7		10.0	11.5	11.0
	Copper (Cu)	ug/g	34.3	28.1	26.6	29.5	21.7	31.0		18.9	26.3	21.6
	Lead (Pb)	ug/g	11.9	7.8	59.1	7.9	6.2	62.4		4.9	6.5	6.4
	Mercury (Hg)	ug/g	0.0116	0.0072	0.0890	0.0126	<0.0050	0.122		<0.0050	0.0138	0.0067
	Molybdenum (Mo)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0
	Nickel (Ni)	ug/g	37.7	29.6	18.1	29.7	23.2	26.3		19.6	23.6	21.7
	Selenium (Se)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0
	Silver (Ag)	ug/g	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20		<0.20	<0.20	<0.20

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

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Grouping	Analyte	Unit	L2564179-11	L2564179-12	L2564179-13	L2564179-14	L2564179-15	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20
		Sampled Date	25-FEB-21	25-FEB-21	02-MAR-21	01-MAR-21	02-MAR-21	26-FEB-21	02-MAR-21	26-FEB-21	25-FEB-21	01-MAR-21
		Sampled Time	12:00	14:00	12:00	14:00	14:00	12:00	11:00	10:00	16:00	11:00
		Sample ID	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")
Physical Tests	Conductivity	mS/cm	0.198	0.126	0.460	0.675	0.379	0.296	0.778	0.405	0.340	0.289
	% Moisture	%	11.5	5.81	8.29	27.4	26.9	27.1	27.5	16.2	20.5	28.4
	pH	pH units	7.26	8.19	7.76	7.51	7.61	7.37	7.63	7.13	7.45	8.38
Cyanides	Cyanide, Weak Acid Diss	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables	SAR	SAR	<0.10	0.11	6.77	7.16	0.99	0.40	8.93	<0.10	0.97	0.88
	Calcium (Ca)	mg/L	32.9	20.0	10.4	19.7	35.1	37.3	18.0	62.8	33.3	29.4
	Magnesium (Mg)	mg/L	3.87	2.02	0.64	1.19	7.85	5.45	1.72	5.28	5.81	7.38
	Sodium (Na)	mg/L	1.22	1.91	83.2	121	25.0	9.82	148	1.35	23.1	20.6
Metals	Antimony (Sb)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0
	Arsenic (As)	ug/g	5.7	1.3	1.3	3.0	3.5	3.0	5.0	5.4	4.7	3.5
	Barium (Ba)	ug/g	104	41.5	58.8	159	298	276	783	248	204	380
	Beryllium (Be)	ug/g	<0.50	<0.50	<0.50	0.63	0.94	0.79	1.43	0.74	0.69	1.09
	Boron (B)	ug/g	7.9	8.6	6.6	9.3	13.2	12.3	14.5	11.3	10.9	17.2
	Boron (B), Hot Water Ext.	ug/g	0.31	0.11	<0.10	0.16	<0.10	0.35	0.11	0.47	0.24	<0.10
	Cadmium (Cd)	ug/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Chromium (Cr)	ug/g	23.2	13.2	15.5	32.5	49.1	43.1	70.8	37.1	35.8	59.8
	Cobalt (Co)	ug/g	7.5	3.7	5.4	9.3	16.8	10.9	25.2	11.8	11.5	17.9
	Copper (Cu)	ug/g	17.0	9.8	11.5	39.6	31.2	25.9	48.3	31.0	24.1	36.2
	Lead (Pb)	ug/g	22.6	5.7	3.7	69.5	8.8	10.7	13.4	62.6	13.9	9.8
	Mercury (Hg)	ug/g	0.0739	0.0642	0.0067	DLHC 1.06	0.0094	0.0223	0.0102	0.187	0.0252	0.0228
	Molybdenum (Mo)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Nickel (Ni)	ug/g	14.5	7.7	8.8	19.6	34.3	23.9	51.6	24.1	23.5	38.8
	Selenium (Se)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)	ug/g	<0.20	<0.20	<0.20	0.99	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

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		ALS ID	L2564179-21
		Sampled Date	01-MAR-21
		Sampled Time	15:30
		Sample ID	BH26 SS5 (10'-12')
Grouping	Analyte	Unit	
Physical Tests	Conductivity	mS/cm	0.238
	% Moisture	%	23.2
	pH	pH units	7.69
Cyanides	Cyanide, Weak Acid Diss	ug/g	<0.050
Saturated Paste Extractables	SAR	SAR	1.24
	Calcium (Ca)	mg/L	19.6
	Magnesium (Mg)	mg/L	4.01
	Sodium (Na)	mg/L	23.1
Metals	Antimony (Sb)	ug/g	<1.0
	Arsenic (As)	ug/g	3.6
	Barium (Ba)	ug/g	242
	Beryllium (Be)	ug/g	0.76
	Boron (B)	ug/g	11.1
	Boron (B), Hot Water Ext.	ug/g	<0.10
	Cadmium (Cd)	ug/g	<0.50
	Chromium (Cr)	ug/g	41.7
	Cobalt (Co)	ug/g	14.4
	Copper (Cu)	ug/g	26.6
	Lead (Pb)	ug/g	7.4
	Mercury (Hg)	ug/g	0.0067
	Molybdenum (Mo)	ug/g	<1.0
	Nickel (Ni)	ug/g	29.4
	Selenium (Se)	ug/g	<1.0
	Silver (Ag)	ug/g	<0.20

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5	L2564179-6	L2564179-7	L2564179-8	L2564179-9	L2564179-10
		Sampled Date	23-FEB-21	22-FEB-21	23-FEB-21	24-FEB-21	25-FEB-21	24-FEB-21	24-FEB-21	26-FEB-21	26-FEB-21	25-FEB-21
		Sampled Time	13:00	14:00	17:00	15:00	12:00	11:00	11:10	11:30	09:15	12:00
		Sample ID	**BH01 SS1 (0'-2')**	**BH02 SS5 (10-12)**	**BH03 SS1 (0'-2')**	**BH04 SS2 (2'6"-4'6")**	**BH 05 SS8 (25'-27')**	**BH06 SS1 (0'-2')**	**BH06 SS2 (2'6"-4'6")**	**BH07 SS6 (15'-17')**	**BH08 SS2 (2'6"-4'6")**	**BH10 SS4 (7'6"-9'6")**
Grouping	Analyte	Unit										
Metals	Thallium (Tl)	ug/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50		<0.50	<0.50	<0.50
	Uranium (U)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0
	Vanadium (V)	ug/g	78.2	66.1	39.7	69.2	61.6	58.4		42.1	65.2	51.7
	Zinc (Zn)	ug/g	93.5	75.0	148	72.9	55.2	135		51.4	56.3	55.1
Speciated Metals	Chromium, Hexavalent	ug/g	0.37	0.27	0.48	1.10	<0.20	0.33		<0.20	0.34	0.26
Volatile Organic Compounds	Acetone	ug/g		<0.50		<0.50			<0.50		<0.50	<0.50
	Benzene	ug/g	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
	Bromodichloromethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Bromoform	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Bromomethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Carbon tetrachloride	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Chlorobenzene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Dibromochloromethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Chloroform	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,2-Dibromoethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,2-Dichlorobenzene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,3-Dichlorobenzene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,4-Dichlorobenzene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Dichlorodifluoromethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,1-Dichloroethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,2-Dichloroethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,1-Dichloroethylene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	cis-1,2-Dichloroethylene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	trans-1,2-Dichloroethylene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

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SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

Grouping	Analyte	Unit	L2564179-11	L2564179-12	L2564179-13	L2564179-14	L2564179-15	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20
	Sampled Date		25-FEB-21	25-FEB-21	02-MAR-21	01-MAR-21	02-MAR-21	26-FEB-21	02-MAR-21	26-FEB-21	25-FEB-21	01-MAR-21
	Sampled Time		12:00	14:00	12:00	14:00	14:00	12:00	11:00	10:00	16:00	11:00
	Sample ID		BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")
Metals	Thallium (Tl)	ug/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	ug/g	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Vanadium (V)	ug/g	37.4	22.4	28.7	46.9	73.0	59.8	96.2	53.5	55.3	83.1
	Zinc (Zn)	ug/g	60.8	23.6	29.2	326	87.7	67.0	130	119	68.9	107
Speciated Metals	Chromium, Hexavalent	ug/g	0.29	<0.20	0.27	0.36	0.41	1.63	0.38	<0.20	0.25	0.47
Volatile Organic Compounds	Acetone	ug/g		<0.50		<0.50			<0.50	<0.50		<0.50
	Benzene	ug/g	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
	Bromodichloromethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Bromoform	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Bromomethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Carbon tetrachloride	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Chlorobenzene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Dibromochloromethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Chloroform	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,2-Dibromoethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,2-Dichlorobenzene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,3-Dichlorobenzene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,4-Dichlorobenzene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Dichlorodifluoromethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,1-Dichloroethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,2-Dichloroethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,1-Dichloroethylene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	cis-1,2-Dichloroethylene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	trans-1,2-Dichloroethylene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-21
		Sampled Date	01-MAR-21
		Sampled Time	15:30
		Sample ID	BH26 SS5 (10'-12')
Grouping	Analyte	Unit	
Metals	Thallium (Tl)	ug/g	<0.50
	Uranium (U)	ug/g	<1.0
	Vanadium (V)	ug/g	64.4
	Zinc (Zn)	ug/g	69.2
Speciated Metals	Chromium, Hexavalent	ug/g	0.33
Volatile Organic Compounds	Acetone	ug/g	
	Benzene	ug/g	<0.0068
	Bromodichloromethane	ug/g	
	Bromoform	ug/g	
	Bromomethane	ug/g	
	Carbon tetrachloride	ug/g	
	Chlorobenzene	ug/g	
	Dibromochloromethane	ug/g	
	Chloroform	ug/g	
	1,2-Dibromoethane	ug/g	
	1,2-Dichlorobenzene	ug/g	
	1,3-Dichlorobenzene	ug/g	
	1,4-Dichlorobenzene	ug/g	
	Dichlorodifluoromethane	ug/g	
	1,1-Dichloroethane	ug/g	
	1,2-Dichloroethane	ug/g	
	1,1-Dichloroethylene	ug/g	
	cis-1,2-Dichloroethylene	ug/g	
	trans-1,2-Dichloroethylene	ug/g	

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5	L2564179-6	L2564179-7	L2564179-8	L2564179-9	L2564179-10
		Sampled Date	23-FEB-21	22-FEB-21	23-FEB-21	24-FEB-21	25-FEB-21	24-FEB-21	24-FEB-21	26-FEB-21	26-FEB-21	25-FEB-21
		Sampled Time	13:00	14:00	17:00	15:00	12:00	11:00	11:10	11:30	09:15	12:00
		Sample ID	**BH01 SS1 (0'-2')**	**BH02 SS5 (10-12)**	**BH03 SS1 (0'-2')**	**BH04 SS2 (2'6"-4'6")**	**BH 05 SS8 (25'-27')**	**BH06 SS1 (0'-2')**	**BH06 SS2 (2'6"-4'6")**	**BH07 SS6 (15'-17')**	**BH08 SS2 (2'6"-4'6")**	**BH10 SS4 (7'6"-9'6")**
Grouping	Analyte	Unit										
Volatile Organic Compounds	Methylene Chloride	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,2-Dichloropropane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	cis-1,3-Dichloropropene	ug/g		<0.030		<0.030			<0.030		<0.030	<0.030
	trans-1,3-Dichloropropene	ug/g		<0.030		<0.030			<0.030		<0.030	<0.030
	1,3-Dichloropropene (cis & trans)	ug/g		<0.042		<0.042			<0.042		<0.042	<0.042
	Ethylbenzene	ug/g	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
	n-Hexane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Methyl Ethyl Ketone	ug/g		<0.50		<0.50			<0.50		<0.50	<0.50
	Methyl Isobutyl Ketone	ug/g		<0.50		<0.50			<0.50		<0.50	<0.50
	MTBE	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Styrene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,1,1,2-Tetrachloroethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,1,2,2-Tetrachloroethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Tetrachloroethylene	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Toluene	ug/g	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
	1,1,1-Trichloroethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	1,1,2-Trichloroethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Trichloroethylene	ug/g		<0.010		<0.010			<0.010		<0.010	<0.010
	Trichlorofluoromethane	ug/g		<0.050		<0.050			<0.050		<0.050	<0.050
	Vinyl chloride	ug/g		<0.020		<0.020			<0.020		<0.020	<0.020
	o-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	m+p-Xylenes	ug/g	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Xylenes (Total)	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: 4-Bromofluorobenzene	%	104.9	94.3	102.6	91.1	100.1	102.3	91.9	96.0	94.4	93.8

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-11	L2564179-12	L2564179-13	L2564179-14	L2564179-15	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20
		Sampled Date	25-FEB-21	25-FEB-21	02-MAR-21	01-MAR-21	02-MAR-21	26-FEB-21	02-MAR-21	26-FEB-21	25-FEB-21	01-MAR-21
		Sampled Time	12:00	14:00	12:00	14:00	14:00	12:00	11:00	10:00	16:00	11:00
		Sample ID	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")
Grouping	**Analyte**	**Unit**										
Volatile Organic Compounds	Methylene Chloride	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,2-Dichloropropane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	cis-1,3-Dichloropropene	ug/g		<0.030		<0.030			<0.030	<0.030		<0.030
	trans-1,3-Dichloropropene	ug/g		<0.030		<0.030			<0.030	<0.030		<0.030
	1,3-Dichloropropene (cis & trans)	ug/g		<0.042		<0.042			<0.042	<0.042		<0.042
	Ethylbenzene	ug/g	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
	n-Hexane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Methyl Ethyl Ketone	ug/g		<0.50		<0.50			<0.50	<0.50		<0.50
	Methyl Isobutyl Ketone	ug/g		<0.50		<0.50			<0.50	<0.50		<0.50
	MTBE	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Styrene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,1,1,2-Tetrachloroethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,1,2,2-Tetrachloroethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Tetrachloroethylene	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Toluene	ug/g	<0.080	<0.080	<0.080	0.275	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
	1,1,1-Trichloroethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	1,1,2-Trichloroethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Trichloroethylene	ug/g		<0.010		<0.010			<0.010	<0.010		<0.010
	Trichlorofluoromethane	ug/g		<0.050		<0.050			<0.050	<0.050		<0.050
	Vinyl chloride	ug/g		<0.020		<0.020			<0.020	<0.020		<0.020
	o-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	m+p-Xylenes	ug/g	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Xylenes (Total)	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: 4-Bromofluorobenzene	%	103.2	99.9	108.1	100.0	104.9	97.1	94.7	108.6	104.0	90.0

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-21
		Sampled Date	01-MAR-21
		Sampled Time	15:30
		Sample ID	BH26 SS5 (10'-12')
Grouping	**Analyte**	**Unit**	
Volatile Organic Compounds	Methylene Chloride	ug/g	
	1,2-Dichloropropane	ug/g	
	cis-1,3-Dichloropropene	ug/g	
	trans-1,3-Dichloropropene	ug/g	
	1,3-Dichloropropene (cis & trans)	ug/g	
	Ethylbenzene	ug/g	<0.018
	n-Hexane	ug/g	
	Methyl Ethyl Ketone	ug/g	
	Methyl Isobutyl Ketone	ug/g	
	MTBE	ug/g	
	Styrene	ug/g	
	1,1,1,2-Tetrachloroethane	ug/g	
	1,1,2,2-Tetrachloroethane	ug/g	
	Tetrachloroethylene	ug/g	
	Toluene	ug/g	<0.080
	1,1,1-Trichloroethane	ug/g	
	1,1,2-Trichloroethane	ug/g	
	Trichloroethylene	ug/g	
	Trichlorofluoromethane	ug/g	
	Vinyl chloride	ug/g	
	o-Xylene	ug/g	<0.020
	m+p-Xylenes	ug/g	<0.030
	Xylenes (Total)	ug/g	<0.050
	Surrogate: 4-Bromofluorobenzene	%	106.7

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

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ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

Grouping	Analyte	Unit	L2564179-1	L2564179-2	L2564179-3	L2564179-4	L2564179-5	L2564179-6	L2564179-7	L2564179-8	L2564179-9	L2564179-10
		Sampled Date	23-FEB-21	22-FEB-21	23-FEB-21	24-FEB-21	25-FEB-21	24-FEB-21	24-FEB-21	26-FEB-21	26-FEB-21	25-FEB-21
		Sampled Time	13:00	14:00	17:00	15:00	12:00	11:00	11:10	11:30	09:15	12:00
		Sample ID	**BH01 SS1 (0'-2')**	**BH02 SS5 (10-12)**	**BH03 SS1 (0'-2')**	**BH04 SS2 (2'6"-4'6")**	**BH 05 SS8 (25'-27')**	**BH06 SS1 (0'-2')**	**BH06 SS2 (2'6"-4'6")**	**BH07 SS6 (15'-17')**	**BH08 SS2 (2'6"-4'6")**	**BH10 SS4 (7'6"-9'6")**
Volatile Organic Compounds	Surrogate: 1,4-Difluorobenzene	%	99.2	99.8	97.3	92.7	94.2	97.1	97.7	90.4	97.6	94.6
Hydrocarbons	F1 (C6-C10)	ug/g	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0		<5.0	<5.0	<5.0
	F1-BTEX	ug/g	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0		<5.0	<5.0	<5.0
	F2 (C10-C16)	ug/g	<10	<10	<10	<10	<10	<10		<10	<10	<10
	F3 (C16-C34)	ug/g	136	<50	<50	<50	<50	<50		<50	<50	<50
	F4 (C34-C50)	ug/g	290	<50	<50	<50	<50	<50		<50	<50	<50
	F4G-SG (GHH-Silica)	ug/g	1040									
	Total Hydrocarbons (C6-C50)	ug/g	426	<72	<72	<72	<72	<72		<72	<72	<72
	Chrom. to baseline at nC50		NO	YES	YES	YES	YES	YES		YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride	%	80.2	91.8	95.9	92.5	95.2	88.6		96.3	92.3	94.7
	Surrogate: 3,4-Dichlorotoluene	%	70.2	107.2	82.2	97.3	79.9	85.2		77.2	81.0	SURR-ND 49.5

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

Grouping	Analyte	Unit	L2564179-11	L2564179-12	L2564179-13	L2564179-14	L2564179-15	L2564179-16	L2564179-17	L2564179-18	L2564179-19	L2564179-20
		Sampled Date	25-FEB-21	25-FEB-21	02-MAR-21	01-MAR-21	02-MAR-21	26-FEB-21	02-MAR-21	26-FEB-21	25-FEB-21	01-MAR-21
		Sampled Time	12:00	14:00	12:00	14:00	14:00	12:00	11:00	10:00	16:00	11:00
		Sample ID	BH11 SS1 (0'-2')	BH12 SS3 (5'-7')	BH13 SS1 (0'-2')	BH14 SS2 (2'6"-4'6")	BH19 SS4 (7'6"-9'-6")	BH20 SS1 (0'-2')	BH21 SS3 (5'-7')	BH23 SS1 (0'-2')	BH24 SS1 (0'-2')	BH25 SS4 (7'6"-9'6")
Volatile Organic Compounds	Surrogate: 1,4-Difluorobenzene	%	101.9	106.9	105.9	107.0	103.5	95.3	100.5	115.8	103.4	105.5
Hydrocarbons	F1 (C6-C10)	ug/g	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	F1-BTEX	ug/g	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	F2 (C10-C16)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	F3 (C16-C34)	ug/g	56	<50	<50	57	<50	<50	<50	<50	<50	<50
	F4 (C34-C50)	ug/g	71	<50	<50	68	<50	<50	<50	<50	<50	<50
	F4G-SG (GHH-Silica)	ug/g										
	Total Hydrocarbons (C6-C50)	ug/g	127	<72	<72	125	<72	<72	<72	<72	<72	<72
	Chrom. to baseline at nC50		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride	%	92.6	91.5	91.7	89.5	92.5	90.0	93.9	91.0	89.1	90.1
	Surrogate: 3,4-Dichlorotoluene	%	80.5	105.7	86.2	99.8	82.1	77.4	63.9	75.2	77.9	80.8

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

		ALS ID	L2564179-21
		Sampled Date	01-MAR-21
		Sampled Time	15:30
		Sample ID	BH26 SS5 (10'-12')
Grouping	Analyte	Unit	
Volatile Organic Compounds	Surrogate: 1,4-Difluorobenzene	%	103.9
Hydrocarbons	F1 (C6-C10)	ug/g	<5.0
	F1-BTEX	ug/g	<5.0
	F2 (C10-C16)	ug/g	<10
	F3 (C16-C34)	ug/g	<50
	F4 (C34-C50)	ug/g	<50
	F4G-SG (GHH-Silica)	ug/g	
	Total Hydrocarbons (C6-C50)	ug/g	<72
	Chrom. to baseline at nC50		YES
	Surrogate: 2-Bromobenzotrifluoride	%	93.9
	Surrogate: 3,4-Dichlorotoluene	%	85.0

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

Summary of Guideline Exceedances: Ontario Regulation 153/04 - April 15, 2011 Standards

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use						
L2564179-1	BH01 SS1 (0'-2')	Metals	Barium (Ba)	359	220	ug/g
		Hydrocarbons	F4 (C34-C50)	290	120	ug/g
			F4G-SG (GHH-Silica)	1040	120	ug/g
L2564179-2	BH02 SS5 (10-12)	Metals	Barium (Ba)	280	220	ug/g
L2564179-4	BH04 SS2 (2'6"-4'6")	Metals	Barium (Ba)	275	220	ug/g
		Speciated Metals	Chromium, Hexavalent	1.10	0.66	ug/g
L2564179-5	BH 05 SS8 (25'-27')	Metals	Barium (Ba)	275	220	ug/g
L2564179-6	BH06 SS1 (0'-2')	Metals	Barium (Ba)	264	220	ug/g
L2564179-8	BH07 SS6 (15'-17')	Metals	Barium (Ba)	246	220	ug/g
L2564179-13	BH13 SS1 (0'-2')	Saturated Paste Extractables	SAR	6.77	2.4	SAR
L2564179-14	BH14 SS2 (2'6"-4'6")	Physical Tests	Conductivity	0.675	0.57	mS/cm
		Saturated Paste Extractables	SAR	7.16	2.4	SAR
		Metals	Mercury (Hg)	1.06	0.27	ug/g
			Silver (Ag)	0.99	0.5	ug/g
			Zinc (Zn)	326	290	ug/g
		Volatile Organic Compounds	Toluene	0.275	0.2	ug/g
L2564179-15	BH19 SS4 (7'6"-9'-6")	Metals	Barium (Ba)	298	220	ug/g
L2564179-16	BH20 SS1 (0'-2')	Metals	Barium (Ba)	276	220	ug/g
		Speciated Metals	Chromium, Hexavalent	1.63	0.66	ug/g
L2564179-17	BH21 SS3 (5'-7')	Physical Tests	Conductivity	0.778	0.57	mS/cm
		Saturated Paste Extractables	SAR	8.93	2.4	SAR
		Metals	Barium (Ba)	783	220	ug/g
			Chromium (Cr)	70.8	70	ug/g
			Cobalt (Co)	25.2	21	ug/g
			Vanadium (V)	96.2	86	ug/g
L2564179-18	BH23 SS1 (0'-2')	Metals	Barium (Ba)	248	220	ug/g
L2564179-20	BH25 SS4 (7'6"-9'6")	Metals	Barium (Ba)	380	220	ug/g
L2564179-21	BH26 SS5 (10'-12')	Metals	Barium (Ba)	242	220	ug/g
T2-Soil-Ind/Com/Commu Property Use (Coarse)						
L2564179-17	BH21 SS3 (5'-7')	Metals	Barium (Ba)	783	670	ug/g
			Vanadium (V)	96.2	86	ug/g
T2-Soil-Ind/Com/Commu Property Use (Fine)						
L2564179-17	BH21 SS3 (5'-7')	Metals	Barium (Ba)	783	670	ug/g

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ALS Environmental

ANALYTICAL REPORT

Summary of Guideline Exceedances: Ontario Regulation 153/04 - April 15, 2011 Standards

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
T2-Soil-Ind/Com/Commu Property Use (Fine)						
L2564179-17	BH21 SS3 (5'-7')	Metals	Vanadium (V)	96.2	86	ug/g
T2-Soil-Res/Park/Inst. Property Use (Coarse)						
L2564179-13	BH13 SS1 (0'-2')	Saturated Paste Extractables	SAR	6.77	5	SAR
L2564179-14	BH14 SS2 (2'6"-4'6")	Saturated Paste Extractables	SAR	7.16	5	SAR
		Metals	Mercury (Hg)	1.06	0.27	ug/g
L2564179-17	BH21 SS3 (5'-7')	Physical Tests	Conductivity	0.778	0.7	mS/cm
		Saturated Paste Extractables	SAR	8.93	5	SAR
		Metals	Barium (Ba)	783	390	ug/g
			Cobalt (Co)	25.2	22	ug/g
			Vanadium (V)	96.2	86	ug/g
T2-Soil-Res/Park/Inst. Property Use (Fine)						
L2564179-13	BH13 SS1 (0'-2')	Saturated Paste Extractables	SAR	6.77	5	SAR
L2564179-14	BH14 SS2 (2'6"-4'6")	Saturated Paste Extractables	SAR	7.16	5	SAR
L2564179-17	BH21 SS3 (5'-7')	Physical Tests	Conductivity	0.778	0.7	mS/cm
		Saturated Paste Extractables	SAR	8.93	5	SAR
		Metals	Barium (Ba)	783	390	ug/g
			Cobalt (Co)	25.2	22	ug/g
			Vanadium (V)	96.2	86	ug/g

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
SURR-ND	Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
B-HWS-R511-WT	Soil	Boron-HWE-O.Reg 153/04 (July 2011)	HW EXTR, EPA 6010B

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
BTX-511-HS-WT	Soil	BTEX-O.Reg 153/04 (July 2011)	SW846 8260

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
CN-WAD-R511-WT	Soil	Cyanide (WAD)-O.Reg 153/04 (July 2011)	MOE 3015/APHA 4500CN I-WAD

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
CR-CR6-IC-WT	Soil	Hexavalent Chromium in Soil	SW846 3060A/7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT	Soil	F1-O.Reg 153/04 (July 2011)	E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT	Soil	F2-F4-O.Reg 153/04 (July 2011)	CCME Tier 1

Petroleum Hydrocarbons (F2-F4 fractions) are extracted from soil with 1:1 hexane:acetone using a rotary extractor. Extracts are treated with silica gel to remove polar organic interferences. F2, F3, & F4 are analyzed by GC-FID. F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where both F4 (C34-C50) and F4G-sg are reported for a sample, the larger of the two values is used for comparison against the relevant CCME guideline for F4.
7. F4G-sg cannot be added to the C6 to C50 hydrocarbon results to obtain an estimate of total extractable hydrocarbons.
8. This method is validated for use.
9. Data from analysis of validation and quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram, unless otherwise indicated.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F4G-ADD-511-WT	Soil	F4G SG-O.Reg 153/04 (July 2011)	MOE DECPH-E3398/CCME TIER 1

F4G, gravimetric analysis, is determined if the chromatogram does not return to baseline at or before C50. A soil sample is extracted with a solvent mix, the solvent is evaporated and the weight of the residue is determined.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT	Soil	SAR-O.Reg 153/04 (July 2011)	SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

VOC-1,3-DCP-CALC-WT	Soil	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Soil	VOC-O.Reg 153/04 (July 2011)	SW846 8260 (511)

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	**Soil**							
Batch R5401946								
WG3502651-4 DUP		**L2564031-1**						
Boron (B), Hot Water Ext.		0.14	0.12		ug/g	17	30	16-MAR-21
WG3502651-2 IRM		**WT SAR4**						
Boron (B), Hot Water Ext.			101.5		%		70-130	16-MAR-21
WG3502651-3 LCS								
Boron (B), Hot Water Ext.			106.0		%		70-130	16-MAR-21
WG3502651-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	16-MAR-21
Batch R5402042								
WG3502647-4 DUP		**L2564218-2**						
Boron (B), Hot Water Ext.		0.21	0.21		ug/g	1.0	30	16-MAR-21
WG3502647-2 IRM		**WT SAR4**						
Boron (B), Hot Water Ext.			98.2		%		70-130	16-MAR-21
WG3502647-3 LCS								
Boron (B), Hot Water Ext.			107.0		%		70-130	16-MAR-21
WG3502647-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	16-MAR-21
BTX-511-HS-WT	**Soil**							
Batch R5398896								
WG3498828-4 DUP		**WG3498828-3**						
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	10-MAR-21
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	10-MAR-21
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	10-MAR-21
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	10-MAR-21
WG3498828-2 LCS								
Benzene			115.1		%		70-130	10-MAR-21
Ethylbenzene			110.5		%		70-130	10-MAR-21
m+p-Xylenes			101.9		%		70-130	10-MAR-21
o-Xylene			109.2		%		70-130	10-MAR-21
Toluene			108.9		%		70-130	10-MAR-21
WG3498828-1 MB								
Benzene			<0.0068		ug/g		0.0068	10-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	10-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	10-MAR-21
o-Xylene			<0.020		ug/g		0.02	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Soil**							
Batch R5398896								
WG3498828-1 MB								
Toluene			<0.080		ug/g		0.08	10-MAR-21
Surrogate: 1,4-Difluorobenzene			110.1		%		50-140	10-MAR-21
Surrogate: 4-Bromofluorobenzene			111.9		%		50-140	10-MAR-21
WG3498828-5 MS		**WG3498828-3**						
Benzene			113.4		%		60-140	10-MAR-21
Ethylbenzene			114.0		%		60-140	10-MAR-21
m+p-Xylenes			106.0		%		60-140	10-MAR-21
o-Xylene			112.4		%		60-140	10-MAR-21
Toluene			112.0		%		60-140	10-MAR-21
Batch R5398899								
WG3498953-4 DUP		**WG3498953-3**						
Benzene		0.101	0.102		ug/g	0.9	40	10-MAR-21
Ethylbenzene		0.097	0.097		ug/g	0.7	40	10-MAR-21
m+p-Xylenes		0.283	0.285		ug/g	1.0	40	10-MAR-21
o-Xylene		0.156	0.157		ug/g	0.8	40	10-MAR-21
Toluene		0.261	0.264		ug/g	1.3	40	10-MAR-21
WG3498953-2 LCS								
Benzene			105.8		%		70-130	10-MAR-21
Ethylbenzene			98.7		%		70-130	10-MAR-21
m+p-Xylenes			90.8		%		70-130	10-MAR-21
o-Xylene			98.0		%		70-130	10-MAR-21
Toluene			97.7		%		70-130	10-MAR-21
WG3498953-1 MB								
Benzene			<0.0068		ug/g		0.0068	10-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	10-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	10-MAR-21
o-Xylene			<0.020		ug/g		0.02	10-MAR-21
Toluene			<0.080		ug/g		0.08	10-MAR-21
Surrogate: 1,4-Difluorobenzene			107.6		%		50-140	10-MAR-21
Surrogate: 4-Bromofluorobenzene			108.8		%		50-140	10-MAR-21
WG3498953-5 MS		**WG3498953-3**						
Benzene			108.5		%		60-140	10-MAR-21
Ethylbenzene			106.2		%		60-140	10-MAR-21
m+p-Xylenes			97.9		%		60-140	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Soil**							
Batch R5398899								
WG3498953-5 MS		**WG3498953-3**						
o-Xylene			105.4		%		60-140	10-MAR-21
Toluene			104.2		%		60-140	10-MAR-21
CN-WAD-R511-WT	**Soil**							
Batch R5399837								
WG3500283-3 DUP		**L2565660-16**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	11-MAR-21
WG3500283-2 LCS								
Cyanide, Weak Acid Diss			100.7		%		80-120	11-MAR-21
WG3500283-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	11-MAR-21
WG3500283-4 MS		**L2565660-16**						
Cyanide, Weak Acid Diss			100.4		%		70-130	11-MAR-21
Batch R5401739								
WG3500674-3 DUP		**L2564179-12**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	16-MAR-21
WG3500674-2 LCS								
Cyanide, Weak Acid Diss			88.2		%		80-120	16-MAR-21
WG3500674-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	16-MAR-21
WG3500674-4 MS		**L2564179-12**						
Cyanide, Weak Acid Diss			87.5		%		70-130	16-MAR-21
CR-CR6-IC-WT	**Soil**							
Batch R5401299								
WG3500856-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			99.9		%		70-130	15-MAR-21
WG3500856-3 DUP		**L2564179-12**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	15-MAR-21
WG3500856-2 LCS								
Chromium, Hexavalent			96.0		%		80-120	15-MAR-21
WG3500856-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	15-MAR-21
Batch R5401748								
WG3501011-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			102.9		%		70-130	16-MAR-21
WG3501011-3 DUP		**L2564504-9**						
Chromium, Hexavalent		0.76	0.86		ug/g	12	35	16-MAR-21

Quality Control Report

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Oakville ON L6H 5R7
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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CR-CR6-IC-WT	**Soil**							
Batch R5401748								
WG3501011-2 LCS								
Chromium, Hexavalent			103.8		%		80-120	16-MAR-21
WG3501011-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	16-MAR-21
EC-WT	**Soil**							
Batch R5402036								
WG3502653-4 DUP		**WG3502653-3**						
Conductivity		0.875	0.868		mS/cm	0.8	20	16-MAR-21
WG3502653-2 IRM		**WT SAR4**						
Conductivity			100.0		%		70-130	16-MAR-21
WG3503260-1 LCS								
Conductivity			97.1		%		90-110	16-MAR-21
WG3502653-1 MB								
Conductivity			<0.0040		mS/cm		0.004	16-MAR-21
Batch R5402040								
WG3502649-4 DUP		**WG3502649-3**						
Conductivity		0.185	0.200		mS/cm	7.6	20	16-MAR-21
WG3502649-2 IRM		**WT SAR4**						
Conductivity			100.8		%		70-130	16-MAR-21
WG3503198-1 LCS								
Conductivity			97.3		%		90-110	16-MAR-21
WG3502649-1 MB								
Conductivity			<0.0040		mS/cm		0.004	16-MAR-21
F1-HS-511-WT	**Soil**							
Batch R5398464								
WG3498335-4 DUP		**WG3498335-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	09-MAR-21
WG3498335-2 LCS								
F1 (C6-C10)			109.1		%		80-120	10-MAR-21
WG3498335-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	09-MAR-21
Surrogate: 3,4-Dichlorotoluene			117.7		%		60-140	09-MAR-21
WG3498335-5 MS		**WG3498335-3**						
F1 (C6-C10)			79.4		%		60-140	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
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Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-511-WT	**Soil**							
Batch	**R5398896**							
WG3498828-4	**DUP**	**WG3498828-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	10-MAR-21
WG3498828-2	**LCS**							
F1 (C6-C10)			92.8		%		80-120	10-MAR-21
WG3498828-1	**MB**							
F1 (C6-C10)			<5.0		ug/g		5	10-MAR-21
Surrogate: 3,4-Dichlorotoluene			93.2		%		60-140	10-MAR-21
WG3498828-5	**MS**	**WG3498828-3**						
F1 (C6-C10)			91.3		%		60-140	10-MAR-21
Batch	**R5398899**							
WG3498953-4	**DUP**	**WG3498953-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	10-MAR-21
WG3498953-2	**LCS**							
F1 (C6-C10)			89.9		%		80-120	10-MAR-21
WG3498953-1	**MB**							
F1 (C6-C10)			<5.0		ug/g		5	10-MAR-21
Surrogate: 3,4-Dichlorotoluene			85.2		%		60-140	10-MAR-21
WG3498953-5	**MS**	**WG3498953-3**						
F1 (C6-C10)			86.6		%		60-140	10-MAR-21
F2-F4-511-WT	**Soil**							
Batch	**R5399892**							
WG3499263-3	**DUP**	**WG3499263-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	11-MAR-21
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	11-MAR-21
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	11-MAR-21
WG3499263-2	**LCS**							
F2 (C10-C16)			102.1		%		80-120	11-MAR-21
F3 (C16-C34)			106.1		%		80-120	11-MAR-21
F4 (C34-C50)			106.1		%		80-120	11-MAR-21
WG3499263-1	**MB**							
F2 (C10-C16)			<10		ug/g		10	11-MAR-21
F3 (C16-C34)			<50		ug/g		50	11-MAR-21
F4 (C34-C50)			<50		ug/g		50	11-MAR-21
Surrogate: 2-Bromobenzotrifluoride			97.0		%		60-140	11-MAR-21
WG3499263-4	**MS**	**WG3499263-5**						
F2 (C10-C16)			101.1		%		60-140	11-MAR-21
F3 (C16-C34)			104.0		%		60-140	11-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Soil**							
Batch R5399892								
WG3499263-4	**MS**	**WG3499263-5**						
F4 (C34-C50)			106.2		%		60-140	11-MAR-21
Batch R5400242								
WG3500062-3	**DUP**	**WG3500062-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	12-MAR-21
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
WG3500062-2	**LCS**							
F2 (C10-C16)			85.8		%		80-120	12-MAR-21
F3 (C16-C34)			87.1		%		80-120	12-MAR-21
F4 (C34-C50)			91.3		%		80-120	12-MAR-21
WG3500062-1	**MB**							
F2 (C10-C16)			<10		ug/g		10	12-MAR-21
F3 (C16-C34)			<50		ug/g		50	12-MAR-21
F4 (C34-C50)			<50		ug/g		50	12-MAR-21
Surrogate: 2-Bromobenzotrifluoride			88.7		%		60-140	12-MAR-21
WG3500062-4	**MS**	**WG3500062-5**						
F2 (C10-C16)			84.9		%		60-140	12-MAR-21
F3 (C16-C34)			89.3		%		60-140	12-MAR-21
F4 (C34-C50)			93.2		%		60-140	12-MAR-21
Batch R5400519								
WG3500598-3	**DUP**	**WG3500598-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	12-MAR-21
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
WG3500598-2	**LCS**							
F2 (C10-C16)			97.1		%		80-120	12-MAR-21
F3 (C16-C34)			98.3		%		80-120	12-MAR-21
F4 (C34-C50)			97.4		%		80-120	12-MAR-21
WG3500598-1	**MB**							
F2 (C10-C16)			<10		ug/g		10	12-MAR-21
F3 (C16-C34)			<50		ug/g		50	12-MAR-21
F4 (C34-C50)			<50		ug/g		50	12-MAR-21
Surrogate: 2-Bromobenzotrifluoride			98.7		%		60-140	12-MAR-21
WG3500598-4	**MS**	**WG3500598-5**						

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Soil**							
Batch R5400519								
WG3500598-4 MS		**WG3500598-5**						
F2 (C10-C16)			95.0		%		60-140	12-MAR-21
F3 (C16-C34)			95.0		%		60-140	12-MAR-21
F4 (C34-C50)			95.6		%		60-140	12-MAR-21
F4G-ADD-511-WT	**Soil**							
Batch R5400350								
WG3501376-2 LCS								
F4G-SG (GHH-Silica)			71.6		%		60-140	11-MAR-21
WG3501376-1 MB								
F4G-SG (GHH-Silica)			<250		ug/g		250	11-MAR-21
HG-200.2-CVAA-WT	**Soil**							
Batch R5401795								
WG3502645-2 CRM		**WT-SS-2**						
Mercury (Hg)			102.7		%		70-130	16-MAR-21
WG3502645-6 DUP		**WG3502645-5**						
Mercury (Hg)		0.0121	0.0134		ug/g	10	40	16-MAR-21
WG3502645-3 LCS								
Mercury (Hg)			96.0		%		80-120	16-MAR-21
WG3502645-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-MAR-21
Batch R5401802								
WG3502639-2 CRM		**WT-SS-2**						
Mercury (Hg)			103.2		%		70-130	16-MAR-21
WG3502639-6 DUP		**WG3502639-5**						
Mercury (Hg)		0.0081	0.0092		ug/g	13	40	16-MAR-21
WG3502639-3 LCS								
Mercury (Hg)			105.0		%		80-120	16-MAR-21
WG3502639-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-MAR-21
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-2 CRM		**WT-SS-2**						
Antimony (Sb)			101.1		%		70-130	16-MAR-21
Arsenic (As)			103.5		%		70-130	16-MAR-21
Barium (Ba)			106.9		%		70-130	16-MAR-21
Beryllium (Be)			101.7		%		70-130	16-MAR-21
Boron (B)			9.3		mg/kg		3.5-13.5	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-2 CRM		**WT-SS-2**						
Cadmium (Cd)			98.2		%		70-130	16-MAR-21
Chromium (Cr)			102.1		%		70-130	16-MAR-21
Cobalt (Co)			102.5		%		70-130	16-MAR-21
Copper (Cu)			96.2		%		70-130	16-MAR-21
Lead (Pb)			100.2		%		70-130	16-MAR-21
Molybdenum (Mo)			97.6		%		70-130	16-MAR-21
Nickel (Ni)			99.7		%		70-130	16-MAR-21
Selenium (Se)			0.15		mg/kg		0-0.34	16-MAR-21
Silver (Ag)			111.1		%		70-130	16-MAR-21
Thallium (Tl)			0.080		mg/kg		0.029-0.129	16-MAR-21
Uranium (U)			97.4		%		70-130	16-MAR-21
Vanadium (V)			104.2		%		70-130	16-MAR-21
Zinc (Zn)			95.6		%		70-130	16-MAR-21
WG3502639-6 DUP		**WG3502639-5**						
Antimony (Sb)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	16-MAR-21
Arsenic (As)		2.86	2.53		ug/g	12	30	16-MAR-21
Barium (Ba)		47.9	41.9		ug/g	13	40	16-MAR-21
Beryllium (Be)		0.43	0.38		ug/g	11	30	16-MAR-21
Boron (B)		7.4	6.5		ug/g	13	30	16-MAR-21
Cadmium (Cd)		0.072	0.074		ug/g	2.3	30	16-MAR-21
Chromium (Cr)		13.1	13.4		ug/g	2.2	30	16-MAR-21
Cobalt (Co)		6.68	5.84		ug/g	13	30	16-MAR-21
Copper (Cu)		13.4	11.5		ug/g	16	30	16-MAR-21
Lead (Pb)		5.96	5.20		ug/g	14	40	16-MAR-21
Molybdenum (Mo)		0.29	0.23		ug/g	22	40	16-MAR-21
Nickel (Ni)		13.8	11.8		ug/g	16	30	16-MAR-21
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-MAR-21
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-MAR-21
Thallium (Tl)		0.112	0.096		ug/g	15	30	16-MAR-21
Uranium (U)		0.511	0.438		ug/g	15	30	16-MAR-21
Vanadium (V)		30.2	26.6		ug/g	13	30	16-MAR-21
Zinc (Zn)		32.5	28.6		ug/g	13	30	16-MAR-21
WG3502639-4 LCS								

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-4 LCS								
Antimony (Sb)			111.2		%		80-120	16-MAR-21
Arsenic (As)			111.3		%		80-120	16-MAR-21
Barium (Ba)			104.2		%		80-120	16-MAR-21
Beryllium (Be)			104.2		%		80-120	16-MAR-21
Boron (B)			101.4		%		80-120	16-MAR-21
Cadmium (Cd)			102.9		%		80-120	16-MAR-21
Chromium (Cr)			106.7		%		80-120	16-MAR-21
Cobalt (Co)			105.6		%		80-120	16-MAR-21
Copper (Cu)			104.1		%		80-120	16-MAR-21
Lead (Pb)			107.4		%		80-120	16-MAR-21
Molybdenum (Mo)			107.8		%		80-120	16-MAR-21
Nickel (Ni)			104.3		%		80-120	16-MAR-21
Selenium (Se)			110.1		%		80-120	16-MAR-21
Silver (Ag)			108.0		%		80-120	16-MAR-21
Thallium (Tl)			110.0		%		80-120	16-MAR-21
Uranium (U)			104.7		%		80-120	16-MAR-21
Vanadium (V)			110.6		%		80-120	16-MAR-21
Zinc (Zn)			103.0		%		80-120	16-MAR-21
WG3502639-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-MAR-21
Arsenic (As)			<0.10		mg/kg		0.1	16-MAR-21
Barium (Ba)			<0.50		mg/kg		0.5	16-MAR-21
Beryllium (Be)			<0.10		mg/kg		0.1	16-MAR-21
Boron (B)			<5.0		mg/kg		5	16-MAR-21
Cadmium (Cd)			<0.020		mg/kg		0.02	16-MAR-21
Chromium (Cr)			<0.50		mg/kg		0.5	16-MAR-21
Cobalt (Co)			<0.10		mg/kg		0.1	16-MAR-21
Copper (Cu)			<0.50		mg/kg		0.5	16-MAR-21
Lead (Pb)			<0.50		mg/kg		0.5	16-MAR-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-MAR-21
Nickel (Ni)			<0.50		mg/kg		0.5	16-MAR-21
Selenium (Se)			<0.20		mg/kg		0.2	16-MAR-21
Silver (Ag)			<0.10		mg/kg		0.1	16-MAR-21
Thallium (Tl)			<0.050		mg/kg		0.05	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-1 MB								
Uranium (U)			<0.050		mg/kg		0.05	16-MAR-21
Vanadium (V)			<0.20		mg/kg		0.2	16-MAR-21
Zinc (Zn)			<2.0		mg/kg		2	16-MAR-21
Batch R5402569								
WG3502645-2 CRM		**WT-SS-2**						
Antimony (Sb)			90.7		%		70-130	16-MAR-21
Arsenic (As)			101.9		%		70-130	16-MAR-21
Barium (Ba)			109.4		%		70-130	16-MAR-21
Beryllium (Be)			98.9		%		70-130	16-MAR-21
Boron (B)			8.7		mg/kg		3.5-13.5	16-MAR-21
Cadmium (Cd)			98.5		%		70-130	16-MAR-21
Chromium (Cr)			107.4		%		70-130	16-MAR-21
Cobalt (Co)			102.1		%		70-130	16-MAR-21
Copper (Cu)			99.1		%		70-130	16-MAR-21
Lead (Pb)			95.7		%		70-130	16-MAR-21
Molybdenum (Mo)			95.9		%		70-130	16-MAR-21
Nickel (Ni)			101.9		%		70-130	16-MAR-21
Selenium (Se)			0.18		mg/kg		0-0.34	16-MAR-21
Silver (Ag)			78.6		%		70-130	16-MAR-21
Thallium (Tl)			0.068		mg/kg		0.029-0.129	16-MAR-21
Uranium (U)			87.8		%		70-130	16-MAR-21
Vanadium (V)			107.9		%		70-130	16-MAR-21
Zinc (Zn)			100.3		%		70-130	16-MAR-21
WG3502645-6 DUP		**WG3502645-5**						
Antimony (Sb)		0.14	0.11		ug/g	23	30	16-MAR-21
Arsenic (As)		6.60	5.51		ug/g	18	30	16-MAR-21
Barium (Ba)		119	97.8		ug/g	19	40	16-MAR-21
Beryllium (Be)		0.59	0.50		ug/g	17	30	16-MAR-21
Boron (B)		11.6	10.3		ug/g	12	30	16-MAR-21
Cadmium (Cd)		0.095	0.085		ug/g	10	30	16-MAR-21
Chromium (Cr)		22.2	18.4		ug/g	19	30	16-MAR-21
Cobalt (Co)		11.9	10.1		ug/g	17	30	16-MAR-21
Copper (Cu)		39.7	33.5		ug/g	17	30	16-MAR-21
Lead (Pb)		9.40	8.36		ug/g	12	40	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402569								
WG3502645-6 DUP		**WG3502645-5**						
Molybdenum (Mo)		0.46	0.38		ug/g	18	40	16-MAR-21
Nickel (Ni)		24.2	20.2		ug/g	18	30	16-MAR-21
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-MAR-21
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-MAR-21
Thallium (Tl)		0.131	0.108		ug/g	19	30	16-MAR-21
Uranium (U)		0.573	0.509		ug/g	12	30	16-MAR-21
Vanadium (V)		35.7	29.2		ug/g	20	30	16-MAR-21
Zinc (Zn)		58.0	48.9		ug/g	17	30	16-MAR-21
WG3502645-4 LCS								
Antimony (Sb)			105.1		%		80-120	16-MAR-21
Arsenic (As)			108.8		%		80-120	16-MAR-21
Barium (Ba)			104.7		%		80-120	16-MAR-21
Beryllium (Be)			102.9		%		80-120	16-MAR-21
Boron (B)			100.8		%		80-120	16-MAR-21
Cadmium (Cd)			103.3		%		80-120	16-MAR-21
Chromium (Cr)			104.9		%		80-120	16-MAR-21
Cobalt (Co)			106.0		%		80-120	16-MAR-21
Copper (Cu)			104.2		%		80-120	16-MAR-21
Lead (Pb)			103.3		%		80-120	16-MAR-21
Molybdenum (Mo)			106.2		%		80-120	16-MAR-21
Nickel (Ni)			104.6		%		80-120	16-MAR-21
Selenium (Se)			110.0		%		80-120	16-MAR-21
Silver (Ag)			103.7		%		80-120	16-MAR-21
Thallium (Tl)			105.2		%		80-120	16-MAR-21
Uranium (U)			97.7		%		80-120	16-MAR-21
Vanadium (V)			110.3		%		80-120	16-MAR-21
Zinc (Zn)			107.3		%		80-120	16-MAR-21
WG3502645-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-MAR-21
Arsenic (As)			<0.10		mg/kg		0.1	16-MAR-21
Barium (Ba)			<0.50		mg/kg		0.5	16-MAR-21
Beryllium (Be)			<0.10		mg/kg		0.1	16-MAR-21
Boron (B)			<5.0		mg/kg		5	16-MAR-21
Cadmium (Cd)			<0.020		mg/kg		0.02	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402569								
WG3502645-1 MB								
Chromium (Cr)			<0.50		mg/kg		0.5	16-MAR-21
Cobalt (Co)			<0.10		mg/kg		0.1	16-MAR-21
Copper (Cu)			<0.50		mg/kg		0.5	16-MAR-21
Lead (Pb)			<0.50		mg/kg		0.5	16-MAR-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-MAR-21
Nickel (Ni)			<0.50		mg/kg		0.5	16-MAR-21
Selenium (Se)			<0.20		mg/kg		0.2	16-MAR-21
Silver (Ag)			<0.10		mg/kg		0.1	16-MAR-21
Thallium (Tl)			<0.050		mg/kg		0.05	16-MAR-21
Uranium (U)			<0.050		mg/kg		0.05	16-MAR-21
Vanadium (V)			<0.20		mg/kg		0.2	16-MAR-21
Zinc (Zn)			<2.0		mg/kg		2	16-MAR-21
MOISTURE-WT	**Soil**							
Batch R5399508								
WG3499986-3 DUP		**L2564179-1**						
% Moisture		19.8	18.2		%	8.2	20	11-MAR-21
WG3499986-2 LCS								
% Moisture			99.6		%		90-110	11-MAR-21
WG3499986-1 MB								
% Moisture			<0.25		%		0.25	11-MAR-21
Batch R5400107								
WG3501016-3 DUP		**L2564177-2**						
% Moisture		19.5	18.8		%	3.4	20	12-MAR-21
WG3501016-2 LCS								
% Moisture			99.4		%		90-110	12-MAR-21
WG3501016-1 MB								
% Moisture			<0.25		%		0.25	12-MAR-21
PH-WT	**Soil**							
Batch R5400397								
WG3500902-1 DUP		**L2564179-12**						
pH		8.19	8.10	J	pH units	0.09	0.3	12-MAR-21
WG3501252-1 LCS								
pH			6.96		pH units		6.9-7.1	12-MAR-21

Quality Control Report

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2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-WT	**Soil**							
Batch R5401412								
WG3500681-1 DUP		**L2564265-15**						
pH		7.90	7.85	J	pH units	0.05	0.3	15-MAR-21
WG3502485-1 LCS								
pH			7.00		pH units		6.9-7.1	15-MAR-21
Batch R5401939								
WG3500944-1 DUP		**L2564179-13**						
pH		7.76	7.80	J	pH units	0.04	0.3	16-MAR-21
WG3502923-1 LCS								
pH			6.95		pH units		6.9-7.1	16-MAR-21
SAR-R511-WT	**Soil**							
Batch R5401950								
WG3502649-4 DUP		**WG3502649-3**						
Calcium (Ca)		14.7	15.2		mg/L	3.3	30	16-MAR-21
Sodium (Na)		27.6	28.8		mg/L	4.3	30	16-MAR-21
Magnesium (Mg)		1.41	1.44		mg/L	2.1	30	16-MAR-21
WG3502649-2 IRM		**WT SAR4**						
Calcium (Ca)			108.2		%		70-130	16-MAR-21
Sodium (Na)			93.3		%		70-130	16-MAR-21
Magnesium (Mg)			106.0		%		70-130	16-MAR-21
WG3502649-5 LCS								
Calcium (Ca)			105.3		%		80-120	16-MAR-21
Sodium (Na)			101.6		%		80-120	16-MAR-21
Magnesium (Mg)			101.2		%		80-120	16-MAR-21
WG3502649-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	16-MAR-21
Sodium (Na)			<0.50		mg/L		0.5	16-MAR-21
Magnesium (Mg)			<0.50		mg/L		0.5	16-MAR-21
Batch R5402045								
WG3502653-4 DUP		**WG3502653-3**						
Calcium (Ca)		78.8	78.5		mg/L	0.4	30	16-MAR-21
Sodium (Na)		85.9	85.2		mg/L	0.8	30	16-MAR-21
Magnesium (Mg)		10.1	10.0		mg/L	1.0	30	16-MAR-21
WG3502653-2 IRM		**WT SAR4**						
Calcium (Ca)			97.7		%		70-130	16-MAR-21
Sodium (Na)			95.7		%		70-130	16-MAR-21
Magnesium (Mg)			100.9		%		70-130	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R5402045								
WG3502653-5 LCS								
Calcium (Ca)			106.7		%		80-120	16-MAR-21
Sodium (Na)			102.0		%		80-120	16-MAR-21
Magnesium (Mg)			102.0		%		80-120	16-MAR-21
WG3502653-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	16-MAR-21
Sodium (Na)			<0.50		mg/L		0.5	16-MAR-21
Magnesium (Mg)			<0.50		mg/L		0.5	16-MAR-21
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-4 DUP		**WG3498335-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	09-MAR-21
Benzene		0.0068	0.0073		ug/g	6.5	40	09-MAR-21
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	09-MAR-21
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-4 DUP		**WG3498335-3**						
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	09-MAR-21
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	09-MAR-21
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	09-MAR-21
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	09-MAR-21
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	09-MAR-21
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	09-MAR-21
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	09-MAR-21
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	09-MAR-21
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	09-MAR-21
WG3498335-2 LCS								
1,1,1,2-Tetrachloroethane			101.0		%		60-130	09-MAR-21
1,1,2,2-Tetrachloroethane			66.0		%		60-130	09-MAR-21
1,1,1-Trichloroethane			104.1		%		60-130	09-MAR-21
1,1,2-Trichloroethane			93.9		%		60-130	09-MAR-21
1,1-Dichloroethane			101.1		%		60-130	09-MAR-21
1,1-Dichloroethylene			102.4		%		60-130	09-MAR-21
1,2-Dibromoethane			97.7		%		70-130	09-MAR-21
1,2-Dichlorobenzene			106.2		%		70-130	09-MAR-21
1,2-Dichloroethane			94.0		%		60-130	09-MAR-21
1,2-Dichloropropane			99.9		%		70-130	09-MAR-21
1,3-Dichlorobenzene			121.2		%		70-130	09-MAR-21
1,4-Dichlorobenzene			120.6		%		70-130	09-MAR-21
Acetone			98.5		%		60-140	09-MAR-21
Benzene			99.8		%		70-130	09-MAR-21
Bromodichloromethane			102.0		%		50-140	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-2 LCS								
Bromoform			85.9		%		70-130	09-MAR-21
Bromomethane			93.4		%		50-140	09-MAR-21
Carbon tetrachloride			108.5		%		70-130	09-MAR-21
Chlorobenzene			104.1		%		70-130	09-MAR-21
Chloroform			103.6		%		70-130	09-MAR-21
cis-1,2-Dichloroethylene			103.2		%		70-130	09-MAR-21
cis-1,3-Dichloropropene			97.1		%		70-130	09-MAR-21
Dibromochloromethane			96.9		%		60-130	09-MAR-21
Dichlorodifluoromethane			65.1		%		50-140	09-MAR-21
Ethylbenzene			107.9		%		70-130	09-MAR-21
n-Hexane			97.1		%		70-130	09-MAR-21
Methylene Chloride			99.2		%		70-130	09-MAR-21
MTBE			102.2		%		70-130	09-MAR-21
m+p-Xylenes			108.0		%		70-130	09-MAR-21
Methyl Ethyl Ketone			85.6		%		60-140	09-MAR-21
Methyl Isobutyl Ketone			84.6		%		60-140	09-MAR-21
o-Xylene			115.6		%		70-130	09-MAR-21
Styrene			103.0		%		70-130	09-MAR-21
Tetrachloroethylene			107.7		%		60-130	09-MAR-21
Toluene			104.8		%		70-130	09-MAR-21
trans-1,2-Dichloroethylene			103.3		%		60-130	09-MAR-21
trans-1,3-Dichloropropene			101.4		%		70-130	09-MAR-21
Trichloroethylene			105.0		%		60-130	09-MAR-21
Trichlorofluoromethane			100.5		%		50-140	09-MAR-21
Vinyl chloride			98.5		%		60-140	09-MAR-21
WG3498335-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,1-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
1,2-Dibromoethane			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-1 MB								
1,2-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichloropropane			<0.050		ug/g		0.05	09-MAR-21
1,3-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
1,4-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Acetone			<0.50		ug/g		0.5	09-MAR-21
Benzene			<0.0068		ug/g		0.0068	09-MAR-21
Bromodichloromethane			<0.050		ug/g		0.05	09-MAR-21
Bromoform			<0.050		ug/g		0.05	09-MAR-21
Bromomethane			<0.050		ug/g		0.05	09-MAR-21
Carbon tetrachloride			<0.050		ug/g		0.05	09-MAR-21
Chlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Chloroform			<0.050		ug/g		0.05	09-MAR-21
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Dibromochloromethane			<0.050		ug/g		0.05	09-MAR-21
Dichlorodifluoromethane			<0.050		ug/g		0.05	09-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	09-MAR-21
n-Hexane			<0.050		ug/g		0.05	09-MAR-21
Methylene Chloride			<0.050		ug/g		0.05	09-MAR-21
MTBE			<0.050		ug/g		0.05	09-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	09-MAR-21
Methyl Ethyl Ketone			<0.50		ug/g		0.5	09-MAR-21
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	09-MAR-21
o-Xylene			<0.020		ug/g		0.02	09-MAR-21
Styrene			<0.050		ug/g		0.05	09-MAR-21
Tetrachloroethylene			<0.050		ug/g		0.05	09-MAR-21
Toluene			<0.080		ug/g		0.08	09-MAR-21
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Trichloroethylene			<0.010		ug/g		0.01	09-MAR-21
Trichlorofluoromethane			<0.050		ug/g		0.05	09-MAR-21
Vinyl chloride			<0.020		ug/g		0.02	09-MAR-21
Surrogate: 1,4-Difluorobenzene			115.9		%		50-140	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-1 MB								
Surrogate: 4-Bromofluorobenzene			112.0		%		50-140	09-MAR-21
WG3498335-5 MS		**WG3498335-3**						
1,1,1,2-Tetrachloroethane			111.3		%		50-140	10-MAR-21
1,1,2,2-Tetrachloroethane			105.3		%		50-140	10-MAR-21
1,1,1-Trichloroethane			111.9		%		50-140	10-MAR-21
1,1,2-Trichloroethane			102.9		%		50-140	10-MAR-21
1,1-Dichloroethane			100.5		%		50-140	10-MAR-21
1,1-Dichloroethylene			99.6		%		50-140	10-MAR-21
1,2-Dibromoethane			113.1		%		50-140	10-MAR-21
1,2-Dichlorobenzene			111.5		%		50-140	10-MAR-21
1,2-Dichloroethane			104.8		%		50-140	10-MAR-21
1,2-Dichloropropane			100.9		%		50-140	10-MAR-21
1,3-Dichlorobenzene			114.3		%		50-140	10-MAR-21
1,4-Dichlorobenzene			116.9		%		50-140	10-MAR-21
Acetone			107.3		%		50-140	10-MAR-21
Benzene			104.1		%		50-140	10-MAR-21
Bromodichloromethane			115.3		%		50-140	10-MAR-21
Bromoform			120.3		%		50-140	10-MAR-21
Bromomethane			103.3		%		50-140	10-MAR-21
Carbon tetrachloride			119.6		%		50-140	10-MAR-21
Chlorobenzene			109.2		%		50-140	10-MAR-21
Chloroform			112.0		%		50-140	10-MAR-21
cis-1,2-Dichloroethylene			114.9		%		50-140	10-MAR-21
cis-1,3-Dichloropropene			103.3		%		50-140	10-MAR-21
Dibromochloromethane			111.8		%		50-140	10-MAR-21
Dichlorodifluoromethane			98.0		%		50-140	10-MAR-21
Ethylbenzene			101.7		%		50-140	10-MAR-21
n-Hexane			83.7		%		50-140	10-MAR-21
Methylene Chloride			102.3		%		50-140	10-MAR-21
MTBE			106.2		%		50-140	10-MAR-21
m+p-Xylenes			102.8		%		50-140	10-MAR-21
Methyl Ethyl Ketone			112.9		%		50-140	10-MAR-21
Methyl Isobutyl Ketone			95.4		%		50-140	10-MAR-21
o-Xylene			112.3		%		50-140	10-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-5 MS		**WG3498335-3**						
Styrene			106.1		%		50-140	10-MAR-21
Tetrachloroethylene			112.0		%		50-140	10-MAR-21
Toluene			99.1		%		50-140	10-MAR-21
trans-1,2-Dichloroethylene			90.9		%		50-140	10-MAR-21
trans-1,3-Dichloropropene			95.1		%		50-140	10-MAR-21
Trichloroethylene			119.8		%		50-140	10-MAR-21
Trichlorofluoromethane			108.9		%		50-140	10-MAR-21
Vinyl chloride			96.7		%		50-140	10-MAR-21

COMMENTS: RRQC-Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
Batch R5399216								
WG3498942-4 DUP		**WG3498942-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	10-MAR-21
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	10-MAR-21
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-4 DUP		**WG3498942-3**						
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	10-MAR-21
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	10-MAR-21
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	10-MAR-21
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	10-MAR-21
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	10-MAR-21
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	10-MAR-21
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	10-MAR-21
WG3498942-2 LCS								
1,1,1,2-Tetrachloroethane			99.2		%		60-130	09-MAR-21
1,1,2,2-Tetrachloroethane			118.0		%		60-130	09-MAR-21
1,1,1-Trichloroethane			97.5		%		60-130	09-MAR-21
1,1,2-Trichloroethane			105.1		%		60-130	09-MAR-21
1,1-Dichloroethane			101.2		%		60-130	09-MAR-21
1,1-Dichloroethylene			97.7		%		60-130	09-MAR-21
1,2-Dibromoethane			105.2		%		70-130	09-MAR-21
1,2-Dichlorobenzene			103.1		%		70-130	09-MAR-21
1,2-Dichloroethane			99.5		%		60-130	09-MAR-21
1,2-Dichloropropane			101.5		%		70-130	09-MAR-21
1,3-Dichlorobenzene			102.0		%		70-130	09-MAR-21
1,4-Dichlorobenzene			102.6		%		70-130	09-MAR-21
Acetone			114.2		%		60-140	09-MAR-21
Benzene			98.1		%		70-130	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-2 LCS								
Bromodichloromethane			106.3		%		50-140	09-MAR-21
Bromoform			109.1		%		70-130	09-MAR-21
Bromomethane			97.0		%		50-140	09-MAR-21
Carbon tetrachloride			99.7		%		70-130	09-MAR-21
Chlorobenzene			99.5		%		70-130	09-MAR-21
Chloroform			101.9		%		70-130	09-MAR-21
cis-1,2-Dichloroethylene			106.7		%		70-130	09-MAR-21
cis-1,3-Dichloropropene			108.6		%		70-130	09-MAR-21
Dibromochloromethane			100.9		%		60-130	09-MAR-21
Dichlorodifluoromethane			70.5		%		50-140	09-MAR-21
Ethylbenzene			100.3		%		70-130	09-MAR-21
n-Hexane			92.1		%		70-130	09-MAR-21
Methylene Chloride			102.6		%		70-130	09-MAR-21
MTBE			101.5		%		70-130	09-MAR-21
m+p-Xylenes			99.3		%		70-130	09-MAR-21
Methyl Ethyl Ketone			108.2		%		60-140	09-MAR-21
Methyl Isobutyl Ketone			109.7		%		60-140	09-MAR-21
o-Xylene			108.8		%		70-130	09-MAR-21
Styrene			102.1		%		70-130	09-MAR-21
Tetrachloroethylene			99.2		%		60-130	09-MAR-21
Toluene			99.98		%		70-130	09-MAR-21
trans-1,2-Dichloroethylene			101.1		%		60-130	09-MAR-21
trans-1,3-Dichloropropene			108.0		%		70-130	09-MAR-21
Trichloroethylene			99.8		%		60-130	09-MAR-21
Trichlorofluoromethane			95.3		%		50-140	09-MAR-21
Vinyl chloride			99.3		%		60-140	09-MAR-21
WG3498942-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,1-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
1,2-Dibromoethane			<0.050		ug/g		0.05	09-MAR-21

Client:	Thurber Engineering Ltd. (Oakville) 2010 Winston Park Drive Unit 103 Oakville ON L6H 5R7
Contact:	Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-1 MB								
1,2-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichloropropane			<0.050		ug/g		0.05	09-MAR-21
1,3-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
1,4-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Acetone			<0.50		ug/g		0.5	09-MAR-21
Benzene			<0.0068		ug/g		0.0068	09-MAR-21
Bromodichloromethane			<0.050		ug/g		0.05	09-MAR-21
Bromoform			<0.050		ug/g		0.05	09-MAR-21
Bromomethane			<0.050		ug/g		0.05	09-MAR-21
Carbon tetrachloride			<0.050		ug/g		0.05	09-MAR-21
Chlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Chloroform			<0.050		ug/g		0.05	09-MAR-21
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Dibromochloromethane			<0.050		ug/g		0.05	09-MAR-21
Dichlorodifluoromethane			<0.050		ug/g		0.05	09-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	09-MAR-21
n-Hexane			<0.050		ug/g		0.05	09-MAR-21
Methylene Chloride			<0.050		ug/g		0.05	09-MAR-21
MTBE			<0.050		ug/g		0.05	09-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	09-MAR-21
Methyl Ethyl Ketone			<0.50		ug/g		0.5	09-MAR-21
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	09-MAR-21
o-Xylene			<0.020		ug/g		0.02	09-MAR-21
Styrene			<0.050		ug/g		0.05	09-MAR-21
Tetrachloroethylene			<0.050		ug/g		0.05	09-MAR-21
Toluene			<0.080		ug/g		0.08	09-MAR-21
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Trichloroethylene			<0.010		ug/g		0.01	09-MAR-21
Trichlorofluoromethane			<0.050		ug/g		0.05	09-MAR-21
Vinyl chloride			<0.020		ug/g		0.02	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-1 MB								
Surrogate: 1,4-Difluorobenzene			118.5		%		50-140	09-MAR-21
Surrogate: 4-Bromofluorobenzene			111.5		%		50-140	09-MAR-21
WG3498942-5 MS		**WG3498942-3**						
1,1,1,2-Tetrachloroethane			104.0		%		50-140	10-MAR-21
1,1,2,2-Tetrachloroethane			115.5		%		50-140	10-MAR-21
1,1,1-Trichloroethane			103.1		%		50-140	10-MAR-21
1,1,2-Trichloroethane			107.6		%		50-140	10-MAR-21
1,1-Dichloroethane			103.2		%		50-140	10-MAR-21
1,1-Dichloroethylene			104.9		%		50-140	10-MAR-21
1,2-Dibromoethane			107.0		%		50-140	10-MAR-21
1,2-Dichlorobenzene			106.2		%		50-140	10-MAR-21
1,2-Dichloroethane			102.2		%		50-140	10-MAR-21
1,2-Dichloropropane			104.9		%		50-140	10-MAR-21
1,3-Dichlorobenzene			104.6		%		50-140	10-MAR-21
1,4-Dichlorobenzene			104.9		%		50-140	10-MAR-21
Acetone			113.4		%		50-140	10-MAR-21
Benzene			102.6		%		50-140	10-MAR-21
Bromodichloromethane			109.6		%		50-140	10-MAR-21
Bromoform			111.4		%		50-140	10-MAR-21
Bromomethane			104.5		%		50-140	10-MAR-21
Carbon tetrachloride			106.0		%		50-140	10-MAR-21
Chlorobenzene			103.4		%		50-140	10-MAR-21
Chloroform			106.1		%		50-140	10-MAR-21
cis-1,2-Dichloroethylene			110.8		%		50-140	10-MAR-21
cis-1,3-Dichloropropene			109.2		%		50-140	10-MAR-21
Dibromochloromethane			104.3		%		50-140	10-MAR-21
Dichlorodifluoromethane			101.3		%		50-140	10-MAR-21
Ethylbenzene			105.4		%		50-140	10-MAR-21
n-Hexane			102.1		%		50-140	10-MAR-21
Methylene Chloride			105.5		%		50-140	10-MAR-21
MTBE			105.7		%		50-140	10-MAR-21
m+p-Xylenes			103.9		%		50-140	10-MAR-21
Methyl Ethyl Ketone			103.4		%		50-140	10-MAR-21
Methyl Isobutyl Ketone			109.6		%		50-140	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-5 MS		**WG3498942-3**						
o-Xylene			114.2		%		50-140	10-MAR-21
Styrene			105.5		%		50-140	10-MAR-21
Tetrachloroethylene			103.7		%		50-140	10-MAR-21
Toluene			105.3		%		50-140	10-MAR-21
trans-1,2-Dichloroethylene			105.2		%		50-140	10-MAR-21
trans-1,3-Dichloropropene			108.6		%		50-140	10-MAR-21
Trichloroethylene			104.2		%		50-140	10-MAR-21
Trichlorofluoromethane			105.9		%		50-140	10-MAR-21
Vinyl chloride			112.0		%		50-140	10-MAR-21

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Cyanides							
Cyanide (WAD)-O.Reg 153/04 (July 2011)							
	1	23-FEB-21 13:00	11-MAR-21 13:00	14	16	days	EHT
	2	22-FEB-21 14:00	10-MAR-21 19:00	14	16	days	EHT
	3	23-FEB-21 17:00	11-MAR-21 13:00	14	16	days	EHT
	4	24-FEB-21 15:00	11-MAR-21 13:00	14	15	days	EHT
	6	24-FEB-21 11:00	11-MAR-21 13:00	14	15	days	EHT
Hydrocarbons							
F2-F4-O.Reg 153/04 (July 2011)							
	1	23-FEB-21 13:00	10-MAR-21 14:00	14	15	days	EHT
	2	22-FEB-21 14:00	09-MAR-21 14:00	14	15	days	EHT
	3	23-FEB-21 17:00	11-MAR-21 13:00	14	16	days	EHT
	4	24-FEB-21 15:00	11-MAR-21 13:00	14	15	days	EHT
	6	24-FEB-21 11:00	11-MAR-21 13:00	14	15	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2564179 were received on 05-MAR-21 16:00.

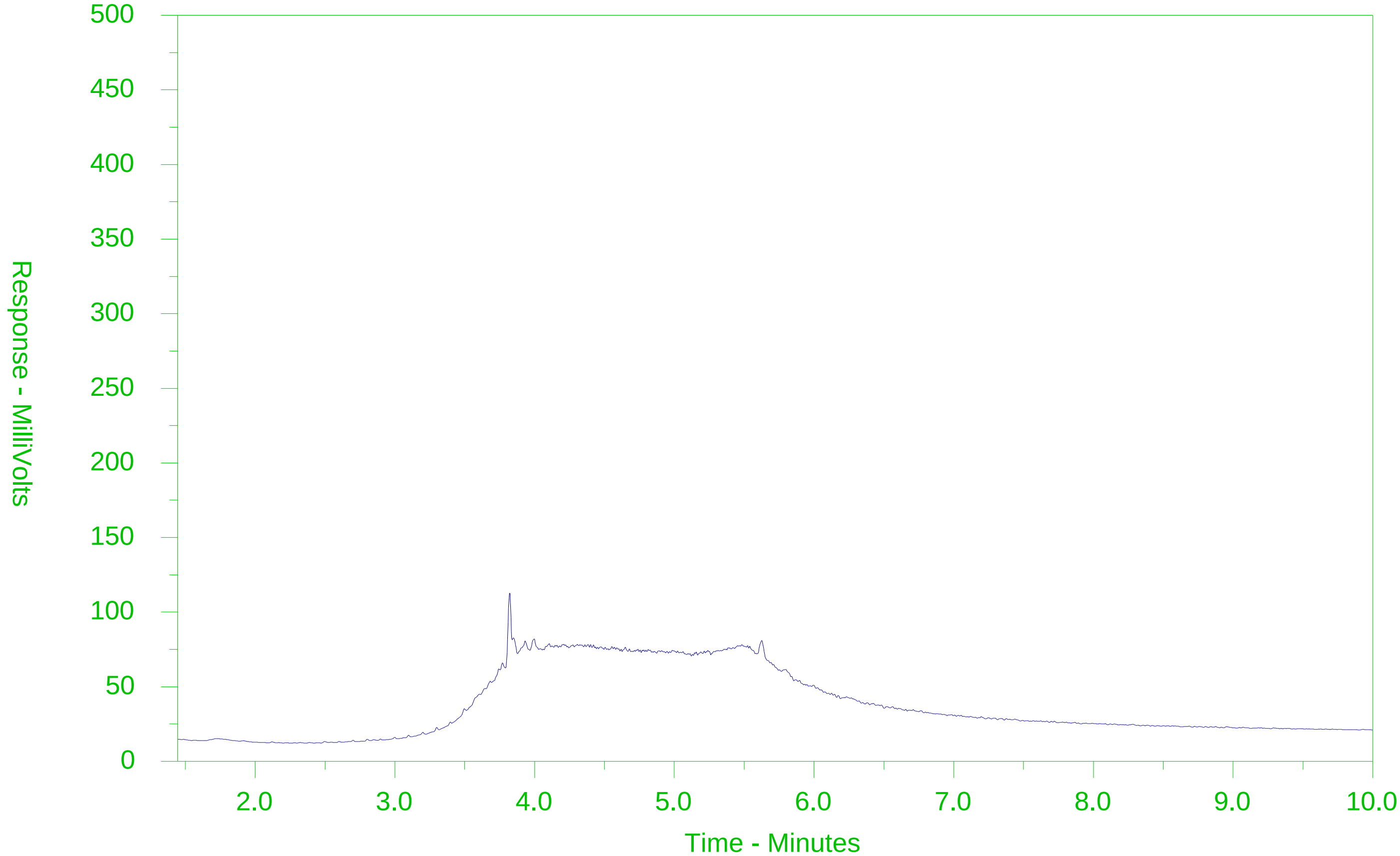
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-1
Client Sample ID: BH01 SS1 (0'-2')



←F2→	←	F3→	←F4→	
nC10	nC16	nC34	nC50	
174°C	287°C	481°C	575°C	
346°F	549°F	898°F	1067°F	
Gasoline →		← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →				

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

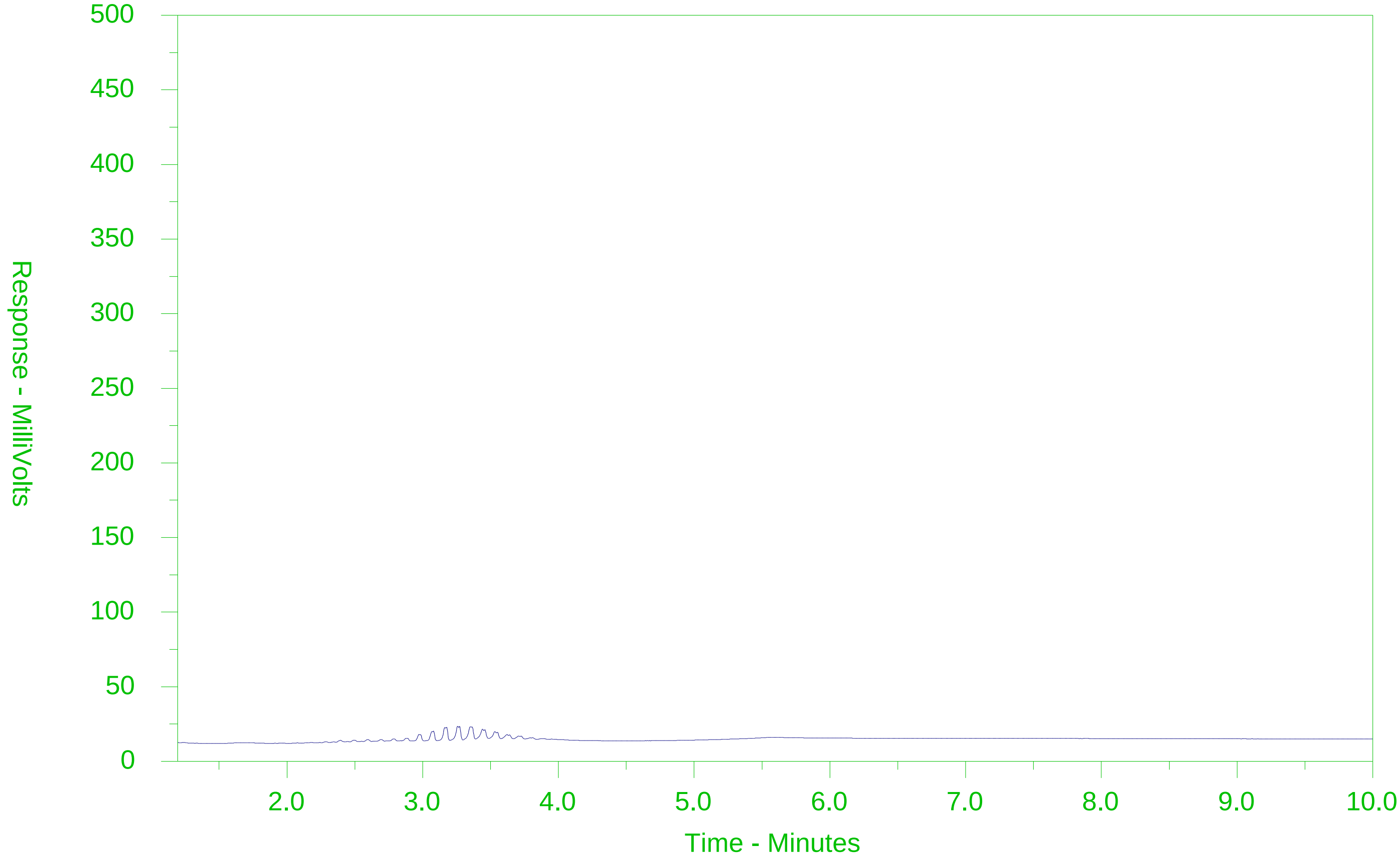
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-2
Client Sample ID: BH02 SS5 (10-12)



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

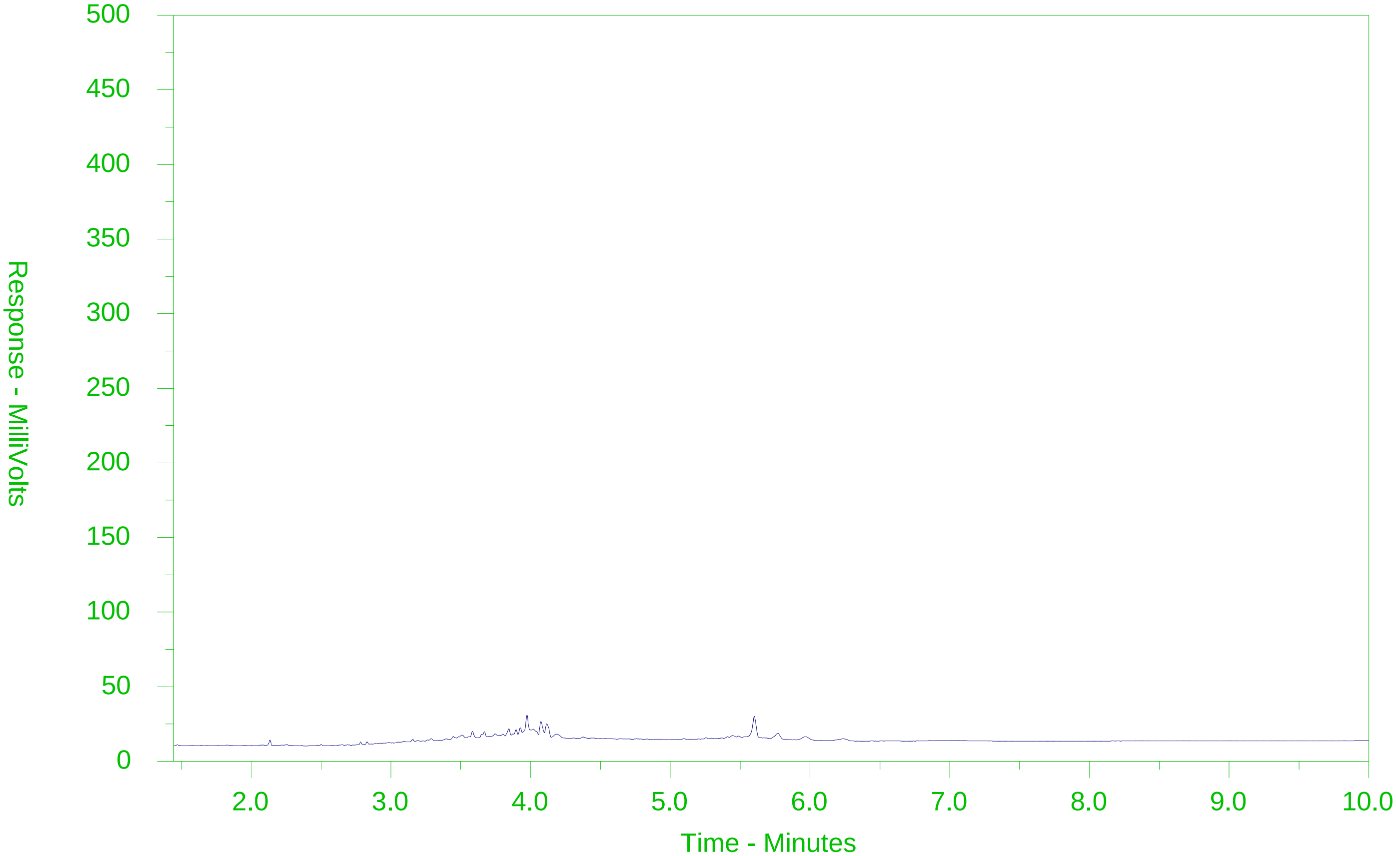
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-3
Client Sample ID: BH03 SS1 (0'-2')



←F2→	←	F3→	←F4→	
nC10	nC16	nC34	nC50	
174°C	287°C	481°C	575°C	
346°F	549°F	898°F	1067°F	
Gasoline →		← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →				

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

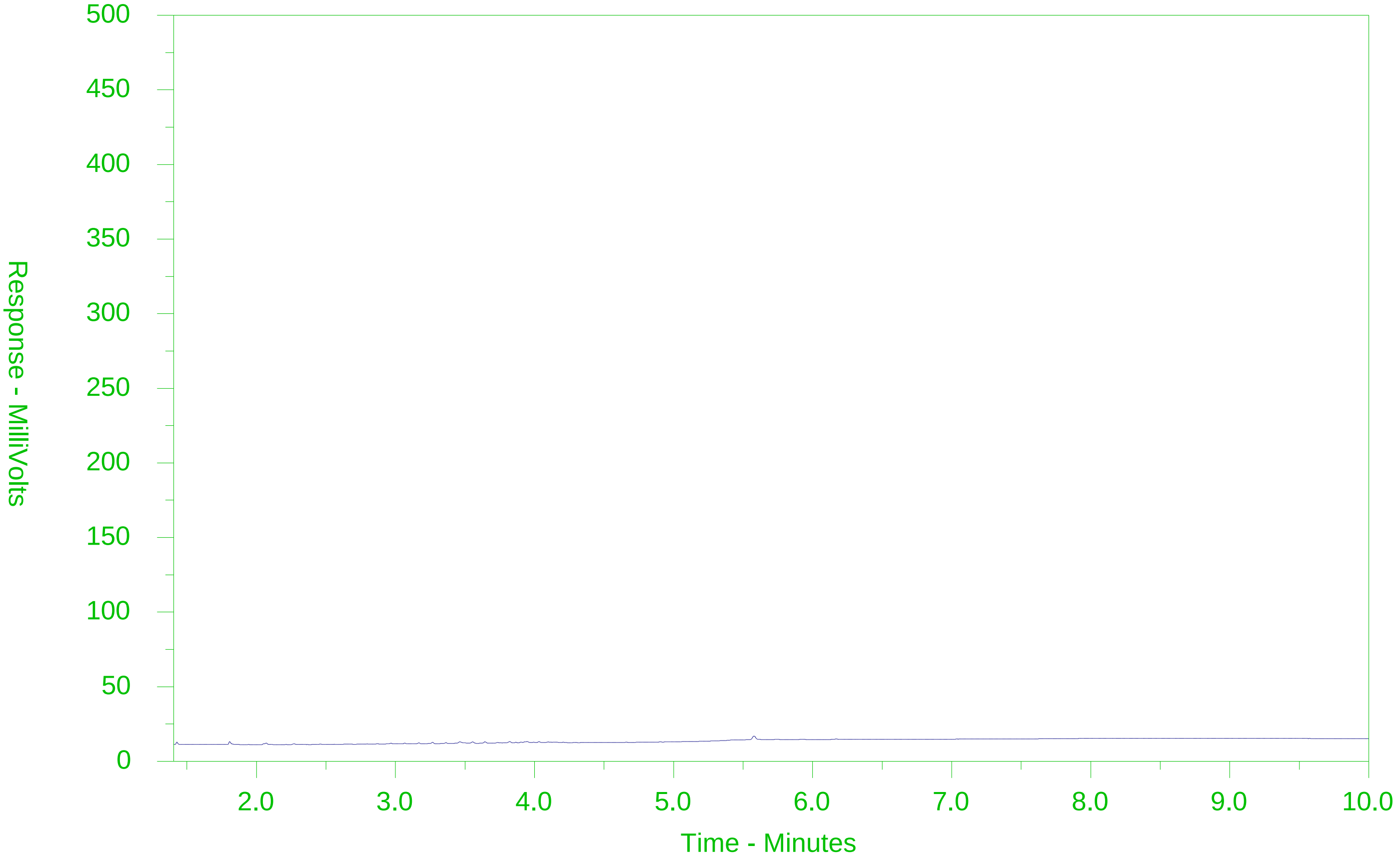
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-4
Client Sample ID: BH04 SS2 (2'6"-4'6")



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

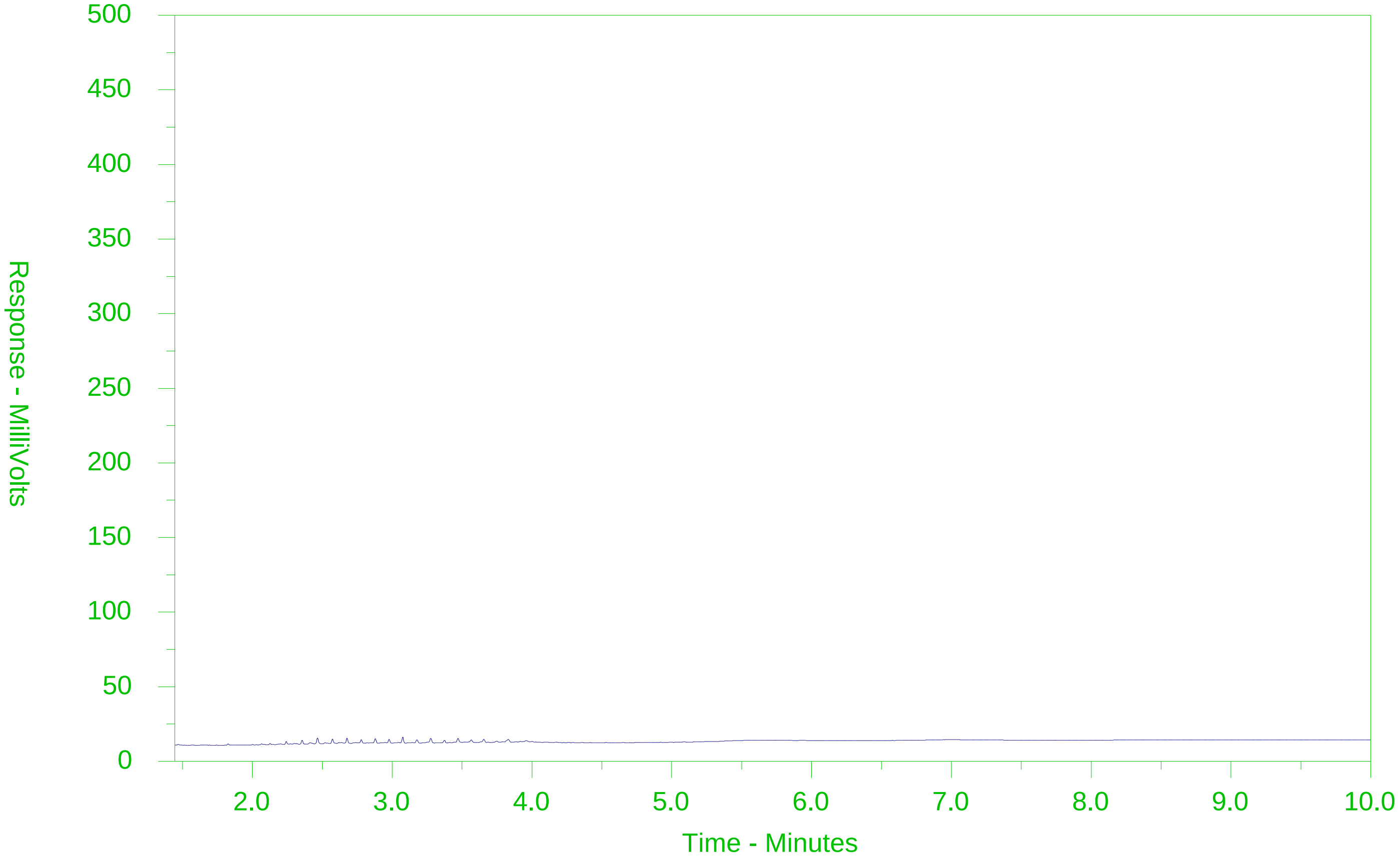
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-5
Client Sample ID: BH 05 SS8 (25'-27')



←F2→	←	F3	→← F4 →	
nC10	nC16	nC34	nC50	
174°C	287°C	481°C	575°C	
346°F	549°F	898°F	1067°F	
Gasoline →		← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →				

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

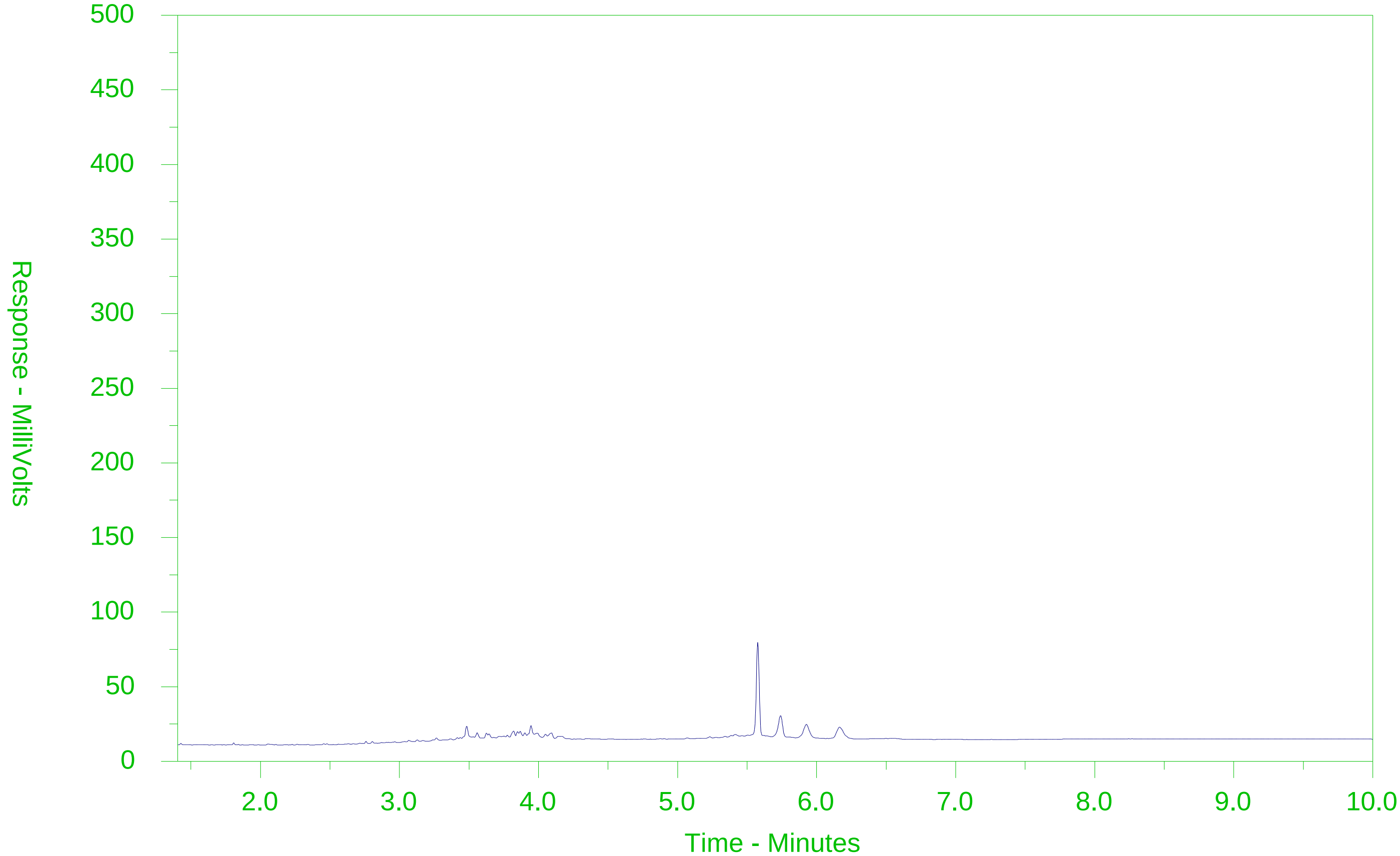
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-6
Client Sample ID: BH06 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

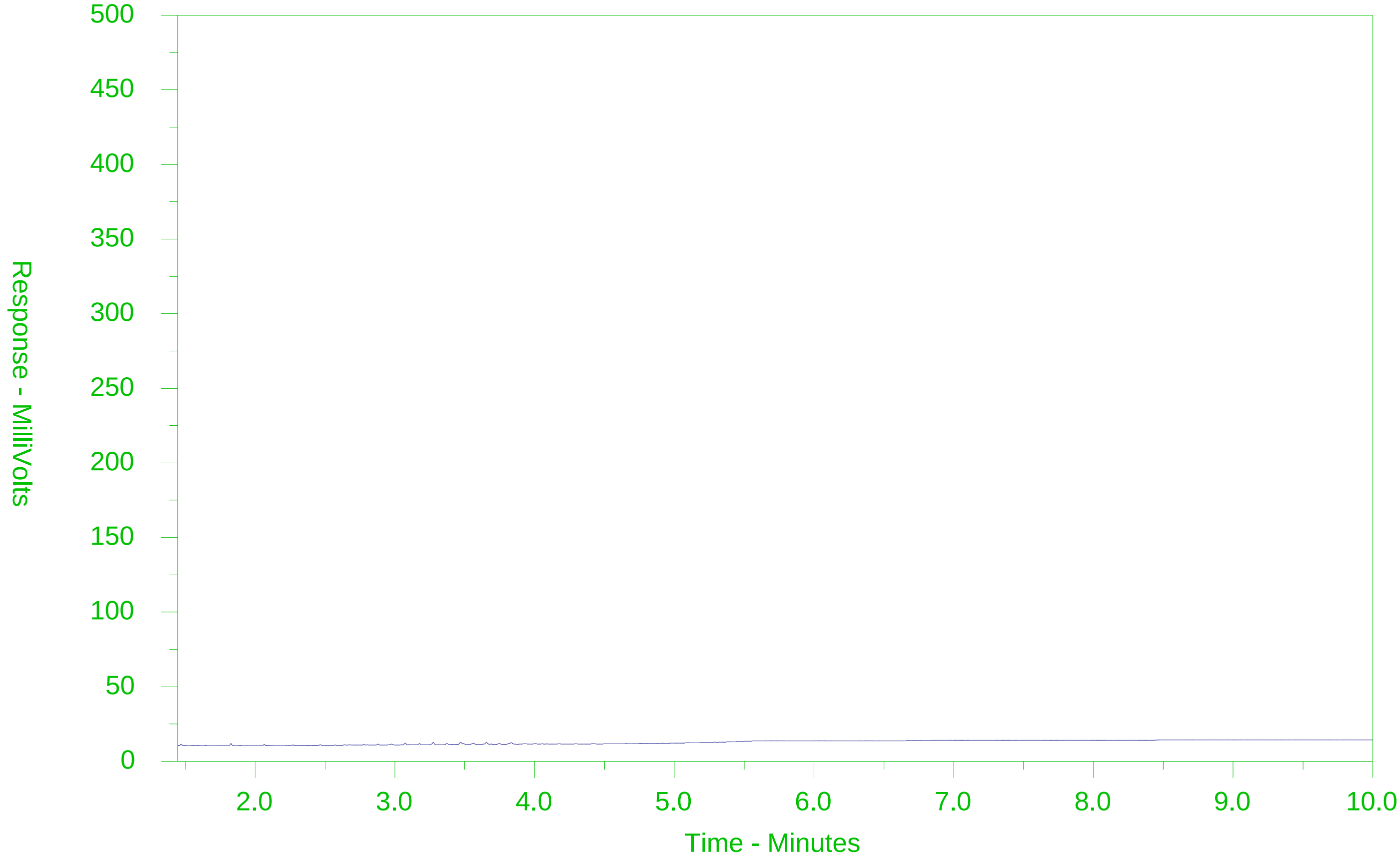
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-8
Client Sample ID: BH07 SS6 (15'-17')



←F2→	←	F3	→←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

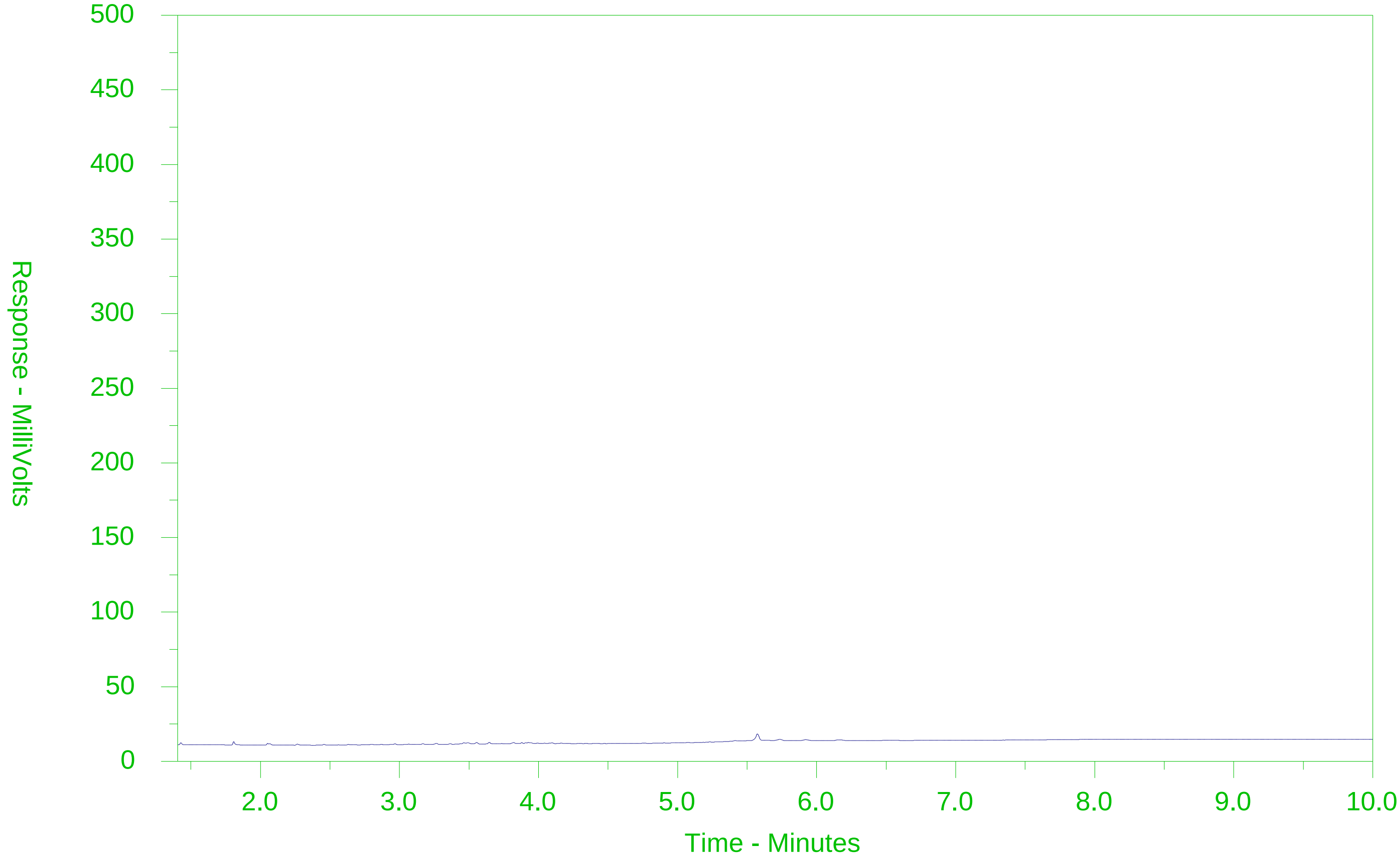
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-9
Client Sample ID: BH08 SS2 (2'6"-4'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

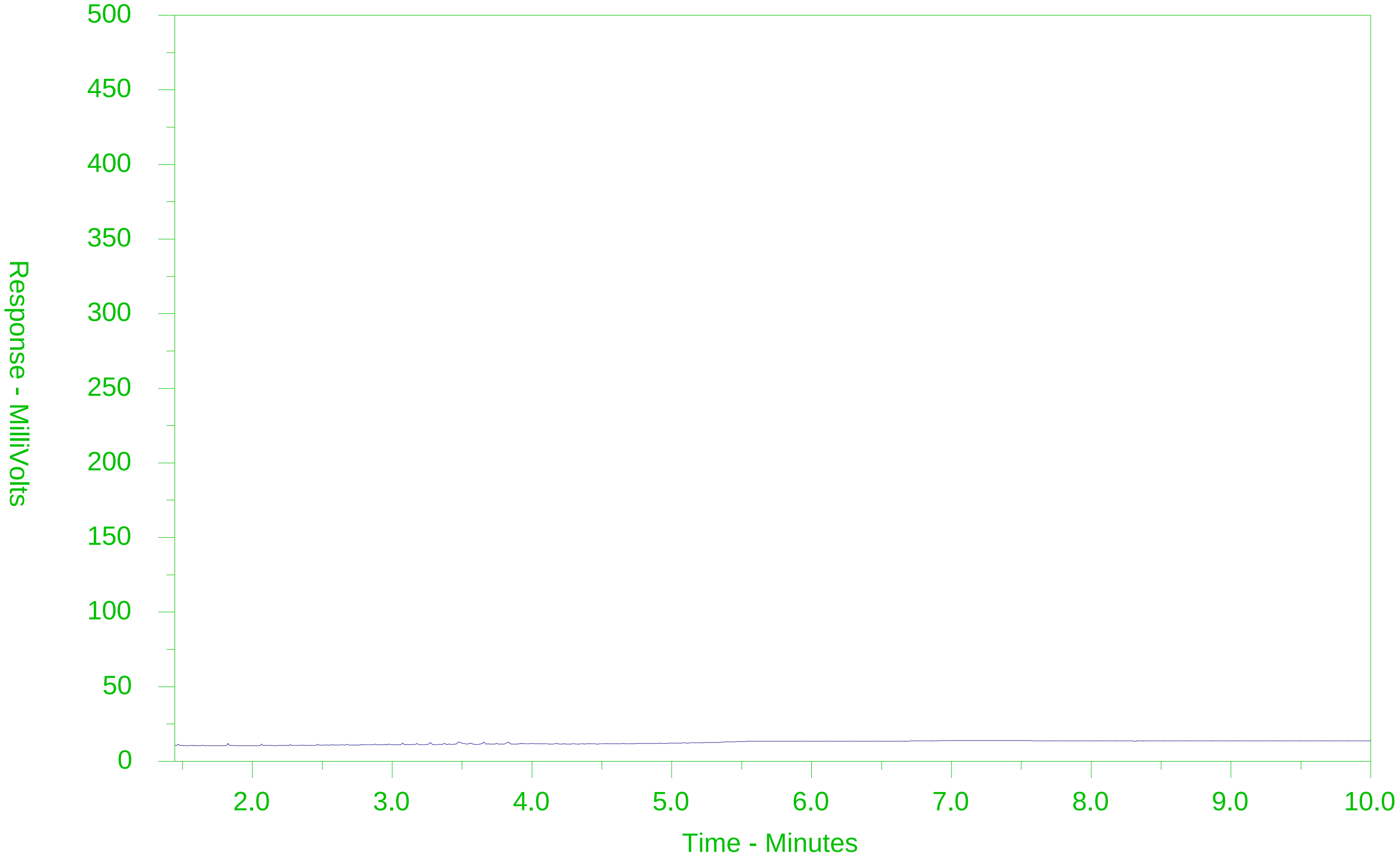
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-10
Client Sample ID: BH10 SS4 (7'6"-9'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

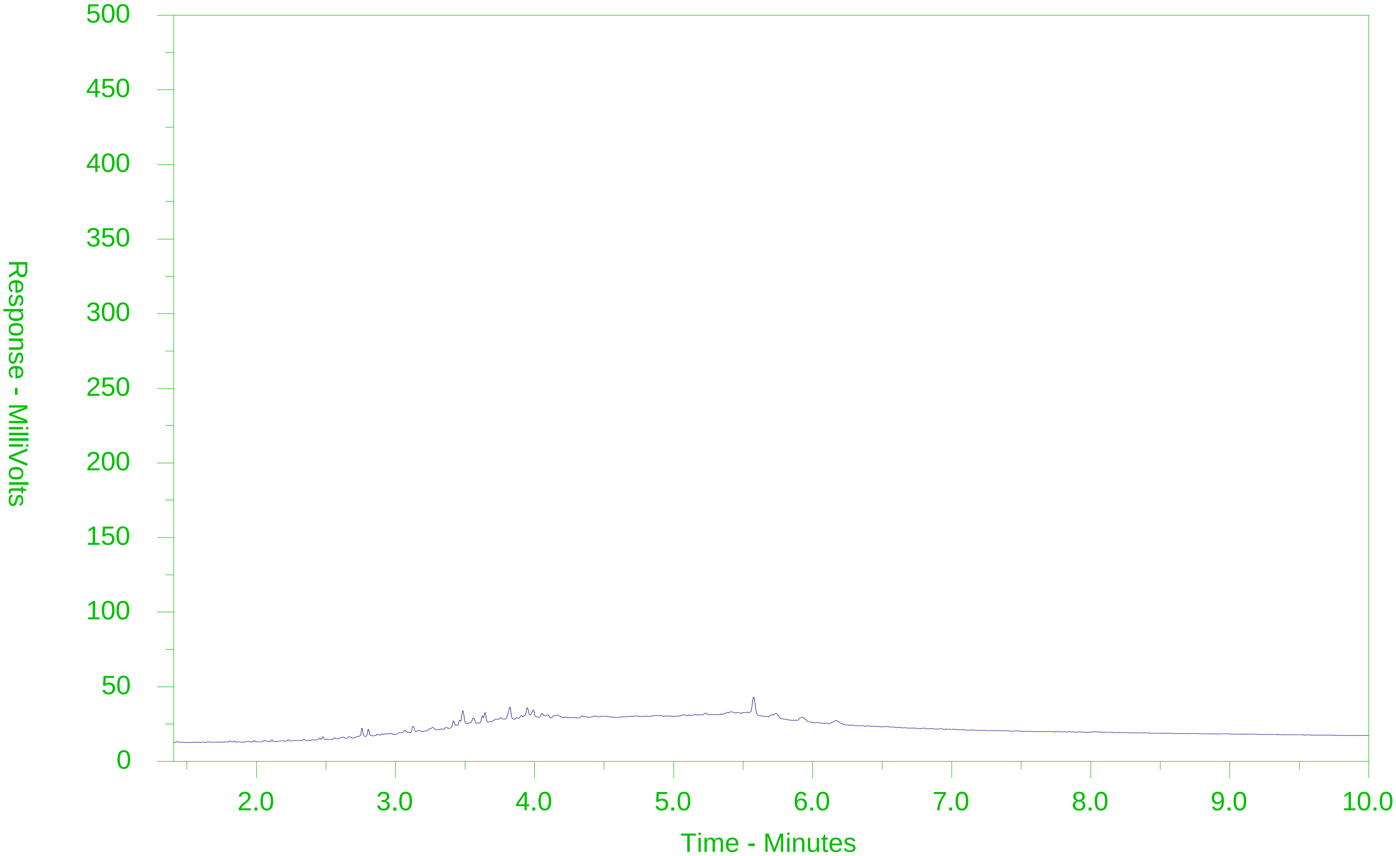
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-11
Client Sample ID: BH11 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

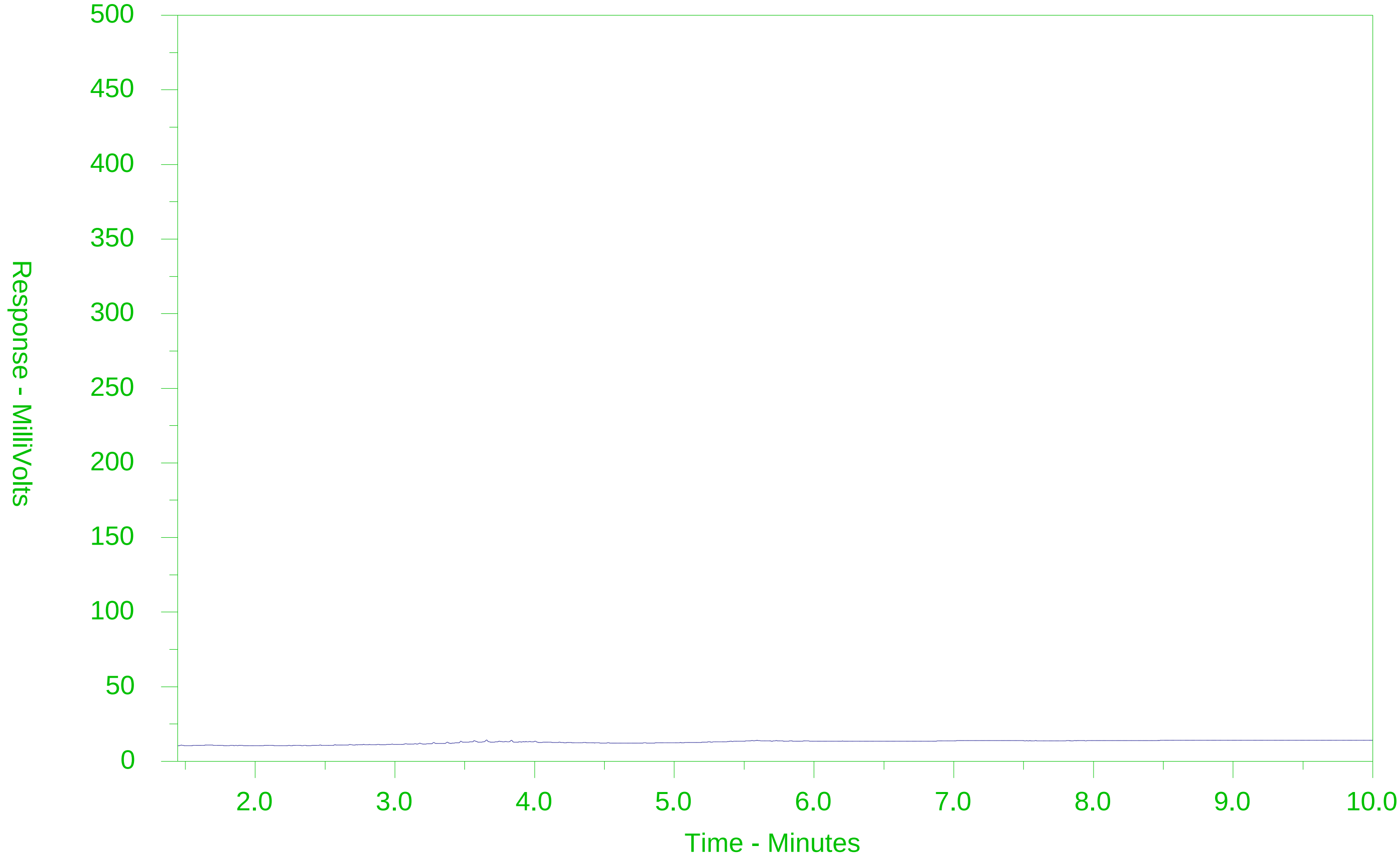
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-12
Client Sample ID: BH12 SS3 (5'-7')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

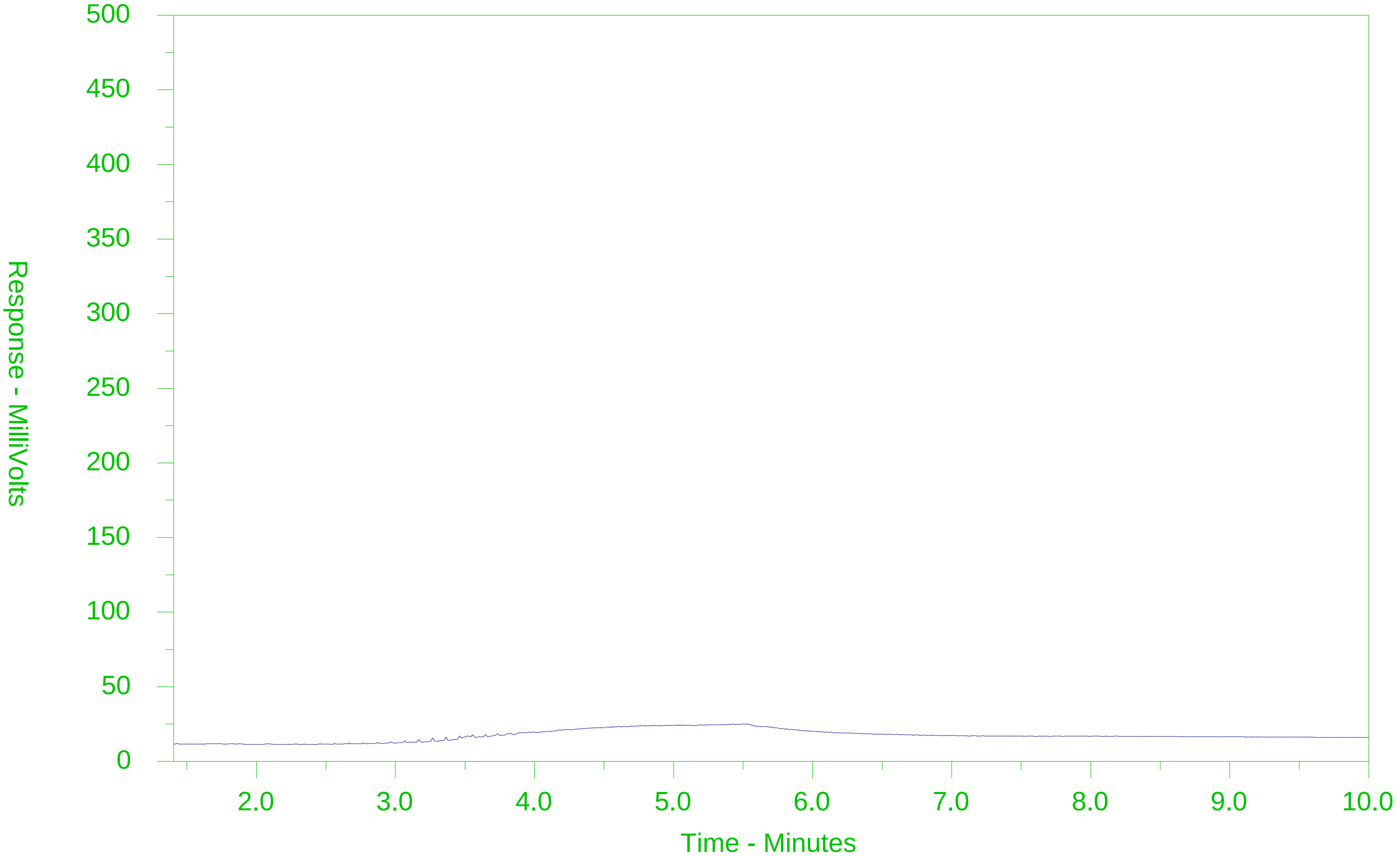
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-13
Client Sample ID: BH13 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

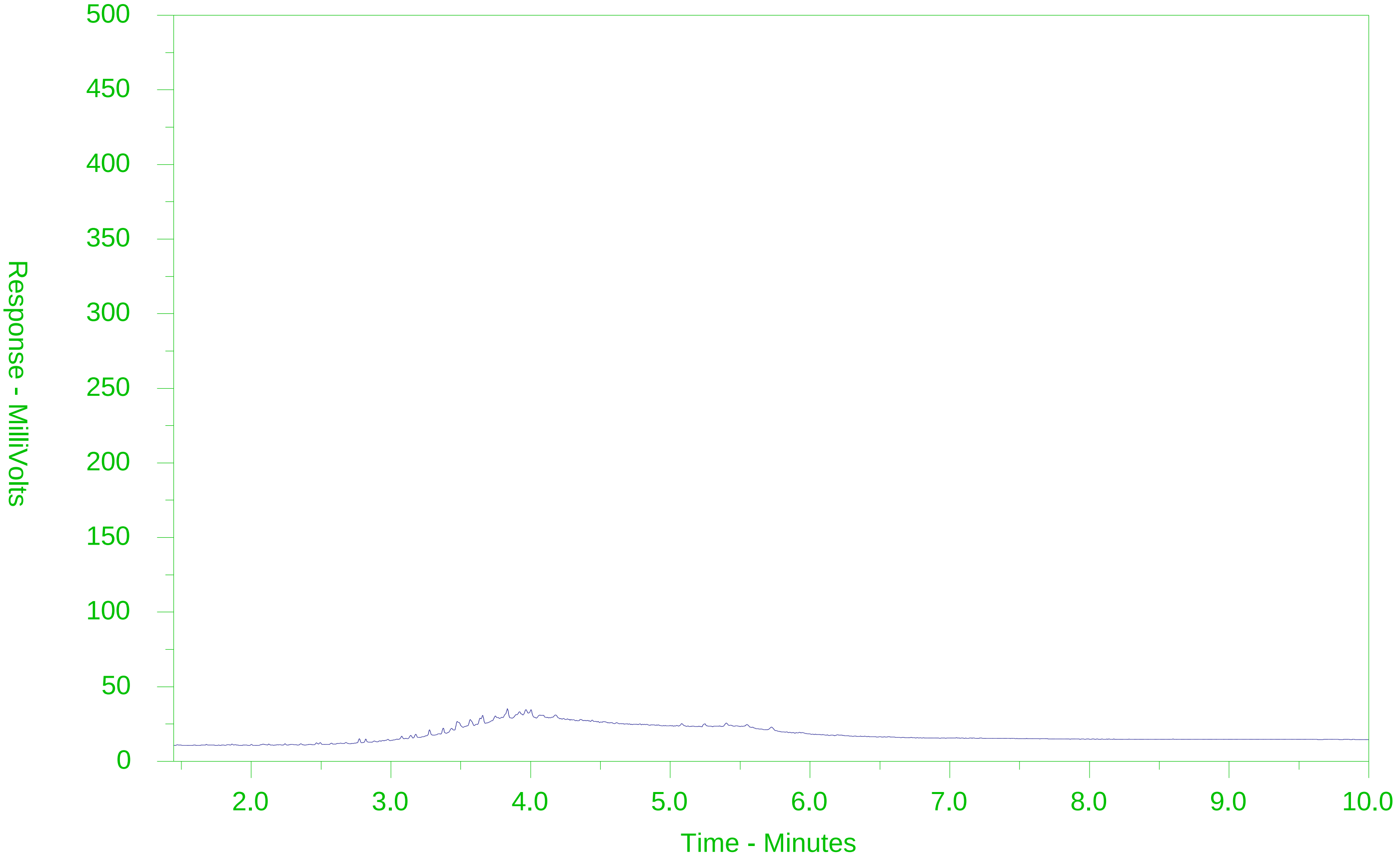
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-14
Client Sample ID: BH14 SS2 (2'6"-4'6")



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

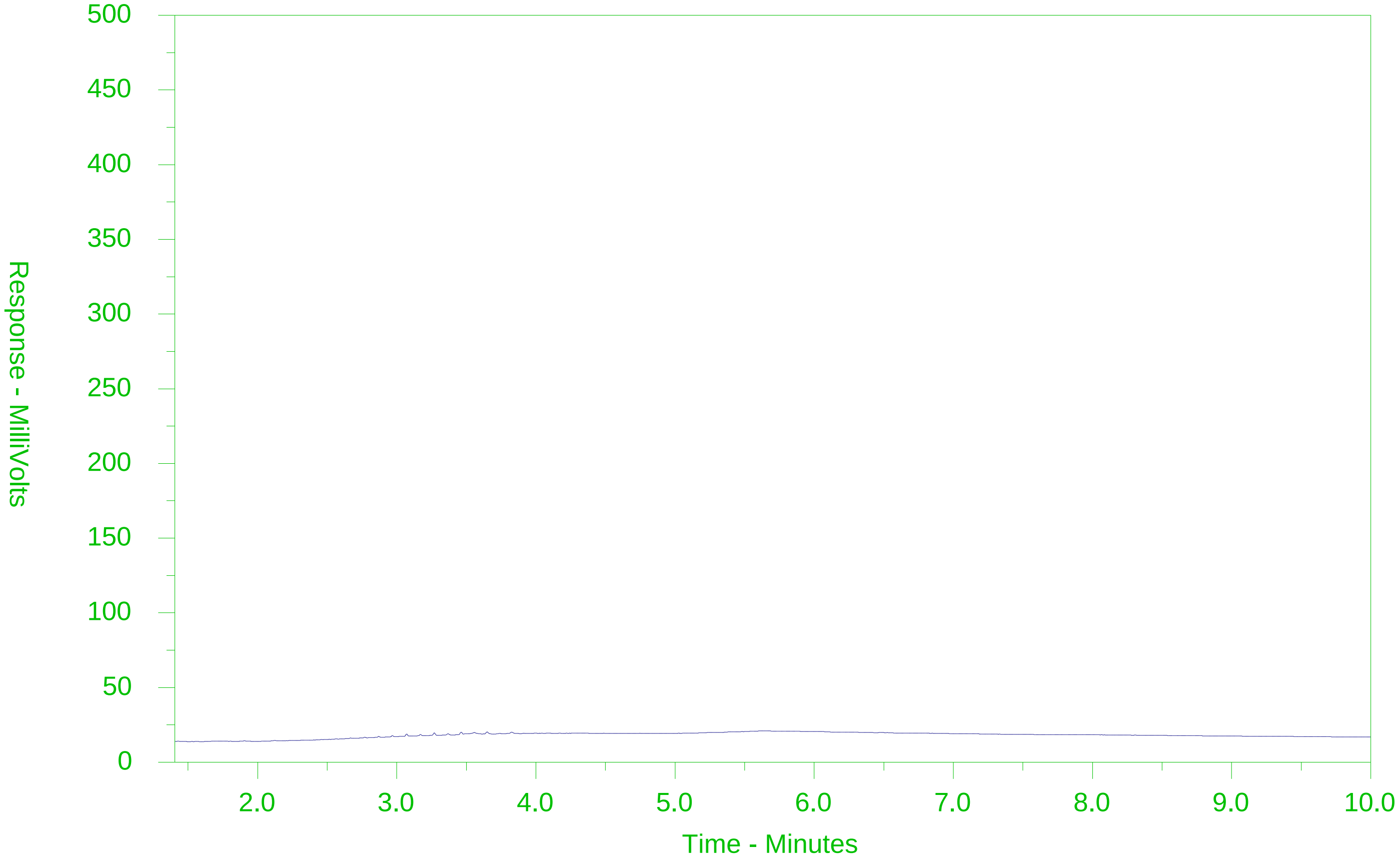
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-15
Client Sample ID: BH19 SS4 (7'6"-9'-6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

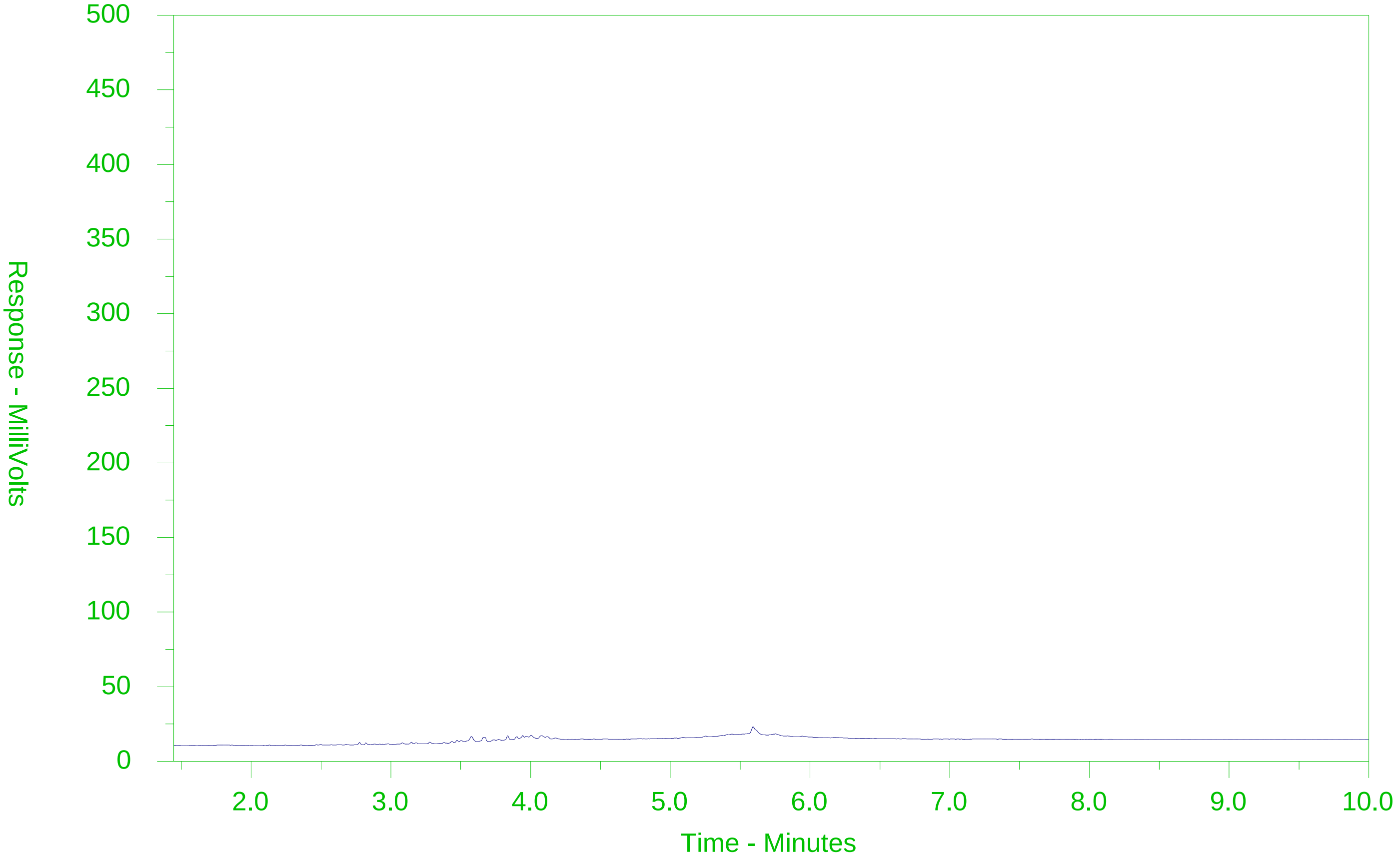
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-16
Client Sample ID: BH20 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

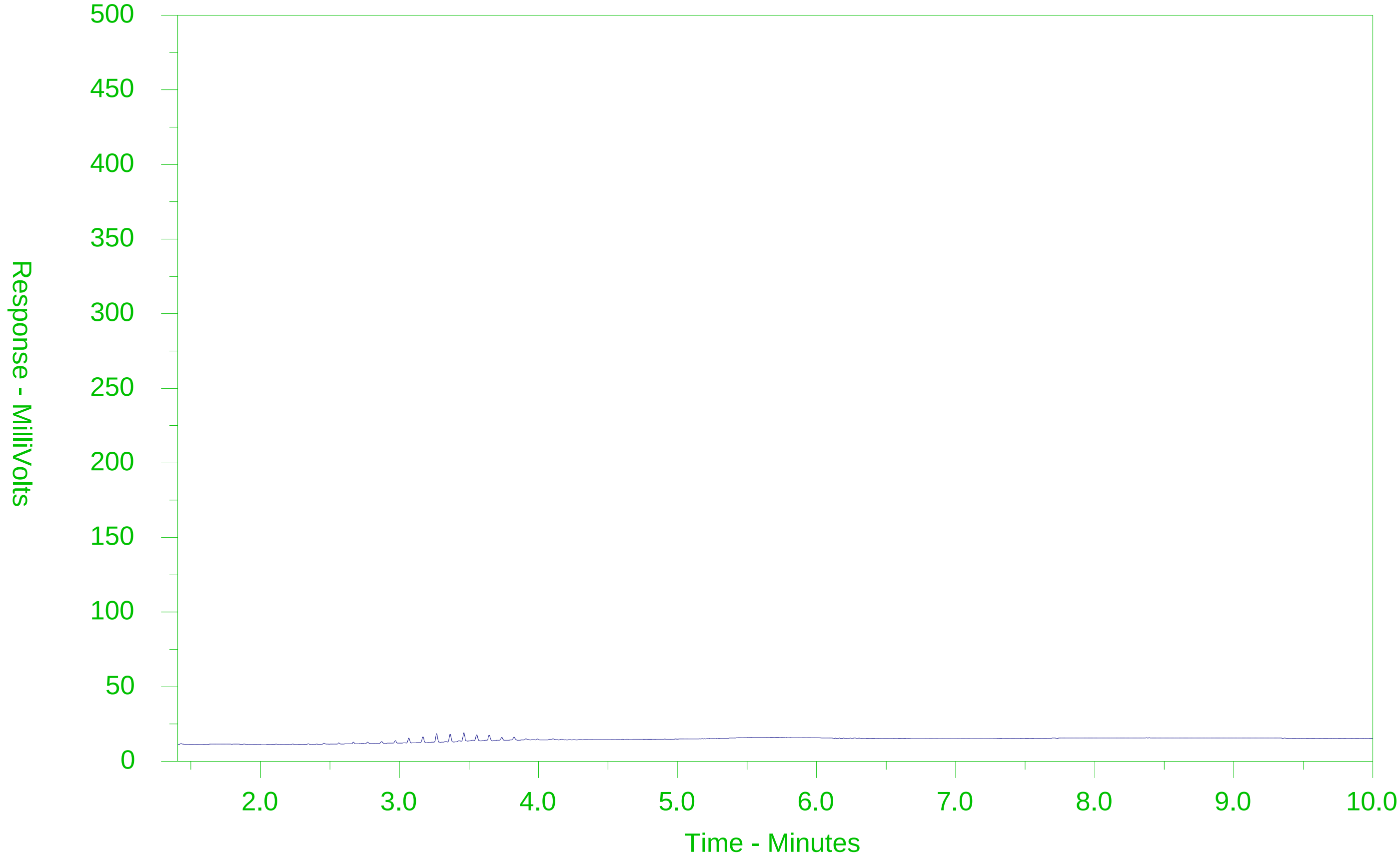
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-17
Client Sample ID: BH21 SS3 (5'-7')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

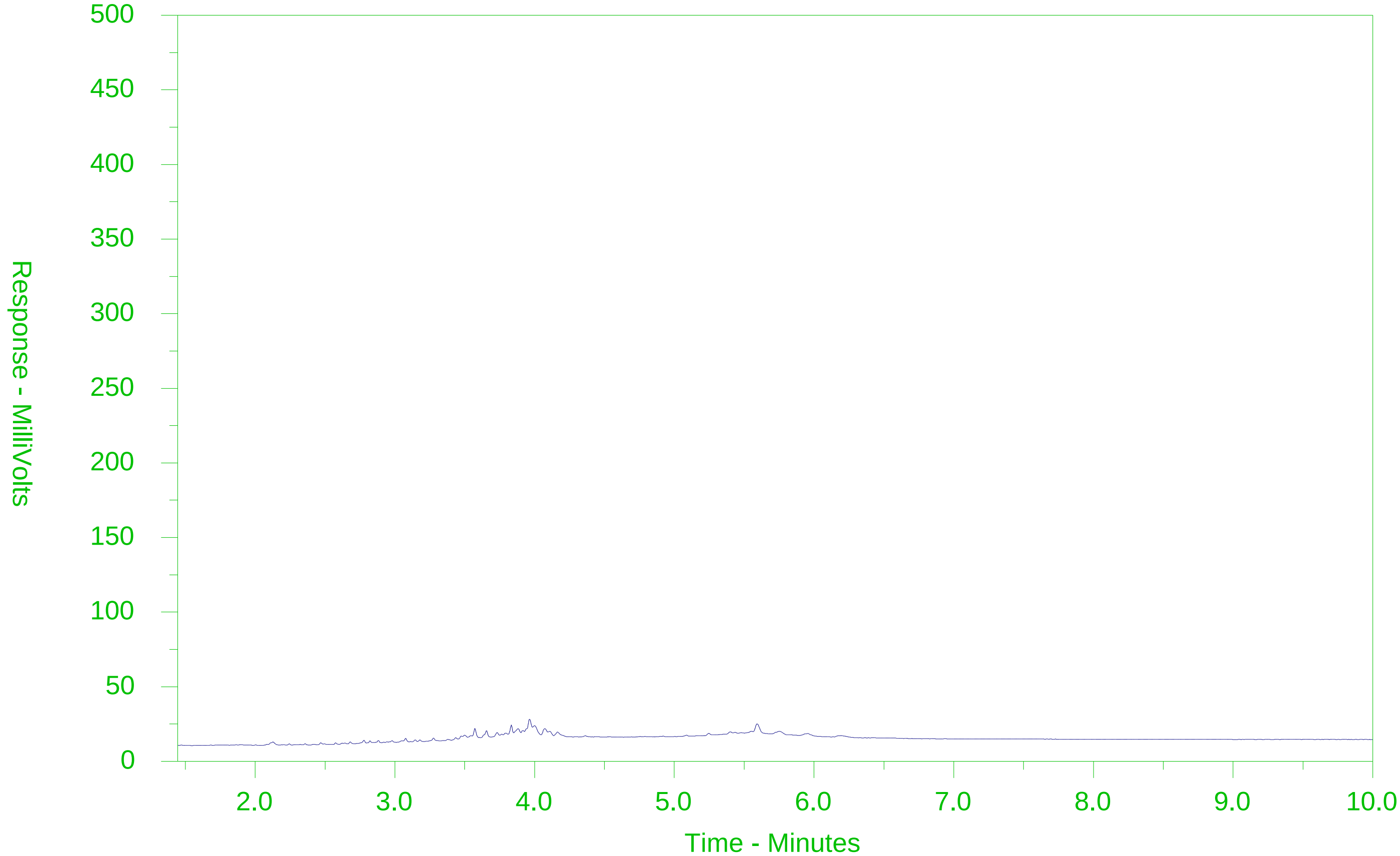
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-18
Client Sample ID: BH23 SS1 (0'-2')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

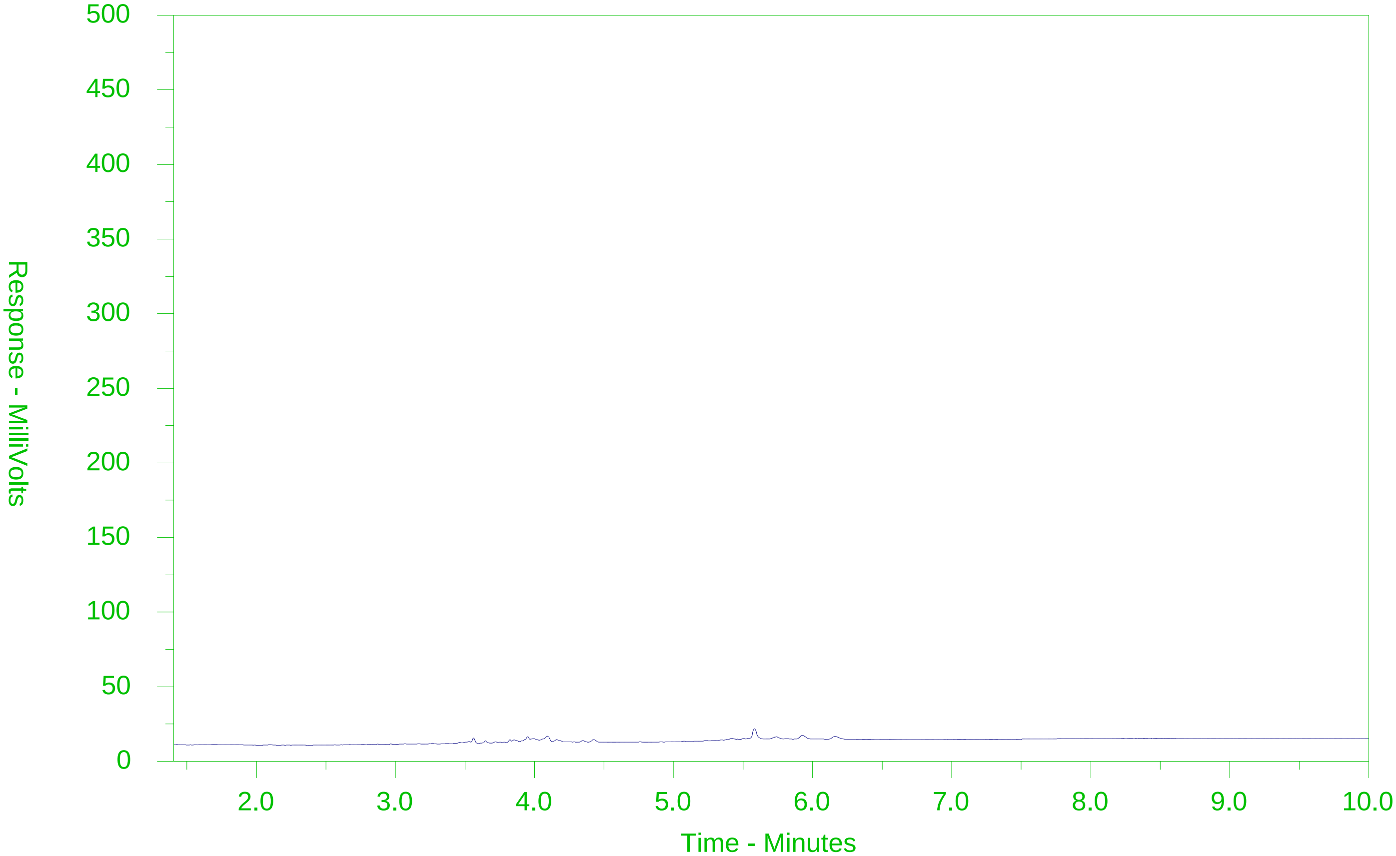
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-19
Client Sample ID: BH24 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

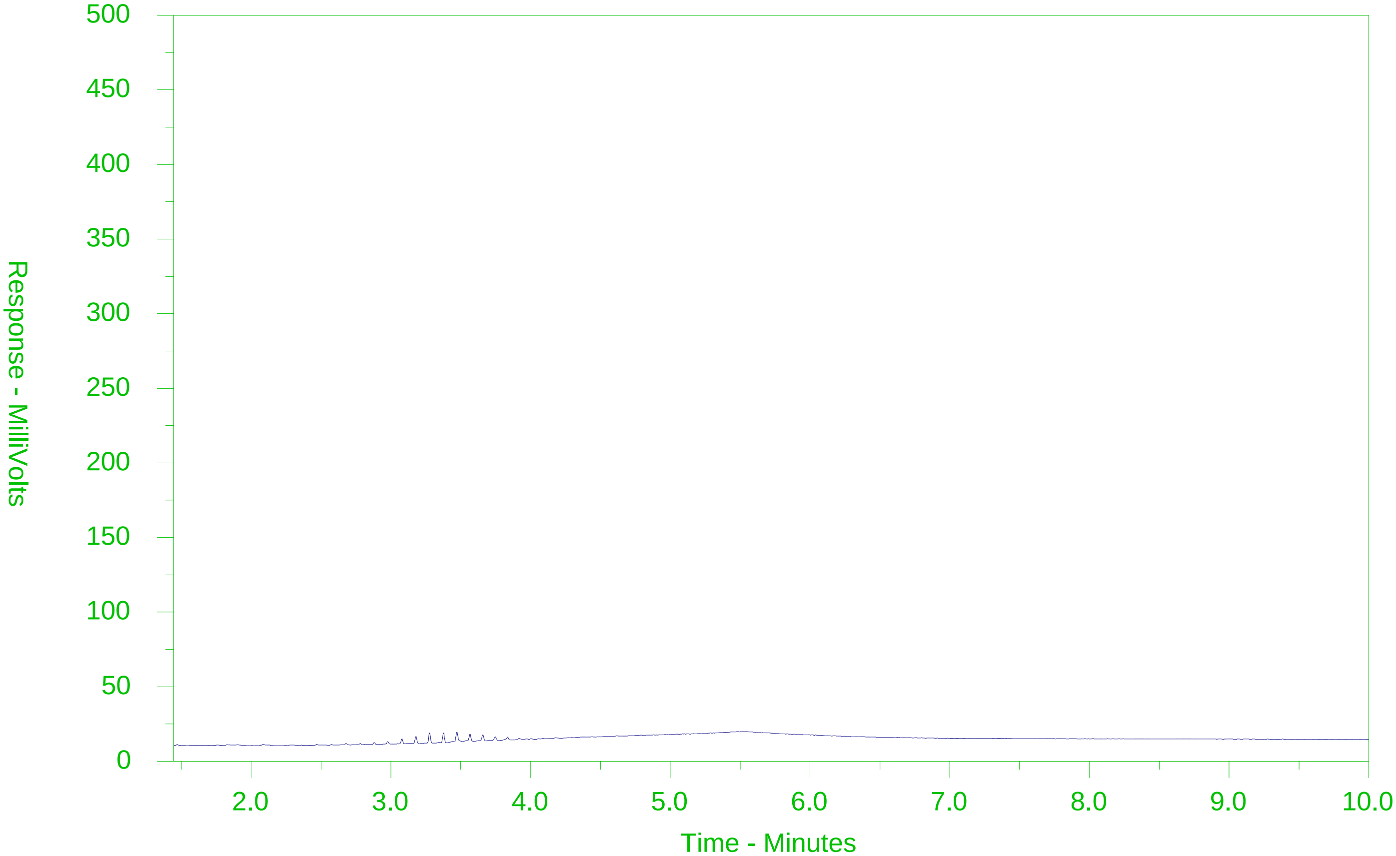
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-20
Client Sample ID: BH25 SS4 (7'6"-9'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

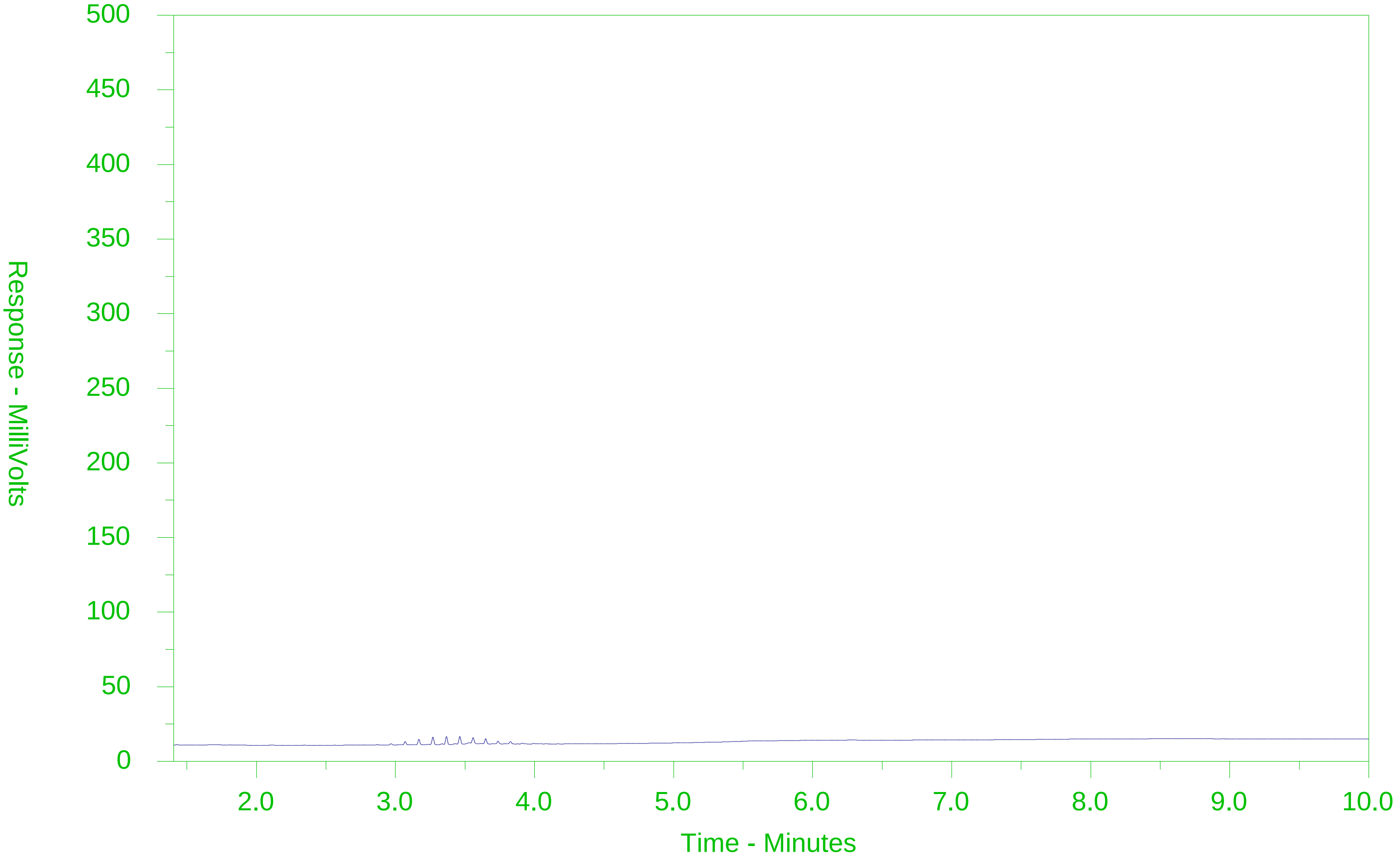
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-21
Client Sample ID: BH26 SS5 (10'-12')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

Chain of Custody

L2564179-COFC

COC Number: 20 -

Page 1 of 2

ALS www.alsglobal.com

Report To	Contact and company name below will appear on the final report
Company:	Thurber Engineering Ltd.
Contact:	Rachel Bourassa
Phone:	~~905-829-8666~~ 416 523 1015
	Company address below will appear on the final report
Street:	2010 Winston Park Drive, Suite 103
City/Province:	Oakville, Ontario
Postal Code:	L6H 5R7
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Thurber Engineering Ltd.
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☑ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax rbourassa@thurber.ca

Email 2

Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax accountingON@thurber.ca

Email 2

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information

ALS Account # / Quote #: 25053 / 84199

Job #:

PO / AFE:

LSD:

ALS Lab Work Order # (lab use only): L2564179

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Contact: Amanda Overholster | Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O. Reg. 153/04 Metals & Inorganics	O. Reg. 153/04 BTEX/PHC F1-F4	O. Reg. 153/04 VOCs	Corrosivity	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
1	BH01 SS1 (0'-2')	23-Feb-21	1:00	Soil	4	✓	✓					
2	BH02 SS5 (10-12)	22-Feb-21	2:00	"	7	✓	✓	✓				
3	BH03 SS1 (0'-2')	23-Feb-21	3:00	"	4	✓	✓					
4	BH04 SS2 (2'6"-4'6")	24-Feb-21	3:00	"	7	✓	✓	✓				
5	BH05 SS8 (25'-27')	25-Feb-21	12:00	"	4	✓	✓					
6	BH06 SS1 (0'-2')	24-Feb-21	11:00	"	4	✓	✓					
7	BH06 SS2 (2'6'-4'6")	24-Feb-21	11:10	"	3			✓				
8	BH07 SS6 (15'-17')	26-Feb-21	11:30	"	4	✓	✓					
9	BH08 SS2 (2'6"-4'6")	26-Feb-21	9:15	"	7	✓	✓					
10	BH10 SS4 (7'6"-9'6")	25-Feb-21	12:00	"	7	✓	✓	✓				
11	BH11 SS1 (0'-2')	25-Feb-21	12:00	"	4	✓	✓					
12	BH12 ~~SS4 (7'6"-9'6")~~ SS3 (5'-7')	25-Feb-21	2:00	"	7	✓	✓	✓				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C 8.5

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rachel Bourassa	Date: March 5, 21	Time:	Received by:	Date:	Time:	Received by: MJ	Date: Mar 5/21	Time: 13:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS www.alsglobal.com

Chai[illegible]n

L2564179-COFC

COC Number: 20 -

Report To — Contact and company name below will appear on the final report

Company: Thurber Engineering Ltd.
Contact: Rachel Bourassa
Phone: ~~905-829-8666~~ 416 523 1015

Company address below will appear on the final report

Street: 2010 Winston Park Drive, Suite 103
City/Province: Oakville, Ontario
Postal Code: L6H 5R7

Invoice To — Same as Report To ☐ YES ☑ NO
Copy of Invoice with Report ☑ YES ☐ NO
Company: Thurber Engineering Ltd.
Contact:

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A
☑ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: rbourassa@thurber.ca
Email 2
Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: accountingON@thurber.ca
Email 2

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

Project Information

ALS Account # / Quote #: 25053 / 84199
Job #: 30726
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only): L2564179
ALS Contact: Amanda Overholster
Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O. Reg. 153/04 Metals & Inorganics	O. Reg. 153/04 BTEX/PHC F1-F4	O. Reg. 153/04 VOCs		Corrosivity	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	~~[illegible]~~							✓					
13	BH 13 SS1 (0-2')	2-Mar-21	12:00	Soil	4	✓	✓						
14	BH 14 SS2 (2'6"-4'6")	1-Mar-21	2:00	"	7	✓	✓	✓					
15	BH 19 SS4 (7'6"-9'6")	2-Mar-21	2:00	"	4	✓	✓						
16	BH 20 SS1 (0'-2')	26-Feb-21	12:00	"	4	✓	✓						
17	BH 21 SS3 (5'-7')	2-Mar-21	11:00	"	7	✓	✓	✓					
18	BH 23 SS1 (0'-2')	26-Feb-21	10:00	"	7	✓	✓	✓					
19	BH 24 SS1 (0'-2)	25-Feb-21	4:00	"	4	✓	✓						
20	BH 25 SS4 (7'6"-9'6")	01-Mar-21	11:00	Soil	7	✓	✓	✓					
21	BH 26 SS5 (10'-12')	1-Mar-21	3:30	"	4	✓	✓						

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO
Cooler Custody Seals Intact: ☐ YES ☐ N/A   Sample Custody Seals Intact: ☐ YES ☐ N/A
INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 8.3

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rachel Bourassa	Date: March 5/21	Time:	Received by:	Date:	Time:	Received by: [signature]	Date: Mar 5/21	Time: 16:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY   AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Thurber Engineering Ltd. (Oakville)
ATTN: Rachel Bourssa
2010 Winston Park Drive
Unit 103
Oakville ON L6H 5R7

Date Received: 05-MAR-21
Report Date: 07-APR-21 12:23 (MT)
Version: FINAL REV. 3

Client Phone: 905-829-8666

Certificate of Analysis

Lab Work Order #: L2564179

Project P.O. #: NOT SUBMITTED
Job Reference: 30726
C of C Numbers:
Legal Site Desc:

Comments: 07-APR-21 Revised report comparing to Reg 153 Table 1&2 RPIICC per client request. - A.Overholster
07-APR-21 Revised report comparing to Reg 406 Table 2.1 per client request. - A.Overholster

Amanda Overholster
Account Manager

ANALYTICAL GUIDELINE REPORT

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-1 BH01 SS1 (0'-2')								
Sampled By: CLIENT on 23-FEB-21 @ 13:00								
Matrix: SOIL								
Physical Tests								
Conductivity	0.215		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
% Moisture	19.8		0.25	%	11-MAR-21			
pH	7.71		0.10	pH units	15-MAR-21			
Cyanides								
Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables								
SAR	1.57		0.10	SAR	16-MAR-21	5	5	12
Calcium (Ca)	16.8		0.50	mg/L	16-MAR-21			
Magnesium (Mg)	4.25		0.50	mg/L	16-MAR-21			
Sodium (Na)	27.8		0.50	mg/L	16-MAR-21			
Metals								
Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
Arsenic (As)	4.0		1.0	ug/g	16-MAR-21	11	18	18
Barium (Ba)	359		1.0	ug/g	16-MAR-21	390	390	670
Beryllium (Be)	1.09		0.50	ug/g	16-MAR-21	4	4	8
Boron (B)	16.9		5.0	ug/g	16-MAR-21	120	120	120
Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
Chromium (Cr)	54.7		1.0	ug/g	16-MAR-21	160	160	160
Cobalt (Co)	17.8		1.0	ug/g	16-MAR-21	22	22	80
Copper (Cu)	34.3		1.0	ug/g	16-MAR-21	140	140	230
Lead (Pb)	11.9		1.0	ug/g	16-MAR-21	45	120	120
Mercury (Hg)	0.0116		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
Nickel (Ni)	37.7		1.0	ug/g	16-MAR-21	100	100	270
Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
Vanadium (V)	78.2		1.0	ug/g	16-MAR-21	86	86	86
Zinc (Zn)	93.5		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals								
Chromium, Hexavalent	0.37		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds								
Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
Surrogate: 4-Bromofluorobenzene	104.9		50-140	%	10-MAR-21			
Surrogate: 1,4-Difluorobenzene	99.2		50-140	%	10-MAR-21			
Hydrocarbons								
F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

ALS Environmental

ANALYTICAL GUIDELINE REPORT

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-1	BH01 SS1 (0'-2')								
Sampled By:	CLIENT on 23-FEB-21 @ 13:00								
Matrix:	SOIL						#1	#2	#3
Hydrocarbons									
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	136		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	290		50	ug/g	12-MAR-21	2800	2800	3300
	F4G-SG (GHH-Silica)	1040		250	ug/g	11-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	426		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	NO			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	80.2		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	70.2		60-140	%	10-MAR-21			
L2564179-2	BH02 SS5 (10-12)								
Sampled By:	CLIENT on 22-FEB-21 @ 14:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.300		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	24.2		0.25	%	11-MAR-21			
	pH	7.89		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	11-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.46		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	39.8		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	8.20		0.50	mg/L	16-MAR-21			
	Sodium (Na)	12.2		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	2.5		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	280		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.86		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	12.8		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	45.7		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	14.3		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	28.1		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	7.8		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0072		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	29.6		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	66.1		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	75.0		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-2	BH02 SS5 (10-12)								
Sampled By:	CLIENT on 22-FEB-21 @ 14:00								
Matrix:	SOIL								
Speciated Metals									
	Chromium, Hexavalent	0.27		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	09-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	09-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	09-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	09-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Tetrachloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	09-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	09-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	09-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	09-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	09-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	94.3		50-140	%	09-MAR-21			
	Surrogate: 1,4-Difluorobenzene	99.8		50-140	%	09-MAR-21			

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-2	BH02 SS5 (10-12)								
Sampled By:	CLIENT on 22-FEB-21 @ 14:00								
Matrix:	SOIL						#1	#2	#3
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	11-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	11-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	11-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	11-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	11-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	11-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	91.8		60-140	%	11-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	107.2		60-140	%	09-MAR-21			
L2564179-3	BH03 SS1 (0'-2')								
Sampled By:	CLIENT on 23-FEB-21 @ 17:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.416		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	39.6		0.25	%	11-MAR-21			
	pH	7.32		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	1.45		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	44.1		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	6.91		0.50	mg/L	16-MAR-21			
	Sodium (Na)	39.1		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.0		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	210		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.58		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	8.9		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.56		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	30.6		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	8.3		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	26.6		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	59.1		1.0	ug/g	16-MAR-21	*45	120	120
	Mercury (Hg)	0.0890		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	18.1		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	39.7		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	148		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-3	BH03 SS1 (0'-2')								
Sampled By:	CLIENT on 23-FEB-21 @ 17:00								
Matrix:	SOIL						#1	#2	#3
Speciated Metals									
	Chromium, Hexavalent	0.48		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	102.6		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	97.3		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	95.9		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	82.2		60-140	%	10-MAR-21			
L2564179-4	BH04 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 24-FEB-21 @ 15:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.150		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	25.1		0.25	%	11-MAR-21			
	pH	7.52		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.42		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	18.9		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	3.54		0.50	mg/L	16-MAR-21			
	Sodium (Na)	7.56		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	4.5		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	275		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.88		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	10.1		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.19		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	50.6		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	12.4		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	29.5		1.0	ug/g	16-MAR-21	140	140	230

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-4	BH04 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 24-FEB-21 @ 15:00								
Matrix:	SOIL								
Metals									
	Lead (Pb)	7.9		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0126		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	29.7		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	69.2		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	72.9		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	1.10		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	09-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	09-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	09-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	09-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-4	BH04 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 24-FEB-21 @ 15:00								
Matrix:	SOIL						#1	#2	#3
Volatile Organic Compounds									
	Tetrachloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	09-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	09-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	09-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	09-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	09-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	91.1		50-140	%	09-MAR-21			
	Surrogate: 1,4-Difluorobenzene	92.7		50-140	%	09-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	92.5		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	97.3		60-140	%	09-MAR-21			
L2564179-5	BH 05 SS8 (25'-27')								
Sampled By:	CLIENT on 25-FEB-21 @ 12:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.266		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	25.5		0.25	%	11-MAR-21			
	pH	8.25		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.34		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	15.1		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	20.6		0.50	mg/L	16-MAR-21			
	Sodium (Na)	8.77		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	2.5		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	275		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.70		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	18.5		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.29		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	42.7		1.0	ug/g	16-MAR-21	160	160	160

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-5	BH 05 SS8 (25'-27')								
Sampled By:	CLIENT on 25-FEB-21 @ 12:00								
Matrix:	SOIL						#1	#2	#3
Metals									
	Cobalt (Co)	11.0		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	21.7		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	6.2		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	<0.0050		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	23.2		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	61.6		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	55.2		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	<0.20		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	100.1		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	94.2		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	95.2		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	79.9		60-140	%	10-MAR-21			
L2564179-6	BH06 SS1 (0'-2')								
Sampled By:	CLIENT on 24-FEB-21 @ 11:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.262		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	26.0		0.25	%	11-MAR-21			
	pH	7.34		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	<0.10		0.10	SAR	16-MAR-21	5	5	12

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

ALS Environmental

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ANALYTICAL GUIDELINE REPORT

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-6 BH06 SS1 (0'-2')								
Sampled By: CLIENT on 24-FEB-21 @ 11:00								
Matrix: SOIL								
Saturated Paste Extractables								
Calcium (Ca)	41.1		0.50	mg/L	16-MAR-21			
Magnesium (Mg)	3.65		0.50	mg/L	16-MAR-21			
Sodium (Na)	1.33		0.50	mg/L	16-MAR-21			
Metals								
Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
Arsenic (As)	4.7		1.0	ug/g	16-MAR-21	11	18	18
Barium (Ba)	264		1.0	ug/g	16-MAR-21	390	390	670
Beryllium (Be)	0.77		0.50	ug/g	16-MAR-21	4	4	8
Boron (B)	10.4		5.0	ug/g	16-MAR-21	120	120	120
Boron (B), Hot Water Ext.	0.24		0.10	ug/g	16-MAR-21	1.5	1.5	2
Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
Chromium (Cr)	43.4		1.0	ug/g	16-MAR-21	160	160	160
Cobalt (Co)	12.7		1.0	ug/g	16-MAR-21	22	22	80
Copper (Cu)	31.0		1.0	ug/g	16-MAR-21	140	140	230
Lead (Pb)	62.4		1.0	ug/g	16-MAR-21	*45	120	120
Mercury (Hg)	0.122		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
Nickel (Ni)	26.3		1.0	ug/g	16-MAR-21	100	100	270
Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
Vanadium (V)	58.4		1.0	ug/g	16-MAR-21	86	86	86
Zinc (Zn)	135		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals								
Chromium, Hexavalent	0.33		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds								
Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
Surrogate: 4-Bromofluorobenzene	102.3		50-140	%	10-MAR-21			
Surrogate: 1,4-Difluorobenzene	97.1		50-140	%	10-MAR-21			
Hydrocarbons								
F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
Surrogate: 2-Bromobenzotrifluoride	88.6		60-140	%	12-MAR-21			
Surrogate: 3,4-Dichlorotoluene	85.2		60-140	%	10-MAR-21			

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-7	BH06 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 24-FEB-21 @ 11:10								
Matrix:	SOIL								
Physical Tests									
	% Moisture	24.1		0.25	%	11-MAR-21			
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	10-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	10-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Tetrachloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	10-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	10-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	91.9		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	97.7		50-140	%	10-MAR-21			

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

ANALYTICAL GUIDELINE REPORT

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-8 BH07 SS6 (15'-17')								
Sampled By: CLIENT on 26-FEB-21 @ 11:30								
Matrix: SOIL								
Physical Tests								
Conductivity	0.235		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
% Moisture	24.7		0.25	%	11-MAR-21			
pH	7.85		0.10	pH units	15-MAR-21			
Cyanides								
Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables								
SAR	0.56		0.10	SAR	16-MAR-21	5	5	12
Calcium (Ca)	23.3		0.50	mg/L	16-MAR-21			
Magnesium (Mg)	4.27		0.50	mg/L	16-MAR-21			
Sodium (Na)	11.2		0.50	mg/L	16-MAR-21			
Metals								
Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
Arsenic (As)	1.5		1.0	ug/g	16-MAR-21	11	18	18
Barium (Ba)	246		1.0	ug/g	16-MAR-21	390	390	670
Beryllium (Be)	0.50		0.50	ug/g	16-MAR-21	4	4	8
Boron (B)	7.8		5.0	ug/g	16-MAR-21	120	120	120
Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
Chromium (Cr)	27.9		1.0	ug/g	16-MAR-21	160	160	160
Cobalt (Co)	10.0		1.0	ug/g	16-MAR-21	22	22	80
Copper (Cu)	18.9		1.0	ug/g	16-MAR-21	140	140	230
Lead (Pb)	4.9		1.0	ug/g	16-MAR-21	45	120	120
Mercury (Hg)	<0.0050		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
Nickel (Ni)	19.6		1.0	ug/g	16-MAR-21	100	100	270
Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
Vanadium (V)	42.1		1.0	ug/g	16-MAR-21	86	86	86
Zinc (Zn)	51.4		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals								
Chromium, Hexavalent	<0.20		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds								
Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
Surrogate: 4-Bromofluorobenzene	96.0		50-140	%	10-MAR-21			
Surrogate: 1,4-Difluorobenzene	90.4		50-140	%	10-MAR-21			
Hydrocarbons								
F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-8	BH07 SS6 (15'-17')								
Sampled By:	CLIENT on 26-FEB-21 @ 11:30								
Matrix:	SOIL						#1	#2	#3
Hydrocarbons									
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	96.3		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	77.2		60-140	%	10-MAR-21			
L2564179-9	BH08 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 26-FEB-21 @ 09:15								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.136		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	14.6		0.25	%	11-MAR-21			
	pH	7.65		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.36		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	17.8		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	3.01		0.50	mg/L	16-MAR-21			
	Sodium (Na)	6.30		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.4		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	206		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.78		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	12.2		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	41.0		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	11.5		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	26.3		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	6.5		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0138		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	23.6		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	65.2		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	56.3		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	0.34		0.20	ug/g	15-MAR-21	8	8	8

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-9 BH08 SS2 (2'6"-4'6")								
Sampled By: CLIENT on 26-FEB-21 @ 09:15								
Matrix: SOIL								
Volatile Organic Compounds								
Acetone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
Benzene	<0.0068		0.0068	ug/g	09-MAR-21	0.02	0.02	0.02
Bromodichloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Bromoform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Bromomethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Carbon tetrachloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Chlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.083	0.083	0.083
Dibromochloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Chloroform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,2-Dibromoethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,2-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	3.4	3.4	6.8
1,3-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.26	0.26	0.26
1,4-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Dichlorodifluoromethane	<0.050		0.050	ug/g	09-MAR-21	1.5	1.5	1.5
1,1-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,2-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,1-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Methylene Chloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,2-Dichloropropane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
cis-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
trans-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
Ethylbenzene	<0.018		0.018	ug/g	09-MAR-21	0.05	0.05	0.05
n-Hexane	<0.050		0.050	ug/g	09-MAR-21	2.5	2.5	2.5
Methyl Ethyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
Methyl Isobutyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
MTBE	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Styrene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Tetrachloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Toluene	<0.080		0.080	ug/g	09-MAR-21	0.2	0.2	0.2
1,1,1-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.11	0.11	0.12
1,1,2-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
Trichloroethylene	<0.010		0.010	ug/g	09-MAR-21	0.05	0.05	0.05
Trichlorofluoromethane	<0.050		0.050	ug/g	09-MAR-21	0.17	0.25	0.25
Vinyl chloride	<0.020		0.020	ug/g	09-MAR-21	0.02	0.02	0.02
o-Xylene	<0.020		0.020	ug/g	09-MAR-21			
m+p-Xylenes	<0.030		0.030	ug/g	09-MAR-21			
Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
Surrogate: 4-Bromofluorobenzene	94.4		50-140	%	09-MAR-21			
Surrogate: 1,4-Difluorobenzene	97.6		50-140	%	09-MAR-21			
Hydrocarbons								
F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-9	BH08 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 26-FEB-21 @ 09:15								
Matrix:	SOIL						#1	#2	#3
Hydrocarbons									
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	92.3		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	81.0		60-140	%	09-MAR-21			
L2564179-10	BH10 SS4 (7'6"-9'6")								
Sampled By:	CLIENT on 25-FEB-21 @ 12:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.180		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	22.9		0.25	%	11-MAR-21			
	pH	7.84		0.10	pH units	15-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.61		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	16.6		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	4.38		0.50	mg/L	16-MAR-21			
	Sodium (Na)	10.9		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	2.0		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	171		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.67		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	10.8		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	33.9		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	11.0		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	21.6		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	6.4		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0067		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	21.7		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	51.7		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	55.1		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									

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* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use   **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-10	BH10 SS4 (7'6"-9'6")								
Sampled By:	CLIENT on 25-FEB-21 @ 12:00								
Matrix:	SOIL								
Speciated Metals									
	Chromium, Hexavalent	0.26		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	10-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	10-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Tetrachloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	10-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	10-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	93.8		50-140	%	09-MAR-21			
	Surrogate: 1,4-Difluorobenzene	94.6		50-140	%	09-MAR-21			

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-10	BH10 SS4 (7'6"-9'6")								
Sampled By:	CLIENT on 25-FEB-21 @ 12:00								
Matrix:	SOIL						#1	#2	#3
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	94.7		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	49.5	SURR-ND	60-140	%	10-MAR-21			
L2564179-11	BH11 SS1 (0'-2')								
Sampled By:	CLIENT on 25-FEB-21 @ 12:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.198		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	11.5		0.25	%	11-MAR-21			
	pH	7.26		0.10	pH units	12-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	<0.10		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	32.9		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	3.87		0.50	mg/L	16-MAR-21			
	Sodium (Na)	1.22		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	5.7		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	104		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	<0.50		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	7.9		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.31		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	23.2		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	7.5		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	17.0		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	22.6		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0739		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	14.5		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	37.4		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	60.8		5.0	ug/g	16-MAR-21	340	340	340

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-11 BH11 SS1 (0'-2') Sampled By: CLIENT on 25-FEB-21 @ 12:00 Matrix: SOIL							#1	#2	#3
Speciated Metals									
	Chromium, Hexavalent	0.29		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	103.2		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	101.9		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	56		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	71		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	127		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	92.6		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	80.5		60-140	%	10-MAR-21			
L2564179-12 BH12 SS3 (5'-7') Sampled By: CLIENT on 25-FEB-21 @ 14:00 Matrix: SOIL							#1	#2	#3
Physical Tests									
	Conductivity	0.126		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	5.81		0.25	%	11-MAR-21			
	pH	8.19		0.10	pH units	12-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.11		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	20.0		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	2.02		0.50	mg/L	16-MAR-21			
	Sodium (Na)	1.91		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	1.3		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	41.5		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	<0.50		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	8.6		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.11		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	13.2		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	3.7		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	9.8		1.0	ug/g	16-MAR-21	140	140	230

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-12	BH12 SS3 (5'-7')								
Sampled By:	CLIENT on 25-FEB-21 @ 14:00								
Matrix:	SOIL								
Metals									
	Lead (Pb)	5.7		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0642		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	7.7		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	22.4		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	23.6		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	<0.20		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	10-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	10-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-12 BH12 SS3 (5'-7')									
Sampled By: CLIENT on 25-FEB-21 @ 14:00									
Matrix: SOIL							#1	#2	#3
Volatile Organic Compounds									
	Tetrachloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	10-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	10-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	99.9		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	106.9		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	91.5		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	105.7		60-140	%	09-MAR-21			
L2564179-13 BH13 SS1 (0'-2')									
Sampled By: CLIENT on 02-MAR-21 @ 12:00									
Matrix: SOIL							#1	#2	#3
Physical Tests									
	Conductivity	0.460		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	8.29		0.25	%	11-MAR-21			
	pH	7.76		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	6.77		0.10	SAR	16-MAR-21	*5	*5	12
	Calcium (Ca)	10.4		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	0.64		0.50	mg/L	16-MAR-21			
	Sodium (Na)	83.2		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	1.3		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	58.8		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	<0.50		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	6.6		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	15.5		1.0	ug/g	16-MAR-21	160	160	160

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-13 BH13 SS1 (0'-2')								
Sampled By: CLIENT on 02-MAR-21 @ 12:00								
Matrix: SOIL						#1	#2	#3
Metals								
Cobalt (Co)	5.4		1.0	ug/g	16-MAR-21	22	22	80
Copper (Cu)	11.5		1.0	ug/g	16-MAR-21	140	140	230
Lead (Pb)	3.7		1.0	ug/g	16-MAR-21	45	120	120
Mercury (Hg)	0.0067		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
Nickel (Ni)	8.8		1.0	ug/g	16-MAR-21	100	100	270
Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
Vanadium (V)	28.7		1.0	ug/g	16-MAR-21	86	86	86
Zinc (Zn)	29.2		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals								
Chromium, Hexavalent	0.27		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds								
Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
Surrogate: 4-Bromofluorobenzene	108.1		50-140	%	10-MAR-21			
Surrogate: 1,4-Difluorobenzene	105.9		50-140	%	10-MAR-21			
Hydrocarbons								
F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
Surrogate: 2-Bromobenzotrifluoride	91.7		60-140	%	12-MAR-21			
Surrogate: 3,4-Dichlorotoluene	86.2		60-140	%	10-MAR-21			
L2564179-14 BH14 SS2 (2'6"-4'6")								
Sampled By: CLIENT on 01-MAR-21 @ 14:00								
Matrix: SOIL						#1	#2	#3
Physical Tests								
Conductivity	0.675		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
% Moisture	27.4		0.25	%	11-MAR-21			
pH	7.51		0.10	pH units	16-MAR-21			
Cyanides								
Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables								
SAR	7.16		0.10	SAR	16-MAR-21	*5	*5	12

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use
#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use
#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

ALS Environmental

ANALYTICAL GUIDELINE REPORT

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Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-14	BH14 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 01-MAR-21 @ 14:00								
Matrix:	SOIL								
Saturated Paste Extractables									
	Calcium (Ca)	19.7		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	1.19		0.50	mg/L	16-MAR-21			
	Sodium (Na)	121		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.0		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	159		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.63		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	9.3		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.16		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	32.5		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	9.3		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	39.6		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	69.5		1.0	ug/g	16-MAR-21	*45	120	120
	Mercury (Hg)	1.06	DLHC	0.050	ug/g	16-MAR-21	*0.24	*0.27	*0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	19.6		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	0.99		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	46.9		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	326		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	0.36		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	10-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-14	BH14 SS2 (2'6"-4'6")								
Sampled By:	CLIENT on 01-MAR-21 @ 14:00								
Matrix:	SOIL						#1	#2	#3
Volatile Organic Compounds									
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	10-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Tetrachloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	0.275		0.080	ug/g	10-MAR-21	*0.2	*0.2	*0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	10-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	10-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	100.0		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	107.0		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	57		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	68		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	125		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	89.5		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	99.8		60-140	%	09-MAR-21			
L2564179-15	BH19 SS4 (7'6"-9'-6")								
Sampled By:	CLIENT on 02-MAR-21 @ 14:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.379		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	26.9		0.25	%	11-MAR-21			
	pH	7.61		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

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Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-15	BH19 SS4 (7'6"-9'-6")								
Sampled By:	CLIENT on 02-MAR-21 @ 14:00								
Matrix:	SOIL								
Saturated Paste Extractables									
	SAR	0.99		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	35.1		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	7.85		0.50	mg/L	16-MAR-21			
	Sodium (Na)	25.0		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.5		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	298		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.94		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	13.2		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	49.1		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	16.8		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	31.2		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	8.8		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0094		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	34.3		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	73.0		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	87.7		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	0.41		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	104.9		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	103.5		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	92.5		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	82.1		60-140	%	10-MAR-21			

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-15	BH19 SS4 (7'6"-9'-6")								
Sampled By:	CLIENT on 02-MAR-21 @ 14:00								
Matrix:	SOIL						#1	#2	#3
L2564179-16	BH20 SS1 (0'-2')								
Sampled By:	CLIENT on 26-FEB-21 @ 12:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.296		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	27.1		0.25	%	11-MAR-21			
	pH	7.37		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.40		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	37.3		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	5.45		0.50	mg/L	16-MAR-21			
	Sodium (Na)	9.82		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.0		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	276		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.79		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	12.3		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.35		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	43.1		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	10.9		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	25.9		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	10.7		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0223		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	23.9		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	59.8		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	67.0		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	1.63		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	97.1		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	95.3		50-140	%	10-MAR-21			

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-16 BH20 SS1 (0'-2') Sampled By: CLIENT on 26-FEB-21 @ 12:00 Matrix: SOIL							#1	#2	#3
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	90.0		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	77.4		60-140	%	10-MAR-21			
L2564179-17 BH21 SS3 (5'-7') Sampled By: CLIENT on 02-MAR-21 @ 11:00 Matrix: SOIL							#1	#2	#3
Physical Tests									
	Conductivity	0.778		0.0040	mS/cm	16-MAR-21	*0.7	*0.7	1.4
	% Moisture	27.5		0.25	%	11-MAR-21			
	pH	7.63		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	8.93		0.10	SAR	16-MAR-21	*5	*5	12
	Calcium (Ca)	18.0		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	1.72		0.50	mg/L	16-MAR-21			
	Sodium (Na)	148		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	5.0		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	783		1.0	ug/g	16-MAR-21	*390	*390	*670
	Beryllium (Be)	1.43		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	14.5		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.11		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	70.8		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	25.2		1.0	ug/g	16-MAR-21	*22	*22	80
	Copper (Cu)	48.3		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	13.4		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0102		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	51.6		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	96.2		1.0	ug/g	16-MAR-21	*86	*86	*86
	Zinc (Zn)	130		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

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Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-17	BH21 SS3 (5'-7')								
Sampled By:	CLIENT on 02-MAR-21 @ 11:00								
Matrix:	SOIL								
Speciated Metals									
	Chromium, Hexavalent	0.38		0.20	ug/g	15-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	09-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	09-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	09-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	09-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Tetrachloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	09-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	09-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	09-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	09-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	09-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	94.7		50-140	%	09-MAR-21			
	Surrogate: 1,4-Difluorobenzene	100.5		50-140	%	09-MAR-21			

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#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-17	BH21 SS3 (5'-7')								
Sampled By:	CLIENT on 02-MAR-21 @ 11:00								
Matrix:	SOIL						#1	#2	#3
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	93.9		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	63.9		60-140	%	09-MAR-21			
L2564179-18	BH23 SS1 (0'-2')								
Sampled By:	CLIENT on 26-FEB-21 @ 10:00								
Matrix:	SOIL						#1	#2	#3
Physical Tests									
	Conductivity	0.405		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	16.2		0.25	%	11-MAR-21			
	pH	7.13		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	<0.10		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	62.8		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	5.28		0.50	mg/L	16-MAR-21			
	Sodium (Na)	1.35		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	5.4		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	248		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.74		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	11.3		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	0.47		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	37.1		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	11.8		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	31.0		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	62.6		1.0	ug/g	16-MAR-21	*45	120	120
	Mercury (Hg)	0.187		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	24.1		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	53.5		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	119		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									

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#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-18	BH23 SS1 (0'-2')								
Sampled By:	CLIENT on 26-FEB-21 @ 10:00								
Matrix:	SOIL								
Speciated Metals									
	Chromium, Hexavalent	<0.20		0.20	ug/g	16-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	09-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	09-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	09-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	09-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	09-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	09-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Tetrachloroethylene	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	09-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	09-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	09-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	09-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	09-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	09-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	108.6		50-140	%	09-MAR-21			
	Surrogate: 1,4-Difluorobenzene	115.8		50-140	%	09-MAR-21			

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-18 BH23 SS1 (0'-2')								
Sampled By: CLIENT on 26-FEB-21 @ 10:00								
Matrix: SOIL						#1	#2	#3
Hydrocarbons								
F1 (C6-C10)	<5.0		5.0	ug/g	09-MAR-21	17	25	25
F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
Surrogate: 2-Bromobenzotrifluoride	91.0		60-140	%	12-MAR-21			
Surrogate: 3,4-Dichlorotoluene	75.2		60-140	%	09-MAR-21			
L2564179-19 BH24 SS1 (0'-2')								
Sampled By: CLIENT on 25-FEB-21 @ 16:00								
Matrix: SOIL						#1	#2	#3
Physical Tests								
Conductivity	0.340		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
% Moisture	20.5		0.25	%	11-MAR-21			
pH	7.45		0.10	pH units	16-MAR-21			
Cyanides								
Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables								
SAR	0.97		0.10	SAR	16-MAR-21	5	5	12
Calcium (Ca)	33.3		0.50	mg/L	16-MAR-21			
Magnesium (Mg)	5.81		0.50	mg/L	16-MAR-21			
Sodium (Na)	23.1		0.50	mg/L	16-MAR-21			
Metals								
Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
Arsenic (As)	4.7		1.0	ug/g	16-MAR-21	11	18	18
Barium (Ba)	204		1.0	ug/g	16-MAR-21	390	390	670
Beryllium (Be)	0.69		0.50	ug/g	16-MAR-21	4	4	8
Boron (B)	10.9		5.0	ug/g	16-MAR-21	120	120	120
Boron (B), Hot Water Ext.	0.24		0.10	ug/g	16-MAR-21	1.5	1.5	2
Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
Chromium (Cr)	35.8		1.0	ug/g	16-MAR-21	160	160	160
Cobalt (Co)	11.5		1.0	ug/g	16-MAR-21	22	22	80
Copper (Cu)	24.1		1.0	ug/g	16-MAR-21	140	140	230
Lead (Pb)	13.9		1.0	ug/g	16-MAR-21	45	120	120
Mercury (Hg)	0.0252		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
Nickel (Ni)	23.5		1.0	ug/g	16-MAR-21	100	100	270
Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
Vanadium (V)	55.3		1.0	ug/g	16-MAR-21	86	86	86
Zinc (Zn)	68.9		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals								

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-19 BH24 SS1 (0'-2')									
Sampled By: CLIENT on 25-FEB-21 @ 16:00									
Matrix: SOIL							#1	#2	#3
Speciated Metals									
	Chromium, Hexavalent	0.25		0.20	ug/g	16-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	104.0		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	103.4		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	89.1		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	77.9		60-140	%	10-MAR-21			
L2564179-20 BH25 SS4 (7'6"-9'6")									
Sampled By: CLIENT on 01-MAR-21 @ 11:00									
Matrix: SOIL							#1	#2	#3
Physical Tests									
	Conductivity	0.289		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	28.4		0.25	%	11-MAR-21			
	pH	8.38		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	0.88		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	29.4		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	7.38		0.50	mg/L	16-MAR-21			
	Sodium (Na)	20.6		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.5		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	380		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	1.09		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	17.2		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	59.8		1.0	ug/g	16-MAR-21	160	160	160
	Cobalt (Co)	17.9		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	36.2		1.0	ug/g	16-MAR-21	140	140	230

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-20	BH25 SS4 (7'6"-9'6")								
Sampled By:	CLIENT on 01-MAR-21 @ 11:00								
Matrix:	SOIL								
Metals									
	Lead (Pb)	9.8		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0228		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	38.8		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	83.1		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	107		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	0.47		0.20	ug/g	16-MAR-21	8	8	8
Volatile Organic Compounds									
	Acetone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Bromodichloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromoform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Bromomethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Carbon tetrachloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.083	0.083	0.083
	Dibromochloromethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Chloroform	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dibromoethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	3.4	3.4	6.8
	1,3-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.26	0.26	0.26
	1,4-Dichlorobenzene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Dichlorodifluoromethane	<0.050		0.050	ug/g	10-MAR-21	1.5	1.5	1.5
	1,1-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Methylene Chloride	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,2-Dichloropropane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	cis-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	trans-1,3-Dichloropropene	<0.030		0.030	ug/g	10-MAR-21			
	1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g	11-MAR-21	0.05	0.05	0.05
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	n-Hexane	<0.050		0.050	ug/g	10-MAR-21	2.5	2.5	2.5
	Methyl Ethyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	Methyl Isobutyl Ketone	<0.50		0.50	ug/g	10-MAR-21	0.5	0.5	0.5
	MTBE	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Styrene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05

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Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use   **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-20 BH25 SS4 (7'6"-9'6")									
Sampled By: CLIENT on 01-MAR-21 @ 11:00									
Matrix: SOIL							#1	#2	#3
Volatile Organic Compounds									
	Tetrachloroethylene	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	1,1,1-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.11	0.11	0.12
	1,1,2-Trichloroethane	<0.050		0.050	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichloroethylene	<0.010		0.010	ug/g	10-MAR-21	0.05	0.05	0.05
	Trichlorofluoromethane	<0.050		0.050	ug/g	10-MAR-21	0.17	0.25	0.25
	Vinyl chloride	<0.020		0.020	ug/g	10-MAR-21	0.02	0.02	0.02
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	11-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	90.0		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	105.5		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	90.1		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	80.8		60-140	%	10-MAR-21			
L2564179-21 BH26 SS5 (10'-12')									
Sampled By: CLIENT on 01-MAR-21 @ 15:30									
Matrix: SOIL							#1	#2	#3
Physical Tests									
	Conductivity	0.238		0.0040	mS/cm	16-MAR-21	0.7	0.7	1.4
	% Moisture	23.2		0.25	%	12-MAR-21			
	pH	7.69		0.10	pH units	16-MAR-21			
Cyanides									
	Cyanide, Weak Acid Diss	<0.050		0.050	ug/g	16-MAR-21	0.051	0.051	0.051
Saturated Paste Extractables									
	SAR	1.24		0.10	SAR	16-MAR-21	5	5	12
	Calcium (Ca)	19.6		0.50	mg/L	16-MAR-21			
	Magnesium (Mg)	4.01		0.50	mg/L	16-MAR-21			
	Sodium (Na)	23.1		0.50	mg/L	16-MAR-21			
Metals									
	Antimony (Sb)	<1.0		1.0	ug/g	16-MAR-21	7.5	7.5	40
	Arsenic (As)	3.6		1.0	ug/g	16-MAR-21	11	18	18
	Barium (Ba)	242		1.0	ug/g	16-MAR-21	390	390	670
	Beryllium (Be)	0.76		0.50	ug/g	16-MAR-21	4	4	8
	Boron (B)	11.1		5.0	ug/g	16-MAR-21	120	120	120
	Boron (B), Hot Water Ext.	<0.10		0.10	ug/g	16-MAR-21	1.5	1.5	2
	Cadmium (Cd)	<0.50		0.50	ug/g	16-MAR-21	1	1.2	1.9
	Chromium (Cr)	41.7		1.0	ug/g	16-MAR-21	160	160	160

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use **#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use**

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Sample Details Grouping	Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1	#2	#3
L2564179-21	BH26 SS5 (10'-12')								
Sampled By:	CLIENT on 01-MAR-21 @ 15:30								
Matrix:	SOIL								
Metals									
	Cobalt (Co)	14.4		1.0	ug/g	16-MAR-21	22	22	80
	Copper (Cu)	26.6		1.0	ug/g	16-MAR-21	140	140	230
	Lead (Pb)	7.4		1.0	ug/g	16-MAR-21	45	120	120
	Mercury (Hg)	0.0067		0.0050	ug/g	16-MAR-21	0.24	0.27	0.27
	Molybdenum (Mo)	<1.0		1.0	ug/g	16-MAR-21	6.9	6.9	40
	Nickel (Ni)	29.4		1.0	ug/g	16-MAR-21	100	100	270
	Selenium (Se)	<1.0		1.0	ug/g	16-MAR-21	2.4	2.4	5.5
	Silver (Ag)	<0.20		0.20	ug/g	16-MAR-21	20	20	40
	Thallium (Tl)	<0.50		0.50	ug/g	16-MAR-21	1	1	3.3
	Uranium (U)	<1.0		1.0	ug/g	16-MAR-21	23	23	33
	Vanadium (V)	64.4		1.0	ug/g	16-MAR-21	86	86	86
	Zinc (Zn)	69.2		5.0	ug/g	16-MAR-21	340	340	340
Speciated Metals									
	Chromium, Hexavalent	0.33		0.20	ug/g	16-MAR-21	8	8	8
Volatile Organic Compounds									
	Benzene	<0.0068		0.0068	ug/g	10-MAR-21	0.02	0.02	0.02
	Ethylbenzene	<0.018		0.018	ug/g	10-MAR-21	0.05	0.05	0.05
	Toluene	<0.080		0.080	ug/g	10-MAR-21	0.2	0.2	0.2
	o-Xylene	<0.020		0.020	ug/g	10-MAR-21			
	m+p-Xylenes	<0.030		0.030	ug/g	10-MAR-21			
	Xylenes (Total)	<0.050		0.050	ug/g	12-MAR-21	0.091	0.091	0.091
	Surrogate: 4-Bromofluorobenzene	106.7		50-140	%	10-MAR-21			
	Surrogate: 1,4-Difluorobenzene	103.9		50-140	%	10-MAR-21			
Hydrocarbons									
	F1 (C6-C10)	<5.0		5.0	ug/g	10-MAR-21	17	25	25
	F1-BTEX	<5.0		5.0	ug/g	12-MAR-21	17	25	25
	F2 (C10-C16)	<10		10	ug/g	12-MAR-21	10	10	26
	F3 (C16-C34)	<50		50	ug/g	12-MAR-21	240	240	240
	F4 (C34-C50)	<50		50	ug/g	12-MAR-21	2800	2800	3300
	Total Hydrocarbons (C6-C50)	<72		72	ug/g	12-MAR-21			
	Chrom. to baseline at nC50	YES			No Unit	12-MAR-21			
	Surrogate: 2-Bromobenzotrifluoride	93.9		60-140	%	12-MAR-21			
	Surrogate: 3,4-Dichlorotoluene	85.0		60-140	%	10-MAR-21			

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Ontario Regulation 406/19 - Excess Soils - 17-December-20 = [Suite] - ON-406-T2.1-SOIL-ALL-AG/RPI/ICC

#1: T2.1 - Volume Independent Soil - Agricultural or Other Property Use

#2: T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

#3: T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
SURR-ND	Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference***
B-HWS-R511-WT	Soil	Boron-HWE-O.Reg 153/04 (July 2011)	HW EXTR, EPA 6010B

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

BTX-511-HS-WT	Soil	BTEX-O.Reg 153/04 (July 2011)	SW846 8260

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CN-WAD-R511-WT	Soil	Cyanide (WAD)-O.Reg 153/04 (July 2011)	MOE 3015/APHA 4500CN I-WAD

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CR-CR6-IC-WT	Soil	Hexavalent Chromium in Soil	SW846 3060A/7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Reference Information

F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT	Soil	F1-O.Reg 153/04 (July 2011)	E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT	Soil	F2-F4-O.Reg 153/04 (July 2011)	CCME Tier 1

Petroleum Hydrocarbons (F2-F4 fractions) are extracted from soil with 1:1 hexane:acetone using a rotary extractor. Extracts are treated with silica gel to remove polar organic interferences. F2, F3, & F4 are analyzed by GC-FID. F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where both F4 (C34-C50) and F4G-sg are reported for a sample, the larger of the two values is used for comparison against the relevant CCME guideline for F4.
7. F4G-sg cannot be added to the C6 to C50 hydrocarbon results to obtain an estimate of total extractable hydrocarbons.
8. This method is validated for use.
9. Data from analysis of validation and quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram, unless otherwise indicated.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F4G-ADD-511-WT	Soil	F4G SG-O.Reg 153/04 (July 2011)	MOE DECPH-E3398/CCME TIER 1

F4G, gravimetric analysis, is determined if the chromatogram does not return to baseline at or before C50. A soil sample is extracted with a solvent mix, the solvent is evaporated and the weight of the residue is determined.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Reference Information

MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT	Soil	SAR-O.Reg 153/04 (July 2011)	SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

VOC-1,3-DCP-CALC-WT	Soil	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Soil	VOC-O.Reg 153/04 (July 2011)	SW846 8260 (511)

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

*** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	**Soil**							
Batch R5401946								
WG3502651-4 DUP		**L2564031-1**						
Boron (B), Hot Water Ext.		0.14	0.12		ug/g	17	30	16-MAR-21
WG3502651-2 IRM		**WT SAR4**						
Boron (B), Hot Water Ext.			101.5		%		70-130	16-MAR-21
WG3502651-3 LCS								
Boron (B), Hot Water Ext.			106.0		%		70-130	16-MAR-21
WG3502651-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	16-MAR-21
Batch R5402042								
WG3502647-4 DUP		**L2564218-2**						
Boron (B), Hot Water Ext.		0.21	0.21		ug/g	1.0	30	16-MAR-21
WG3502647-2 IRM		**WT SAR4**						
Boron (B), Hot Water Ext.			98.2		%		70-130	16-MAR-21
WG3502647-3 LCS								
Boron (B), Hot Water Ext.			107.0		%		70-130	16-MAR-21
WG3502647-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	16-MAR-21
BTX-511-HS-WT	**Soil**							
Batch R5398896								
WG3498828-4 DUP		**WG3498828-3**						
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	10-MAR-21
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	10-MAR-21
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	10-MAR-21
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	10-MAR-21
WG3498828-2 LCS								
Benzene			115.1		%		70-130	10-MAR-21
Ethylbenzene			110.5		%		70-130	10-MAR-21
m+p-Xylenes			101.9		%		70-130	10-MAR-21
o-Xylene			109.2		%		70-130	10-MAR-21
Toluene			108.9		%		70-130	10-MAR-21
WG3498828-1 MB								
Benzene			<0.0068		ug/g		0.0068	10-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	10-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	10-MAR-21
o-Xylene			<0.020		ug/g		0.02	10-MAR-21

ALS Environmental

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Soil**							
Batch R5398896								
WG3498828-1 MB								
Toluene			<0.080		ug/g		0.08	10-MAR-21
Surrogate: 1,4-Difluorobenzene			110.1		%		50-140	10-MAR-21
Surrogate: 4-Bromofluorobenzene			111.9		%		50-140	10-MAR-21
WG3498828-5 MS		**WG3498828-3**						
Benzene			113.4		%		60-140	10-MAR-21
Ethylbenzene			114.0		%		60-140	10-MAR-21
m+p-Xylenes			106.0		%		60-140	10-MAR-21
o-Xylene			112.4		%		60-140	10-MAR-21
Toluene			112.0		%		60-140	10-MAR-21
Batch R5398899								
WG3498953-4 DUP		**WG3498953-3**						
Benzene		0.101	0.102		ug/g	0.9	40	10-MAR-21
Ethylbenzene		0.097	0.097		ug/g	0.7	40	10-MAR-21
m+p-Xylenes		0.283	0.285		ug/g	1.0	40	10-MAR-21
o-Xylene		0.156	0.157		ug/g	0.8	40	10-MAR-21
Toluene		0.261	0.264		ug/g	1.3	40	10-MAR-21
WG3498953-2 LCS								
Benzene			105.8		%		70-130	10-MAR-21
Ethylbenzene			98.7		%		70-130	10-MAR-21
m+p-Xylenes			90.8		%		70-130	10-MAR-21
o-Xylene			98.0		%		70-130	10-MAR-21
Toluene			97.7		%		70-130	10-MAR-21
WG3498953-1 MB								
Benzene			<0.0068		ug/g		0.0068	10-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	10-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	10-MAR-21
o-Xylene			<0.020		ug/g		0.02	10-MAR-21
Toluene			<0.080		ug/g		0.08	10-MAR-21
Surrogate: 1,4-Difluorobenzene			107.6		%		50-140	10-MAR-21
Surrogate: 4-Bromofluorobenzene			108.8		%		50-140	10-MAR-21
WG3498953-5 MS		**WG3498953-3**						
Benzene			108.5		%		60-140	10-MAR-21
Ethylbenzene			106.2		%		60-140	10-MAR-21
m+p-Xylenes			97.9		%		60-140	10-MAR-21

Quality Control Report

Client:	Thurber Engineering Ltd. (Oakville) 2010 Winston Park Drive Unit 103 Oakville ON L6H 5R7
Contact:	Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Soil**							
Batch R5398899								
WG3498953-5 MS		**WG3498953-3**						
o-Xylene			105.4		%		60-140	10-MAR-21
Toluene			104.2		%		60-140	10-MAR-21
CN-WAD-R511-WT	**Soil**							
Batch R5399837								
WG3500283-3 DUP		**L2565660-16**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	11-MAR-21
WG3500283-2 LCS								
Cyanide, Weak Acid Diss			100.7		%		80-120	11-MAR-21
WG3500283-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	11-MAR-21
WG3500283-4 MS		**L2565660-16**						
Cyanide, Weak Acid Diss			100.4		%		70-130	11-MAR-21
Batch R5401739								
WG3500674-3 DUP		**L2564179-12**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	16-MAR-21
WG3500674-2 LCS								
Cyanide, Weak Acid Diss			88.2		%		80-120	16-MAR-21
WG3500674-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	16-MAR-21
WG3500674-4 MS		**L2564179-12**						
Cyanide, Weak Acid Diss			87.5		%		70-130	16-MAR-21
CR-CR6-IC-WT	**Soil**							
Batch R5401299								
WG3500856-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			99.9		%		70-130	15-MAR-21
WG3500856-3 DUP		**L2564179-12**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	15-MAR-21
WG3500856-2 LCS								
Chromium, Hexavalent			96.0		%		80-120	15-MAR-21
WG3500856-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	15-MAR-21
Batch R5401748								
WG3501011-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			102.9		%		70-130	16-MAR-21
WG3501011-3 DUP		**L2564504-9**						
Chromium, Hexavalent		0.76	0.86		ug/g	12	35	16-MAR-21

ALS Environmental

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CR-CR6-IC-WT	**Soil**							
Batch R5401748								
WG3501011-2 LCS								
Chromium, Hexavalent			103.8		%		80-120	16-MAR-21
WG3501011-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	16-MAR-21
EC-WT	**Soil**							
Batch R5402036								
WG3502653-4 DUP		**WG3502653-3**						
Conductivity		0.875	0.868		mS/cm	0.8	20	16-MAR-21
WG3502653-2 IRM		**WT SAR4**						
Conductivity			100.0		%		70-130	16-MAR-21
WG3503260-1 LCS								
Conductivity			97.1		%		90-110	16-MAR-21
WG3502653-1 MB								
Conductivity			<0.0040		mS/cm		0.004	16-MAR-21
Batch R5402040								
WG3502649-4 DUP		**WG3502649-3**						
Conductivity		0.185	0.200		mS/cm	7.6	20	16-MAR-21
WG3502649-2 IRM		**WT SAR4**						
Conductivity			100.8		%		70-130	16-MAR-21
WG3503198-1 LCS								
Conductivity			97.3		%		90-110	16-MAR-21
WG3502649-1 MB								
Conductivity			<0.0040		mS/cm		0.004	16-MAR-21
F1-HS-511-WT	**Soil**							
Batch R5398464								
WG3498335-4 DUP		**WG3498335-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	09-MAR-21
WG3498335-2 LCS								
F1 (C6-C10)			109.1		%		80-120	10-MAR-21
WG3498335-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	09-MAR-21
Surrogate: 3,4-Dichlorotoluene			117.7		%		60-140	09-MAR-21
WG3498335-5 MS		**WG3498335-3**						
F1 (C6-C10)			79.4		%		60-140	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-511-WT	**Soil**							
Batch R5398896								
WG3498828-4 DUP		**WG3498828-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	10-MAR-21
WG3498828-2 LCS								
F1 (C6-C10)			92.8		%		80-120	10-MAR-21
WG3498828-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	10-MAR-21
Surrogate: 3,4-Dichlorotoluene			93.2		%		60-140	10-MAR-21
WG3498828-5 MS		**WG3498828-3**						
F1 (C6-C10)			91.3		%		60-140	10-MAR-21
Batch R5398899								
WG3498953-4 DUP		**WG3498953-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	10-MAR-21
WG3498953-2 LCS								
F1 (C6-C10)			89.9		%		80-120	10-MAR-21
WG3498953-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	10-MAR-21
Surrogate: 3,4-Dichlorotoluene			85.2		%		60-140	10-MAR-21
WG3498953-5 MS		**WG3498953-3**						
F1 (C6-C10)			86.6		%		60-140	10-MAR-21
F2-F4-511-WT	**Soil**							
Batch R5399892								
WG3499263-3 DUP		**WG3499263-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	11-MAR-21
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	11-MAR-21
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	11-MAR-21
WG3499263-2 LCS								
F2 (C10-C16)			102.1		%		80-120	11-MAR-21
F3 (C16-C34)			106.1		%		80-120	11-MAR-21
F4 (C34-C50)			106.1		%		80-120	11-MAR-21
WG3499263-1 MB								
F2 (C10-C16)			<10		ug/g		10	11-MAR-21
F3 (C16-C34)			<50		ug/g		50	11-MAR-21
F4 (C34-C50)			<50		ug/g		50	11-MAR-21
Surrogate: 2-Bromobenzotrifluoride			97.0		%		60-140	11-MAR-21
WG3499263-4 MS		**WG3499263-5**						
F2 (C10-C16)			101.1		%		60-140	11-MAR-21
F3 (C16-C34)			104.0		%		60-140	11-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Soil**							
Batch R5399892								
WG3499263-4 MS		**WG3499263-5**						
F4 (C34-C50)			106.2		%		60-140	11-MAR-21
Batch R5400242								
WG3500062-3 DUP		**WG3500062-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	12-MAR-21
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
WG3500062-2 LCS								
F2 (C10-C16)			85.8		%		80-120	12-MAR-21
F3 (C16-C34)			87.1		%		80-120	12-MAR-21
F4 (C34-C50)			91.3		%		80-120	12-MAR-21
WG3500062-1 MB								
F2 (C10-C16)			<10		ug/g		10	12-MAR-21
F3 (C16-C34)			<50		ug/g		50	12-MAR-21
F4 (C34-C50)			<50		ug/g		50	12-MAR-21
Surrogate: 2-Bromobenzotrifluoride			88.7		%		60-140	12-MAR-21
WG3500062-4 MS		**WG3500062-5**						
F2 (C10-C16)			84.9		%		60-140	12-MAR-21
F3 (C16-C34)			89.3		%		60-140	12-MAR-21
F4 (C34-C50)			93.2		%		60-140	12-MAR-21
Batch R5400519								
WG3500598-3 DUP		**WG3500598-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	12-MAR-21
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	12-MAR-21
WG3500598-2 LCS								
F2 (C10-C16)			97.1		%		80-120	12-MAR-21
F3 (C16-C34)			98.3		%		80-120	12-MAR-21
F4 (C34-C50)			97.4		%		80-120	12-MAR-21
WG3500598-1 MB								
F2 (C10-C16)			<10		ug/g		10	12-MAR-21
F3 (C16-C34)			<50		ug/g		50	12-MAR-21
F4 (C34-C50)			<50		ug/g		50	12-MAR-21
Surrogate: 2-Bromobenzotrifluoride			98.7		%		60-140	12-MAR-21
WG3500598-4 MS		**WG3500598-5**						

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Client: Thurber Engineering Ltd. (Oakville)
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Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Soil**							
Batch R5400519								
WG3500598-4 MS		**WG3500598-5**						
F2 (C10-C16)			95.0		%		60-140	12-MAR-21
F3 (C16-C34)			95.0		%		60-140	12-MAR-21
F4 (C34-C50)			95.6		%		60-140	12-MAR-21
F4G-ADD-511-WT	**Soil**							
Batch R5400350								
WG3501376-2 LCS								
F4G-SG (GHH-Silica)			71.6		%		60-140	11-MAR-21
WG3501376-1 MB								
F4G-SG (GHH-Silica)			<250		ug/g		250	11-MAR-21
HG-200.2-CVAA-WT	**Soil**							
Batch R5401795								
WG3502645-2 CRM		**WT-SS-2**						
Mercury (Hg)			102.7		%		70-130	16-MAR-21
WG3502645-6 DUP		**WG3502645-5**						
Mercury (Hg)		0.0121	0.0134		ug/g	10	40	16-MAR-21
WG3502645-3 LCS								
Mercury (Hg)			96.0		%		80-120	16-MAR-21
WG3502645-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-MAR-21
Batch R5401802								
WG3502639-2 CRM		**WT-SS-2**						
Mercury (Hg)			103.2		%		70-130	16-MAR-21
WG3502639-6 DUP		**WG3502639-5**						
Mercury (Hg)		0.0081	0.0092		ug/g	13	40	16-MAR-21
WG3502639-3 LCS								
Mercury (Hg)			105.0		%		80-120	16-MAR-21
WG3502639-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-MAR-21
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-2 CRM		**WT-SS-2**						
Antimony (Sb)			101.1		%		70-130	16-MAR-21
Arsenic (As)			103.5		%		70-130	16-MAR-21
Barium (Ba)			106.9		%		70-130	16-MAR-21
Beryllium (Be)			101.7		%		70-130	16-MAR-21
Boron (B)			9.3		mg/kg		3.5-13.5	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-2 CRM		**WT-SS-2**						
Cadmium (Cd)			98.2		%		70-130	16-MAR-21
Chromium (Cr)			102.1		%		70-130	16-MAR-21
Cobalt (Co)			102.5		%		70-130	16-MAR-21
Copper (Cu)			96.2		%		70-130	16-MAR-21
Lead (Pb)			100.2		%		70-130	16-MAR-21
Molybdenum (Mo)			97.6		%		70-130	16-MAR-21
Nickel (Ni)			99.7		%		70-130	16-MAR-21
Selenium (Se)			0.15		mg/kg		0-0.34	16-MAR-21
Silver (Ag)			111.1		%		70-130	16-MAR-21
Thallium (Tl)			0.080		mg/kg		0.029-0.129	16-MAR-21
Uranium (U)			97.4		%		70-130	16-MAR-21
Vanadium (V)			104.2		%		70-130	16-MAR-21
Zinc (Zn)			95.6		%		70-130	16-MAR-21
WG3502639-6 DUP		**WG3502639-5**						
Antimony (Sb)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	16-MAR-21
Arsenic (As)		2.86	2.53		ug/g	12	30	16-MAR-21
Barium (Ba)		47.9	41.9		ug/g	13	40	16-MAR-21
Beryllium (Be)		0.43	0.38		ug/g	11	30	16-MAR-21
Boron (B)		7.4	6.5		ug/g	13	30	16-MAR-21
Cadmium (Cd)		0.072	0.074		ug/g	2.3	30	16-MAR-21
Chromium (Cr)		13.1	13.4		ug/g	2.2	30	16-MAR-21
Cobalt (Co)		6.68	5.84		ug/g	13	30	16-MAR-21
Copper (Cu)		13.4	11.5		ug/g	16	30	16-MAR-21
Lead (Pb)		5.96	5.20		ug/g	14	40	16-MAR-21
Molybdenum (Mo)		0.29	0.23		ug/g	22	40	16-MAR-21
Nickel (Ni)		13.8	11.8		ug/g	16	30	16-MAR-21
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-MAR-21
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-MAR-21
Thallium (Tl)		0.112	0.096		ug/g	15	30	16-MAR-21
Uranium (U)		0.511	0.438		ug/g	15	30	16-MAR-21
Vanadium (V)		30.2	26.6		ug/g	13	30	16-MAR-21
Zinc (Zn)		32.5	28.6		ug/g	13	30	16-MAR-21
WG3502639-4 LCS								

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Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-4 LCS								
Antimony (Sb)			111.2		%		80-120	16-MAR-21
Arsenic (As)			111.3		%		80-120	16-MAR-21
Barium (Ba)			104.2		%		80-120	16-MAR-21
Beryllium (Be)			104.2		%		80-120	16-MAR-21
Boron (B)			101.4		%		80-120	16-MAR-21
Cadmium (Cd)			102.9		%		80-120	16-MAR-21
Chromium (Cr)			106.7		%		80-120	16-MAR-21
Cobalt (Co)			105.6		%		80-120	16-MAR-21
Copper (Cu)			104.1		%		80-120	16-MAR-21
Lead (Pb)			107.4		%		80-120	16-MAR-21
Molybdenum (Mo)			107.8		%		80-120	16-MAR-21
Nickel (Ni)			104.3		%		80-120	16-MAR-21
Selenium (Se)			110.1		%		80-120	16-MAR-21
Silver (Ag)			108.0		%		80-120	16-MAR-21
Thallium (Tl)			110.0		%		80-120	16-MAR-21
Uranium (U)			104.7		%		80-120	16-MAR-21
Vanadium (V)			110.6		%		80-120	16-MAR-21
Zinc (Zn)			103.0		%		80-120	16-MAR-21
WG3502639-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-MAR-21
Arsenic (As)			<0.10		mg/kg		0.1	16-MAR-21
Barium (Ba)			<0.50		mg/kg		0.5	16-MAR-21
Beryllium (Be)			<0.10		mg/kg		0.1	16-MAR-21
Boron (B)			<5.0		mg/kg		5	16-MAR-21
Cadmium (Cd)			<0.020		mg/kg		0.02	16-MAR-21
Chromium (Cr)			<0.50		mg/kg		0.5	16-MAR-21
Cobalt (Co)			<0.10		mg/kg		0.1	16-MAR-21
Copper (Cu)			<0.50		mg/kg		0.5	16-MAR-21
Lead (Pb)			<0.50		mg/kg		0.5	16-MAR-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-MAR-21
Nickel (Ni)			<0.50		mg/kg		0.5	16-MAR-21
Selenium (Se)			<0.20		mg/kg		0.2	16-MAR-21
Silver (Ag)			<0.10		mg/kg		0.1	16-MAR-21
Thallium (Tl)			<0.050		mg/kg		0.05	16-MAR-21

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Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402526								
WG3502639-1 MB								
Uranium (U)			<0.050		mg/kg		0.05	16-MAR-21
Vanadium (V)			<0.20		mg/kg		0.2	16-MAR-21
Zinc (Zn)			<2.0		mg/kg		2	16-MAR-21
Batch R5402569								
WG3502645-2 CRM		**WT-SS-2**						
Antimony (Sb)			90.7		%		70-130	16-MAR-21
Arsenic (As)			101.9		%		70-130	16-MAR-21
Barium (Ba)			109.4		%		70-130	16-MAR-21
Beryllium (Be)			98.9		%		70-130	16-MAR-21
Boron (B)			8.7		mg/kg		3.5-13.5	16-MAR-21
Cadmium (Cd)			98.5		%		70-130	16-MAR-21
Chromium (Cr)			107.4		%		70-130	16-MAR-21
Cobalt (Co)			102.1		%		70-130	16-MAR-21
Copper (Cu)			99.1		%		70-130	16-MAR-21
Lead (Pb)			95.7		%		70-130	16-MAR-21
Molybdenum (Mo)			95.9		%		70-130	16-MAR-21
Nickel (Ni)			101.9		%		70-130	16-MAR-21
Selenium (Se)			0.18		mg/kg		0-0.34	16-MAR-21
Silver (Ag)			78.6		%		70-130	16-MAR-21
Thallium (Tl)			0.068		mg/kg		0.029-0.129	16-MAR-21
Uranium (U)			87.8		%		70-130	16-MAR-21
Vanadium (V)			107.9		%		70-130	16-MAR-21
Zinc (Zn)			100.3		%		70-130	16-MAR-21
WG3502645-6 DUP		**WG3502645-5**						
Antimony (Sb)		0.14	0.11		ug/g	23	30	16-MAR-21
Arsenic (As)		6.60	5.51		ug/g	18	30	16-MAR-21
Barium (Ba)		119	97.8		ug/g	19	40	16-MAR-21
Beryllium (Be)		0.59	0.50		ug/g	17	30	16-MAR-21
Boron (B)		11.6	10.3		ug/g	12	30	16-MAR-21
Cadmium (Cd)		0.095	0.085		ug/g	10	30	16-MAR-21
Chromium (Cr)		22.2	18.4		ug/g	19	30	16-MAR-21
Cobalt (Co)		11.9	10.1		ug/g	17	30	16-MAR-21
Copper (Cu)		39.7	33.5		ug/g	17	30	16-MAR-21
Lead (Pb)		9.40	8.36		ug/g	12	40	16-MAR-21

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Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402569								
WG3502645-6 DUP		**WG3502645-5**						
Molybdenum (Mo)		0.46	0.38		ug/g	18	40	16-MAR-21
Nickel (Ni)		24.2	20.2		ug/g	18	30	16-MAR-21
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-MAR-21
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-MAR-21
Thallium (Tl)		0.131	0.108		ug/g	19	30	16-MAR-21
Uranium (U)		0.573	0.509		ug/g	12	30	16-MAR-21
Vanadium (V)		35.7	29.2		ug/g	20	30	16-MAR-21
Zinc (Zn)		58.0	48.9		ug/g	17	30	16-MAR-21
WG3502645-4 LCS								
Antimony (Sb)			105.1		%		80-120	16-MAR-21
Arsenic (As)			108.8		%		80-120	16-MAR-21
Barium (Ba)			104.7		%		80-120	16-MAR-21
Beryllium (Be)			102.9		%		80-120	16-MAR-21
Boron (B)			100.8		%		80-120	16-MAR-21
Cadmium (Cd)			103.3		%		80-120	16-MAR-21
Chromium (Cr)			104.9		%		80-120	16-MAR-21
Cobalt (Co)			106.0		%		80-120	16-MAR-21
Copper (Cu)			104.2		%		80-120	16-MAR-21
Lead (Pb)			103.3		%		80-120	16-MAR-21
Molybdenum (Mo)			106.2		%		80-120	16-MAR-21
Nickel (Ni)			104.6		%		80-120	16-MAR-21
Selenium (Se)			110.0		%		80-120	16-MAR-21
Silver (Ag)			103.7		%		80-120	16-MAR-21
Thallium (Tl)			105.2		%		80-120	16-MAR-21
Uranium (U)			97.7		%		80-120	16-MAR-21
Vanadium (V)			110.3		%		80-120	16-MAR-21
Zinc (Zn)			107.3		%		80-120	16-MAR-21
WG3502645-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-MAR-21
Arsenic (As)			<0.10		mg/kg		0.1	16-MAR-21
Barium (Ba)			<0.50		mg/kg		0.5	16-MAR-21
Beryllium (Be)			<0.10		mg/kg		0.1	16-MAR-21
Boron (B)			<5.0		mg/kg		5	16-MAR-21
Cadmium (Cd)			<0.020		mg/kg		0.02	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5402569								
WG3502645-1 MB								
Chromium (Cr)			<0.50		mg/kg		0.5	16-MAR-21
Cobalt (Co)			<0.10		mg/kg		0.1	16-MAR-21
Copper (Cu)			<0.50		mg/kg		0.5	16-MAR-21
Lead (Pb)			<0.50		mg/kg		0.5	16-MAR-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-MAR-21
Nickel (Ni)			<0.50		mg/kg		0.5	16-MAR-21
Selenium (Se)			<0.20		mg/kg		0.2	16-MAR-21
Silver (Ag)			<0.10		mg/kg		0.1	16-MAR-21
Thallium (Tl)			<0.050		mg/kg		0.05	16-MAR-21
Uranium (U)			<0.050		mg/kg		0.05	16-MAR-21
Vanadium (V)			<0.20		mg/kg		0.2	16-MAR-21
Zinc (Zn)			<2.0		mg/kg		2	16-MAR-21
MOISTURE-WT	**Soil**							
Batch R5399508								
WG3499986-3 DUP		**L2564179-1**						
% Moisture		19.8	18.2		%	8.2	20	11-MAR-21
WG3499986-2 LCS								
% Moisture			99.6		%		90-110	11-MAR-21
WG3499986-1 MB								
% Moisture			<0.25		%		0.25	11-MAR-21
Batch R5400107								
WG3501016-3 DUP		**L2564177-2**						
% Moisture		19.5	18.8		%	3.4	20	12-MAR-21
WG3501016-2 LCS								
% Moisture			99.4		%		90-110	12-MAR-21
WG3501016-1 MB								
% Moisture			<0.25		%		0.25	12-MAR-21
PH-WT	**Soil**							
Batch R5400397								
WG3500902-1 DUP		**L2564179-12**						
pH		8.19	8.10	J	pH units	0.09	0.3	12-MAR-21
WG3501252-1 LCS								
pH			6.96		pH units		6.9-7.1	12-MAR-21

Quality Control Report

Client:	Thurber Engineering Ltd. (Oakville) 2010 Winston Park Drive Unit 103 Oakville ON L6H 5R7
Contact:	Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-WT	**Soil**							
Batch R5401412								
WG3500681-1 DUP		**L2564265-15**						
pH		7.90	7.85	J	pH units	0.05	0.3	15-MAR-21
WG3502485-1 LCS								
pH			7.00		pH units		6.9-7.1	15-MAR-21
Batch R5401939								
WG3500944-1 DUP		**L2564179-13**						
pH		7.76	7.80	J	pH units	0.04	0.3	16-MAR-21
WG3502923-1 LCS								
pH			6.95		pH units		6.9-7.1	16-MAR-21
SAR-R511-WT	**Soil**							
Batch R5401950								
WG3502649-4 DUP		**WG3502649-3**						
Calcium (Ca)		14.7	15.2		mg/L	3.3	30	16-MAR-21
Sodium (Na)		27.6	28.8		mg/L	4.3	30	16-MAR-21
Magnesium (Mg)		1.41	1.44		mg/L	2.1	30	16-MAR-21
WG3502649-2 IRM		**WT SAR4**						
Calcium (Ca)			108.2		%		70-130	16-MAR-21
Sodium (Na)			93.3		%		70-130	16-MAR-21
Magnesium (Mg)			106.0		%		70-130	16-MAR-21
WG3502649-5 LCS								
Calcium (Ca)			105.3		%		80-120	16-MAR-21
Sodium (Na)			101.6		%		80-120	16-MAR-21
Magnesium (Mg)			101.2		%		80-120	16-MAR-21
WG3502649-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	16-MAR-21
Sodium (Na)			<0.50		mg/L		0.5	16-MAR-21
Magnesium (Mg)			<0.50		mg/L		0.5	16-MAR-21
Batch R5402045								
WG3502653-4 DUP		**WG3502653-3**						
Calcium (Ca)		78.8	78.5		mg/L	0.4	30	16-MAR-21
Sodium (Na)		85.9	85.2		mg/L	0.8	30	16-MAR-21
Magnesium (Mg)		10.1	10.0		mg/L	1.0	30	16-MAR-21
WG3502653-2 IRM		**WT SAR4**						
Calcium (Ca)			97.7		%		70-130	16-MAR-21
Sodium (Na)			95.7		%		70-130	16-MAR-21
Magnesium (Mg)			100.9		%		70-130	16-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R5402045								
WG3502653-5 LCS								
Calcium (Ca)			106.7		%		80-120	16-MAR-21
Sodium (Na)			102.0		%		80-120	16-MAR-21
Magnesium (Mg)			102.0		%		80-120	16-MAR-21
WG3502653-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	16-MAR-21
Sodium (Na)			<0.50		mg/L		0.5	16-MAR-21
Magnesium (Mg)			<0.50		mg/L		0.5	16-MAR-21
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-4 DUP		**WG3498335-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	09-MAR-21
Benzene		0.0068	0.0073		ug/g	6.5	40	09-MAR-21
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	09-MAR-21
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-4 DUP		**WG3498335-3**						
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	09-MAR-21
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	09-MAR-21
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	09-MAR-21
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	09-MAR-21
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	09-MAR-21
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	09-MAR-21
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	09-MAR-21
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	09-MAR-21
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	09-MAR-21
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	09-MAR-21
WG3498335-2 LCS								
1,1,1,2-Tetrachloroethane			101.0		%		60-130	09-MAR-21
1,1,2,2-Tetrachloroethane			66.0		%		60-130	09-MAR-21
1,1,1-Trichloroethane			104.1		%		60-130	09-MAR-21
1,1,2-Trichloroethane			93.9		%		60-130	09-MAR-21
1,1-Dichloroethane			101.1		%		60-130	09-MAR-21
1,1-Dichloroethylene			102.4		%		60-130	09-MAR-21
1,2-Dibromoethane			97.7		%		70-130	09-MAR-21
1,2-Dichlorobenzene			106.2		%		70-130	09-MAR-21
1,2-Dichloroethane			94.0		%		60-130	09-MAR-21
1,2-Dichloropropane			99.9		%		70-130	09-MAR-21
1,3-Dichlorobenzene			121.2		%		70-130	09-MAR-21
1,4-Dichlorobenzene			120.6		%		70-130	09-MAR-21
Acetone			98.5		%		60-140	09-MAR-21
Benzene			99.8		%		70-130	09-MAR-21
Bromodichloromethane			102.0		%		50-140	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-2 LCS								
Bromoform			85.9		%		70-130	09-MAR-21
Bromomethane			93.4		%		50-140	09-MAR-21
Carbon tetrachloride			108.5		%		70-130	09-MAR-21
Chlorobenzene			104.1		%		70-130	09-MAR-21
Chloroform			103.6		%		70-130	09-MAR-21
cis-1,2-Dichloroethylene			103.2		%		70-130	09-MAR-21
cis-1,3-Dichloropropene			97.1		%		70-130	09-MAR-21
Dibromochloromethane			96.9		%		60-130	09-MAR-21
Dichlorodifluoromethane			65.1		%		50-140	09-MAR-21
Ethylbenzene			107.9		%		70-130	09-MAR-21
n-Hexane			97.1		%		70-130	09-MAR-21
Methylene Chloride			99.2		%		70-130	09-MAR-21
MTBE			102.2		%		70-130	09-MAR-21
m+p-Xylenes			108.0		%		70-130	09-MAR-21
Methyl Ethyl Ketone			85.6		%		60-140	09-MAR-21
Methyl Isobutyl Ketone			84.6		%		60-140	09-MAR-21
o-Xylene			115.6		%		70-130	09-MAR-21
Styrene			103.0		%		70-130	09-MAR-21
Tetrachloroethylene			107.7		%		60-130	09-MAR-21
Toluene			104.8		%		70-130	09-MAR-21
trans-1,2-Dichloroethylene			103.3		%		60-130	09-MAR-21
trans-1,3-Dichloropropene			101.4		%		70-130	09-MAR-21
Trichloroethylene			105.0		%		60-130	09-MAR-21
Trichlorofluoromethane			100.5		%		50-140	09-MAR-21
Vinyl chloride			98.5		%		60-140	09-MAR-21
WG3498335-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,1-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
1,2-Dibromoethane			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-1 MB								
1,2-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichloropropane			<0.050		ug/g		0.05	09-MAR-21
1,3-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
1,4-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Acetone			<0.50		ug/g		0.5	09-MAR-21
Benzene			<0.0068		ug/g		0.0068	09-MAR-21
Bromodichloromethane			<0.050		ug/g		0.05	09-MAR-21
Bromoform			<0.050		ug/g		0.05	09-MAR-21
Bromomethane			<0.050		ug/g		0.05	09-MAR-21
Carbon tetrachloride			<0.050		ug/g		0.05	09-MAR-21
Chlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Chloroform			<0.050		ug/g		0.05	09-MAR-21
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Dibromochloromethane			<0.050		ug/g		0.05	09-MAR-21
Dichlorodifluoromethane			<0.050		ug/g		0.05	09-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	09-MAR-21
n-Hexane			<0.050		ug/g		0.05	09-MAR-21
Methylene Chloride			<0.050		ug/g		0.05	09-MAR-21
MTBE			<0.050		ug/g		0.05	09-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	09-MAR-21
Methyl Ethyl Ketone			<0.50		ug/g		0.5	09-MAR-21
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	09-MAR-21
o-Xylene			<0.020		ug/g		0.02	09-MAR-21
Styrene			<0.050		ug/g		0.05	09-MAR-21
Tetrachloroethylene			<0.050		ug/g		0.05	09-MAR-21
Toluene			<0.080		ug/g		0.08	09-MAR-21
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Trichloroethylene			<0.010		ug/g		0.01	09-MAR-21
Trichlorofluoromethane			<0.050		ug/g		0.05	09-MAR-21
Vinyl chloride			<0.020		ug/g		0.02	09-MAR-21
Surrogate: 1,4-Difluorobenzene			115.9		%		50-140	09-MAR-21

ALS Environmental

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-1 MB								
Surrogate: 4-Bromofluorobenzene			112.0		%		50-140	09-MAR-21
WG3498335-5 MS		**WG3498335-3**						
1,1,1,2-Tetrachloroethane			111.3		%		50-140	10-MAR-21
1,1,2,2-Tetrachloroethane			105.3		%		50-140	10-MAR-21
1,1,1-Trichloroethane			111.9		%		50-140	10-MAR-21
1,1,2-Trichloroethane			102.9		%		50-140	10-MAR-21
1,1-Dichloroethane			100.5		%		50-140	10-MAR-21
1,1-Dichloroethylene			99.6		%		50-140	10-MAR-21
1,2-Dibromoethane			113.1		%		50-140	10-MAR-21
1,2-Dichlorobenzene			111.5		%		50-140	10-MAR-21
1,2-Dichloroethane			104.8		%		50-140	10-MAR-21
1,2-Dichloropropane			100.9		%		50-140	10-MAR-21
1,3-Dichlorobenzene			114.3		%		50-140	10-MAR-21
1,4-Dichlorobenzene			116.9		%		50-140	10-MAR-21
Acetone			107.3		%		50-140	10-MAR-21
Benzene			104.1		%		50-140	10-MAR-21
Bromodichloromethane			115.3		%		50-140	10-MAR-21
Bromoform			120.3		%		50-140	10-MAR-21
Bromomethane			103.3		%		50-140	10-MAR-21
Carbon tetrachloride			119.6		%		50-140	10-MAR-21
Chlorobenzene			109.2		%		50-140	10-MAR-21
Chloroform			112.0		%		50-140	10-MAR-21
cis-1,2-Dichloroethylene			114.9		%		50-140	10-MAR-21
cis-1,3-Dichloropropene			103.3		%		50-140	10-MAR-21
Dibromochloromethane			111.8		%		50-140	10-MAR-21
Dichlorodifluoromethane			98.0		%		50-140	10-MAR-21
Ethylbenzene			101.7		%		50-140	10-MAR-21
n-Hexane			83.7		%		50-140	10-MAR-21
Methylene Chloride			102.3		%		50-140	10-MAR-21
MTBE			106.2		%		50-140	10-MAR-21
m+p-Xylenes			102.8		%		50-140	10-MAR-21
Methyl Ethyl Ketone			112.9		%		50-140	10-MAR-21
Methyl Isobutyl Ketone			95.4		%		50-140	10-MAR-21
o-Xylene			112.3		%		50-140	10-MAR-21

ALS Environmental

Quality Control Report

Workorder: L2564179 Report Date: 07-APR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5398464								
WG3498335-5 MS		**WG3498335-3**						
Styrene			106.1		%		50-140	10-MAR-21
Tetrachloroethylene			112.0		%		50-140	10-MAR-21
Toluene			99.1		%		50-140	10-MAR-21
trans-1,2-Dichloroethylene			90.9		%		50-140	10-MAR-21
trans-1,3-Dichloropropene			95.1		%		50-140	10-MAR-21
Trichloroethylene			119.8		%		50-140	10-MAR-21
Trichlorofluoromethane			108.9		%		50-140	10-MAR-21
Vinyl chloride			96.7		%		50-140	10-MAR-21

COMMENTS: RRQC-Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
Batch R5399216								
WG3498942-4 DUP		**WG3498942-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	10-MAR-21
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	10-MAR-21
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-4 DUP		**WG3498942-3**						
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	10-MAR-21
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	10-MAR-21
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	10-MAR-21
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	10-MAR-21
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	10-MAR-21
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	10-MAR-21
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	10-MAR-21
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	10-MAR-21
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	10-MAR-21
WG3498942-2 LCS								
1,1,1,2-Tetrachloroethane			99.2		%		60-130	09-MAR-21
1,1,2,2-Tetrachloroethane			118.0		%		60-130	09-MAR-21
1,1,1-Trichloroethane			97.5		%		60-130	09-MAR-21
1,1,2-Trichloroethane			105.1		%		60-130	09-MAR-21
1,1-Dichloroethane			101.2		%		60-130	09-MAR-21
1,1-Dichloroethylene			97.7		%		60-130	09-MAR-21
1,2-Dibromoethane			105.2		%		70-130	09-MAR-21
1,2-Dichlorobenzene			103.1		%		70-130	09-MAR-21
1,2-Dichloroethane			99.5		%		60-130	09-MAR-21
1,2-Dichloropropane			101.5		%		70-130	09-MAR-21
1,3-Dichlorobenzene			102.0		%		70-130	09-MAR-21
1,4-Dichlorobenzene			102.6		%		70-130	09-MAR-21
Acetone			114.2		%		60-140	09-MAR-21
Benzene			98.1		%		70-130	09-MAR-21

Quality Control Report

Workorder: L2564179 Report Date: 07-APR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-2 LCS								
Bromodichloromethane			106.3		%		50-140	09-MAR-21
Bromoform			109.1		%		70-130	09-MAR-21
Bromomethane			97.0		%		50-140	09-MAR-21
Carbon tetrachloride			99.7		%		70-130	09-MAR-21
Chlorobenzene			99.5		%		70-130	09-MAR-21
Chloroform			101.9		%		70-130	09-MAR-21
cis-1,2-Dichloroethylene			106.7		%		70-130	09-MAR-21
cis-1,3-Dichloropropene			108.6		%		70-130	09-MAR-21
Dibromochloromethane			100.9		%		60-130	09-MAR-21
Dichlorodifluoromethane			70.5		%		50-140	09-MAR-21
Ethylbenzene			100.3		%		70-130	09-MAR-21
n-Hexane			92.1		%		70-130	09-MAR-21
Methylene Chloride			102.6		%		70-130	09-MAR-21
MTBE			101.5		%		70-130	09-MAR-21
m+p-Xylenes			99.3		%		70-130	09-MAR-21
Methyl Ethyl Ketone			108.2		%		60-140	09-MAR-21
Methyl Isobutyl Ketone			109.7		%		60-140	09-MAR-21
o-Xylene			108.8		%		70-130	09-MAR-21
Styrene			102.1		%		70-130	09-MAR-21
Tetrachloroethylene			99.2		%		60-130	09-MAR-21
Toluene			99.98		%		70-130	09-MAR-21
trans-1,2-Dichloroethylene			101.1		%		60-130	09-MAR-21
trans-1,3-Dichloropropene			108.0		%		70-130	09-MAR-21
Trichloroethylene			99.8		%		60-130	09-MAR-21
Trichlorofluoromethane			95.3		%		50-140	09-MAR-21
Vinyl chloride			99.3		%		60-140	09-MAR-21
WG3498942-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,1-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1,2-Trichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,1-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
1,2-Dibromoethane			<0.050		ug/g		0.05	09-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-1 MB								
1,2-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichloroethane			<0.050		ug/g		0.05	09-MAR-21
1,2-Dichloropropane			<0.050		ug/g		0.05	09-MAR-21
1,3-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
1,4-Dichlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Acetone			<0.50		ug/g		0.5	09-MAR-21
Benzene			<0.0068		ug/g		0.0068	09-MAR-21
Bromodichloromethane			<0.050		ug/g		0.05	09-MAR-21
Bromoform			<0.050		ug/g		0.05	09-MAR-21
Bromomethane			<0.050		ug/g		0.05	09-MAR-21
Carbon tetrachloride			<0.050		ug/g		0.05	09-MAR-21
Chlorobenzene			<0.050		ug/g		0.05	09-MAR-21
Chloroform			<0.050		ug/g		0.05	09-MAR-21
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Dibromochloromethane			<0.050		ug/g		0.05	09-MAR-21
Dichlorodifluoromethane			<0.050		ug/g		0.05	09-MAR-21
Ethylbenzene			<0.018		ug/g		0.018	09-MAR-21
n-Hexane			<0.050		ug/g		0.05	09-MAR-21
Methylene Chloride			<0.050		ug/g		0.05	09-MAR-21
MTBE			<0.050		ug/g		0.05	09-MAR-21
m+p-Xylenes			<0.030		ug/g		0.03	09-MAR-21
Methyl Ethyl Ketone			<0.50		ug/g		0.5	09-MAR-21
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	09-MAR-21
o-Xylene			<0.020		ug/g		0.02	09-MAR-21
Styrene			<0.050		ug/g		0.05	09-MAR-21
Tetrachloroethylene			<0.050		ug/g		0.05	09-MAR-21
Toluene			<0.080		ug/g		0.08	09-MAR-21
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	09-MAR-21
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	09-MAR-21
Trichloroethylene			<0.010		ug/g		0.01	09-MAR-21
Trichlorofluoromethane			<0.050		ug/g		0.05	09-MAR-21
Vinyl chloride			<0.020		ug/g		0.02	09-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-1 MB								
Surrogate: 1,4-Difluorobenzene			118.5		%		50-140	09-MAR-21
Surrogate: 4-Bromofluorobenzene			111.5		%		50-140	09-MAR-21
WG3498942-5 MS		**WG3498942-3**						
1,1,1,2-Tetrachloroethane			104.0		%		50-140	10-MAR-21
1,1,2,2-Tetrachloroethane			115.5		%		50-140	10-MAR-21
1,1,1-Trichloroethane			103.1		%		50-140	10-MAR-21
1,1,2-Trichloroethane			107.6		%		50-140	10-MAR-21
1,1-Dichloroethane			103.2		%		50-140	10-MAR-21
1,1-Dichloroethylene			104.9		%		50-140	10-MAR-21
1,2-Dibromoethane			107.0		%		50-140	10-MAR-21
1,2-Dichlorobenzene			106.2		%		50-140	10-MAR-21
1,2-Dichloroethane			102.2		%		50-140	10-MAR-21
1,2-Dichloropropane			104.9		%		50-140	10-MAR-21
1,3-Dichlorobenzene			104.6		%		50-140	10-MAR-21
1,4-Dichlorobenzene			104.9		%		50-140	10-MAR-21
Acetone			113.4		%		50-140	10-MAR-21
Benzene			102.6		%		50-140	10-MAR-21
Bromodichloromethane			109.6		%		50-140	10-MAR-21
Bromoform			111.4		%		50-140	10-MAR-21
Bromomethane			104.5		%		50-140	10-MAR-21
Carbon tetrachloride			106.0		%		50-140	10-MAR-21
Chlorobenzene			103.4		%		50-140	10-MAR-21
Chloroform			106.1		%		50-140	10-MAR-21
cis-1,2-Dichloroethylene			110.8		%		50-140	10-MAR-21
cis-1,3-Dichloropropene			109.2		%		50-140	10-MAR-21
Dibromochloromethane			104.3		%		50-140	10-MAR-21
Dichlorodifluoromethane			101.3		%		50-140	10-MAR-21
Ethylbenzene			105.4		%		50-140	10-MAR-21
n-Hexane			102.1		%		50-140	10-MAR-21
Methylene Chloride			105.5		%		50-140	10-MAR-21
MTBE			105.7		%		50-140	10-MAR-21
m+p-Xylenes			103.9		%		50-140	10-MAR-21
Methyl Ethyl Ketone			103.4		%		50-140	10-MAR-21
Methyl Isobutyl Ketone			109.6		%		50-140	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R5399216								
WG3498942-5 MS		**WG3498942-3**						
o-Xylene			114.2		%		50-140	10-MAR-21
Styrene			105.5		%		50-140	10-MAR-21
Tetrachloroethylene			103.7		%		50-140	10-MAR-21
Toluene			105.3		%		50-140	10-MAR-21
trans-1,2-Dichloroethylene			105.2		%		50-140	10-MAR-21
trans-1,3-Dichloropropene			108.6		%		50-140	10-MAR-21
Trichloroethylene			104.2		%		50-140	10-MAR-21
Trichlorofluoromethane			105.9		%		50-140	10-MAR-21
Vinyl chloride			112.0		%		50-140	10-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Cyanides							
Cyanide (WAD)-O.Reg 153/04 (July 2011)							
	1	23-FEB-21 13:00	11-MAR-21 13:00	14	16	days	EHT
	2	22-FEB-21 14:00	10-MAR-21 19:00	14	16	days	EHT
	3	23-FEB-21 17:00	11-MAR-21 13:00	14	16	days	EHT
	4	24-FEB-21 15:00	11-MAR-21 13:00	14	15	days	EHT
	6	24-FEB-21 11:00	11-MAR-21 13:00	14	15	days	EHT
Hydrocarbons							
F2-F4-O.Reg 153/04 (July 2011)							
	1	23-FEB-21 13:00	10-MAR-21 14:00	14	15	days	EHT
	2	22-FEB-21 14:00	09-MAR-21 14:00	14	15	days	EHT
	3	23-FEB-21 17:00	11-MAR-21 13:00	14	16	days	EHT
	4	24-FEB-21 15:00	11-MAR-21 13:00	14	15	days	EHT
	6	24-FEB-21 11:00	11-MAR-21 13:00	14	15	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2564179 were received on 05-MAR-21 16:00.

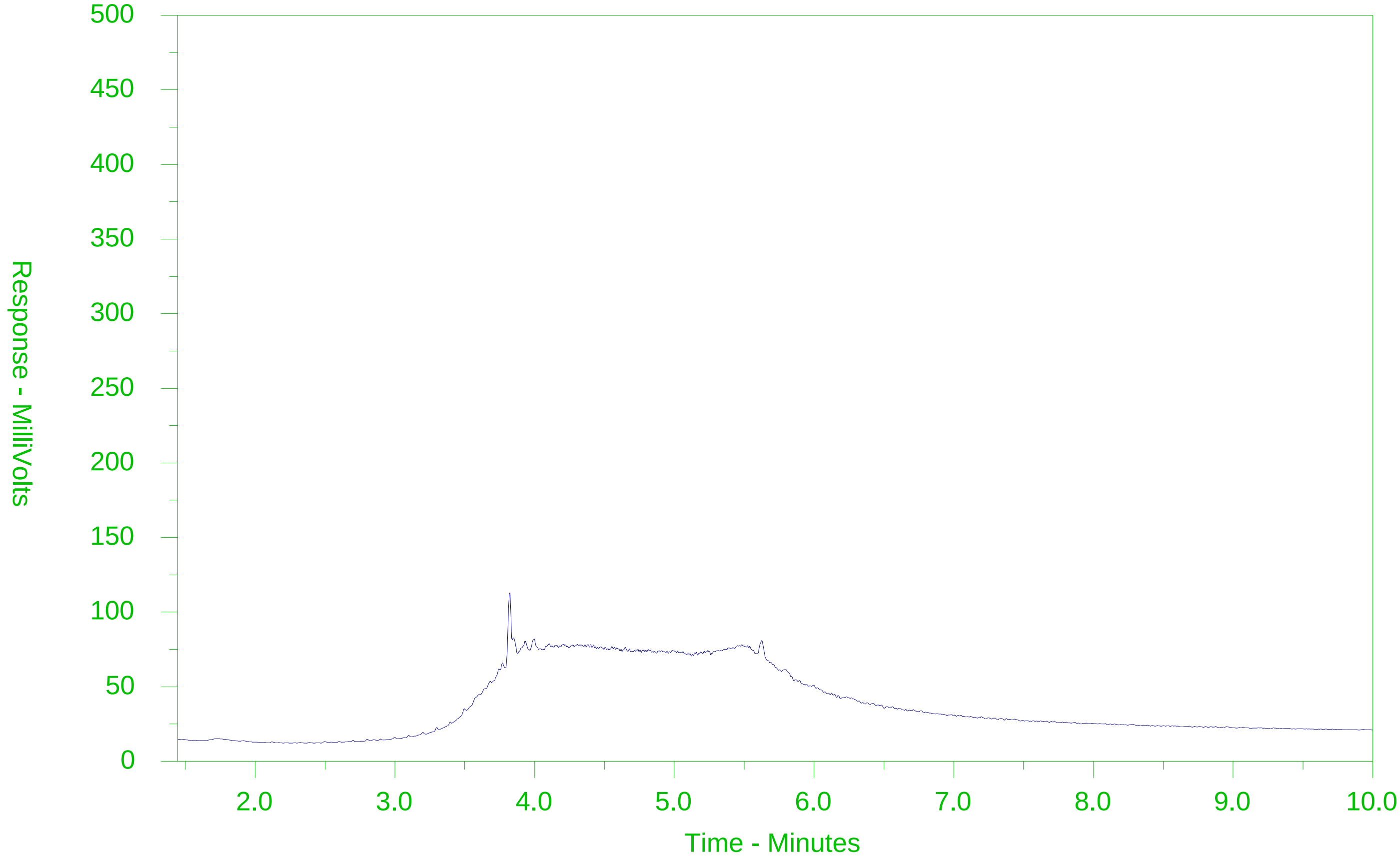
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-1
Client Sample ID: BH01 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

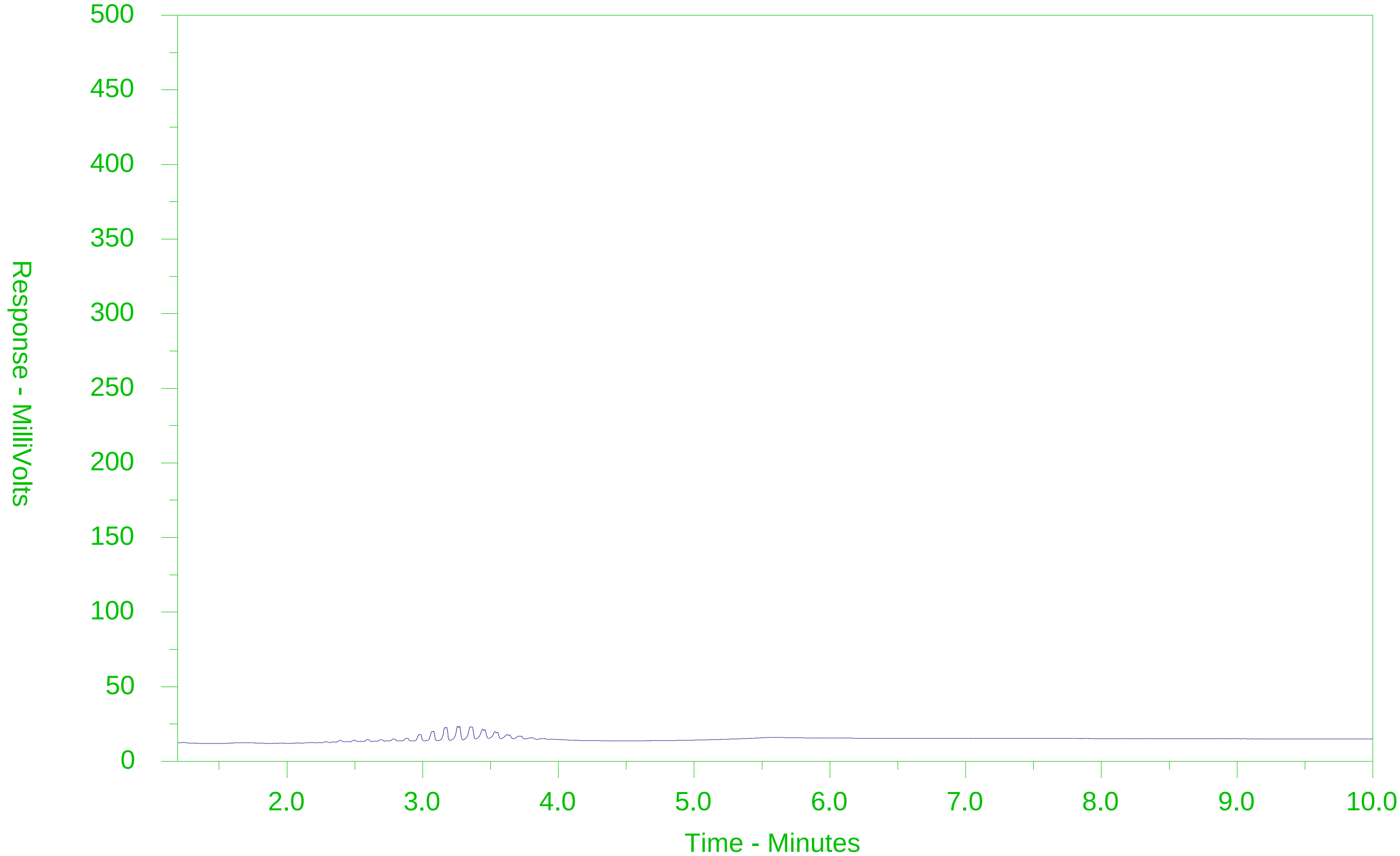
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-2
Client Sample ID: BH02 SS5 (10-12)



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

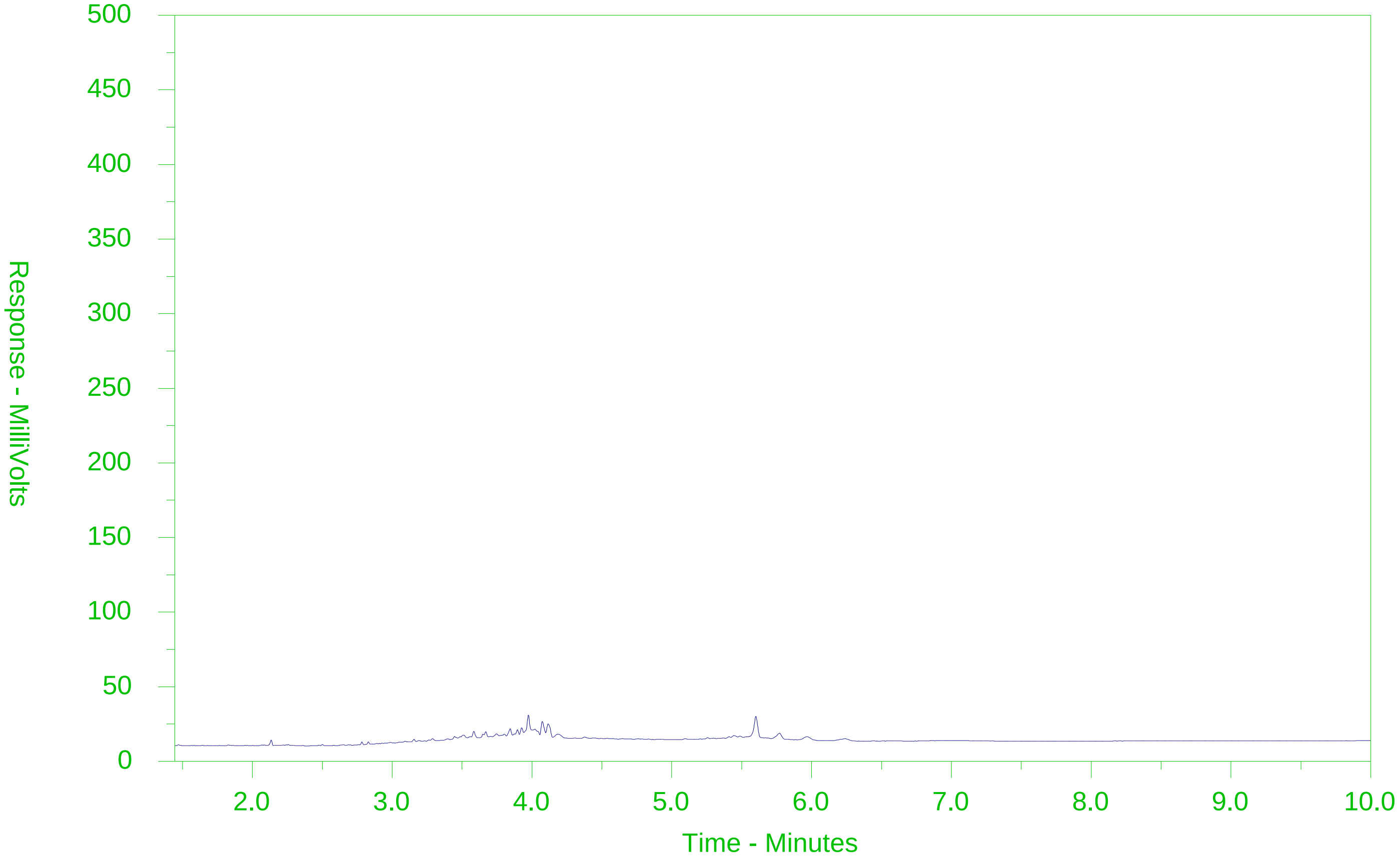
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 **HYDROCARBON DISTRIBUTION REPORT**

ALS Sample ID: L2564179-3
Client Sample ID: BH03 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

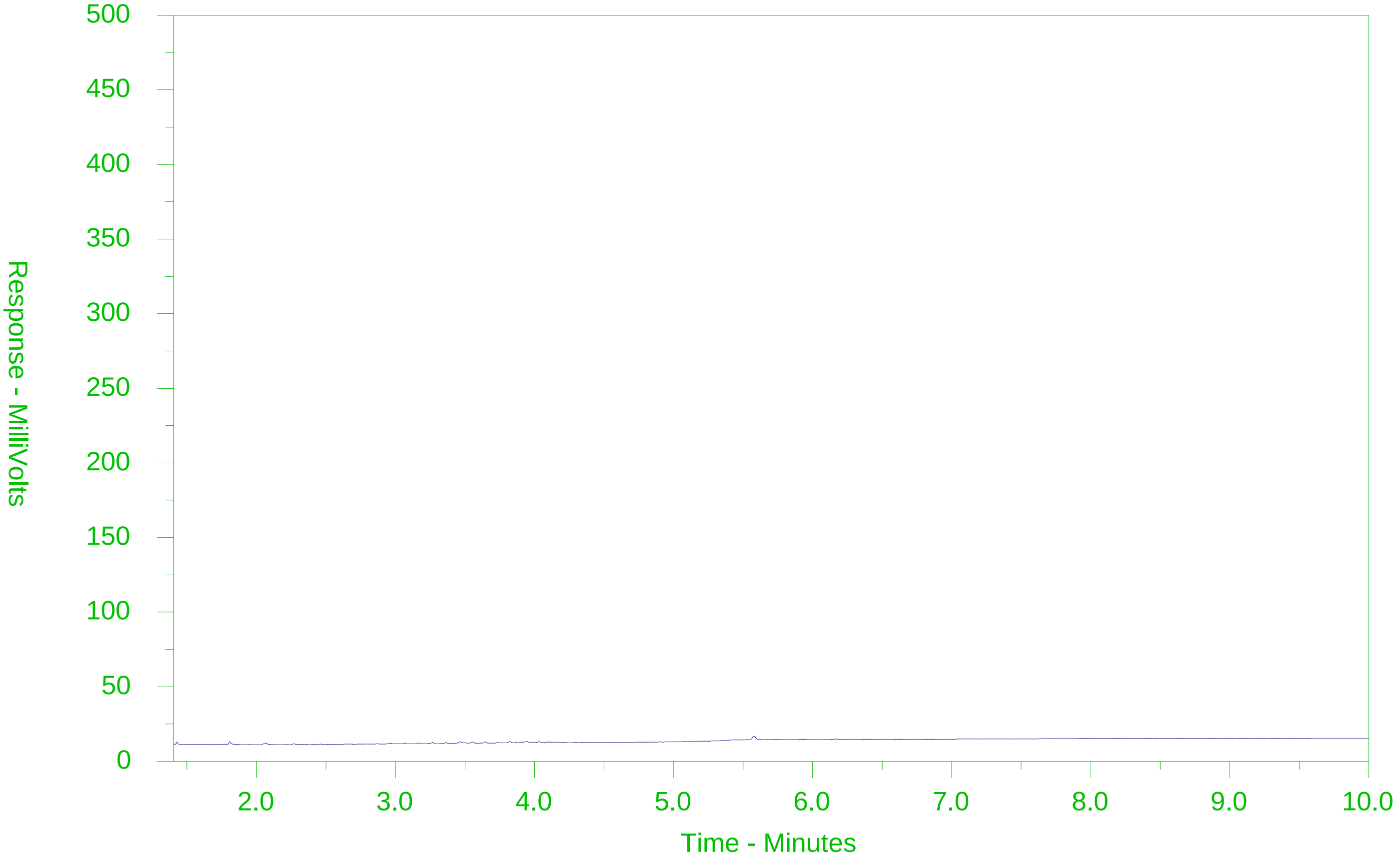
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-4
Client Sample ID: BH04 SS2 (2'6"-4'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

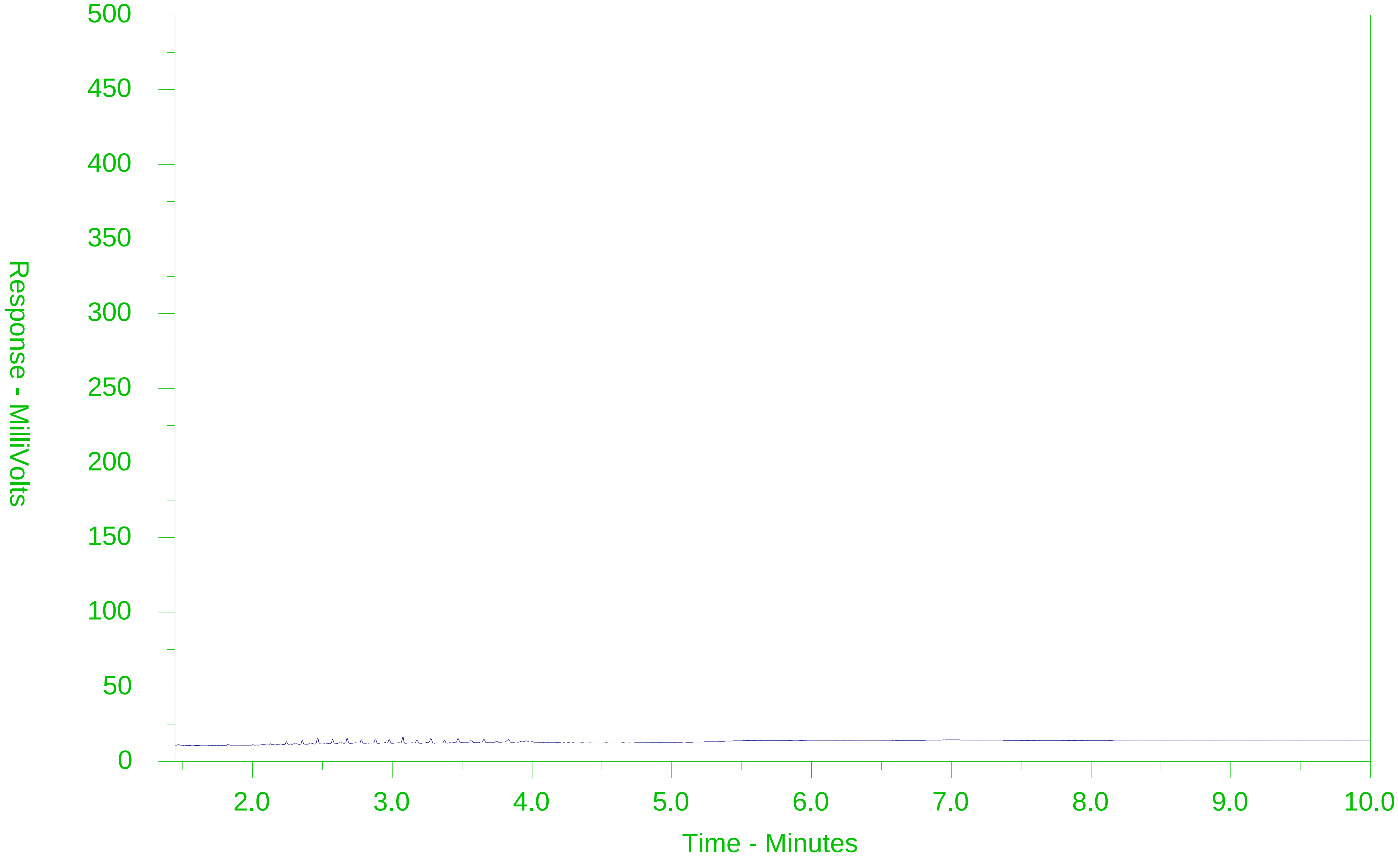
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-5
Client Sample ID: BH 05 SS8 (25'-27')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

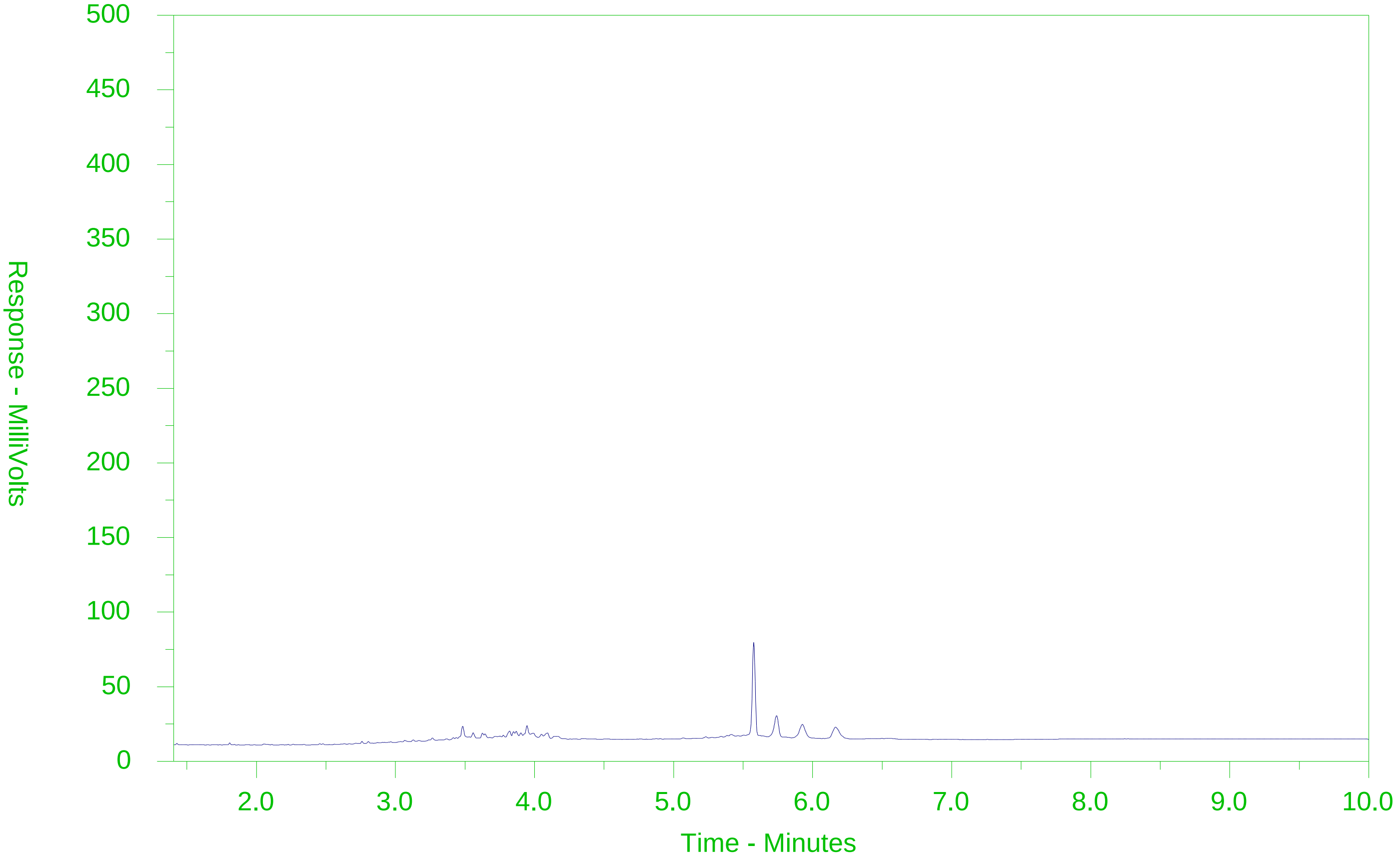
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-6
Client Sample ID: BH06 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

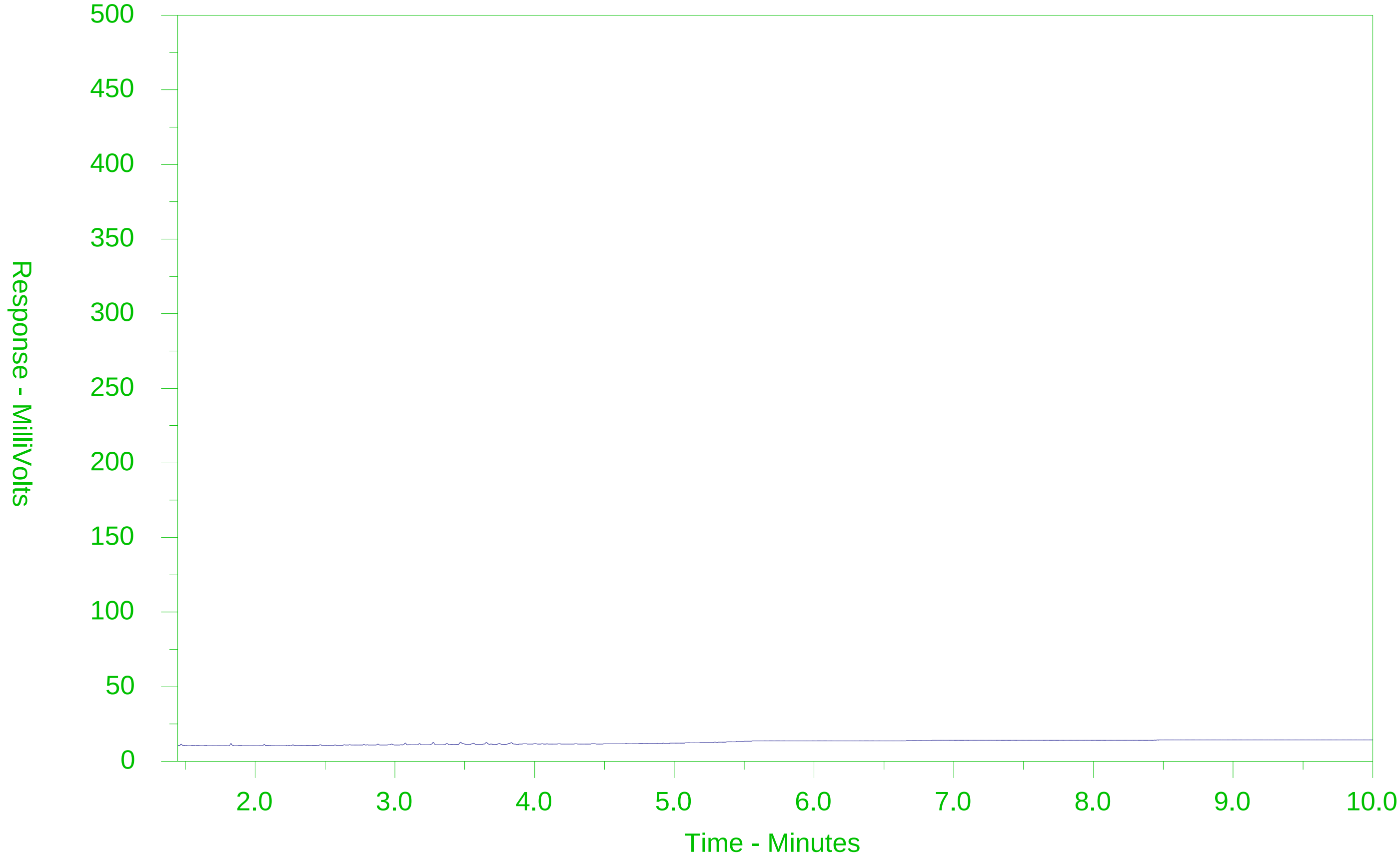
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-8
Client Sample ID: BH07 SS6 (15'-17')



←F2→	←F3	→← F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

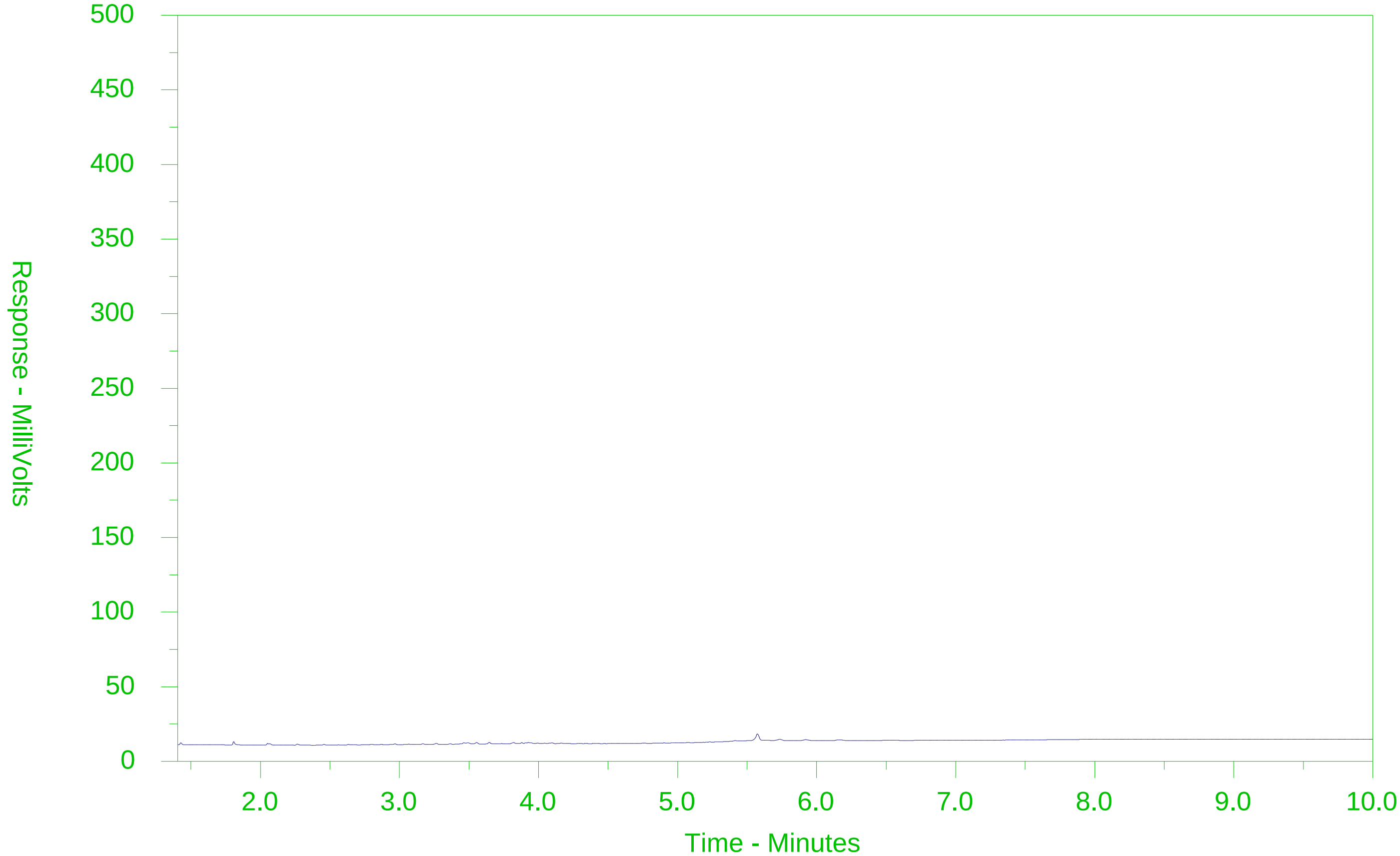
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-9
Client Sample ID: BH08 SS2 (2'6"-4'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

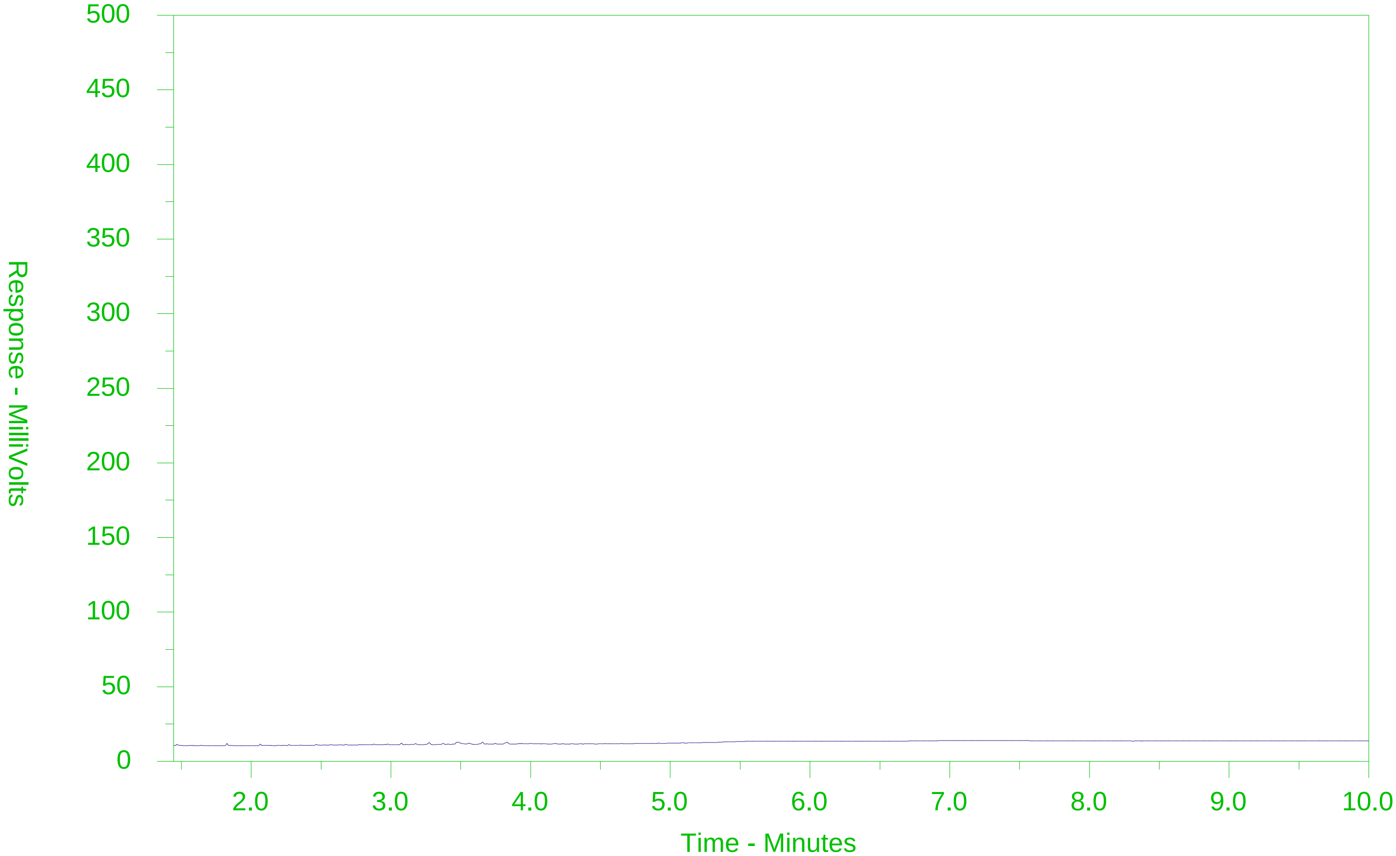
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-10
Client Sample ID: BH10 SS4 (7'6"-9'6")



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

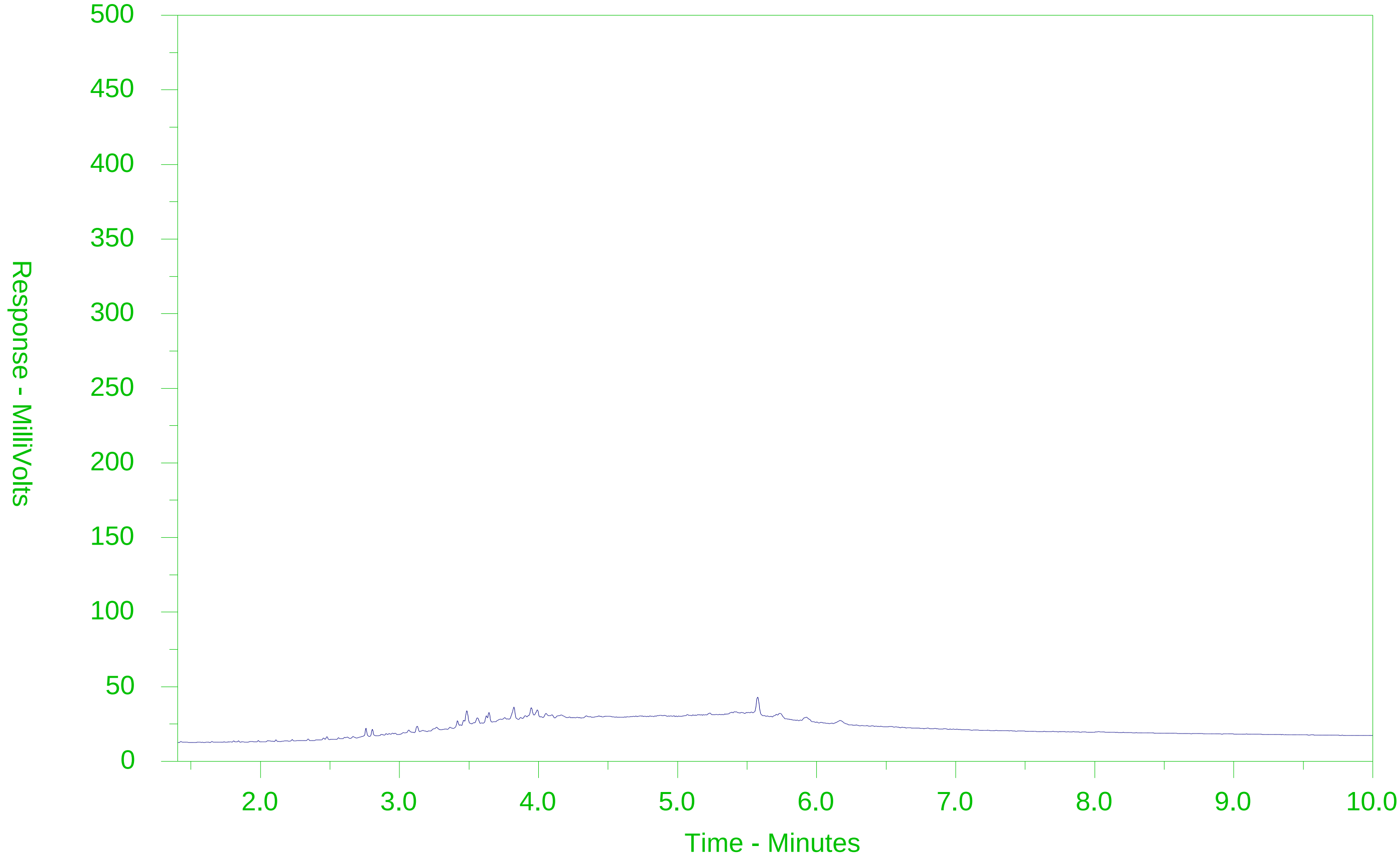
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-11
Client Sample ID: BH11 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

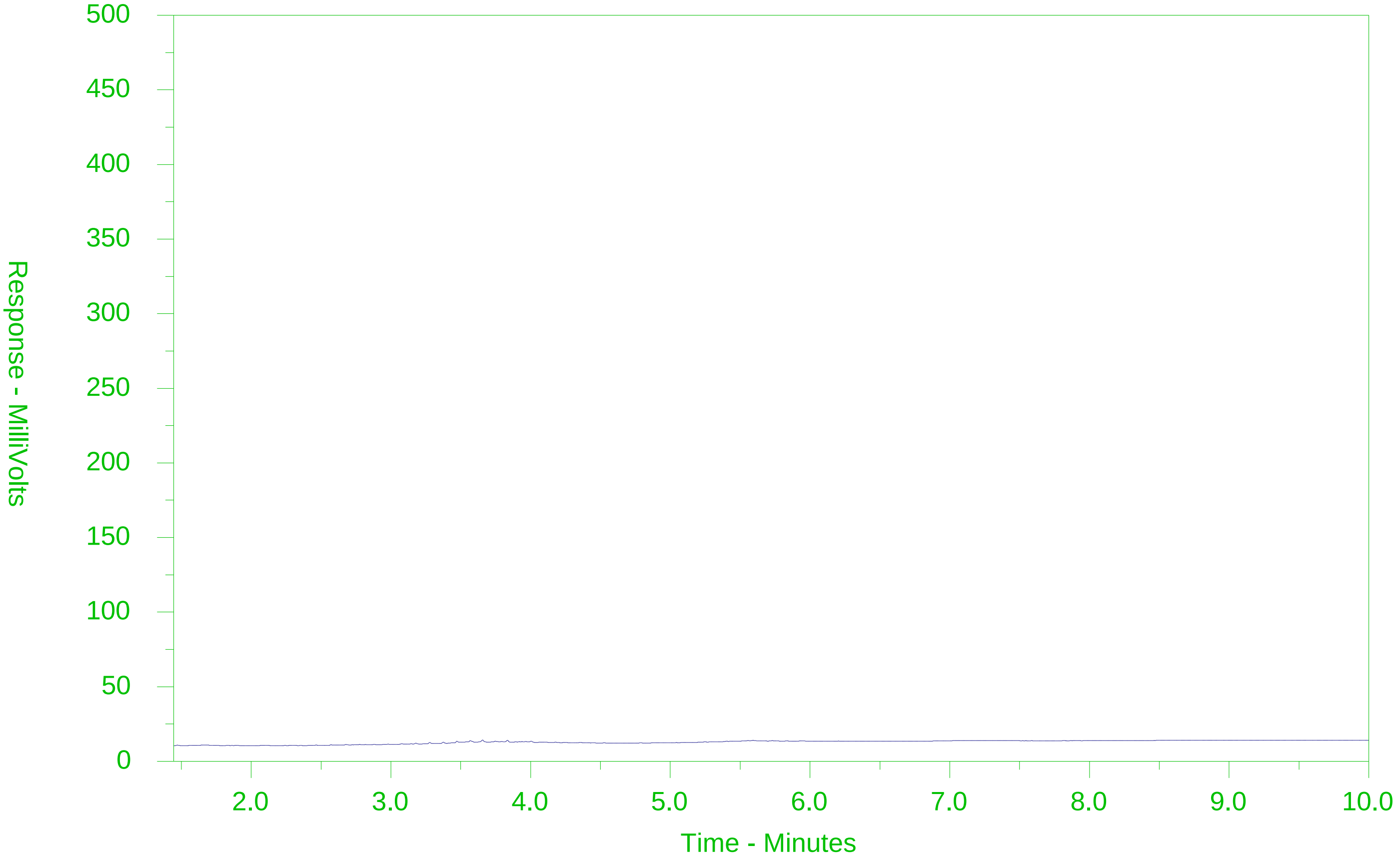
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-12
Client Sample ID: BH12 SS3 (5'-7')



←F2→	←F3→		←F4→	
nC10	nC16	nC34	nC50	
174°C	287°C	481°C	575°C	
346°F	549°F	898°F	1067°F	
Gasoline →		← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →				

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

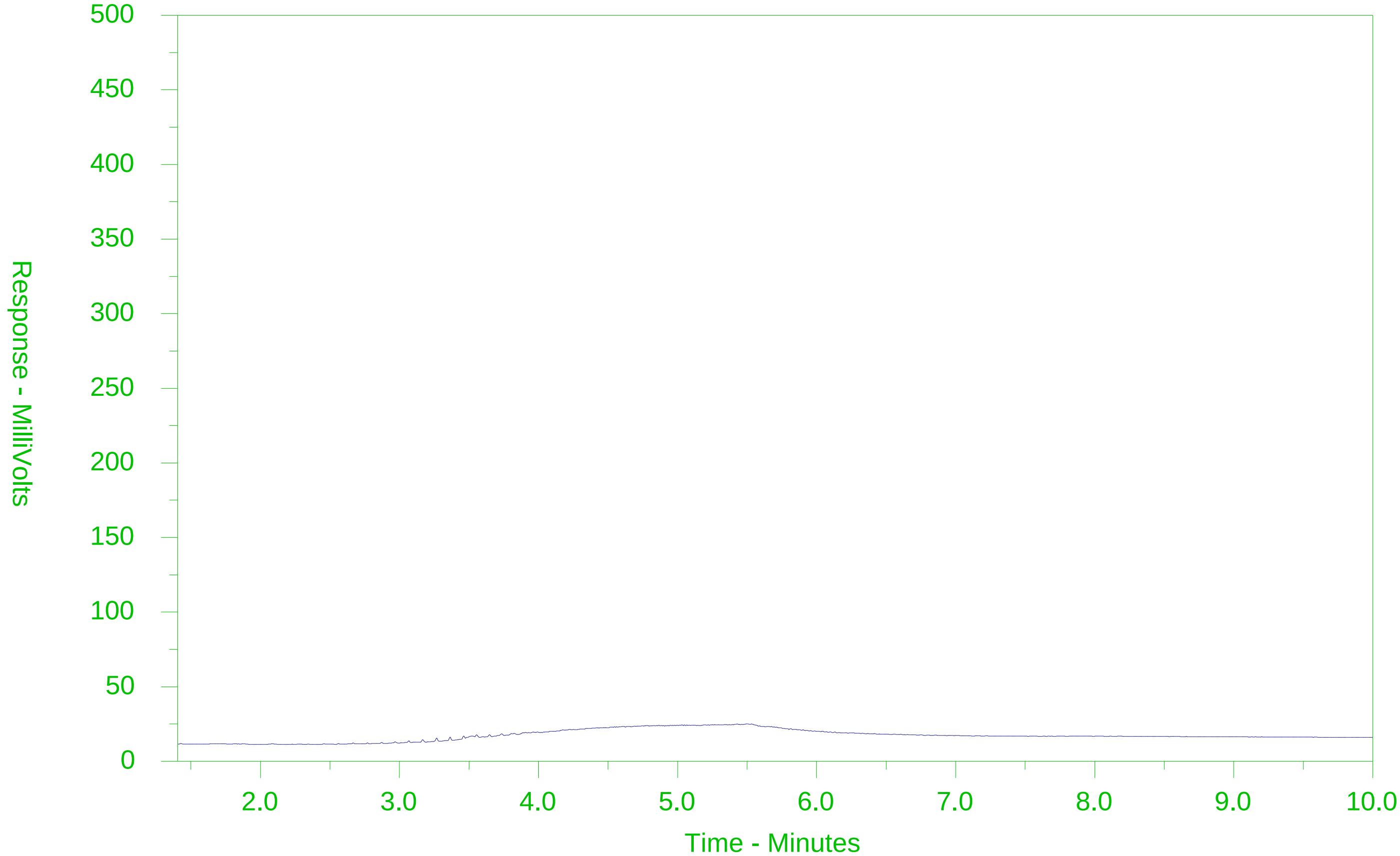
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-13
Client Sample ID: BH13 SS1 (0'-2')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

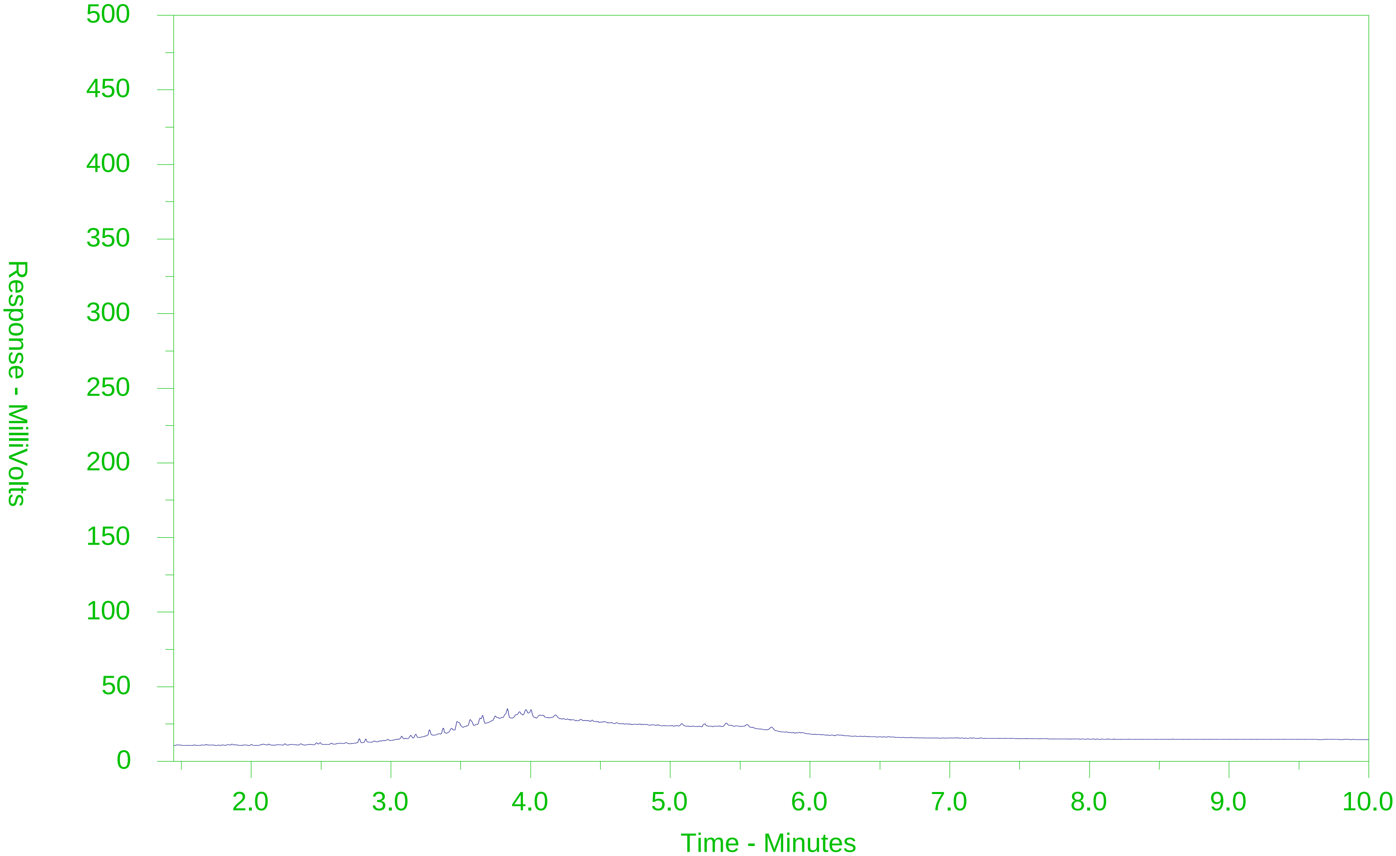
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-14
Client Sample ID: BH14 SS2 (2'6"-4'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

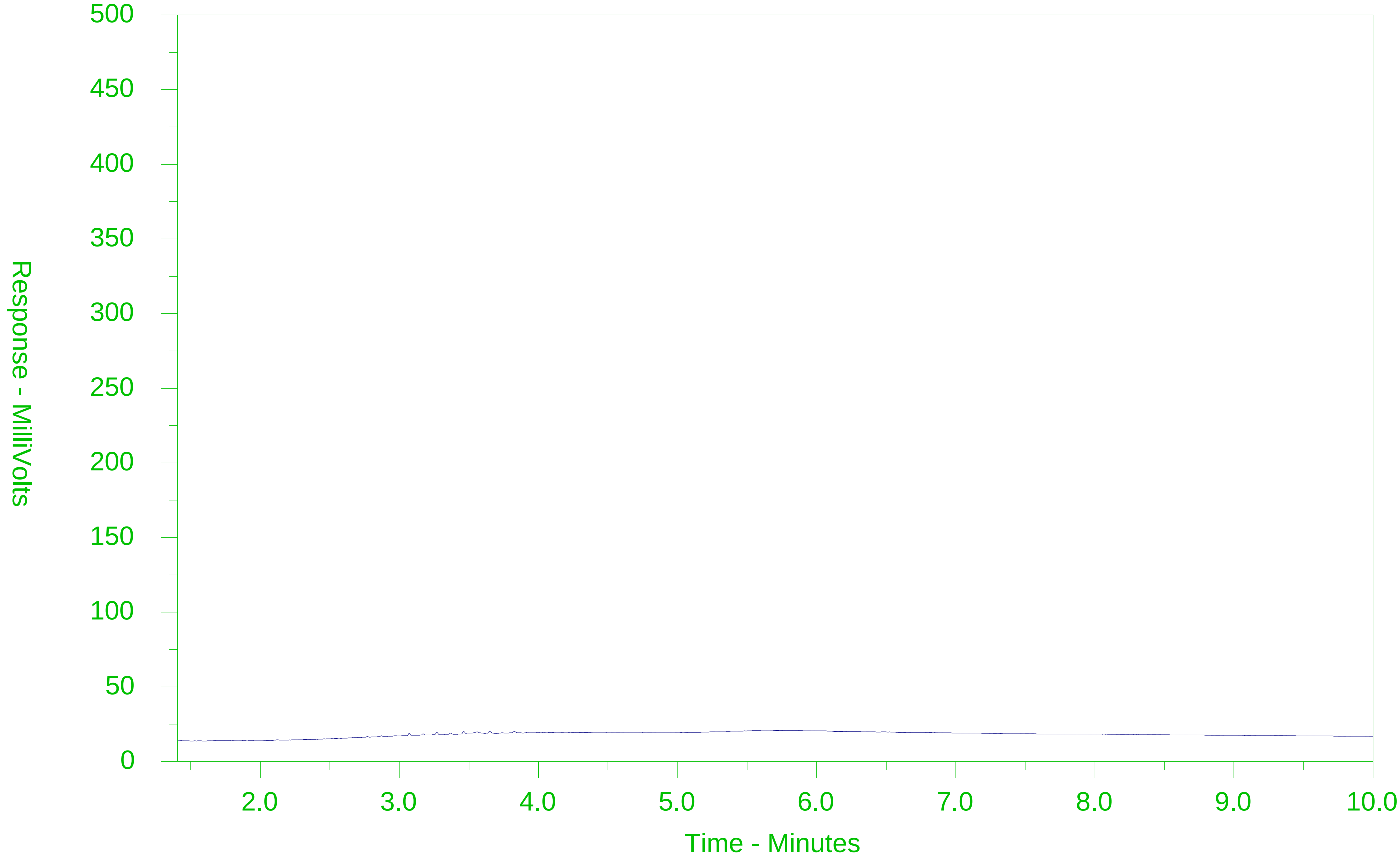
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-15
Client Sample ID: BH19 SS4 (7'6"-9'-6")



←F2→	←	F3	→← F4 →
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

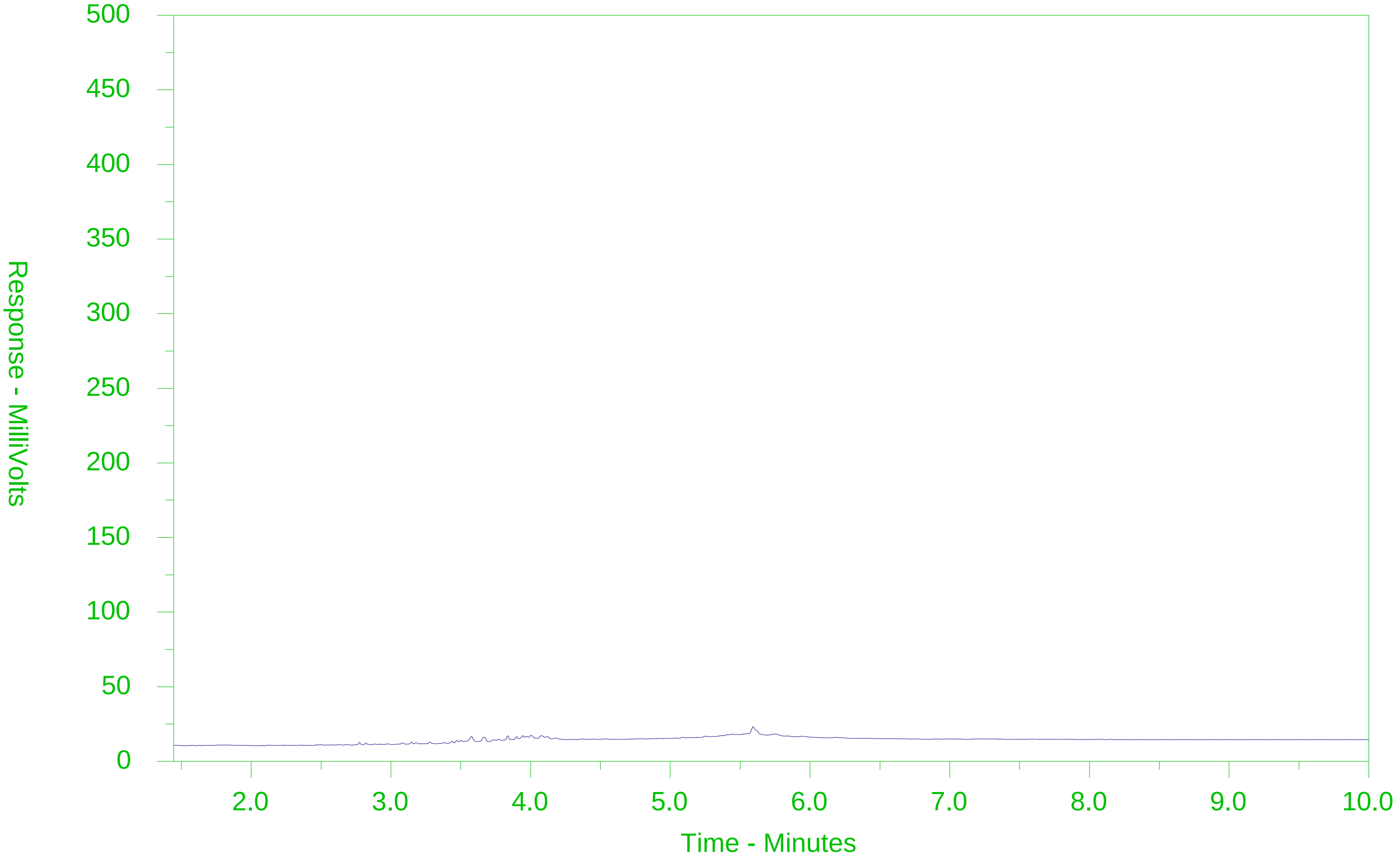
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-16
Client Sample ID: BH20 SS1 (0'-2')



←F2→	←	F3 →	← F4 →	
nC10	nC16	nC34	nC50	
174°C	287°C	481°C	575°C	
346°F	549°F	898°F	1067°F	
Gasoline →		← Motor Oils/Lube Oils/Grease →		
← Diesel/Jet Fuels →				

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

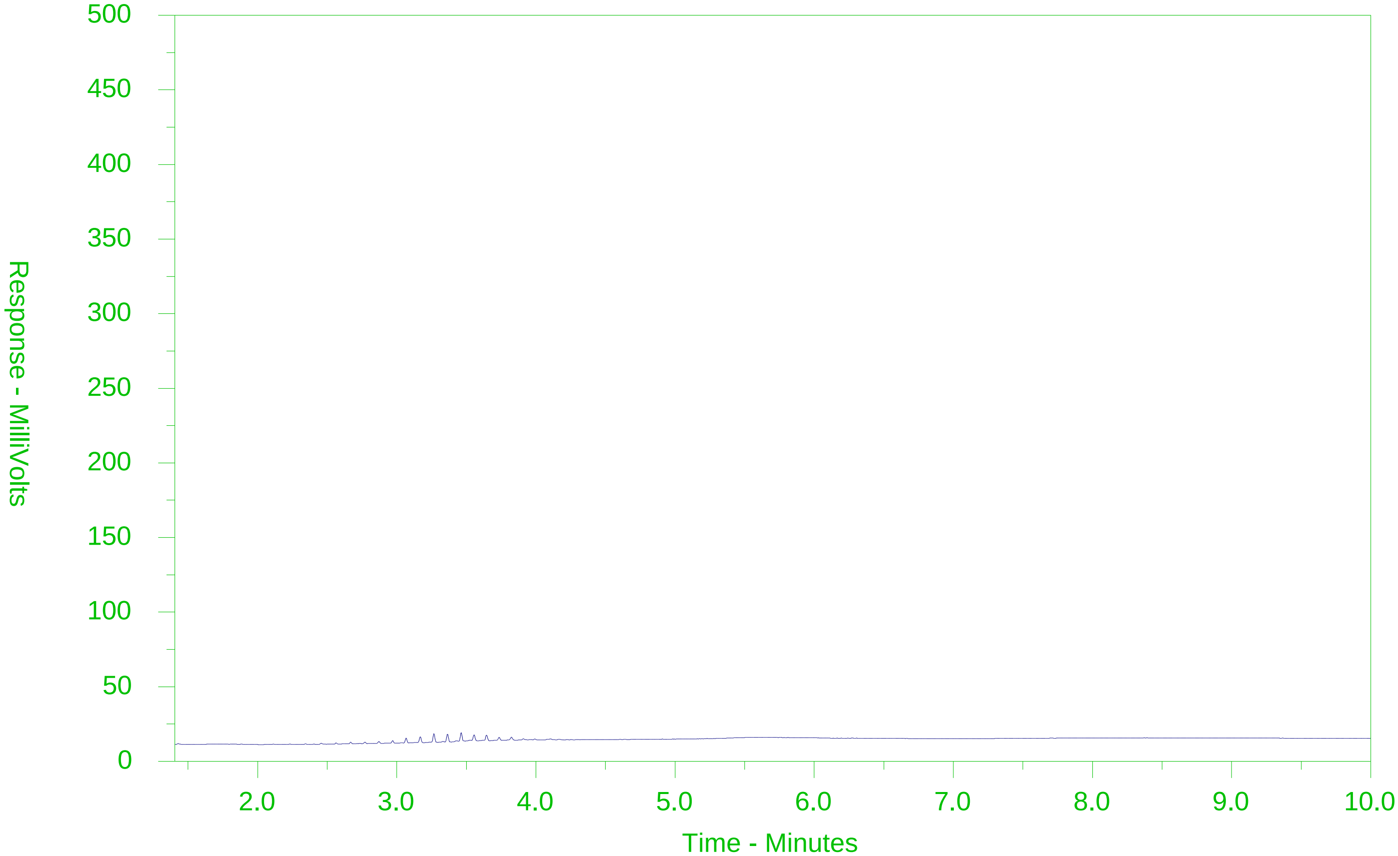
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-17
Client Sample ID: BH21 SS3 (5'-7')



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C 346°F	287°C 549°F	481°C 898°F	575°C 1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

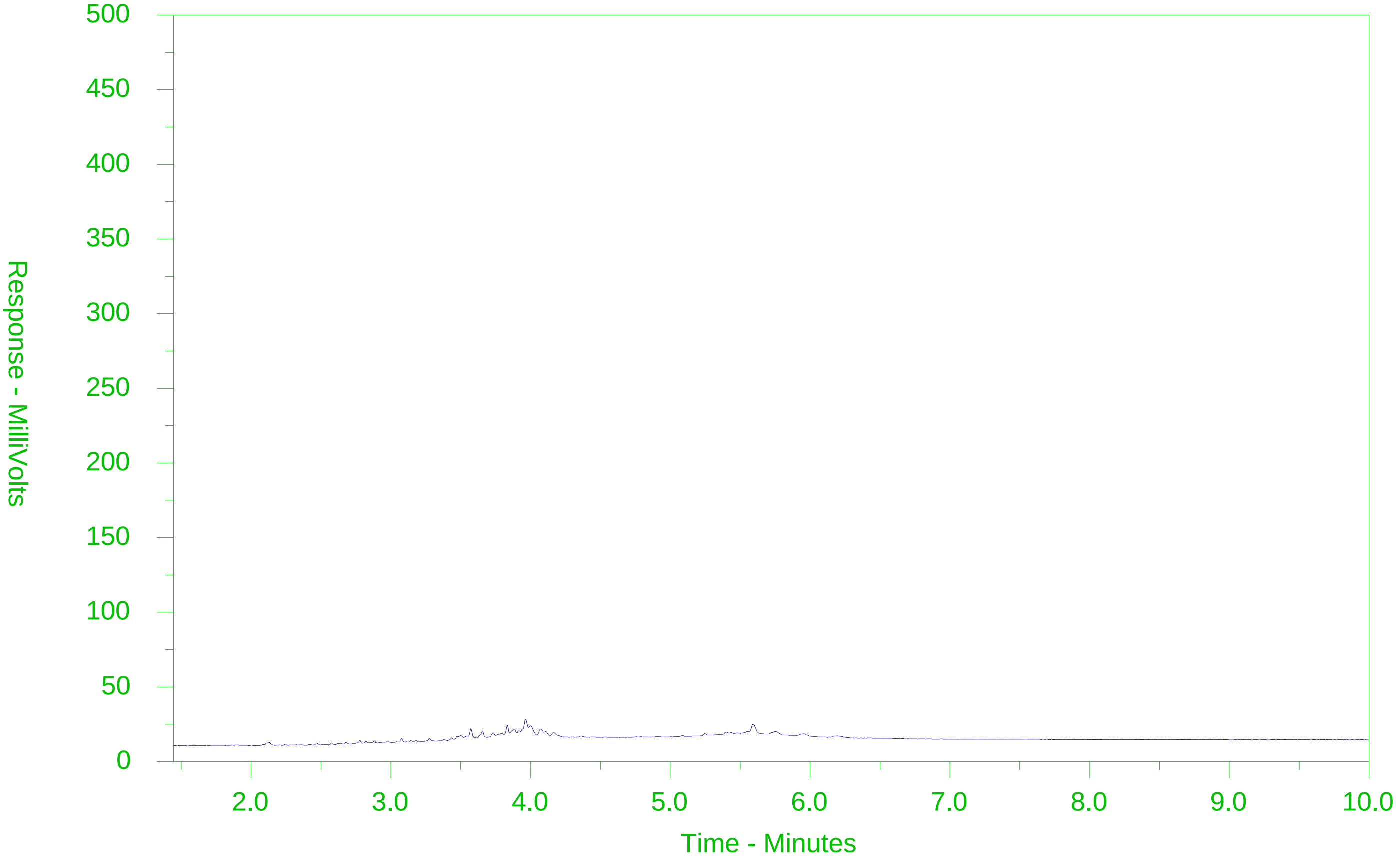
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-18
Client Sample ID: BH23 SS1 (0'-2')



←F2→	←	F3	→←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

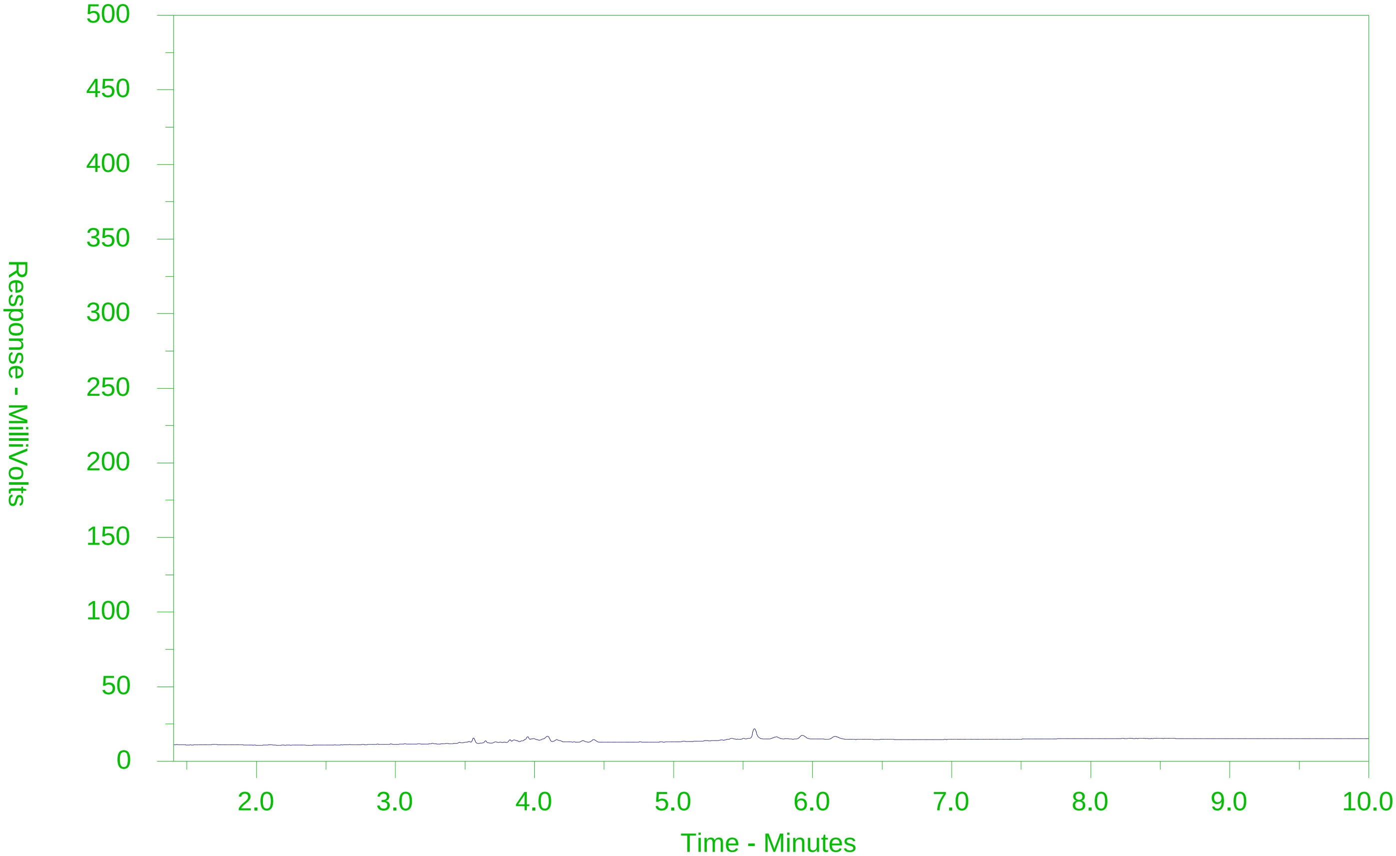
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-19
Client Sample ID: BH24 SS1 (0'-2')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

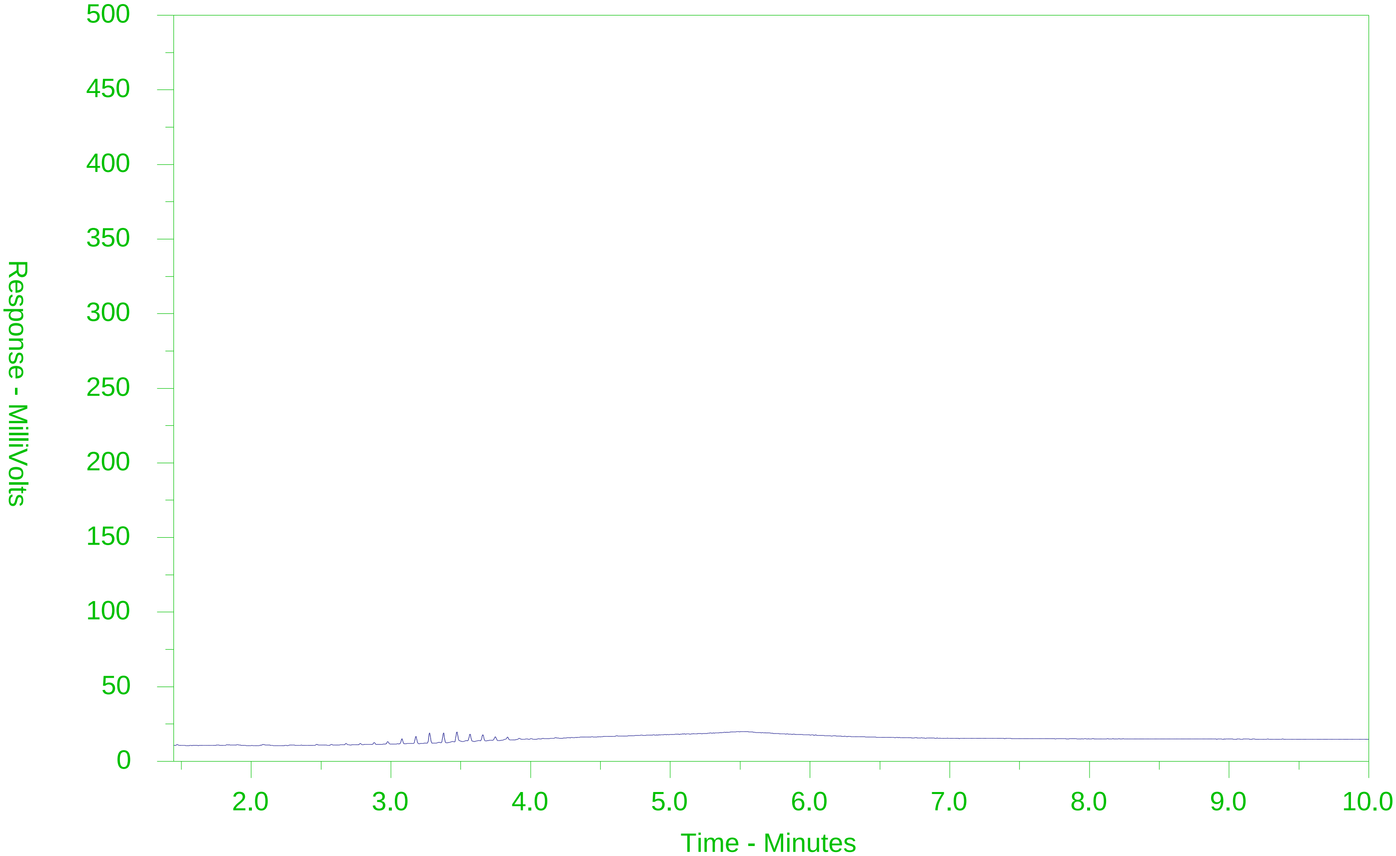
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-20
Client Sample ID: BH25 SS4 (7'6"-9'6")



←F2→	←F3→		←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

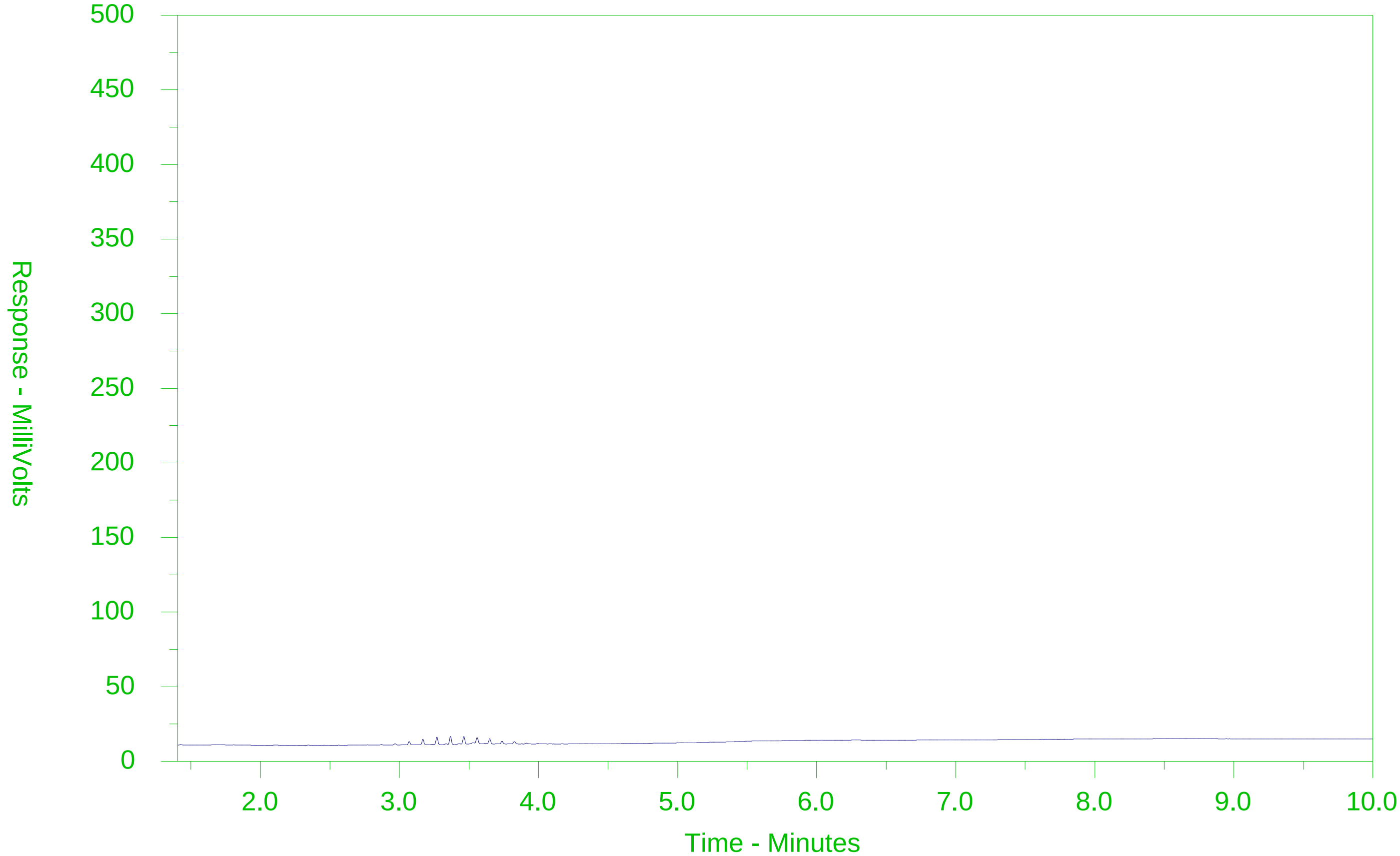
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2564179-21
Client Sample ID: BH26 SS5 (10'-12')



←F2→	←	F3→	←F4→
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

Chain of [barcode] L2564179-COFC

ALS www.alsglobal.com

COC Number: 20 -

ML

Report To	Contact and company name below will appear on the final report
Company:	Thurber Engineering Ltd.
Contact:	Rachel Bourassa
Phone:	~~905-829-8666~~ 416 523 1015
	Company address below will appear on the final report
Street:	2010 Winston Park Drive, Suite 103
City/Province:	Oakville, Ontario
Postal Code:	L6H 5R7
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Thurber Engineering Ltd.
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☑ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax rbourassa@thurber.ca

Email 2

Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax accountingON@thurber.ca

Email 2

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

Project Information

ALS Account # / Quote #: 25053 / 84199

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): L2564179 8X

ALS Contact: Amanda Overholster | Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O. Reg. 153/04 Metals & Inorganics	O. Reg. 153/04 BTEX/PHC F1-F4	O. Reg. 153/04 VOCs	Corrosivity	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
1	BH01 SS1 (0'-2')	23-Feb-21	1:00	Soil	4	✓	✓					
2	BH02 SS5 (10-12)	22-Feb-21	2:00	"	7	✓	✓	✓				
3	BH03 SS1 (0'-2')	23-Feb-21	3:00	"	4	✓	✓					
4	BH04 SS2 (2'6"-4'6")	24-Feb-21	3:00	"	7	✓	✓	✓				
5	BH05 SS8 (25'-27')	25-Feb-21	12:00	"	4	✓	✓					
6	BH06 SS1 (0'-2')	24-Feb-21	11:00	"	4	✓	✓					
7	BH06 SS2 (2'6"-4'6")	24-Feb-21	11:10	"	3			✓				
8	BH07 SS6 (15'-17')	26-Feb-21	11:30	"	4	✓	✓					
9	BH08 SS2 (2'6"-4'6")	26-Feb-21	9:15	"	7	✓	✓	✓				
10	BH10 SS4 (7'6"-9'6")	25-Feb-21	12:00	"	7	✓	✓	✓				
11	BH11 SS1 (0'-2')	25-Feb-21	12:00	"	4	✓	✓					
12	BH12 ~~SS4 (7'6"-9'6")~~ SS3 (5'-7')	25-Feb-21	2:00	"	7	✓	✓	✓				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 8.5

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rachel Bourassa	Date: March 5, 21	Time:	Received by:	Date:	Time:	Received by: MJ	Date: Mar 5/21	Time: 13:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

AUG 2020 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS www.alsglobal.com

Chai[n of Custody] L2564179-COFC

COC Number: 20 -

Report To	Contact and company name below will appear on the final report	**Reports / Recipients**	
Company:	Thurber Engineering Ltd.	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Contact:	Rachel Bourassa	Merge QC/QCI Reports with COA	☑ YES ☐ NO ☐ N/A
Phone:	~~905-829-8666~~ 416 523 1015	☑ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Street:	2010 Winston Park Drive, Suite 103	Email 1 or Fax	rbourassa@thurber.ca
City/Province:	Oakville, Ontario	Email 2	
Postal Code:	L6H 5R7	Email 3	
Invoice To	Same as Report To ☐ YES ☑ NO	**Invoice Recipients**	
	Copy of Invoice with Report ☑ YES ☐ NO	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Company:	Thurber Engineering Ltd.	Email 1 or Fax	accountingON@thurber.ca
Contact:		Email 2	

Turnaround Time (TAT) Requested

- ☑ Routine [R] if received by 3pm M-F - no surcharges apply
- ☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
- ☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
- ☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
- ☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
- ☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

Project Information		**Oil and Gas Required Fields (client use)**	
ALS Account # / Quote #:	25053 / 84199	AFE/Cost Center:	PO#
Job #:	30726	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2564179	ALS Contact: Amanda Overholster	Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O. Reg. 153/04 Metals & Inorganics	O. Reg. 153/04 BTEX/PHC F1-F4	O. Reg. 153/04 VOCs		Corrosivity	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	~~[illegible]~~							~~✓~~					
13	BH 13 SS1 (0'-2')	2-Mar-21	12:00	Soil	4	✓	✓						
14	BH 14 SS2 (2'6"-4'6")	1-Mar-21	2:00	"	7	✓	✓	✓					
15	BH 19 SS4 (7'6"-9'6")	2-Mar 21	2:00	"	4	✓	✓						
16	BH 20 SS1 (0'-2')	26-Feb-21	12:00	"	4	✓	✓						
17	BH 21 SS3 (5'-7')	2-Mar-21	11:00	"	7	✓	✓	✓					
18	BH 23 SS1 (0'-2')	26-Feb-21	10:00	"	7	✓	✓	✓					
19	BH 24 SS1 (0'-2)	25-Feb-21	4:00	"	4	✓	✓						
20	BH 25 SS4 (7'6"-9'6")	01-Mar-21	11:00	Soil	7	✓	✓	✓					
21	BH 26 SS5 (10'-12')	1-Mar-21	3:30	"	4	✓	✓						

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 8.3

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rachel Bourassa	Date: March 5/21	Time:	Received by:	Date:	Time:	Received by: [signature]	Date: Mar 5/21	Time: 16:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Thurber Engineering Ltd. (Oakville)
ATTN: Rachel Bourssa
2010 Winston Park Drive
Unit 103
Oakville ON L6H 5R7

Date Received: 05-MAR-21
Report Date: 18-MAR-21 12:30 (MT)
Version: FINAL REV. 2

Client Phone: 905-829-8666

Certificate of Analysis

Lab Work Order #: L2564174

Project P.O. #: NOT SUBMITTED
Job Reference: 30726
C of C Numbers:
Legal Site Desc:

Amanda Overholster
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit

Ontario Regulation 406/19 - Excess Soils - 17-December-20 - T3.1 - Leachate Screening Levels - Res/Park/Inst Property Use

(No parameter exceedances)

Ontario Regulation 406/19 - Excess Soils - 17-December-20 - T3.1 - Leachate Screening Levels - Ind/Com/Commu Property Use

(No parameter exceedances)

ANALYTICAL REPORT

Sample Preparation - WASTE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2564174-1	L2564174-2	L2564174-3	L2564174-4	L2564174-5
Sample Date				23-FEB-21	25-FEB-21	26-FEB-21	25-FEB-21	01-MAR-21
Sample ID				BH01 SPLP	BH05 SPLP	BH08 SPLP	BH12 SPLP	BH25 SPLP
Initial pH	pH units	-	-	9.21	9.18	9.42	9.06	9.39
Final pH	pH units	-	-	9.05	8.95	9.08	9.07	9.37

Guide Limit #1: T3.1 - Leachate Screening Levels - Res/Park/Inst Property Use
Guide Limit #2: T3.1 - Leachate Screening Levels - Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

SPLP Metals - WASTE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2564174-1 23-FEB-21 BH01 SPLP	L2564174-2 25-FEB-21 BH05 SPLP	L2564174-3 26-FEB-21 BH08 SPLP	L2564174-4 25-FEB-21 BH12 SPLP	L2564174-5 01-MAR-21 BH25 SPLP
Antimony (Sb)	ug/L	-	-	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic (As)	ug/L	-	-	<5.0	<5.0	<5.0	<5.0	<5.0
Barium (Ba)	ug/L	4600	4600	<100	<100	<100	<100	<100
Beryllium (Be)	ug/L	11	11	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	-	-	<500	<500	<500	<500	<500
Cadmium (Cd)	ug/L	-	0.5	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium (Cr)	ug/L	130	130	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt (Co)	ug/L	10	10	<2.0	<2.0	<2.0	<2.0	<2.0
Copper (Cu)	ug/L	14	14	<10	<10	<10	<10	<10
Lead (Pb)	ug/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Molybdenum (Mo)	ug/L	-	1500	<10	<10	<10	<10	<10
Nickel (Ni)	ug/L	78	78	<20	<20	<20	<20	<20
Selenium (Se)	ug/L	10	10	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.3	0.3	<0.25	<0.25	<0.25	<0.25	<0.25
Thallium (Tl)	ug/L	-	80	<0.80	<0.80	<0.80	<0.80	<0.80
Uranium (U)	ug/L	20	20	<15	<15	<15	<15	<15
Vanadium (V)	ug/L	-	-	11.2	<5.0	6.5	8.0	7.8
Zinc (Zn)	ug/L	180	180	<30	<30	<30	<30	<30

Guide Limit #1: T3.1 - Leachate Screening Levels - Res/Park/Inst Property Use
Guide Limit #2: T3.1 - Leachate Screening Levels - Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Volatile Organic Compounds - WATER

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2564174-1	L2564174-2	L2564174-3	L2564174-4	L2564174-5
Sample Date				23-FEB-21	25-FEB-21	26-FEB-21	25-FEB-21	01-MAR-21
Sample ID				BH01 SPLP	BH05 SPLP	BH08 SPLP	BH12 SPLP	BH25 SPLP
1,3-Dichloropropene (cis & trans)	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50

Guide Limit #1: T3.1 - Leachate Screening Levels - Res/Park/Inst Property Use
Guide Limit #2: T3.1 - Leachate Screening Levels - Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ALS Environmental

ANALYTICAL REPORT

SPLP VOCs - WASTE

Analyte	Unit	Guide Limits #1	Guide Limits #2	L2564174-1	L2564174-2	L2564174-3	L2564174-4	L2564174-5
Sample Date				23-FEB-21	25-FEB-21	26-FEB-21	25-FEB-21	01-MAR-21
Sample ID				BH01 SPLP	BH05 SPLP	BH08 SPLP	BH12 SPLP	BH25 SPLP
Bromomethane	ug/L	0.5	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon tetrachloride	ug/L	0.2	0.2	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroform	ug/L	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylene dibromide	ug/L	0.2	0.2	<0.20	<0.20	<0.20	<0.20	<0.20
1,2-Dichlorobenzene	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethane	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethylene	ug/L	0.5	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,2-Dichloroethylene	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethylene	ug/L	0.5	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,3-Dichloropropene	ug/L	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
trans-1,3-Dichloropropene	ug/L	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,1,2-Tetrachloroethane	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethylene	ug/L	0.5	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	ug/L	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
Trichloroethylene	ug/L	0.5	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Surrogate: 4-Bromofluorobenzene	%	-	-	104.5	100.0	95.5	105.3	102.2
Surrogate: 1,4-Difluorobenzene	%	-	-	102.4	103.0	103.7	104.0	104.4

Guide Limit #1: T3.1 - Leachate Screening Levels - Res/Park/Inst Property Use
Guide Limit #2: T3.1 - Leachate Screening Levels - Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
LEACH-MSPLP-WT	Waste	Modified SPLP Extraction	E9003

A Sample (100g) of soil is leached for 18 +/- 2 hours with 2.0 liters of splp leaching fluid #2 (pH = 5). For the analysis of metals, the leachate is filtered through a 0.45um filter using a metals free filtering system prior to digestion and analysis.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-SPLP-WT	Waste	SPLP Leachable Metals	EPA 200.8

An extract produced by the Synthetic Precipitation Leaching Procedure (SPLP) as per EPA 1312 or Ontario MECP E9003 is analyzed by Collision/Reaction Cell ICPMS. The extract is filtered through a 0.6 to 0.8 micron glass fibre filter for Method 1312 or through a 0.45um filter for Method E9003.

ALS Test Code	Matrix	Test Description	Method Reference**
VOC-1,3-DCP-CALC-WT	Water	Regulation 153 VOCs	SW8260B/SW8270C
VOC-SPLP-WT	Waste	VOCs for O. R153/04 SPLP Leachate	SW846 8260

A sample of waste is leached in a zero headspace extractor at 30–2 rpm for 18–2.0 hours with the appropriate leaching solution.After tumbling the leachate is analyzed directly by headspace technology, followed by GC/MS using internal standard quantitation.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2564174 Report Date: 18-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-SPLP-WT	**Waste**							
Batch R5399169								
WG3499432-4 DUP		**WG3499432-3**						
Antimony (Sb)		<5.0	<5.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Arsenic (As)		<5.0	<5.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Barium (Ba)		<100	<100	RPD-NA	ug/L	N/A	25	10-MAR-21
Beryllium (Be)		<2.0	<2.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Boron (B)		<500	<500	RPD-NA	ug/L	N/A	25	10-MAR-21
Cadmium (Cd)		<0.10	<0.10	RPD-NA	ug/L	N/A	25	10-MAR-21
Chromium (Cr)		<5.0	<5.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Cobalt (Co)		<2.0	<2.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Copper (Cu)		<10	<10	RPD-NA	ug/L	N/A	25	10-MAR-21
Lead (Pb)		<2.0	<2.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Molybdenum (Mo)		<10	<10	RPD-NA	ug/L	N/A	25	10-MAR-21
Nickel (Ni)		<20	<20	RPD-NA	ug/L	N/A	25	10-MAR-21
Selenium (Se)		<1.0	<1.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Silver (Ag)		<0.25	<0.25	RPD-NA	ug/L	N/A	25	10-MAR-21
Thallium (Tl)		<0.80	<0.80	RPD-NA	ug/L	N/A	25	10-MAR-21
Uranium (U)		<15	<15	RPD-NA	ug/L	N/A	25	10-MAR-21
Vanadium (V)		<5.0	<5.0	RPD-NA	ug/L	N/A	25	10-MAR-21
Zinc (Zn)		<30	<30	RPD-NA	ug/L	N/A	25	10-MAR-21
WG3499432-2 LCS								
Antimony (Sb)			108.0		%		70-130	10-MAR-21
Arsenic (As)			104.0		%		70-130	10-MAR-21
Barium (Ba)			107.2		%		70-130	10-MAR-21
Beryllium (Be)			102.7		%		70-130	10-MAR-21
Boron (B)			97.1		%		70-130	10-MAR-21
Cadmium (Cd)			99.5		%		70-130	10-MAR-21
Chromium (Cr)			100.5		%		70-130	10-MAR-21
Cobalt (Co)			102.9		%		70-130	10-MAR-21
Copper (Cu)			100.4		%		70-130	10-MAR-21
Lead (Pb)			99.7		%		70-130	10-MAR-21
Molybdenum (Mo)			104.2		%		70-130	10-MAR-21
Nickel (Ni)			99.9		%		70-130	10-MAR-21
Selenium (Se)			96.6		%		70-130	10-MAR-21
Silver (Ag)			101.4		%		70-130	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-SPLP-WT	**Waste**							
Batch R5399169								
WG3499432-2 LCS								
Thallium (Tl)			101.7		%		70-130	10-MAR-21
Uranium (U)			99.4		%		70-130	10-MAR-21
Vanadium (V)			103.4		%		70-130	10-MAR-21
Zinc (Zn)			99.2		%		70-130	10-MAR-21
WG3499432-1 MB								
Antimony (Sb)			<5.0		ug/L		5	10-MAR-21
Arsenic (As)			<5.0		ug/L		5	10-MAR-21
Barium (Ba)			<100		ug/L		100	10-MAR-21
Beryllium (Be)			<2.0		ug/L		2	10-MAR-21
Boron (B)			<500		ug/L		500	10-MAR-21
Cadmium (Cd)			<0.10		ug/L		0.1	10-MAR-21
Chromium (Cr)			<5.0		ug/L		5	10-MAR-21
Cobalt (Co)			<2.0		ug/L		2	10-MAR-21
Copper (Cu)			<10		ug/L		10	10-MAR-21
Lead (Pb)			<2.0		ug/L		2	10-MAR-21
Molybdenum (Mo)			<10		ug/L		10	10-MAR-21
Nickel (Ni)			<20		ug/L		20	10-MAR-21
Selenium (Se)			<1.0		ug/L		1	10-MAR-21
Silver (Ag)			<0.25		ug/L		0.25	10-MAR-21
Thallium (Tl)			<0.80		ug/L		0.8	10-MAR-21
Uranium (U)			<15		ug/L		15	10-MAR-21
Vanadium (V)			<5.0		ug/L		5	10-MAR-21
Zinc (Zn)			<30		ug/L		30	10-MAR-21
WG3499432-5 MS		**WG3499432-3**						
Antimony (Sb)			98.8		%		50-140	10-MAR-21
Arsenic (As)			102.1		%		50-140	10-MAR-21
Barium (Ba)			105.6		%		50-140	10-MAR-21
Beryllium (Be)			97.4		%		50-140	10-MAR-21
Boron (B)			95.1		%		50-140	10-MAR-21
Cadmium (Cd)			98.6		%		50-140	10-MAR-21
Chromium (Cr)			100.0		%		50-140	10-MAR-21
Cobalt (Co)			101.5		%		50-140	10-MAR-21
Copper (Cu)			97.4		%		50-140	10-MAR-21
Lead (Pb)			100.8		%		50-140	10-MAR-21

Quality Control Report

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-SPLP-WT	**Waste**							
Batch R5399169								
WG3499432-5 MS		**WG3499432-3**						
Molybdenum (Mo)			99.0		%		50-140	10-MAR-21
Nickel (Ni)			98.7		%		50-140	10-MAR-21
Selenium (Se)			95.6		%		50-140	10-MAR-21
Silver (Ag)			115.5		%		50-140	10-MAR-21
Thallium (Tl)			97.6		%		50-140	10-MAR-21
Uranium (U)			99.1		%		70-130	10-MAR-21
Vanadium (V)			103.1		%		50-140	10-MAR-21
Zinc (Zn)			96.2		%		50-140	10-MAR-21
VOC-SPLP-WT	**Waste**							
Batch R5399015								
WG3499050-1 LCS								
1,1,1,2-Tetrachloroethane			97.6		%		70-130	09-MAR-21
1,1,2,2-Tetrachloroethane			105.8		%		70-130	09-MAR-21
1,1,2-Trichloroethane			101.8		%		70-130	09-MAR-21
1,1-Dichloroethane			94.8		%		70-130	09-MAR-21
1,1-Dichloroethylene			93.9		%		70-130	09-MAR-21
1,2-Dichlorobenzene			100.2		%		70-130	09-MAR-21
1,2-Dichloroethane			101.2		%		70-130	09-MAR-21
1,2-Dichloropropane			97.5		%		70-130	09-MAR-21
1,4-Dichlorobenzene			98.7		%		70-130	09-MAR-21
Bromomethane			99.4		%		70-130	09-MAR-21
Carbon tetrachloride			99.5		%		70-130	09-MAR-21
Chloroform			100.8		%		70-130	09-MAR-21
cis-1,2-Dichloroethylene			103.2		%		70-130	09-MAR-21
cis-1,3-Dichloropropene			100.6		%		70-130	09-MAR-21
Ethylene dibromide			108.1		%		70-130	09-MAR-21
Tetrachloroethylene			102.0		%		70-130	09-MAR-21
trans-1,2-Dichloroethylene			87.3		%		70-130	09-MAR-21
trans-1,3-Dichloropropene			100.9		%		70-130	09-MAR-21
Trichloroethylene			101.5		%		70-130	09-MAR-21
WG3499050-2 MB								
1,1,1,2-Tetrachloroethane			<0.50		ug/L		0.5	09-MAR-21
1,1,2,2-Tetrachloroethane			<0.50		ug/L		0.5	09-MAR-21
1,1,2-Trichloroethane			<0.50		ug/L		0.5	09-MAR-21

ALS Environmental

Quality Control Report

Workorder: L2564174 Report Date: 18-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7

Contact: Rachel Bourssa

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-SPLP-WT	**Waste**							
Batch R5399015								
WG3499050-2 MB								
1,1-Dichloroethane			<0.50		ug/L		0.5	09-MAR-21
1,1-Dichloroethylene			<0.50		ug/L		0.5	09-MAR-21
1,2-Dichlorobenzene			<0.50		ug/L		0.5	09-MAR-21
1,2-Dichloroethane			<0.50		ug/L		0.5	09-MAR-21
1,2-Dichloropropane			<0.50		ug/L		0.5	09-MAR-21
1,4-Dichlorobenzene			<0.50		ug/L		0.5	09-MAR-21
Bromomethane			<0.50		ug/L		0.5	09-MAR-21
Carbon tetrachloride			<0.20		ug/L		0.2	09-MAR-21
Chloroform			<1.0		ug/L		1	09-MAR-21
cis-1,2-Dichloroethylene			<0.50		ug/L		0.5	09-MAR-21
cis-1,3-Dichloropropene			<0.20		ug/L		0.2	09-MAR-21
Ethylene dibromide			<0.20		ug/L		0.2	09-MAR-21
Tetrachloroethylene			<0.50		ug/L		0.5	09-MAR-21
trans-1,2-Dichloroethylene			<0.50		ug/L		0.5	09-MAR-21
trans-1,3-Dichloropropene			<0.20		ug/L		0.2	09-MAR-21
Trichloroethylene			<0.50		ug/L		0.5	09-MAR-21
Surrogate: 1,4-Difluorobenzene			103.0		%		60-140	09-MAR-21
Surrogate: 4-Bromofluorobenzene			104.8		%		60-140	09-MAR-21

Quality Control Report

Workorder: L2564174 Report Date: 18-MAR-21

Client: Thurber Engineering Ltd. (Oakville)
2010 Winston Park Drive Unit 103
Oakville ON L6H 5R7
Contact: Rachel Bourssa

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS www.alsglobal.com

Chain of Cu L2564174-COFC

COC Number: 20 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Thurber Engineering Ltd.
Contact:	Rachel Bourassa
Phone:	~~905-829-8666~~ 416 5237015
	Company address below will appear on the final report
Street:	2010 Winston Park Drive, Suite 103
City/Province:	Oakville, Ontario
Postal Code:	L6H 5R7
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Thurber Engineering Ltd.
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☑ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax rbourassa@thurber.ca

Email 2

Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax accountingON@thurber.ca

Email 2

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

Project Information

ALS Account # / Quote #: 25053 / 84199

Job #: 30726

PO / AFE:

LSD:

ALS Lab Work Order # (lab use only): L2564174

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Contact: Amanda Overholster | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Reg. 406: MET-R406-LEACHATE-WT	Reg. 406: VOC-R406-LEACHATE-WT	LEACH-MSPLP-WT	LEACH-ZHE-MSPLP-WT	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH01 SPLP	23-Feb-21	2:00	Soil	2	✓	✓	✓	✓			
	BH05 SPLP	25-Feb-21	5:00	"	2	✓	✓	✓	✓			
	BH08 SPLP	26-Feb-21	12:00	"	2	✓	✓	✓	✓			
	BH 12 SPLP	25-Feb-21	4:00	"	2	✓	✓	✓	✓			
	BH 28 SPLP	01-Mar-21	11:30	"	2	✓	✓	✓	✓			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Reg. 406 mSPLP

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C | FINAL COOLER TEMPERATURES °C: 8.5

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rachel Bourassa	Date: March 5, 2021	Time:	Received by:	Date:	Time:	Received by:	Date: Mar 5/21	Time: 10:08

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

THURBER ENGINEERING LTD.

APPENDIX I

Seismic Hazard Calculation

Results of Geophysical Testing

Government of Canada Gouvernement du Canada

2020 National Building Code of Canada Seismic Hazard Tool

This application provides seismic values for the design of buildings in Canada under Part 4 of the National Building Code of Canada (NBC) 2020 as prescribed in Article 1.1.3.1. of Division B of the NBC 2020.

Seismic Hazard Values

User requested values

Code edition	NBC 2020
Site designation X_V	X_{419}
Latitude (°)	44.24
Longitude (°)	-76.961

Please select one of the tabs below.

NBC 2020 Additional Values Plots API

Background Information

The 5%-damped spectral acceleration ($S_a(T,X)$, where T is the period, in s, and X is the site designation) and peak ground acceleration (PGA(X)) values are given in units of acceleration due to gravity (g, 9.81 m/s^2). Peak ground velocity (PGV(X)) values are given in m/s. Probability is expressed in terms of percent exceedance in 50 years. Further information on the calculation of seismic hazard is provided under the *Background Information* tab.

The 2%-in-50-year seismic hazard values are provided in accordance with Article 4.1.8.4. of the NBC 2020. The 5%- and 10%-in-50-year values are provided for additional performance checks in accordance with Article 4.1.8.23. of the NBC 2020.

See the *Additional Values* tab for additional seismic hazard values, including values for other site designations, periods, and probabilities not defined in the NBC 2020.

NBC 2020 - 2%/50 years (0.000404 per annum) probability

$S_a(0.2, X_{419})$	$S_a(0.5, X_{419})$	$S_a(1.0, X_{419})$	$S_a(2.0, X_{419})$	$S_a(5.0, X_{419})$	$S_a(10.0, X_{419})$	$PGA(X_{419})$	$PGV(X_{419})$
0.306	0.19	0.106	0.0513	0.014	0.00491	0.131	0.126

The log-log interpolated 2%/50 year $S_a(4.0, X_{419})$ value is : **0.0192**

▼ Tables for 5% and 10% in 50 year values

NBC 2020 - 5%/50 years (0.001 per annum) probability

$S_a(0.2, X_{419})$	$S_a(0.5, X_{419})$	$S_a(1.0, X_{419})$	$S_a(2.0, X_{419})$	$S_a(5.0, X_{419})$	$S_a(10.0, X_{419})$	$PGA(X_{419})$	$PGV(X_{419})$
0.182	0.115	0.0628	0.0294	0.00753	0.00267	0.0778	0.0714

The log-log interpolated 5%/50 year $S_a(4.0, X_{419})$ value is : **0.0105**

NBC 2020 - 10%/50 years (0.0021 per annum) probability

$S_a(0.2, X_{419})$	$S_a(0.5, X_{419})$	$S_a(1.0, X_{419})$	$S_a(2.0, X_{419})$	$S_a(5.0, X_{419})$	$S_a(10.0, X_{419})$	$PGA(X_{419})$	$PGV(X_{419})$

$S_a(0.2, X_{419})$	$S_a(0.5, X_{419})$	$S_a(1.0, X_{419})$	$S_a(2.0, X_{419})$	$S_a(5.0, X_{419})$	$S_a(10.0, X_{419})$	$PGA(X_{419})$	$PGV(X_{419})$
0.117	0.0748	0.0398	0.018	0.0043	0.00153	0.05	0.0436

The log-log interpolated 10%/50 year $S_a(4.0, X_{419})$ value is : **0.0061**

Download CSV

Go back to the seismic hazard calculator form

Date modified: 2021-04-06

November 27th, 2023

Transmited by email : sdunlop@thurber.ca
Our ref : GPR-23-05012

Mr. Stephen Dunlop, M.A.Sc., P.Eng.
Associate, Senior Geotechnical Engineer
Thurber Engineering Ltd.
Suite 104, 2460 Lancaster Road
Ottawa, Ontario K1B 4S5

Object: **Rock Profiling and Site Classification from Seismic surveys**
300 Water Street, Napanee (ON)

Dear Sir,

Geophysics GPR International inc. has been mandated by **Thurber Engineering Ltd.** to carry out a geophysical investigation at the Town's Water Pollution Control Plant, in Napanee (ON). The investigation used the seismic refraction and the Multi-channel Analysis of Surface Waves (MASW) methods. The seismic refraction aimed to profile the rock topography for the footprint of the proposed structures, as recent geotechnical boreholes revealed some gradients related to rock depths between the North and South ends of the vacant lot. From the MASW results, the seismic shear wave velocity values were calculated for the soil and the rock, to determine the Site Class.

Three (3) seismic refraction lines were surveyed N-S, crossing the location of the proposed new structures, located west of the existing facility. One (1) seismic line was investigated for the MASW survey, at the south end of the lot. The surveys were carried out on November 2nd, 2023, by Mr. Charles Trottier, M.Sc. Phys. and Mrs. Karyne Faguy, B.Sc.Geophysics. Figure 1 shows the regional location of the site and Figure 2 illustrates the location of the seismic lines.

The following sections briefly describe the principle of the survey method, the survey design, and the results.

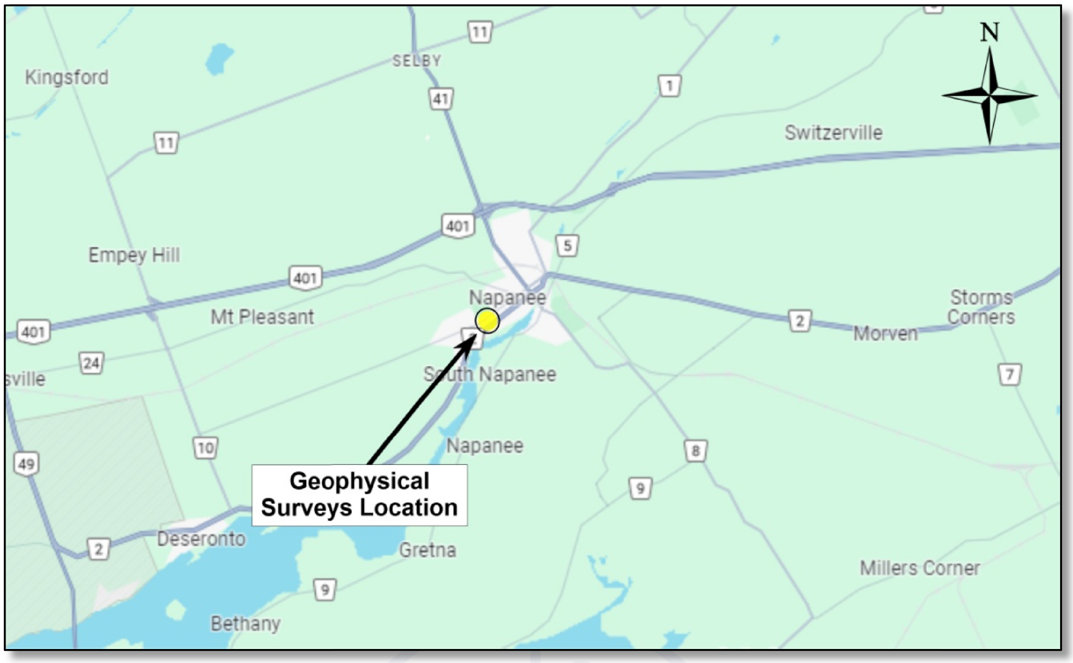


Figure 1 : Regional Location of the Site
(Source : Google Maps)

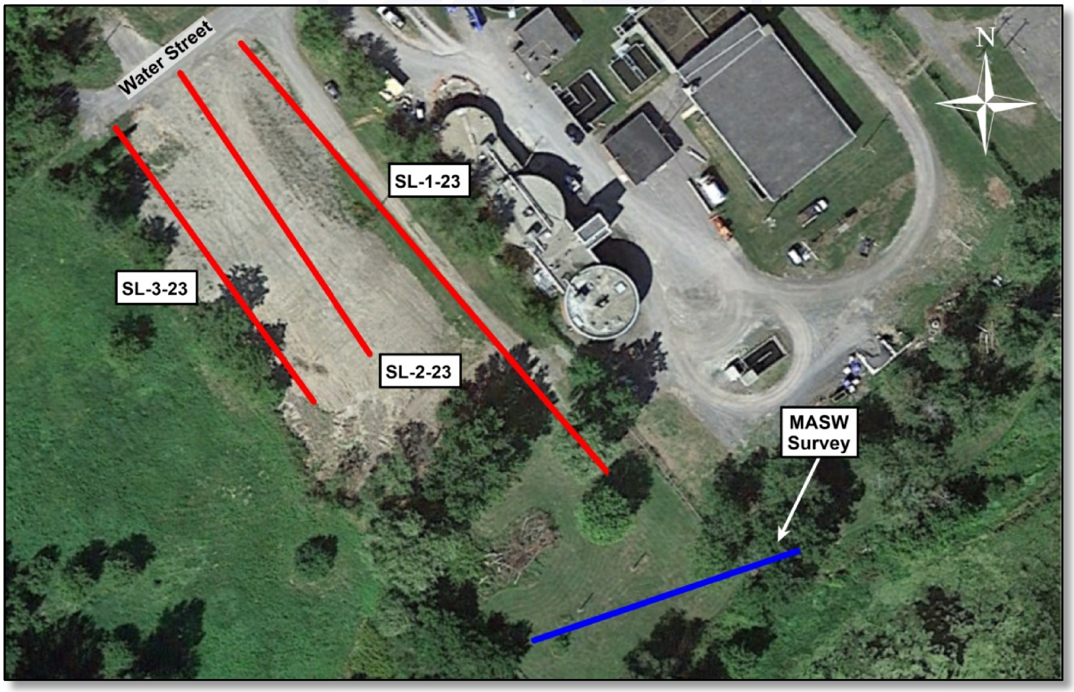


Figure 2 : Location of the Seismic Profiles
(Source : Google Earth™)

Theory

Seismic Refraction Principle

The seismic refraction method consists of recording the propagation velocity of the compressional seismic wave (V_P). Impacts, using a sledgehammer, are generated at various locations along the profile. In particular, impacts are generated on both ends of the seismic array, creating waves that travel in both direction along the profiled section. This allows adequate compensation for (possibly) unknown upward or downward dipping of the different refracted layers. The Hawkins method, also known as "Plus-Minus" method (or "ABC") and a variant of the "Common Reciprocal Method", was used to complete the calculations. Figure 3 illustrates the basic operating principle for a seismic refraction survey.

This method allows for the calculation of the depths and seismic velocities of the various layers, as long as the thicknesses and specific seismic velocities of the layers vary over reasonable horizontal distances. It is the preferred method for relatively simple geological models. In order to identify a layer, however, the seismic wave must be refracted, which means that the seismic refraction method cannot detect velocity inversion or layers of insufficient thickness.

The usual expected accuracy of the calculated depths is ±1 metre within the first 10 metres of depth, and ±10 % for interfaces at more than 10 metres deep.

For a complete description of the method, see *Technical Report E-73-4 Seismic Refraction Exploration for Engineering Site Investigations, B.B. Redpath, NTIS, Explosive Excavation Research Laboratory Livermore, California, 1973.*

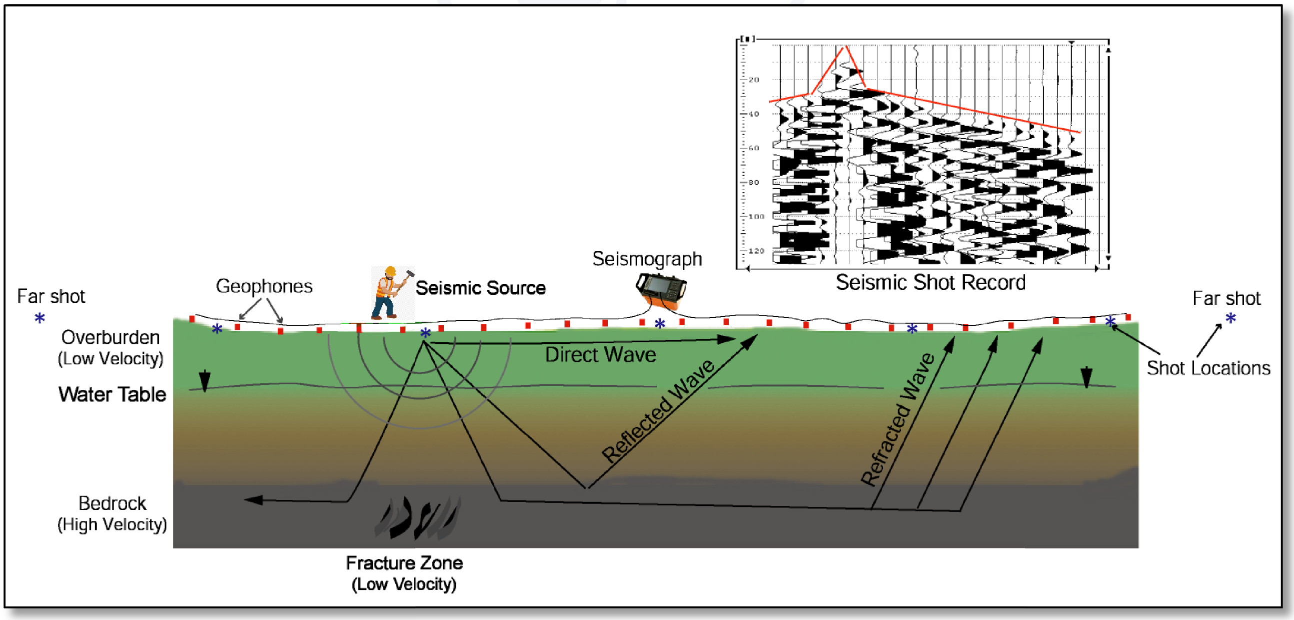


Figure 3: Seismic Refraction Operation Principle

Multi-channel Analysis of Surface Waves (MASW) Principle

The *Multi-channel Analysis of Surface Waves* (MASW) and the *SPatial AutoCorrelation* (SPAC or MAM, for *Microtremors Array Method*) are seismic methods used to evaluate the shear wave velocities of subsurface materials through the analysis of the dispersion properties of the Rayleigh surface wave. The MASW is considered an "active" method, with a seismic signal induced at a known location and time. Conversely, the SPAC is considered a "passive" method, using the low frequency “ambient” vibrations produced by sources away from the seismic array. The later method can also be used with "active" seismic source records. The SPAC method generally allows for deeper Vs soundings. The dispersion curve obtain from the SPAC method can then be merged with the one of higher frequency from the MASW to obtain more complete calculation.

The dispersion properties are expressed as a change of velocities with respect to frequencies. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow, higher frequency waves. The inversion of the Rayleigh wave dispersion curve yields a shear wave velocity (V_S) depth profile (sounding).

The main processing sequence involved data inspection, with data edition when required; spectral analysis ("phase shift" for MASW, and "cross-correlation" for SPAC); “picking” of the fundamental mode; and 1D inversion of the MASW and SPAC shot records using the SeisImagerSW™ software. The data inversions used a nonlinear least squares algorithm.

Figure 4 schematically outlines the basic operating procedure for the MASW method. Figure 5 illustrates an example of a MASW/SPAC records, the corresponding spectrogram analysis and resulting 1D V_S model.

In theory, all the shot records for a given seismic spread should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation, local surface seismic velocities variations, and/or dipping of overburden layers or rock. In general, the precision of the calculated seismic shear wave velocities (V_S) is estimated to be 15% or better.

For a more detailed explanation of the method, see *Shear Wave Velocity Measurement Guidelines for Canadian Seismic Site Characterization in Soil and Rock*, Hunter, J.A., Crow, H.L., et al., Geological Surveys of Canada, General Information Product 110, 2015.

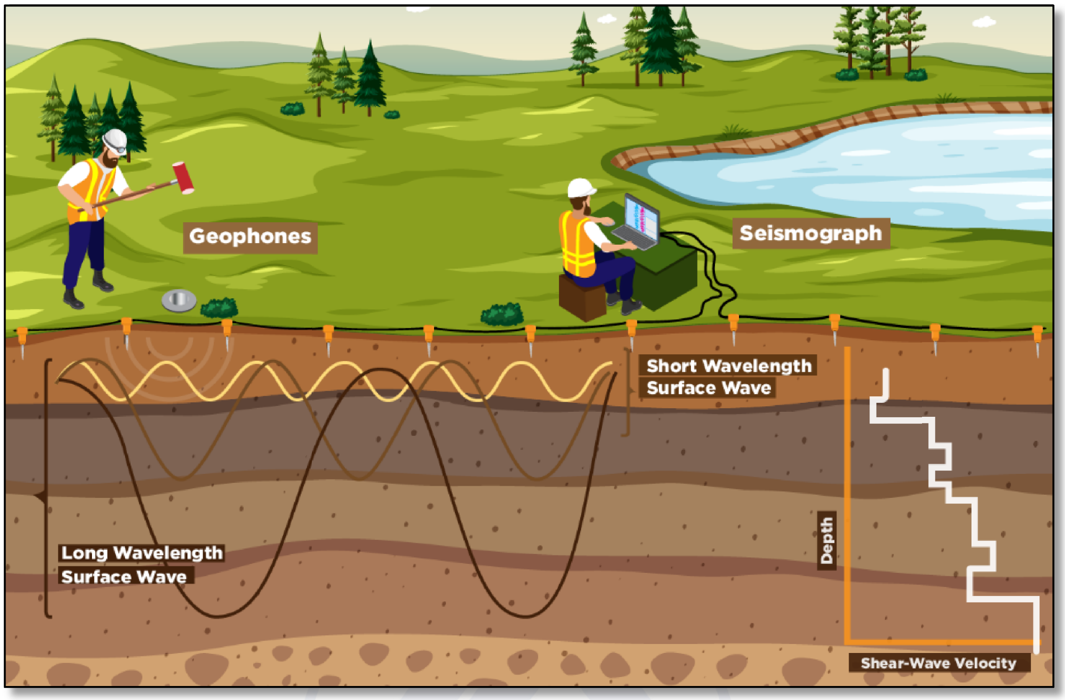


Figure 4: MASW Operating Principle

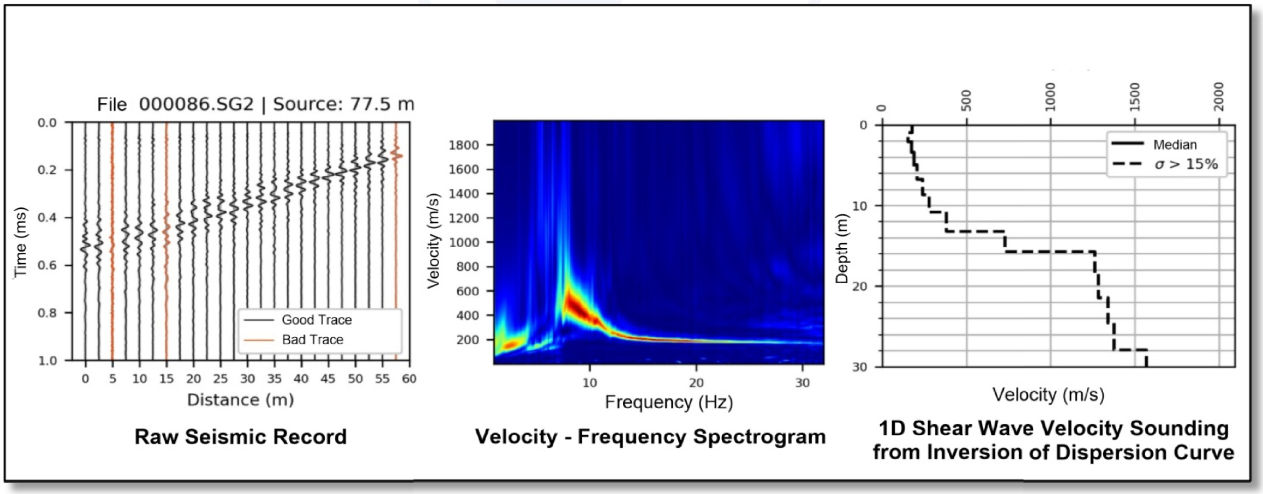


Figure 5: Example of a MASW/SPAC record, Phase Velocity - Frequency curve of the Rayleigh wave and resulting 1D Shear Wave Velocity Model

Survey Design

Four (4) seismic lines were surveyed at 300 Water Street, west of the Town's Water Pollution Control Plant, in Napanee (ON). The seismic acquisition spreads were laid crossing the location of the proposed structures, with a North-South orientation for the seismic refraction surveys and West-East for the MASW (Figure 2). The geophones spacing was 3.0 metres for the refraction and 2.5 metres for the MASW, using 24 geophones per seismic profile. One additional, shorter seismic spread, with geophone spacing of 1.0 metre, was carried out for the MASW survey. The later is used to get a better estimation for the near surface materials.

The first refraction line (SL-1-23) investigated contained two seismic profiles of 69 metres. An overlap of eight geophones between the profiles was used. SL-2-23 and SL-3-23 each contained one profile of 69 meters.

The seismic records were obtained with a seismograph Terraloc Pro (from ABEM Instrument), connected to an array of 24 4.5 Hz geophones. A 9 kg sledgehammer was used as the energy source. The records counted 24 traces of 4096 samples, sampled at 50 µs for the refraction, and at 1000 µs for the MASW. The records also included a pre-trigged portion of 10 ms. An on-site stacking procedure was also used to improve the Signal-over-Noise ratio. For the seismic refraction surveys, seven (7) impacts were produced at pre-determined locations: 2 shots close to the seismic array (hereafter referred to as "Close Shot"), ones off each end; 2 shots further away from the geophone spread (hereafter referred to as "Far Shot"); 1 shot in the center of the spread; and 2 intermediate shots, within the spread, spaced evenly about the center. The impacts were recorded off both ends of the seismic spreads for the MASW survey.

The shear wave depth sounding can be considered as the average of the bulk area within the geophone spread, especially for its central half-length.

Results

Refraction

The seismic refraction results are presented in Appendix I. The results were produced by the Hawkins method, the conventional processing of the seismic refraction data. Results are presented as elevations, which were extracted from the stratigraphic profile A-A of the Thurber reference plan. This reference plan used the geotechnical boreholes elevations. The coordinate system used is in UTM NAD83 zone 18.

The profiles show a black line that represents the ground surface, a pink line that represents the material with a higher seismic velocity, or a saturated material and a red line below that presents the bedrock profile. The velocities of each layer of materials are indicated in green. Compression wave velocities (V_P) are generally representative of the nature of the materials.

The positions of the boreholes within 8 metres of the surveys are shown on the profiles, indicated by a checkered circle above a vertical black line. The black line has a length proportional to the bedrock depth or the end depth of the borehole, based on the data provided by the client. Adjacent to the circle is the name of the borehole and its offset in metres from the seismic spread.

The calculations for the three seismic lines have shown two layers of unconsolidated materials overlying the bedrock. The surface material (300 to 500 m/s) could be associated with loose sand, sand and silt, or unsaturated gravelly silt. That first layer of material sits atop a second saturated or denser layer (1000 to 1500 m/s), located below the pink line, which could correspond to clayey soil, confirmed by the geotechnical information.

The ground surface and rock topography gradient appears in the refraction results. The bedrock topography shows a 6.5 meters drop over a distance of 117 metres; the southern extremity presents the rock of lower elevations.

The bedrock elevation was found to be varying between 67 and 75 meters, corresponding to bedrock depth of approximately 6 to 11 meters from the surface. The depth to bedrock increases (elevation decreases) from chainage 0+030, for SL-1-23 and SL-3-23, and from chainage 0+036, for SL-2-23, towards the southern extremity of the lines, going from about 6 to 7 meters to over 11 meters. The downward slope is accentuated for SL-1-23 between the chainage 0+030 and 0+039.

The investigation wells and seismic results show a good correlation. Over the three seismic lines, the sound bedrock velocities vary from 5 500 m/s to 5 600 m/s. No low seismic velocities zones were calculated in the bedrock.

MASW

The MASW calculated V_S results are presented in Appendix II.

The $\overline{V}_{S30}$ value results from the harmonic mean of the shear wave velocities, from the surface to 30 metres deep. It is calculated by dividing the total depth of interest (30 metres) by the sum of the time spent in each velocity layer from the surface down to 30 metres, as:

$$\bar{V}_{S30} = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} H_i / V_i} \quad | \quad \sum_{i=1}^{N} H_i = 30 \text{ m}$$

(N: number of layers; H_i : thickness of layer "i" ; V_i : V_S of layer "i")

Thus, the $\overline{V}_{S30}$ value represents the seismic shear wave velocity of an equivalent homogeneous single layer response, between the surface and 30 metres deep.

The calculated $\overline{V}_{S30}$ value of the actual site is 418.9 m/s, corresponding to the Site Class "C". Some low seismic velocities were calculated from the surface up to 2.1 metres deep.

CONCLUSION

Geophysics GPR carried out seismic surveys at the Town’s Water Pollution Control Plant, in Napanee (ON). The seismic surveys used the seismic refraction method to profile the rock topography, for the footprint of the proposed structures, and the MASW methods to identify the Site Class. The seismic refraction results are presented in Appendix I as for the MASW calculated V_S results; they are presented in Appendix II.

Three (3) seismic refraction lines were surveyed N-S, crossing the location of the proposed new structures, located west of the Town’s Water Pollution Control Plant. One (1) seismic line was investigated for the MASW survey, at the southern extremity of the lot. The surveys were carried out on November 2nd, 2023.

The calculations for the three seismic refraction lines resulted in the identification of two layers of unconsolidated materials overlying the bedrock. The ground surface and rock topography gradient appears in the refraction results. The bedrock topography shows a 6.5 metres drop over a distance of 117 metres. The depth of the bedrock was calculated at around 6 to 7 metres for the north extremity and at 9 to 11 metres for the south end. This downward slope is accentuated between chainage 0+030 and 0+039 for SL-1-23.

The $\overline{V}_{S30}$ value of the actual site is 419 m/s, corresponding to the Site Class "C" (360 < $\overline{V}_{S30}$ ≤ 760 m/s), as determined through the MASW and SPAC methods, Table 4.1.8.4.-A of the NBC (2015), and the Building Code, O. Reg. 332/12.

Some low seismic velocities were calculated from the surface up to 2.1 metres deep. A geotechnical assessment of the corresponding materials could be required for the potential of liquefaction, the degree of clays sensitivity, and other critical parameters.

It must be noted that other geotechnical information gleaned on site; including the presence of liquefiable soils, very soft clays, high moisture content etc. (cf. Table 4.1.8.4.-A of the NBC 2015) can supersede the Site classification provided in this report based on the $\overline{V}_{S30}$ value.

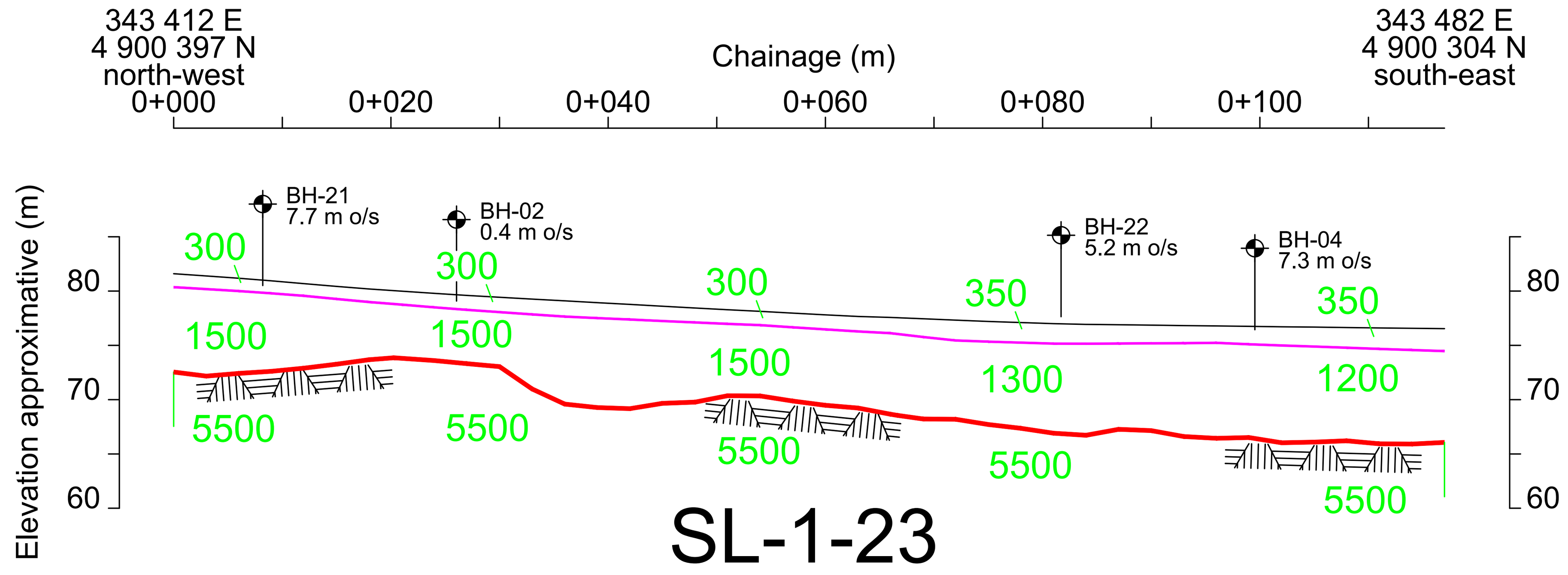
The V_S values calculated are representative of the in situ materials and are not corrected for the total and effective stresses.

With hope that the findings in this report have met your satisfaction, we extend our most distinguished regards.

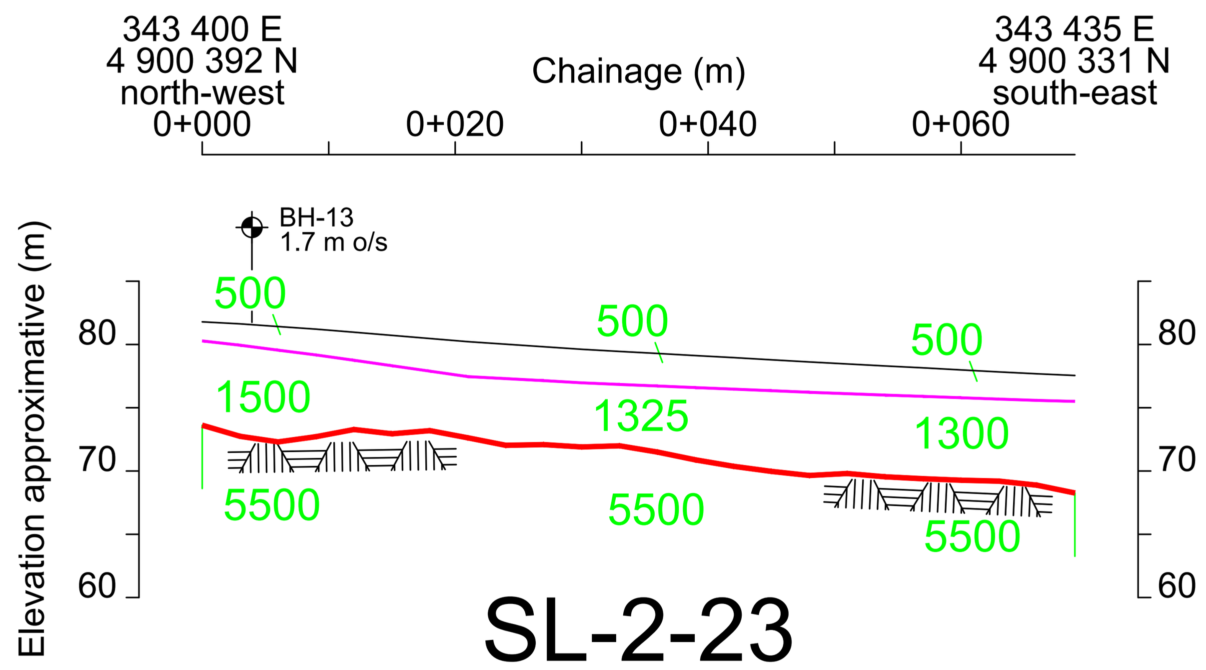
Karyne Faguy

Karyne Faguy, Geoph. .
Project Manager

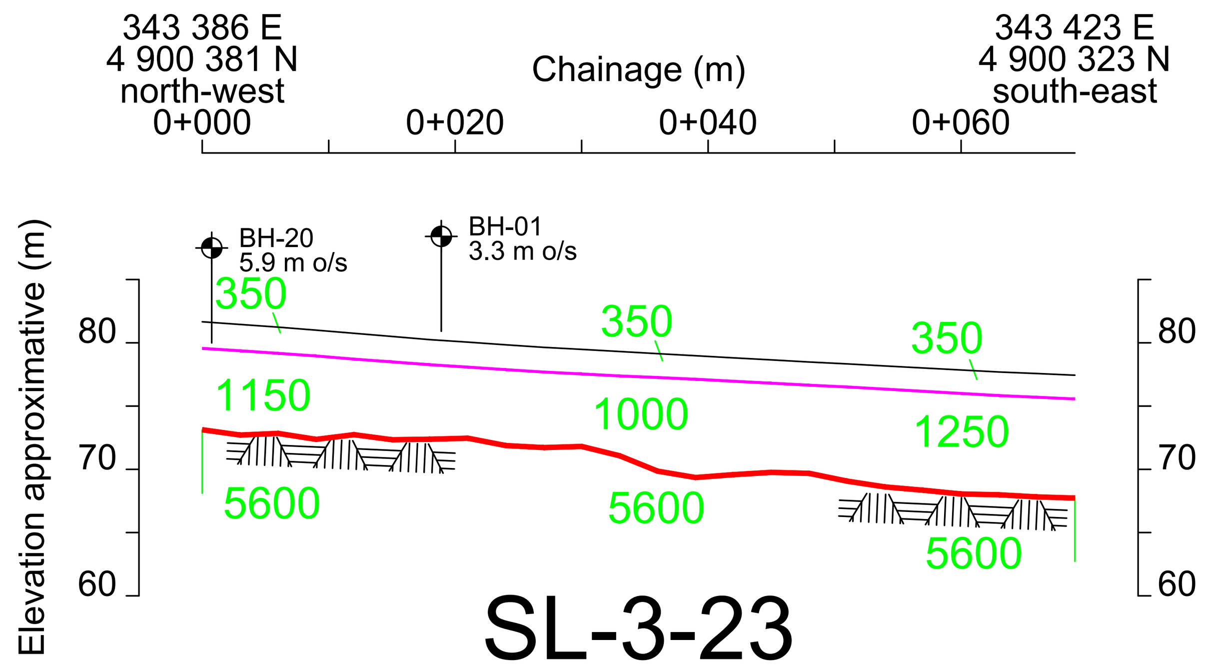
Appendix I
Seismic Refraction



SL-1-23

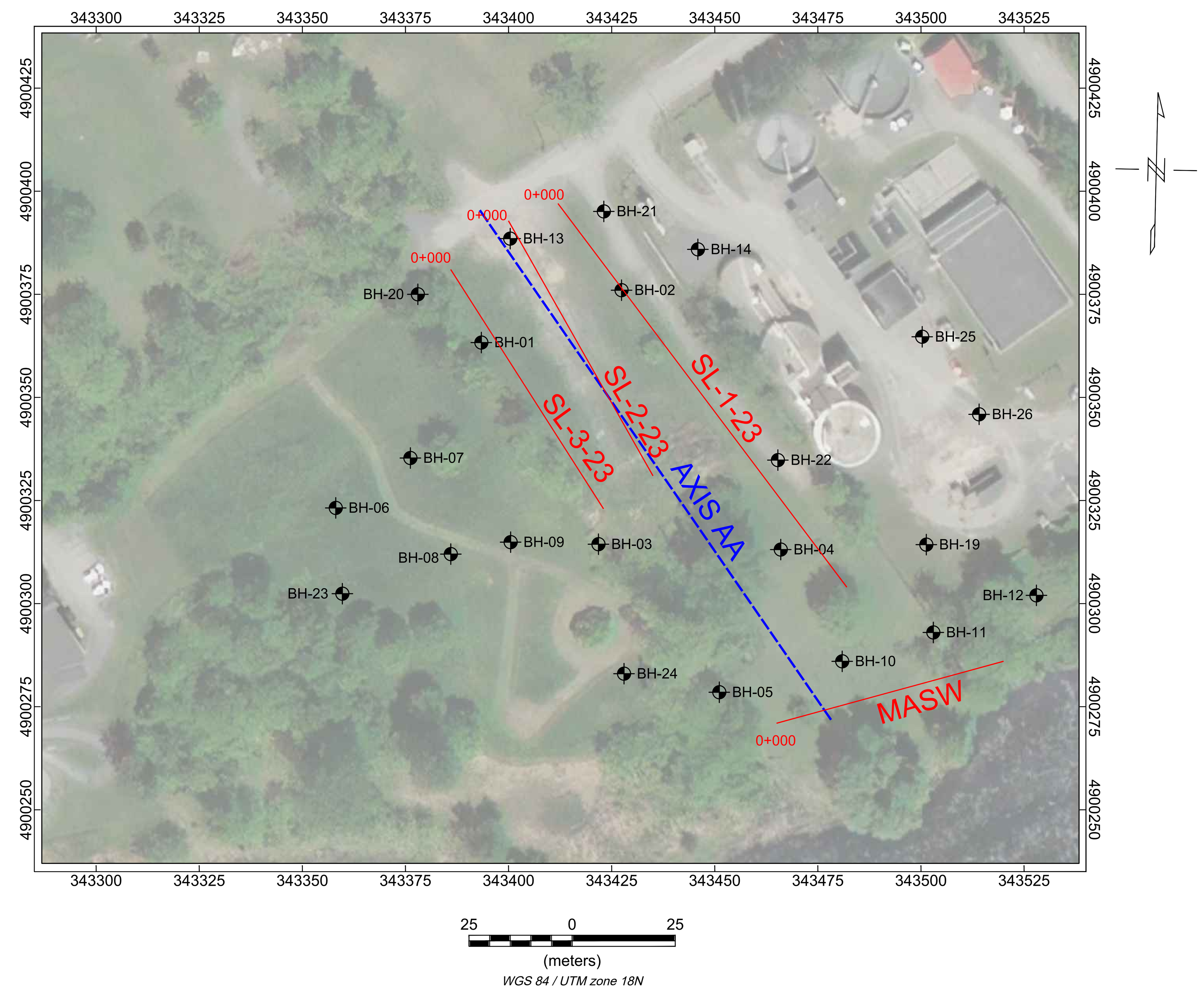


SL-2-23



SL-3-23

LOCATION PLAN



LEGEND

- TOPOGRAPHIC PROFILE
- 5050 VELOCITY SEISMICS m/s
- REFRACTOR PROFILE
- BEDROCK PROFILE
- BOREHOLE

NO VALID FOR CONSTRUCTION

No.	NOTES
1	THE SEISMIC SURVEY WAS EXECUTED BY GEOPHYSICS GPR INTERNATIONAL INC. ON NOVEMBER 2nd, 2023.
2	THE COORDINATE SYSTEM IS IN UTM NAD83 ZONE 18.
3	THE TOPOGRAPHIC PROFILE OF THE SEISMIC LINES IS A PROJECTION OF THE STRATIGRAPHIC PROFILE A-A OF THE THURBER REFERENCE DRAWING.
4	REFER TO THE REPORT GPR23-05012 (NOVEMBER 2023) BY GEOPHYSICS GPR FOR A DETAILED DESCRIPTION OF METHODOLOGY, LIMITATIONS AND ACCURACY.

No	DESSINS DE REFERENCE DRAWINGS
1	IMAGE GOOGLE
2	THURBER ENGINEERING LTD, drawing no.: 30726-1.

No	DATE	MODIFICATIONS	GPR APP.

SCEAU PROFESSIONNEL

PROFESSIONAL SEAL

GEOPHYSICS GPR INTERNATIONAL INC.

DESSINÉ PAR DRAWN BY	A. Beaudoin, tech.		
VERIFIÉ PAR CHECKED BY	K. Faguy, B. Sc.		
APPROUVÉ PAR APPROVED BY	C. Trottier, M. Sc.		
# CONTRAT CONTRACT #	GPR23-05012	DATE	November 2023
ÉCHELLE SCALE	1 : 500	# DESSIN DRAWING #	23-11-541-00

CLIENT CLIENT
THURBER ENGINEERING LTD

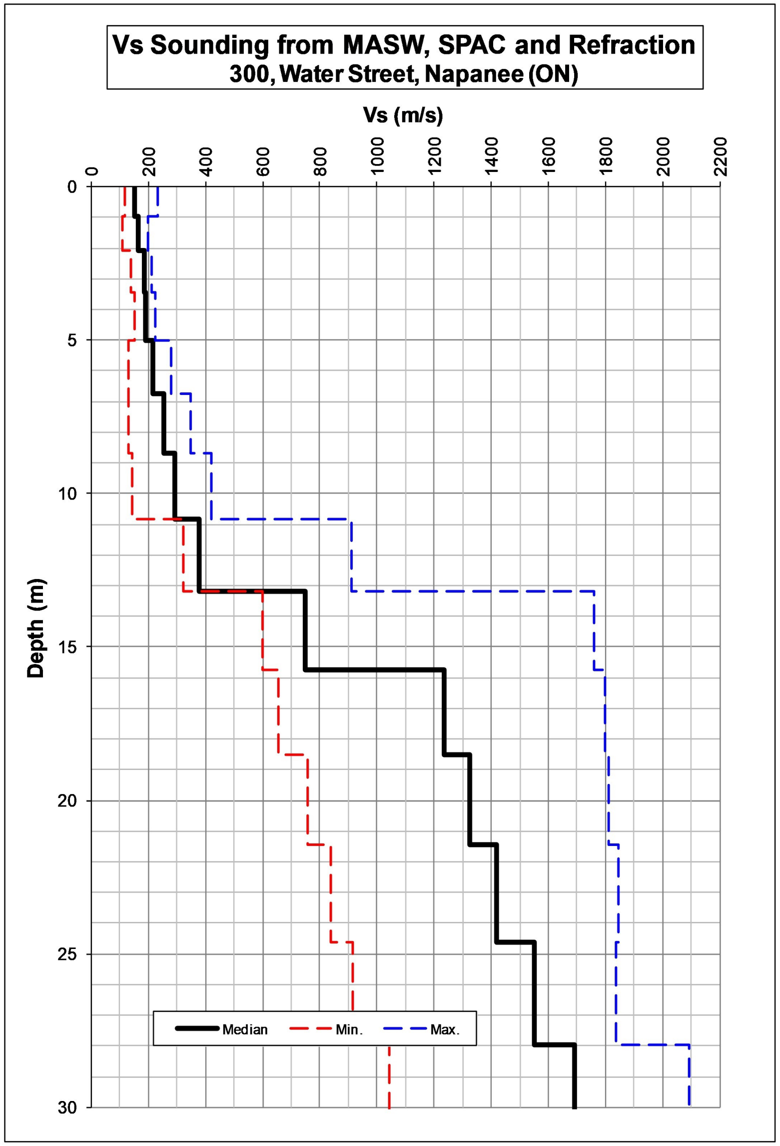
PROJET PROJECT
NAPANEE WATER POLLUTION CONTROL PLANT

TITRE TITLE
SEISMICS REFRACTION SURVEYS
SL-1-23 TO SL-3-23

Appendix II

Multi-channel Analysis of Surface Waves («MASW»)

Multi-channel Analysis of Surface Waves (MASW)



Depth	Vs			Thickness	Cumulative Thickness	Delay for med. Vs	Cumulative Delay	Vs at given Depth
	Min.	Median	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(s)	(m/s)
0	**118.8**	**150.1**	231.0	Grade Level (November 2nd, 2023)				
0.95	**110.2**	**165.6**	199.6	0.95	0.95	0.006329	0.006329	150.1
2.10	**138.2**	184.9	211.0	1.15	2.10	0.006944	0.013273	158.2
3.45	**151.6**	188.4	225.2	1.35	3.45	0.007302	0.020576	167.7
5.00	**130.6**	215.3	281.5	1.55	5.00	0.008228	0.028804	173.6
6.75	**129.7**	254.0	349.5	1.75	6.75	0.008127	0.036931	182.8
8.70	**141.7**	292.2	419.1	1.95	8.70	0.007678	0.044608	195.0
10.85	321.6	379.6	909.5	2.15	10.85	0.007357	0.051966	208.8
13.20	600.0	747.3	1758.6	2.35	13.20	0.006191	0.058157	227.0
15.75	653.9	1236.1	1800.0	2.55	15.75	0.003412	0.061569	255.8
18.50	756.7	1322.8	1810.1	2.75	18.50	0.002225	0.063794	290.0
21.45	837.5	1419.6	1843.2	2.95	21.45	0.002230	0.066024	324.9
24.60	916.9	1550.6	1837.9	3.15	24.60	0.002219	0.068243	360.5
27.95	1042.8	1692.8	2093.3	3.35	27.95	0.002160	0.070403	397.0
30				2.05	30.00	0.001211	0.071614	418.9

V_{S30} (m/s)	**418.9**
Site Class	**C**

**Some low seismic velocities were calculated from the surface up to 2.1 metres deep.*

A geotechnical assessment of the corresponding materials could be required for the potential of liquefaction, the degree of clays sensitivity, and other critical parameters.

Title: MASW - Napanee		
Client: Thurber Engineering Ltd.		
Survey Site : 300 Water Street, Napanee (ON)		
Draw : Karyne Faguy, Geoph.		App. : Charles Trottier, M.Sc. Phys.
GEOPHYSIQUE GPR INTERNATIONAL INC	Date : Nov. 2nd, 2023	Sketch :
	Our reference : GPR23-05012	

THURBER ENGINEERING LTD.

APPENDIX J

Conetec Report

PRESENTATION OF SITE INVESTIGATION RESULTS

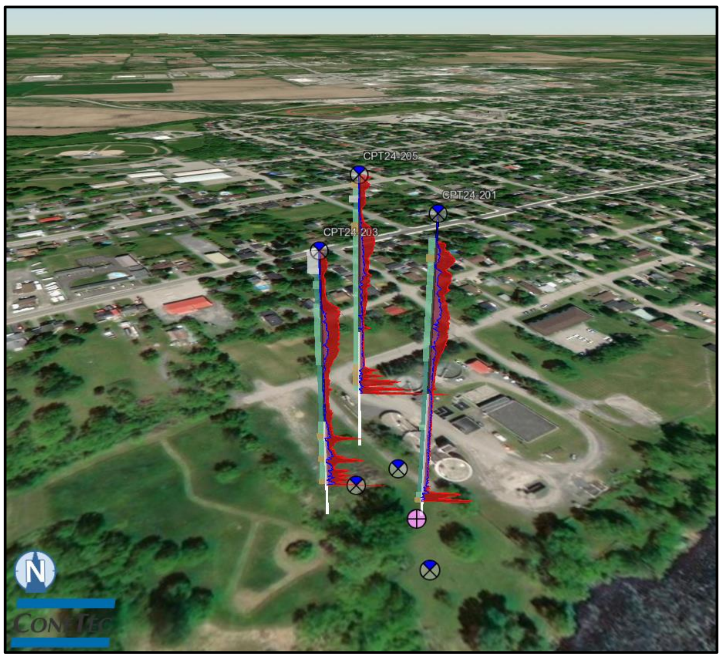
Napanee WPCP

Prepared for:

Thurber Engineering Ltd.

ConeTec Job No: 24-05-27250

Project Start Date: 2024-02-21
Project End Date: 2024-02-22
Report Date: 2024-02-28



Prepared by:

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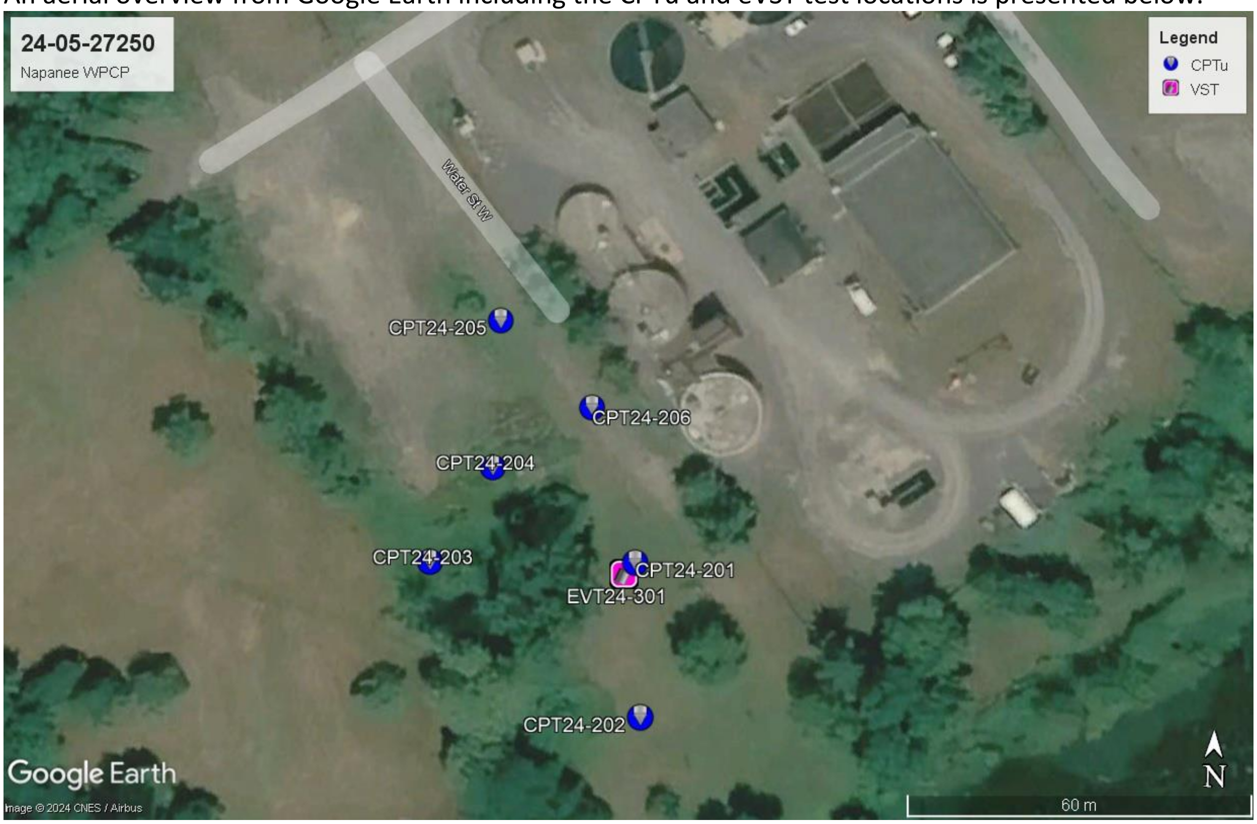
Introduction

The enclosed report presents the results of the site investigation program conducted by ConeTec Investigations Ltd. for Thurber Engineering Ltd. at Greater Napanee Water Pollution Control Plant (WPCP) in Ontario. The program consisted of six cone penetration tests (CPTu) and one electric vane shear test (eVST) location. Please note that this report, which also includes all accompanying data, are subject to the 3rd Party Disclaimer and Client Disclaimer that follow in the 'Limitations' section of this report.

Project Information

Project	
Client	Thurber Engineering Ltd.
Project	Napanee WPCP
ConeTec project number	24-05-27250

An aerial overview from Google Earth including the CPTu and eVST test locations is presented below.



Rig Description	Deployment System	Test Type
Track mounted drill rig (GT8)	Drill head	CPTu, eVST

Coordinates		
Test Type	Collection Method	EPSG Number
CPTu, eVST	Consumer grade GPS	32618

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (bar)
684:T1000F10U35	684	10	150	1000	10	35
Cone 684 was used for all CPTu soundings.						

Cone Penetration Test (CPTu)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Additional plots	• Advanced plots • Soil Behaviour Type (SBT) scatter plots

Calculated Geotechnical Parameter Tables	
Additional information	The Normalized Soil Behaviour Type Chart based on Q_{tn} (SBT Q_{tn}) (Robertson, 2009) was used to classify the soil for this project. A detailed set of calculated CPTu parameters have been generated and are provided in Excel format files in the release folder. The CPTu parameter calculations are based on values of corrected tip resistance (q_t) sleeve friction (f_s) and pore pressure (u_2). Effective stresses are calculated based on unit weights that have been assigned to the individual soil behaviour type zones and the assumed equilibrium pore pressure profile. Soils were classified as either drained or undrained based on the Q_{tn} Normalized Soil Behaviour Type Chart (Robertson, 2009). Calculations for both drained and undrained parameters were included for materials that classified as silt mixtures (zone 4) and as sand mixtures – silty sand to sandy silt (zone 5).

Electric Field Vane Shear Test (eVST)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Load cell capacity	100 N·m
Load cell location	Surface
Additional comments	Peak undrained shear strength values (S_u) are over-plotted on the CPTu S_u profile for comparison.

Limitations

3rd Party Disclaimer

This report titled "Napanee WPCP", referred to as the ("Report"), was prepared by ConeTec for Thurber Engineering Ltd. The Report is confidential and may not be distributed to or relied upon by any third parties without the express written consent of ConeTec. Any third parties gaining access to the Report do not acquire any rights as a result of such access. Any use which a third party makes of the Report, or any reliance on or decisions made based on it, are the responsibility of such third parties. ConeTec accepts no responsibility for loss, damage and/or expense, if any, suffered by any third parties as a result of decisions made, or actions taken or not taken, which are in any way based on, or related to, the Report or any portion(s) thereof.

Client Disclaimer

ConeTec was retained by Thurber Engineering Ltd. to collect and provide the raw data ("Data") which is included in this report titled "Napanee WPCP", which is referred to as the ("Report"). ConeTec has collected and reported the Data in accordance with current industry standards. No other warranty, express or implied, with respect to the Data is made by ConeTec. In order to properly understand the Data included in the Report, reference must be made to the documents accompanying and other sources referenced in the Report in their entirety. Any analysis, interpretation, judgment, calculations and/or geotechnical parameters (collectively "Interpretations") included in the Report, including those based on the Data, are outside the scope of ConeTec's retainer and are included in the Report as a courtesy only. Other than the Data, the contents of the Report (including any Interpretations) should not be relied upon in any fashion without independent verification and ConeTec is in no way responsible for any loss, damage or expense resulting from the use of, and/or reliance on, such material by any party.

Cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd., a subsidiary of ConeTec.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and two geophone sensors for recording seismic signals. All signals are amplified and measured with minimum sixteen-bit resolution down hole within the cone body, and the signals are sent to the surface using a high bandwidth, error corrected digital interface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 millimeters diameter over a length of 32 millimeters with tapered leading and trailing edges) located at a distance of 585 millimeters above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is six millimeters thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meets or exceeds those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

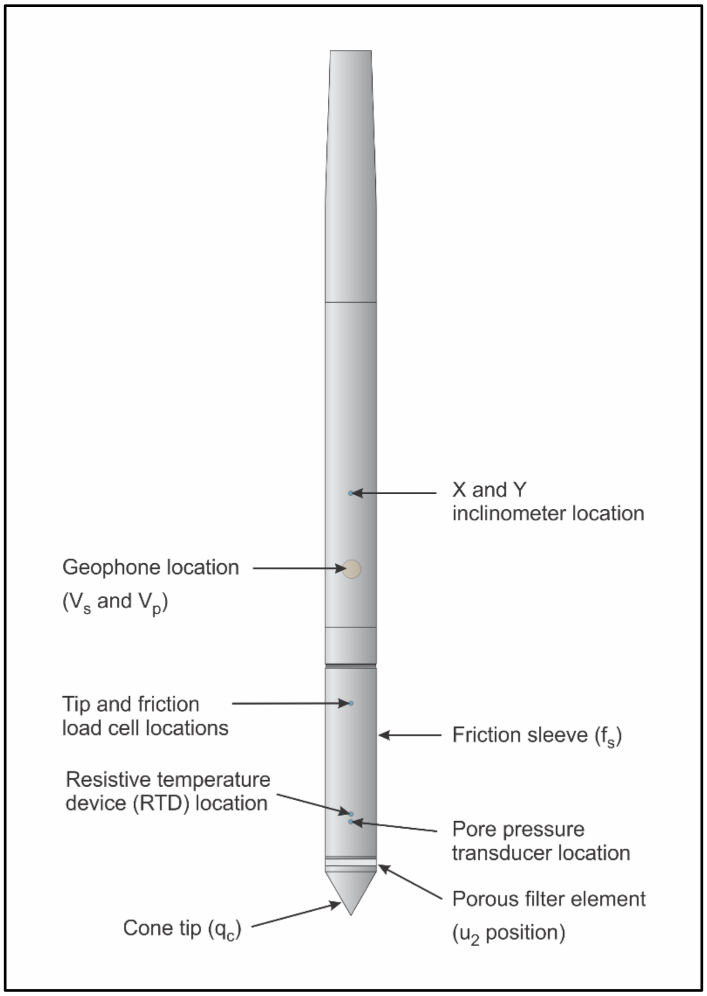


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal interface box and power supply. The signal interface combines depth increment signals, seismic trigger signals and the downhole digital data. This combined data is then sent to the Windows based computer for collection and presentation. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording interval is 2.5 centimeters; custom recording intervals are possible.

The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPTu operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of two centimeters per second, within acceptable tolerances. Typically one meter length rods with an outer diameter of 38.1 millimeters are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil under vacuum pressure prior to use
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson et al. (1986) and Robertson (1990, 2009). It should be noted that it is not always possible to accurately identify a soil behaviour type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behaviour type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al. (1986):

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of files with calculated geotechnical parameters were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the methods used is also included in the data release folder.

For additional information on CPTu interpretations and calculated geotechnical parameters, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

References

ASTM D5778-20, 2020, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-20.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

Mayne, P.W., 2013, “Evaluating yield stress of soils from laboratory consolidation and in-situ cone penetration tests”, Sound Geotechnical Research to Practice (Holtz Volume) GSP 230, ASCE, Reston/VA: 406-420. DOI: 10.1061/9780784412770.027.

Mayne, P.W. and Peuchen, J., 2012, “Unit weight trends with cone resistance in soft to firm clays”, Geotechnical and Geophysical Site Characterization *4,* Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

Mayne, P.W., 2014, “Interpretation of geotechnical parameters from seismic piezocone tests”, CPT’14 Keynote Address, Las Vegas, NV, May 2014.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158. DOI: 10.1139/T90-014.

Robertson, P.K., 2009, “Interpretation of cone penetration tests – a unified approach”, Canadian Geotechnical Journal, Volume 46: 1337-1355. DOI: 10.1139/T09-065.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

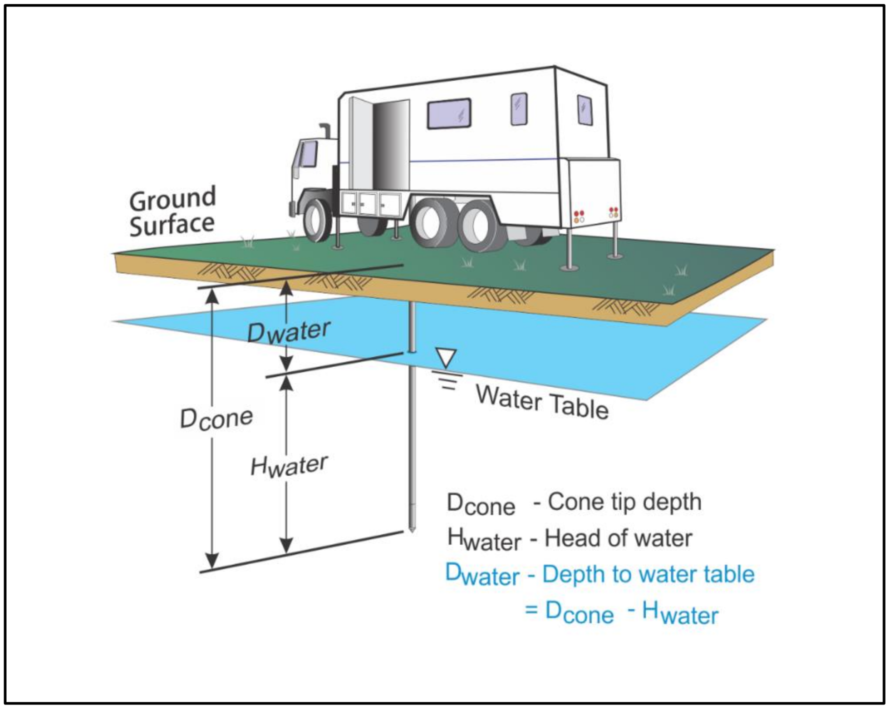


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behaviour.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

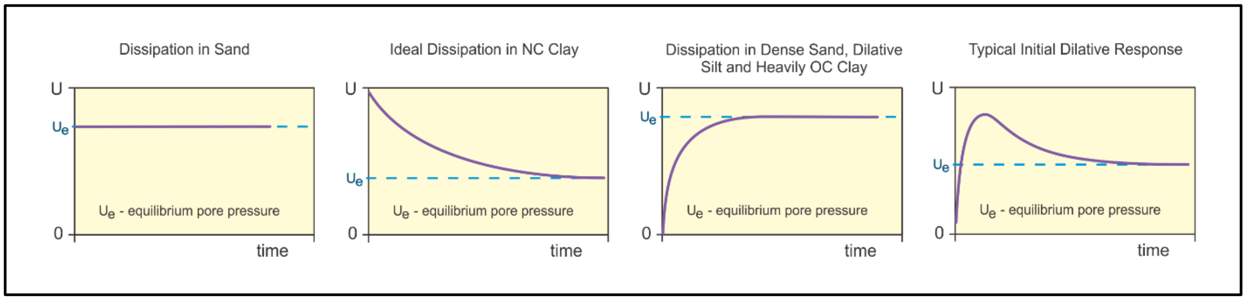


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve in Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby, 1991 showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

References

Teh, C.I., and Houlsby, G.T., 1991, “An analytical study of the cone penetration test in clay”, Geotechnique, 41(1): 17-34. DOI: 10.1680/geot.1991.41.1.17.

The electric field vane system is manufactured by Adara Systems Ltd., a subsidiary of ConeTec. An illustration of the uphole vane system configuration is presented in Figure eVST.

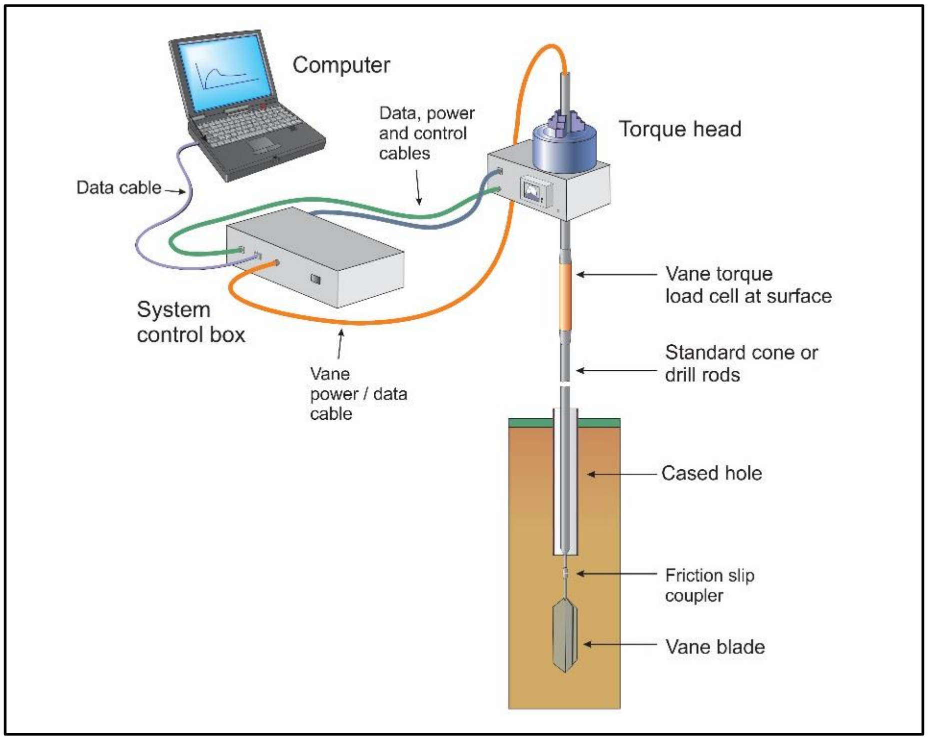


Figure eVST. Illustration of the uphole electric field vane system configuration

The vane system is designed with an array of strain gauges in a load cell that measure the applied torque. The torque signal is amplified and converted to digital data within the tool and transmitted to the data acquisition system through a shielded cable. The system uses a friction slip coupler to permit the free slip or play of approximately fifteen degrees between the rods and the vane blade in order to isolate and record rod friction from the soil before rotation of the vane blade starts. The system is designed to use vane blades of various sizes and configurations that connect to the friction slip coupler. The vane blades manufactured by Adara have dimensions and tolerances that are in general accordance with the current ASTM D2573 standards. In very soft soil conditions and at the request of the client, ConeTec may use a large diameter vane blade that exceeds the ASTM D2573 maximum size specifications in order to maximize torque resolution. In very stiff soil conditions and at the request of the client, ConeTec may use a smaller diameter vane blade than the minimum size specified in ASTM D2573 in order to obtain a peak torque below the capacity of the load cell.

The electric motor (capable of 100 Newton-meters of torque) is designed to clamp onto and rotate the rods and vane blade at a constant rate.

ConeTec's calibration criteria of the load cells are in accordance with the current ASTM D2573 standard.

The data acquisition system consists of a computer that records the vane data every 0.2 degrees of rotation. The system records the following parameters and saves them to a file as the test is conducted:

- Torque in Newton-meters
- Rotation in degrees
- Elapsed time in seconds (from the start of the test)

All testing is performed in accordance to ConeTec's field vane testing operating procedures and in general accordance with the current ASTM D2573 standard. For additional information on vane shear testing refer to Greig et al. (1987).

Prior to the start of a vane shear test profile, a suitable sized vane blade is selected, the vane system is powered on and the vane load cell baseline reading is recorded with the load cell hanging freely in a vertical position.

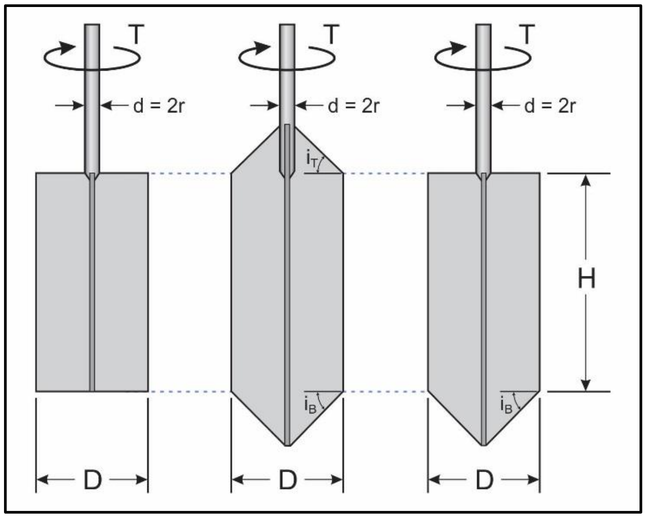
The vane blade, slip coupler and rods are advanced to the desired test depth through a cased hole, typically using AWJ drill rods or one-meter length rods with an outer diameter of 1.5 inches (38.1 millimeters). Test depths are referenced to the middle of the rectangular portion of the vane blade. The motor rotates the rods at a near constant rate up to and beyond the yield stress (peak) until the load remains near constant (post peak). Following post peak readings, the vane blade is then rapidly rotated clockwise ten times to completely remold the soil. The test procedure is repeated in order to record the remolded strength of the soil. The vane blade is then advanced to the next depth and the procedure is repeated or the vane blade is retracted to allow for drilling and vane blade size changes. Once the vane profile is complete, the final baseline of the load cell is recorded and compared to previous reading as a QA/QC check.

Undrained shear strength from the field vane, $(S_u)_{fv}$, is calculated from torque measurements using the following general equation (ASTM D2573) taking into consideration the case of rectangular or tapered ends at the top and/or bottom of the vane blade.

$$(S_u)_{fv} = \frac{12 \cdot T_{max}}{\pi D^2 \left(\frac{D}{\cos(i_T)} + \frac{D}{\cos(i_B)} + 6H \right)}$$

where:

$(S_u)_{fv}$	=	undrained shear strength from the field vane
T_{max}	=	maximum value of torque
D	=	vane diameter
H	=	height of the rectangular portion of the vane
i_T	=	angle of taper at vane top (with respect to horizontal)
i_B	=	angle of taper at vane bottom (with respect to horizontal)



For rectangular vane blades where H/D = 2, the above equation simplifies to:

$$(S_u)_{fv} = \frac{6 \cdot T_{max}}{7\pi D^3}$$

The recorded rod friction is subtracted from the peak and remolded torque. No correction factors are applied to the vane results to derive the mobilized shear strength ($\tau_{mobilized}$).

A summary of the vane shear tests, a table of results and individual VST plots are provided in the relevant appendices. Tabular data in Excel format is provided in the data release folder.

References

ASTM D2573 / D2573M-18, 2018, "Standard Test Method for Field Vane Shear Test in Saturated Fine-Grained Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D2573_D2573M-18.

Greig, J.W., R.G. Campanella and P.K. Robertson, 1987, "Comparison of Field Vane Results With Other In-Situ Test Results", International Symposium on Laboratory and Field Vane Shear Strength Testing, ASTM, Tampa, FL, Proceedings.

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots
- Soil Behaviour Type (SBT) Scatter Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots
- Electric Field Vane Shear Test Profile Summary and Results
- Electric Field Vane Shear Test Plots
- Description of Methods for Calculated CPT Geotechnical Parameters

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

	Job No:	24-05-27250
	Client:	Thurber Engineering Ltd.
	Project:	Napanee WPCP
	Start Date:	2024-02-21
	End Date:	2024-02-22

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Cone Area (cm^2)	Assumed Phreatic Surface[1] (m)	Final Depth (m)	Northing[2] (m)	Easting[2] (m)	Refer to Notation Number
CPT24-201	24-05-27250_CP201	2024-02-21	684:T1000F10U35	10	1.9	8.750	4900313	343466	
CPT24-202	24-05-27250_CP202	2024-02-22	684:T1000F10U35	10	1.9	10.825	4900286	343467	
CPT24-203	24-05-27250_CP203	2024-02-22	684:T1000F10U35	10	0.2	7.225	4900313	343429	
CPT24-204	24-05-27250_CP204	2024-02-22	684:T1000F10U35	10	1.3	7.925	4900330	343440	
CPT24-205	24-05-27250_CP205	2024-02-22	684:T1000F10U35	10	0.2	7.300	4900357	343441	
CPT24-206	24-05-27250_CP206	2024-02-22	684:T1000F10U35	10	1.2	8.575	4900341	343458	

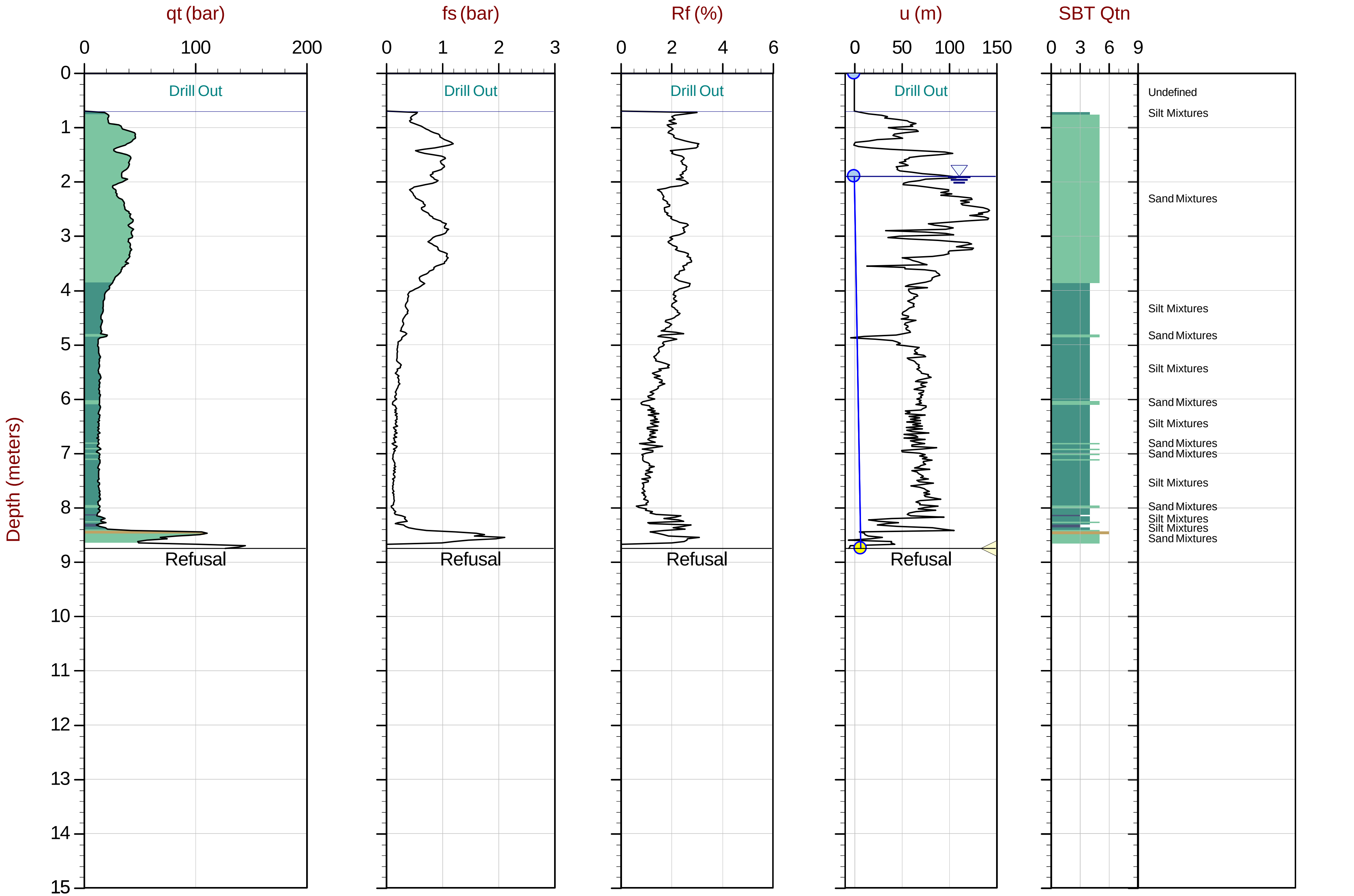
1. The assumed phreatic surface was based on pore pressure dissipation tests. Hydrostatic conditions were assumed for the calculated parameters.
2. Coordinates were collected with a consumer grade GPS device with datum WGS84/UTM Zone 18 North.

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-21 16:12
Site: Napanee WPCP

Sounding: CPT24-201
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 8.750 m / 28.71 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP201.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900313m E: 343466m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

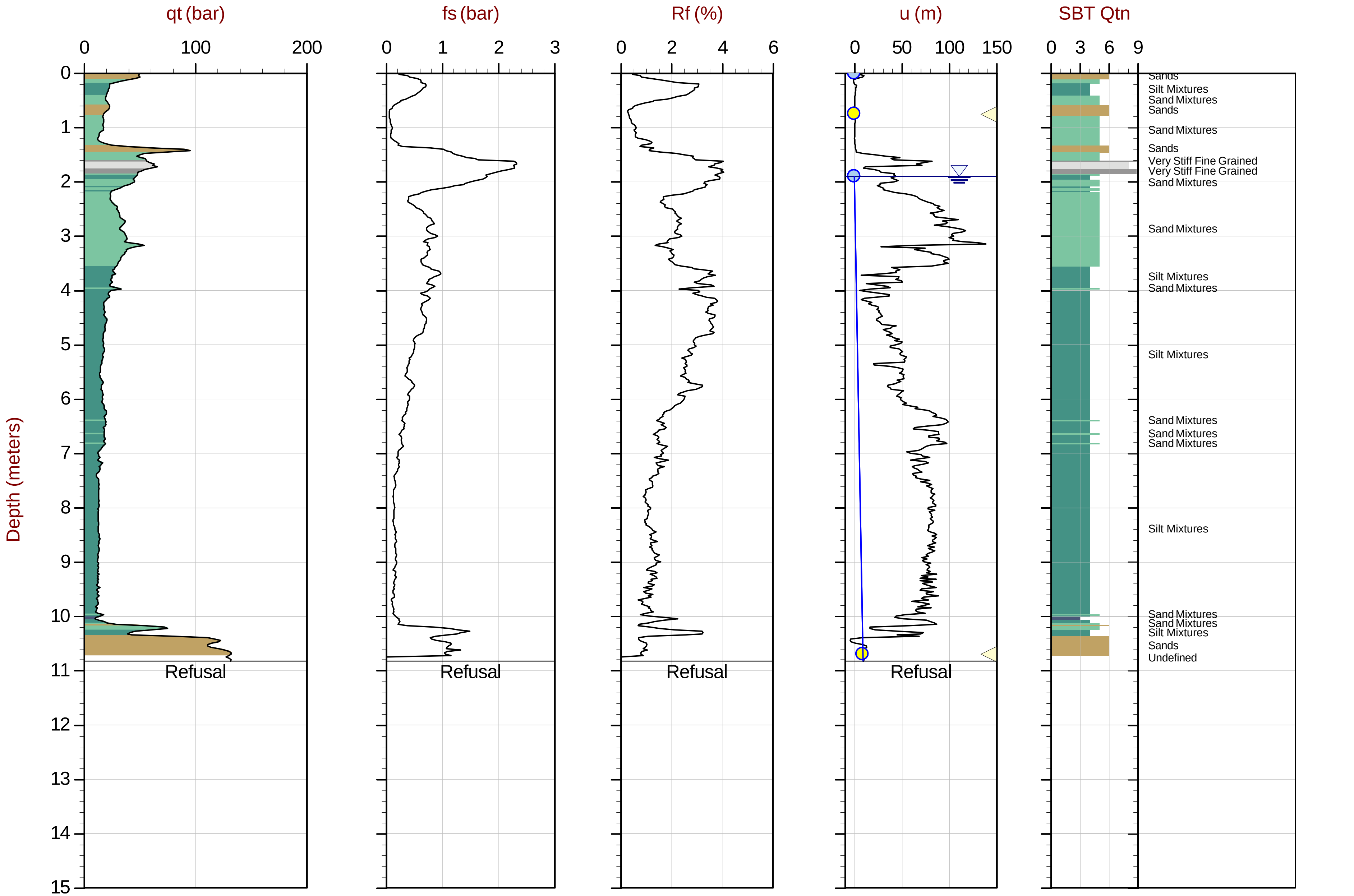
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Thurber

Job No: 24-05-27250
Date: 2024-02-22 08:08
Site: Napanee WPCP

Sounding: CPT24-202
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 10.825 m / 35.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP202.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900286m E: 343467m
Sheet No: 1 of 1

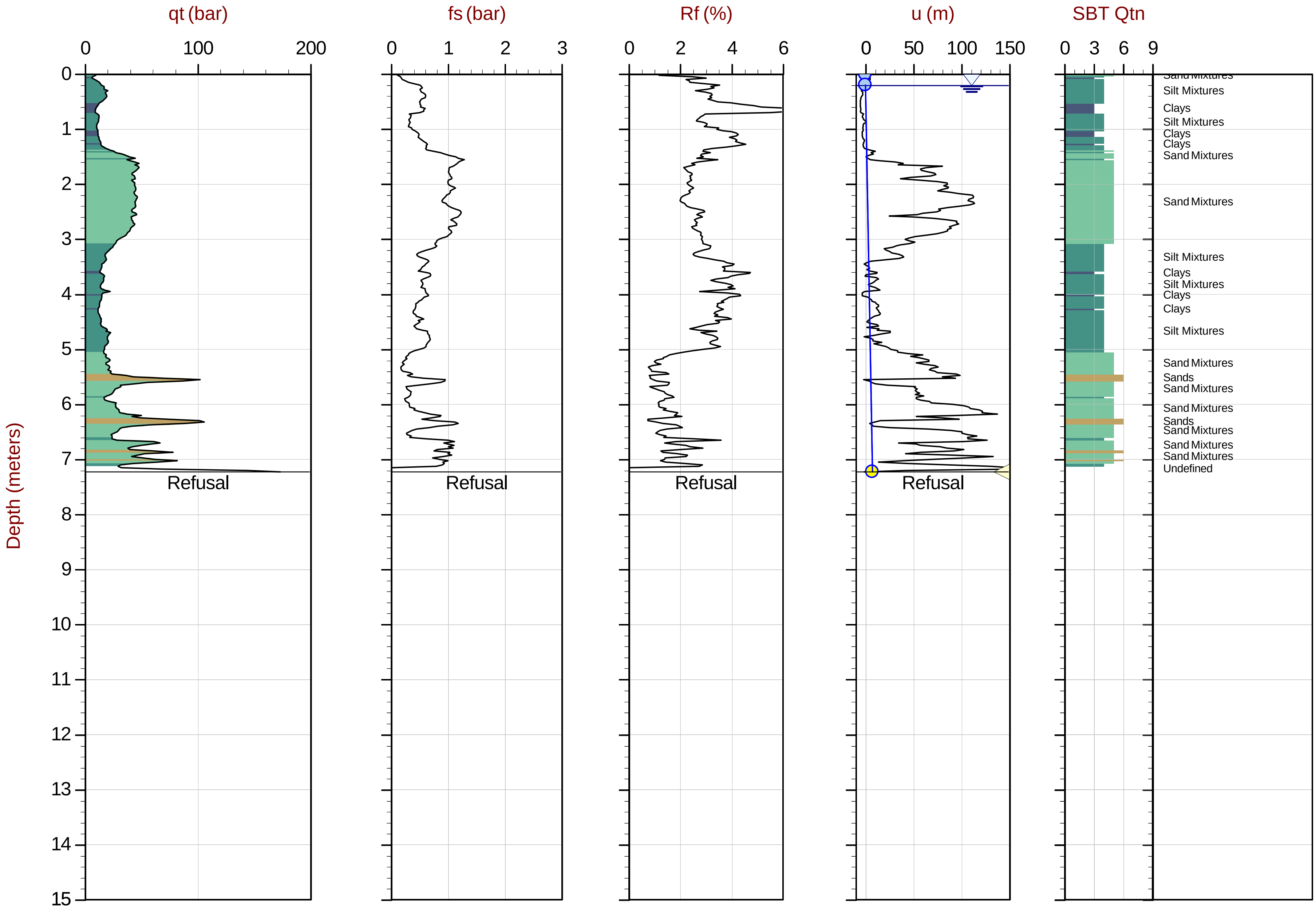
Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Thurber

Job No: 24-05-27250
Date: 2024-02-22 10:21
Site: Napanee WPCP

Sounding: CPT24-203
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 7.225 m / 23.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP203.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900313m E: 343429m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

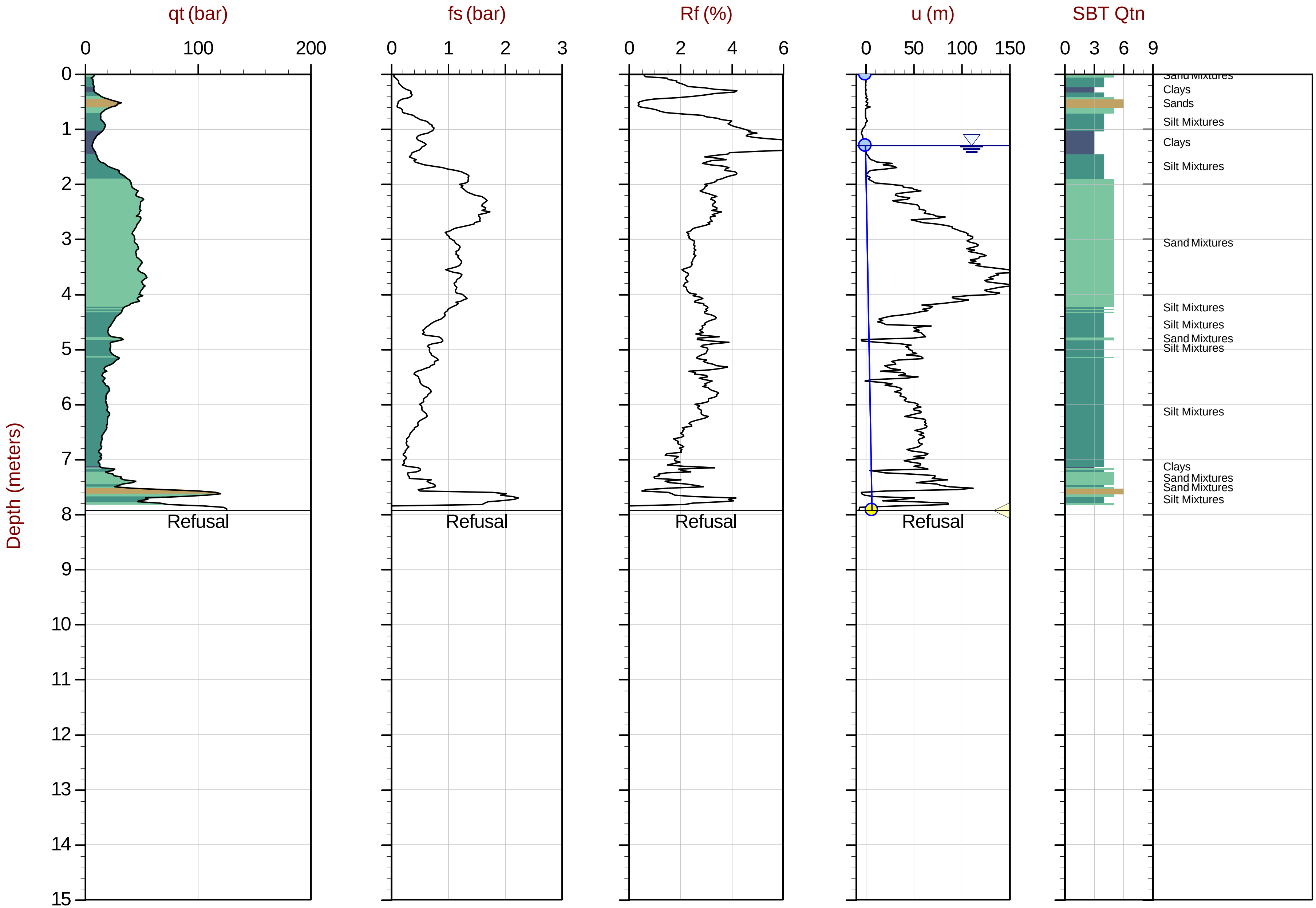
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Thurber

Job No: 24-05-27250
Date: 2024-02-22 09:01
Site: Napanee WPCP

Sounding: CPT24-204
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 7.925 m / 26.00 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP204.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900330m E: 343440m
Sheet No: 1 of 1

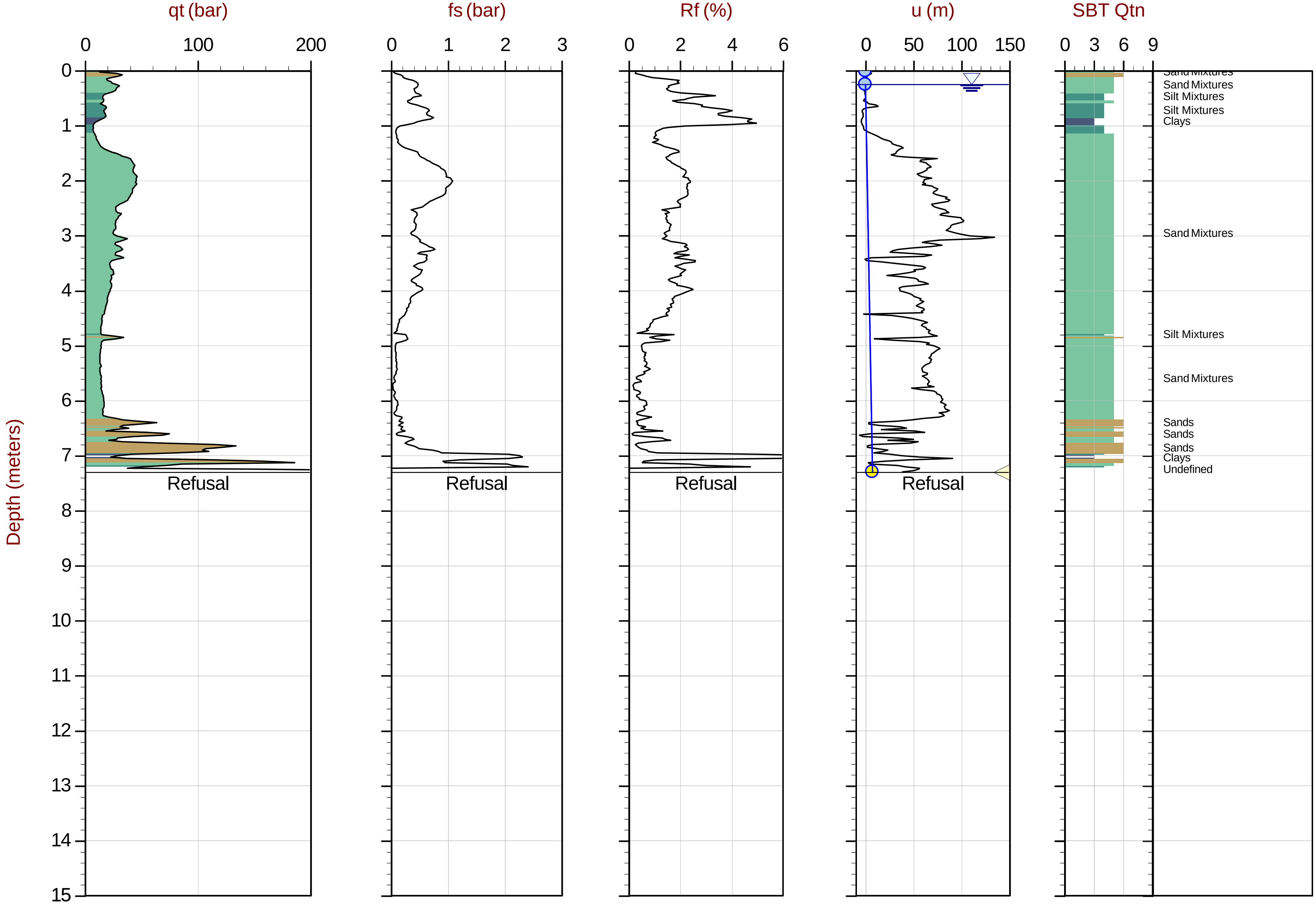
Overplot Item: Ueq   Assumed Ueq   Dissipation, Ueq achieved   Dissipation, Ueq not achieved   Dissipation, Ueq assumed   Ueq Line   Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Thurber

Job No: 24-05-27250
Date: 2024-02-22 12:14
Site: Napanee WPCP

Sounding: CPT24-205
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 7.300 m / 23.95 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP205.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900357m E: 343441m
Sheet No: 1 of 1

Overplot Item: Ueq   Assumed Ueq   Dissipation, Ueq achieved   Dissipation, Ueq not achieved   Dissipation, Ueq assumed   Ueq Line   Hydrostatic Line

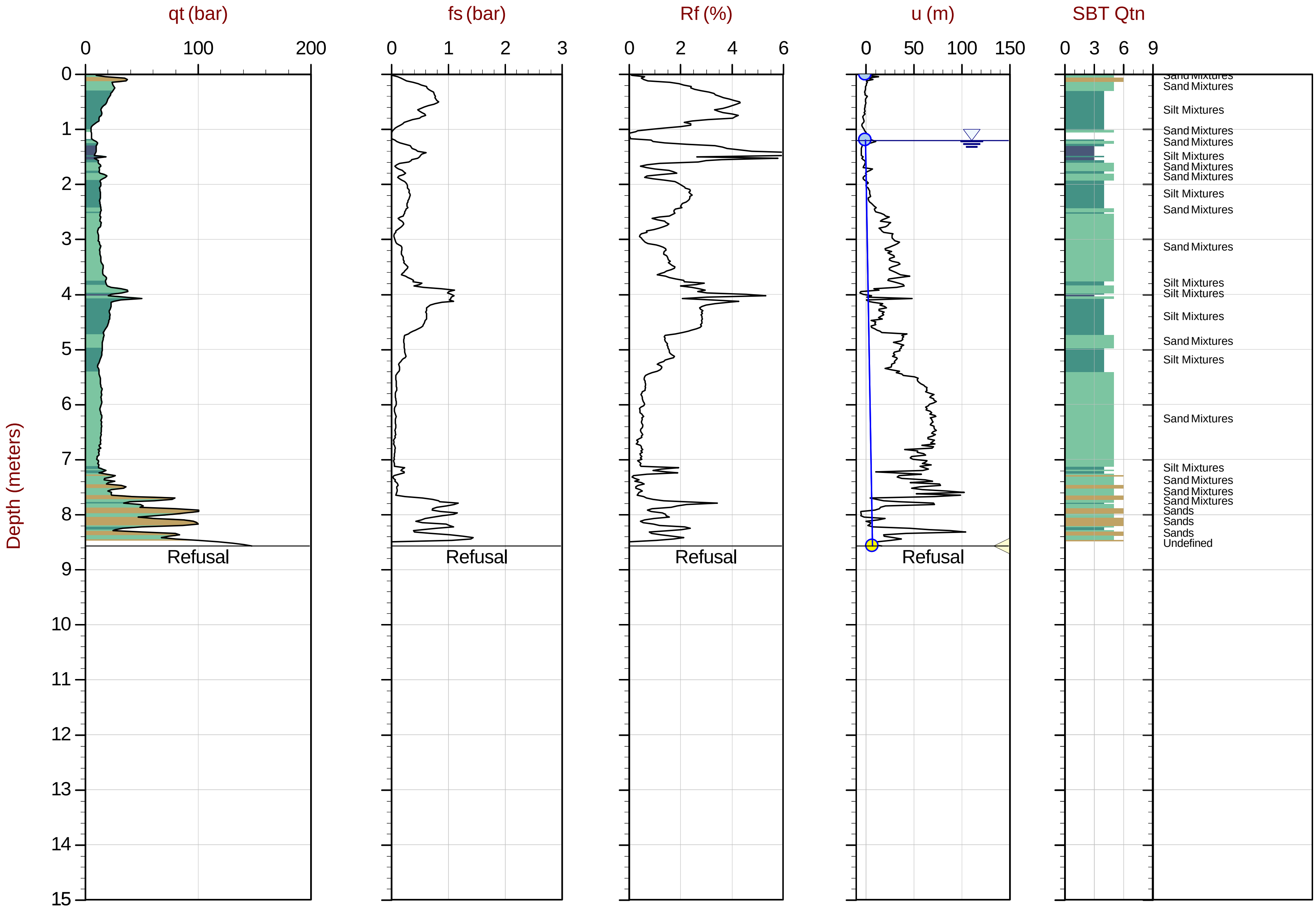
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-22 11:34
Site: Napanee WPCP

Sounding: CPT24-206
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 8.575 m / 28.13 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP206.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900341m E: 343458m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

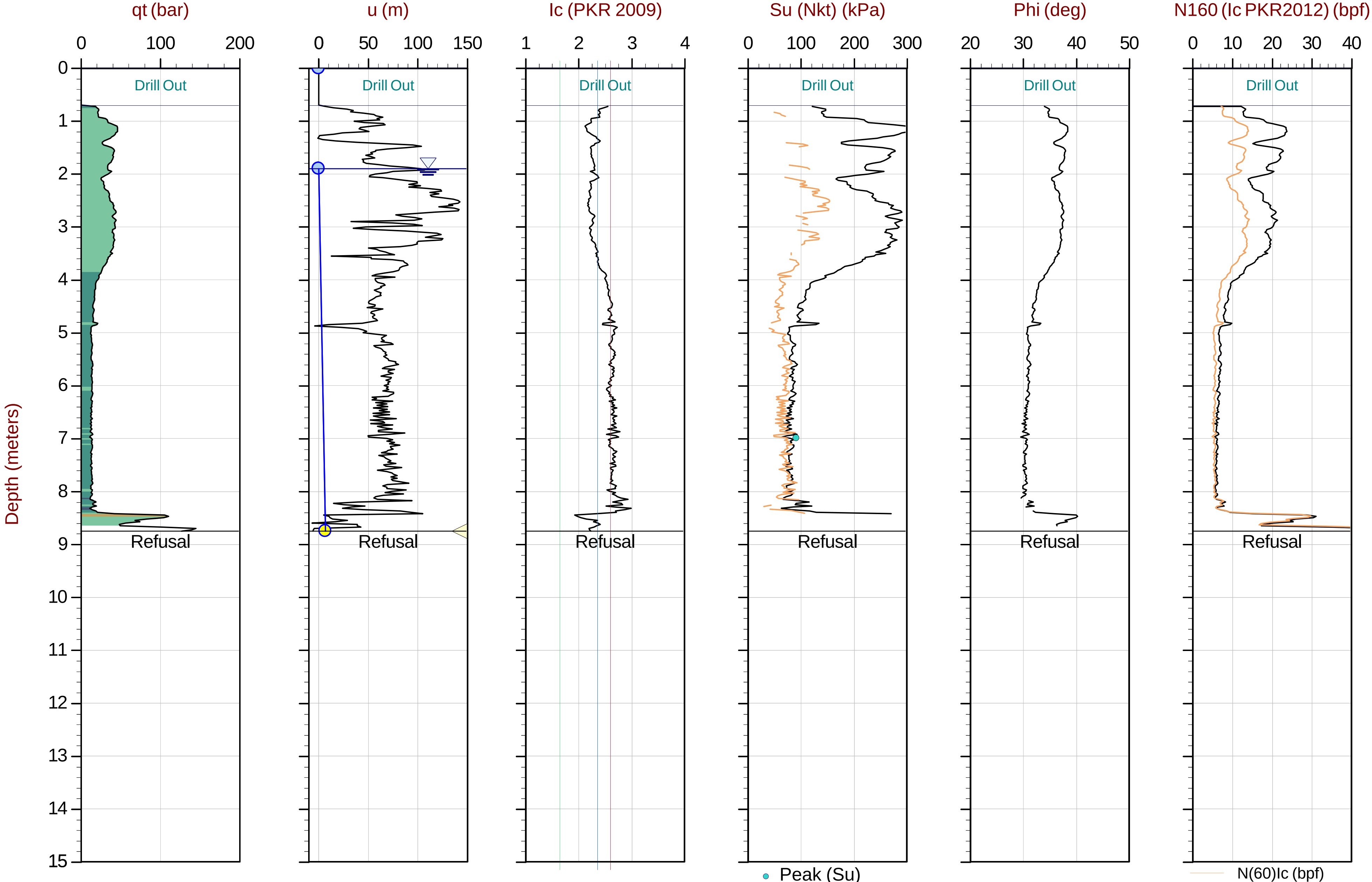
Advanced Cone Penetration Plots

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-21 16:12
Site: Napanee WPCP

Sounding: CPT24-201
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 8.750 m / 28.71 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP201.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900313m E: 343466m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

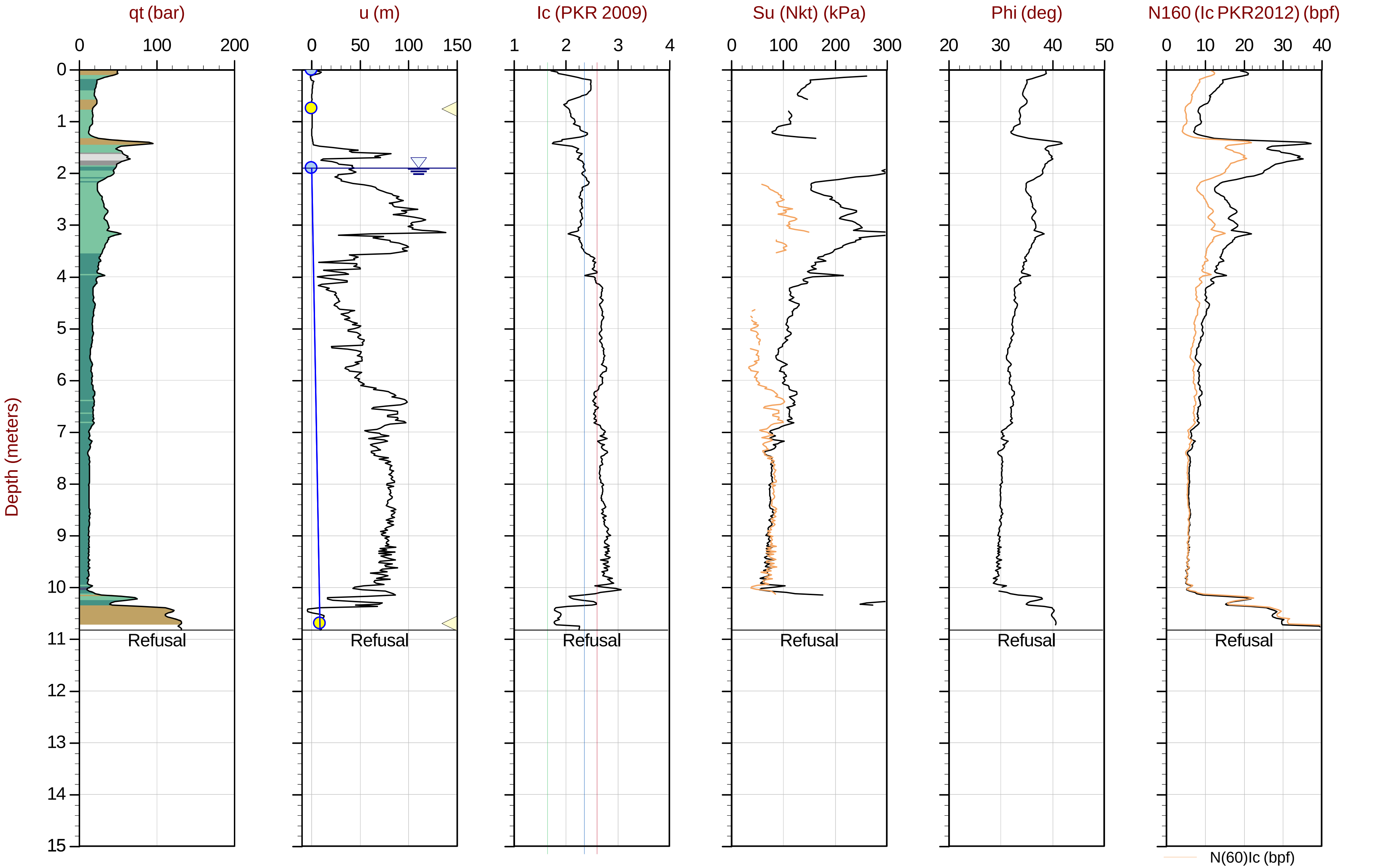
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-22 08:08
Site: Napanee WPCP

Sounding: CPT24-202
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 10.825 m / 35.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

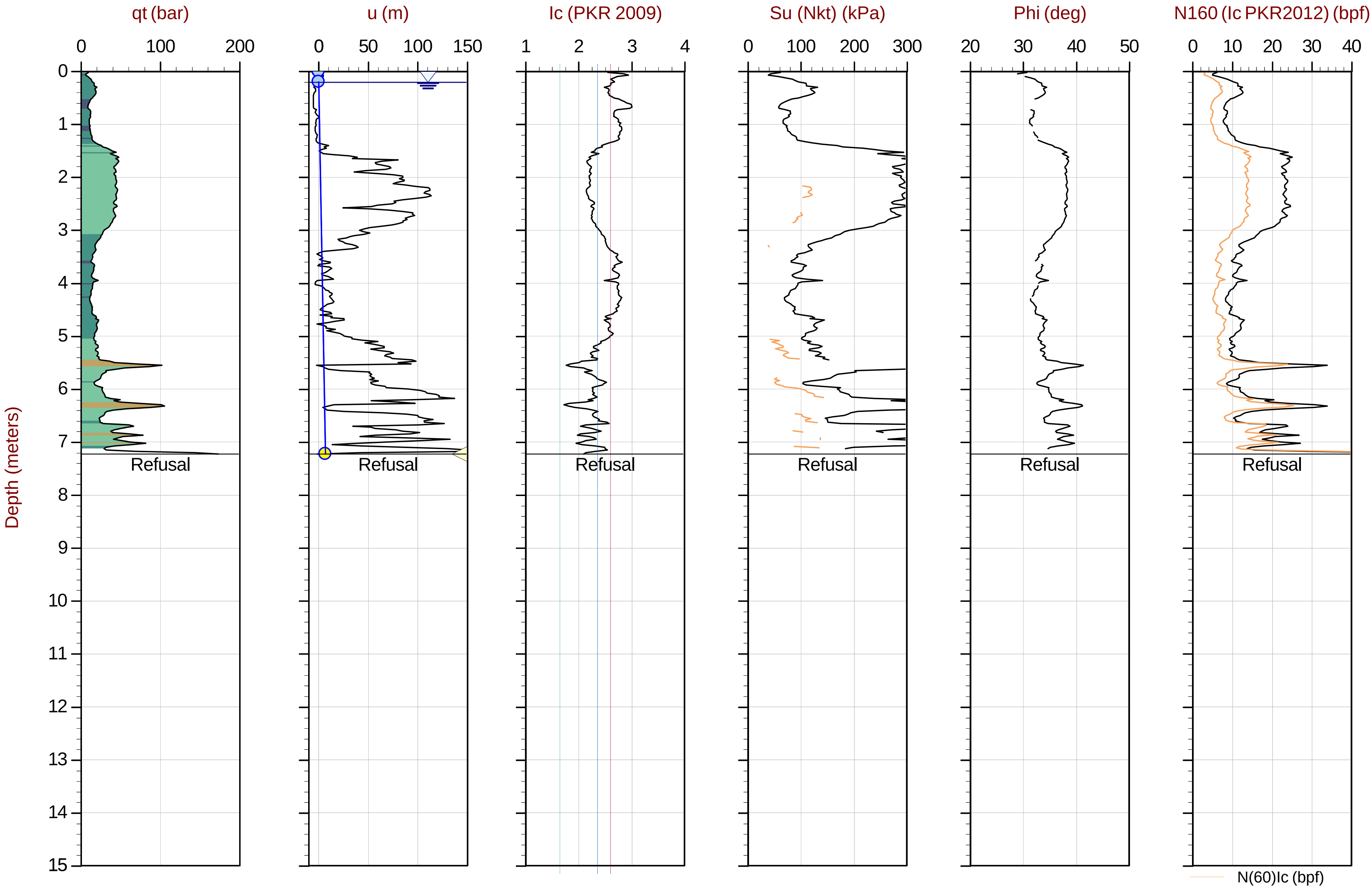
File: 24-05-27250_CP202.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900286m E: 343467m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Job No: 24-05-27250
Date: 2024-02-22 10:21
Site: Napanee WPCP
Sounding: CPT24-203
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 7.225 m / 23.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP203.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900313m E: 343429m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

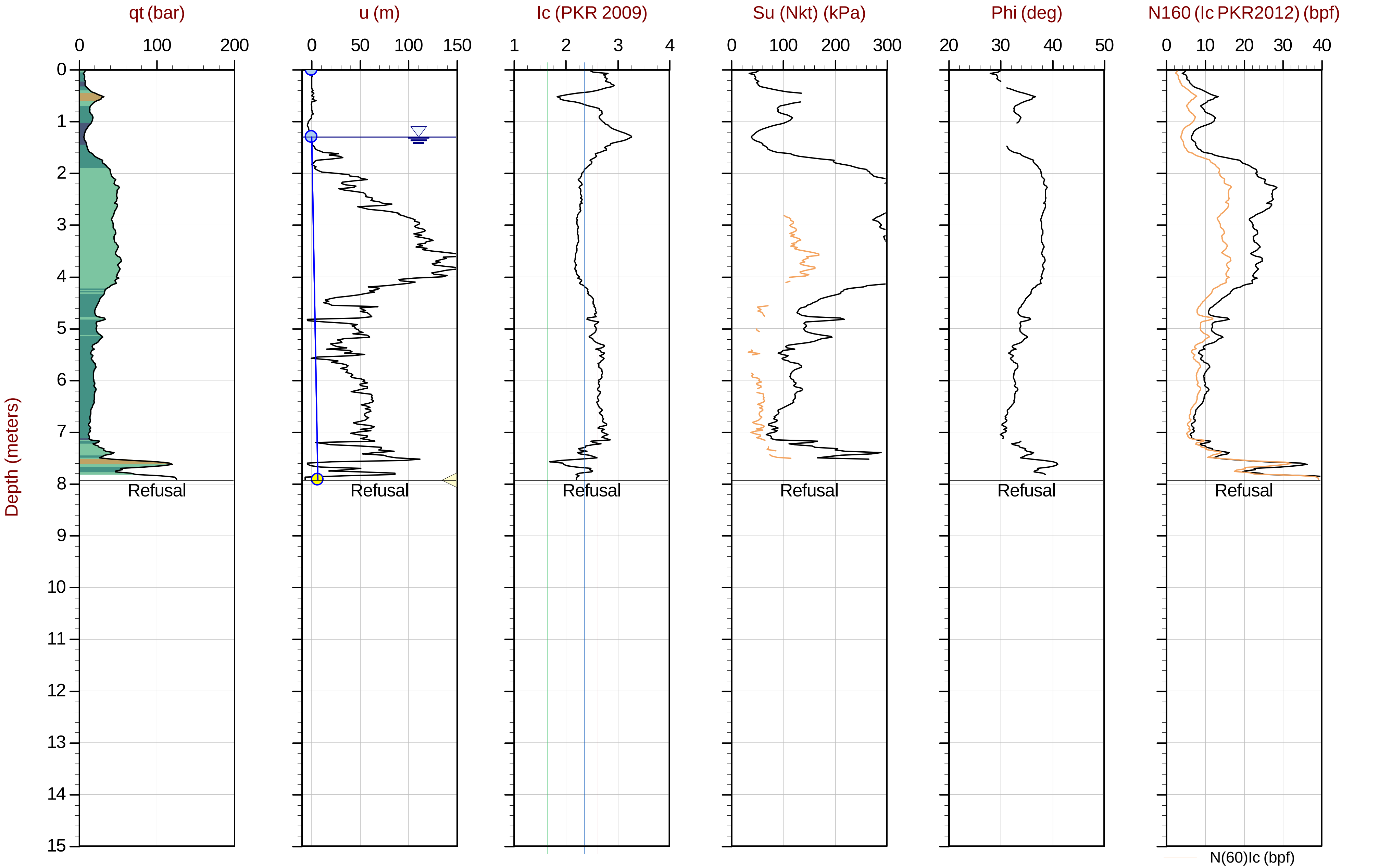
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Thurber

Job No: 24-05-27250
Date: 2024-02-22 09:01
Site: Napanee WPCP

Sounding: CPT24-204
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 7.925 m / 26.00 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP204.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900330m E: 343440m
Sheet No: 1 of 1

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Ueq Line, Hydrostatic Line

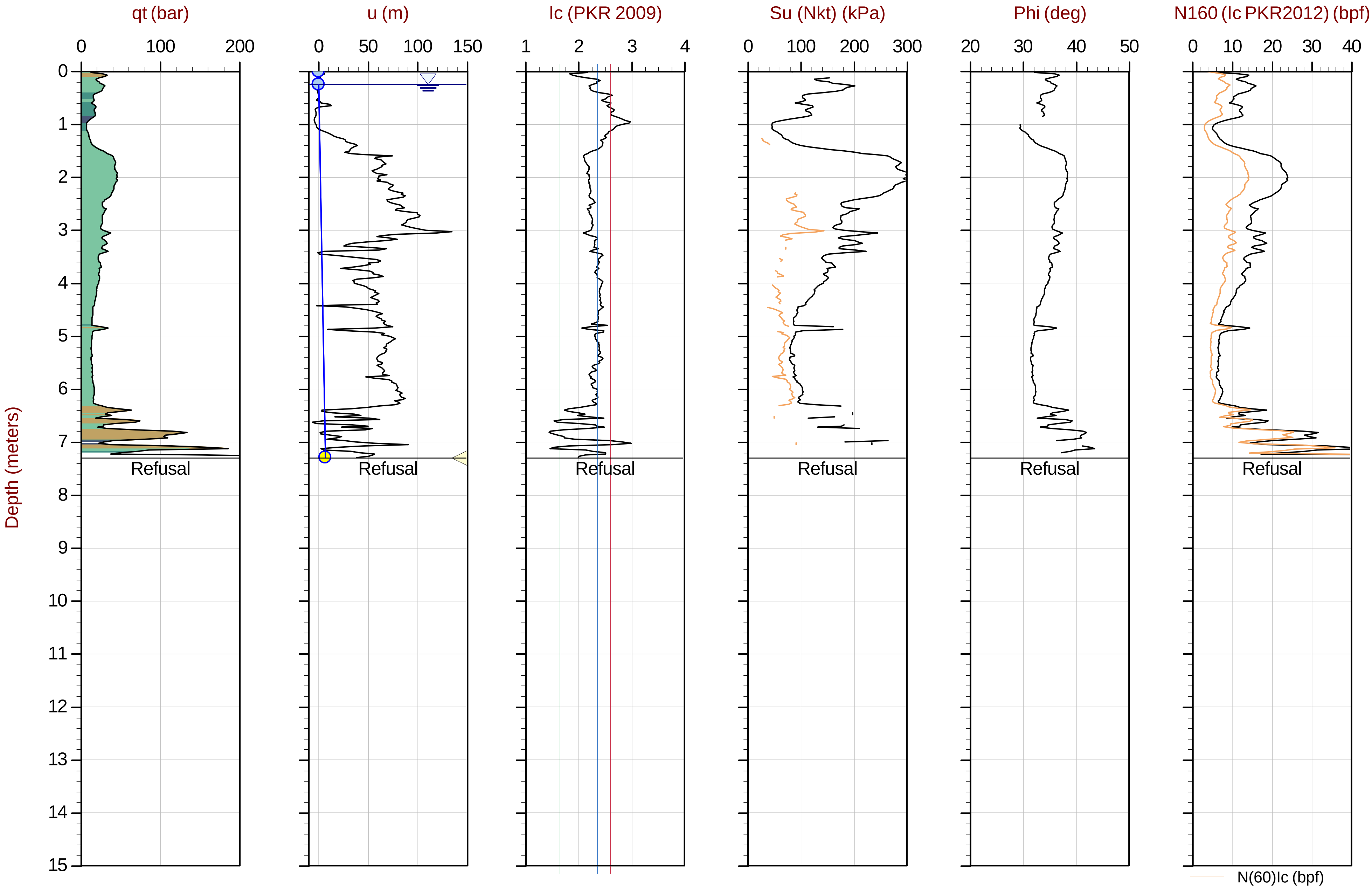
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Thurber

Job No: 24-05-27250
Date: 2024-02-22 12:14
Site: Napanee WPCP

Sounding: CPT24-205
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 7.300 m / 23.95 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP205.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900357m E: 343441m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

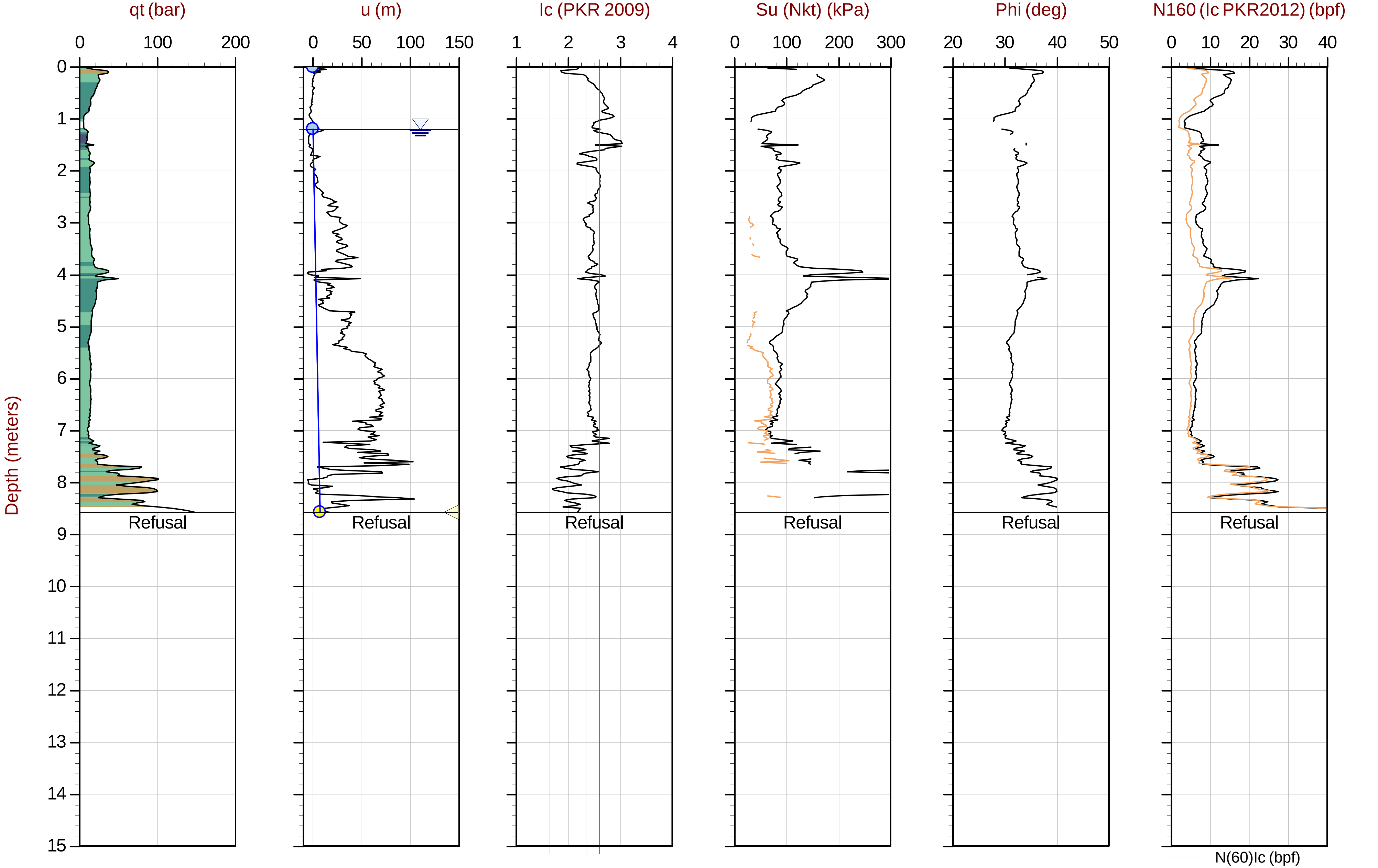
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-22 11:34
Site: Napanee WPCP

Sounding: CPT24-206
Cone: 684:T1000F10U35 Area=10 cm²



Max Depth: 8.575 m / 28.13 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-05-27250_CP206.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 9.0

SBT: Robertson, 2009 and 2010
Coords: UTM 18N N: 4900341m E: 343458m
Sheet No: 1 of 1

Overplot Item: Ueq Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Dissipation, Ueq assumed Ueq Line Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

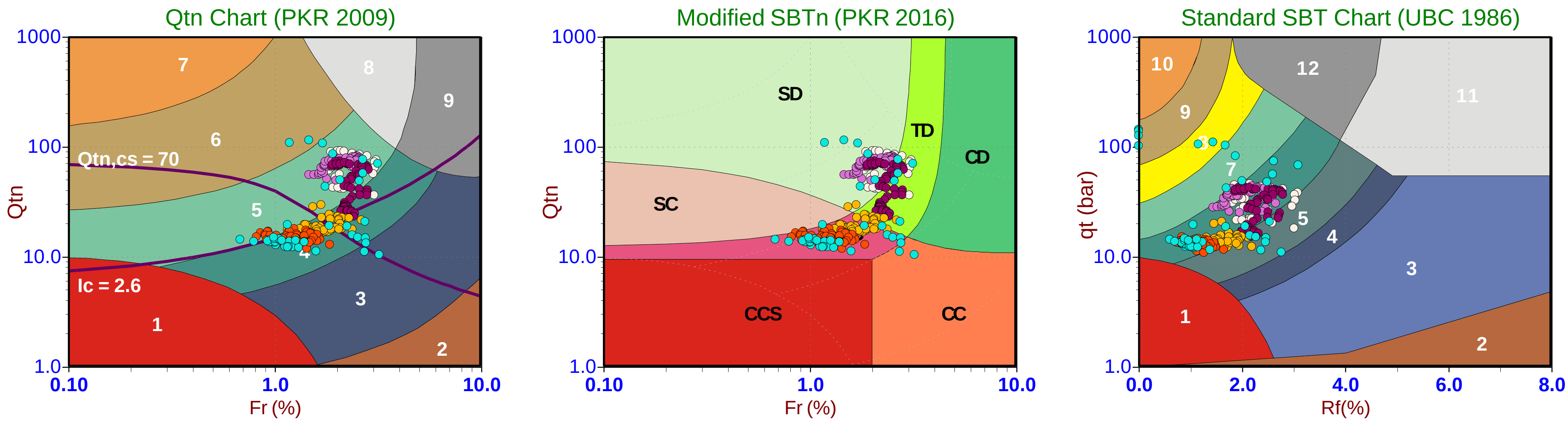
Soil Behaviour Type (SBT) Scatter Plots

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-21 16:12
Site: Napanee WPCP

Sounding: CPT24-201
Cone: 684:T1000F10U35 Area=10 cm²



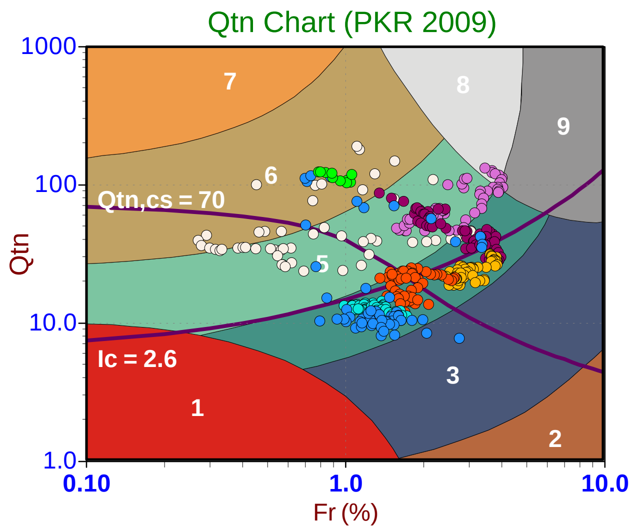
Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

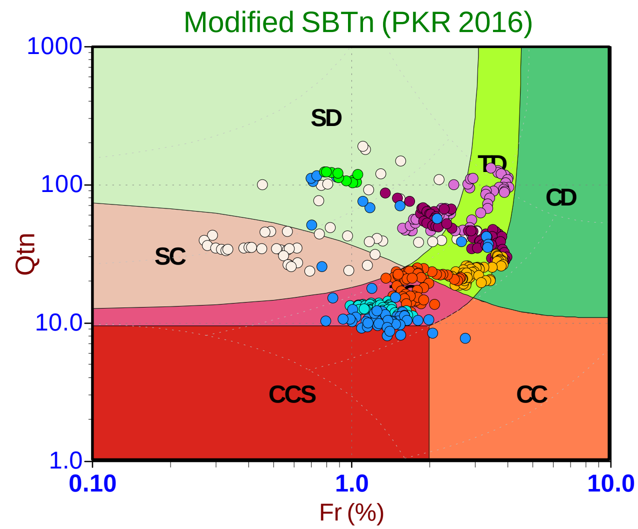
Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

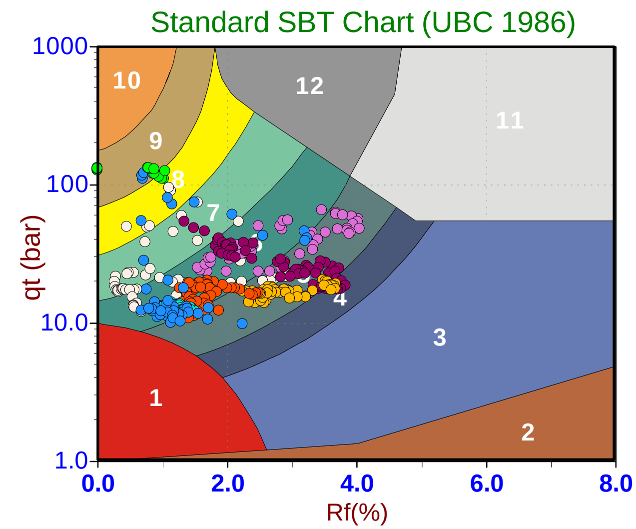
Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Thurber	Job No: 24-05-27250 Date: 2024-02-22 08:08 Site: Napanee WPCP	Sounding: CPT24-202 Cone: 684:T1000F10U35 Area=10 cm²







Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

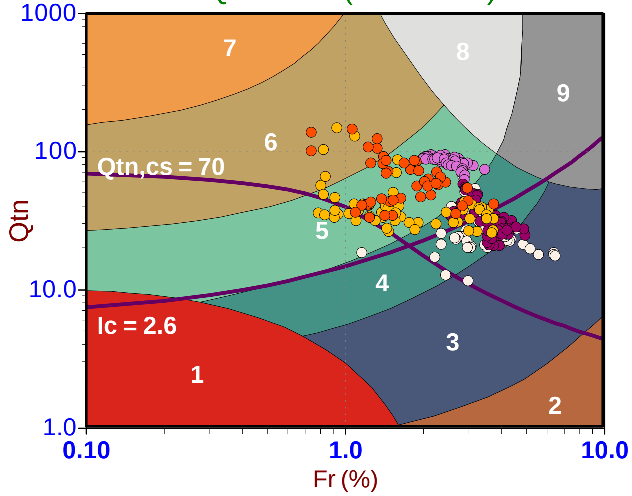
Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Thurber

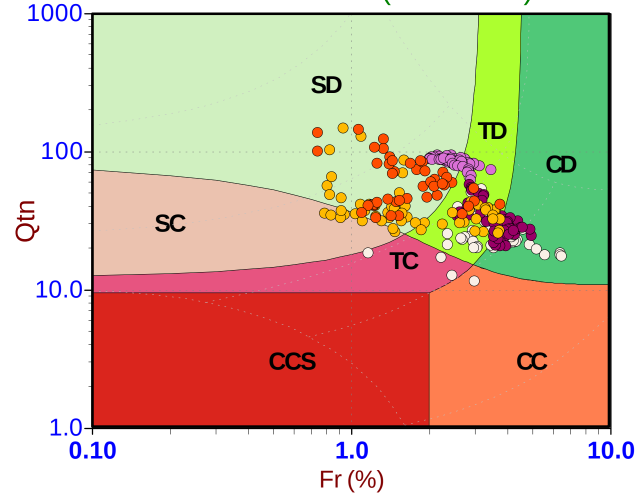
Job No: 24-05-27250
Date: 2024-02-22 10:21
Site: Napanee WPCP

Sounding: CPT24-203
Cone: 684:T1000F10U35 Area=10 cm²

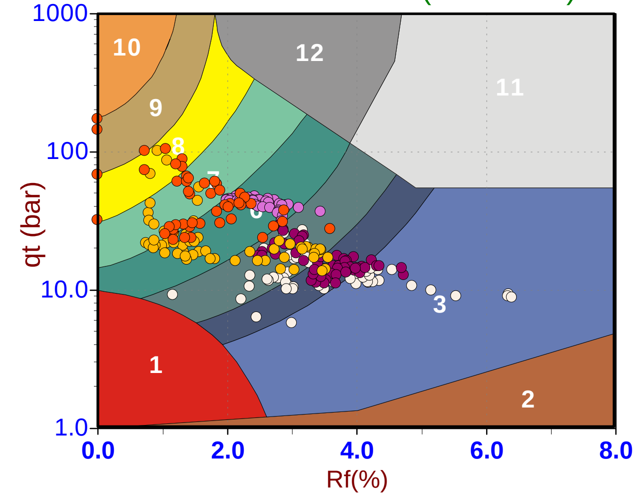
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

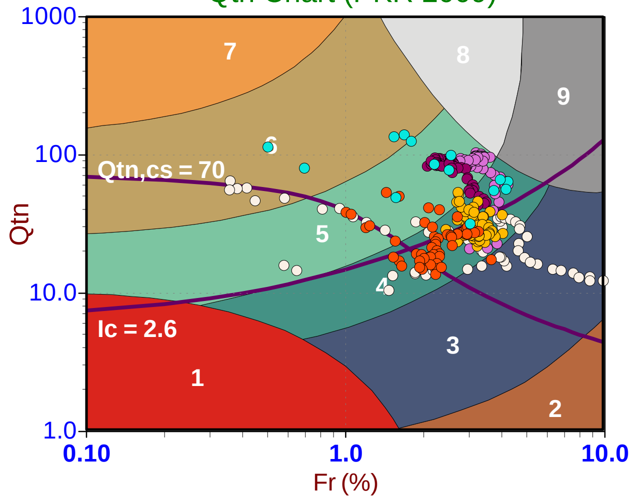
CONETEC

Thurber

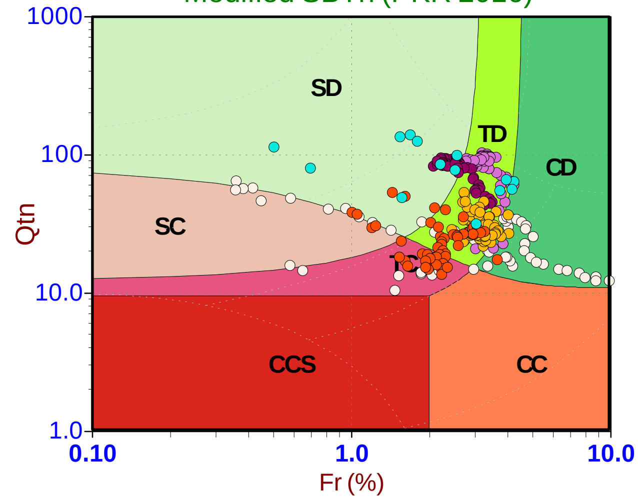
Job No: 24-05-27250
Date: 2024-02-22 09:01
Site: Napanee WPCP

Sounding: CPT24-204
Cone: 684:T1000F10U35 Area=10 cm²

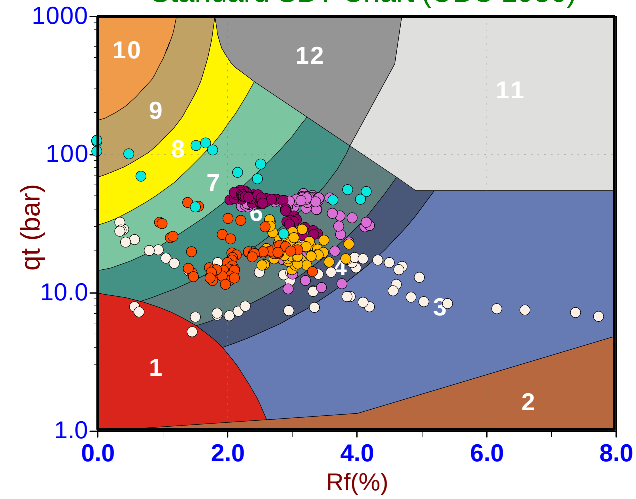
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

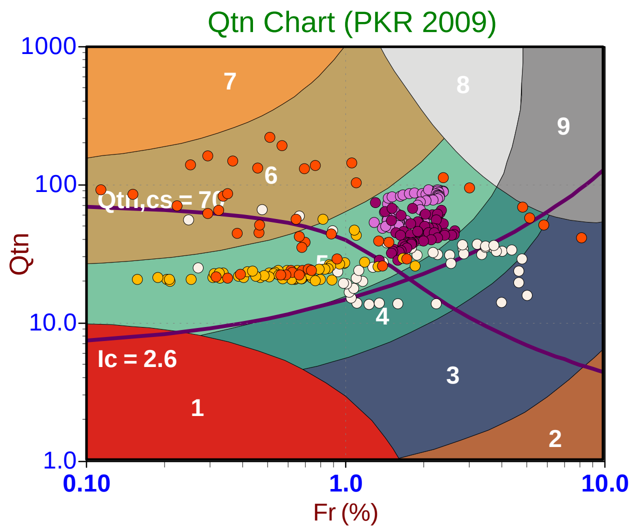
Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

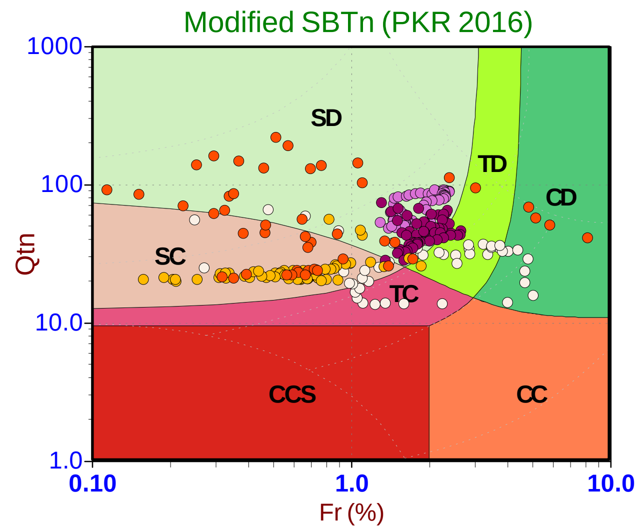
Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

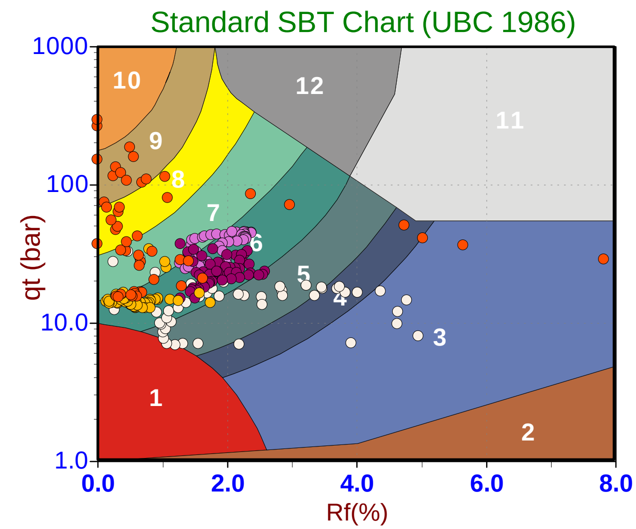
Job No: 24-05-27250	Sounding: CPT24-205
Date: 2024-02-22 12:14	Cone: 684:T1000F10U35 Area=10 cm²
Site: Napanee WPCP	

CONETEC

Thurber







Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

Legend
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- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
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- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

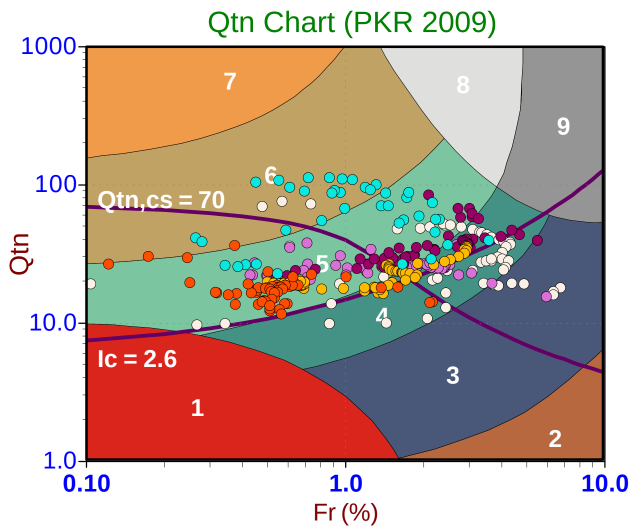
Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

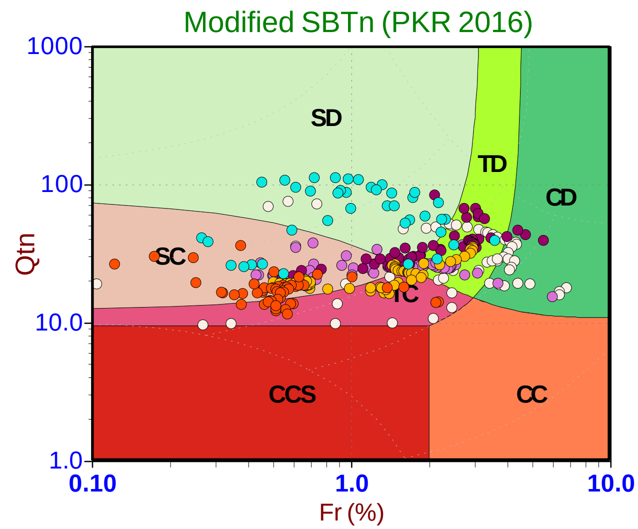
ConeTec

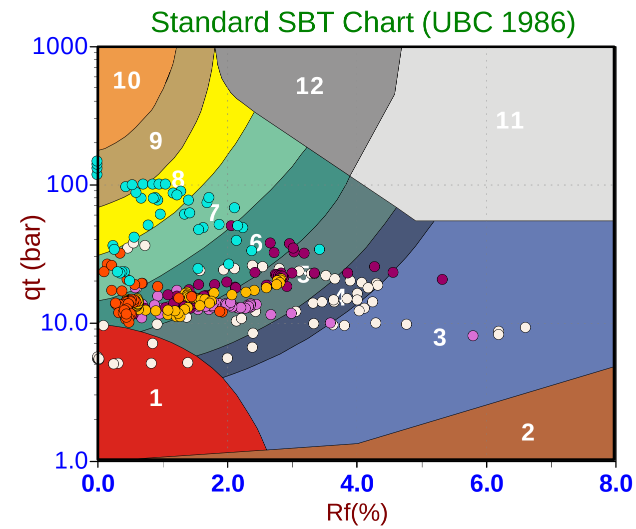
Thurber

Job No: 24-05-27250
Date: 2024-02-22 11:34
Site: Napanee WPCP

Sounding: CPT24-206
Cone: 684:T1000F10U35 Area=10 cm²







Depth Ranges
- >0.0 to 1.5 m
- >1.5 to 3.0 m
- >3.0 to 4.5 m
- >4.5 to 6.0 m
- >6.0 to 7.5 m
- >7.5 to 9.0 m
- >9.0 to 10.5 m
- >10.5 to 12.0 m
- >12.0 to 13.5 m
- >13.5 to 15.0 m
- >15.0 m

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

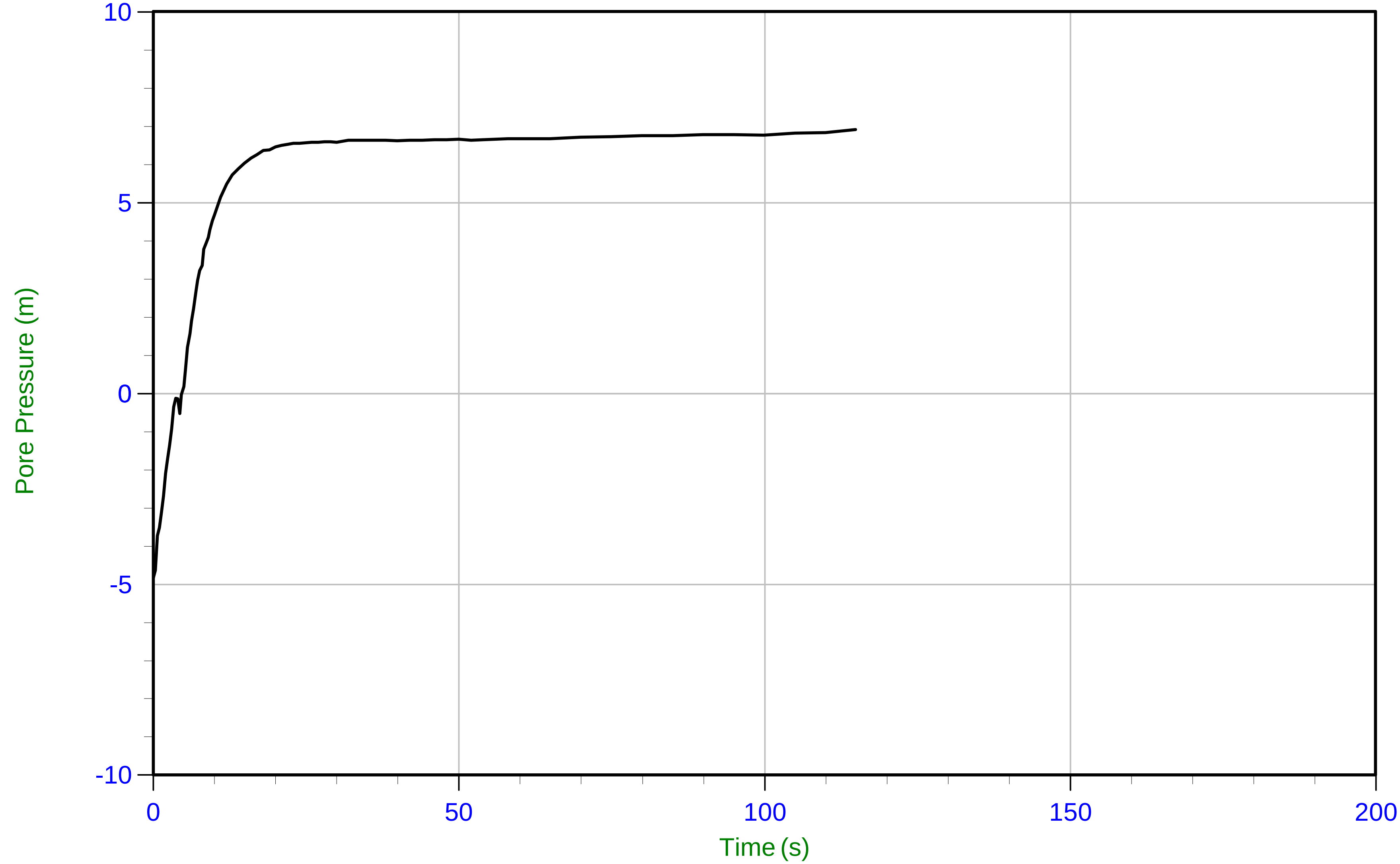
Job No:	24-05-27250
Client:	Thurber Engineering Ltd.
Project:	Napanee WPCP
Start Date:	2024-02-21
End Date:	2024-02-22

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (m)	$U_{initial}$ (m)	U_{max} (m)	U_{min} (m)	U_{final} (m)	Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)	t_{50} $(s)_1$	Assumed Rigidity Index (I_r)	c_h $(cm^2/min)_2$	Refer to Notation Number
CPT24-201	24-05-27250_CP201	10	115	8.750	-4.8	6.9	-4.8	6.9	6.9	1.9				
CPT24-202	24-05-27250_CP202	10	75	0.750	0.2	0.2	-2.6	-0.2	0.0					
CPT24-202	24-05-27250_CP202	10	630	10.700	11.1	11.1	5.8	8.8	8.8	1.9				
CPT24-203	24-05-27250_CP203	10	315	7.225	5.6	9.8	3.6	7.0	7.0	0.2	11.0	100	42.4	
CPT24-204	24-05-27250_CP204	10	415	7.925	-6.3	6.7	-6.3	6.6	6.6	1.3				
CPT24-205	24-05-27250_CP205	10	680	7.300	36.3	36.3	7.1	7.1	7.1	0.2	14.9	100	31.4	
CPT24-206	24-05-27250_CP206	10	690	8.575	55.2	56.8	7.4	7.4	7.4	1.2	19.9	100	23.5	

1. Time for 50 percent dissipation was based on U_{max}, U_{min}, and the applied U_{eq}. Note the time is relative to where U_{max} occurred.
2. Teh and Houlsby, 1991.

Thurber	Job No: 24-05-27250 Date: 2024-02-21 16:12 Site: Napanee WPCP	Sounding: CPT24-201 Cone: 684:T1000F10U35 Area=10 cm²

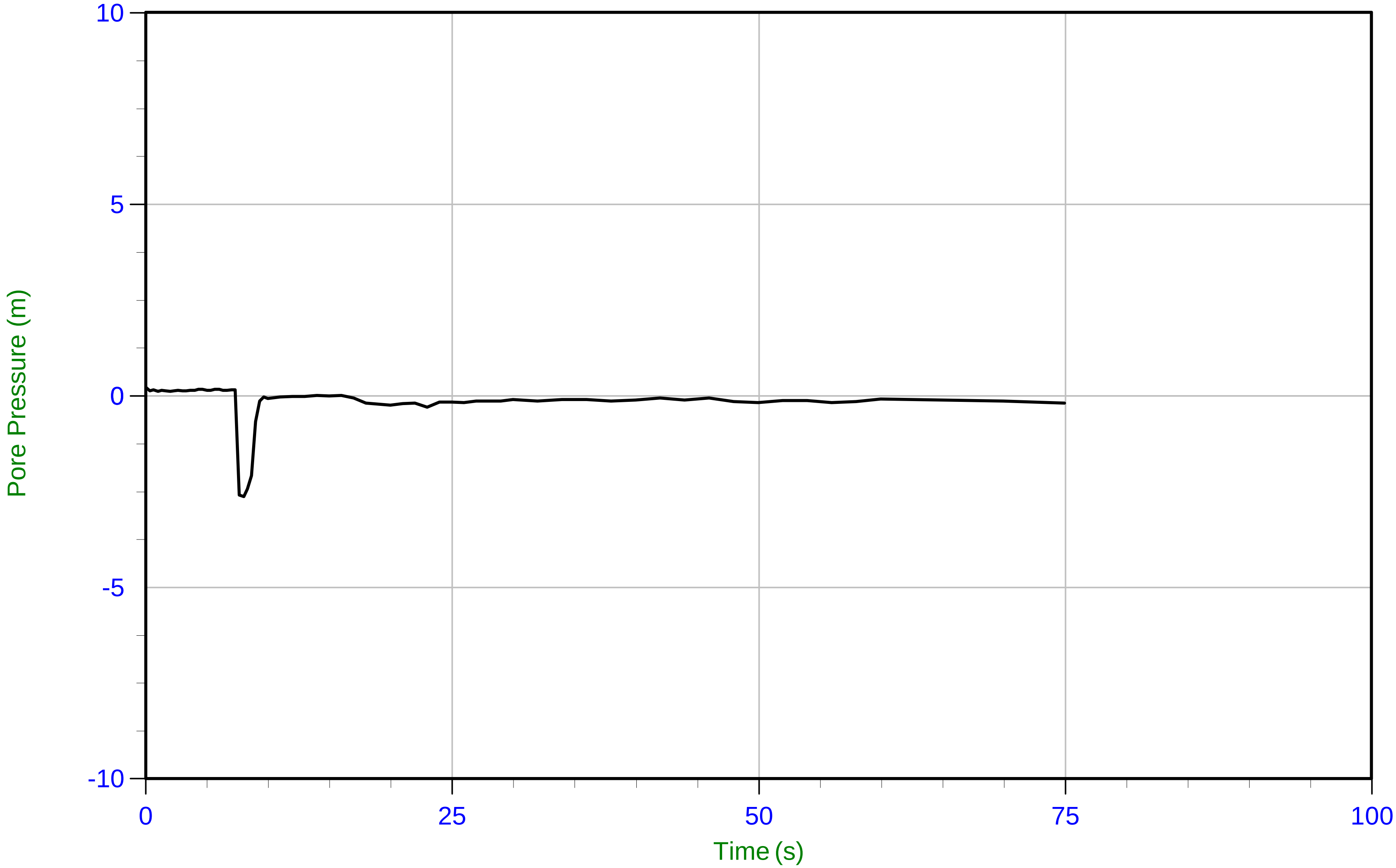


Trace Summary:

Filename: 24-05-27250_CP201.PPF2	u Min: -4.8 m	WT: 1.9 m / 6.1 ft
Depth: 8.750 m / 28.707 ft	u Max: 6.9 m	Ueq: 6.9 m
Duration: 115.0 s	u Final: 6.9 m	

CONETEC

Thurber	Job No: 24-05-27250 Date: 2024-02-22 08:08 Site: Napanee WPCP Sounding: CPT24-202 Cone: 684:T1000F10U35 Area=10 cm²



Trace Summary:

Filename: 24-05-27250_CP202.PPF2
Depth: 0.750 m / 2.461 ft
Duration: 75.0 s

u Min: -2.6 m
u Max: 0.2 m
u Final: -0.2 m

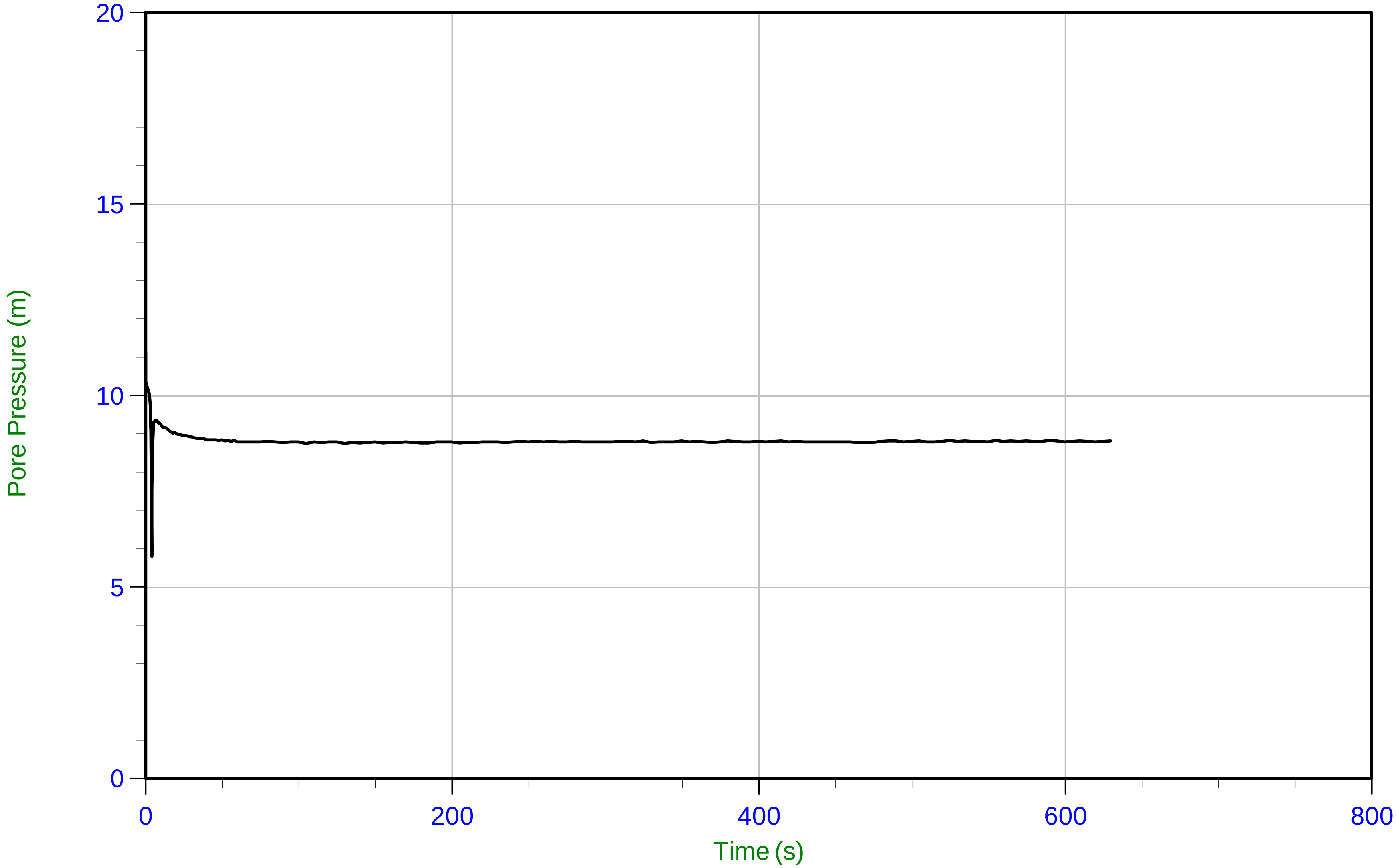
WT: 0.8 m / 2.5 ft
Ueq: 0.0 m

CONETEC

Thurber

Job No: 24-05-27250
Date: 2024-02-22 08:08
Site: Napanee WPCP

Sounding: CPT24-202
Cone: 684:T1000F10U35 Area=10 cm²



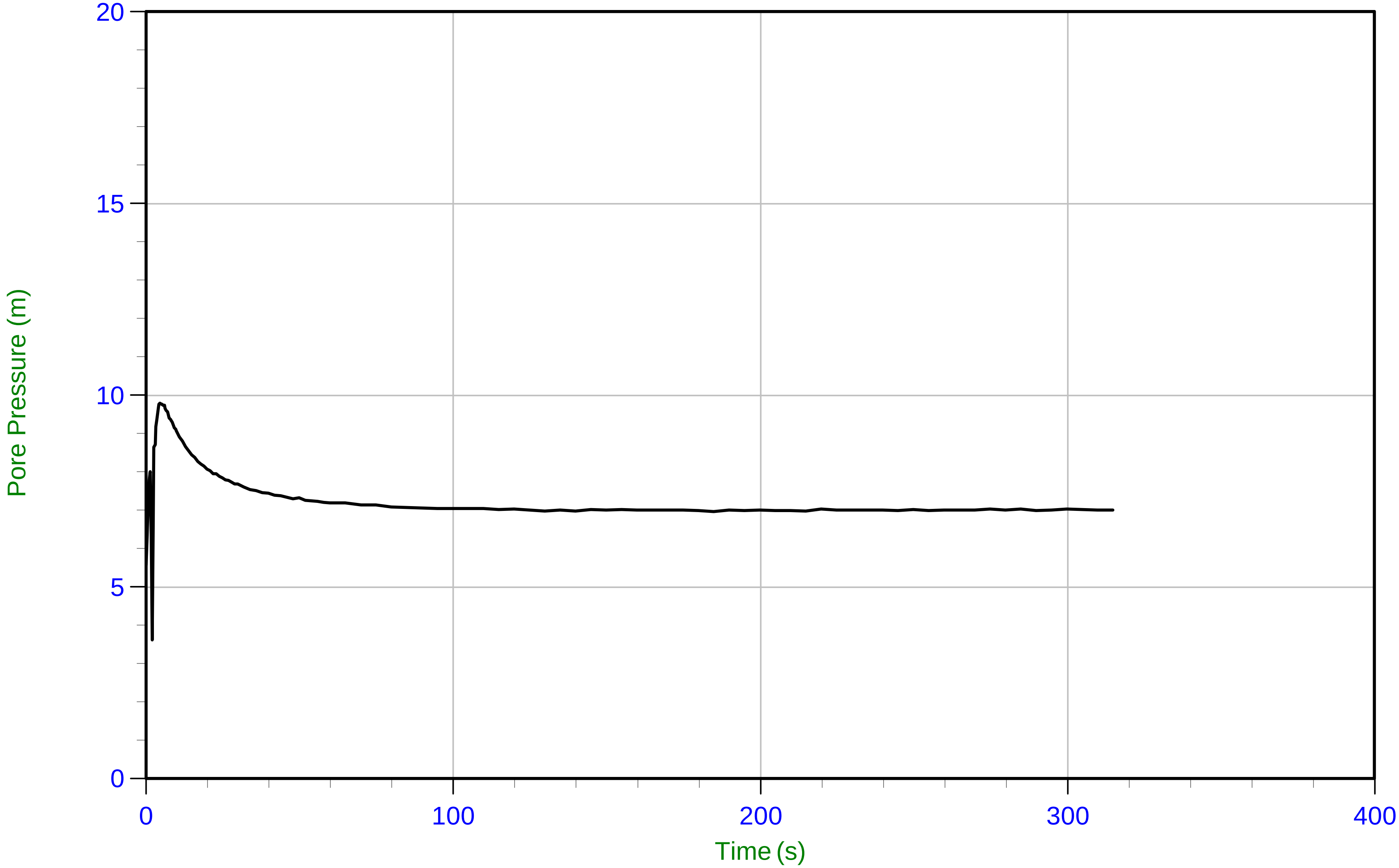
Trace Summary:

Filename: 24-05-27250_CP202.PPF2
Depth: 10.700 m / 35.105 ft
Duration: 629.9 s

u Min: 5.8 m
u Max: 11.1 m
u Final: 8.8 m

WT: 1.9 m / 6.3 ft
Ueq: 8.8 m

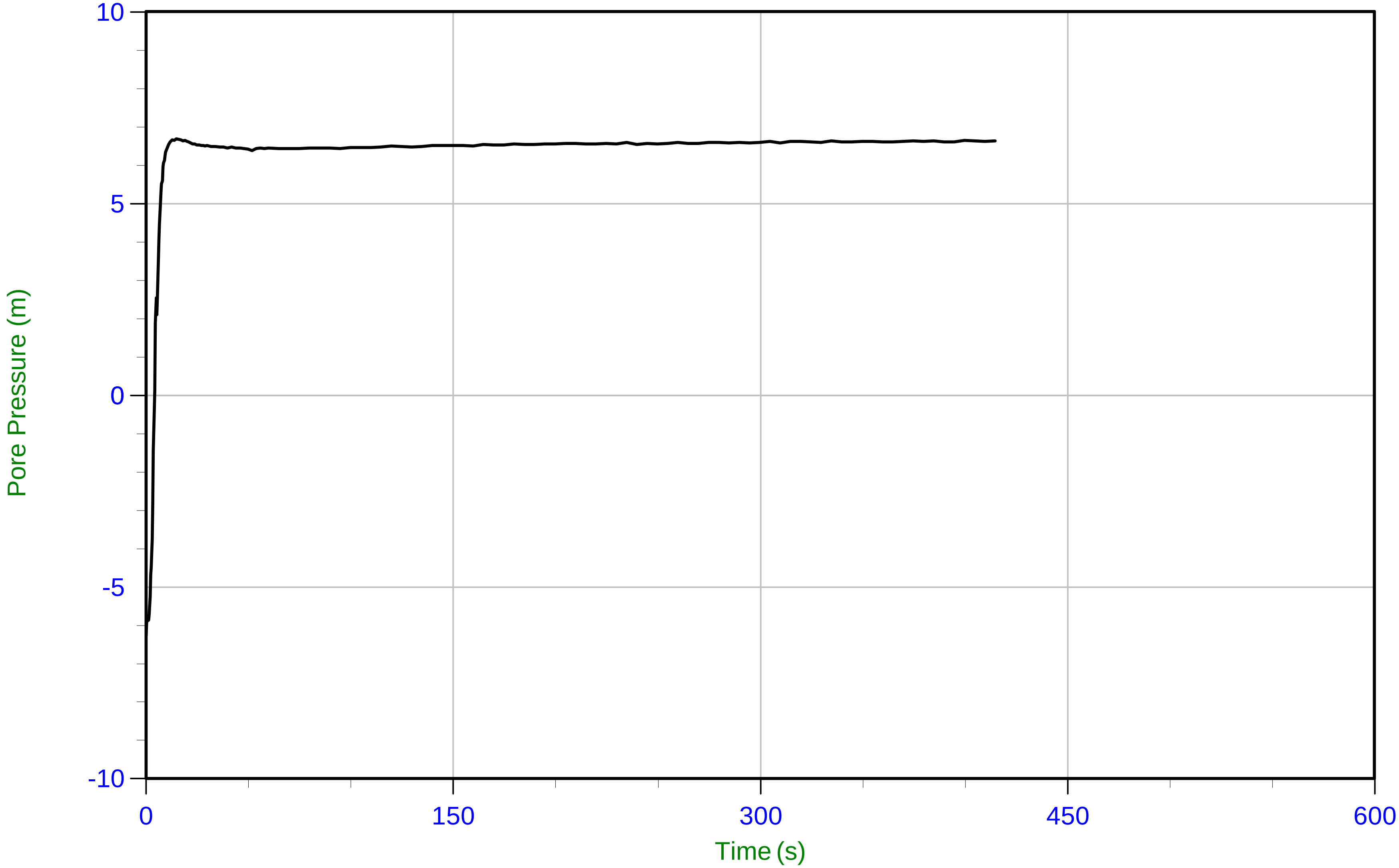
Thurber	Job No: 24-05-27250 Date: 2024-02-22 10:21 Site: Napanee WPCP	Sounding: CPT24-203 Cone: 684:T1000F10U35 Area=10 cm²



Trace Summary:

Filename: 24-05-27250_CP203.PPF2	u Min: 3.6 m	WT: 0.2 m / 0.7 ft	T(50): 11.0 s
Depth: 7.225 m / 23.704 ft	u Max: 9.8 m	Ueq: 7.0 m	Ir: 100
Duration: 314.9 s	u Final: 7.0 m	U(50): 8.40 m	Ch: 42.4 cm²/min

Thurber	Job No: 24-05-27250 Date: 2024-02-22 09:01 Site: Napanee WPCP	Sounding: CPT24-204 Cone: 684:T1000F10U35 Area=10 cm²



Trace Summary:

Filename: 24-05-27250_CP204.PPF2
Depth: 7.925 m / 26.000 ft
Duration: 414.9 s

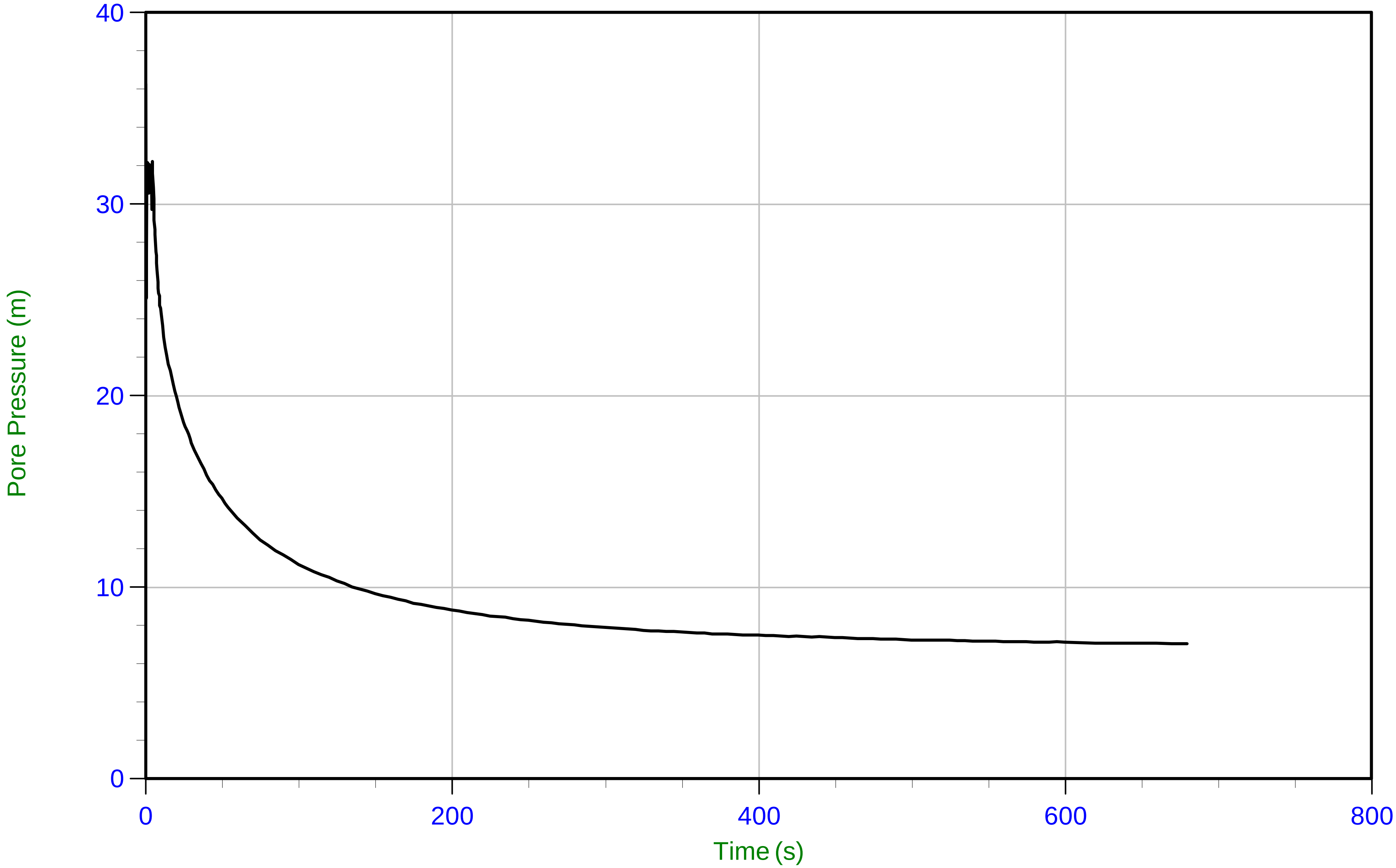
u Min: -6.3 m
u Max: 6.7 m
u Final: 6.6 m

WT: 1.3 m / 4.4 ft
Ueq: 6.6 m

Thurber

Job No: 24-05-27250
Date: 2024-02-22 12:14
Site: Napanee WPCP

Sounding: CPT24-205
Cone: 684:T1000F10U35 Area=10 cm²



Trace Summary:

Filename: 24-05-27250_CP205.PPF2
Depth: 7.300 m / 23.950 ft
Duration: 679.9 s

u Min: 7.0 m
u Max: 36.3 m
u Final: 7.1 m

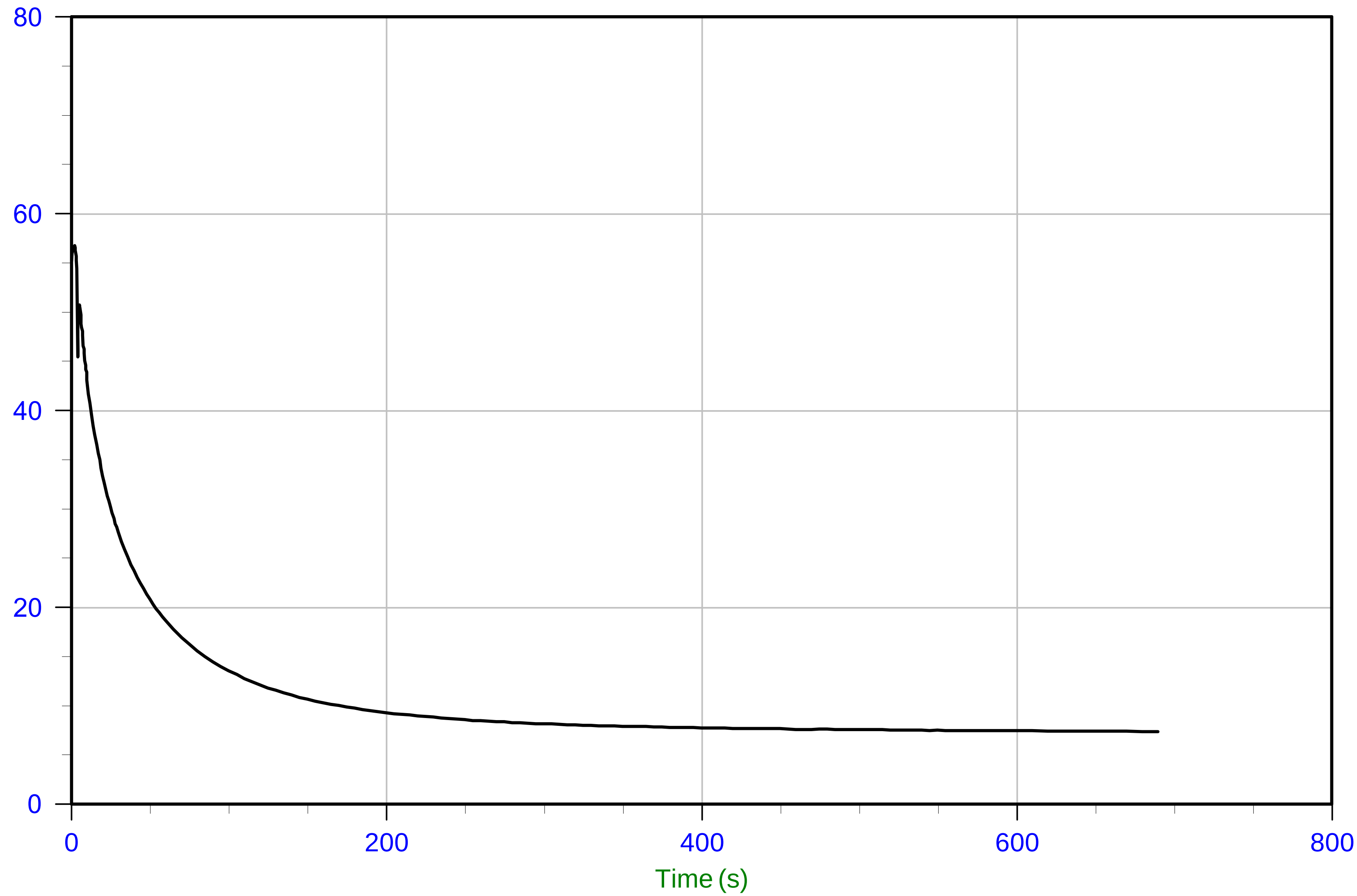
WT: 0.2 m / 0.8 ft
Ueq: 7.1 m
U(50): 21.67 m

T(50): 14.9 s
Ir: 100
Ch: 31.4 cm²/min

Thurber

Job No: 24-05-27250
Date: 2024-02-22 11:34
Site: Napanee WPCP

Sounding: CPT24-206
Cone: 684:T1000F10U35 Area=10 cm²



Trace Summary: Filename: 24-05-27250_CP206.PPF2	u Min: 7.4 m	WT: 1.2 m / 3.9 ft	T(50): 19.9 s
Depth: 8.575 m / 28.133 ft	u Max: 56.8 m	Ueq: 7.4 m	Ir: 100
Duration: 689.9 s	u Final: 7.4 m	U(50): 32.08 m	Ch: 23.5 cm²/min

Electric Field Vane Shear Test Profile Summary and Results

Job Number:	24-05-27250
Client:	Thurber Engineering Ltd.
Project:	Napanee WPCP
Start Date:	2024-02-21
End Date:	2024-02-21

ELECTRIC FIELD VANE SHEAR TEST SUMMARY

Sounding ID	File Name	Adjacent CPT Sounding ID	Date From	Date To	Northing[1] (m)	Easting[1] (m)	Refer to Notation Number
EVT24-301	24-05-27250_EVT24-301	CPT24-201	2024-02-21	2024-02-21	4900311	343464	

1. Coordinates were collected with a consumer grade GPS device with datum WGS84/UTM Zone 18 North.

Job Number: 24-05-27250
Client: Thurber Engineering Ltd
Project: Napanee WPCP
Start Date: 2024-02-21
End Date: 2024-02-21

ELECTRIC FIELD VANE SHEAR TEST RESULTS

Sounding ID	File Name	Date	Load Cell Serial Number	Load Cell Location	Casing/Drillout Depth (m)	Test Depth[1] (m)	Vane Diameter D (mm)	Vane Height H (mm)	Top Taper Angle i_T (deg)	Bottom Taper Angle i_B (deg)	Vane Factor (kPa/Nm)	Peak Torque (Nm)	Peak Stress (kPa)	Peak Frictional Stress (kPa)	Su Peak (kPa)	Refer to Notation Number
EVT24-301	24-05-27250_EVT24-301	2024-02-21	GA07-066	Surface	4.57	5.49	75	150	45	45	0.6106	>118.9				2, 3
EVT24-301	24-05-27250_EVT24-301	2024-02-21	GA07-066	Surface	6.10	7.01	50	100	45	45	2.0608	44.4	91.5	8.1	83.4	3
EVT24-301	24-05-27250_EVT24-301	2024-02-21	GA07-066	Surface	7.62	8.54	50	100	45	45	2.0608	>111.6				2, 3

1. Test depths are referenced to the middle of the vane.
2. The vane load cell was maxed out during the testing. The presented torque value is the maximum recorded torque and not the actual peak torque.
3. No remold test was completed.

Job Number: 24-05-27250
Client: Thurber Engineering Ltd
Project: Napanee WPCP
Start Date: 2024-02-21
End Date: 2024-02-21

ELECTRIC FIELD VANE SHEAR TEST TIMING

Sounding ID	Date	Test Depth[1] (m)	Vane Insertion Time (HH:mm)	Peak Test Start Time (HH:mm)	Insertion to Start Interval (min)	Start to Failure Interval (sec)	Peak Test Avg Rate (deg/sec)	Refer to Notation Number
EVT24-301	2024-02-21	5.49	11:22	11:25	3		0.08	
EVT24-301	2024-02-21	7.01	12:45	12:46	1	695	0.11	
EVT24-301	2024-02-21	8.54	14:06	14:08	2		0.10	

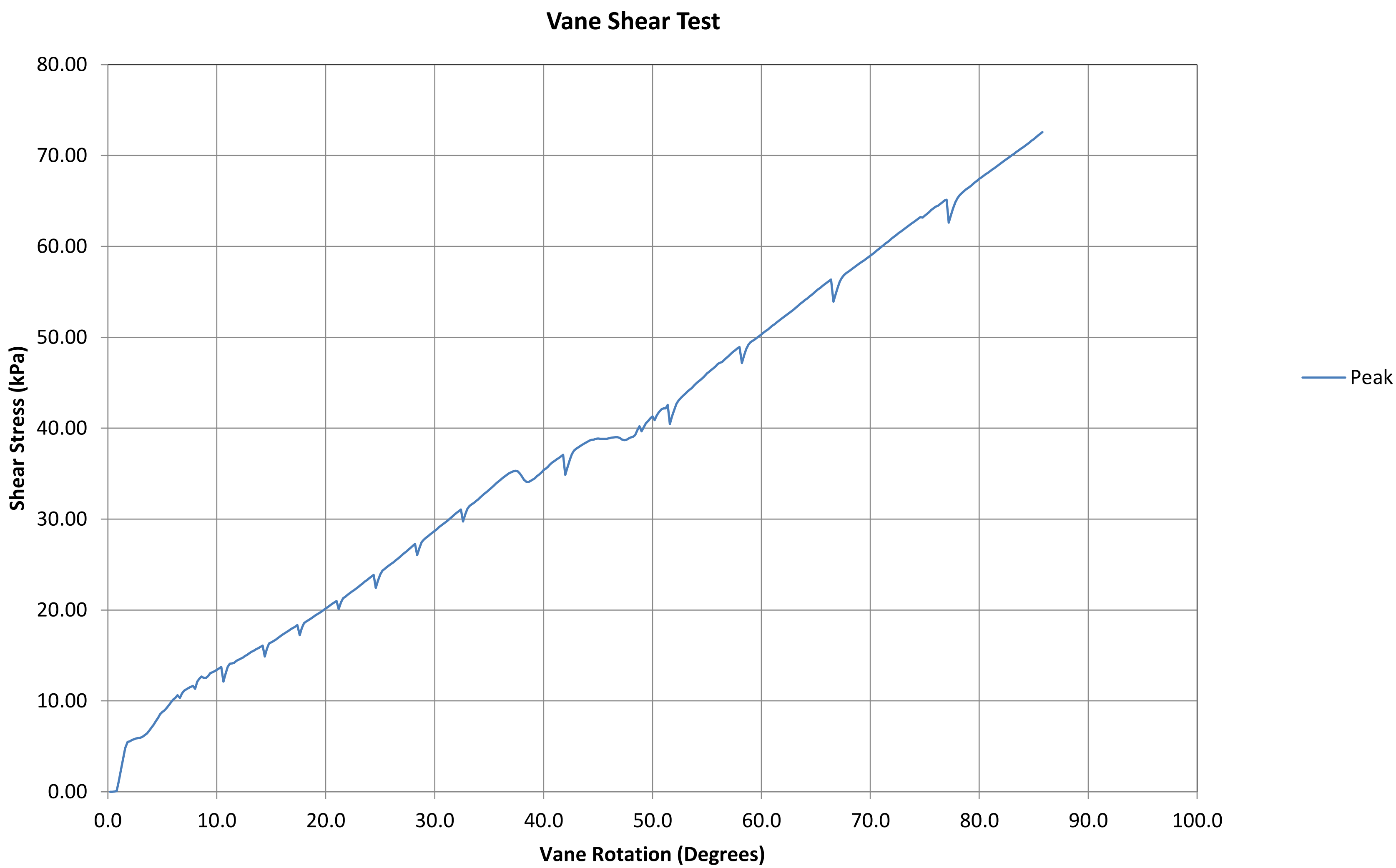
1. Test depths are referenced to the middle of the vane.

Electric Field Vane Shear Test Plots

Job Number: 24-05-27250
Client: Thurber Engineering Ltd.
Project: Napanee WPCP
Sounding: EVT24-301

Test Date: 21-Feb-2024 11:25
Test Depth (m): 5.49
Vane Type: Adara solid double tapered 75 x 150 mm (45°, 45°)

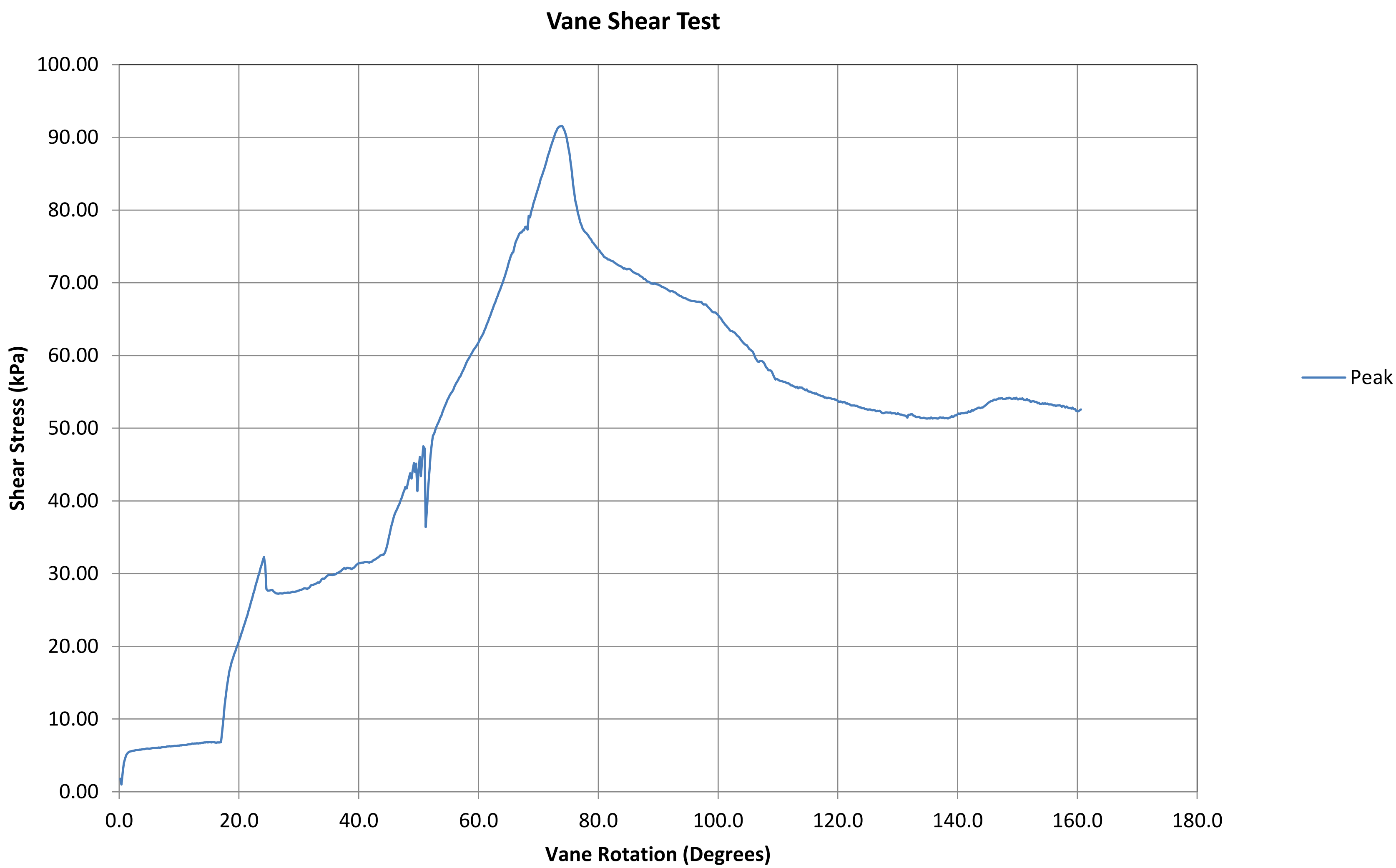
Coordinate System: WGS 84 / UTM zone 18N
Northing (m): 4900311
Easting (m): 343464



Job Number: 24-05-27250
Client: Thurber Engineering Ltd.
Project: Napanee WPCP
Sounding: EVT24-301

Test Date: 21-Feb-2024 12:46
Test Depth (m): 7.01
Vane Type: Adara solid double tapered 50 x 100 mm (45°, 45°)

Coordinate System: WGS 84 / UTM zone 18N
Northing (m): 4900311
Easting (m): 343464

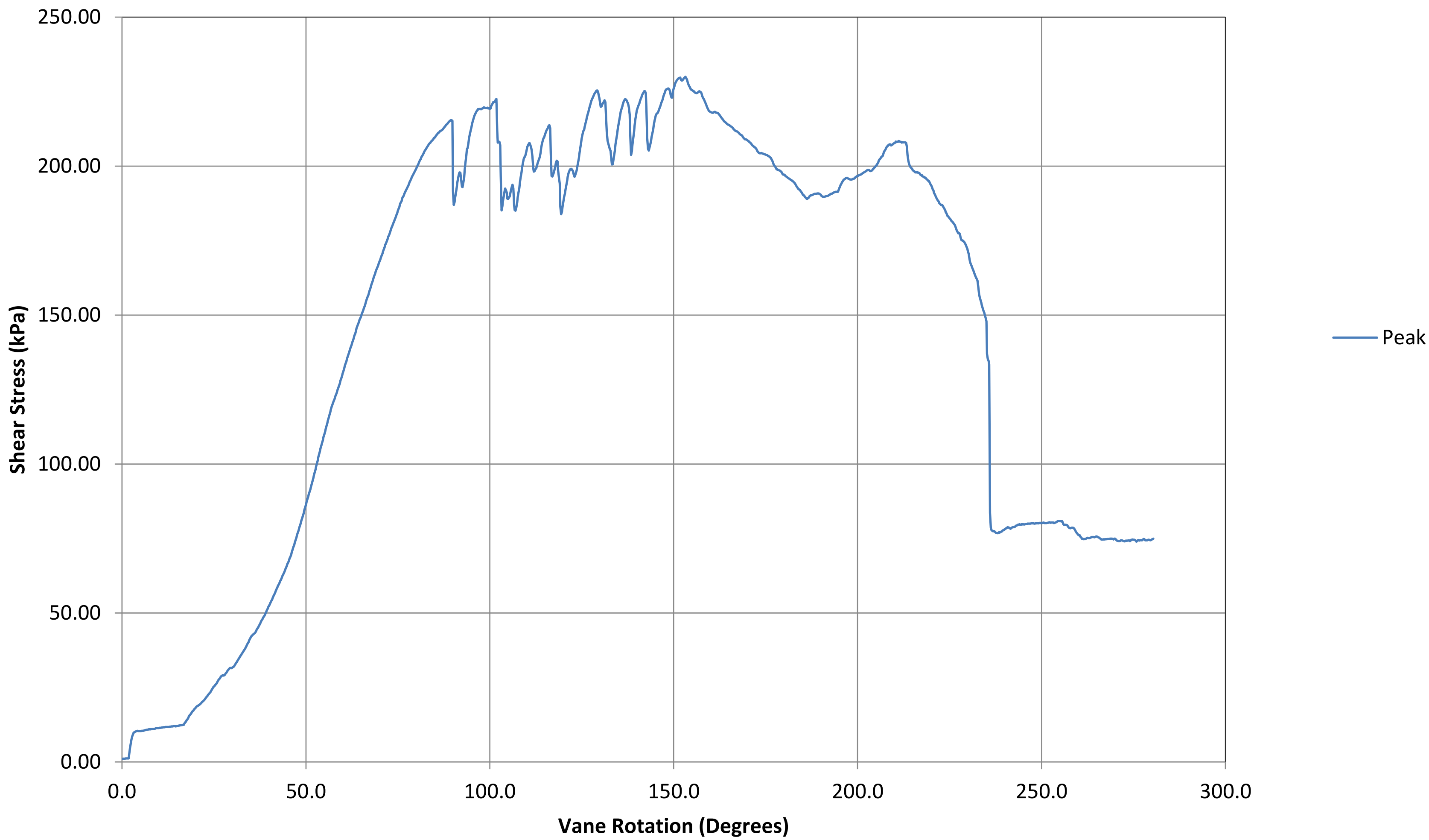


Job Number: 24-05-27250
Client: Thurber Engineering Ltd.
Project: Napanee WPCP
Sounding: EVT24-301

Test Date: 21-Feb-2024 14:08
Test Depth (m): 8.54
Vane Type: Adara solid double tapered 50 x 100 mm (45°, 45°)

Coordinate System: WGS 84 / UTM zone 18N
Northing (m): 4900311
Easting (m): 343464

Vane Shear Test



Description of Methods for Calculated CPT Geotechnical Parameters

CALCULATED CPT GEOTECHNICAL PARAMETERS

A Detailed Description of the Methods Used in ConeTec's CPT Geotechnical Parameter Calculation and Plotting Software

Revision SZW-Rev 18

Revised February 10, 2023

Prepared by Jim Greig, M.A.Sc, P.Eng (BC, AB, ON)

Limitations

The geotechnical parameter output was prepared specifically for the site and project named in the accompanying report subject to objectives, site conditions and criteria provided to ConeTec by the client. The output may not be relied upon by any other party or for any other site without the express written permission of ConeTec Group (ConeTec) or any of its affiliates. For this project, ConeTec has provided site investigation services, prepared factual data reporting and produced geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

To understand the calculations that have been performed and to be able to reproduce the calculated parameters the user is directed to the basic descriptions for the methods in this document and the detailed descriptions and their associated limitations and appropriateness in the technical references cited for each parameter.

ConeTec's Calculated CPT Geotechnical Parameters as of February 10, 2023.

ConeTec's CPT parameter calculation and plotting routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. Due to drainage conditions and the basic assumptions and limitations of the correlations, not all geotechnical parameters provided are considered applicable for all soil types. The results are presented only as a guide for geotechnical use and should be carefully examined for consideration in any geotechnical design. Reference to current literature is strongly recommended. ConeTec does not warranty the correctness or the applicability of any of the geotechnical parameters calculated by the program and does not assume liability for any use of the results in any design or review. For verification purposes we recommend that representative hand calculations be done for any parameter that is critical for design purposes. The end user of the parameter output should also be fully aware of the techniques and the limitations of any method used by the program. The purpose of this document is to inform the user as to which methods were used and to direct the end user to the appropriate technical papers and/or publications for further reference.

The geotechnical parameter output was prepared specifically for the site and project named in the accompanying report subject to objectives, site conditions and criteria provided to ConeTec by the client. The output may not be relied upon by any other party or for any other site without the express written permission of ConeTec Group (ConeTec) or any of its affiliates.

The CPT calculations are based on values of tip resistance, sleeve friction and pore pressures considered at each data point or averaged over a user specified layer thickness (e.g., 0.20 m). Note that q_t is the tip resistance corrected for pore pressure effects and q_c is the recorded tip resistance. The corrected tip resistance (corrected using u_2 pore pressure values) is used for all calculations. Since all ConeTec cones have equal end area friction sleeves pore pressure corrections to sleeve friction, f_s, are not performed.

Corrected tip resistance: $q_t = q_c + (1\text{-}a) \cdot u_2$ (consistent units are required)

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure from behind the tip (u_2 position)
a is the Net Area Ratio for the cone (typically 0.80 for ConeTec cones)

The total stress calculations are based on soil unit weight values that have been assigned to the Soil Behavior Type (SBT) zones, from a user defined unit weight profile, by using a single uniform value throughout the profile, through unit weight estimation techniques described in various technical papers or from a combination of these methods. The parameter output files indicate the method(s) used.

Effective vertical overburden stresses are calculated using the total stress and equilibrium pore pressure (u_{eq} or u_o) values derived from an assumed hydrostatic distribution of pore pressures below the water table or from a user defined equilibrium pore pressure profile (typically obtained from CPT dissipation tests) or a combination of the two. For over water projects the stress effects of the column of water above the mudline are taken into account as is the appropriate unit weight of water. How this is done depends on where the instruments are zeroed (i.e. on deck or at the mudline). The parameter output files indicate the method(s) used.

A majority of parameter calculations are derived from or driven by results based on material types as determined by the various soil behavior type charts depicted in Figures 1 through 6. The parameter output files indicate the method(s) used.

The Soil Behavior Type classification chart shown in Figure 1 is the classic non-normalized SBT Chart developed at the University of British Columbia and reported in Robertson, Campanella, Gillespie and Greig (1986). Figure 2 shows the original normalized (linear method) SBTn chart developed by Robertson (1990). The Bq classification charts shown in Figures 3a and 3b incorporate pore pressures into the SBT classification and are based on the methods described in Robertson (1990). Many of these charts have been summarized in Lunne, Robertson and Powell (1997). The Jefferies and Davies SBT chart shown in Figure 3c is based on the techniques discussed in Jefferies and Davies (1993) which introduced the concept of the Soil Behavior Type Index parameter, I_c. Take note that the I_c parameter developed by Robertson and Fear (1995) and Robertson and Wride (1998) is similar in concept but uses a slightly different calculation method than that defined by Jefferies and Davies (1993) as the latter incorporates pore pressure in their technique through the use of the Bq parameter. The normalized Qtn SBT chart shown in Figure 4 is based on the work by Robertson (2009) utilizing a variable stress ratio exponent, n, for normalization based on a slightly modified redefinition and iterative approach for I_c. The boundary curves drawn on the chart are based on the work described in Robertson (2010).

Figure 5 shows a revised 1986 SBT Chart presented to CPT'10 by Robertson (2010b). It is known as the Updated non-normalized Soil Behavior Chart (also referred to as the Rev SBT Chart (PKR2010) in our output files). This chart was produced to be more in line with all post-1986 Robertson charts having the same 9 soil type zones, a $\log_{10}$ axis for friction ratio, R_f in this case, and a unitless tip resistance axis.

Figure 6 shows a revised behavior based chart by Robertson (2016) depicting contractive-dilative zones. As the zones represent material behavior rather than soil gradation ConeTec has chosen a set of zone colors that are less likely to be confused with material type colors from previous SBT charts. These colors differ from those used by Dr. Robertson. A green palette was selected for the dilative (desirable) side of the chart and a red palette for the contractive side of the chart.

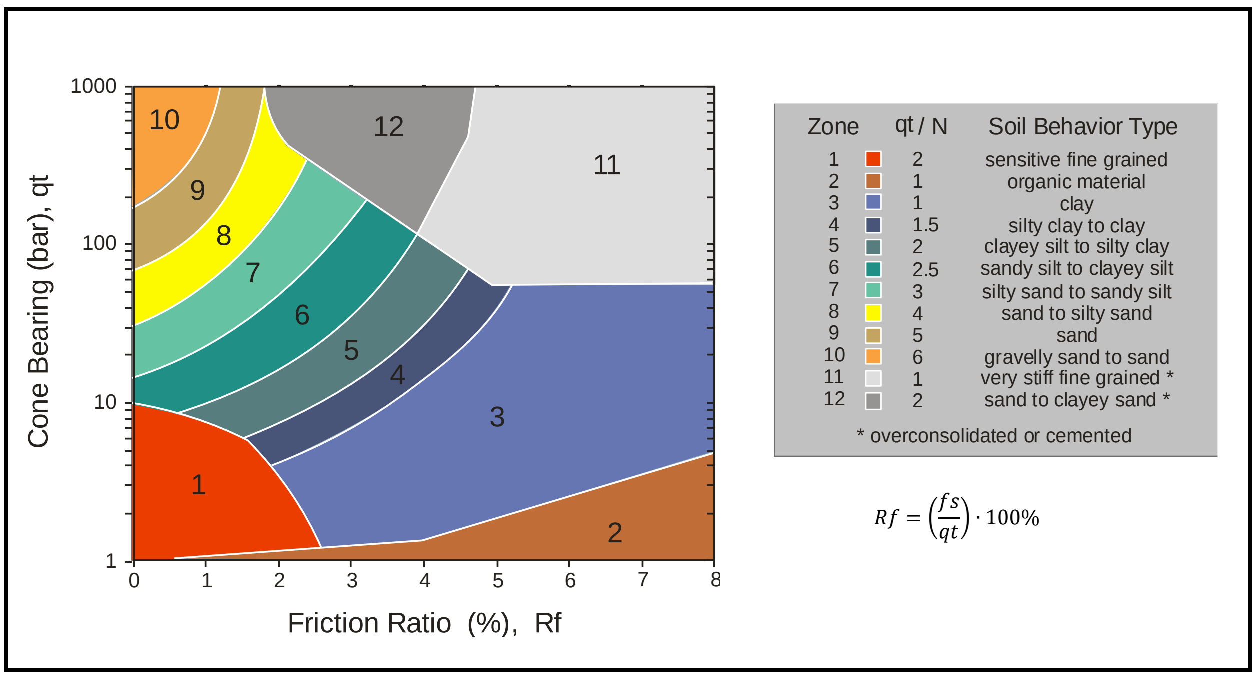


Figure 1. Non-normalized Soil Behavior Type Classification Chart (SBT)

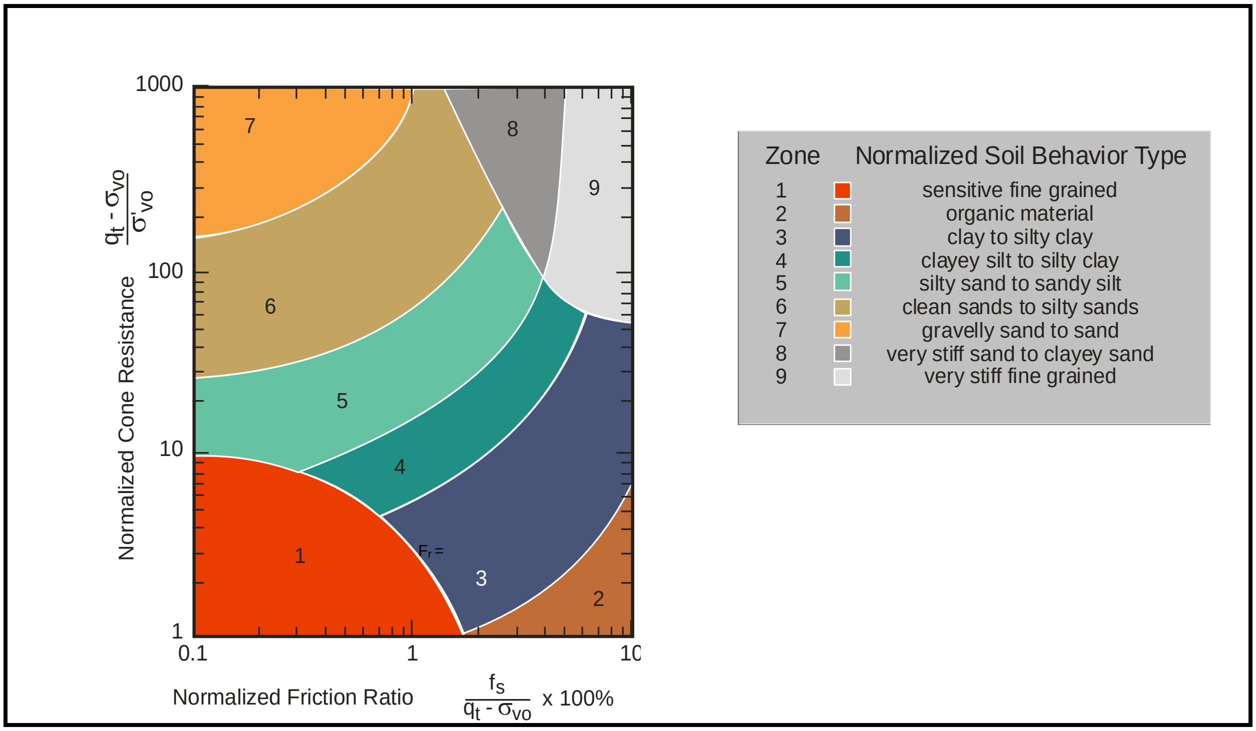


Figure 2. Normalized Soil Behavior Type Classification Chart (SBTn)

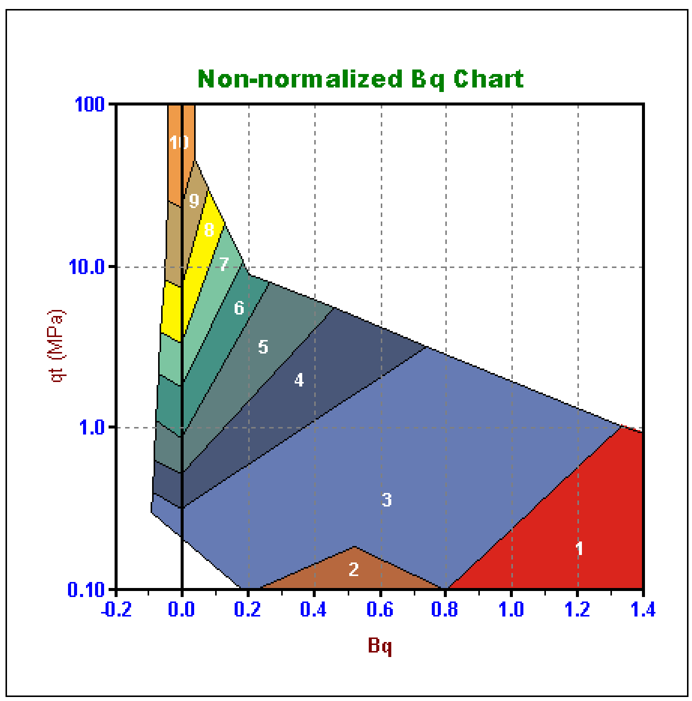


Figure 3a. Alternate Soil Behavior Type Chart (SBT Bq): q_t - B_q

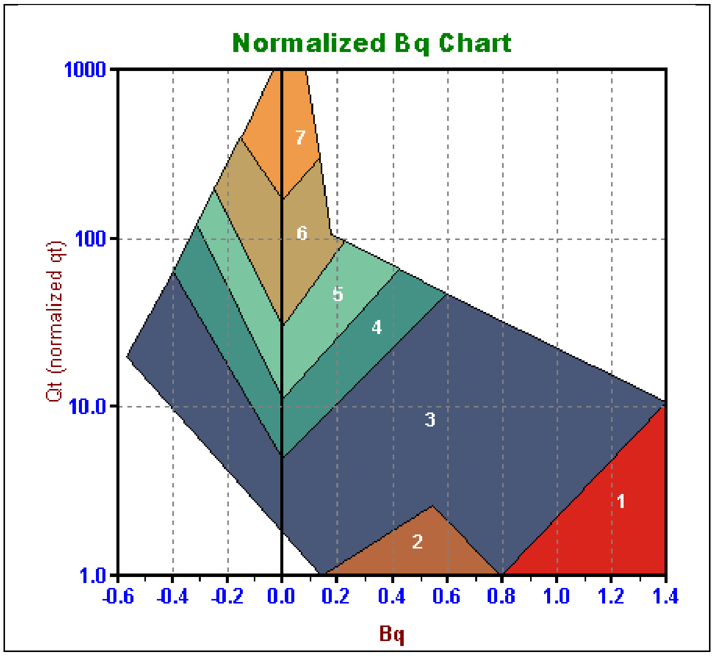


Figure 3b. Alternate Soil Behavior Type Charts (SBT Bqn): Q_t-B_q

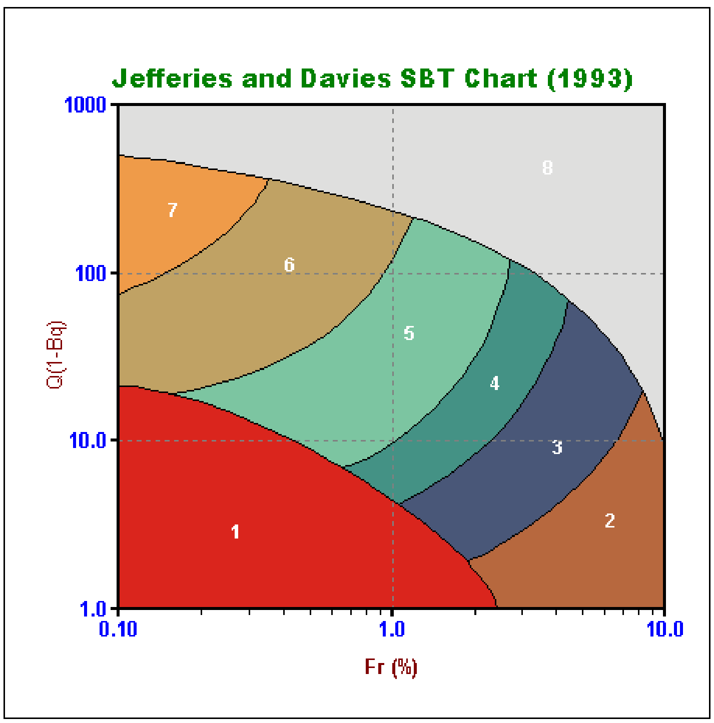


Figure 3c. Alternate Soil Behavior Type Charts: $Q(1-B_q)$ - F_r

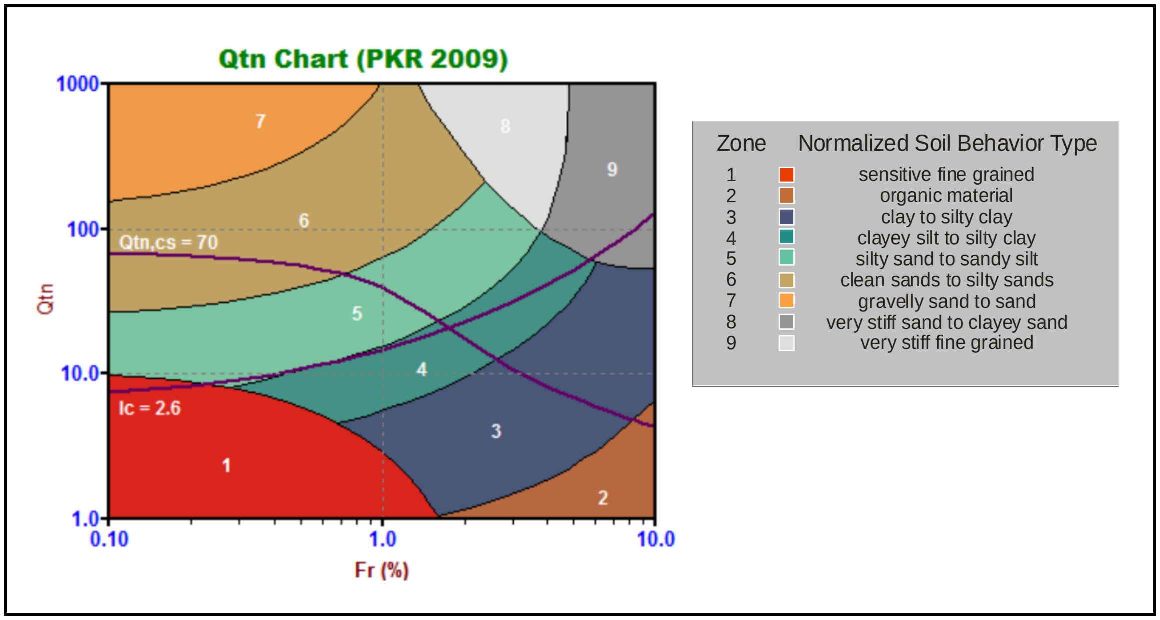


Figure 4. Normalized Soil Behavior Type Chart using Q_{tn} (SBT Qtn)

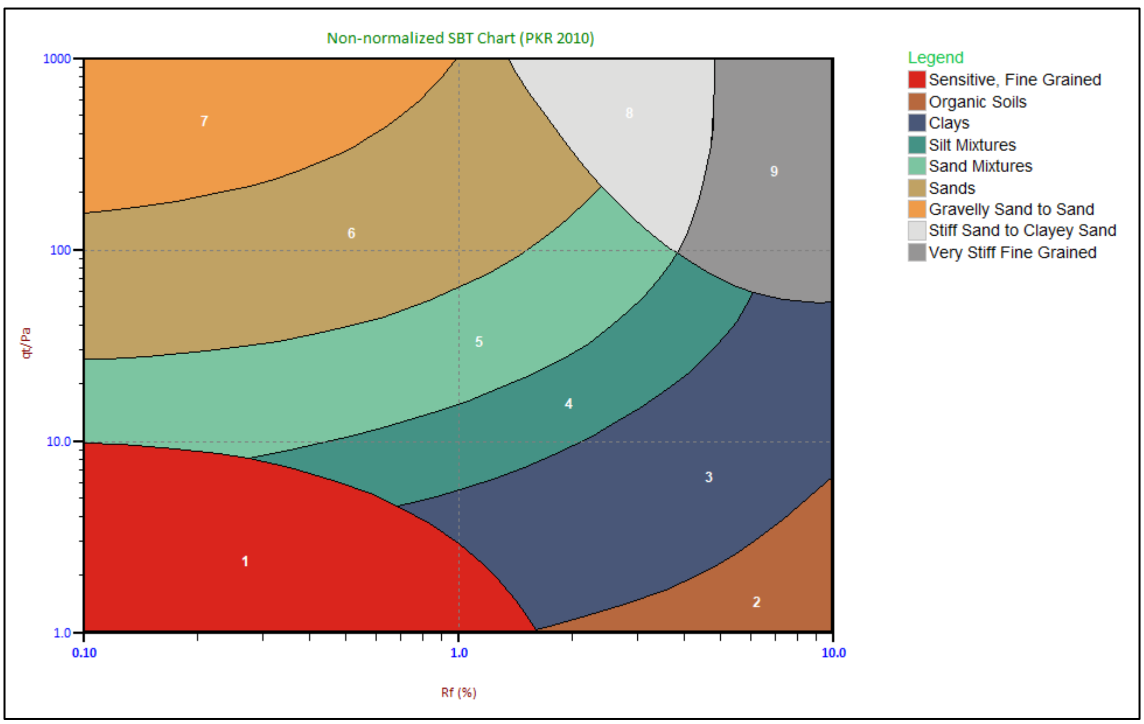


Figure 5. Non-normalized Soil Behavior Type Chart (2010)

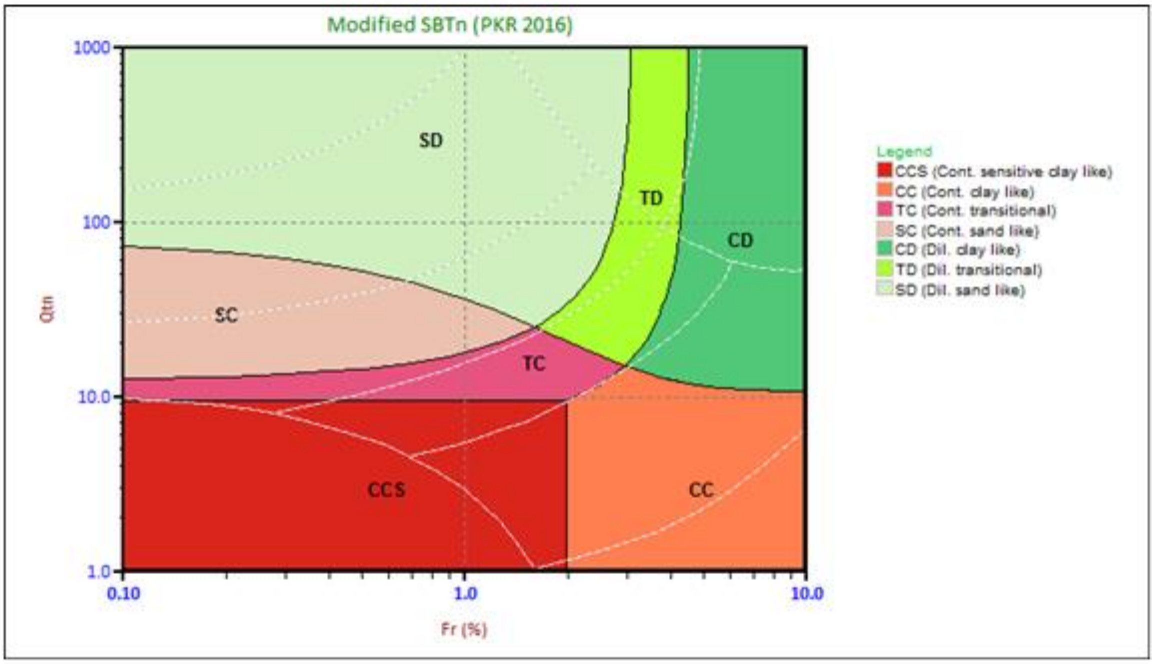


Figure 6. Modified SBTn Behavior Based Chart

Details regarding the geotechnical parameter calculations are provided in Tables 1a and 1b. The appropriate references cited are listed in Table 2. Non-liquefaction specific parameters are detailed in Table 1a and liquefaction specific parameters are detailed in Table 1b.

Where methods are based on charts or techniques that are too complex to describe in this summary, we recommend that the user refer to the cited material. Specific limitations for each method are described in the cited material.

Where the results of a calculation/correlation are deemed *'invalid'* the value will be represented by the text strings "-9999", "-9999.0", the value 0.0 (Zero) or an empty cell. Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g., drilled out section or data gap).

2. Where the calculation method is inappropriate, for example, drained parameters in a material behaving in an undrained manner (and vice versa).

3. Where input values are beyond the range of the referenced charts or specified limitations of the correlation method.

4. Where pre-requisite or intermediate parameter calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the calculated parameters listed in Tables 1and 1a may be included in the output files delivered with this report.

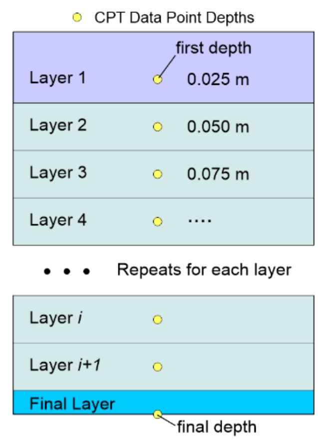
The output files are typically provided in Microsoft Excel XLS, XLSX or CSV format. The ConeTec software has several options for output depending on the number or types of calculated parameters desired or those specifically contracted for by the client. Each output file is named using the original file base name (from the .COR file) followed by a three or four character indicator of the output set selected (e.g. BSC, TBL, NLI, NL2, IFI, IFI2, IFI3) and possibly followed by an operator selected suffix identifying the characteristics of the particular calculation run.

Table 1a. CPT Parameter Calculation Methods – Non liquefaction Parameters

Reference Notes: CK* - Common Knowledge, U* - Unpublished

Calculated Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where calculations are done at each point then Mid Layer Depth = Recorded Depth)*	*[Depth (Layer Top) + Depth (Layer Bottom)]/ 2.0*	CK*
Elevation	Elevation of Mid Layer is based on the sounding collar elevation supplied by the client or through a site survey In Sweden a variation of elevation is used where the elevation increases with depth. We refer to this as inverse elevation.	Elevation = Collar Elevation – Depth InverseElevation = Collar Elevation + Depth	CK* N/A
Avg qc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when calculations are done at each point*	CK*
Avg qt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a)\cdot u_2$ Averaged q_t is not calculated using the average q_c and averaged u values. Averaged q_t is based on the average of the q_t values calculated at each data point.	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when calculations are done at each point*	1
Avg fs	Averaged sleeve friction (f_s) No pore pressure corrections are applied to f_s.	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when calculations are done at each point*	CK*
Avg Rf	Averaged friction ratio (R_f) where friction ratio is defined as: $R_f = 100\% \cdot \frac{fs}{q_t}$	$AvgRf = 100\% \cdot \frac{Avgfs}{Avgqt}$ *not an average of individual R_f values*	CK*
Avg u	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when calculations are done at each point*	CK*
Avg Res	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$AvgRes = \frac{1}{n}\sum_{i=1}^{n} Resistivity_i$ *n=1 when calculations are done at each point*	CK*
Avg UVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$AvgUVIF = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when calculations are done at each point*	CK*
Avg Temp	Averaged Temperature (this data is not always available)	$AvgTemp = \frac{1}{n}\sum_{i=1}^{n} Temperature_i$ *n=1 when calculations are done at each point*	CK*
Avg Gamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$AvgGamma = \frac{1}{n}\sum_{i=1}^{n} Gamma_i$ *n=1 when calculations are done at each point*	CK*
SBT	Soil Behavior Type as defined by Robertson et al 1986 (often referred to as Robertson and Campanella, 1986)	See Figure 1	1, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson 1990 (linear normalization using Q_t, now referred to as Q_{t1})	See Figure 2	2, 5

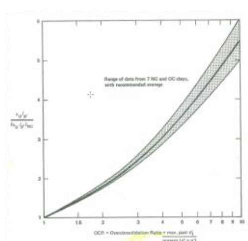
Calculated Parameter	Description	Equation	Ref
SBT-Bq	Non-normalized Soil Behavior type based on non-normalized tip resistance and the B_q parameter	See Figure 3a	1, 2, 5
SBT-Bqn	Normalized Soil Behavior type based on normalized tip resistance (Q_t, now called Q_{t1}) and the B_q parameter	See Figure 3b	2, 5
SBT-JandD	Soil Behavior Type as defined by Jeffries and Davies	See Figure 3c	7
SBT Qtn	Soil Behavior Type as defined by Robertson (2009) using a variable stress ratio exponent for normalization based on $I_{c\ (PKR\ 2009)}$	See Figure 4	15
Modified Non-normalized SBT Chart SBT (PKR2010)	This is a revised version of the simple 1986 non-normalized SBT chart (presented at CPT '10). The revised version has been reduced from 12 zones to 9 zones to be similar to the normalized Robertson charts. Other updates include a dimensionless tip resistance normalized to atmospheric pressure, q_t/P_a, on the vertical axis and a log scale for non-normalized friction ratio, R_f, along the horizontal axis.	See Figure 5	33
Modified SBTn (contractive /dilative)	Modified SBTn chart as defined by Robertson (2016) indicating zones of contractive/dilative behavior. Note that ConeTec displays the chart with colors different from Robertson. ConeTec's colors were chosen to avoid confusion with soil type descriptions.	See Figure 6	30
Unit Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) value assigned to each SBTn zone 4) value assigned to SBTn zone as determined from Robertson and Wride (1998) based on q_{c1n} 5) values assigned to SBT Qtn zones 6) values based on Robertson updated non-normalized Soil Behavior Type Chart (2010b) 6) Mayne f_s (sleeve friction) method 7) Robertson and Cabal 2010 method 8) user supplied unit weight profile The last option may co-exist with any of the other options.	See references	3, 5, 15, 21, 24, 29, 33

Calculated Parameter	Description	Equation	Ref
TStress σ_v	Total vertical overburden stress at Mid Layer Depth *A layer is defined as the averaging interval specified by the user where depths are reported at their respective mid-layer depth.* For data calculated at each point layers are defined using the recorded depth as the mid-point of the layer. Thus, a layer starts half-way between the previous depth and the current depth unless this is the first point in which case the layer start is at zero depth. The layer bottom is half-way from the current depth to the next depth unless it is the last data point. Defining layers affects how stresses are calculated since the unit weight attributed to a data point is used throughout the entire layer. This means that to calculate the stresses the total stress at the top and bottom of a layer are required. The stress at mid layer is determined by adding the incremental stress from the layer top to the mid-layer depth. The stress at the layer bottom becomes the stress at the top of the subsequent layer. Stresses are NOT calculated from mid-point to mid-point. For over-water work the total stress due to the column of water above the mud line is taken into account where appropriate.	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness 	CK*
EStress σ_v'	Effective vertical overburden stress at mid-layer depth.	$\sigma_v' = \sigma_v - u_{eq}$	CK*
Equil u u_{eq} or u_0	Equilibrium pore pressures are determined from one of the following user selectable options: 1) hydrostatic below the water table 2) user supplied profile 3) combination of those above When a user supplied profile is used/provided a linear interpolation is performed between equilibrium pore pressures defined at specific depths. If the profile values start below the water table then a linear transition from zero pressure at the water table to the first defined pointed is used. Equilibrium pore pressures may come from dissipation tests, adjacent piezometers or other sources. Occasionally, an extra equilibrium point ("assumed value") will be provided in the profile that does not come from a recorded value to smooth out any abrupt changes or to deal with material interfaces. These "assumed" values will be indicated on our plots and in tabular summaries.	For the hydrostatic option: $u_{eq} = \gamma_w \cdot (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is the unit weight of water D is the current depth D_{wt} is the depth to the water table	CK*
K_0	Coefficient of earth pressure at rest, K_0.	$K_0 = (1 - \sin\Phi')\, OCR^{\sin\Phi'}$	17
C_n	Overburden stress correction factor used for $(N_1)_{60}$ and older CPT parameters.	$C_n = (P_a/\sigma_v')^{0.5}$ where *$0.0 < C_n < 2.0$ (user adjustable, typically ranging from 1.7 to 2.0)* *P_a is atmospheric pressure (100 kPa)*	4, 12

Calculated Parameter	Description	Equation	Ref
C_q	Overburden stress normalizing factor.	$C_q = 1.8 / [0.8 + (\sigma_v'/P_a)]$ where *$0.0 < C_q < 2.0$ (user adjustable)* *P_a is atmospheric pressure (100 kPa)* *Robertson and Wride define C_q to be the same as C_n. The Olson definition above is used in the program.*	3, 12
N_{60}	SPT N value at 60% energy calculated from q_t/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	5
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure.	$(N_1)_{60} = C_n \bullet N_{60}$	4
$N_{60}I_c$	SPT N_{60} values based on the I_c parameter, as defined by Robertson and Wride 1998 (3), or by Robertson 2009 (15).	$(q_t/P_a)/\ N_{60} = 8.5\ (1 - I_c/4.6)$ $(q_t/P_a)/\ N_{60} = 10^{(1.1268 - 0.2817Ic)}$ P_a being atmospheric pressure	3, 5 15, 31
$(N_1)_{60}I_c$	SPT N_{60} value corrected for overburden pressure (using N_{60} I_c). User has 3 options.	1) $(N_1)_{60}Ic = C_n \bullet (N_{60}\, I_c)$ 2) $q_{c1n}/\ (N_1)_{60}I_c = 8.5\ (1 - I_c/4.6)$ 3) $(Q_{tn})/\ (N_1)_{60}I_c = 10^{(1.1268 - 0.2817Ic)}$	4 5 15, 31
S_u or S_u (N_{kt})	Undrained shear strength based on q_t S_u factor N_{kt} is user selectable.	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
S_u or S_u (N_{du}) or S_u ($N_{\Delta u}$)	Undrained shear strength based on pore pressure S_u factor $N_{\Delta u}$ is user selectable.	$Su = \frac{u_2 - u_{eq}}{N_{\Delta u}}$	1, 5
D_r	Relative Density determined from one of the following user selectable options: 1) Ticino Sand 2) Hokksund Sand 3) Schmertmann (1978) 4) Jamiolkowski (1985) - All Sands 5) Jamiolkowski et al (2003) (various compressibilities, K_o)	See reference (methods 1 through 4) Jamiolkowski et al (2003) reference	5 14
PHI ϕ	Friction Angle determined from one of the following user selectable options (methods 1 through 4 are for sands and method 5 is for silts and clays): 1) Campanella and Robertson 2) Durgunoglu and Mitchel 3) Janbu 4) Kulhawy and Mayne 5) NTH method (clays and silts)	See appropriate reference	5 5 5 11 23
Delta U/q_t $\Delta u/q_t$ du/q_t	Differential pore pressure ratio (older parameter used before B_q was established)	$= \frac{\Delta u}{qt}$ *where:* $\Delta u = u - u_{eq}$ *and* *u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	39

Calculated Parameter	Description	Equation	Ref
B_q	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ where: $\Delta u = u - u_{eq}$ *and u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	1, 2, 5
Net q_t or qtNet	Net tip resistance (used in many subsequent correlations)	$qt - \sigma_v$	36
q_e or qE or q_E	Effective tip resistance (using the dynamic pore pressure u_2 and not equilibrium pore pressure)	$q_t - u_2$	36
qeNorm	Normalized effective tip resistance	$\frac{qt - u_2}{\sigma_v'}$	36
Q_t or Norm: Qt or Q_{t1}	Normalized q_t for Soil Behavior Type classification as defined by Robertson (1990) using a linear stress normalization. Note this is different from Q_{tn}. This parameter was renamed to Q_{t1} in Robertson, 2009. Without normalization limits this parameter calculates to very high unrealistic values at low stresses.	$Qt = \frac{qt - \sigma_v}{\sigma_v'}$	2, 5, 15
F_r or Norm: Fr	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson (1990)	$Fr = 100\% \cdot \frac{fs}{qt - \sigma_v}$	2, 5
$Q(1-B_q)$ $Q(1-B_q) + 1$	$Q(1-B_q)$ grouping as suggested by Jefferies and Davies for their classification chart and the establishment of their I_c parameter. Later papers added the +1 term to the equation.	$Q \cdot (1 - Bq)$ $Q \cdot (1 - Bq) + 1$ *where Bq is defined as above and Q is the same as the normalized tip resistance, Q_{t1}, defined above*	6, 7, 34
q_{c1}	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method has stress units)	$q_{c1} = q_t \cdot (Pa/\sigma_v')^{0.5}$ where: P_a = atmospheric pressure	21
q_{c1} (0.5)	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method is unit-less)	$q_{c1}\,(0.5) = (q_t/P_a) \cdot (Pa/\sigma_v')^{0.5}$ where: P_a = atmospheric pressure	5
q_{c1} (C_n)	Normalized tip resistance, q_{c1}, based on C_n (this method has stress units)	$q_{c1}(Cn) = C_n * q_t$	5, 12
q_{c1} (C_q)	Normalized tip resistance, q_{c1}, based on C_q (this method has stress units)	$q_{c1}\,(Cq) = C_q * q_t$ (some papers use q_c)	5, 12
q_{c1n}	normalized tip resistance, q_{c1n}, using a variable stress ratio exponent, n (where n=0.0, 0.70, or 1.0) (this method is unit-less)	$q_{c1n} = (q_t / P_a)(P_a/\sigma_v')^n$ where: P_a = atm. Pressure and n varies as described below	3

Calculated Parameter	Description	Equation	Ref
I_c or Ic (RW1998)	Soil Behavior Type Index as defined by Robertson and Wride (1997, 1998) for estimating grain size characteristics and providing smooth gradational changes across the SBTn chart. Ic(RW1998) is different from that of Jefferies and Davies (7) and is different from Ic(PKR2009).	$I_c = [(3.47 - \log_{10}Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ *Where:* $Q = \left(\frac{qt - \sigma_v}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *Or* $Q = q_{c1n} = \left(\frac{qt}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *depending on the iteration in determining* I_c *And* *Fr is in percent* P_a *= atmospheric pressure* *n has the following distinct values:* *0.5, 0.75 and 1.0* *and is determined in an iterative manner based on the resulting* I_c *in each iteration* *Note that NCEER replaced 0.75 with 0.70*	3, 4, 5 10
I_c (PKR 2009)	Soil Behavior Type Index, I_c (PKR 2009) is based on a variable stress ratio exponent n, which itself is based on I_c (PKR 2009). An iterative calculation is required to determine I_c (PKR 2009) and its corresponding n (PKR 2009).	I_c *(PKR 2009) =* $[(3.47 - \log_{10}Q_{tn})^2 + (1.22 + \log_{10}F_r)^2]^{0.5}$	15
n (PKR 2009)	Stress ratio exponent n, based on I_c (PKR 2009). An iterative calculation is required to determine n (PKR 2009) and its corresponding I_c (PKR 2009).	*n (PKR 2009) =* $0.381 (I_c) + 0.05 (\sigma_v'/P_a) - 0.15$	15
Q_{tn} (PKR 2009)	Normalized tip resistance using a variable stress ratio exponent based on I_c (PKR 2009) and n (PKR 2009). An iterative calculation is required to determine Q_{tn} (PKR 2009).	$Q_{tn} = [(qt - \sigma_v)/P_a](P_a/\sigma_v')^n$ *where* P_a *= atmospheric pressure (100 kPa)* *n = stress ratio exponent described above*	15
FC	Apparent fines content (%)	$FC=1.75(Ic^{3.25}) - 3.7$ $FC=100$ *for* $I_c > 3.5$ $FC=0$ *for* $I_c < 1.26$ $FC = 5\%$ *if* $1.64 < I_c < 2.6$ *AND* $F_r<0.5$	3
I_c Zone	This parameter is the Soil Behavior Type zone based on the I_c parameter (valid for zones 2 through 7 on SBTn or SBT Qtn charts)	$I_c < 1.31$ Zone = 7 $1.31 < I_c < 2.05$ Zone = 6 $2.05 < I_c < 2.60$ Zone = 5 $2.60 < I_c < 2.95$ Zone = 4 $2.95 < I_c < 3.60$ Zone = 3 $I_c > 3.60$ Zone = 2	3
CD	The contractive / dilative boundary on Robertson's Modified SBTn (contractive/dilative) Chart shown in Figure 6 above. The boundary is marked as CD = 70 on the chart in the relevant paper. Similar to the $Q_{tn,cs} = 70$ line in Figure 4.	$CD = 70 = (Q_{tn} - 11) (1 + 0.06F_r)^{17}$ lower bound of CD = 60: $CD = 60 = (Q_{tn} - 9.5) (1 + 0.06F_r)^{17}$	30

Calculated Parameter	Description	Equation	Ref
I_B	Hyberbolic fit defining the boundary between SBT soil types proposed by Schneider as a better fit than the I_c circles. I_B = 32 represents the boundary for most sand like soils. I_B = 22 represents the upper boundary for most clay like soils. The region between I_B=22 and I_B=32 is the "transitional soil" zone.	$I_B = 100\ (Q_{tn} + 10) / (70 + Q_{tn}\ F_r)$	30
State Param or State Parameter or ψ	The state parameter index, ψ, is defined as the difference between the current void ratio, e, and the critical void ratio, e_c. Positive ψ - contractive soil Negative ψ - dilative soil This is based on the work by Been and Jefferies (1985) and Plewes, Davies and Jefferies (1992) This method uses mean normal stresses based on a uniform value of K_0 or a calculated K_0 using methods described elsewhere in this document	See reference	6, 8
Yield Stress σ_p'	Yield stress is calculated using the following methods 1) General method 2) 1st order approximation using q_tNet (clays) 3) 1st order approximation using Δu_2 (clays) 4) 1st order approximation using q_e (clays) 5) Based on Vs	All stresses in kPa 1) $\sigma_p' = 0.33\cdot(q_t - \sigma_v)^{m'}\ (\sigma_{atm}/100)^{1-m'}$ where $m' = 1 - \dfrac{0.28}{1+(I_c/2.65)^{25}}$ 2) $\sigma_p' = 0.33\cdot(q_t - \sigma_v)$ 3) $\sigma_p' = 0.54\cdot(\Delta u_2)$ $\Delta u_2 = u_2 - u_0$ 4) $\sigma_p' = 0.60\cdot(q_t - u_2)$ 5) $\sigma_p' = (Vs/4.59)^{1.47}$	19 20 20 20 18
OCR OCR(JS1978) YSR(Mayne2014) YSR (qtNet) YSR (deltaU) YSR (qe) YSR (Vs) OCR (PKR2015)	Over Consolidation Ratio based on 1) Schmertmann (1978) method involving a plot plot of S_u/σ_v' /($S_u/\sigma_v')_{NC}$ and OCR  2) based on Yield stresses described above 3) approximate version based on qtNet 4) approximate version based on Δu 5) approximate version based on effective tip, q_e 6) approximate version based on shear wave velocity, V_s and σ_v' 7) based on Qt	1) requires a user defined value for NC Su/P_c' ratio 2 through 5) *based on yield stresses* 6) YSR (Vs) = $\sigma_p'(Vs) / \sigma_v'$ 7) OCR = $0.25\cdot(Qt)^{1.25}$	9 19 20 20 20 18 32
Es/qt	Intermediate parameter for calculating Young's Modulus, E, in sands. It is the Y axis of the reference chart. Note that Figured 5.59 from reference 5, Lunne, Robertson and Powell, (LRP) has an error. The X axis values are too high by a factor of 10. The plot is based on Baldi's (not Bellotti as cited in	Based on Figure 5.59 in the reference	5, 37

Calculated Parameter	Description	Equation	Ref
	LRP) original Figure 3 where the X axis is: $\frac{q_c}{\sqrt{\sigma'_v}}$ (both in kPa) with a range of 200 to 3000. Figure 5.59 from LRP shows a dimensionless form of the equation, q_{c1}, displaying the same range of values. Figure 5.59's X axis uses $q_{c1} = \left(\frac{q_c}{P_a}\right)\left(\frac{P_a}{\sigma'_v}\right)^{0.5}$ The two expressions are not the same: they differ by a factor of $\frac{\sqrt{P_a}}{P_a}$. With P_a taken to be 100 kPa the factor is 1/10. Substituting typical values of 200 bar (20000 kPa) for q_c and 225 kPa for σ_v' one gets: 20000 / 15 = 1333.33 for Bellotti's axis and $(200/1)(100/225)^{0.5}$ = 200 * (10/15) = 133.3 for LRP's axis (noting that P_a = 1 bar) showing a factor of 10 difference.		
Es or E_s Young's Modulus E	Young's Modulus based on the work done in Italy. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in the E_s/q_t chart. E_s is evaluated for an axial strain of 0.1%.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3}(\sigma'_v + \sigma'_h + \sigma'_h)$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress *and* $\sigma_h = K_o \cdot \sigma_v'$ with K_o assumed to be 0.5	5
Delta U/TStress $\Delta u / \sigma_v$	Differential pore pressure ratio with respect to total stress	$= \frac{\Delta u}{\sigma_v}$ *where:* $\Delta u = u - u_{eq}$	39
Delta U/EStress, P Value, Excess Pore Pressure Ratio $\Delta u/\sigma_v'$	Differential pore pressure ratio with respect to effective stress. Key parameter (P, Normalized Pore Pressure Parameter, Excess Pore Pressure Ratio) in the Winckler et. al. static liquefaction method.	$= \frac{\Delta u}{\sigma'_v}$ *where:* $\Delta u = u - u_{eq}$	25, 25a
Su/EStress S_u/σ_v'	Undrained shear strength ratio with respect to vertical effective overburden stress using the S_u (N_{kt}) method	$= Su(N_{kt}) / \sigma_v'$	9, 23
Vs or V_s	Recorded shear wave velocities (not estimated). The shear wave velocities are typically collected over 1 m depth intervals. Each data point over the relevant depth range is assigned the same V_s value.	recorded data	27
Vp or V_p	Recorded compression wave (or P wave) velocities (not estimated). The P wave velocities are typically collected over 1 m depth intervals. Each data point over the relevant depth range is assigned the same V_p value.	recorded data	27

Calculated Parameter	Description	Equation	Ref
V_{s30} V_{s100}	The average shear wave velocity of the near surface materials to a depth of 30 m (100 ft). It is based on the sum of all travel times through all layers in the top 30m (100 ft). V_{s100} is the same calculation as V_{s30} except down to a depth of 100 feet.	$V_{s30} = \frac{total\ thickness\ of\ all\ layers\ to\ 30\ m}{\Sigma\left(\frac{layer\ thickness}{layer\ shear\ wave\ velocity}\right)}$ $V_{s30} = \frac{total\ thickness\ of\ all\ layers\ to\ 30\ m}{\Sigma\ (layer\ travel\ times)}$	38
G_{max}	G_{max} determined from SCPT shear wave velocities (not estimated values). Note that seismic data (V_s) is collected over set depth intervals (typically 1 meter). Each data point over the test segment is assigned the same V_s value. Since soil density changes with depth, slightly different G_{max} values may be calculated over the test depth interval.	$G_{max} = \rho V_s^2$ where ρ is the mass density of the soil determined from the estimated unit weights at each test depth	27
qtNet/G_{max}	Net tip resistance ratio with respect to the small strain modulus G_{max} determined from SCPT shear wave velocities (not estimated values)	$= (qt - \sigma_v) / G_{max}$ where $G_{max} = \rho V_s^2$ and ρ is the mass density of the soil determined from the estimated unit weights at each test depth	15, 28, 30
qUlt	A site specific and client specific parameter for estimating the limiting stress for "crane walk" accessibility	$q_{ult} = CraneWalkFactor \cdot S_u$ Where: *CraneWalkFactor* is client provided	U*
Estimated G_o	Estimated value for small strain shear modulus	$G_o = 0.0188[10^{(0.55Ic + 1,68)}](q_t - \sigma_v)$	15
Estimated E_{25}	Estimated value for Young's Modulus, E, at a 25% working load	$E_{25} = \alpha_E$ (qtNet) where $\alpha_E = 0.015[10^{(0.55Ic + 1,68)}]$	15
k_{SBT}	Estimated soil permeability derived from Soil Behavior Type (SBT) Chart I_c values.	For $1.0 < I_c \leq 3.27$: $k = 10^{(0.952 - 3.04Ic)}$ in m/s For $3.27 < Ic < 4.0$: $k = 10^{(-4.52 - 1.37Ic)}$ in m/s	35
M or D' Constrained Modulus	Constrained Modulus based on 1) Robertson, M 2) Mayne, D'	1) Robertson $M = \alpha_M (q_t - \sigma_v)$ $I_c > 2.2$ (fine grained) $\alpha_M = Qt$ when $Qt < 14$ $\alpha_M = 14$ when $Qt > 14$ $Ic < 2.2$ (coarse grained) $\alpha_M = 0.0188\ [10^{(0.55Ic + 1.68)})$ $D' = \alpha_D (qt - \sigma_v)$ where $\alpha_D = 5$	32 23

Table 1b. CPT Parameter Calculation Methods – Liquefaction Parameters

Calculated Parameter	Description	Equation	Ref
K_{SPT} or K_s	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) \cdot (FC - 5))$	10
K_{CPT} or K_c (RW1998)	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference) $K_c = -0.403\, I_c^4 + 5.581\, I_c^3 - 21.63 I_c^2 + 33.75\, I_c - 17.88$	3, 10
K_c (PKR 2010)	Clean sand equivalent factor to be applied to Q_{tn}	$K_c = 1.0$ for $I_c \leq 1.64$ $K_c = -0.403\, I_c^4 + 5.581\, I_c^3 - 21.63 I_c^2 + 33.75\, I_c - 17.88$ for $I_c > 1.64$	16
$(N_1)_{60cs}I_c$	Clean sand equivalent SPT $(N_1)_{60}I_c$. User has 3 options.	1) $(N_1)_{60cs}Ic = \alpha + \beta((N_1)_{60}I_c)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}I_c)$ 3) $(q_{c1ncs})/ (N_1)_{60cs}I_c = 8.5\,(1 - I_c/4.6)$ FC ≤ 5%: $\alpha = 0$, $\beta = 1.0$ FC ≥ 35% $\alpha = 5.0$, $\beta = 1.2$ 5% < FC < 35% $\alpha = \exp[1.76 - (190/FC^2)]$ $\beta = [0.99 + (FC^{1.5}/1000)]$	10 10 5
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \cdot K_{cpt}$	3
$Q_{tn,cs}$ (PKR 2010)	Clean sand equivalent for Q_{tn} described above - Q_{tn} being the normalized tip resistance based on a variable stress exponent as defined by Robertson (2009)	$Q_{tn,cs} = Q_{tn} \cdot K_c$ (PKR 2016)	16
Su(Liq)/ESv or $S_u(Liq)/\sigma_v'$	Liquefied shear strength ratio as defined by Olson and Stark	$\frac{S_u(Liq)}{\sigma_v'} = 0.03 + 0.0143(q_{c1})$ Note: σ_v' and s_v' are synonymous	13
Su(Liq)/ESv or $S_u(Liq)/\sigma_v'$ (PKR 2010)	Liquefied shear strength ratio as defined by Robertson (2010)	$\frac{S_u(Liq)}{\sigma_v'}$ Based on a function involving $Q_{tn,cs}$	16
S_u (Liq) (PKR 2010)	Liquefied shear strength derived from the liquefied shear strength ratio and effective overburden stress	$S_u(Liq) = \sigma_v' \cdot \left(\frac{S_u(Liq)}{\sigma_v'}\right)$	16
Cont/Dilat Tip	Contractive / Dilative q_{c1} Boundary based on $(N_1)_{60}$	$(\sigma_v')_{boundary} = 9.58 \times 10^{-4}\, [(N_1)_{60}]^{4.79}$ q_{c1} is calculated from specified q_t(MPa)/N ratio	13
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833\, [q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93\, [q_{c1ncs}/1000]^3 + 0.08$	10
Kg or K_g	Small strain Stiffness Ratio Factor, K_g	$[G_{max}/q_t]/[q_{c1n}{}^{-m}]$ m = empirical exponent, typically 0.75	26

Calculated Parameter	Description	Equation	Ref
K_g*	Revised K_g factor extended to fine grained soils (Robertson).	$K_g^* = (G_o / q_n)(Q_{tn})^{0.75}$ where q_n is the net tip resistance = $q_t - \sigma_v$	30
SP Distance	State Parameter Distance, Winckler static liquefaction method	Perpendicular distance on Q_{tn} chart from plotted point to state parameter Ψ = -0.05 curve	25
URS NP Fr	Normalized friction ratio point on Ψ = -0.05 curve used in SP distance calculation		25
URS NP Q_{tn}	Normalized tip resistance (Q_{tn}) point on Ψ = -0.05 curve used in SP Distance calculation		25

Table 2. References

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